Spring meeting of the DPG Division Hadronic and Nuclear Physics (HK) and EPS European Nuclear Physics Conference 2009

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Overview of Plenary and Parallel Sessions

Invited Plenary Talks

HK 22.1	Tu	11:00–11:45	Audi-Max	**LHC Experiments and Physics** — •Peter Jenni
HK 22.2	Tu	11:45–12:30	Audi-Max	**Cosmic Matter in the FAIR Laboratory** — •Horst Stoecker
HK 44.1	We	11:00–11:45	Audi-Max	**Symmetries and phase transitions in nuclei** — •Francesco Iachello
HK 44.2	We	11:45–12:30	Audi-Max	**ALICE at the dawn of LHC** — •Kai Schweda

Invited Talks

HK 1.1	Mo	10:00–10:30	Audi-Max	**Detection of dark matter : status and prospects** — •Gilles Gerbier
HK 2.1	Mo	11:00–11:30	Audi-Max	**Overview on Physics with radioactive ion beams (exchanged with HK 78.1)** — •Zsolt Podolyak
HK 2.2	Mo	11:30–12:00	Audi-Max	**The structure of the nucleon from DIS experiments** — •Franco Bradamante
HK 2.3	Mo	12:00–12:30	Audi-Max	**Moments of Exotic Nuclei** — •Gerda Neyens
HK 2.4	Mo	12:30–13:00	Audi-Max	**Non-exponential electron capture decay of hydrogen-like ions** — •Yuri Litvinov
HK 21.1	Tu	9:00– 9:30	Audi-Max	**Lattice QCD in Hadron Physics** — •Andreas Schäfer
HK 21.2	Tu	9:30–10:00	Audi-Max	**Nuclear Astrophysics with Radioactive Beams** — •Philip Woods
HK 21.3	Tu	10:00–10:30	Audi-Max	**Nuclear force studies in few-nucleon systems** — •Johan Messchendorp
HK 22.3	Tu	12:30–13:00	Audi-Max	**SPIRAL2 at GANIL: Next Generation of ISOL facility for intense secondary radioactive ion beams** — •Sydney Gales
HK 43.1	We	9:00– 9:30	Audi-Max	**Determination of V_{ud} from mirror transitions and the role of atom and ion traps** — •Oscar Naviliat-Cuncic
HK 43.2	We	9:30–10:00	Audi-Max	**Light Meson Experiments** — •Tord Johansson
HK 43.3	We	10:00–10:30	Audi-Max	**Nuclear Astrophysics at the Gran Sasso underground laboratory** — •Heide Costantini
HK 44.3	We	12:30–13:00	Audi-Max	**NuPECC: A New Long Range Plan for Nuclear Physics in Europe** — •Guenther Rosner
HK 65.1	Th	9:00– 9:30	Audi-Max	**Hypernuclear Physics** — •Tullio Bressani
HK 65.2	Th	9:30–10:00	Audi-Max	**Neutrino Mass and Oscillations** — •Christian Weinheimer
HK 65.3	Th	10:00–10:30	Audi-Max	**The QCD phase diagram from lattice simulations** — •Owe Philipsen
HK 66.1	Th	11:00–11:30	Audi-Max	**Precision experiments with cold and ultracold neutrons** — •Klaus Kirch
HK 66.2	Th	11:30–12:00	Audi-Max	**Spectroscopy with Belle, BaBar, BES, PANDA.** — •Diego Bettoni
HK 66.3	Th	12:00–12:30	Audi-Max	**Density Functionals in Nuclear Structure Physics** — •Dario Vretenar
HK 66.4	Th	12:30–13:00	Audi-Max	**Two-proton radioactivity as a tool of nuclear structure** — •Bertram Blank
HK 78.1	Fr	9:00– 9:30	Audi-Max	**The Strongly Coupled Quark Gluon Plasma Produced at RHIC (exchanged with HK 2.1)** — •Axel Drees

HK 78.2	Fr	9:30–10:00	Audi-Max	**Field Theory in Hadron Physics** — •Marc Vanderhaeghen

Invited Group Reports

HK 3.1	Mo	14:00–14:30	H-ZO 10	**Exploring hot and dense QCD matter with heavy-flavour probes at RHIC** — •Andre Mischke
HK 4.1	Mo	14:00–14:30	H-ZO 20	**Recent Kaon Photoproduction Results from CLAS** — •David Ireland
HK 4.2	Mo	14:30–15:00	H-ZO 20	**Baryon Structure and Spectroscopy at ELSA** — •Reinhard Beck
HK 5.1	Mo	14:00–14:30	H-ZO 30	**The spin strucure of the nucleon** — •Mauro Anselmino
HK 5.2	Mo	14:30–15:00	H-ZO 30	**Recent results from the COMPASS experiment at CERN** — •Fabienne Kunne
HK 6.1	Mo	14:00–14:30	H-ZO 40	**Shell Structure in Neutron-Rich Nuclei around Z=20** — •Bogdan Fornal
HK 6.2	Mo	14:30–15:00	H-ZO 40	**Recent results on knockout reactions at relativistic energies in the psd shell** — •Dolores Cortina-Gil
HK 7.1	Mo	14:00–14:30	H-ZO 50	**Applications of in-medium chiral dynamics** — •Paolo Finelli, Norbert Kaiser, Dario Vretenar, Wolfram Weise
HK 8.1	Mo	14:00–14:30	H-ZO 70	**Chasing theta-13 with the Double Chooz experiment** — •Thierry Lasserre
HK 11.1	Mo	14:00–14:30	H-ZO 100	**Theory of three- and four-body scattering** — •Arnoldas Deltuva
HK 12.1	Mo	16:30–17:00	H-ZO 10	**Recent lattice results on the QCD phase diagram** — •Sandor Katz
HK 14.1	Mo	16:30–17:00	H-ZO 30	**Hadron physics from lattice QCD** — •Christine Davies
HK 15.3	Mo	17:00–17:30	H-ZO 40	**The structure of moderately neutron-rich nuclei studied with the CLARA-PRISMA setup and perspectives for the AGATA Demonstrator coupled to PRISMA.** — •Andres Gadea
HK 15.4	Mo	17:30–18:00	H-ZO 40	**Coulomb excitation and Transfer Experiments at REX-ISOLDE*** — •Thorsten Kröll
HK 16.1	Mo	16:30–17:00	H-ZO 60	**Nuclear Structure Studies of the Heaviest Elements** — •Paul Greenlees
HK 16.8	Mo	18:30–19:00	H-ZO 60	**New ideas on the formation of heavy and superheavy neutron rich nuclei** — •Valery Zagrebaev, Walter Greiner
HK 17.1	Mo	16:30–17:00	H-ZO 70	**Measuring the highest-energy particles in the universe** — •Heino Falcke
HK 20.1	Mo	16:30–17:00	H-ZO 50	**Energy Initiatives of the European Physical Society** — •Friedrich Wagner
HK 20.2	Mo	17:00–17:45	H-ZO 50	**European energy options** — •Sven Kullander
HK 20.3	Mo	17:45–18:30	H-ZO 50	**Technology for Society's Energy and Climate Needs - Economic Analysis of Policy Options** — •Gunnar Eskeland
HK 20.4	Mo	18:30–19:00	H-ZO 50	**Nuclear Energy of the Future** — •Adrien Bidaud, S.. David, O. Méplan
HK 23.1	Tu	14:00–14:30	H-ZO 10	**Leptons and heavy mesons - signals from high density/ high temperature matter?** — •Joerg Aichelin, Pol-Bernard Gossiaux
HK 24.1	Tu	14:00–14:30	H-ZO 20	**The PANDA experiment at FAIR** — •Paola Gianotti
HK 26.1	Tu	14:00–14:30	H-ZO 40	**Mass measurements at JYFLTRAP** — •Ari Jokinen
HK 27.7	Tu	15:30–16:00	H-ZO 50	**Modern Beyond Mean Field Theories** — •J. Luis Egido, Tomás R. Rodríguez
HK 28.1	Tu	14:00–14:30	H-ZO 60	**Proton and alpha induced reactions relevant for the astrophysical p-process** — •György Gyürky
HK 33.2	Tu	17:00–17:30	H-ZO 10	**Collective Phenomena in Heavy Ion Collisions** — •Mihai Petrovici
HK 34.1	Tu	16:30–17:00	H-ZO 20	**Chiral Perturbation Theory and Mesons** — •Johan Bijnens
HK 37.1	Tu	16:30–17:00	H-ZO 50	**Two-proton radioactivity and nuclear structure** — •Marek Pfützner
HK 38.1	Tu	16:30–17:00	H-ZO 60	**Photon-induced experiments for nuclear astrophysics*** — •Kerstin Sonnabend
HK 38.2	Tu	17:00–17:30	H-ZO 60	**Nuclear physics aspects of the nucleosynthetic p process: where do we stand ?** — •S. V. Harissopulos
HK 39.1	Tu	16:30–17:00	H-ZO 70	**Nuclear physics aspects of double beta decay** — •Jouni Suhonen
HK 46.1	We	14:00–14:30	H-ZO 20	**Overview of the MAMI facility in Mainz** — •Achim Denig
HK 51.1	We	14:00–14:30	H-ZO 70	**Antihydrogen** — •Jochen Walz

HK 54.1	We	14:00–14:30	H-ZO 100	**Beta decay measurements of importance for reactor heat calculations** — •Alejandro Algora
HK 55.2	We	17:00–17:30	H-ZO 10	**Hadronic matter at finite baryon densities - what do we know about it?** — •Yvonne Leifels
HK 56.1	We	16:30–17:00	H-ZO 20	**Recent results from the WASA-at-COSY experiment** — •Andrzej Kupsc
HK 58.1	We	16:30–17:00	H-ZO 40	**Aspects of gamma spectroscopy in reactions induced by light ions** — •Nicolae Marius Marginean
HK 60.1	We	16:30–17:00	H-ZO 60	**The r-process nucleosynthesis: a long-standing mystery in astrophysics** — •Stephane Goriely
HK 69.1	Th	16:30–17:00	H-ZO 20	**Probing resonance matter with virtual photons** — •Tetyana Galatyuk
HK 70.1	Th	16:30–17:00	H-ZO 30	**Superscaling analyses, lepton scattering and nucleon momentum distributions in nuclei** — •Anton Antonov
HK 70.2	Th	17:00–17:30	H-ZO 30	**Overview of recent HERMES results** — •Charlotte Van Hulse
HK 71.1	Th	16:30–17:00	H-ZO 40	**The GDR strength function in exotic nuclei measured with gamma decay** — •Angela Bracco
HK 77.1	Th	16:30–17:00	H-ZO 100	**Modern ion-beam techniques for material science and for preserving cultural heritage** — •Milko Jaksic

Fachsitzungen

HK 1.1–1.1	Mo	9:00–10:30	Audi-Max	**Plenary I**
HK 2.1–2.4	Mo	11:00–13:00	Audi-Max	**Plenary II**
HK 3.1–3.6	Mo	14:00–16:00	H-ZO 10	**Heavy Ion Collisions and QCD phases**
HK 4.1–4.6	Mo	14:00–16:00	H-ZO 20	**Hadron Structure and Spectroscopy I**
HK 5.1–5.6	Mo	14:00–16:00	H-ZO 30	**Hadron Structure and Spectroscopy II**
HK 6.1–6.6	Mo	14:00–16:00	H-ZO 40	**Nuclear Structure and Dynamics I**
HK 7.1–7.7	Mo	14:00–16:00	H-ZO 50	**Nuclear Structure and Dynamics II**
HK 8.1–8.6	Mo	14:00–16:00	H-ZO 70	**Astroparticle Physics**
HK 9.1–9.7	Mo	14:00–16:00	H-ZO 80	**Accelerators and Instrumentation I**
HK 10.1–10.7	Mo	14:00–16:00	H-ZO 90	**Accelerators and Instrumentation II**
HK 11.1–11.7	Mo	14:00–16:00	H-ZO 100	**Few-body physics**
HK 12.1–12.8	Mo	16:30–19:00	H-ZO 10	**Heavy Ion Collisions and QCD phases**
HK 13.1–13.10	Mo	16:30–19:00	H-ZO 20	**Hadron Structure and Spectroscopy I**
HK 14.1–14.8	Mo	16:30–19:00	H-ZO 30	**Hadron Structure and Spectroscopy II**
HK 15.1–15.8	Mo	16:30–19:00	H-ZO 40	**Nuclear Structure and Dynamics I**
HK 16.1–16.8	Mo	16:30–19:00	H-ZO 60	**Nuclear Structure and Dynamics II**
HK 17.1–17.7	Mo	16:30–19:00	H-ZO 70	**Astroparticle Physics**
HK 18.1–18.10	Mo	16:30–19:00	H-ZO 80	**Accelerators and Instrumentation I**
HK 19.1–19.8	Mo	16:30–19:00	H-ZO 90	**Accelerators and Instrumentation II**
HK 20.1–20.4	Mo	16:30–19:00	H-ZO 50	**Energy for the future**
HK 21.1–21.3	Tu	9:00–10:30	Audi-Max	**Plenary III**
HK 22.1–22.3	Tu	11:00–13:00	Audi-Max	**Plenary IV**
HK 23.1–23.6	Tu	14:00–16:00	H-ZO 10	**Heavy Ion Collisions and QCD phases**
HK 24.1–24.6	Tu	14:00–16:00	H-ZO 20	**Hadron Structure and Spectroscopy I**
HK 25.1–25.8	Tu	14:00–16:00	H-ZO 30	**Hadron Structure and Spectroscopy II**
HK 26.1–26.6	Tu	14:00–16:00	H-ZO 40	**Nuclear Structure and Dynamics I**
HK 27.1–27.7	Tu	14:00–16:00	H-ZO 50	**Nuclear Structure and Dynamics II**
HK 28.1–28.6	Tu	14:00–16:00	H-ZO 60	**Nuclear Astrophysics**
HK 29.1–29.7	Tu	14:00–16:00	H-ZO 70	**Astroparticle Physics**
HK 30.1–30.7	Tu	14:00–16:00	H-ZO 80	**Accelerators and Instrumentation I**
HK 31.1–31.7	Tu	14:00–16:00	H-ZO 90	**Accelerators and Instrumentation II**
HK 32.1–32.6	Tu	14:00–15:45	H-ZO 100	**Few-body physics**
HK 33.1–33.8	Tu	16:30–19:00	H-ZO 10	**Heavy Ion Collisions and QCD phases**
HK 34.1–34.9	Tu	16:30–19:00	H-ZO 20	**Hadron Structure and Spectroscopy I**
HK 35.1–35.8	Tu	16:30–19:00	H-ZO 30	**Hadron Structure and Spectroscopy II**
HK 36.1–36.10	Tu	16:30–19:00	H-ZO 40	**Nuclear Structure and Dynamics I**
HK 37.1–37.8	Tu	16:30–19:00	H-ZO 50	**Nuclear Structure and Dynamics II**
HK 38.1–38.7	Tu	16:30–18:45	H-ZO 60	**Nuclear Astrophysics**

HK 39.1–39.7	Tu	16:30–18:30	H-ZO 70	**Astroparticle Physics**
HK 40.1–40.9	Tu	16:30–19:00	H-ZO 80	**Accelerators and Instrumentation I**
HK 41.1–41.9	Tu	16:30–19:00	H-ZO 90	**Accelerators and Instrumentation II**
HK 42.1–42.6	Tu	16:30–18:15	H-ZO 100	**Few-body physics**
HK 43.1–43.3	We	9:00–10:30	Audi-Max	**Plenary V**
HK 44.1–44.3	We	11:00–13:00	Audi-Max	**Plenary VI**
HK 45.1–45.7	We	14:00–16:00	H-ZO 10	**Heavy Ion Collisions and QCD phases**
HK 46.1–46.7	We	14:00–16:00	H-ZO 20	**Hadron Structure and Spectroscopy I**
HK 47.1–47.7	We	14:00–16:00	H-ZO 30	**Hadron Structure and Spectroscopy II**
HK 48.1–48.8	We	14:00–16:00	H-ZO 40	**Nuclear Structure and Dynamics I**
HK 49.1–49.7	We	14:00–16:00	H-ZO 50	**Nuclear Structure and Dynamics II**
HK 50.1–50.7	We	14:00–16:00	H-ZO 60	**Nuclear Astrophysics**
HK 51.1–51.7	We	14:00–16:00	H-ZO 70	**Fundamental Symmetries**
HK 52.1–52.7	We	14:00–16:00	H-ZO 80	**Accelerators and Instrumentation I**
HK 53.1–53.8	We	14:00–16:00	H-ZO 90	**Accelerators and Instrumentation II**
HK 54.1–54.6	We	14:00–16:00	H-ZO 100	**Nuclear Physics Applications**
HK 55.1–55.8	We	16:30–19:00	H-ZO 10	**Heavy Ion Collisions and QCD phases**
HK 56.1–56.9	We	16:30–19:00	H-ZO 20	**Hadron Structure and Spectroscopy I**
HK 57.1–57.10	We	16:30–19:00	H-ZO 30	**Hadron Structure and Spectroscopy II**
HK 58.1–58.9	We	16:30–19:00	H-ZO 40	**Nuclear Structure and Dynamics I**
HK 59.1–59.9	We	16:30–19:00	H-ZO 50	**Nuclear Structure and Dynamics II**
HK 60.1–60.7	We	16:30–18:45	H-ZO 60	**Nuclear Astrophysics**
HK 61.1–61.8	We	16:30–18:45	H-ZO 70	**Fundamental Symmetries**
HK 62.1–62.8	We	16:30–19:00	H-ZO 80	**Accelerators and Instrumentation I**
HK 63.1–63.8	We	16:30–19:00	H-ZO 90	**Accelerators and Instrumentation II**
HK 64.1–64.5	We	16:30–18:15	H-ZO 100	**Nuclear Physics Applications**
HK 65.1–65.3	Th	9:00–10:30	Audi-Max	**Plenary VII**
HK 66.1–66.4	Th	11:00–13:00	Audi-Max	**Plenary VIII**
HK 67.1–67.112	Th	14:00–16:00	Audi-Max	**Poster Session**
HK 68.1–68.9	Th	16:30–19:00	H-ZO 10	**Heavy Ion Collisions and QCD phases**
HK 69.1–69.8	Th	16:30–19:00	H-ZO 20	**Hadron Structure and Spectroscopy I**
HK 70.1–70.8	Th	16:30–19:00	H-ZO 30	**Hadron Structure and Spectroscopy II**
HK 71.1–71.7	Th	16:30–19:00	H-ZO 40	**Nuclear Structure and Dynamics I**
HK 72.1–72.9	Th	16:30–19:00	H-ZO 50	**Nuclear Structure and Dynamics II**
HK 73.1–73.5	Th	16:30–18:00	H-ZO 60	**Nuclear Astrophysics**
HK 74.1–74.7	Th	16:30–18:30	H-ZO 70	**Fundamental Symmetries**
HK 75.1–75.9	Th	16:30–19:00	H-ZO 80	**Accelerators and Instrumentation I**
HK 76.1–76.8	Th	16:30–19:00	H-ZO 90	**Accelerators and Instrumentation II**
HK 77.1–77.5	Th	16:30–18:00	H-ZO 100	**Nuclear Physics Applications**
HK 78.1–78.2	Fr	9:00–10:30	Audi-Max	**Plenary IX**
HK 79.1–79.5	Fr	11:00–12:45	H-ZO 10	**Heavy Ion Collisions and QCD phases**
HK 80.1–80.7	Fr	11:00–12:45	H-ZO 20	**Hadron Structure and Spectroscopy I**
HK 81.1–81.7	Fr	11:00–12:45	H-ZO 30	**Hadron Structure and Spectroscopy II**
HK 82.1–82.6	Fr	11:00–12:45	H-ZO 40	**Nuclear Structure and Dynamics I**
HK 83.1–83.5	Fr	11:00–12:45	H-ZO 50	**Nuclear Structure and Dynamics II**
HK 84.1–84.7	Fr	11:00–12:45	H-ZO 80	**Accelerators and Instrumentation I**
HK 85.1–85.7	Fr	11:00–12:45	H-ZO 90	**Accelerators and Instrumentation II**

Public evening lecture

Tuesday, March 17, 2009 19:00 Audimax

Applications of Nuclear Physics
Prof. Dr. Walter Kutschera — Institut für Isotopenforschung und Kernphysik, Universität Wien

Mitgliederversammlung DPG Fachverband Hadronen und Kerne

Mittwoch 19:00–21:00 Raum HZ-O 80

- Bericht des KHuK Vorsitzenden

- Bericht zu Verbundforschung und DFG Fachkollegien
- Bericht des Fachverbandsvorsitzenden
- Tagungsplanung
- Promotionspreis
- Verschiedenes

HK 1: Plenary I

Time: Monday 9:00–10:30 Location: Audi-Max

Welcome

Invited Talk HK 1.1 Mo 10:00 Audi-Max
Detection of dark matter : status and prospects — •Gilles Gerbier — CEA Saclay, BP 2, 91191 Gif s Yvette, France

Identifying the nature of the Dark Matter in the universe is one of the most central issues of modern science. Weakly Interacting Massive Particles (WIMPs), originating from new physics at the TeV scale, constitute an attractive class of candidates. Such WIMPs would be concentrated in the halo of our galaxy and could be detected through elastic scattering on suitable targets in an underground terrestrial laboratory or by their annhilation products in dense parts of the galaxy, neutrinos, positrons, antiprotons, gamma rays. A summary of the numerous experimental investigations will be given with emphasis on most recent results and expected sensitivities from future experiments.

HK 2: Plenary II

Time: Monday 11:00–13:00 Location: Audi-Max

Invited Talk HK 2.1 Mo 11:00 Audi-Max
Overview on Physics with radioactive ion beams (exchanged with HK 78.1) — •Zsolt Podolyak — University of Surrey, Guildford, UK

The appearance of radioactive beam facilities can be viewed as a revolution in nuclear physics, in a similar way to how stable beam accelerators revolutionised the understanding of the atomic nucleus and led to applications in many different fields of science and everyday life. The importance of this step-change is recognised world-wide and the first generation of radioactive beam facilities is already in operation. A second generation, aimed at increasing the number of accelerated radioactive species, the range of energies and the beam intensities, is now in design, planning and construction.

The radioactive ion beam facilities address and will continue to address the fundamental questions of nuclear physics, such as:

- What are the limits of nuclear existence? What is the heaviest element we can make and where does the neutron-dripline lie?

- Do new forms of collective motion occur far from the valley of nuclear stability?

- Are there new forms of nuclear matter in very loosely bound nuclear systems?

- How does the ordering of quantum states, with all of its consequent implications for nuclear structure and reactions, alter in highly dilute or neutron-rich matter?

- How are the elements and isotopes found in the Universe formed?

An overview of the physics addressed with radioactive ion beams will be presented.

Invited Talk HK 2.2 Mo 11:30 Audi-Max
The structure of the nucleon from DIS experiments — •Franco Bradamante — Trieste University and INFN Section

An update is given of the QCD structure of the nucleon as it has been unveiled in DIS experiments. Emphasis will be given to the most recent results from the experiments which use polarized lepton beams and/or polarized targets, namely the HERMES experiment at DESY and the COMPASS experiment at CERN. In these experiments identification of the hadrons in the current jet has made tagging of the struck quark possible, thus allowing flavour separation of the parton distributions.

An important step forward in the understanding of the nucleon structure is the recent extraction of the transversity distributions. These distributions describe the correlations between the quark spin and the nucleon spin in a transversely polarized nucleon, and are believed to play a role in the various transverse spin effects which have been known since many years in hadron-hadron reactions and are still unexplained.

Invited Talk HK 2.3 Mo 12:00 Audi-Max
Moments of Exotic Nuclei — •Gerda Neyens — K.U. Leuven, Instituut voor Kern- en Stralingsfysica, Leuven, Belgium

Magnetic dipole moments and electric quadrupole moments are fundamental properties of nuclei. They reveal information about the nuclear structure and about the interaction that holds the nucleons together in the atomic nucleus. As the electrons in atoms, the nucleons (protons and neutrons) in the atomic nucleus can be described as moving in a mean field induced by the other nucleons. However, while the atomic electrons are interacting through the well-known electromagnetic interaction, the description of the nuclear forces is less understood and *effective* interactions are being used to model the nuclear properties. Not only do nuclear moments allow to test the validity of nuclear model predictions, these parameters can also serve as an input to improve on the parametrisation of the models.

In this talk, I will present recent experimental developments and results from moments measurements on exotic isotopes produced by projectile fragmentation and by the ISOL method.

Invited Talk HK 2.4 Mo 12:30 Audi-Max
Non-exponential electron capture decay of hydrogen-like ions — •Yuri Litvinov — GSI Helmholtzzentrum für Schwerionenforschung, 64291 Darmstadt, Germany

In this contribution we report on the observation of time-modulated orbital electron-capture decays of hydrogen-like 140Pr58+ and 142Pm60+ ions coasting in the ion storage-cooler ring ESR at GSI. By using non-destructive, time-resolved Schottky mass spectrometry of single ions it turned out that the expected exponential decay is periodically modulated in time with an oscillation period of about 7 seconds for both systems. By our special detection technique most of systematic errors, such as time-modulated detection efficiencies, can be excluded - at the expense of restricted counting statistics, however.

The interpretation of the observed effect is broadly disputed in literature. Some scenarios show that our observations can be attributed to the coherent creation of finite mass eigenstates of the electron neutrino in these two-body weak decays.

Electron capture decay of hydrogen-like 122I52+ has been studied very recently to investigate a possible scaling of the modulation frequency with the mass of the recoiling daughter nucleus. The data analysis is still in progress. The experiment and the preliminary results will be discussed.

HK 3: Heavy Ion Collisions and QCD phases

Time: Monday 14:00–16:00 Location: H-ZO 10

Invited Group Report HK 3.1 Mo 14:00 H-ZO 10
Exploring hot and dense QCD matter with heavy-flavour probes at RHIC — •Andre Mischke — Institute for Subatomic Physics, Faculty of Science, Utrecht University, the Netherlands

Calculations from Lattice-QCD predict that at high energy densities a phase transition between hadronic matter and a deconfined state formed by quarks and gluons, the Quark-Gluon Plasma, occurs. The Relativistic Heavy-Ion Collider (RHIC) at Brookhaven National Laboratory (Upton, US) has yielded compelling evidence for the formation of this novel state of matter in high energy nuclear collisions. Measure-

ments of the momentum distribution of emitted particles and comparison with hydrodynamic model calculations have shown that the matter behaves almost like an ideal fluid.

The investigation of heavy-flavour production in nuclear collisions provides key tests of parton energy-loss models and, thus, yields profound insight into the properties of the produced highly-dense QCD matter. Theoretical models based on perturbative QCD predict that heavy quarks should experience smaller energy loss than light quarks when propagating through the extremely dense medium due to the mass-dependent suppression (so-called dead-cone effect). Moreover, heavy quarks allow testing predictions from AdS/CFT, a formalism which provides a conjectured connection between strongly interacting gauge theories and string theory.

In this talk, recent results on charm and bottom production at RHIC and perspectives at CERN's Large Hadron Collider are reviewed.

Group Report HK 3.2 Mo 14:30 H-ZO 10

Equation of state of the QGP in a virial expansion — •Stefano Mattiello and Wolfgang Cassing — Institut für Theoretische Physik, Universität Giessen, Germany

Recent observations at the Relativistic Heavy-Ion Collider indicate that the quark gluon plasma (QGP) created in ultrarelativistic Au + Au collisions is interacting more strongly than hadronic matter. To relax the approximation of the QGP as an ideal gas we use a generalised version of the classical virial expansion for $\mu_{\mathrm{q}} = 0$ to calculate the partition function with a potential extracted from lattice calculations. We can describe three-flavour QCD lattice data with almost physical masses for the pressure, speed of sound and interaction measure at nonzero temperature and vanishing chemical potential. For the deconfined phase we use a phenomenological model which includes non-perturbative effects from dimension two gluon condensates that describe the free energy of quenched QCD very well. The hadronic phase is parametrised by a generalised resonance-gas model. Therefore, we extend this approach to finite densities introducing an explicit μ-dependence of the interaction. We calculate pressure, quark-number density, entropy and energy density and compare the results with lattice calculations. We, furthermore, investigate the structure of the phase diagram by calculating the isobaric and isentropic lines.
Work supported by DFG.

HK 3.3 Mo 15:00 H-ZO 10

Series expansions in lattice QCD at finite temperature — •Jens Langelage and Owe Philipsen — Institut für Theoretische Physik, Westfälische Wilhelms-Universität Münster

We calculate several observables in finite temperature lattice QCD in strong coupling expansions. Among these observables are the equation of state and the Polyakov loop susceptibility.

We use these series to get estimates for the critical parameters of the corresponding phase transition. For the pure gauge case our results are in good agreement with results from Monte Carlo simulations.

HK 3.4 Mo 15:15 H-ZO 10

Critical point in the QCD phase diagram: role of axial U(1) anomaly and strange quark mass — •Nino Bratovic, Thomas Hell, Simon Rössner, and Wolfram Weise — Physik Department, TU München, 85748 Garching, Germany

We use the Nambu-Jona-Lasinio model extended by Polyakov-loop dynamics (PNJL model) for $2 + 1$ flavours in order to study the QCD phase diagram and associated thermodynamic quantities. In this approach, spontaneous chiral symmetry breaking as well as confinement are realized dynamically in terms of the respective order parameters. In particular, we investigate the existence and location of the critical endpoint in the phase diagram. The dependence on the strength of the $\mathrm{U}(1)_A$ symmetry-breaking 't Hooft interaction and on the strange quark mass m_s is examined. Our findings are compared to related results from other groups.

Work supported in part by BMBF, GSI and the DFG Excellence Cluster "Origin and Structure of the Universe".

HK 3.5 Mo 15:30 H-ZO 10

Conical Correlations, Bragg Peaks, and Transverse Flow Deflections in Jet Tomography — •Barbara Betz[1,2], Miklos Gyulassy[3], Jorge Noronha[3], Dirk Rischke[1,4], and Giorgio Torrieri[1,4] — [1]Institut für Theoretische Physik, Goethe-Universität Frankfurt — [2]Helmholtz Research School, Universität Frankfurt, GSI and FIAS — [3]Department of Physics, Columbia University — [4]Frankfurt Institute for Advance Studies, FIAS, Frankfurt

New results are presented on away side jet correlations [1] computed in a variety of (3+1)d hydrodynamic scenarios extending our work in Ref. [2] to include stopped jets, the effects of possible Bragg peak deposition and transverse background expansion. We contrast pQCD and AdS string drag plasma-jet coupling dynamics [3] and discuss strategies for experimental falsification of models using tagged heavy quark jet tomography.

[1] H. Stöcker, Nucl. Phys. A **750** (2005) 121; F. Antinori and E. V. Shuryak, J. Phys. G **31**, L19 (2005); A. Adare *et al.* [PHENIX Collaboration], Phys. Rev. C **78**, 014901 (2008); J. G. Ulery [STAR Collaboration], Nucl. Phys. A **783**, 511 (2007). [2] B. Betz, M. Gyulassy, J. Noronha and G. Torrieri, arXiv:0807.4526 [hep-ph]. [3] J. Noronha, M. Gyulassy and G. Torrieri, arXiv:0807.1038 [hep-ph]; R. B. Neufeld, B. Muller and J. Ruppert, Phys. Rev. C **78**, 041901 (2008).

HK 3.6 Mo 15:45 H-ZO 10

Investigation of jet-quenching and elliptic flow within a pQCD partonic transport model — •Oliver Fochler, Zhe Xu, and Carsten Greiner — Institut für Theoretische Physik, Goethe Universität Frankfurt

We investigate the gluonic contribution to the nuclear modification factor, R_{AA}, for central Au+Au collisions at the RHIC-energy of $\sqrt{s} = 200\,\mathrm{AGeV}$ employing the perturbative QCD-based parton cascade BAMPS including radiative processes. A flat quenching pattern is obtained up to transverse momenta of 30 GeV. When compared to results from the GLV formalism, the suppression is found to be slightly stronger. We demonstrate that the present microscopic transport description provides excellent means of investigating both jet-quenching and a strong build-up of elliptic flow in terms of the same standard perturbative QCD interactions.

HK 4: Hadron Structure and Spectroscopy I

Time: Monday 14:00–16:00 Location: H-ZO 20

Invited Group Report HK 4.1 Mo 14:00 H-ZO 20

Recent Kaon Photoproduction Results from CLAS — •David Ireland — University of Glasgow, Glasgow, United Kingdom

Kaon photoproduction in the resonance region affords an ideal opportunity to study the spectrum of nucleon resonances. It is, however, crucial that polarization observables be measured in order to disentangle contributing processes. The prospect of a "complete" measurement being made is not far off, but a number of double polarization observables have already been measured using the CLAS detector at the Thomas Jefferson National Accelerator Facility in the US. This talk will review some of the recent results for the $\gamma p \to K^+\Lambda$ and $\gamma p \to K^+\Sigma^0$ reactions. Preliminary measurements of the photon beam asymmetry, Σ, and the double polarization observables O_x and O_z, using a beam of linearly polarized tagged photons will also be discussed.

Invited Group Report HK 4.2 Mo 14:30 H-ZO 20

Baryon Structure and Spectroscopy at ELSA — •Reinhard Beck for the CBELSA/TAPS-Collaboration — Helmholtz-Institut für Strahlen- und Kernphysik, Nußallee 14-16, D-53115 Bonn

Photoproduction of single and multi-meson final states have been investigated at the electron stretcher ring ELSA to study the spectrum and the properties of excited baryons. Especially, the measurements of double polarization observables is of crucial importance to increase the sensitivity for small resonance contributions and to reduce the ambiguties in the existing solutions for the excitation spectrum.

With the Crystal Barrel/TAPS experiment at ELSA, new precise data with linearly and circularly polarized photons on a longitudinally polarized target have been taken. The first results for the double polarization observables E and G in single and multi-meson photoproduction will be presented and compared to quark model predictions

and existing partial wave solutions.

Supported by the DFG (SFB/TR16)

HK 4.3 Mo 15:00 H-ZO 20

Measurement of the $\gamma n \to K^+\Sigma^-$ at Jefferson Lab — •Sergio Anefalos Pereira — Instituto Nazionali di Fisica Nucleare, Laboratori Nazionali di Frascati, Via E. Fermi,40 -I 00044 Frascati (Roma)

A comprehensive study of the electromagnetic strangeness production has been undertaken at Jefferson Lab. Among the six elementary strangeness photoproduction reactions on the nucleon, $\gamma n \to K^0\Lambda$, $\gamma n \to K^0\Sigma^0$, $\gamma n \to K^+\Sigma^-$, $\gamma p \to K^+\Lambda$, $\gamma p \to K^+\Sigma^0$, $\gamma p \to K^0\Sigma^+$, there are cross section data for all γp reactions. For the γn reactions, there is only data for the $\gamma n \to K^+\Sigma^-$ channel, and in a very limited energy and angular range. The actual theoretical predictions for the strangeness photoproduction cross section on neutron differ widely depending on the data set fitted for the proton channels.

Here will be presented preliminary $\gamma n(p) \to K^+\Sigma^-(p)$ differential cross section measured with the CLAS large acceptance spectrometer at the Jefferson Lab Hall-B, over a wide range of kaon scattering angles (10° and 140°) using a deuterium target with a tagged photon beam in the energy range from 1.0 up to 3.6 GeV. These measurements can be used to improve the predictive power of the actual theoretical description of hyperon photoproduction by adding more constraints to the Kaon-Hyperon-Nucleon coupling constants.

HK 4.4 Mo 15:15 H-ZO 20

A new look at the $[\mathbf{70}, 1^-]$ baryon multiplet in the $1/N_c$ expansion — •Nicolas Matagne[1] and Florica Stancu[2] — [1]Institut für Theoretische Physik, Universität Giessen, Germany — [2]University of Liège, Institute of Physics B5, Sart Tilman, B-4000 Liège 1, Belgium

So far, the masses of excited states of mixed orbital symmetry and in particular those of nonstrange $[\mathbf{70}, 1^-]$ baryons derived in the $1/N_c$ expansion were based on the separation of a system of N_c quarks into a symmetric core and an excited quark. Here we avoid this separation and show that an advantage of this new approach is to substantially reduce the number of linearly independent operators entering the mass formula. A novelty is that the isospin-isospin term becomes as dominant in Δ as the spin-spin term in N resonances.

HK 4.5 Mo 15:30 H-ZO 20

Gauge-invariant coupling to spin-$\frac{3}{2}$ resonances. — •Vitaly Shklyar, Horst Lenske, and Ulrich Mosel — Institut für Theoretische Physik, Universität Giessen, Germany

A gauge invariant interaction of the Δ-resonance to the final πN and γN is discussed. It is shown that the gauge-invariant coupling invented by Pascalutsa eliminates 'off-shell' degrees of freedom only for the Rarita-Schwinger propagator but fails in the general case. The origin of the problem is discussed and a generalized gauge-invariant coupling is deduced. Finally, the full Lagrangian depends on one free parameter which reflects a freedom in choosing an 'off-shell' content of the theory. The calculated πN scattering amplitude shows no dependency on the specific choice of the parameter. This reflect the fact that physical observables do not depend on any 'off-shell' contributions and do not depend on the free parameter of Lagrangian.

Work supported by DFG.

HK 4.6 Mo 15:45 H-ZO 20

From the ABC Effect to the ABC-Resonance – the First Genuine Dibaryon State?* — •Mikhail Bashkanov for the WASA-at-COSY-Collaboration — Physikalisches Institut der Universität Tübingen

The ABC effect – an intriguing low-mass enhancement in the $\pi\pi$ invariant mass spectrum – is known from inclusive measurements of two-pion production in nuclear fusion reactions. Its explanation has been a long-standing problem since 50 years.

New exclusive and kinematically complete measurements of the most basic fusion reaction $pn \to d\pi^0\pi^0$ have been carried out with WASA at COSY covering the full energy region, where the ABC effect can be observed. These measurements with a two orders of magnitude higher statistics than the previous CELSIUS-WASA measurements reveal the ABC effect to be the consequence of a narrow resonance in the pn and $d\pi^0\pi^0$ systems with a mass 90 MeV below the $\Delta\Delta$ mass and a width of 50 MeV. The latter is 5 times smaller than what is expected from a conventional t-channel $\Delta\Delta$ excitation. According to the angular distributions the quantum numbers should be $I(J^P) = 0(1^+)$ or $0(3^+)$. Such a dibaryon resonance has been predicted by various theoretical calculations, some of which even predict this resonance to be a member of a dibaryon multiplet.

From the fact that the ABC effect is observed also for double-pionic fusion processes to heavier nuclei, we conclude that this resonance is robust enough to survive even in nuclei. * supported by BMBF, COSY-FFE, DFG (Eur. Graduate School) and Wallenberg Foundation

HK 5: Hadron Structure and Spectroscopy II

Time: Monday 14:00–16:00 Location: H-ZO 30

Invited Group Report HK 5.1 Mo 14:00 H-ZO 30

The spin strucure of the nucleon — •Mauro Anselmino — University of Torino & INFN, Torino, Italy

The study of the spin structure of the nucleon has made impressive progress in the last years. In particular the transverse structure of the nucleon has received much attention, not only regarding spin but also the intrinsic motion of partons inside protons and neutrons and their space distribution. Spin and intrinsic, or orbital, motion might be strictly correlated. New data have been released, which have prompted new theoretical extraction of transverse spin dependent distribution and fragmentation functions. The measurement and understanding of transverse single spin asymmetries has much progressed as well. A review of the most recent new results is presented.

Invited Group Report HK 5.2 Mo 14:30 H-ZO 30

Recent results from the COMPASS experiment at CERN — •Fabienne Kunne for the COMPASS-Collaboration — IRFU CEA Saclay, France

COMPASS is a multipurpose fixed target experiment running at CERN, designed to scatter polarized muons as well as hadrons with energies of several hundred GeVs, on various targets, polarized or not. After having completed a program on nucleon spin physics (2002-2007), we are currently starting a program on light meson spectroscopy (2008-2009).

All recent results on spin physics will be discussed. They include measurements of the gluon polarization from both the open charm and the high pT channels, extraction of the strange quark polarization, measurement of the longitudinal polarization of lambda and anti lambda, and results on transversity among which the Collins and Sivers asymmetries on the proton. First results on meson spectroscopy will be shortly summarized and plans for the future will be presented.

HK 5.3 Mo 15:00 H-ZO 30

k_t-factorisation in the Drell-Yan process — •Fabian Eichstädt, Stefan Leupold, and Ulrich Mosel — Institut für Theoretische Physik, Universität Giessen, Germany

The transverse-momentum spectrum of Drell-Yan pairs still eludes a complete, K-factor free description, as does to some extent also the invariant-mass distribution. In this context we critically investigate factorisation of unintegrated parton distributions in the Drell-Yan process. We employ the full initial parton kinematics for the cross section instead of the usual collinear approach simply folded by a Gaussian for the transverse-momentum distribution. We find that the standard, x-independent Gaussian k_t-distribution for the initial partons does not coincide with the parton-model result for the double-differential Drell-Yan invariant mass distribution. It turns out that one is very sensitive to the low-x behaviour of the sea-quark parton distributions. We also suggest an alternative prescription which weakens this sensitivity and brings the results back to the parton-model results. We finally examine the consequences of the different k_t-distributions for the triple-differential Drell-Yan cross section.

Work supported by DFG.

HK 5.4 Mo 15:15 H-ZO 30

Transverse target spin asymmetries on a proton target at COMPASS — •Andreas Richter — for the COMPASS collabora-

tion — Physikalisches Institut, Universität Erlangen-Nürnberg, 91058 Erlangen, Germany

COMPASS is a fixed target experiment at the CERN M2 external beamline using a 160 GeV/c polarised μ^+ beam. After the data taking in 2002-04 with a transversely polarised deuterium target, in 2007 COMPASS has taken data with a transversely polarised proton (NH_3) target. For getting a full description of the spin structure of the nucleon at leading twist at quark level it is necessary to know three quark distribution functions, namely the unpolarised distribution function $q(x)$, the helicity distribution function $\Delta q(x)$ and the transverse spin distribution function $\Delta_T q(x)$. One possible way to extract the transverse spin distribution function is the measurement of the Collins effect in semi-inclusive DIS on a transversely polarised target, describing the fragmentation of transversely polarised quarks in to spinless hadrons. Simultaneously the Sivers effect was studied, measuring the correlation of the transverse polarisation of a nucleon and the transverse momentum of an unpolarised quark. Results on the Collins and Sivers asymmetries will be presented and will be compared to COMPASS deuteron data. The work is supported by the BMBF.

HK 5.5 Mo 15:30 H-ZO 30

Deeply Virtual Compton Scattering on unpolarized hydrogen and deuterium targets at the HERMES experiment — •Dietmar Zeiler for the HERMES-Collaboration — Friedrich-Alexander-Universität Erlangen, Germany

In this presentation preliminary results on azimuthal asymmetries in leptoproduction of real photons on both unpolarized hydrogen and deuterium targets measured at the HERMES experiment will be discussed. The analysis includes the extraction of asymmetries originating from the interference of Deeply Virtual Compton Scattering (DVCS) and Bethe-Heitler amplitudes by simultaneously fitting data taken with different beam charges and helicities. Sizeable asymmetry amplitudes for the main moments of the beam-charge asymmetry and the beam-spin asymmetry for both targets have been found. The moments related to the squared DVCS amplitude are compatible with zero. All results have been compared to model calculations.

This project is funded by the BMBF, project no 06 ER 143.

HK 5.6 Mo 15:45 H-ZO 30

Dual parametrisation and Abel transform tomography for the DVCS amplitude. — •Alena Moiseeva — Institut fuer Theoretische Physik II, Ruhr-Universitaet Bochum, 44780 Bochum

We present a way to extract the maximum amount of information about Generalized Parton Distributions (GPDs) from amplitudes of hard exclusive processes. For investigation of the amplitudes we use the dual parametrization of GPDs, which provides us very handy and flexible tool to describe the amplitudes in terms of single function-so-called quintessence function. We show that relation between the quintessence function and the amplitude of the hard exclusive process corresponds to Abel transform tomography.

HK 6: Nuclear Structure and Dynamics I

Time: Monday 14:00–16:00 Location: H-ZO 40

Invited Group Report HK 6.1 Mo 14:00 H-ZO 40

Shell Structure in Neutron-Rich Nuclei around Z=20 — •Bogdan Fornal — Institute of Nuclear Physics, Polish Academy of Sciences, Krakow, Poland

It has been proven that the idea of a shell structure may be considered as an essential concept in understanding the atomic nucleus. According to that picture, the nucleons in a nucleus occupy well defined orbitals what implies that they move in a well defined average potential. The non-uniformities of the quantum states distribution in energy form the shells separated by the energy gaps - complete filling of the shells in nuclei along the stability valley occurs at magic numbers of nucleons: 2, 8, 20, 28, 50, 82, and 126. Recent investigations have shown, however, that magic numbers are not as universal as one might think. Examples of structural changes in nuclei with large neutron excess include the appearance of energy gap at N=32. The existence of this energy gap around Z=20 arises from the sizable energy spacing between the neutron p3/2 orbital and the higher lying p1/2 and f5/2 states. The studies of the location of single-particle states in 49Ca also pointed to a 2-MeV energy spacing between the two higher lying neutron orbitals p1/2 and f5/2. Such a finding could possibly have pointed to the presence of another subshell closure associated with the filling of the p1/2 orbital, i.e., at N = 34. However, the structure of very neutron-rich nuclei around Z=20 appeared to be very hard to reach. In the presentation, the status and perspectives of experimental investigations of the shell structure in exotic nuclei from the vicinity of N=34 will be discussed.

Invited Group Report HK 6.2 Mo 14:30 H-ZO 40

Recent results on knockout reactions at relativistic energies in the psd shell — •Dolores Cortina-Gil — Universidad Santiago de Compostela

Large isospin variations in exotic nuclei are predicted to modify the nuclear mean-field picture together with the long and short-range correlations. The role of certain residual interactions becomes enhanced with proton-neutron asymmetry, in particular the monopole interaction that acts between proton-neutron spin-orbit partners. The combination of all these effects is at the origin of the observed change in traditional magic numbers. Recent studies of light neutron-rich isotopes near the neutron dripline have shown very exciting issues suggesting the collapse of the N=20 shell closure in favour of the appearance of new magic numbers at N=14,16. The study of nuclear structure in the vicinity of these new magic numbers represents a key issue for the understanding of the evolution of the shell structure with isospin.

Direct reactions are currently used to explore nuclear structure. These reactions, exciting a minimal number of degrees of freedom, are very precise probes of single-particle motion. Among them, the reaction channel involving the removal of a single nucleon, known as one-neutron nuclear knockout, is favoured because of its relatively high cross-section. Using the FRS at GSI, we have studied this reaction channel in several experiments to elucidate the wave function of exotic nuclei.

We will present in this talk few selected experimental examples corresponding to nuclear knockout of Z=6-13 n-rich exotic projectiles.

HK 6.3 Mo 15:00 H-ZO 40

Shell model description of negative parity intruder states in sd nuclei — •Mouna Bouhelal[1,2], Florent Haas[1], Etienne Caurier[1], and Frédéric Nowacki[1] — [1]IPHC, CNRS/IN2P3, Université de Strasbourg, F-67037 Strasbourg Cedex 2, France — [2]Département des Sciences de la Matière, Université de Tébessa, Tébessa 12002, Algérie

To describe in a consistent way the negative parity intruder states throughout the sd shell, a new interaction has been developed in the psdpf model space with a ^4He core. These 1 $\hbar\omega$ states result from the promotion of one nucleon from p to sd shell for nuclei close to ^{16}O or from sd to pf for nuclei close to ^{40}Ca. Our interaction is based on existing interactions for the major shells; however, to describe the 1 $\hbar\omega$ states the cross shell parts are essential. They have been adjusted through a fitting procedure involving the well known negative parity states of sd nuclei close to the stability line.

The obtained PSDPF interaction has then be used to calculate energy spectra and electromagnetic properties of nuclei throughout sd. As an example, we will present our results for isotopic chains of P and S isotopes with $N \sim Z - 2$ to N=20 and compare them with experimental spectroscopic data

HK 6.4 Mo 15:15 H-ZO 40

Measurement of the one-neutron removal momentum distribution characterizes ^{24}O as a new doubly magic nucleus — •A. Prochazka for the s322-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany — Justus-Liebig-Universität, Gießen, Germany

First results are reported on the momentum distribution after one-neutron removal from ^{24}O at 920 MeV/u. The investigated isotopes were produced by projectile fragmentation of a 1 GeV/u ^{48}Ca beam in a beryllium production target placed at the entrance of the FRagment Separator (FRS). They were separated and identified in-flight at the mid-focal plane of the separator, where a carbon reaction target was

placed. Due to the high resolution of the FRS, operated in dispersion matched-mode, precise momentum measurements of secondary fragments could be performed. The secondary fragments produced in the C target were detected at the final achromatic focal plane of the FRS thus providing the measurements independently of the large momentum spread of the primary fragments. The ^{23}O momentum distribution in the projectile rest frame and the one-neutron removal cross section can be well explained by using an eikonal model with a nearly pure $2s_{1/2}$ occupation probability. This large s-wave probability indicates a spherical shell closure at N=16, thereby experimentally confirming earlier suggestions that ^{24}O is a new doubly magic nucleus.

HK 6.5 Mo 15:30 H-ZO 40

Benchmarking relativistic knock-out reactions with ^{48}Ca* — •Sabine Schwertel for the S277-Collaboration — E12 Physik Department, TU München, Garching

The evolution of shell structure in neutron rich nuclei far from the valley of stability is one of the most interesting topics in modern nuclear-structure research. Knockout experiments in combination with high resolution γ-spectroscopy can be used to probe single-particle states and to test theoretical predictions.

As part of a knock-out experiment on ^{56}Ti at the GSI FRS a reference experiment was performed with ^{48}Ca primary beam to establish the method. Several detectors (TPCs, MUSIC, TOF) provided a full identification of all incoming and outgoing fragments and the measurement of the momentum transfer in the knockout-reaction on an event-by-event basis. To tag reaction channels with excited residual nuclei, the Miniball spectrometer was used.

Momentum distributions and spectroscopic factors were determined for ^{47}K and ^{47}Ca. These are compared to shell model predictions as well as to values from transfer electron scattering experiments.

* supported by BMBF 06MT238

HK 6.6 Mo 15:45 H-ZO 40

In-trap decay of ^{61}Mn and Coulomb excitation of ^{61}Mn/^{61}Fe — •Jarno Van de Walle for the IS468-Collaboration — ISOLDE CERN, Geneve, Switzerland

In an explorative experiment at REX-ISOLDE, the feasibility to produce a post-accelerated beam of neutron rich iron isotopes by means of in-trap decay of neutron rich manganese isotopes was investigated. Iron isotopes are not directly accessible from the primary target, due to their long diffusion time in the primary target. The available highly selective Resonance Ionization Laser Ion Source (RILIS) [1] was utilized to produce an intense and pure beam of ^{61}Mn (half-life = 670(40) ms) isotopes. This beam was injected in the REXTRAP [2] and the EBIS (Electron Beam Ion Source) [3], where the isotopes were trapped and charge bred over extended time periods, in order to obtain a significant amount of the β^- decay daughter ^{61}Fe (half life = 5.98(6) min).

In this contribution the proof of principle of this production method at REX-ISOLDE will be given, together with the first physics results on the Coulomb excitation of ^{61}Mn and ^{61}Fe and the technical difficulties that were encountered. Some other potential candidates for in-trap decay experiments will be given. This in-trap decay of radioactive isotopes provides potentially an alternative method to produce post-accelerated beams of elements which are difficult to extract from thick ISOL targets at current and future facilities.

[1] V.N. Fedoseyev *et al.*, Hyp. Int. **127**, (200) 409.
[2] F. Ames *et al.*, Nucl. Instr. Meth. A **538**, (2005) 17.
[3] F. Wenander *et al.*, Nucl. Phys. A **701**, (2002) 528.

HK 7: Nuclear Structure and Dynamics II

Time: Monday 14:00–16:00 Location: H-ZO 50

Invited Group Report HK 7.1 Mo 14:00 H-ZO 50

Applications of in-medium chiral dynamics — •Paolo Finelli[1], Norbert Kaiser[2], Dario Vretenar[3], and Wolfram Weise[2] — [1]Physics Department, University of Bologna and INFN (Italy) — [2]Physik Department, Technische Universität München — [3]Physics Department, University of Zagreb (Croatia)

A relativistic nuclear energy density functional is developed, guided by two important features that establish connections with chiral dynamics and the symmetry breaking pattern of low-energy QCD:

a) strong scalar and vector fields related to in-medium changes of QCD vacuum condensates;

b) long- and intermediate-range interactions generated by one-and two-pion exchange, derived from in-medium chiral perturbation theory, with explicit inclusion of $\Delta(1232)$ excitations.

Applications are presented for the the description of ground-state properties and collective excitations of medium and heavy nuclei.

The extension to hypernuclei will also be presented, showing a new interpretation of the Λ-nucleus spin-orbit potential.

Work supported by MIUR and INFN (Italy) and BMBF, GSI and DFG Cluster of Excellence "Origin and Structure of the Universe"(Germany).

HK 7.2 Mo 14:30 H-ZO 50

Symmetry interaction and Many-body correlations. — •Massimo Papa — Istituto Nazionale Fisica Nucleare Catania Via. S.Sofia 64 95123 Catania (Italy)

Many-body correlations generated by the symmetry potential are spontaneusly generated in molecular dynamics approaches. The effect of these correlations on the collision dynamics at Fermi energies is discussed. In particular we show that two-body correlations generated by the symmetry potential are able to produce large effects in simple observables such as the charge distributions. A comparison with the predictions, based on EOS static calculations, is also discussed.

HK 7.3 Mo 14:45 H-ZO 50

Transformation of nuclear potentials from partial wave representation into operator representation — •Dennis Weber, Hans Feldmeier, and Thomas Neff — GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany

Realistic interactions reproduce the nucleon-nucleon scattering data and the properties of the deuteron. There exist several transformation methods to include short-range correlations for applications in many-body methods. Two of these transformation methods are the "Unitary Correlation Operator Method" (UCOM) and the "Similarity Renormalization Group Method" (SRG).

The potentials often are not given in the operator representation but by matrix elements in momentum space. However some many-body approaches like "Fermionic Molecular Dynamics" (FMD) can only use the operator representation. In this case the operator representation has to be determined from the matrix elements of the potential.

We show a method to extract the operator representation of a potential from the partial wave basis matrix elements for the UCOM- and the SRG-transformed Argonne V18 potential and to study the "nonlocality" of the interaction.

HK 7.4 Mo 15:00 H-ZO 50

Femtoscopy in nuclear dynamics — •Giuseppe Verde — INFN, Sezione di Catania, Catania, Italy

Intensity interferometry and imaging techniques will be presented as tools to probe the space-time properties of nuclear reactions [1]. Applications to p-p correlation functions measured in collisions at E/A=50-150 MeV will be shown to disentangling fast pre-equilibrium and slow evaporative emissions [1]. The profile (space-time image) of the emitting source also probes nuclear transport properties and the density dependence of the symmetry energy, relevant to both nuclear physics and astrophysics [2]. The extension of the technique to complex particles will also be discussed [3].

Correlation techniques are also used to access spectroscopic properties of unbound nuclei [4]. An application to the sequential and simultaneous decay of unbound states of ^{10}C into two protons and two alphas will be described [4]. This study shows that these techniques can provide tools to access the dynamics and spectroscopy of exotic nuclei, an interesting perspectives for future radioactive beam facilities.

[1] G. Verde et al., European Physical Journal A 30 (2006) 81; G. Verde et al., Physical Review C 65 (2002) 054609
[2] G. Verde et al., Physical Review C 67 (2003) 034606, L.W. Chen et al., Physical Review C 69 (2004) 054606

[3] G. Verde et al., Physics Letters B 653 (2007) 12
[4] W.P Tan et al., Physical Review C 69 (2004) 061304, F. Grenier et al., Nuclear Physics A 811 (2008) 233

HK 7.5 Mo 15:15 H-ZO 50

High-Density Symmetry Energy in Heavy Ion Collisions* — Vaia Prassa[1], Theodoros Gaitanos[2], Graziella Ferini[3], Maria Colonna[3], Massimo Di Toro[3], Vincenzo Greco[3], and •Hermann Wolter[4] — [1]Univ. of Thessaloniki, Greece — [2]Inst. Theor. Physics, Univ. Giessen, Germany — [3]INFN; Lab. Naz. del Sud, Catania, Italy — [4]Univ. of Munich, Munich, Germany

The density dependence of the nuclear symmetry energy is an issue of great current interest with respect to exotic nuclear structure, heavy ion collisions, neutron stars and supernovae. However, there are large differences in the predictions of theoretical models and rather few experimental constraints. This is particularly true for the symmetry energy at densities above saturation. Generally the symmetry energy is small relative to the bulk energy, and thus one has to rely on differences and ratios of observables. We discuss predictions for possible observables in relativistic heavy ion collisions, which have the potentiual of constraining the high density symmetry energy: (1) proton/neutron and light cluster flow and pre-equilibrium emission, and (2) pion and kaon production, especially yield ratios. We will particularly discuss the robustness of the predictions.

*Supported in part by DFG Cluster of Excellence "Origin and Structure of the Universe"

HK 7.6 Mo 15:30 H-ZO 50

Chiral Effective Field Theory for Nuclear Matter — •Andre Lacour[1], Jose Antonio Oller[2], and Ulf-G. Meissner[1,3] — [1]Helmholtz-Institut für Strahlen- und Kernphysik (Theorie), Universität Bonn, Nußallee 14-16, D-53115 Bonn, Germany — [2]Departamento de Fisica. Universidad de Murcia. E-30071 Murcia, Spain — [3]Forschungszentrum Jülich, Institut für Kernphysik (Theorie), D-52425 Jülich, Germany

A novel chiral power counting for nuclear matter with nucleons and pions as degrees of freedom will be presented. This allows for systematic expansion taking into account both local as well as pion-mediated inter-nucleon interactions. It also identifies some non-perturbative string of diagrams, related to NN initial and final state interactions, to be resummed. We have applied this power counting to the pion self-energy in asymmetric nuclear matter.

HK 7.7 Mo 15:45 H-ZO 50

Relativistic random-phase approximation with density-dependent meson-nucleon couplings at finite temperature — •Yifei Niu[1,2], Nils Paar[2], Dario Vretenar[2], and Jie Meng[1] — [1]State Key Lab Nucl. Phys. & Tech., School of Physics, Peking University, Beijing 100871, China — [2]Physics Department, Faculty of Science, University of Zagreb, Zagreb 10000, Croatia

The fully self-consistent relativistic random-phase approximation (RRPA) framework based on effective interactions with a phenomenological density dependence is extended to finite temperatures. The RRPA configuration space is built from the spectrum of single-nucleon states at finite temperature obtained by the temperature dependent relativistic mean field (RMF-T) theory based on effective Lagrangian with density dependent meson-nucleon vertex functions. As an illustration, the dependence of binding energy, radius, entropy and single particle levels on temperature for spherical nucleus ^{208}Pb is investigated in RMF-T theory. The finite temperature RRPA has been employed in studies of giant monopole and dipole resonances, and the evolution of resonance properties has been studied as a function of temperature. In addition, exotic modes of excitation have been systematically explored at finite temperatures, with an emphasis on the case of pygmy dipole resonances.

HK 8: Astroparticle Physics

Time: Monday 14:00–16:00 Location: H-ZO 70

Invited Group Report HK 8.1 Mo 14:00 H-ZO 70

Chasing theta-13 with the Double Chooz experiment — •Thierry Lasserre — CEA/DSM/IRFU/SPP, 91191 Gif-s-Yvette, France

Neutrino oscillation physics is entering a precision measurement area. The smallness of the theta-13 neutrino mixing angle is still enigmatic and should be resolved. Double Chooz will use two identical detectors near the Chooz nuclear power station to search for a non vanishing theta-13, and hopefully open the way to experiments aspiring to discover CP violation in the leptonic sector.

Group Report HK 8.2 Mo 14:30 H-ZO 70

Suche nach solaren Axionen mit dem CAST-Experiment — •Julia Vogel, Horst Fischer, Jürgen Franz, Elisabeth Gruber, Tillmann Guthörl, Donghwa Kang und Kay Königsmann für die CAST-Kollaboration — Albert-Ludwigs-Universität Freiburg

Das CERN Axion Solar Telescope (CAST) sucht nach solaren Axionen, die im Kern der Sonne durch den sogenannten Primakoff-Effekt erzeugt werden. Dazu verwendet CAST einen LHC Prototyp-Magneten, in dessen 9 Tesla starkem Feld Axionen in Röntgenphotonen im keV-Bereich umgewandelt werden könnten. Der Magnet kann der Sonne jeden Tag für insgesamt etwa 3 h nachgeführt werden.
Die Analyse der Daten, die mit Vakuum im Magneten während der ersten Phase des Experiments aufgenommen wurden, lieferte die bisher beste experimentelle Obergrenze auf die Axion-Photon-Kopplungskonstante $g_{a\gamma}$ für Axionmassen m_a bis etwa 0.1 eV. Um die Sensitivität des Experiments auf einen höheren Massenbereich auszudehnen, hat CAST die Suche nach Axionen mit Helium im Magneten fortgesetzt. Für einen festen He-Druck ist die Kohärenz zwischen Axionen und Photonen bei einer bestimmten Axionmasse erfüllt und man erreicht eine maximale Sensitivität. Im ersten Teil dieser zweiten Phase, bei dem ^{4}He-Gas verwendet wurde, konnte der Massenbereich bis 0.39 eV abgedeckt werden und das Experiment dringt in von Axionmodellen bevorzugte Regionen im Axion-Phasenraum ($g_{a\gamma}$ vs. m_a) ein. Mit ^{3}He wird derzeit der Massenbereich für Axionen weiter ausgedehnt. In diesem Vortrag werden die Ergebnisse der ^{4}He-Phase vorgestellt und vorläufige Resultate der ^{3}He-Phase präsentiert.

HK 8.3 Mo 15:00 H-ZO 70

Simulations of the entrance and exit regions of the KATRIN main spectrometer — Ferenc Glück[2], •Karen Hugenberg[1], Kathrin Valerius[1], Christian Weinheimer[1], and Michael Zacher[1] for the KATRIN-Collaboration — [1]IKP, WWU Münster — [2]IEKP, Universität Karlsruhe

The KArlsruhe TRItium Neutrino experiment aims to determine the electron neutrino mass m_{ν_e} with a sensitivity of 0.2 eV (90 % C.L.) by measuring the shape of the endpoint of the tritium β-spectrum. For this measurement a high resolution spectrometer on the basis of magnetic adiabatic collimation in combination with an electrostatic filter is under construction. It has a diameter of 10 m and a length of 24 m. To reduce background arising in the surface material due to cosmic muons and intrinsic radioactivity, a wire electrode with sub-mm wire diameters will be installed to screen the sensitive spectrometer volume from background electrons. The impact of this wire electrode on the performance of the spectrometer has been studied using a dedicated computer code based on the boundary element method.

This contribution focuses on design simulations for the critical entrance and exit regions of the spectrometer. Different background effects such as particle storage in Penning traps and high electric field strength are discussed. Their avoidance while preserving the intrinsic properties of the spectrometer is essential to reach the desired sensitivity of the experiment. The design has been finalized and the construction of the electrode system is in progress.

This work is financed by the BMBF under code 05A08PM1.

HK 8.4 Mo 15:15 H-ZO 70

Assembly and production of the wire electrode for the KATRIN-Experiment — Sebastian Benning, Volker Hannen, •Björn Hillen, Hans-Werner Ortjohann, Matthias Prall, Christian Weinheimer, and Michael Zacher for the KATRIN-Collaboration — Institut für Kernphysik, Universität Münster

The KArlsuhe TRItium Neutrinomass-Experiment allows the determi-

nation of the electron antineutrino with a sensitivity of 0,2 eV (95% C.L.). This parameter is important for cosmology and particle phyics and can be determined in a model-independent way from a measurement of the endpoint region of the Tritium beta-spectrum. The central part of the experiment, a 23 m long spectrometer with a diameter of 10 m, is based on the principle of a MAC-E-filter. On the inner surface of the spectrometer vessel a double layer wire electrode will be installed, which on one hand reduces the background generated by the cosmic radiation and radioactive isotops in the vessel material and one the other hand adjusts the electric field. The wire electrode has a modular design. Overall 248 modules are produced with high precision in Münster under cleanroom conditions. The talk gives an overview of the functionality and the production of the wire electrode modules and an outline of the actual production status. This project is supported by BMBF under contract number 05A08PM1.

HK 8.5 Mo 15:30 H-ZO 70

Der Double Chooz Szintillator — Christoph Aberle, •Christian Buck, Francis Xavier Hartmann, Manfred Lindner, Stefan Schönert und Ute Schwan — MPIK Heidelberg

Mit dem neuen Reaktorneutrinoexperiment Double Chooz sollen grundlegende Erkenntnisse über einen der Mischungsparameter bei Neutrinooszillationen, Θ13, gewonnen werden. Zum effektiveren Nachweis des in der Neutrinoreaktion freiwerdenden Neutrons wird dem im Experiment verwendeten Flüssigszintillator Gadolinium (Gd) beigemischt. Die bisher in Reaktorneutrinoexperimenten verwendeten Gd-beladenen Flüssigszintillatoren waren bezüglich der Langzeitstabilität der optischen Eigenschaften limitiert. Um die hohen Anforderungen des Experiments an die metallbeladene Flüssigkeit erfüllen zu können, wurde deshalb eigens ein neuer Gd-Szintillator entwickelt.

Die notwendige Löslichkeit des Gd in der organischen Szintillatorbasis erreicht man hier, indem man es in einen metallorganischen ß-Diketon Komplex einbindet. Die speziellen chemischen Eigenschaften eines solchen Komplexes gewährleisten Stabilität, sowie optische und radiochemische Reinheit. Im Vortrag werden die relevanten Eigenschaften der Flüssigkeit beschrieben und der aktuelle Stand der Double Chooz Szintillatorproduktion dargestellt. Einer der beiden Double Chooz Detektoren soll noch im Laufe des Jahres 2009 gefüllt werden.

HK 8.6 Mo 15:45 H-ZO 70

Photomultiplierkalibrationen für das Reaktorneutrinoexperiment Double Chooz — Christian Bauer[1], Klaus Jänner[1], •Florian Kaether[1], Conradin Langbrandtner[1], Manfred Lindner[1], Sebastian Lucht[2], Stefan Schönert[1], Anselm Stüken[2] und Christopher Wiebusch[2] — [1]MPI für Kernphysik Heidelberg — [2]RWTH Aachen

Die inneren Detektoren des Double Chooz Reaktorneutrinoexperiments werden jeweils von 390 Photomultipliern observiert um Lichtpulse von neutrinoerzeugten Ereignissen im Szintillatorvolumen aufzuzeichnen. Rund 800 PMTs mussten im Vorfeld getested und kalibriert werden, um eine möglichst gute Kenntnis über die Eigenschaften und das Verhalten der Detektoren zu erlangen. Für diese Kalibrationen wurde am MPI für Kernphysik in Heidelberg in Zusammenarbeit mit der RWTH Aachen ein Teststand aufgebaut, der eine gleichzeitige Eichung von 30 PMTs ermöglicht. Diese beinhaltet die Bestimmung der nominellen operativen Hochspannung, Dunkelrate, Sensitivität, Eigenschaften von einzelnen Photo-Elektronen und lineares Verhalten bei höheren Lichtintensitäten, zeitlicher Signalverlauf u.a. Der Vortrag gibt einen Überblick über den Aufbau und die Testergebnisse.

HK 9: Accelerators and Instrumentation I

Time: Monday 14:00–16:00 Location: H-ZO 80

Group Report HK 9.1 Mo 14:00 H-ZO 80

Event reconstruction and analysis in the CBM experiment — •Volker Friese for the CBM-Collaboration — GSI Darmstadt

The Compressed Baronic Matter (CBM) experiment, being developed for operation at the future FAIR facility in Darmstadt, will investigate nuclear collisions at unprecedented interaction rates of up to 10 MHz, which will give access to extremly rare probes like charm production near threshold. Fast, efficient and precise algorithms for both online and offline reconstruction are required to achieve the physics goals of CBM. We will discuss the current approaches to various aspects of event reconstruction in CBM, such as track reconstruction in the main tracking system (STS), reconstruction of displaced vertices of open charm, pattern recognition in the RICH detector, and shower reconstruction in the EM calorimeter. Selected results of feasibility studies for physics observables based on these algorithms will be presented as well.

HK 9.2 Mo 14:30 H-ZO 80

Reconstruction performance of the ALICE Transition Radiation Detector — •Markus Fasel[1,2], Anton Andronic[1], and Bercuci Alexandru[1] for the ALICE-TRD-Collaboration — [1]GSI, Planckstr. 1, 64291 Darmstadt — [2]Technische Universität Darmstadt, Hochschulstraße 12, 64289 Darmstadt

The Transition Radiation Detector(TRD) is an important component of the ALICE experiment at LHC. With tracking and particle identification capabilities, the TRD will contribute significantly to the measurement of quarkonia, open heavy flavours, and jets. During the commissioning of the LHC in the fall of 2008 cosmic-ray data were taken with the ALICE setup including four supermodules of the Transition Radiation Detector. We present the results on the reconstruction performance of the TRD obtained with cosmic-rays. We focus on the position resolution and the accuracy of matching with the Time Projection Chamber.

HK 9.3 Mo 14:45 H-ZO 80

Study of the effect of data compression on the position resolution of the ALICE TRD — •Svenja Wulff for the ALICE-TRD-Collaboration — Institut für Kernphysik, WWU Münster, Germany

The Transition Radiation Detector (TRD) of ALICE at the Large Hadron Collider consists of 540 Xe gas-filled drift chambers with a total active area of roughly 700 m^2 read out via 1.2 million electronic channels. To keep the readout time as short as possible and to optimize the usage of mass storage the data is compressed on the fly. One method is the so-called 'zero suppression'. The Tracklet Processing Chip is the component of the TRD front-end electronics and performs digital filtering of the raw data including baseline subtraction, tail cancellation and corrections of gain variations. For the purpose of zero suppression it is equipped with a mechanism to mark channels for read out based on three criteria to avoid that channels are read out containing fluctuations around the baseline only.

A systematic study of the effect of zero suppression with various sets of criteria on the event size and on the position resolution of the read out chambers will be presented. Cosmic rays have been used for this study.

HK 9.4 Mo 15:00 H-ZO 80

The ALICE High-Level Trigger — •Jochen Thäder for the ALICE-HLT-Collaboration — Kirchhoff-Institut für Physik, Universität Heidelberg

The High-Level Trigger (HLT) for the heavy ion experiment ALICE is a PC cluster of several 100 nodes, which has to reduce the data rate of up to 25 GB/s to at most 1.25 GB/s before permanent storage. For the ongoing commissioning of the ALICE detector and the first year LHC injection tests, the HLT has installed the first 100 nodes, consisting of a group of front-end processor nodes which receive the data from the front-end electronics and a group of computing nodes, as well as the HLT management infrastructure.

During the ALICE commissioning in 2008, the HLT itself was commissioned as a part of of the whole ALICE data-taking system. It was performing online first and second level reconstruction, online data compression and calibration as well as providing online event visualization for the DiMuon, PHOS, SDD, TPC and TRD detectors. Online raw data compression and reconstruction for SDD and PHOS detectors were performed during the first LHC runs.

The experiences made during the commissioning of the HLT itself, the ALICE cosmic runs as well as the first LHC runs will be presented in this talk.

Work on the ALICE High-Level Trigger has been financed by the German Federal Ministry of Education and Research (BMBF) as

part of its program "Förderschwerpunkt Hadronen- und Kernphysik - Großgeräte der physikalischen Grundlagenforschung".

HK 9.5 Mo 15:15 H-ZO 80

Exploiting Virtualisation at Alice HLT — •Stefan Boettger, Volker Lindenstruth, and Udo Kebschull for the ALICE-HLT-Collaboration — Kirchhoff-Institut für Physik, Heidelberg

The Alice HLT cluster is a computing farm intended to do on-line event processing for the ALICE Experiment at CERN. It is known that at run-time of the experiment there are phases where few or no data is available for processing. The same applies for maintenance cycles of both the experiment and the cluster. With respect to the costs of maintaining and running such a cluster there is the need to maximize the usage of this computing facility. Therefor the usage of those idle times with third-party off-line physics computations was proposed. To satisfy the constraints of on-line and off-line applications and to avoid interferences, the usage of os virtualisation has been evaluated. Moreover, a comparison between Vmware-Server and Xen concerning system-level performance and usability was done. Results show Xen to be superior to Vmware-Server regarding general performance measurements, yet being more complicated to install and maintain. It could be shown that os virtualisation is a feasible way of using idle cycles, avoiding application interferences and maximizing cluster usage by suspending and migrating of virtual systems. A future extension based on automated switching between on-line and off-line data processing using the SysMES cluster management framework is proposed.

HK 9.6 Mo 15:30 H-ZO 80

Upgrade of the HADES data acquisition system — •Marek Palka for the HADES-Collaboration — Jagiellonian University, Cracow, Poland — Gesellschaft für Schwerionenforschung, Darmstadt, Germany

Next years HADES will be moved to the upcoming FAIR accelerator complex. Here, HADES-at-FAIR will continue its experimental program. Due to mentioned future plans, the detector undergoes an upgrade. In order to be able to take the data in the Au+Au collision system at 8 GeV/u with a sustained trigger rate of 20 kHz (in peak 100 kHz) and expected average amount of the data 300 MB/s, our trigger and readout system has to be improved. A major part of the new DAQ system is the general-purpose Trigger and Readout Board (TRB), which serves as a platform for all other subsystems. To broaden the spectrum of possible applications, in the future DAQ-systems, we added a very high data-rate digital interface connector to this board (15 Gbit/s). It gives the possibility to mount an add-on boards to the TRB. The add-on boards then provide the detector-specific interfaces (special connectors) or FEE (like ADCs) and additional computing resources (FPGAs). All required add-on modules for the HADES-at-FAIR upgrade have been built and their basic functionality has been tested. The major steps of the upgrade program will be shown in several parts : overview of the general DAQ concept, general readout platform, readout electronics for our detectors (add-ons), new event building concept, slow control, trigger distribution system and moreover also a part of the front-end electronics.

HK 9.7 Mo 15:45 H-ZO 80

TrbNet - The Trigger and Readout Network for the HADES experiment — •Jan Michel[1], Michael Böhmer[3], Ingo Fröhlich[1], Marek Palka[4], Joachim Stroth[1,2], Attilio Tarantola[2], and Michael Traxler[2] for the HADES-Collaboration — [1]Institut für Kernphysik, Goethe-Universität, Germany — [2]GSI, Darmstadt, Germany — [3]TU München, Germany — [4]Jagiellonian University, Krakow, Poland

The HADES experiment is currently undergoing a rebuilt of the data readout system. Here, boards equipped with freely configurable FPGAs and high bandwidth data links have been designed. In this context, a new trigger distribution and data transportation protocol has been developed.

The main features are a fast and reliable data transport as well as a wide range of configuration options to adapt to the special needs of each subsystem. All boards will be accessible independently to allow for extensive controlling and monitoring features. Since the same network will be used for both trigger distribution and data transport, special care had to be taken to deliver trigger signals to the whole network within a few microseconds to keep the deadtime of the detector low.

In this contribution the concept and structure of the protocol is presented. Work supported by EU under the contracts CNI (515876) and the BMBF.

HK 10: Accelerators and Instrumentation II

Time: Monday 14:00–16:00 Location: H-ZO 90

Group Report HK 10.1 Mo 14:00 H-ZO 90

PENeLOPE: progress towards a new precise neutron lifetime measurement — •Rüdiger Picker, Igor Altarev, Beatrice Franke, Erwin Gutsmiedl, Joachim Hartmann, Stefan Materne, Axel Müller, Stephan Paul, Rainer Stoepler, and Christian Tietze — Technische Universität München, Physik Department

The neutron lifetime τ_{n} allows access to fundamental parameters of the weak interaction. Therefore, a precise knowledge of τ_{n} provides direct tests of the Standard Model of particle physics. Moreover, a precise knowledge of the neutron lifetime is important for astrophysical models. However, recent results disagree with the PDG value of 885.7 ± 0.8 s by roughly 6σ. To resolve this discrepancy, we are developing an experiment with a superconducting magnetic trap for ultracold neutrons (UCN) at Technische Universität München. The UCN will be trapped in a multipole field with a flux density of up to 2 T and will be additionally bound to the top by gravitation. This makes extraction and detection of the decay protons possible and allows a direct measurement of the neutron decay rate. The envisaged precision of $\Delta\tau_{\mathrm{n}} < 0.1$ s demands very long storage lifetimes and a good handle on systematic effects.. Several measures are taken to avoid these effects or investigate their influence on the extracted lifetime value extensively. The big storage volume of around 700 dm^3 and the expected high neutron flux of the UCN source at the FRMII give more than 10^7 neutrons per filling of the storage volume. The talk will report on the measurement principle and the current status of the setup. Supported by MLL, DPG and the excellence initiative EXC 153.

HK 10.2 Mo 14:30 H-ZO 90

On the release of 83mKr — •Makhsud Rasulbaev[1], Reiner Vianden[1], Karl Maier[1], Henrik Arlinghaus[2], Marcus Beck[2], Tim Schäfer[2], Christian Weinheimer[2], and Miroslav Zboril[2] for the KATRIN-Collaboration — [1]HISKP der Universität Bonn, Bonn, Germany — [2]Institut für Kernphysik der Universität Münster, Münster, Germany

The mono-energetic electrons with the kinetic energy of 17.8 keV from ^{83m}Kr ($t_{1/2} = 1.83$ h), daughter isotope of ^{83}Rb decay, are exploited for the calibration and monitoring of the main spectrometer voltage in the KATRIN experiment, which of utmost importance for the long term stability of the measurements. Until now there were problems with the release of ^{83m}Kr out of ^{83}Rb source. It was investigated how heating of the Rb source, following vacuum evacuation of the volume can improve the release of ^{83m}Kr.

HK 10.3 Mo 14:45 H-ZO 90

Further development of the precision HV divider for the KATRIN experiment — •Stephan Bauer, Frank Hochschulz, Stephan Rosendahl, Matthias Prall, and Christian Weinheimer for the KATRIN-Collaboration — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster

To determine the mass of the $\overline{\nu_e}$ with a sub-eV sensitivity the KATRIN-(KArlsruhe TRItium Neutrino-) experiment measures the tritium β spectrum in the endpoint region using a MAC-E type spectrometer. To reach the desired sensitivity the retarding potential of the MAC-E-filter of -18.6 kV must be monitored with a precision of 3 ppm. For that purpose a precision high voltage divider for voltages of up to 30 kV was developed in cooperation with the PTB (Physikalisch-Technische Bundesanstalt) Braunschweig. This first divider has been proven to deliver the necessary accuracy and stability.

For redundancy reasons and as a replacement during the calibration periods a second high voltage divider was developed based upon the

experience gained from the first divider. The main goal of the development of the second divider was the improvement of the longterm stability and to expand the possible field of application to other experiments. In this talk the improvements of the second divider are shown along with calibration results obtained at the PTB.

This project is supported by BMBF under contract number 05A08PM1.

HK 10.4 Mo 15:00 H-ZO 90

A large-area low-temperature proton detector for the neutron lifetime experiment PENeLOPE — •Christian Tietze, Igor Altarev, Heinz Angerer, Beatrice Franke, Erwin Gutsmiedl, Joachim Hartmann, Stefan Materne, Axel Reimer Mueller, Stephan Paul, and Rüdiger Picker — Physik-Department, Technische Universität München

The neutron lifetime τ_n is a quantity very important for fundamental physics and cosmology. The new experiment PENeLOPE shall determine τ_n by trapping ultra-cold neutrons in a magnetic multipole field and by gravitation. Their lifetime will be determined precisely by both, counting the remaining neutrons after one storage period and online measurements of the time distribution of the decay protons. It is planned to use a scintillation counter as proton detector; it shall consist of a thin CsI layer evaporated on a UV-transparent light guide. The signals will be read out with large-area avalanche photodiodes (LAAPDs). As the whole arrangement is situated next to superconducting coils of PENeLOPE, the detector has to work at high magnetic fields and cryogenic temperatures. Extensive investigations were performed to prove the feasibility of the setup. The gain of two different types of LAAPDs was measured down to 25 K and found to be nearly constant. Additionally, the temperature dependent light output of CsI was measured as well as its behaviour after exposition to humid air. The talk will cover further developments of the detector concept as well as its integration into the PENeLOPE cryostat. This work is supported by MLL, DFG and by the Cluster of Excellence EXC 153.

HK 10.5 Mo 15:15 H-ZO 90

A high Resolution Phoswich detector: LaBr3(Ce) coupled with LaCl3(Ce) — •Mariano Carmona Gallardo[1], Jose Antonio Briz Monago[1], Olof Tengblad[1], Manuela Turrion Nieves[1], Vincent Guglielmina[1], and Bilal El Bakkari[2] — [1]IEM-CSIC, Madrid, Spain — [2]Dep. of Physics, Rabat, Marocco

The gamma calorimeter CALIFA which is to surround the Target position of the R3B experiments at FAIR is to detect high energy gammas and protons emitted in Nuclear Reactions at Relativistic Energies.

In the design of CALIFA's forward cap an innovative solution using two scintillating crystals stacked together one after the other in a so called Phoswich configuration is being considered. Simulations show that the gamma deposit most of the energy in the vicinity of the first impact and this with high probability happens already in a few cm of material. Combining two materials one could thus distinguish at what depth the impact happens; use a first short crystal of a high resolution material followed by a longer piece of a less expensive material. The second layer is used to fully absorb the gamma energy or in the case of first hit in the second layer to veto that specific event.

For protons, two layers detector is also useful in order to determine the initial energy. It is possible to determine the initial energy by the energy loss in two shorter crystals.

We report here on results that has been obtained with a Phoswich detector made from 30 mm long LaBr3(:Ce) stacked with 50 mm long LaCl3(:Ce) crystals in a cylindrical configuration of 20 mm diameter.

HK 10.6 Mo 15:30 H-ZO 90

Development of a Time-of-Flight Detector System for Isochronous Mass Spectrometry at FAIR — •Natalia Kuzminchuk[1,2], Hans Geissel[1,2], Ronja Knöbel[1,2], Christophor Kozhuharov[2], Serguei Litvinov[2], Yuri Litvinov[2], Wolfgang Plass[1,2], Christoph Scheidenberger[1,2], Baohua Sun[2], and Helmut Weick[2] — [1]Justus-Liebig Universität Gießen, Germany — [2]GSI, Darmstadt, Germany

At the FAIR facility, the projectile fragment separator Super-FRS will provide beams of exotic nuclei with unprecedented intensity. The new Collector Ring (CR) is optimized to accept the large-emittance secondary beams provided by the Super-FRS. High-precision mass measurements of exotic nuclei with life times as short as a few tens of microseconds will be performed with Isochronous Mass Spectrometry (IMS) at the CR.

For these measurements a dual detector system is under development. In the detectors, ions passing a thin carbon foil release secondary electrons, which are transported to microchannel plates by electric and magnetic fields. The time dispersion in the electron flight due to the velocity spread of the secondary emission electrons and the initial spatial distribution on the foil was investigated. The influence of the MCP dead time on the rate capability of the detectors was examined. An initial design of a new detector will be presented, which incorporates corresponding improvements in timing performance, rate capability and includes position-sensitive detection for beam tracking.

HK 10.7 Mo 15:45 H-ZO 90

A Multiple-Reflection Time-of-Flight Isobar Separator and Mass Spectrometer (MR-TOF-MS) for the LEB at FAIR — •Timo Dickel[1], Wolfgang R. Plass[1,2], Arno Becker[1], Ulrich Czok[1], Hans Geissel[1,2], Christian Jesch[1], Martin Petrick[1], Christoph Scheidenberger[1,2], André Simon[1], and Mikhail I. Yavor[3] — [1]Justus-Liebig-Universität Gießen — [2]GSI, Darmstadt — [3]Inst. for Analytical Instrum., Russian Academy of Sci., St. Petersburg

At the LEB of the Super-FRS at FAIR, precision measurements of very short-lived nuclei will be performed. For these experiments (MATS, LASPEC), the nuclei have to be stopped, cooled, separated and measured fast and efficiently. To achieve this goal, a multi-purpose, non-scanning mass spectrometer with single-ion sensitivity, a multiple-reflection time-of-flight mass spectrometer, has been developed.

It will be positioned behind the gas-filled stopping cell at the LEB, where it can be used as a broadband mass spectrometer, an isobar separator or a high-precision mass spectrometer. The broadband mode will be used for optimization of the range and range-compression in the Super-FRS and the stopping and extraction from the gas cell. Isobaric contamination that is produced by secondary reactions in the degraders or by charge-exchange reactions in the gas cell can be orders of magnitude larger than the ions of interest. To remove these ions, the isobar separator mode is required, in which up to 10^7 isobaric ions/s can be handled. The high-precision mode enables measurements with an accuracy of 10^{-6} to 10^{-7} in about 2 ms. In this contribution the basic characteristics and performance of the device will be presented.

HK 11: Few-body physics

Time: Monday 14:00–16:00 Location: H-ZO 100

Invited Group Report HK 11.1 Mo 14:00 H-ZO 100

Theory of three- and four-body scattering — •Arnoldas Deltuva — Centro de Fisica Nuclear, University of Lisbon, Portugal

Few-body nuclear reactions are described in the framework of Alt, Grassberger, and Sandhas equations that are Faddeev-like integral equations. The Coulomb interaction between charged particles is included using the method of screening and renormalization. Momentum-space partial-wave basis is used for solving those equations. Results are obtained for proton-deuteron elastic scattering and breakup, electromagnetic disintegration of 3He, low-energy four-nucleon elastic and transfer reactions, and for direct nuclear reactions dominated by three-body degrees of freedom, e.g., d+4He, d+12C, and p+11Be.

HK 11.2 Mo 14:30 H-ZO 100

Deuteron-Proton Breakup as a Probe of Three-Nucleon System Dynamics — •Stanislaw Kistryn[1], Elzbieta Stephan[2], and Nasser Kalantar-Nayestanaki[3] — [1]Jagiellonian University, PL-30059 Krakow, Poland — [2]University of Silesia, PL-4007 Katowice, Poland — [3]Kernfysisch Versneller Instituut, NL-9747 Groningen,

Modern nucleon-nucleon (NN) interaction models can be probed quantitatively in the three-nucleon (3N) environment by means of rigorous technique of solving the Faddeev equations and comparing the calculated observables with the measured ones. It has been found that a

proper description of the experimental data cannot be achieved with the use of NN forces alone. This indicates a necessity of including additional dynamics: subtle effects of suppressed degrees of freedom, introduced by means of genuine 3N forces. Also other contributions (Coulomb force, relativistic effects) have to be taken into account.

A large set of high precision, exclusive cross-section data for the ^{1}H($\vec{\text{d}}$,pp)n breakup reaction at 130 MeV deuteron energy, contribute significantly to constrain the physical assumptions underlying the theoretical interaction models. Comparison of nearly 1800 cross-section data points with the predictions using nuclear interactions generated in various ways (semi-phenomenological meson exchanges, coupled barion channels approach, chiral perturbation theory), allowed to establish for the first time a clear evidence of importance of the 3N forces in the breakup process. Moreover, the results confirmed predictions of sizable Coulomb force influences in this reaction. Studies on the importance of the relativistic effects are under way.

HK 11.3 Mo 14:45 H-ZO 100

Analyzing Powers of the Deuteron-Proton Breakup in a Wide Phase Space Region — •Elzbieta Stephan[1], Stanislaw Kistryn[2], and Nasser Kalantar-Nayestanaki[3] — [1]University of Silesia, PL-4007 Katowice — [2]Jagiellonian University, PL-30059 Krakow — [3]Kernfysisch Versneller Instituut, NL-9747 Groningen

Deuteron-proton breakup can serve as a very rich testing ground for modern calculations based on model nucleon-nucleon interactions and including also subtle effects of the so-called three-nucleon force (3NF). In the case of experiment exploring a significant part of the phase space, data obtained for continuum of final states constitute a large base for comparisons with theoretical predictions. Moreover, studies with transversally polarized deuterons give access to two vector and three tensor analyzing powers, some of which vanish in the case of the elastic scattering process.

A dedicated experiment has been performed at KVI Groningen, with the use of 130 MeV polarized deuteron beam and high acceptance position-sensitive detection system. About 800 data points have been analyzed for each spin observable: vector A_x, A_y and tensor A_{xx}, A_{xy}, A_{yy} analyzing powers of the ^{1}H($\vec{\text{d}}$,pp)n breakup reaction. Theoretical predictions generally describe analyzing power data quite well and the quality of description provided by various approaches is rather similar. There are, however, configurations where the agreement between the data and theory is not so satisfactory. These discrepancies are not always cured by inclusion of 3NF, what indicates incompleteness of the treatment of the spin part of three nucleon system dynamics.

HK 11.4 Mo 15:00 H-ZO 100

The MAX-lab tagged photon facility — •Lennart Isaksson — MAX-lab, Lund University, Sweden

The tagged photon facility at MAX-lab in Lund, Sweden has recently been upgraded to higher energy. The present facility consists of a ∼200 MeV linac followed by a pulse stretcher ring. The extracted electron beam (∼50% duty factor) is used to generate a bremsstrahlung beam and photons are tagged by a choice of two different tagging spectrometers, optimized for different energy regions. The tagged photon range may presently be chosen between 15 MeV and 185 MeV. The energy resolution is typically ∼0.5 MeV and the tagged intensity is $\sim 10^6$ MeV^{-1} s^{-1}. The available energy may increase somewhat in the near future.

The initial experimental programme includes Compton scattering on deuterium using very large NaI detectors, (γ,π^+) measurements using both solid-state and scintillator set-ups, and tests of electromagnetic calorimeter elements for the PANDA detector. Initial tests have been performed on total absorption cross-section measurements on ^{4}He, using an active target, and on ^{6,7}Li. A linearly polarized photon beam from coherent bremsstrahlung is being commissioned.

The MAX-lab tagged photon facility will be presented and an overview of the present experimental programme given.

HK 11.5 Mo 15:15 H-ZO 100

Ab-initio longitudinal response function of 4He — •Sonia Bacca[1], Nir Barnea[2], Winfried Leidemann[3], and Giuseppina Orlandini[3] — [1]TRIUMF, Vancouver, B.C., Canada — [2]Racah Institute of Physics, Hebrew University, Jerusalem, Israel — [3]Dipartimento di Fisica, Universita' di Trento and INFN, Italy

We report on our recent ab-initio calculation of the inclusive longitudinal electron scattering off 4He with two- and three-nucleon forces [1]. The full four-body continuum dynamics is considered exactly via the Lorentz integral transform method. We show results for various kinematics up to q=500 MeV/c and compare it with available experimental data. The great importance of the final state interaction is demonstrated. The plane wave impulse approximation particularly fails in the quasi-elastic peak at low energies. The effect of the three-nucleon force results in the reduction of the quasi-elastic peak by 10% for momentum transfers q between 300 and 500 MeV/c. A good agreement with experimental data is found in the peak region. Only at q=500 MeV/c some discrepancies between theory and experiment are present in the low- and high-energy range. Interestingly, the effect of the three-nucleon force increases significantly at lower q, up to about 40% at q=100 MeV/c. Our findings suggest that the longitudinal response function is an electromagnetic observable, where one can learn about the not yet well established three-nucleon force. Unfortunately, at low momentum transfer experimental data are still missing.

[1] S. Bacca, N. Barnea, W. Leidemann, G. Orlandini, arXiv:0811.4624.

HK 11.6 Mo 15:30 H-ZO 100

Recent results for trinucleon transverse response functions using the LIT method — •Edward L. Tomusiak[1], Victor D. Efros[2], Winfried Leidemann[3,4], and Giuseppina Orlandini[3,4] — [1]Dept. of Physics and Astronomy, University of Victoria, Victoria, BC V8P 1A1, Canada — [2]Russian Research Centre "Kurchatov Institute", 123182 Moscow, Russia — [3]Dipartimento di Fisica, Universita' di Trento, Via Sommarive 14, 38100 Trento, Italy — [4]Istituto Nazionale di Fisica Nucleare, Gruppo Collegato di Trento

The ^{3}He and ^{3}H electron scattering transverse response functions $R_T(q,\omega)$ are calculated using the AV18 nucleon-nucleon potential and the UrbanaIX three-body force. The transition to continuum states is treated ab initio via the Lorentz Integral Transform (LIT) method [1]. The electromagnetic interactions include exchange currents. Their construction is unambiguous for boson exchange potentials, but require a prescription for "phenomenological" forces. Since the calculation is carried out in coordinate space the Arenhövel-Schwamb technique [2] is used for constructing consistent π- and ρ-like exchange currents for the AV18 potential. Theoretical results are compared to existing experimental data [3] in the threshold region at q=0.0882, 1.64 and 2.47 fm^{-1}, both for ^{3}He and ^{3}H.

[1] V.D. Efros, W. Leidemann, and G. Orlandini, Phys. Lett. B 338, 130 (1994).
[2] H. Arenhövel and M. Schwamb, Eur. Phys. J. A, 12, 207 (2001).
[3] G. A. Retzlaff et al. Phys. Rev. C49, 1263 (1994).

HK 11.7 Mo 15:45 H-ZO 100

pions in nuclei — •leila joulaeizadeh[1], jose bacelar[1], igor gašparić[2], and herbert löhner[1] — [1]KVI, University of Groningen, Groningen, The Netherlands — [2]Ruder Bošković Institute, Zagreb, Croatia

The role of pions in nuclei has been studied in pionic fusion, a highly coherent process in which two nuclei fuse to a united nucleus. The available center-of-mass energy is emitted in the pion channel. This production mechanism is sensitive to the pion-nucleon interaction and the structure of the fused nuclei, in particular to their cluster components. The experiment exploits the two-photon decay of neutral pions and provides the exclusive cross sections for the $^4He(^3He,\pi^0)^7Be$ and $^6Li(^4He,\pi^0)^{10}B$ reactions at energies just above the coherent production threshold. The pion angular distributions and their dependence on the fused system mass reflect the importance of the cluster substructure of nuclei and the pion interaction in nuclei.

[1] L. Joulaeizadeh et al., Pionic Fusion Experiments at Subthreshold Energies, AIP proceedings, Carpathian Summer School of Physics 2007, 475 (2008), ISBN 978-0-7354-0490-8.

HK 12: Heavy Ion Collisions and QCD phases

Time: Monday 16:30–19:00 Location: H-ZO 10

Invited Group Report HK 12.1 Mo 16:30 H-ZO 10

Recent lattice results on the QCD phase diagram — •Sandor Katz — Eotvos University, Budapest, Hungary

Recent results on lattice QCD thermodynamics will be reviewed. The transition temperature, equation of state and the curvature of the phase diagram will be presented. Results from different collaborations will be compared to each other.

Group Report HK 12.2 Mo 17:00 H-ZO 10

Phases of QCD, role of strangeness and PNJL model with $2+1$ flavors — •Thomas Hell, Nino Bratovic, Marco Cristoforetti, Simon Rössner, and Wolfram Weise — Physik-Department, Technische Universität München, D-85747 Garching, Germany

We investigate the QCD phase diagram within a three-flavor Nambu and Jona-Lasinio (NJL) model including the Polyakov loop as an order parameter for the confinement-deconfinement transition. Of particular interest is the impact of diquark condensation and color superconducting phases in the high-density region.

Furthermore, we present a nonlocal covariant extension [1] of the three-flavor NJL model, with built-in constraints from the running coupling of QCD at high-momentum and instanton physics at low-momentum scales. The momentum-dependent dynamical quark mass derived from this approach is in agreement with results from Dyson-Schwinger equations and lattice QCD. At finite temperature, the inclusion of the Polyakov loop and its gauge invariant coupling to quarks reproduces the dynamical entanglement of the chiral and deconfinement crossover transitions as in the (local) PNJL model, but now without the requirement of introducing an artificial momentum cutoff. Steps beyond the mean-field approximation are made including mesonic correlations through quark-antiquark ring summations.

[1] T. Hell et al., arXiv:0810.1099, Phys. Rev. **D** (2008), in print.

Work supported by BMBF, GSI, the DFG Excellence Cluster "Origin and Structure of the Universe" and by the Elitenetzwerk Bayern.

HK 12.3 Mo 17:30 H-ZO 10

Quarkyonic matter and chiral symmetry breaking in the Nambu-Jona–Lasinio model with Polyakov loops in large N_c — •Chihiro Sasaki[1], Larry McLerran[2], and Krzysztof Redlich[3] — [1]Dep. of Physics, Technische Universitaet Muenchen, Garching, Germany — [2]Dep. of Physics, Brookhaven National Laboratory, Upton, USA — [3]Institute for Theoretical Physics, University of Wroclaw, Wroclaw, Poland

The appearance of a new phase in dense QCD, quarkyonic matter, in the limit of large number of colors is studied within Nambu–Jona-Lassinio model coupled to Polyakov loops. The interplay of this novel phase with the chiral symmetry restoration and color deconfinement is discussed.

The model describes 3 phases (chirally broken, quarkyonic and chirally restored) in the confined phase. We show that in large N_c the phase diagram coincides with the one conjectured by McLerran and Pisarski. The N_c-dependence of chiral critical end point is also discussed.

The work of C. S. has been supported in part by the DFG cluster of excellence "Origin and Structure of the Universe".

HK 12.4 Mo 17:45 H-ZO 10

Shear viscosity and out of equilibrium dissipative hydrodynamics — •Andrej El, Zhe Xu, and Carsten Greiner — Goethe Universität Frankfurt am Main

We compare the solution of Israel-Stewart equations in (0+1) dimensions for a system with ongoing chemical equilibration to the results of calculations by microscopic partonic cascade BAMPS with pQCD $2 \leftrightarrow 2$ and $2 \leftrightarrow 3$ processes implemented. The shear viscosity coefficient needed to solve IS equations is calculated by an expression, which is derived from kinetic theory using Grad's method. We demonstrate an agreement between the viscous hydrodynamic calculations and the microscopic transport results on η/s, except when employing a small α_s. At $\alpha_s = 0.3$ we obtain $\eta/s \approx 0.18$. On the other hand we demonstrate that for such small α_s the gluon system is far from kinetic and chemical equilibrium, which indicates the break down of hydrodynamics. The comparison of dissipative hydrodynamic and BAMPS calculations shows the importance of chemical equilibration: without an ongoing chemical equilibration the system evolves faster to a state where hydrodynamics becomes invalid.

HK 12.5 Mo 18:00 H-ZO 10

Suppression of forward dilepton production from an anisotropic QGP — •Mauricio Martinez[1] and Michael Strickland[2] — [1]Helmholtz Reseach School and FIAS, Ruth-Moufang-Str. 1 60438, Frankfurt am Main, Germany — [2]Department of Physics, Gettysburg College, Gettysburg, PA 17325

We calculate the rapidity dependence of leading-order medium dilepton yields resulting from a quark-gluon plasma which has a local time-dependent anisotropy in momentum space. We present a phenomenological model which includes temporal evolution of the plasma anisotropy parameter, ξ, and the hard momentum scale, p_{hard}. Our model interpolates between 1+1 dimensional collisionally-broadened expansion at early times and 1+1 dimensional ideal hydrodynamic expansion at late times. Using our model, we find that at LHC energies, forward high-energy medium dilepton production would be suppressed by up to a factor of 3 if one assumes an isotropization/thermalization time of 2 fm/c. Therefore, it may be possible to use forward dilepton yields to experimentally determine the time of onset of locally isotropic hydrodynamic expansion of the quark-gluon plasma as produced in ultrarelativistic heavy-ion collisions.

HK 12.6 Mo 18:15 H-ZO 10

Role of the tetraquark in the chiral phase transition — •Achim Heinz[1], Stefan Strüber[1], Francesco Giacosa[1], and Dirk H. Rischke[1,2] — [1]Institute for Theoretical Physics, Geothe University, Max-von-Laue-Str. 1, D-60438 Frankfurt am Main, Germany — [2]Frankfurt Institute for Advanced Studies, Geothe University, Ruth-Moufang-Str. 1, D-60438 Frankfurt am Main, Germany

By using a simple chiral invariant two-flavor model, we determine the implication of a light tetraquark field on chiral symmetry restoration at nonzero temperature. The order of phase transition depends on the mixing between quarkonium and tetraquark. In order to obtain a crossover phase transition, as favored by lattice QCD studies, a large mixing between scalar quarkonium and tetraquark fields is required. To be consistent with recently advocated interpretations of spectroscopy data we chose a light ($\sim$ 0.4 GeV), predominantly tetraquark state, and a heavy ($\sim$ 1.2 GeV), predominantly quarkonium state in the vacuum. With increasing temperature the mixing increases until a interchange of roles takes place. The originally heavy, predominantly quarkonium state becomes the light state and the originally light, predominantly tetraquark state becomes the heavy state. After the interchange, as expected, the chiral symmetry is restored.

HK 12.7 Mo 18:30 H-ZO 10

The Chiral Transition in QCD: on the quark mass dependence of Goldstone fluctuations — •Wolfgang Unger — Fakultät für Physik, Universität Bielefeld

Due to fluctuations of the Goldstone pion modes, the chiral susceptibility is expected to diverge in the IR when the chiral limit is approached at temperatures which are large but below the chiral transition temperature. We summarize how this expectation is borne out of chiral perturbation theory in the continuum limit, treating the connected and disconnected contributions separately. Based on rooted staggered chiral perturbation theory we further study possible modifications due to taste violations which arise in the staggered lattice discretization scheme for the quarks. These analytic findings are then confronted with our present numerical results on the chiral susceptibility obtained from simulations with N_f=2+1 flavors at small light quark masses.

HK 12.8 Mo 18:45 H-ZO 10

QCD equation of state from a HTL quasiparticle model — •Robert Schulze — Forschungszentrum Dresden-Rossendorf, Dresden, Germany

We present a quasiparticle model based on a two-loop effective action equipped with hard thermal loop (HTL) dispersion relations and an effective running coupling strength. The model allows for an extrapolation of present QCD lattice results at small or zero chemical potential to larger baryon densities. The resulting QCD equation of

state is combined with the hadron sector to arrive at a useable form for hydrodynamical simulations of heavy-ion collisions over a large energy interval. Particular attention is paid to a tachyonic plasmino mode arising in the Landau damping regime, leading to oddities of particle densities and quark partial pressures at small temperatures and medium chemical potential. Implications for quark/neutron stars are discussed.

HK 13: Hadron Structure and Spectroscopy I

Time: Monday 16:30–19:00 Location: H-ZO 20

HK 13.1 Mo 16:30 H-ZO 20

Hyperon reconstruction and analysis — •Roman Dzhygadlo[1], Albrecht Gillitzer[2], and Jim Ritman[2] for the PANDA-Collaboration — [1]Universität Bonn — [2]Forschungszentrum Jülich

The hyperon excitation spectrum is still poorly known. This is particularly the case for the Ξ and the Ω spectrum. The knowledge on nucleon resonances is mainly based on the πN channel were as little is known on their coupling to ΛK or ΣK final states. In order to improve this situation, simulation and analysis studies were performed to reconstruct hyperons in the PANDA (Λ, Ξ) and in the COSY-TOF (Λ, Σ) experiments. In the simulations a Straw Tube Tracking (STT) subdetector was used. In the PANDA experiment a STT detector is the baseline option for the Central Tracker, the COSY-TOF experiment has recently been upgraded with a STT detector. The analysis for COSY-TOF was performed within the COSY-TOF simulation-analysis software, for PANDA the PANDAROOT framework was used. In both cases the hyperons were reconstructed with real track and vertex finders. The resulting hyperon invariant mass distribution and the obtained reconstruction efficiency will be shown. The achieved signal-to-background level for different background channels will be discussed.

Supported in part by Forschungszentrum Jülich

HK 13.2 Mo 16:45 H-ZO 20

Energy dependence of the cross section for $pp \to \{pp\}_s\gamma$ at intermediate energies — •Dmitry Tsirkov, Tatyana Azaryan, Sergey Dymov, Vladimir Komarov, Anatoly Kulikov, Vladimir Kurbatov, George Macharashvili, and Yury Uzikov for the ANKE-Collaboration — Laboratory of Nuclear Problems, Joint Institute for Nuclear Research, 141980 Dubna, Russia

The fundamental reaction $pp \to \{pp\}_s\gamma$, where $\{pp\}_s$ is a proton pair with excitation energy of $E_{pp} < 3\,\mathrm{MeV}$, has been observed with the ANKE spectrometer at COSY-Jülich. This is equivalent to photodisintegration of a free $^1S_0$ diproton for photon energies $E_\gamma \approx T_p/2$. Previously only photodisintegration of a diproton bound within a nucleus has been observed. The integral cross section of the reaction was calculated in the range of c. m. angles $0° < \theta_{pp} < 20°$ for proton beam energies of $T_p = 0.353, 0.500, 0.550, 0.625\,\mathrm{GeV}$, as well as upper limits for 0.318 and 0.800 GeV. The energy dependence obtained shows clear bump around $T_p = 0.550\,\mathrm{GeV}$, which may reflect the influence of the Δ(1232) excitation, even though this channel is suppressed compared to the similar $np \to \gamma d$ reaction. The results of the research might help to understand the underlying dynamics of the short range NN interaction, since quantum numbers for the $pp \to \{pp\}_s\gamma$ reaction differ from those of the extensively studied deuteron photodisintegration.

Supported by the COSY-FFE program.

HK 13.3 Mo 17:00 H-ZO 20

Status of the Analysis of Double Pion Production in Proton-Proton Collisions — •Tamer Tolba and James Ritman for the WASA-at-COSY-Collaboration — Institut für Kernphysik and Jülich Center for Hadron Physics, Forschungszentrum Jülich, D-52425 Jülich, Germany

Pion production, especially double pion production, in proton-proton collisions is one of the sources of information on the nucleon-nucleon (NN) interaction and on nucleon resonance properties.
The mechanisms for double pion production in proton-proton collisions are strongly momentum dependent and are dominated by baryon resonance intermediate states.
In this work, the WASA-at-COSY facility is used to measure double pion production at a proton beam kinetic energy of 1400 MeV.
The status of the analysis will be presented.

Supported by BMBF and Wallenberg Foundation.

HK 13.4 Mo 17:15 H-ZO 20

Analysis of the $pp \to \Lambda pK^+$ Reaction at $T_p = 2.26$ GeV * — •Katharina Ehrhardt, Heinz Clement, Evgueny Doroshkevich, Arthur Erhardt, and Gerhard J. Wagner for the COSY-TOF-Collaboration — Physikalisches Institut der Universität Tübingen

Our effort to contribute to the pentaquark search [1] with a precision measurement resulted also in a high-statistics measurement of the $pp \to \Lambda pK^+$ reaction at $T_p = 2.26$ GeV as a by-product. In the two-particle invariant masses these data cover the kinematical ranges of $N^* \to \Lambda K^+$ decays including the P11(1710) resonance decay. Our analysis focusses on structures in the Dalitz plots, which would be indicative of the excitation of strange and non-strange baryon resonances decaying into pK^+ and ΛK^+ channels, respectively as well as of possible dibaryon resonances in the Λp system. With regard to the latter we also investigate the K^+ missing mass spectrum for possible signals of a $\Lambda p\pi^0$ resonance and a ppK^- bound system discussed in connection with recent FINUDA results.

First results of the analysis will be presented.

[1] M. Abdel-Bary et al., Phys.Lett. **B 649** (2007) 252

* supported by BMBF, COSY-FFE, DFG (Eur. Graduate School)

HK 13.5 Mo 17:30 H-ZO 20

Studium der Λ(1405) Resonanz mit HADES — •Eliane Epple, Alexander Schmah und Laura Fabbietti — Technische Universität München

Die Kenntnis der Struktur der Λ(1405)-Resonanz ist ausschlaggebend für ein besseres Verständniss der $\bar{K}N$-Wechselwirkung und damit wichtig für die Vorhersage von möglichen kaonischen Bindungszuständen. Das HADES Spektrometer am Schwerionensynchrotron der Gesellschaft für Schwerionenforschung in Darmstadt hat sich neben der e^+/e^- Identifikation auch für die Messung von Hadronen etabliert [1]. Insbesondere der Nachweis von geladenen Kaonen konnte in Schwerionenreaktionen mit gutem Signal zu Untergrund Verhältnis aufgezeigt werden [2]. Die entwickelten Methoden werden nun, unter anderem, für die Rekonstruktion der Λ(1405) Resonanz in der Reaktion $p + p \to \Lambda(1405) + p + K^+$ verwendet. Eine gemessene Statistik von $1.2 \cdot 10^9$ p+p Reaktionen bei einer kinetischen Strahlenergie von 3.5 GeV ermöglicht die exklusive Rekonstruktion durch missing mass und invariant mass Techniken in dem Zerfallskanal $\Lambda(1405) \to \Sigma^0\pi^0$.
Umfangreiche Simulationen zur Bestimmung der Akzeptanzen und Rekonstruktionseffizienzen sowie erste vorläufige Ergebnisse der Datenanalyse werden vorgestellt.
Diese Arbeit wird durch die HGF sowie durch das Exzellence Cluster Universe unterstützt.
[1] PhD thesis Alexander Schmah, TU Darmstadt, 2008
[2] Diploma thesis Manuel Lorenz, Johann Wolfgang Goehte-Universität Frankfurt, 2008

HK 13.6 Mo 17:45 H-ZO 20

Baryon Form Factors in the Chiral Quark-Soliton Model — •Tim Ledwig[1], Antonio Silva[2], and Marc Vanderhaeghen[1] — [1]Institut für Kernphysik, Johannes Gutenberg-Universität Mainz, Mainz, Germany — [2]Centro de Fisica Computacional, Universidade de Coimbra, Coimbra, Portugal

We investigate the form factors of the vector and axial-vector current between baryon states in the SU(3) chiral quark-soliton model. This relativistic model has only four parameters from which three are determined in the meson-sector whereas only one remains for the whole baryon-sector. One advantage of this model is therefore that various observables of all ground-state baryons can be investigated in the same scheme by having fixed only once these parameters.

Results are given for the electromagnetic form factors of the Δ(1232) as well as for the magnetic moments of the decuplet baryons. Special interest is given to the Δ electric quadrupole form factor. We take linear 1/Nc and strange quark mass corrections into account. In addition we discuss also form factors of the semileptonic hyperon decays and

properties of the pentaquark Θ^+.

HK 13.7 Mo 18:00 H-ZO 20

Measurement of the neutron electric form factor in the reaction $^3\vec{\mathrm{He}}(\vec{e},e'n)pp$ — •Björn Sören Schlimme for the A1-Collaboration — Institut für Kernphysik, Universität Mainz, J.-J.-Becher-Weg 45, D-55099 Mainz

The neutron electric form factor G_{en} was measured in a double polarization experiment at $Q^2 = 1.58\,(\mathrm{GeV/c})^2$. The 1.5 GeV polarized electron beam was provided by the new accelerator stage of the Mainz Mikrotron, MAMI-C. A polarized ^{3}He gas target served as an effective polarized neutron target with freely adjustable polarization orientation. The scattered electrons were detected by a magnetic spectrometer in coincidence with the knocked out neutrons detected in a nucleon detector. Beam helicity asymmetries are sensitive to G_{en} for a neutron polarization perpendicular to the momentum transfer. Asymmetries for parallel orientation are dominated by G_{mn} and can be used for a reduction of systematic errors. Perpendicular and parallel asymmetries were measured to provide a measurement of $G_{\mathrm{en}}/G_{\mathrm{mn}}$. Employing the results of existing absolute G_{mn} measurements, G_{en} can be extracted. The experimental setup and preliminary results will be shown.

HK 13.8 Mo 18:15 H-ZO 20

New narrow nucleon N*(1685) — Vyacheslav Kuznetsov[1] and •Maxim Polyakov[2] — [1]Kyungpook National University, 702-701, Daegu, Republic of Korea — [2]Institut für Theoretische Physik II, Ruhr-Universität Bochum, 44780 Bochum

We argue that the existence of a new narrow (Gamma <25 MeV) nucleon resonance N*(1685) is strongly supported by recent data on eta-photoproduction off the nucleon. The resonance has much stronger photo-coupling to the neutron than to the proton. This nucleon resonance is a good candidate for the non-strange member of the exotic anti-decouplet of baryons – the partner of the pentaquark Theta+. All up to date known properties of new N*(1685) are summarized.

HK 13.9 Mo 18:30 H-ZO 20

The mass of the Δ resonance in a finite volume: fourth-order calculations — •Dominik Hoja[1,2], Véronique Bernard[3], Ulf-G. Meissner[1,2,4], and Akaki Rusetsky[1,2] — [1]Helmholtz-Institut für Strahlen- und Kernphysik (Theorie), Universität Bonn — [2]Bethe Center for Theoretical Physics, Universität Bonn — [3]Université Louis Pasteur, Laboratoire de Physique Théorique — [4]Institut für Kernphysik und Jülich Center for Hadron Physics, Forschungszentrum Jülich

The self-energy of the Δ resonance in a finite volume is calculated by using chiral effective field theory with explicit spin-3/2 fields. The calculations are performed up-to-and-including fourth order in the small scale expansion and yield an explicit parameterization of the energy spectrum of the interacting πN pair in a finite box in terms of both the quark mass and the box size L. We show that finite-volume corrections are sizable at small quark masses. The values of certain low-energy constants are extracted from fitting to the available data in lattice QCD.

Work supported in part by DFG (TR 16).

HK 13.10 Mo 18:45 H-ZO 20

The Bound State Approach and Hyperfine Splitting for Heavy Baryons — •Egidijus Norvaisas, Darius Jurciukonis, and Vidas Regelskis — VU Institute of Theoretical Physics and Astronomy, Vilnius, Lithuania

We consider the Skyrme model in the bound state approach for the unitary fields U(**x**,t) belonging to a irreducible representation (λ,μ) of the SU(3) group. The bounded meson field is expanded pertubatively. Therefore model Lagrangian brakes into two parts corresponding soliton and meson field with soliton field in the background. We treat soliton field quantum mechanically *ab initio* and leave chiral symmetry group $\mathrm{SU(2)_R} \otimes \mathrm{SU(2)_L}$ explicit unbroken. Due to the canonical quantization of the soliton we get different spin and isospin of soliton. Noncommutativity of quantum variables leads to quantum soliton stabilizing term. This term depends on the representation (λ,μ) and lowers soliton mass. The symmetry breaking and Wess-Zumino terms play a crucial role for the bounded field and also depend on representation. We find semiclassical Hamiltonian describing bounds states in the background of the quantum soliton. The representation (λ,μ) influences the explicit expression of Hamiltonian and can be interpreted as a new discrete phenomenological parameter of the model. The calculations are done for the spectra of the strange, charm and bottom baryons, where they are treated as a bound states of quantum soliton and appropriate flavor meson.

HK 14: Hadron Structure and Spectroscopy II

Time: Monday 16:30–19:00 Location: H-ZO 30

Invited Group Report HK 14.1 Mo 16:30 H-ZO 30

Hadron physics from lattice QCD — •Christine Davies — Dept of Physics and Astronomy, University of Glasgow, Glasgow, UK

I will review recent results from lattice QCD with a particular focus on accurate heavy hadron spectroscopy and the determination of quark masses.

I will also discuss what lattice QCD calculations will able to do in future.

Group Report HK 14.2 Mo 17:00 H-ZO 30

Hadron structure in lattice QCD and ChPT — •Philipp Hägler — Institut für Theoretische Physik T39, Physik-Department der TU München, James-Franck-Strasse, D-85747 Garching

This talk summarizes recent results from hadron structure calculations in lattice QCD. Substantial progress has been made in particular with respect to nucleon form factors and moments of (generalized) parton distributions. These observables allow us to investigate a number of fundamental physics questions related to, e.g., the distribution of charge and momentum in hadrons and their internal spin structure. Results from chiral perturbation theory required for the extrapolation of the lattice data to the physical point will be briefly discussed and applied to selected hadron structure observables.

HK 14.3 Mo 17:30 H-ZO 30

Lorentz-Invarianz-Relationen zwischen Partonverteilungen und Wandzura-Wilczek-Näherung — Andreas Metz[1], Peter Schweitzer[2] und •Tobias Teckentrup[3] — [1]Temple University, Philadelphia, USA — [2]University of Connecticut, Storrs, USA — [3]Institut für Theoretische Physik II, Ruhr-Universität Bochum, Deutschland

Partonverteilungen (PDFs), welche von höherem Twist und/oder abhängig vom Transversalimpuls $\mathbf{p}_T$ sind, enthalten wichtige Informationen über die partonische Struktur des Nukleons. Diese Informationen sind ergänzend zu denen, die in den gewöhnlichen Twist-2 PDFs enthalten sind. Die sogenannten Lorentz-Invarianz-Relationen (LIRs) stellen einen Zusammenhang zwischen gewöhnlichen Twist-3 PDFs und Momenten von $\mathbf{p}_T$-abhängigen PDFs her. Die LIRs können somit genutzt werden, um z. B. unbekannte durch besser bekannte PDFs auszudrücken. Es ist jedoch modellunabhängig gezeigt worden, dass die LIRs verletzt sind.

Betrachtet man die LIRs jedoch nun modellunabhängig in der Wandzura-Wilczek-Näherung, d. h. wenn man sowohl Quark-Gluon-Quark-Korrelatoren als auch Stromquark-Massen-Terme vernachlässigt, so kann gezeigt werden, dass die LIRs nicht verletzt sind. Dieses ist ein Hinweis darauf, dass die Verletzung der LIRs vermutlich numerisch klein ist und in bestimmten Fällen sogar vernachlässigt werden kann.

Diese Arbeit wird teilweise durch das BMBF und T. T. durch das Cusanuswerk gefördert.

HK 14.4 Mo 17:45 H-ZO 30

Partonic pole matrix elements for fragmentation — •Stephan Meissner[1] and Andreas Metz[2] — [1]Institut für Theoretische Physik II, Ruhr-Universität Bochum, Germany — [2]Department of Physics, Temple University, Philadelphia, USA

In the parton picture hard physical processes can conveniently be described in terms of parton distribution functions (PDFs) and fragmentation functions (FFs). While it is sufficient to consider only two-parton correlation functions at leading twist, three-parton correlation functions need to be taken into account at subleading twist.

Of these three-parton correlation functions the partonic pole matrix elements (PPMEs) are of particular interest, as they are connected to single spin asymmetries and universality breaking terms of PDFs and FFs. So far the studies in this field mostly dealt with PPMEs for PDFs, while PPMEs for FFs were only considered within models. We, however, obtained new, model-independent information on PPMEs for FFs. Our results as well as their physical implications will be presented in this talk.

HK 14.5 Mo 18:00 H-ZO 30

Transverse Momentum Distributions of Quarks in the Nucleon from Lattice QCD — •Bernhard Musch[1], Philipp Hägler[1], John Negele[2], Andreas Schäfer[3], and Dru Renner[4] — [1]Institut für Theoretische Physik T39, Technische Universität München, D-85747 Garching, Germany — [2]Massachusetts Institute of Technology, Cambridge, MA02139, USA — [3]Universität Regensburg, D-93040 Regensburg, Germany — [4]Deutsches Elektronen-Synchrotron DESY, D-15738 Zeuthen, Germany

Transverse momentum dependent parton distribution functions encode information about the intrinsic motion of quarks inside the nucleon. They are important non-perturbative ingredients for our understanding of, e.g., azimuthal asymmetries in SIDIS. We present first lattice calculations, based on MILC gauge configurations and propagators from LHPC [1]. We employ non-local operators, consisting of spatially separated quark creation and annihilation operators connected by a straight Wilson line, whose renormalization requires the removal of a divergence linear in the lattice cutoff 1/a. In the kinematical range accessible to us, the resulting distributions show a Gaussian behavior with respect to transverse momentum. Moreover, we find that the transverse momentum densities of polarized quarks in a polarized nucleon are deformed, i.e., not axially symmetric.

Supported by the DFG Emmy Noether-program, BMBF, U.S. DOE grant DE-FG02-94ER40818 and the Excellence Cluster Universe.

[1] B. Musch, Ph. Hägler et al, PoS LC2008 053

HK 14.6 Mo 18:15 H-ZO 30

Moments of Parton Distribution Functions from Lattice QCD — Marina Dorati[1], •Thomas Hemmert[2], and Andreas Schäfer[2] — [1]Universita degli Studi di Pavia, Italy — [2]Universität Regensburg, Germany

We present results for the first isovector moment <x>_u-d of the unpolarized parton distribution functions at next-to-leading one-loop order in Baryon Chiral Perturbation Theory, extending the work of ref.[1] to the next order. The first isovector moment <Delta x>_u-d of the polarized parton distribution functions is also presented at next-to-leading one-loop order. Both chiral extrapolation functions are then fitted simultaneously to Lattice QCD data from the LHPC, QCDSF and RBC collaborations. The convergence behavior of the chiral series for the conflicting data sets is studied and a critical discussion of the resulting extrapolated values at the physical point is presented.

[1] M. Dorati, T.A. Gail and T.R. Hemmert, Nucl. Phys. A798, 96 (2008)

HK 14.7 Mo 18:30 H-ZO 30

Double polarization measurements in π^0 and η photoproduction for the observable E — •Manuela Gottschall for the CBELSA/TAPS-Collaboration — Helmholtz-Institut für Strahlen- und Kernphysik, Nußallee 14-16, D-53115 Bonn

In contrast to the excitation spectrum of an atom, where the spectral lines are easy to disentangle, the excitation spectrum of the nucleon consists of several overlapping resonances. To study and identify the contributing resonances, a partial wave analysis is needed. To get an unambiguous solution, at least 8 well chosen single and double polarization observables are necessary. With the new Crystal-Barrel/TAPS experiment at the electron stretcher accelerator ELSA, it is presently possible to measure double polarization observables with a linearly or circularly polarized beam and a longitudinally polarized butanol target. Because of its nearly 4π angular coverage and its high detection efficiency for photons, the Crystal-Barrel/TAPS setup is very well suited for the study of the neutral meson photoproduction at the nucleon.

In this talk first results of the measurement of the double polarization observable E in the reactions $\vec{\gamma}\vec{p} \to p\pi^0$ and $\vec{\gamma}\vec{p} \to p\eta$ will be presented.

Supported by the Deutsche Forschungsgemeinschaft (SFB/TR 16).

HK 14.8 Mo 18:45 H-ZO 30

Polarised Strangeness Photoproduction at CBELSA-TAPS — •Ralf Ewald for the CBELSA/TAPS-Collaboration — Physikalisches Institut, Universität Bonn

Albeit quark models explain the known baryon spectrum reasonably well, they all overpredict the number of states significantly. This is normally called the *missing resonance* problem. A possible solution may be, that these resonances remained undetected in π-induced reactions, but have a sizeable coupling to decay channels with strangeness involved. Therefore associated Kaon-Hyperon photoproduction is investigated at ELSA.

Data were taken using the combined photon spectrometers Crystal Barrel and TAPS and polarised photonbeam with energies up to 2.9 GeV. This setup was well suited to detect multi photon final states and was therefore ideal to measure the reaction channel $\gamma p \to \Sigma^+ K_s^0 \to p\pi^0\pi^0\pi^0 \to p6\gamma$. This talk deals with the present status of my analysis of this reaction and preliminary results for cross sections and the polarisation observables Σ and P.

* sponsored by the DFG(SFB/TR 16)

HK 15: Nuclear Structure and Dynamics I

Time: Monday 16:30–19:00 Location: H-ZO 40

HK 15.1 Mo 16:30 H-ZO 40

Characterization of the 101 keV isomeric state in ^{72}Br — •José Antonio Briz Monago for the IS398-Collaboration — IEM-CSIC, Madrid, Spain

Far from stability the main part of the Gamow-Teller (GT) strength is within the Q_β-window. Theoretical calculations [1] predict very different GT strength distributions for different deformations of the parent nucleus ground state (prolate-spherical-oblate) for neutron deficient nuclei in the mass region around A=70. This gives the opportunity to determine the deformation of a nucleus by the study of the beta decay with a highly sensitive setup.

Measurements of the $_\beta$-decay of ^{72}Kr were performed at ISOLDE with a Total Absorption Gamma Spectrometer (TAGS) but the analysis of the data has revealed the need for additional information. For this reason, complementary measurements have been performed in order to determine the conversion electron coefficients of the low energy transitions following the decay of ^{72}Kr. Of particular interest is the precise determination of the half-life of the 101 keV isomeric state and the multipolarity of the γ-transition connecting this state to the ground state as the spin of the latter one has been debated [2,3]. In this contribution, we will report the results obtained in this work.

[1] P. Sarriguren et al., Nucl. Phys. A658, 13 (1999)
[2] W.E. Collins et al., Phys. Rev. C9, 1457 (1974)
[3] I. Piqueras et al., Eur. Phys. J. A16, 313-329 (2003)

HK 15.2 Mo 16:45 H-ZO 40

Study of collectivity in ^{62}Zn — •Michael Albers, Dennis Mücher, Jan Jolie, Christoph Fransen, Andrey Blazhev, Pavel Petkov, Désirée Radeck, and Christian Bernards — Institut für Kernphysik, Universität zu Köln

The experimental proof for the existence of proton-neutron mixed symmetry states has been shown in several, mostly stable nuclei in the 50<A<150 mass region in the last years by analysing M1 transitions to fully symmetric states, which are the main experimental signatures for the existence of these states. Since information about mixed symmetry states in unstable nuclei is very sparse, experiments have been performed at the Tandem accelerator of the Institut für Kernphysik in Cologne to identify the first mixed symmetry state $2^+_{ms,1}$ in several unstable N=48,52 isotones, but absolute transition strengths could not be obtained until now. An additional experiment was performed at the IKP in Cologne using the ^{61}Ni(^{3}He, 2nγ)^{62}Zn reaction to identify the first mixed symmetry state in ^{62}Zn. Utilizing the high efficiency

HORUS cube spectrometer, which allows the analysis of $\gamma\gamma$ angular correlations and the determination of lifetimes via the DSA Method, absolute transition strengths in ^{62}Zn could be obtained, by which a fragmentation of the mixed symmetry state $2^+_{ms,1}$ turned out to be the case.

The results have been complemented to the systematical trends in the Z=30 Zinc isotopes and a predicted loss of collectivity in the lighter Zn isotopes up to ^{58}Zn could be verified.

Supported by DFG under grant JO397 3-2

Invited Group Report HK 15.3 Mo 17:00 H-ZO 40

The structure of moderately neutron-rich nuclei studied with the CLARA-PRISMA setup and perspectives for the AGATA Demonstrator coupled to PRISMA. — •Andres Gadea — CSIC-Instituto Fisica Corpuscular, Valencia, Spain and INFN-Laboratori Nazionali di Legnaro, Italy

The study of neutron-rich nuclei, in particular large isospin values, is one of the most challenging problems in nuclear structure. Among the open questions is of special interest the evolution of the nuclear effective interactions, in particular of the monopole term, with consequences in the quenching of the known shell gaps and development of new ones. Recently it was developed a new setup at LNL by coupling the CLARA array to the magnetic spectrometer PRISMA This setup aims at measuring in-beam prompt coincidences of gamma-rays detected with CLARA in coincidence with the products of multinucleon-transfer reactions and deep-inelastic collisions, detected by PRISMA. In this contribution we will briefly describe the capabilities of the setup as well as the results obtained for nuclei in the vicinity of 78Ni, populated in the 238U + 82Se at 505 MeV reaction, in the vicinity of 132Sn where the nuclear species had been populated in the 238U + 136Xe at 940 MeV reaction and in the vicinity of 48Ca populated in the 238U and 208Pb + 48Ca reactions at 330 MeV and 310 MeV respectively. A lifetime RDDS technique, developed in collaboration with IKP Cologne, and result in the 48Ca region will be also presented. During 2009 the upcoming setup with the AGATA Demonstrator and PRISMA will start the experimental campaign at LNL.

Invited Group Report HK 15.4 Mo 17:30 H-ZO 40

Coulomb excitation and Transfer Experiments at REX-ISOLDE* — •Thorsten Kröll — TU Darmstadt — TU München

The aim of recent research in nuclear physics is the understanding of the structure of nuclei far off stability. In this contribution, the highly successful experimental programme in this field based on the use of post-accelerated radioactive ion beams (RIBs) obtained from the REX-ISOLDE facility at CERN will be presented. The beams utilised range from Li up to Rn comprising more than 60 isotopes from both the proton- and neutron-rich side of the nuclear chart.

The research programme covers a wide range of topics like the evolution of magic numbers, the intriguing phenomenon of shape coexistence, and reactions of astrophysical interest. The experimental methods are "safe" Coulomb excitation and one- and two-nucleon transfer (or capture) reactions investigated by high-resolution γ-ray spectroscopy with the MINIBALL spectrometer as well as particle spectroscopy with a Si detector array.

The status and recent results of the programme as well as perspectives for future experiments and the upgrade to HIE-ISOLDE will be presented and discussed.

* Supported by BMBF (Nr. 06MT238), EU (EURONS Nr. 506065), DFG (Excellence Cluster Universe), and the MINIBALL/REX-ISOLDE collaboration.

HK 15.5 Mo 18:00 H-ZO 40

Nuclear structure studies in the area around the valence maximum of ^{170}Dy with CLARA + PRISMA — •Pär-Anders Söderström for the 170Dy-Collaboration — Uppsala University

While the existence of shell closures and the search for exotic "doubly magic" nuclei is a cornerstone of our understanding of the atomic nucleus, their even-even, "doubly-mid-shell" counterparts are arguably even more rare. Above the *sd* shell, the corresponding doubly mid-shell, even-even systems which are particle bound are limited to ^{28}Si, ^{38}Si, ^{48}Cr and ^{170}Dy. Assuming the standard spherical shell gaps, ^{170}Dy might naively be expected to be amongst the most collective of all nuclei. The double mid-shell at ^{170}Dy may also represent the single best hope in the entire Segré chart for the empirical realization of the SU(3) dynamical symmetry of the interacting boson model.

An experiment for nuclear structure studies of ^{170}Dy and its neighbors has been performed at Laboratori Nazionali di Legnaro. Multi-nucleon transfer reactions with a ^{82}Se beam on a ^{170}Er target were used to reach the neutron-rich isotopes. The reaction fragments were identified using the magnetic spectrometer PRISMA and the gamma-ray spectra were recorded using the CLARA germanium detector array. The analysis of this data is ongoing. Preliminary gamma-ray spectra for neutron rich isotopes in this area will be presented as well as relative cross sections for production of these isotopes in multi-nucleon transfer reactions.

HK 15.6 Mo 18:15 H-ZO 40

Results from d(^{30}Mg, ^{31}Mg)p at REX-ISOLDE — •Vinzenz Bildstein, Roman Gernhäuser, Thorsten Kröll, Reiner Krücken, and Kathrin Winter for the Is 454-Collaboration — Physik-Department E12, TU München, Germany

Thirty years after the discovery of the "island of inversion" [1] the borders of the island are still not well determined and in particular the evolution of the single-particle structure is not well investigated.

Transfer reactions yield important spectroscopic information, i.e. spin and parity assignments as well as spectroscopic factors. Since the transfered nucleon can occupy excited states, the properties of these states can be studied as well.

In order to study transfer reactions in inverse kinematics at REX-ISOLDE with MINIBALL a new setup was built covering a large solid angle. This new setup overcomes the limitations of previous transfer experiments performed at REX-ISOLDE [2].

In the first experiment the nucleus ^{31}Mg which is right on the edge of the "island of inversion" was studied via the d(^{30}Mg, ^{31}Mg)p reaction.

Preliminary results of this beam time will be shown as well as future plans for transfer experiments at REX-ISOLDE.

[1] C. Thibault et al., Phys. Rev. C 12, 644 (1975)

[2] M. Pantea, PhD Thesis, TU Darmstadt, Germany (2005)

*supported by BMBF 06MT238, DFG Cluster of Excellence "Origin of the Universe" and the EU through RII3-EURONS (contract no. 506065).

HK 15.7 Mo 18:30 H-ZO 40

Shape coexistence in the "Island of inversion": Search for the 0^+_2 state in ^{32}Mg applying a two-neutron transfer reaction — •Kathrin Wimmer, Vinzenz Bildstein, Roman Gernhäuser, Thorsten Kröll, and Reiner Krücken — Physik-Department E12, Technische Universität München

The "Island of inversion" is a region in the nuclear chart around the neutron rich $N = 20$ isotopes of Na, Mg and Al isotopes, where intruder fp-orbitals favoring deformed shapes compete with the normal spherical *sd* configurations. The two-neutron transfer reaction starting from the normal ground state of ^{30}Mg is expected to favor the population of its analogue in ^{32}Mg, the excited 0^+_2 state which has a similar particle-hole structure. This state is practically not reachable in Coulomb excitation and its population has neither been observed in the β decay of ^{32}Na nor in heavy-ion induced reactions. We populated states in ^{32}Mg by a (t,p) two-neutron transfer reaction in inverse kinematics with a ^{30}Mg beam at 1.83 MeV/u from REX-ISOLDE impinging on a tritium-loaded Ti target. Recoiling light particles, like protons and tritons, were detected in the new segmented Silicon detector array especially designed for transfer reactions surrounded by the MINIBALL γ-ray detector.

First results of this beam time which took place in October 2008 will be presented.

This work is supported by BMBF 06MT238, EURONS (contract No. RII3-CT-2004-506065) and the DFG Cluster of Excellence "Origin and Structure of the Universe"(www.universe-cluster.de)

HK 15.8 Mo 18:45 H-ZO 40

Coulomb excitation at the border of the island of inversion – the case of ^{31}Mg — •Michael Seidlitz, Peter Reiter, and Dennis Mücher for the IS410-Collaboration — Institut für Kernphysik, Universität zu Köln

The ground state properties of ^{31}Mg indicate a dramatic change of nuclear shape at $N = 19$ with a highly deformed $J^\pi = 1/2^+$ ground state, implying that ^{31}Mg is part of the *island of inversion* [1]. The unknown collective properties of excited states were subject of a Coulomb excitation experiment at REX-ISOLDE, CERN, employing a radioactive ^{31}Mg beam. De-excitation γ-rays were detected by the MINIBALL γ-spectrometer in coincidence with scattered particles in a segmented Si-detector. The level scheme of ^{31}Mg was extended. Spin and parity assignment of the 945 keV state yielded a $(3/2^+, 5/2^+)$ value. De-excitation of this state is dominated by a strong collective $M1$ transi-

tion to the $(3/2_1^+)$ state. The deduced $B(E2)$ and $B(M1) > 0.145\mu_N^2$ values are in good agreement with the properties of a rotational band built on the $1/2^+$ ground state [2].

[1] G. Neyens *et al.*, Phys.Rev.Lett **94**, 022501 (2005)
[2] F. Marechal *et al.*, Phys.Rev. C **72**, 044314 (2005)
Supported by the German BMBF (06KY205I).

HK 16: Nuclear Structure and Dynamics II

Time: Monday 16:30–19:00 Location: H-ZO 60

Invited Group Report HK 16.1 Mo 16:30 H-ZO 60

Nuclear Structure Studies of the Heaviest Elements — •Paul Greenlees — Department of Physics, University of Jyväskylä, P.O.Box 35,*40014 Jyväskylä, Finland

Over the past decade or so, modern γ-ray spectroscopic techniques have enabled the structure of heavy elements to be investigated in detail. A major program of research has been carried out to study the so-called transfermium nuclei in the region of ^{254}No close to the N=152 deformed sub-shell gap. These nuclei are the heaviest for which detailed in-beam and decay spectroscopy can be performed (see Herzberg and Greenlees, Prog. Part. Nuc. Phys. **61**, 674 (2008) for a review).

Initial in-beam measurements in the region focussed on γ-ray spectroscopy of even-even nuclei, studying the ground-state yrast bands and allowing extraction of parameters such as the moments of inertia, and proving the deformed nature of these nuclei. More recently, attention has switched to odd-mass nuclei such as ^{253}No, ^{251}Md and ^{255}Lr, the latter being the heaviest nucleus so far studied in-beam. Rotational bands have been observed in all these nuclei. Non-yrast and K-isomeric states have recently been studied through the use of both in-beam and focal plane decay spectroscopy, yielding data which can be used to determine the excitation energies and configurations of two-quasiparticle states for comparison to the predictions of various theories.

An overview of the most recent results and the experimental techniques used will be presented. Perspectives for the development of new devices for further studies in this region will also be discussed.

HK 16.2 Mo 17:00 H-ZO 60

Hyperdeformed Fission Resonances observed in ^{232}U* — •L. Csige[1,3], M. Csatlos[1], T. Faestermann[2], Z. Gacsi[1], J. Gulyas[1], D. Habs[3], R. Hertenberger[3], M. Hunyadi[1], A. Krasznahorkay[1], R. Lutter[3], H.-J. Maier[3], P.G. Thirolf[3], and H.-F. Wirth[3] — [1]Inst. of Nucl. Res. of the Hungarian Acad. of Sciences, Debrecen, Hungary — [2]TU München, Physik Department E12, Garching, Germany — [3]LMU München, Fakultät f. Physik, Garching, Germany

Hyperdeformed (HD) third minima are expected to appear in the potential energy surface of many actinide nuclei according to theoretical calculations. The existence of HD states was experimentally established earlier in the uranium isotopes ^{234,236}U [1,2]. In a recent experiment the fission probability of ^{232}U was measured as a function of the excitation energy using the ^{231}Pa(^{3}He,df) reaction at the Garching Q3D magnet spectrograph. Sub-barrier fission resonances have been observed for the first time in the excitation energy region E=4.5-4.8 MeV and interpreted as being rotational bands with rotational parameters characteristic to a HD nuclear shape ($\hbar^2/2\Theta = 1.9$ keV). Fission barrier poarameters were extracted and angular distributions of the fission fragments were determined in order to deduce the K value of the rotational bands. According to our new results ^{232}U can be a good candidate to search for discrete γ transitions of hyperdeformed states.

[1] A. Krasznahorkay et al., Phys. Rev. Lett. **80** (1998) 2073. [2] M. Csatlós et al., Phys. Lett. **B615** (2005) 175.

*supported by DFG Cluster of Excellence UNIVERSE and by DFG under contract HA 1101/12-1

HK 16.3 Mo 17:15 H-ZO 60

Mass measurements of No isotopes at SHIPTRAP — •Michael Dworschak for the SHIPTRAP-Collaboration — GSI Helmholtzzentrum, 64291 Darmstadt, Germany

The Penning trap mass spectrometer SHIPTRAP at GSI Darmstadt was set up for high-precision mass measurements of heavy radionuclides produced in fusion-evaporation reactions and separated from the primary beam by the velocity filter SHIP. Two interesting regions in the chart of nuclides that can be accessed by this production method are the region around the doubly magic ^{100}Sn and the region of elements heavier than uranium.

Recently, first mass measurements of the three nobelium isotopes $^{252-254}$No (Z=102) - which were produced in the reaction $^{206-208}$PbS(^{48}Ca,2n)$^{252-254}$No - were performed with the SHIPTRAP Penning trap mass spectrometer. These are the heaviest nuclides ever measured with Penning traps. The lowest production cross section was 400 nb (0.6 particles per second). The No nuclides are of importance to benchmark nuclear structure theories and to improve their predictions of the stability of super heavy elements that is caused by shell effects.

HK 16.4 Mo 17:30 H-ZO 60

Spectroscopy of Transfermium Isotopes at SHIP — •Stanislav Antalic[1], Fritz Peter Hessberger[2], Sigurd Hofmann[2,3], Dieter Ackermann[2], Sophia Heinz[2], Birgit Kindler[2], Ivan Kojouharov[2], Bettina Lommel[2], Rido Mann[2], Štefan Šáro[1], Branislav Streicher[2], Barbara Sulignano[4], and Martin Venhart[1] — [1]Comenius University, Bratislava, Slovakia — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany — [3]Goethe-Universität, Frankfurt am Main, Germany — [4]CEA-Saclay, DAPNIA/SPhN, Gif-sur-Yvette Cedex, France

Recent developments of experimental techniques suited for α-, γ- and CE spectroscopy now allow to study nuclear structure in the region of trans-fermium nuclei. This opened the door to investigate nuclear structure under extreme conditions of heaviest nuclei (Z>100, A>250).

Most interesting examples are studies of K-isomers. Experiments aimed to investigate such phenomena provide important information on the nuclear structure of the heaviest elements and are stringent tests for the quality of nuclear models.

In this contribution the results from studies of multi-quasi-particle isomeric states in ^{253}No and ^{255}Lr performed at SHIP will be presented in detail. Both nuclei are first odd-mass isotopes in the trans-fermium region for which high K-isomers were observed. By decay of the high K-isomer in ^{253}No a rotational band was populated, which was not seen in previous in-beam studies. Additionally, also the recent results on the single particle level systematics for the N = 149, 151 and 153 isotones will be presented.

HK 16.5 Mo 17:45 H-ZO 60

Masses and fission barriers of nuclei in the LSD model — •Krzysztof Pomorski — MCS University

Recently developed Lublin-Strasbourg Drop (LSD) [K. Pomorski, J. Dudek, PRC 67, 044316 (2003)] model together with the microscopic corrections taken from Ref. [P. Moeller et al., ADNDT 59, 185 (1995)] is very successful in describing many features of nuclei. In addition to the classical liquid drop model the LSD contains the curvature term proportional to the A^1/3. The r.m.s. deviation of the LSD binding energies of 2766 isotopes with Z,N > 7 from the experimental ones is 0.698 MeV only. It turns out that the LSD model gives also a satisfactory prediction of the fission barrier heights. In addition, it was found in Ref. [K. Pomorski, J. Dudek, IJMPE 13, 107 (2004)] that taking into account the deformation dependence of the congruence energy proposed by Myers and Swiatecki significantly approaches the LSD-model barrier-heights to the experimental data in the case of light isotopes while the fission barriers for heavy nuclei remain nearly unchanged and agree well with experiment. It was also shown in Ref. [J. Bartel et al., IJMPE 16, 459, (2007)] that the saddle point masses of transactinides from 232Th to 250Cf evaluated using the LSD differ by less than 0.67 MeV from the experimental data.

HK 16.6 Mo 18:00 H-ZO 60

Electron-capture delayed fission (ECDF) in the lead region — •Martin Venhart[1], Andrei Andreyev[1], Stanislav Antalic[2], Jytte Elseviers[1], Dieter Ackermann[3], Fritz Peter Hessberger[3], Sigurd Hofmann[3,4], Mark Huyse[1], Katshuhisa Nishio[5], Piet van Duppen[1], and Cyrillus Wagemans[6] — [1]IKS, KU Leuven, Belgium — [2]Comenius University, Bratislava — [3]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany — [4]Goethe-Universität, Frankfurt am Main, Germany —

[5]JAEA, Japan — [6]University of Ghent, Belgium

Beta-delayed fission is a rare process in which the beta-decaying precursor populates relatively low-excited state in its decay daughter, which may then fission. This allows to study low-energy fission properties e.g. the isospin dependence of the fission barriers. It is currently believed that the beta-delayed fission process is crucial for understanding the r-process path and for the production of the heaviest elements.

In the presentation, the recent experiments performed at the velocity filter SHIP (GSI) and at the mass-separator ISOLDE (CERN) will be discussed. In these experiments, the ECDF decay was unambiguously observed in several very neutron-deficient nuclides in the Pb region (^{192,194}At and ^{180}Tl). ECDF probability and total kinetic energy were determined. Surprisingly, an asymmetric mass distribution of fission fragments was observed in ECDF of ^{180}Tl. Preliminary analysis also shows that the cold fission (no neutron emission) might be the main decay channel in the ECDF decay of this nucleus.

HK 16.7 Mo 18:15 H-ZO 60

Reaction studies about the Q-value influence on the production of superheavy elements — •R. Graeger[1], A. Gorshkov[1], A. Türler[1], A. Yakushev[1], C.E. Düllmann[2], E. Jäger[2], J. Khuyagbaatar[2], J. Krier[2], D. Rudolph[2], M. Schädel[2], B. Schausten[2], J. Dvorak[3], M. Chelnokov[4], A. Kuznetsov[4], J. Even[5], D. Hild[5], J. Kratz[5], J.P. Omtvedt[6], F. Samadani[6], K. Nishio[7], and Q. Zhi[8] — [1]TU München, Garching, Germany — [2]GSI, Darmstadt, Germany — [3]LBNL, Berkeley, USA — [4]FLNR, Dubna, Russian Federation — [5]U Mainz, Mainz, Germany — [6]U Oslo, Oslo, Norway — [7]JAEA, Tokai, Japan — [8]IMP, Lanzhou, China

Superheavy elements only exist due to nuclear shell effects. Theoretical calculations predict maximum stability at doubly-magic spherical nucleus with Z=114 and N=184 and near Z=108 and N=162 with the inclusion of higher orders of deformation. The doubly-magic nucleus 270Hs has been observed for the first time by J. Dvorak, et al. in 4n evaporation channel of the reaction 26Mg + 248Cm [1]. Recently, the formation of 270Hs in a 4n evaporation channel in the fusion reactions with different asymmetry has been studied by theoretical calculations by Liu and Bao [2]. The reactions 48Ca + 226Ra and 36S+ 238U are predicted to result in a higher cross section due to a more negative reaction Q value. The measurement of the nuclear fusion reactions 36S+ 238U at GSI, Darmstadt and 48Ca + 226Ra at FLNR, Dubna has already been started. The first preliminary results will be presented in this contribution. [1]Dvorak et al., Phys.Rev.Lett., Vol97, 242501 (2006) [2]Liu and Bao, Phys.Rev. C, Vol74, 057602 (2006)

Invited Group Report HK 16.8 Mo 18:30 H-ZO 60

New ideas on the formation of heavy and superheavy neutron rich nuclei — •Valery Zagrebaev[1] and Walter Greiner[2] — [1]FLNR, JINR, Dubna, Russia — [2]FIAS, J.W. Goethe-Universität, Frankfurt, Germany

Nowadays, nuclei far from stability are accessible for experimental study in almost any region of the nuclear map. The only exception is the north-east part where a vast blank spot is still unexplored. This area of the nuclear map can be reached neither in fusion–fission reactions nor in fragmentation processes. The unexplored area of heavy neutron-rich nuclides is extremely important for nuclear astrophysics investigations and, in particular, for the understanding of the r-process of astrophysical nucleogenesis. The study of the structural properties of nuclei along the closed neutron shell N = 126 (Z < 80) would also contribute to the present discussion of the quenching of shell effects in neutron rich nuclei.

A novel idea is proposed for the production of these nuclei via low-energy multi-nucleon transfer reactions with stable beams. The estimated yields of neutron-rich nuclei are found to be rather high in such reactions and several tens of new nuclides can be produced, for example, in the near-barrier collision of ^{136}Xe with ^{208}Pb with a cross section higher than one microbarn. This finding may spur new studies at heavy-ion facilities and should have significant impact on future experiments. Fusion reactions with the use of light and medium mass neutron-rich radioactive beams for the production of heavy neutron-rich nuclei will be also discussed in the talk.

HK 17: Astroparticle Physics

Time: Monday 16:30–19:00 Location: H-ZO 70

Invited Group Report HK 17.1 Mo 16:30 H-ZO 70

Measuring the highest-energy particles in the universe — •Heino Falcke — Dept. Astronomy, Radboud University, Nijmegen, NL — ASTRON, Dwingeloo, NL

Since almost 100 hundred years we know that the earth is exposed to cosmic rays, which cause the ionisation of the atmosphere and also genetic mutations. Cosmic rays are actually mainly composed of energetic particles, mostly protons and atomic nuclei. The energy of these particles can reach up to 10^{20} eV, an energy which surpasses what can be achieved in even the largest particle accelerators on earth by many orders of magnitude. For this reason, ultra-high energy cosmic rays are equally interesting to particle physicists as well as astronomers. A big mystery is the origin of these particles. Where do they come from? Which processes can accelerate to such high energies? Candidate sources of cosmic rays are supernova explosions and supermassive black holes. However, also more exotic theories, like the decay of primordial strings have been proposed. A suite of major experiments will be trying to answer these questions in the near future. Among them are the Pierre Auger Observatory, a huge particle detector array in Argentina, KM3NET and IceCube, which are huge neutrino telescopes, and the LOFAR radio telescope, which not only will study the sources of cosmic rays but also is used to constrain some of the highest energy particles one can ever expect to detect. The talk will address the scientific issues surrounding ultra-high energy cosmic rays and neutrinos as well as the related experimental efforts.

Group Report HK 17.2 Mo 17:00 H-ZO 70

Untersuchung der Eigenschaften galaktischer kosmischer Strahlung mit dem KASCADE-Grande Experiment — •Jörg R. Hörandel und KASCADE-Grande Kollaboration — Radboud University Nijmegen, Department of Astrophysics, Nijmegen, The Netherlands

Ausgedehnte Luftschauer entstehen durch Wechselwirkungen hochenergetischer Teilchen der kosmischen Strahlung in der Erdatmosphäre. Mit dem KASCADE-Grande Experiment werden Luftschauer vermessen und daraus die Eigenschaften galaktischer kosmischer Strahlung im Energiebereich von 10^{14} bis 10^{18} eV abgeleitet. Die Interpretation der gemessenen Luftschauerdaten erfordert eine detaillierte Kenntnis der Eigenschaften hochenergetischer hadronischer Wechselwirkungen. Mit KASCADE-Grande werden daher die Eigenschaften der Wechselwirkungen untersucht, in Energie- und kinematischen Bereichen komplementär zu Beschleunigerexperimenten. Die beobachteten Eigenschaften der kosmischen Strahlung, wie ihr Energiespektrum und ihre Elementzusammensetzung geben Aufschlüsse über den Ursprung der galaktischen kosmischen Strahlung. Besonders interessant ist hierbei der Energiebereich von 10^{17} bis 10^{18} eV, in dem ein Übergang von galaktischer kosmischer Strahlung zu einer extragalaktischen Komponente erwartet wird. Neueste Ergebnisse werden vorgestellt.

HK 17.3 Mo 17:30 H-ZO 70

Modelling Geo-magnetic radiation from Extensive Air Showers — •Krijn de Vries[1], Olaf Scholten[1], and Klaus Werner[2] — [1]KVI, University of Groningen, The Netherlands — [2]Subatech, Universaty of Nantes, France

An incoming ultra high energy cosmic ray (UHECR) entering our atmosphere will create a so called extensive air shower (EAS). A cascade of particles flying toward the Earth's surface with extremely high velocities. As a result of this they are concentrated in a thin shower front, which can be visualized by a pancake of particles flying toward the Earth. The deflection of electrons and positrons due to the Earth magnetic field in combination with retardation effectis is responsible for an electromagnetic pulse to be emitted within the radio frequency range.

Concentrating on a macroscopic description, focussing on the net current created due to the deflection of the electrons and positrons in the Earth magnetic field, a model has been made to simulate the radio signal for a realistic air shower. Several different contributions to the electric pulse have been included to obtain more realistic simulations

and have a better comparison with measured data.

HK 17.4 Mo 17:45 H-ZO 70

Probing light dark matter by e^-p scattering — •Tobias Beranek, Achim Denig, and Marc Vanderhaeghen — Institut für Kernphysik, Johannes-Gutenberg Universität, 55099 Mainz

Gamma radiation from the galactic center around 511 keV has been observed for more than thirty years. These data imply that the 511 keV emission line is caused by annihilating low-energy positrons. Recent measurements of SPI spectrometer at the INTEGRAL probe confirm this hypothesis. The number of positrons in the galactic center is not large enough to explain the γ ray intensity in a simple way. A possible explanantion of this observation assumes a new gauge boson U and scalar dark matter particles ϕ with mass of $10 - 100$ MeV. The U boson couples to the Standard model particles as well as to the light dark matter particles ϕ.
We analyse the process $e^-p \rightarrow e^-pU$ as a background process to elastic scattering $e^-p \rightarrow e^-p$ and make a feasibility study for an experimental realization at the MAMI accelerator facility at Mainz. Simulations for the parameter space resulting from various theoretical approaches to light dark matter will be shown.

HK 17.5 Mo 18:00 H-ZO 70

Status and results from the EDELWEISS-2 Dark Matter Search — •Valentin Kozlov for the EDELWEISS-Collaboration — Forschungszentrum Karlsruhe, Institut für Kernphysik

EDELWEISS uses cryogenic Germanium bolometers to search for Dark Matter in form of weakly interacting massive particles, WIMPs. The experiment is situated in the French-Italian Fréjus tunnel, in the Modane underground laboratory LSM with a shielding of 4800 m.w.e against cosmic rays. Since the end of 2007, EDELWEISS is taking data, with a successive increase of target mass and further developments of detector technology.

We will present the status and the latest results of the current data taking with emphasis on the performance of new detectors. These detectors show a significantly improved β/γ-rejection and provide a promising base for a dark matter experiment of the next generation. In addition, the identification of muon-induced background events and special measurements of muon-induced neutrons will be discussed.

This work is supported in part by the German Research Foundation (DFG) through its collaborative research center SFB-TR27 ("Neutrinos and Beyond").

Group Report HK 17.6 Mo 18:15 H-ZO 70

Messung von Radioemission in ausgedehnten Luftschauern mit dem LOPES Experiment — •Jörg R. Hörandel und LOPES Kollaboration — Radboud University Nijmegen, Department of Astrophysics, Nijmegen, The Netherlands

Luftschauer entstehen durch die Wechselwirkung hochenergetischer Teilchen der kosmischen Strahlung in der Atmosphäre. Sekundäre Elektronen (und Positronen) werden im Erdmagnetfeld abgelenkt und emittieren Synchrotronstrahlung. Diese wird mit dem LOPES (LOfar PrototypE Station) Experiment im Frequenzbereich von 40 bis 80 MHz in zwei Polarisationsrichtungen (Nord-Süd und Ost-West) mit einem Dipolantennenfeld registriert. Gleichzeitig werden die Eigenschaften der Luftschauer mit dem KASCADE-Grande Experiment vermessen. Die Intensität der registrierten Radiostrahlung wird als Funktion verschiedener Schauerparameter untersucht, dies sind u.a. Schauerenergie, Abstand zur Schauerachse und Winkel zwischen Erdmagnetfeld und Schauerachse. Neueste Ergebnisse werden präsentiert. Diese zeigen, daß die Messung von Radiostrahlung in Luftschauern auf dem Wege ist, sich als neue Methode zur Messung der Eigenschaften hochenergetischer ($> 10^{16}$ eV) kosmischer Strahlung zu etablieren.

HK 17.7 Mo 18:45 H-ZO 70

The GSI Anomaly — •Hendrik Kienert — Max Planck Institut für Kernphysik, Heidelberg

Recently, an interesting experiment at the ESR facility of GSI Darmstadt has observed a non-exponential decay law for electron capture decays of certain heavy nuclei. Several controversial attempts have been made to explain this effect in terms of neutrino mixing. We briefly describe the experimental results, give an overview of the literature, and show that the effect cannot be due to neutrino mixing. We also briefly discuss alternative explanation attempts and their problems.

HK 18: Accelerators and Instrumentation I

Time: Monday 16:30–19:00 Location: H-ZO 80

HK 18.1 Mo 16:30 H-ZO 80

Beam identification system of the COMPASS-Experiment — •Prometeusz Jasinski — Institut für Kernphysik, Universität Mainz, Johann-Joachim-Becherweg 45, 55099 Mainz

In order to study the production of exotic mesons the COMPASS experiment at CERN took data with a 190 GeV/c hadron beam in the year 2008. The negative hadron beam contains mainly of pions and a small fraction of about 3% of Kaons. To identify and trigger on the small Kaon component, two beam Cherenkov Detectors with Achromatic Ringfocus, so called CEDAR detectors were installed. In the talk I will present the detector performance of the CEDARs during the 2008 run, including their efficiency and the achieved purity of the Kaon signal. Prospects for the upcoming hadron run in 2009 will also be discussed. Supported by BMBF under the contract 06MZ224

HK 18.2 Mo 16:45 H-ZO 80

A Disc DIRC for PID for the PANDA Experiment at FAIR/GSI — •Tibor Keri for the PANDA-Collaboration — Physics Department, Glasgow, UK

Proton-antiproton annihilation is a unique tool to address fundamental questions of the strong interaction and to explore the structure of the nucleon. The PANDA collaboration proposes to build a state-of-the-art universal detector system to study reactions of anti-protons impinging on a proton or nuclear target internal to the high energy storage ring HESR at the planned FAIR facility at GSI, Darmstadt, Germany. Superior particle identification of charged and neutral particles is mandatory to fulfil PANDA's physics aims. Detectors for particle identification comprise energy measurements in tracking detectors, precision Time-Of-Flight detectors, electromagnetic calorimeters, muon chambers and Cherenkov detectors based on the focussing DIRC principle or on the time-of-propagation principle. The central detector will feature a barrel DIRC covering the central region and a novel disc DIRC providing particle identification apabilities in the forward region. Both DIRC systems will benefit from recent advances in detector technology aiming for a 3D DIRC design. The technical design and the current status of the development for the disc DIRC detector will be presented.

HK 18.3 Mo 17:00 H-ZO 80

The Disc DIRC Cherenkov Detektor at PANDA — •Benno Kröck, Avetik Hayrapetyan, Irina Brodski, Klaus Föhl, Marko Zühlsdorf, Michael Düren, Michael Sporleder, Oliver Merle, Peter Koch, and Peter Schönmeier — II. Physikalisches Institut, Universität Gießen, Gießen, Germany

In the PANDA experiment at FAIR a disc DIRC will provide particle identification in the forward region to cover polar angles between 5 and 22°. Two designs exist. One concept uses two space coordinates to measure the Cherenkov angle while the second one uses one space coordinate and the time of propagation (ToP) of the Cherenkov photons. The ToP design requires fast photon detectors on the ≈ 40 ps level. Dispersion causes different propagation times for different wavelengths and has to be considered. Dichroic mirrors are used to reduce dispersion effects by splitting the Cherenkov spektrum into two or more ranges. The performance of the new detector concept has been evaluated by Monte Carlo simulations and reconstruction studies.

HK 18.4 Mo 17:15 H-ZO 80

Multianoden-Microchannelplate-Photomultiplier für den PANDA-DIRC — •Alexander Britting, Wolfgang Eyrich, Albert Lehmann, Andreas Teufel und Fred Uhlig für die PANDA-Kollaboration — Physikalisches Institut IV, Universität Erlangen-Nürnberg

Für den geplanten PANDA-Detektor des neuen FAIR-Komplexes an der GSI in Darmstadt soll die Teilchenidentifikation von Pionen und

Kaonen im wesentlichen durch DIRC-Detektoren (Detection of Internally Reflected Cherenkov Light) erfolgen. Dabei wird der entstehende Cherenkov-Kegel im Medium genutzt und mit Hilfe von Totalreflektion zu den Photosensoren geleitet.

Mit der für den Barrel-DIRC vorgesehenen Abbildungsoptik ist eine Ortsauflösung von ca. 5mm notwendig, um den Cherenkov-Kegel gut zu rekonstruieren. Da sich die Bildebene innerhalb des PANDA-Solenoiden befinden soll, werden ortsauflösende Photomultiplier zur Auslese benötigt, die im Magnetfeld funktionieren. Außerdem soll eine Zeitauflösung von besser als 100 ps erreicht werden, um dispersive Effekte im Radiator zu korrigieren. Als Kandidaten werden großflächige Multianoden-Microchannelplate-Photomultiplier (MCP-PMTs) untersucht. Die Messergebnisse, speziell hinsichtlich Uniformität und Crosstalk-Verhalten der einzelnen Pixel, werden für verschiedene Modelle präsentiert und verglichen.

- Gefördert durch BMBF und GSI -

HK 18.5 Mo 17:30 H-ZO 80

Untersuchung von Microchannel-Plate Photomultipliern für den PANDA DIRC — •Fred Uhlig, Alexander Britting, Wolfgang Eyrich, Albert Lehmann und Andreas Teufel für die PANDA-Kollaboration — Physikalisches Institut IV,Universität Erlangen-Nürnberg

Für das PANDA-Experiment am HESR/FAIR-Komplex der GSI in Darmstadt ist der Einsatz eines DIRC (Detection of Internally Reflected Light) Detektors zur Teilchenidentifikation geplant. Dazu werden die Öffnungswinkel des beim Durchlauf eines relativistischen Teilchens durch einen Radiator emittierten Cherenkov-Kegels bestimmt. Zur Rekonstruktion des Winkels sind zwei Koordinaten notwendig, X-Y oder X-ToP (Time-of-Propagation). Die X-ToP Variante ist eine der Optionen für den Scheiben-DIRC. Für diese Option sind Sensoren notwendig, die eine sehr gute Zeitauflösung von <50 ps für einzelne Photonen in hohen Magnetfeldern bis 2 Tesla erreichen. Außerdem werden niedrige Dunkelzählraten, eine hohe Ratenstabilität und eine lange Lebensdauer verlangt. Bisher gibt es keinen idealen Photosensor, der diese Anforderungen vollständig erfüllt. Als aussichtsreiche Kandidaten werden zur Zeit verschiedenen Modelle von Microchannel-Plate Photomultipliern (MCP-PMTs) untersucht. Unsere neuesten Ergebnisse werden vorgestellt. Ein besonders vielversprechendes Modell von Hamamatsu (R10754-00-L4) wurde speziell für die Anforderungen eines ToP-DIRC für den Belle-Upgrade entwickelt. Die Eigenschaften dieses neuen Multianodensensors wurden im Detail untersucht und werden ebenfalls präsentiert. - Gefördert durch BMBF und GSI-

HK 18.6 Mo 17:45 H-ZO 80

First Test Experiment with a PANDA Disk DIRC Prototype Detector (ToP-design) — •Peter Koch, Irina Brodski, Michael Düren, Klaus Föhl, Avetik Hayrapetian, Benno Kröck, Oliver Merle, Peter Schönmeier, Michael Sporleder, and Marko Zühlsdorf — II. Physikalisches Institut, Universität Giessen, Germany

The Disk DIRC is a forward detector for particle identification in the PANDA experiment at FAIR. It uses the internally reflected Cherenkov light that is emitted by a particle crossing the disk. In the ToP-Design the Time of Propagation of the Cherenkov photons is measured to extract the Cherenkov angle.

A test experiment was done at DESY in Summer 2008 using the 3.5 GeV electron beam. The photons were measured using multichannel plate photomultipliers (MCP-PMTs). The signales were digitized using TDCs with 25 ps resolution. First results are presented.

HK 18.7 Mo 18:00 H-ZO 80

Studies on different MaPMTs for a DIRC detector at the WASA-at-COSY experiment — •Christoph Adolph[1], Jens Bisplinghoff[2], Wolfgang Eyrich[1], Andreas Teufel[1], Cecilia Pizzolotto[1], Adrian Schmidt[1], Christian Vogel[1], Regina Siudak[2], and Kai Ulbrich[2] for the WASA-at-COSY-Collaboration — [1]Physikalisches Institut IV der Universität Erlangen-Nürnberg — [2]Helmholtz Institut für Strahlen- und Kernphysik Universität Bonn

The WASA-at-COSY experiment at the Forschungszentrum Jülich provides a nearly 4π detector including a forward spectrometer for studies on $\eta-$ and $\eta'-$meson decays in proton-proton collisions. Simulations have shown that an additional Detector of Internaly Reflected Cherenkov light (DIRC) in front of the Forward Range Hodoscope will significantly increase the particle identification and energy resolution for both the decayed particles and the background. The light generated inside the DIRC radiator is guided under total internal reflection towards the edge of the radiator where it is focused on a photon readout system by a special optic. For the reconstruction of the Cherenkov angle the photon readout system needs a good spatial resolution. This can be achieved by multi-anode photomultipliers (MaPMT). We report on studies of the characteristics of different MaPMTs (Hamamatsu Type H8500C, H9500 and H6568) and on results from a first test of a DIRC prototype at COSY.

supported by German BMBF and Forschungszentrum Jülich

HK 18.8 Mo 18:15 H-ZO 80

Studies on suface quality of PlexiGlas for a DIRC detector at the WASA-at-COSY experiment — •Adrian Schmidt[1], Christoph Adolph[1], Jens Bisplinghoff[2], Wolfgang Eyrich[1], Andreas Teufel[1], Cecilia Pizzolotto[1], Christian Vogel[1], Regina Siudak[2], and Kai Ulbrich[2] for the WASA-at-COSY-Collaboration — [1]Physikalisches Institut IV der Universität Erlangen-Nürnberg — [2]Helmholtz Institut für Strahlen- und Kernphysik Universität Bonn

The WASA-at-COSY experiment at the Forschungszentrum Jülich provides a nearly 4π detector including a forward spectrometer for studies on $\eta-$ and $\eta'-$meson decays in proton-proton collisions. Simulations have shown that an additional Detector of Internaly Reflected Cherenkov light (DIRC) in front of the Forward Range Hodoscope will significantly increase the particle identification and energy resolution for both the decayed particles and the background. For the reconstruction of the Cherenkov angle of the light generated inside the DIRC radiator, it is necessary that the Cherenkov light is guided isogonal and with only minimal loss to the Photosensors. Most important in this context is a perfect surface texture. We present studies on optical properties of different finished PlexiGlas bars and show the results of a first DIRC prototype test at COSY.

supported by German BMBF and Forschungszentrum Jülich

HK 18.9 Mo 18:30 H-ZO 80

Prototyping a Focussing Lightguide Disc DIRC at WASA for PANDA — •Klaus Föhl, Irina Brodski, Michael Düren, Avetik Hayrapetyan, Benno Kröck, Peter Koch, Oliver Merle, Michael Sporleder, Hasko Stenzel, and M. Zühlsdorf — II. Physikalisches Institut, Universität Giessen, Heinrich-Buff-Ring 16, D-35392 Giessen

For the future PANDA experiment at the FAIR laboratory particle identification is a crucial capability, and the space constraints favour the use of compact DIRC detectors. For the Endcap area in the PANDA Target Spectrometer a novel Focussing Lightguides Disc DIRC is being investigated. The talk will focus on how a prototype could be placed into the existing WASA experiment at COSY, which would inprove the WASA energy resolution for high-energy particles as well as provide proof-of-concept for the PANDA DIRC detector developments.

HK 18.10 Mo 18:45 H-ZO 80

Development of a RICH detector for CBM — •Claudia Hoehne for the CBM-Collaboration — GSI, Darmstadt, Germany

The Compressed Baryonic Matter (CBM) experiment at the Facility for Antiproton and Ion Research (FAIR) at Darmstadt will be a dedicated heavy-ion experiment exploring the intermediate range of the QCD phase diagram with $A + A$ collisions from 10-45 AGeV beam energy. A key observable of the physics program is a precise measurement of low-mass vector mesons and charmonium in their leptonic decay channel. In CBM, electrons will be identified using a gaseous RICH detector combined with several TRD detectors positioned after a system of silicon tracking stations which are located inside a magnetic dipole field.

The concept of the RICH detector, results on R&D as well as feasibility studies in terms of electron efficiency, pion suppression and the invariant mass distributions of low-mass vector mesons and charmonium will be presented. For the RICH detector CO_2 is foreseen as radiator gas. Glass mirrors covered with a reflective Al+MgF_2 coating are developed in cooperation with industry. As photodetector we plan to use MAPMTs coupled to fast, self triggered readout electronics. The usage of wavelengthshifter films is reinvestigated in order to increase the photon conversion efficiency for wavelengths below 300 nm.

HK 19: Accelerators and Instrumentation II

Time: Monday 16:30–19:00 Location: H-ZO 90

Group Report HK 19.1 Mo 16:30 H-ZO 90

The ISOLDE facility - Recent radioactive ion beam development — •Alexander Herlert — CERN, Geneva, Switzerland

The ISOLDE facility at CERN provides a large variety of radioactive ion beams for the investigation of, e.g., nuclear structure, nuclear ground state properties, solid state physics, and fundamental interactions. The radioactive ion beam development has played a key role in the successful physics program at ISOLDE. Recent target and ion source development comprises tests of new nanostructured target materials for the production of C and Kr beams. In addition, a new plasma FEBIAD ion source was constructed that delivers ion beams with up to ten times higher ionization efficiency for light noble gases, which enabled the first observation of ^{229}Rn. The ISCOOL radiofrequency quadrupole cooler and buncher, which is part of the HIE-ISOLDE upgrade, has been applied throughout the 2008 running period and enhanced significantly the beam quality. For the resonance ionization laser ion source RILIS a new solid state laser system has started operation, which is dedicated to obtain better ion beam stability and higher ionization efficiencies, e.g., as is the case of Ga. Finally, the number of available post-accelerated beams at REX-ISOLDE has been increased, now also including for instance ^{10}C on the low-mass side and ^{204}Rn on the high-mass side. An overview of recent achievements will be presented. The support from the ISOLDE collaboration and the ISOLDE technical group is acknowledged.

Group Report HK 19.2 Mo 17:00 H-ZO 90

Developments of dedicated plunger devices for lifetime measurements of excited states in exotic nuclei — •A. Dewald[1], Th. Pissulla[1], M. Hackstein[1], C. Fransen[1], W. Rother[1], H. Iwasaki[1], J. Jolie[1], K.-O. Zell[1], A. Gadea[2], J. J. Valiente Dobón[2], K. Starosta[4], W. Korten[5], A. Görgen[5], C. A. Ur[3], and P. Petkov[6] — [1]IKP Köln, Germany — [2]INFN-LNL Legnaro, Italy — [3]University of Padova, Padova, Italy — [4]NSCL, MSU, US — [5]SPhN, CEA Saclay, France — [6]INRNE, Sofia, Bulgaria

The recoil distance Doppler-shift (RDDS) method is an important technique for the measurement of lifetimes of excited nuclear states from which absolute transition strengths can be derived. In order to use this technique for nuclei far from stability it has to be adapted to the special requirements imposed by the specific nuclear reactions in which these exotic nuclei can be produced and excited. E.g., reactions with radioactive beams or deep inelastic reactions have been successfully applied for this purpose in the past. In this presentation we want to give an overview over recent developments of plunger experiments with radioactive beams at intermediate energies (≈100 MeV/u). In addition we will report on recent developments made for measurements at PRISMA-CLARA (LNL, Legnaro, Italy) and EXOGAM-VAMOS (GANIL, Caen, France) where deep inelastic reactions have been used. Future plans for plunger experiments at PRESPEC and HISPEC (GSI) will be discussed. Supported partly by: DFG, contr.n. DE1516/1; GSI,Fu.E, OK/JOL; EC, I3-EURONS contr.n.RII3-CT-2004-506065

HK 19.3 Mo 17:30 H-ZO 90

Monte Carlo simulation tool for the ^{7}Li(p,n) reaction — •Rene Reifarth[1,2], Michael Heil[1], Franz Käppeler[3], and Ralf Plag[1,2] — [1]GSI, Darmstadt, Germany — [2]Goethe Universität Frankfurt, Germany — [3]FZK, Karlsruhe, Germany

The ^{7}Li(p,n) reaction in combination with a 3.75 MeV Van-de-Graaff accelerator was routinely used at FZK to perform activation as well as time-of-flight measurements with neutrons in the keV-region. Planned new setups with much higher proton currents like SARAF and FRANZ and the availability of liquid-lithium target technology will trigger a renaissance of this method. A detailed understanding of the neutron spectrum is not only important during the planning phase of an experiment, but also during the analysis of activation experiments.

Therefore a Monte-Carlo based program was developed, which allows the simulation of neutron spectra considering the geometry of the setup and the proton energy distribution. The program was developed and tested while accompanying a number of recent activation experiments at FZK. A comparison with measured data, examples of past usages, and potential future applications will be presented.

This project is supported by the HGF Young Investigators Project VH-NG-327.

HK 19.4 Mo 17:45 H-ZO 90

Photon/Neutron Discrimination with Digital Pulse Shape Analysis* — •Bastian Löher[1], M. Miklavec[2], N. Pietralla[1], D. Savran[1], and M. Vencelj[2] — [1]Institut für Kernphysik, Technische Universität Darmstadt, Darmstadt, Germany — [2]Institut Jožef Stefan, Ljulbjana, Slovenia

The discrimination of photons against neutrons is a long-standing issue in nuclear instrumentation. The availability of powerful digital hardware makes it possible to use self learning algorithms to find signal classes. The research in this field is a fundamental necessity for a wide range of experimental applications.

In this work digital pulse shape discrimination is implemented based on a Fuzzy C-Means Clustering algorithm [1]. This way the determination of signal classes is achieved offline in an automated and universally applicable manner. The suitability of this algorithm for discrimination was validated using TOF measurements. The dependence of the *Figure of Merit* on external parameters such as detector high voltage, ADC sampling rate and bit resolution was investigated.

[1] R. O. Duda, P. E. Hart and D. G. Stork: Pattern Classification. John Wiley and Sons Inc., 2nd Ed., New York 2001

* Supported by DFG (SFB 634)

HK 19.5 Mo 18:00 H-ZO 90

A cryogenic gas catcher for high energy radioactive ions — •M. Ranjan[1], P. Dendooven[1], S. Purushothaman[1], I. Moore[2], H. Penttila[2], A. Saastamoinen[2], J. Aysto[2], W. Plass[3], C. Scheidenberger[3,4], H. Weick[4], J. Neumayr[5], P. Thirolf[5], and A. Popov[6] — [1]KVI, University of Groningen, The Netherlands — [2]University of Jyvaskyla, Finland — [3]Justus Liebig University, Giessen, Germany — [4]GSI, Darmstadt, Germany — [5]Ludwig Maximilians University, Munich, Germany — [6]Petersburg Nuclear Physics Institute, Russia

The Facility for Antiproton and Ion Research (FAIR) in Darmstadt, Germany, will allow studies of radioactive isotopes using laser techniques and ion traps. For this purpose, we are developing an ion catcher device that will stop high-energy ions from the Super-FRS in helium gas and extract them as a low-energy beam using DC and RF electric fields. The high purity of the helium gas will be ensured by operation at low temperature.

In order to demonstrate a cryogenic system that stops high-energy ions and extracts them as a low-energy beam, a cryogenic ion guide operating at liquid nitrogen temperature has been developed and has been tested at the IGISOL facility in Jyväskylä, Finland. The performance of this simplified prototype at low temperature and using a high-energy ion beam will be discussed. The operational parameters for a cryogenic gas catcher have been analysed defining the electrical and mechanical specifications of the system. A conceptual design of a cryogenic gas catcher will be presented.

HK 19.6 Mo 18:15 H-ZO 90

A Monolithic Detector Telescope Assembly with Multiplexed Electronic Readout — •Olof Tengblad[1], Miguel Madurga Flores[1], Mariano Carmona Gallardo[1], and Göran Nyman[2] — [1]IEM-CSIC, Madrid, Spain — [2]Chalmers Univ., Göteborg, Sweden

The study of excited states of unbound light nuclei includes the simultaneous detection of several charge particles emitted with very low energy. This puts sever constrains on the detection system to be used. For the detectors, high segmentation is needed to be able to detect several coincident particles, very thin dead layers to reduce the cut-of energy in combination with thin detectors to minimize sensitivity to beta and neutral particles.

For particle mass identification different techniques can be applied; Time of Flight, pulse shape analysis, or telescopes. At low energy heavy particles are easily stopped in the delta E, this makes the pulse shape technique very difficult to apply due to very weak signal and high noise level. A recent approach is using extremely thin DE detectors in monolithic assembly on a thick E detector both doped into the same wafer.

The high segmentation of the detectors leads to experiments with an increased amount of electronic channels. Optimized electronic and the use of multiplexing of the signals makes a high packing ratio possible while still keeping spectroscopy resolution. Detector and electronic de-

velopments made in parallel to experimental studies of multi particle break-up of excited states will be discussed.

HK 19.7 Mo 18:30 H-ZO 90

Fission-fragment timing with poly-crystalline diamond detectors — •Stephan Oberstedt[1], Ruxandra Borcea[1], Franz-Josef Hambsch[1], Andreas Oberstedt[2], Wouter Geerts[1], and Marzio Vidali[1] — [1]European Commission JRC-IRMM, B-2440 Geel — [2]Örebro University, S-70182 Örebro

For the investigation of prompt and delayed neutron emission in neutron-induced fission the two-arm time-of-flight spectrometer VERDI for high resolution fission-fragment spectrometry is being built at the Institute for Reference Materials and Measurements (IRMM). The ultimate goal is to achieve a mass resolution $A/\Delta A \approx 120$ in conjunction with a reasonable counting efficiency. One pre-requisite for such a device is the use of ultra-fast timing detectors, which may be operated at high radiation doses. For this purpose poly-crystalline chemical vapour deposited (pcCVD) diamond detectors have been tested for the first time as time pick-up for binary fission fragments. This type of detectors has demonstrated radiation hardness against a mix of alpha-particles, fission-fragments and prompt fission neutrons at radiation doses typically achieved during one fission experiment. For a 1 $\times$ 1 cm^2 large and 100 μm thick pcCVDD detector an intrinsic timing resolution better than 300 ps has been obtained. Present limitations and possible improvements will be discussed.

HK 19.8 Mo 18:45 H-ZO 90

Development of slowed down beams at GSI. — •Plamen Boutachkov[1], Fabio Farinon[1], Magdalena Górska[1], Jürgen Gerl[1], Katarzyna Hadynska[2], Rudo Janik[3], Ivan Kojouharov[1], Nikolai A. Kondratyev[4], Alvarez Marcos A. G.[5], Ivan Mukha[6], Pawel Napiorkowski[2], Farheen Naqvi[1], Chiara Nociforo[1], Daniel Pietak[2], Wawrzyniec Prokopowicz[1], Stephane Pietri[1], Andrej Prochazka[1], Henning Schaffner[1], Peter Strmen[3], and Helmut Weick[1] — [1]GSI, Darmstadt, Germany — [2]Warsaw University, Warsaw, Poland — [3]Komenského University, Bratislava, Slovakia — [4]FLNR, JINR, Dubna, Russian Federation — [5]CNA, Seville, Spain — [6]Seville University, Seville, Spain

The NUSTAR/HISPEC slowed down beam project[1] at GSI/FAIR is dedicated to rare isotopes with energies of upto 10 MeV/u. These radioactive beams will be used for spectroscopy and reactions studies. The setup for slowing down will utilize a thick degrader positioned after the FRS/Super-FRS separators at GSI/FAIR, followed by transmission detectors for energy and trajectory reconstruction. As a test, Coulomb excitation of a slowed down ^{64}Ni beam on a gold target was performed in Sep-Oct 2008 at GSI. TPC and MCP detectors were used for the tracking of the beam before and after slowing it down. The gold target, placed after the tracking setup, was surrounded partially with two DSSSDs and NaI γ-detectors. The results from the test experiment and a comparison to simulations will be presented.

[1] http://www-linux.gsi.de/ ~wwwnustar/tech_report/09-hispec_despec.pdf * Supported by the MEC, Spain, project FPA2006-13807-C02-01

HK 20: Energy for the future

Time: Monday 16:30–19:00 Location: H-ZO 50

Invited Group Report HK 20.1 Mo 16:30 H-ZO 50

Energy Initiatives of the European Physical Society — •Friedrich Wagner — Max-Planck-Institut für Plasmaphysik Branch Greifswald Wendelsteinstr. 1 D-17491, Greifswald, Germany

We are all aware that energy is gradually getting a rare commodity on one side and that the consequences of burning fossil fuels lead to major changes of our climate. Physics plays a crucial role in the improvement of established energy technologies but also in the development of new energy sources. Electricity is the highest form of energy in a technical context and plays a specific role for societies and their economies. In my report, I will try to elucidate the role physics can play in photo voltaic systems, in nuclear fission and in nuclear fusion. These are areas where the European Physical Society and its Member Societies play an important role in the dissemination of scientific results. Based on its analyses the EPS tries to influence the development of a European energy policy with position papers. In addition, EPS and many of its Member Societies have active Energy Working Groups. Some of the findings and recommendations resulting of the work of these groups will be summarized.

Invited Group Report HK 20.2 Mo 17:00 H-ZO 50

European energy options — •Sven Kullander — Royal Swedish Academy of Sciences, Box 50005, S-10405 Stockholm, Sweden

Energy produced inside the EU27 provides 46% of gross inland consumption. Nearly half of the production comes from nuclear and renewable sources. The EU27 fossil-fuel share of the consumption is 80% since the import consists of fossil fuels. The main target for the EU energy policy is to reduce the CO2 emissions and secure the supply; the dependence on imported fossil fuels must decrease.

The most promising energy sources in a long-term perspective appear to be concentrating solar power, suitable for South Europe, and nuclear energy. Intermittent energy sources such as wind and waves require matching energy, for example hydropower. Bioenergy, particularly motor biofuel, is often considered to be a powerful alternative to fossil fuels. However, competition with food production, biodiversity considerations and greenhouse gas emissions are factors against extensive use of biomass for energy production.

Increased use of electricity for example in the transport sector can be foreseen. Since electricity converts energy to movement essentially without heat losses, important savings can be made when fossil-fuel combustion is replaced by electricity. Since Europe is a rather small continent, a European electric power grid should be a major option for securing electricity supply.

Invited Group Report HK 20.3 Mo 17:45 H-ZO 50

Technology for Society's Energy and Climate Needs - Economic Analysis of Policy Options — •Gunnar Eskeland — Norwegian School of Economics and Business, Bergen, Norway

Taxes levied on energy and emissions (or alternatively tradable quotas, as in the Kyoto protocol or Europes Emission trading system) can do a lot for problems associated with emissions or energy security. Policy instruments such as support for renewables, feed-in-tariffs and energy efficiency support are not that easily understood or justified in basic economics textbooks. But issues of distribution - political feasibility - indicates that these supplementary policies will be prevalent. A consequence is that emission reduction initiatives will be rather shortsighted: since energy prices and emission prices will be lower than optimal, far-sighted research and development will be below what is socially optimal. We argue that public expenditures on energy research and technology is justified and unavoidable. Without it, Europe meets its goals for the short to intermediate term (2020), but fails to address longer term objectives.

Invited Group Report HK 20.4 Mo 18:30 H-ZO 50

Nuclear Energy of the Future — •Adrien Bidaud, S.. David, and O. Méplan — LPSC, Université Joseph Fourier Grenoble 1, CNRS/IN2P3, INPG, France

The coming century may see the end of standard fossil fuels, which represent today 75% of the world energy production and the climate change induced by their greenhouse gas releases. In this context, nuclear power appears as the only energy source available today, able to respond significantly to the growing world energy demand.

Present reactors are based on the fission of U-235 which represents only 0,7% of natural uranium. In a scenario of significant growing of nuclear energy, uranium reserves would be consumed in a few decades. Moreover, the waste production associated with these standards technologies should limit their deployment. It appears clearly today, that innovative technologies such as: GEN IV, thorium fuelled and accelerator-driven reactors have to be explored, in order to reduce considerably the ore consumption and the associated waste production.

We will present the links between the management of minor actinides, the need for electricity at the global scale and the start up of GEN IV reactors. Innovative reactors and fuel management facilities can only be built within a very clear legal frame defining the policy re-

garding safety, dismantlement, waste management, and proliferation. Thus, not only the contributions of nuclear physicists to the efforts of innovative reactor design, but also the importance of public acceptance and the weight of political choices will be pointed out.

HK 21: Plenary III

Time: Tuesday 9:00–10:30 Location: Audi-Max

Invited Talk HK 21.1 Tu 9:00 Audi-Max
Lattice QCD in Hadron Physics — •Andreas Schäfer — Institut für Theoretische Physik, Universität Regensburg, 93040 Regensburg, Germany

In recent years Lattice QCD became a most valuable source of information for many aspects of hadron structure which cannot be directly extracted from experiment. Basically, today one performs lattice calculations of experimentally known quantities to estimate systematic errors and then trusts lattice results for similar but unknown quantities within these uncertainties. Typical examples are the spatial structure of hadrons, the role of strange quarks in nucleon structure, the nature (exotic or non-exotic) of hadronic states, and the spin structure of hadrons. Enormous progress was made in nearly all aspects of such calculations, be it algorithms or hardware or the physics interpretation etc. Many crucial topics for modern high precision lattice calculations have to be delegated to talks in the parallel sessions for lack of time, e.g. the crucial role of chiral perturbation theory and the spectroscopy of excited hadrons.

Invited Talk HK 21.2 Tu 9:30 Audi-Max
Nuclear Astrophysics with Radioactive Beams — •Philip Woods — University of Edinburgh

The presentation will consider the remarkable new opportunties for experimental nuclear astrophysics studies that will be provided by the new generation of European radiaoctive beam facilities. These will become factories for explosive nuclear astrophysics studies. The talk will consider the key astrophysical issues that can be addressed at these facilities, and the novel experimental techniques that will be required.

Invited Talk HK 21.3 Tu 10:00 Audi-Max
Nuclear force studies in few-nucleon systems — •Johan Messchendorp — KVI, University of Groningen, Groningen, The Netherlands

Understanding the exact nature of the nuclear force is one of the long-standing questions in nuclear physics. In 1935, Yukawa has explained the pair-wise nucleon-nucleon (NN) interaction as an exchange of a boson. Current NN models are mainly inspired by Yukawa's idea and provide an excellent description of the high-quality database of proton-proton and neutron-proton scattering and of the properties of the deuteron.

The challenge lies in describing systems which involve more than two nucleons. Even for the simplest three-nucleon system, triton, a pair-wise NN interaction fails to describe such a system accurately enough, which has led to the introduction of three-nucleon forces and to alternative approaches such as chiral perturbation techniques. In the last decade, experiments at various laboratories were conducted to provide high-precision data in few-nucleon scattering processes, such as differential cross sections and polarization observables. These data form the basis to understand the various aspects of the many-body interactions via a rigorous comparison with ab-initio and self-consistent calculations including effects such as Coulomb and relativity.

In this paper, a review will be given of the experimental and theoretical activities in the field of few-nucleon systems. In particular, the most recent discoveries in three and four nucleon scattering reactions will be presented.

HK 22: Plenary IV

Time: Tuesday 11:00–13:00 Location: Audi-Max

Invited Plenary Talk HK 22.1 Tu 11:00 Audi-Max
LHC Experiments and Physics — •Peter Jenni — CERN, Geneva, Switzerland

After more than 15 years of design and construction efforts the LHC and its experiments are finally starting operation. Besides the giant accelerator, which is installed in a ring tunnel of 27 km length about 100 m underground, the not less impressive and complex detectors are ready for data taking. In this talk the status and the physics expectations of the three pp experiments ATLAS, CMS and LHCb will be reviewed (note that the heavy ion programme and its dedicated experiment ALICE will be covered separately). The LHC will allow them to explore fundamental physics questions like: why have particles a mass, what is the non-visible dark matter in the Universe, are there more than four dimensions in Nature, what are the smallest building blocks of matter? The expectations for new discoveries are high, since decades physicists are eagerly awaiting this exploratory step into unknown territory.

Invited Plenary Talk HK 22.2 Tu 11:45 Audi-Max
Cosmic Matter in the FAIR Laboratory — •Horst Stoecker — GSI, Darmstadt, Germany

An overview of the international project, FAIR (Facility for Antiproton and Ion Research), at Darmstadt will be given, including the lay-out and performance characteristics of the facility as well as the science programs to be addressed. Particular focus will be laid on research activities that aim at studying 'Cosmic Matter', i.e. extreme states of matter in hadron, nuclear and plasma physics. Moreover, the status of the project and the schedule for realizing the new facility in international cooperation will be discussed.

Invited Talk HK 22.3 Tu 12:30 Audi-Max
SPIRAL2 at GANIL: Next Generation of ISOL facility for intense secondary radioactive ion beams — •Sydney Gales — GANIL (DSM-CEA/IN2P3-CNRS) Blvd. Henri Becquerel, F-14076 Caen cedex, France

During the last two decades, secondary Radioactive Ion Beams (RIB) has allowed the investigation of a new territory of nuclei with extreme N/Z called *terra incognita*. The quest for Rare Isotope Beams (RIB), which are orders of magnitude more intense than those currently available, is the main motivation behind the design and construction of the next generation of RIB facilities. As selected by the ESFRI committee, the next generation of ISOL facility in Europe is represented by the SPIRAL2 project to be built at GANIL (Caen, France). SPIRAL 2 is based on a high power, CW, superconducting LINAC,delivering 5 mA of deuteron beams at 40MeV (200KW) directed on a C converter+ Uranium target and producing more 1013 fissions/s. The expected radioactive beams intensities in the mass range from A=60 to A=140, will surpass by two order of magnitude any existing facilities in the world. These unstable atoms will be available at energies between few KeV/n to 15 MeV/n. The same driver will accelerate high intensity (100*A to 1 mA), heavier ions up to Ar at 14 MeV/n. Under the 7FP program of European Union called*Preparatory phase* , the SPIRAL2 project has been granted a budget of about 4M€ to build up an international consortium around this new venture. The status of the construction of SPIRAL2 accelerator and associated physics instruments in collaboration with EU and International partners will be presented.

HK 23: Heavy Ion Collisions and QCD phases

Time: Tuesday 14:00–16:00 Location: H-ZO 10

Invited Group Report HK 23.1 Tu 14:00 H-ZO 10

Leptons and heavy mesons - signals from high density/ high temperature matter? — •Joerg Aichelin and Pol-Bernard Gossiaux — Subatech, Nantes,France

Theory predicts that at high density/temperature a plasma of quarks and gluons is created but it is all but easy to find 'smoking gun' signals, experimentally as well as theoretically. The multiplicity and the spectra of most of the hadrons are well described assuming a thermally equilibrated hadron gaz and contain therefore no direct information on the high density/temperature phase. We discuss whether two particles which do not follow this trend, leptons and heavy hadrons (containing either a c or a b quark), give us the desired information. A comparision of the theoretical approaches with present RHIC and future LHC data is presented and the physical consequences are discussed.

Group Report HK 23.2 Tu 14:30 H-ZO 10

Strangeness production and thermal equalibration in the near-threshold heavy ion collisions in FOPI — •Krzysztof Piasecki for the FOPI-Collaboration — Physikalisches Institut, Universität Heidelberg, Germany — Institute of Experimental Physics, Univ. of Warsaw, Poland

In Heavy Ion collisions at 1-2A GeV dense baryonic systems are produced at moderate temperatures. Investigation of the production of Φ [1] mesons and Σ^* [2], K^* [3] strange resonances plays an important role in understanding the equilibration mechanism and quantification of the temperature and baryochemical potential reached in the collision.

Particle yield ratios at freeze out can be described surprisingly well by thermal model without suppression of strangeness production. On the other hand, the concept of thermalization is checked using dynamical models.

An overview of the experimental findings on the short-lived strange particles from the FOPI detector in GSI will be presented.

This work is supported in part by BMBF 06HD190I and EU/FP6 I3 HP.

[1] A. Mangiarotti *et al.*, Nucl. Phys. A **714** (2003) 89
[2] X. Lopez *et al.*, Phys. Rev. C **76**, 055203(**R**) (2007)
[3] X. Lopez (FOPI), J. Phys. G: Nucl. Part. Phys. **35** (2008) 044020

HK 23.3 Tu 15:00 H-ZO 10

Omega production in pp collisions at 3.5 GeV: line shape in the lepton decay channel. — •Attilio Tarantola[1], Anar Rustamov[2], Herbert Stroebele[1], and Joachim Stroth[1,2] for the HADES-Collaboration — [1]Institut für Kernphysik Goethe-Universität, 60486 Frankfurt, Germany — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH, 64291 Darmstadt, Germany

HADES (High Acceptance Di-Electron Spectrometer) operates at SIS18 of GSI, Darmstadt. It is used to study in-medium properties of light vector mesons in ground state and excited nuclear matter. The observables of interest are their spectral functions and in particular possible modifications of width and mass. These can be identified by comparing the results obtained from pp, pA and AA reactions. In this contribution the reconstructed inclusive dilepton spectrum from pp data at 3.5 GeV kinetic beam energy will be presented. Preliminary results of a differential analysis of the omega meson production will be shown as well. The reconstructed omega meson line shape will be the reference for dilepton spectra obtained in pA reaction measured with HADES.

HK 23.4 Tu 15:15 H-ZO 10

Physics with the High Level Trigger of ALICE — •Kalliopi Kanaki for the ALICE-HLT-Collaboration — University of Bergen, Norway

The High Level Trigger (HLT) for the ALICE experiment at LHC will serve a dual role: it will deal with the large amount of data of the detectors and compress them to fit the mass storage capabilities, while enriching at the same time the statistics with meaningful physics content. Most major ALICE detectors are included in the HLT system at the moment, with event reconstruction, monitoring and calibration being some of the tasks performed on-line. In this presentation we will address the physics capabilities of HLT. We will present the methods of event characterization, mainly focusing on jet reconstruction, open charm, J/ψ and Υ production, and γ detection via conversions.

HK 23.5 Tu 15:30 H-ZO 10

Direct Photons in heavy-ion collisions from microscopic transport theory and fluid dynamics — •Bjørn Bäuchle[1,2] and Marcus Bleicher[2] — [1]Frankfurt Institute for Advanced Studies — [2]Institut für Theoretische Physik

Direct photons are a unique probe to get information about the early stages of a heavy-ion reaction. Due to the small rescattering cross-section they can leave the medium unperturbed.

The emission of direct photons in heavy-ion collisions is calculated within the relativistic microscopic transport model UrQMD. We compare results from the pure transport calculation to a hybrid-model calculation, where the high-density part of the evolution is replaced by an ideal 3D fluiddynamic calculation. We also compare the thermal rates from infinite matter-calculations to those used in the fluiddynamic part.

Furthermore, we study the contribution of different production channels and non-thermal collisions to the spectrum of direct photons. Detailed comparison to the measurements by experiments at CERN-SPS (WA98) are undertaken.

HK 23.6 Tu 15:45 H-ZO 10

Resonance Recombination Model for Quarks in the Quark-Gluon Plasma — •Hendrik van Hees[1], Lorenzo Ravagli[2], and Ralf Rapp[2] — [1]Institut für Theoretische Physik, Universität Giessen, Germany — [2]Cyclotron Institute and Physics Department, Texas A&M University, College Station, Texas 77843-3366, U.S.A.

We investigate a quark-recombination model based on the Boltzmann equation, assuming the survival of hadron-resonance like correlations in the sQGP near the hadronisation phase transition. The quark phase-space distributions are taken from a relativistic Langevin simulation for quark diffusion in an equilibrated QGP, described by a thermal elliptically cylindric fireball model, adjusted to the results of hydrodynamic calculations. The drag and diffusion coefficients are inferred from leading-order pQCD interactions augmented by effective Lagrangians with resonances smoothly merging into hadronic states at the phase transition, consistent with our assumption of resonance recombination at T_c. This resonance-recombination model, obeying energy-momentum conservation and leading to thermal equilibrium for the hadrons, reproduces the observed CQNS of $v_2(K_T)$ for the here investigated ϕ, J/ψ, and D-mesons.

Work supported by the US National Science Foundation under grant No. PHY-0449489, and by a Bessel Research Award from the A.-v.-Humboldt foundation.

HK 24: Hadron Structure and Spectroscopy I

Time: Tuesday 14:00–16:00 Location: H-ZO 20

Invited Group Report HK 24.1 Tu 14:00 H-ZO 20

The PANDA experiment at FAIR — •Paola Gianotti — INFN - Laboratori Nazionali di Frascati, Via E. Fermi 40, 00044 Frasscati, Italy

Though strong interaction has been studied for quite a long time, recent findings of new and unexpected resonances, with unresolved properties like the X(3872), show that the hadron spectrum is far from beeing completely understood. This is also underlined by the ongoing discussion on the existence of multi-quark states, and other exotic states with gluonic degrees of freedom.

An antiproton beam of unprecedent intensity and quality will be

soon available at the HESR machine, foreseen as one of the the new FAIR accelerators of Darmstadt. This tool, together with a properly designed new detector (PANDA), will be the ideal environment to copiously produce a wide spectrum of hadrons.

In the past, experiments with antiprotons have already demonstrated to be a rich source of information on many aspects of non-perturbative QCD. The better characteristics of the beam, and the new generation experimental setup will allow to address and clarify most of the open questions in a direct way.

A review of the PANDA experimental progam, and of the detector setup, will be given.

Group Report HK 24.2 Tu 14:30 H-ZO 20

Physics Performance Studies for PANDA at FAIR — •Jan Zhong for the PANDA-Collaboration — Experimentalphysik I, Ruhr-Universität Bochum, 44780 Bochum

With the PANDA experiment at FAIR, it will be possible to study antiproton-proton and antiproton-nucleus collisions up to $\sqrt{s} = 5.5$ GeV. PANDA will cover a broad physics program including hadron spectroscopy, search for gluonic excitations, charmed hadrons in matter, investigation of the structure of the nucleon, and hypernuclear spectroscopy. For a large number of benchmark channels, extensive Monte Carlo simulations have been done in order to determine the acceptance, the reconstruction efficiencies, and background rejection capabilities of the detector. The results of these simulations studies will be presented. Supported by bmb+f and the European Union.

HK 24.3 Tu 15:00 H-ZO 20

Topics in Meson Photoproduction with Crystal Ball/TAPS at MAMI — •Sven Schumann for the A2-Collaboration — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz

Since June 2004 the Crystal Ball/TAPS detector setup at the Mainz Mikrotron (MAMI) is used for experiments with energy-tagged real photons on liquid H_2/D_2 and various solid targets. The photon beam is produced in the bremsstrahlung process by the Glasgow-Mainz tagging system. The Crystal Ball as a spherical segmented photon spectrometer (672 NaI(Tl) crystals) in combination with the TAPS detector as a forward wall provides a solid angle coverage of nearly 4π; additional inner detectors are used for particle identification and track reconstruction. The experimental programme includes topics like photoexcitation of nucleon resonances in π^0 and η production, structure investigation of baryons (such as the $\Delta^+(1232)$ magnetic dipole moment determination), rare meson decays (η, ω), a new measurement of the η mass and studies of nuclear mass distributions using coherent π^0 production on nuclei. An overview of the various experiments and results from both the MAMI-B (883 MeV beam energy) and also the new MAMI-C (1,5 GeV beam energy, operational since 2006) runs will be presented.

HK 24.4 Tu 15:15 H-ZO 20

Diffractive Pion Dissociation into 5 Pion Final States at COMPASS — •Sebastian Neubert[1], Suh-Urk Chung[1,2], Jan Friedrich[1], Stefanie Grabmüller[1], Florian Haas[1], Bernhard Ketzer[1], Stephan Paul[1], Dimitry Ryabchikov[1,3], and Quirin Weitzel[1] for the COMPASS-Collaboration — [1]Technische Universität München, Physik Department E18, 85748 Garching Germany — [2]Brookhaven National Laboratory, Upton, NY 11973, USA — [3]Institute for High Ernergy Physics, 142284 Protvino, Russia

COMPASS is a fixed-target experiment at the CERN SPS, which investigates the structure and spectroscopy of hadrons. In 2004, a first run with a 190 GeV/c π^- beam took place using nuclear targets. Diffractive dissociation reactions observed in this run provide clean access to meson resonances with masses up to 3 GeV/c^2 . Exclusive final states with 5 charged pions have been extracted. The covered range in momentum transfer extends from threshold to a few GeV$^2/c^2$ allowing to study resonance production in different regimes. We will report on the status of the analysis of this unique data set.

HK 24.5 Tu 15:30 H-ZO 20

Photoproduction of η-mesons off the deuteron — •Dominik Werthmüller for the A2-Collaboration — Department of Physics, University of Basel

Photoproduction of η-mesons off a liquid deuterium target has been measured using bremsstrahlung photons produced by MAMI-C with incident energies up to 1.5 GeV. The η-meson was detected through its neutral decays into 2γ and $3\pi^0 \to 6\gamma$, respectively, in a combined setup of the Crystal Ball calorimeter and a TAPS forward wall which results in an almost 4π acceptance. Previous experiments performed by the CBELSA/TAPS and the GRAAL collaborations studying η-photoproduction on the deuteron revealed a bump-like structure of still unknown nature in the quasi-free neutron excitation function around $E_\gamma = 1$ GeV that is not found for the proton. The present experiment aimed at a significant improvement of the statistical quality of the data, in particular for η-mesons at backward angles. Preliminary results for the inclusive $\gamma(d,\eta)X$, the semi-exclusive $\gamma(d,\eta)NN$, and the fully exclusive reactions measured in coincidence with the recoil nucleons will be presented.

Supported by Schweizerischer Nationalfond, DFG, and EU/FP6.

HK 24.6 Tu 15:45 H-ZO 20

Time-like form factors of the nucleon — •Julia Guttmann[1], Andreas Metz[2], and Marc Vanderhaeghen[1] — [1]Institut für Kernphysik, Johannes Gutenberg-Universität, 55099 Mainz — [2]Temple University, Philadelphia, USA

The electromagnetic form factors are an important tool to explore the structure of the nucleon. The extraction of space-like form factors from electron-proton scattering shows a discrepancy between data of unpolarized Rosenbluth measurements and of polarization experiments. This difference can be explained by means of two-photon exchange corrections. In the time-like region no comparable calculations have been done up to now for the corresponding processes.

We investigate the influence of two-photon exchange in the reaction $\bar{p}p \to e^+e^-$ with regard to determination of the time-like form factors and present calculations for future experiments at the PANDA@FAIR project.

HK 25: Hadron Structure and Spectroscopy II

Time: Tuesday 14:00–16:00 Location: H-ZO 30

HK 25.1 Tu 14:00 H-ZO 30

Colour transparency in hard exclusive reactions — •Murat M. Kaskulov, Kai Gallmeister, and Ulrich Mosel — Institut für Theoretische Physik, Universität Giessen, Germany

We present a microscopic approach to hadron attenuation and colour transparency in hard electromagnetic reactions off nuclei. Our results for $(e, e'\pi^+)$ off nuclei support the early onset of the pionic colour transparency observed at JLab. The model results for the colour transparency effect in semi-exclusive electroproduction of strangeness from nuclei will be presented. These results provide a base for similar effects of CBM at FAIR.

Work supported by BMBF.

HK 25.2 Tu 14:15 H-ZO 30

In-medium properties of charm at FAIR — •Laura Tolos — Theory Group, KVI, University of Groningen, Groningen, The Netherlands

We study the properties of charm mesons in hot and dense matter within a self-consistent coupled-channel approach for the experimental conditions of density and temperature expected for the CBM experiment at FAIR/GSI. The in-medium solution at finite temperature accounts for Pauli blocking effects, mean-field binding on all the baryons involved, and meson self-energies. The dynamically-generated $\Lambda_c(2593)$ and $\Sigma_c(2880)$ resonances remain close to their free-space position while acquiring a remarkable width. As a result, the D meson spectral density shows a single pronounced peak for energies close to the D meson free-space mass that broadens with increasing matter density with an extended tail particularly towards lower energies. We also discuss the implications for the $D_{s0}(2317)$, $D_0(2400)$ and the predicted $X(3700)$ resonances at FAIR energies.

HK 25.3 Tu 14:30 H-ZO 30

Dilepton Production in Elementary Nuclear Reactions — •Janus Weil and Ulrich Mosel — Institut für Theoretische Physik, Universität Giessen, Germany

We present dilepton spectra from elementary nuclear reactions, which have been calculated via a semi-classical BUU transport model. We treat photon-induced reactions, as measured by the g7 experiment at JLAB, as well as proton-induced reactions, which have been measured by the KEK-PS E325 and the HADES collaborations. Our analysis aims for an investigation of possible in-medium modifications of the light vector mesons and their influence on experimentally accessible dilepton spectra.
Work supported by DFG.

HK 25.4 Tu 14:45 H-ZO 30

In-Medium Modifications of the ω Meson* — •Mariana Nanova for the CBELSA/TAPS-Collaboration — II. Physikalisches Institut, Giessen University, Germany

The behavior of vector mesons in a dense nuclear medium is one of the most fundamental research topics in hadron physics with respect to the question of chiral symmetry restoration [1]. Evidence for medium modifications of ω-meson has been published in [2]. New results from a re-analysis of the same CBELSA-TAPS experiment on a Nb target will be presented. A more stringent event selection has been applied, requiring a proton in coincidence with the ω-meson which is detected in the $\omega \to \pi^0\gamma$ channel. Because of the high sensitivity of the extracted ω signal shape to the background subtraction a new procedure has been developed to determine the background directly from the data by selecting 4γ events and randomly omitting one of the photons. The status of the analysis will be discussed and compared to the theoretical predictions.
[1] T. Hatsuda and S. H. Lee, *Phys. Rev.* **C 46**, R34 (1992)
[2] D. Trnka et. al, *Phys. Rev. Lett.* **94**, 192303 (2005)
* Funded by DFG (SFB/TR-16)

HK 25.5 Tu 15:00 H-ZO 30

Antiproton measurements in Ar+KCl reactions at 1.76 AGeV — •Manuel Lorenz for the HADES-Collaboration — Institut für Kernphysik, Goethe-Universität, Frankfurt am Main, Germany

A major part of the research in nuclear physics is concerned with the question of the properties of nuclear matter under extreme conditions. At the heavy-ion synchrotron SIS at the GSI, Darmstadt at bombarding energies between 1-2 AGeV nuclear matter is compressed to high densities of 2-3 times ρ_0 and heated to temperatures of around 100 MeV. To keep the information of the early high density phase of the collision undistorted, particles should not undergo the strong interaction. Therefore HADES consequently reconstructs short lived resonances via their decay in e^+e^--pairs.
A different approach is to investigate particles which are produced below their NN-threshold and therefore have a very steep excitation function, which makes them sensitive to predicted medium-effects. In this contribution we present a significant signal of the most extreme subthreshold produced particle at SIS energies, the antiproton. The free NN threshold of antiprotons corresponds to a kinetic beam energy of 5.6 AGeV, i.e. the threshold for antiprotons is much higher than achievable with the Fermi motion. The production yield is a promising observable for the properties of nuclear matter under these extreme conditions.

HK 25.6 Tu 15:15 H-ZO 30

Charmonium Interaction with Nuclear Matter — •Katalin Nikolics for the PANDA-Collaboration — Stefan Meyer Institute, Vienna, Austria

Understanding the charmonium interaction with nuclear matter is important for the description of the photo- and hadro-production of charmonium and charmed hadrons on nuclear targets as well as for diagnostics of hadronic final states in heavy-ion collisions. The suppression of charmonium production in heavy ion collisions is even proposed to be a signal for the formation of Quark-Gluon-Plasma (QGP). Investigating the absorption cross section of charmonium in nuclear matter should yield valuable information on this process.

The first excited state of charmonium, J/ψ, can easily be produced in antiproton-nucleus collisions which will be studied at the PANDA experiment. J/ψ can be identified via its leptonic decay channels. Its interaction with nucleons in the nuclear environment, in particular the J/ψ-nucleon dissociation cross section can be deduced from the measurement of its production as a function of the size of the target nucleus. Simulation studies including both the physics aspects of this process and the detector response to both signal and background are required in order to evaluate the scientific potential of the planned experiments.

This talk will give a brief introduction to the physics of the J/ψ interaction with nuclei and then present first results of simulation studies for the PANDA experiment.

HK 25.7 Tu 15:30 H-ZO 30

Charmed Meson Reconstruction with the PANDA Detector* — •René Jäkel, Kai-Thomas Brinkmann, Ralf Kliemt, and Oscar Reinecke for the PANDA collaboration — Universität Bonn, HISKP, Nussallee 14-16 and TU Dresden, IKTP, Zellescher Weg 19

The PANDA detector at the future GSI-FAIR facility will be a high precision experiment to study a variety of physics aspects of QCD at low energies. Using a high precision antiproton beam with momenta up to 15 GeV/c, the study of the charmonium system, the search of exotic mesonic states and glueballs and the investigation of in-medium modification of charmed mesons will be accessible. These different aspects of the rich physics program require an excellent tracking system to detect short-lived particles, e.g. for the survey of the charmonium system above the $D\bar{D}$ threshold.

To validate the physics performance of the planned PANDA detector, two $\bar{p}p \to D\bar{D}$ channels close to the production threshold in the charmonium system have been selected as benchmarks for the performance of PANDA, in particular for the tracking of charged particles. Although the $D\bar{D}$ production cross sections are unknown, an estimate on the expected signal to background ratio will be given. The main hadronic background sources as well as the physics of these processes will be discussed. $*$ supported by BMBF and EU

HK 25.8 Tu 15:45 H-ZO 30

Analysis Tools and Vertex Reconstruction in PANDA experiment — •Dipak Mishra and Klaus Goetzen for the PANDA-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Planckstr. 1, 64291 Darmstadt

The physics of strong interaction is one of the most challenging and facinating areas of current science. The PANDA experiment will address various questions related to the strong interactions by employing a multi purpose detector at High Energy Storage Ring (HESR) of the upcoming Facility for Anti proton and Ion Research (FAIR). The main physics programs of PANDA experiment are: Study of charmonium states with unprecedented precision, search for gluonic excitations such as hybrids and glueballs, study the properties of mesons in hidden and open charm in nuclear medium, hyper nuclei spectroscopy and many more physics programs.

In high energy experiments like PANDA, the precise determination of new exotic particles (resonances) are very important. These states which decay to stable particles via intermediate metastable states are usually reconstructed by following a bottom-up approach. In order to effectively separate the secondary vertices from the primary ones, all vertices have to be well reconstructed. For that purpose a set of analysis tools based on the Rho Analysis Package are being implemented comprising desirable functionality like e.g. decay tree reconstruction, kinematic and vertex fitting or PID classification. The current status of these developments will be presented.

HK 26: Nuclear Structure and Dynamics I

Time: Tuesday 14:00–16:00 Location: H-ZO 40

Invited Group Report HK 26.1 Tu 14:00 H-ZO 40

Mass measurements at JYFLTRAP — •Ari Jokinen — Department of Physics, P.O. Box 35 (YFL), FIN-40014 University of Jyväskylä, Finland

The mass of the ground state of a nucleus can provide insight into the underlying nuclear structure, such as charge symmetry, shell effects, shape coexistence and so forth. Atomic masses are also needed to test and improve mass predictions and astrophysical network calculations. Finally, precise Q-value measurements provide stringent tests of the Standard Model and contribute to double beta decay and neutrino physics.

The JYFLTRAP facility in the Department of Physics, University of Jyväskylä, is a unique combination of the ion traps and ion guide technique. The latter allows access to regions of the nuclide chart unexplored by conventional ISOL techniques. The tandem Penning trap system comprises two traps within one superconducting solenoid allowing independent purification in the first trap and precision measurement in the second trap. In addition, due to the installation of two traps inside a single superconducting solenoid, new trapping techniques have been developed.

Some of the recent highlights from the JYFLTRAP facility will be reviewed. Those include an evolution of the N=50 shell gap, precision Q-value measurements for weak interaction physics and mass measurements for nuclear astrophysics.

Group Report HK 26.2 Tu 14:30 H-ZO 40

ISOLTRAPs 2008 harvest — •Martin Breitenfeldt for the ISOLTRAP-Collaboration — Ernst-Moritz-Arndt-Universität, Greifswald, Germany

With ISOLTRAP [1] at ISOLDE/CERN mass measurements on exotic nuclides are performed down to an accuracy below $\Delta m/m=10^{-8}$. The obtained mass values are of importance for a number of applications, among others nuclear structure studies, test of mass models, and nucleosynthesis calculations. Recent measurements performed at ISOLTRAP help to examine the halo character of ^{17}Ne [2] and the restoration of the neutron-shell gap at N=82 [3]. In addition, the determination of the mass of ^{81}Zn [4] allowed detailed nucleosynthesis calulations in the vicinity of the waiting-point nuclide ^{80}Zn. Furthermore, for the first time a new isotope was discovered in a Penning trap, namely ^{229}Rn [5]. The new mass values of $^{223-229}$Rn as well as of $^{136-146}$Xe are entering in systematic δV_{pn} studies of the interaction between the valence protons and valence neutrons.

[1] M. Mukherjee *et al.*, Eur. Phys. J. A 35, 1-29 (2008).
[2] W. Geithner *et al.*, *in print* Phys. Rev. Lett.
[3] M. Dworschak *et al.*, Phys. Rev. Lett. 100, 072501 (2008).
[4] S. Baruah *et al.*, *in print* Phys. Rev. Lett.
[5] D. Neidherr *et al.*, *submitted.*

HK 26.3 Tu 15:00 H-ZO 40

TRIGA-TRAP: A Penning trap mass spectrometer at the research reactor TRIGA Mainz — •Jens Ketelaer[1], Klaus Blaum[2,3], Michael Block[4], Klaus Eberhardt[5], Martin Eibach[1], Frank Herfurth[4], Jochen Ketter[1], Konstantin Knuth[1], Szilard Nagy[2], Julia Repp[1], and Christian Smorra[3,5] — [1]Institut für Physik, Universität Mainz, D-55128 Mainz — [2]Max-Planck-Institut für Kernphysik, D-69117 Heidelberg — [3]Physikalisches Institut, Universität Heidelberg, D-69120 Heidelberg — [4]GSI Helmholtzzentrum für Schwerionenforschung GmbH, D-64291 Darmstadt — [5]Institut für Kernchemie, Universität Mainz, D-55128 Mainz

Nuclear masses represent the binding energies and, therefore, the sum of all interactions in the nucleus. They provide an important input parameter to nuclear structure models. Presently, a tremendous interest in masses of very exotic neutron-rich nuclides exists to support theoretical models for the nucleosynthesis via the rapid neutron capture process. The research reactor TRIGA Mainz provides access to a large variety of neutron-rich nuclides produced by thermal-neutron induced fission of an actinide target. The double-Penning trap mass spectrometer TRIGA-TRAP will perform high-precision mass measurements in this region of the nuclear chart as well as on actinides from uranium to californium [1]. It also serves as a test facility for the development of new techniques that will be implemented in future facilities like MATS at FAIR (GSI, Darmstadt). The layout of TRIGA-TRAP as well as recent mass measurements will be presented.

[1] J. Ketelaer et al., Nucl. Instr. Meth. A 594 (2008) 162.

HK 26.4 Tu 15:15 H-ZO 40

High resolution (^{3}He,t) reaction on ^{76}Ge and implications to double β decay — •Jan H. Thies, Dieter Frekers, Eike-W. Grewe, Pia Heinrichs, Peter Puppe, and Tim Ruhe — Westfälische Wilhelms-Universität Münster, Wilhelm-Klemm-Straße 9, 48149 Münster

A high-resolution ^{76}Ge(^{3}He,t)^{76}As measurement was performed at RCNP in Osaka (Japan) using the ^{3}He beam at an incident energy of 420 MeV and the high resolution WS course beam line. An energy resolution of 27 keV was achieved.

The measured data were used to extract the GT$^-$ strength in ^{76}As, which is the intermediate nucleus in the double β decay of ^{76}Ge. We observe that the GT$^-$ strength up to 5 MeV is highly fragmented. To construct the $2\nu\beta\beta$ decay matrix element for ^{76}Ge, these data are then combined with GT$^+$ data from a ^{76}Se(d,^{2}He)^{76}As measurement performed at KVI in Groningen (Netherlands). We note a strong level-by-level anti-correlation, which we attribute to the difference of the intrinsic deformation of the two nuclei, ^{76}Ge and ^{76}Se. We will discuss the implications on the matrix element of the ^{76}Ge $2\nu\beta\beta$ decay.

HK 26.5 Tu 15:30 H-ZO 40

Two–neutrino double beta decay of deformed nuclei within QRPA with realistic interaction — Mohamed Saleh Yousef, •Vadim Rodin, Amand Faessler und Fedor Šimkovic — Institut für Theoretische Physik der Universität Tübingen, Auf der Morgenstelle 14, D-72076 Tübingen, Deutschland

A method to implement a realistic nucleon-nucleon residual interaction based on the Brückner G-matrix (for the Bonn CD force) into the Quasiparticle Random Phase Approximation for deformed nuclei is formulated in Ref. [1]. The two-neutrino double beta decay for ground state to ground state transitions ^{76}Ge$\rightarrow^{76}$Se and ^{150}Nd $\rightarrow^{150}$Sm is calculated along with the Gamow-Teller strength distributions. The effect of deformation on the observables is studied in detail.

[1] M. Saleh Yousef, V. Rodin, A. Faessler, F.Šimkovic, arXiv:0806.0964

HK 26.6 Tu 15:45 H-ZO 40

Neutron Activation of ^{76}Ge — •Georg Meierhofer[1], Petra Kudejova[2,3], Lea Canella[3], Peter Grabmayr[1], Josef Jochum[1], and Jan Jolie[2] — [1]Kepler Center for Astro and Particle Physics, Eberhard Karls Universität Tübingen, 72076 Tübingen, Germany — [2]Institut für Kernphysik, Universität zu Köln, 50937 Cologne, Germany — [3]Institut für Radiochemie, Technische Universität München, 85748 Garching, Germany

The observation of neutrinoless double beta decay is a proof of the Majorana nature of the neutrino. The half-lives for these decays are very long (for ^{76}Ge: $> 10^{25}$ y), therefore background reduction is crucial in double beta experiments. To reduce background from cosmic rays, these experiments are built underground.

The Gerda experiment [1] at the Gran Sasso Laboratory (LNGS) in Italy searches for the neutrinoless double beta decay in ^{76}Ge, an ideal candidate as it can be source and detector at the same time.

A main contribution to the backround arises from the prompt gamma cascades after neutron capture by ^{76}Ge and the following β^--decay of ^{77}Ge. As the prompt gamma decay scheme is poorly known, measurements with isotopically enriched germanium targets were carried out at the PGAA facility at the FRM II (Munich). The measured neutron capture cross section and prompt gamma ray spectra will be used in further MC simulations for the Gerda experiment.

[1] GERDA, Proposal to LNGS, 2004
This work was supported by BMBF (05CD5VT1).

HK 27: Nuclear Structure and Dynamics II

Time: Tuesday 14:00–16:00 Location: H-ZO 50

HK 27.1 Tu 14:00 H-ZO 50

Beyond the relativistic mean-field approximation: configuration mixing calculations — •Tamara Niksic[1], Dario Vretenar[1], and Peter Ring[2] — [1]Physics Department, University of Zagreb, Croatia — [2]Physics Department, Technical University Munich, Germany

The framework of relativistic self-consistent mean-field models is extended to include correlations related to the restoration of broken symmetries and to fluctuations of collective variables. The generator coordinate method is used to perform configuration mixing of angular-momentum and particle-number projected relativistic wave functions. Intrinsic wave functions are generated from the solutions of relativistic mean-field equations, with a constraint on the mass quadrupole moment. The model, currently restricted to axially symmetric shapes, employs a relativistic point-coupling (contact) nucleon-nucleon effective interaction in the particle-hole channel, and a density-independent δ-interaction in the pairing channel. Both global and spectroscopic properties of nuclei are discussed.

In addition, an implementation of the five-dimensional collective Hamiltonian for quadrupole vibrational and rotational degrees of freedom is developed. The parameters are determined by constrained self-consistent mean-field calculation for triaxial shapes. The model is applied to nuclei in the Z=60,62 and 64 with N$\sim$90 region of the periodic chart.

HK 27.2 Tu 14:15 H-ZO 50

Pion production in neutrino-nucleus interactions — •Christophe Praet, Natalie Jachowicz, and Jan Ryckebusch — Ghent University, B-9000 Gent, Belgium

Understanding the process of one-pion production, one of the most prominent reactions at few-GeV energies, is essential for a proper analysis of oscillation experiments. In addition, important questions with regard to the axial sector of hadronic and nuclear physics ask for further investigations. We have developed a formalism to study Δ-mediated one-pion production in neutrino-nucleus interactions [1]. We assess ambiguities stemming from the Δ couplings and quantify the uncertainties in the axial form factors by comparing model predictions with bubble-chamber data. Nuclear effects are described in terms of the relativistic plane-wave impulse approximation using realistic bound-state wave functions. Medium modifications to the Δ mass and width are taken into account. We present various distributions, against Q^2, W and outgoing-lepton variables.

Recently, the process of coherent pion production from nuclei has attracted a lot of interest. We find that nuclear effects are large. We add two new features to the existing models. First, we go beyond the so-called *local approximation*, and take into account the full nuclear dynamics of the process. Second, the attenuation of the pion by the medium is computed by means of Glauber transparencies. We present pion distributions for a variety of target nuclei and neutrino energies.

[1] C. Praet, O. Lalakulich, N. Jachowicz and J. Ryckebusch, arXiv:0804.2750 [nucl-th].

HK 27.3 Tu 14:30 H-ZO 50

Self-consistent theory of charged current neutrino-nucleus reactions — •Nils Paar[1], Tomislav Marketin[1], Dario Vretenar[1], and Peter Ring[2] — [1]Physics Department, Faculty of Science, University of Zagreb, Croatia — [2]Physik-Department der Technischen Universitaet Muenchen, D-85748 Muenchen, Germany

A novel theoretial framework has been introduced for description of neutrino induced reactions with nuclei[1,2]. The properties of target nuclei are determined in a self-consistent way using relativistic mean-field framework based on effective Lagrangians with density dependent meson-nucleon vertex functions. The weak lepton-hadron interaction is expressed in the standard current-current form, the nuclear ground state is described in the relativistic Hartree-Bogoliubov model, and the relevant transitions to excited nuclear states are calculated in the proton-neutron relativistic quasiparticle random phase approximation[3]. This framework has been employed in studies of charged-current neutrino reactions involving nuclei of relevance for neutrino detectors, r-process nuclei, and neutrino-nucleus cross sections averaged over measured neutrino fluxes and supernova neutrino distributions.

[1] N. Paar et al., Phys. Rev. C 77, 024608 (2008).
[2] N. Paar et al., J. Phys. G 35, 014039 (2008).
[3] N. Paar, D. Vretenar, E. Khan, and G. Colo, Rep. Prog. Phys. 70, 691 (2007).

HK 27.4 Tu 14:45 H-ZO 50

Low-lying magnetic excitations of doubly-closed-shell nuclei and the nucleon-nucleon effective interaction — •Viviana De Donno[1], Giampaolo Co'[1], Chiara Maieron[1], Marta Anguiano[2], Antonio Miguel Lallena[2], and Miguel Moreno Torres[2] — [1]Dipartimento di Fisica, Università del Salento and INFN Sezione di Lecce, Via Arnesano, I-73100 Lecce, ITALY — [2]Departamento de Física Atómica, Molecular y Nuclear, Universidad de Granada, E-18071 Granada, SPAIN

The description of low-lying magnetic states of doubly-closed-shell nuclei puts severe constraints on the spin and tensor channels of the effective nucleon-nucleon interaction. A study of the low lying magnetic spectra of ^{12}C , ^{16}O , ^{40}Ca , ^{48}Ca and ^{208}Pb nuclei within the Random Phase Approximation (RPA) theory is presented. An investigation by using four phenomenological effective interactions comparing results for spectra and electron scattering form factors with experimental data is shown. Then self-consistent RPA calculations are presented to test the validity of the finite range D1 Gogny interaction. Particular attention has been paid to observe the sensitivity of the quantities studied to different interactions.

HK 27.5 Tu 15:00 H-ZO 50

Nuclear response using realistic interactions and extended RPA theories — •Panagiota Papakonstantinou, Anneke Günther, Heiko Hergert, Sabine Reinhardt, and Robert Roth — Institut für Kernphysik, T.U. Darmstadt, Germany

Realistic interactions, renormalized within the Unitary Correlation Operator Method, were employed recently in Second RPA (SRPA) calculations of nuclear response. Results will be presented and the main lessons learned will be discussed. In particular, our results, which represent a great improvement over our earlier RPA calculations, as well as physical arguments, suggest the prospect of describing nuclear collective excitations realistically and consistently using extended RPA (ERPA) theories, like SRPA, and renormalized interactions with good convergence properties.

Up to now, only two-body Hamiltonians have been considered and most of the results have been obtained using a softened Argonne V18 potential. Appropriate three-body terms can be included to improve the Hamiltonian. Prospects with chiral interactions will also be discussed. Further issues to be addressed are related to the ERPA method itself: The standard SRPA based on the quasi-boson approximation may not be the best RPA extension, as it suffers from intrinsic inconsistencies and instabilities.

HK 27.6 Tu 15:15 H-ZO 50

Chiral nuclear forces on the lattice — •Hermann Krebs — Universität Bonn, HISKP, Nussallee 14-16, 53115 Bonn

Nuclear lattice simulations based on effective field theory provide a powerful method to describe few- and many-body systems at low energy without losing connection to QCD. The lattice effective field theory approach addresses the few- and many-body problem in nuclear physics by applying non-perturbative lattice methods to low-energy nucleons and pions. The effective Lagrangian is formulated on a space-time lattice and the path integral is evaluated by Monte Carlo sampling. Pions and nucleons are treated as point-like particles on the lattice sites. By using hadronic degrees of freedom and concentrating on low-energy physics, it is possible to probe large volumes and greater number of nucleons than in lattice QCD. In my talk I will present our recent studies of the two nucleon system and neutron matter at subleading order. Accurate description of two-nucleon phase-shifts and ground state energy ratio of dilute neutron matter up to corrections of higher orders show that lattice effective field theory is a promising tool for quantitative studies of low-energy few- and many-body systems.

Invited Group Report HK 27.7 Tu 15:30 H-ZO 50

Modern Beyond Mean Field Theories — •J. Luis Egido and Tomás R. Rodríguez — Universidad Autónoma de Madrid, Madrid, Spain

In this talk we review the progress made in the last years in Beyond Mean Field Theories. After a pedagogical presentation of concepts, like spontaneous symmetry breaking, angular momentum -and particle number- projection as well as configuration mixing, several applications of the theory will be presented.

First we study the recently proposed shell closures at N=32 and N=34. We have calculated the excitation energy of the 2+ states in the Ca, Ti and Cr isotopes. Our results nicely follow the experimental trend in all three nuclides. In particular we predict a shell closure for N=32 but not for N=34.

In a second application the spherical to prolate deformed shape transition in the Neodymium isotopic chain is analyzed. Our results do not support the interpretation of 150Nd as a critical point nucleus and question the interpretation of shape changes as nuclear shape phase transitions.

As a third issue the pathological excitation energies of the 2+ states of the Cd isotopes close to the semimagical 130Cd is analyzed. We find that it can be explained by a very remarkable nuclear structure effect.

Finally, preliminary results of the first triaxial angular momentum projection with the finite range density dependent Gogny interaction will be presented. In all calculations the D1S parametrization of the Gogny force will be used.

HK 28: Nuclear Astrophysics

Time: Tuesday 14:00–16:00 Location: H-ZO 60

Invited Group Report HK 28.1 Tu 14:00 H-ZO 60

Proton and alpha induced reactions relevant for the astrophysical p-process — •György Gyürky — Institute of Nuclear Research (ATOMKI), H-4001 Debrecen, POB.51., Hungary

The astrophysical p-process is the nucleosynthetic mechanism responsible for the production of the so called p-nuclei; the heavy, proton rich isotopes which are not produced by neutron capture reactions in the s- and r-processes. The modeling of the p-process requires the knowledge of the astrophysical site where the process takes place as well as the rates of the thousands of reactions involved in a p-process network. The limited accuracy of p-process models in calculating the p-isotope abundances can in part be attributed to the uncertainties in the reaction rates. These uncertainties are especially high for reactions involving charged particles. Therefore, the experimental investigation of charged particle induced reactions in the relevant mass and energy range is crucial in the development of more accurate p-process models. The measured cross sections can, on one hand, be directly used in the models, and, on the other hand, they can be used to test the statistical model calculations which are widely employed in p-process network calculations.

Recently, the cross section of several proton and alpha-induced reactions has been measured using the activation technique. Some details of the experiments and the results will be shown, the comparison with statistical model predictions and the implication to p-process network calculations will be discussed.

Group Report HK 28.2 Tu 14:30 H-ZO 60

Photon strength functions and cosmic nucleosynthesis. — •Chithra Nair[1], Arnd R. Junghans[1], Martin Erhard[1], Roland Beyer[1], Klaus D. Schilling[1], Ronald Schwengner[1], Andreas Wagner[1], and Eckart Grosse[1,2] — [1]Institut für Strahlenphysik, Forschungszentrum Dresden-Rossendorf, Germany — [2]Institut für Kern- und Teilchenphysik, Technische Universität Dresden, Germany

In network calculations for the cosmic nucleosynthesis the electromagnetic dissociation occurring in hot environments strongly depends on the low energy tail of the photon strength function peaking in the isovector giant dipole resonance (GDR). The widely used procedure of adjusting a single Lorentzian to the (gamma,n) cross section in the GDR maximum is clearly inadequate in various cases. Photodissociation studies of the p-rich nuclei 92Mo and 144Sm into several different exit channels show that competing processes are surprisingly strong, in particular in the tail region. Strength functions derived from a systematic study of many nuclei with A>80 were used in Hauser-Feshbach calculations performed with the code TALYS. They render a consistent description of the GDR for (gamma,n) and for the other observed channels. This study is based on droplet model results for the GDR-energy and on hydrodynamic considerations about its width as well as on nuclear shape parameters. For nuclei with A>80 these are sufficiently well known from nuclear structure studies resulting in a reliable prediction of photon strength functions also for deformed nuclei which can be used in calculations for the cosmic nucleosynthesis.

HK 28.3 Tu 15:00 H-ZO 60

In-beam experiments on (p,γ) and(α,γ) reactions for the astrophysical p process — •Jens Hasper, Marc Büssing, Michael Elvers, Janis Endres, and Andreas Zilges — Institut für Kernphysik, Universität zu Köln

Whereas most nuclei heavier than iron can be produced by neutron-capture processes, 35 proton-rich nuclei are believed to be synthesized exclusively by the p process in the explosive scenario of supernovae type II. This process involves an extensive reaction network consisting of about ten thousand (γ,n), (γ,p) and (γ,α) reactions on more than thousand nuclei. Due to the absence of experimental data, p-process network calculations are based almost completely on theoretically predicted reaction rates, which are subject to rather large uncertainties. A comprehensive experimental data base for these reaction rates is strongly required to improve the accuracy of p-process models. In the last decade increasing effort has been made to provide experimental data on (p,γ) and (α,γ) reactions at astrophysically relevant energies. Most of these experiments have been based on the activation technique which is restricted to the investigation of a very limited number of nuclei. This limitation can be overcome by measuring (p,γ) and (α,γ) reactions directly in in-beam experiments. A particularly suited experimental tool for these measurements is provided by the highly-efficient HPGe detector array HORUS at the ion TANDEM accelerator at the University of Cologne. We will present first results of experiments performed at HORUS on (p,γ) reactions of relevance for the p process.

This project is supported by the DFG under contract ZI 510/5-1.

HK 28.4 Tu 15:15 H-ZO 60

Astrophysical S factor for α-capture on ^{115}Sn — D. Filipescu[1], I. Cata-Danil[1], M. Ivascu[1], D. Bucurescu[1], N.V. Zamfir[1], T. Glodariu[1], L. Stroe[1], C. Mihai[1], N. Marginean[1], G. Cata-Danil[2], D.G. Ghita[1], R. Marginean[1], G. Suliman[1], T. Sava[1], and •S. Pascu[1] — [1]Horia-Hulubei National Institute for Physics and Nuclear Engineering, Magurele-Ilfov, Romania — [2]Physics Department, University Politehnica of Bucharest, Romania

The s and r processes calculations can only account for 50% of the ^{115}Sn abundance, and recent p process calculations cannot explain the remaining fraction. For this reason, the experimental measurement of the S factor of α capture on ^{115}Sn is of high importance in explaining the origin of ^{115}Sn. The cross section of ^{115}Sn$(\alpha,\gamma)^{119}$Te reaction has been measured in the effective center of mass energy from 9.5 to 14.7 MeV. Enriched self-supporting ^{115}Sn (56%) foils were bombarded with α beam delivered by the Bucharest IFIN-HH Tandem Accelerator. The induced activity of ^{119}Te was measured with two large volume GeHP detectors in close geometry to maximize the detector efficiency. The experimental cross section and astrophysical S factor are compared with statistical model predictions for different global α-nucleus optical potential.

HK 28.5 Tu 15:30 H-ZO 60

Photodisintegration of p-process nuclei — •A. Wagner[1], C. Nair[1], M. Erhard[1], D. Bemmerer[1], R. Beyer[1], E. Grosse[1,2], A. Junghans[1], K. Kosev[1], G. Rusev[1], K.D. Schilling[1], and R. Schwengner[1] — [1]Forschungszentrum Dresden-Rossendorf, 01314 Dresden — [2]Technische Universität Dresden, 01062 Dresden

The neutron deficient p-nuclei are shielded from the s- or r-process by stable isotopes. P-nuclei are likely to be formed in high temperature cosmic scenarios like exploding supernovae by photodisintegration reactions on heavy r- or s- seed nuclei. The lack of experimental information on energy-dependent cross sections especially for (γ,p) and (γ,α) reactions reduces the applicability of nucleosynthesis models. Using intense bremsstrahlung produced at the superconducting electron linear accelereator ELBE at Forschungszentrum Dresden-Rossendorf we

investigated (γ,n), (γ,p) and (γ,α) reactions for the medium-mass p-nuclei ^{92}Mo and ^{144}Sm, as well as (γ,n) reactions for ^{100}Mo and ^{154}Sm by photo-activation. The lowest photoactivation yields have been measured in an underground laboratory. The photodisintegration of ^{197}Au serves as a benchmark and it is compared to data measured previously with the positron annihilation technique.

HK 28.6 Tu 15:45 H-ZO 60

First direct mass measurement of the proton rich nuclides ^{85,86,87}Mo and ^{87}Tc — •Emma Haettner for the SHIPTRAP-Collaboration — Justus-Liebig Universität, Gießen — GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt

The masses of proton rich nuclides in the vicinity of $N = Z = 43$ were measured with the Penning trap mass spectrometer SHIPTRAP at GSI. These nuclei were produced in the fusion-evaporation reaction ^{36}Ar+^{54}Fe at energies of 5.0 and 5.9 MeV/u and separated at the velocity filter SHIP. The data are of astrophysical interest since these nuclei are believed to be a part of the rp and νp process paths.

The masses of ^{85}Mo and ^{87}Tc were measured for the first time. The masses of another two nuclides, ^{86,87}Mo, were determined for the first time in a direct mass measurement. For these nuclides the mass excess deviates from values of the 2003 Atomic Mass Evaluation by up to 1.5 MeV, indicating a systematic shift of the mass surface in this region of the nuclear chart. Additionally, the masses of ^{86}Zr and ^{85}Nb were measured and found to be in agreement with the values obtained at JYFLTRAP. The experiment as well as preliminary data on mass values, separation energies and their impact on network calculations of the rp and νp processes will be presented.

HK 29: Astroparticle Physics

Time: Tuesday 14:00–16:00 Location: H-ZO 70

Group Report HK 29.1 Tu 14:00 H-ZO 70

GERDA, searching for the neutrinoless double beta decay in ^{76}Ge — •Peter Grabmayr — Kepler Center for Astro and Particle Physics, Eberhard Karls University, Tübingen

The observation of the neutrinoless double beta decay ($0\nu2\beta$) would verify the commonly assumed Majorana nature of the neutrino. For a Majorana neutrino this process is possible as the neutrino oscillations proof their non-vanishing mass. Consequently, one needs to extended the Standard Model as the lepton number conservation is violated. Discovery of the $0\nu2\beta$ decay could possibly resolve the hierarchy problem and set the mass scale for neutrinos.

$0\nu2\beta$ decay is a very rare process ($T_{1/2} > 10^{25}$ y) which therefore requires extremely low background experimental conditions. ^{76}Ge is well suited for the calorimetric approach where source and detector are identical. The GERDA collaboration has available ∼18 kg of enriched detectors from the previous $0\nu2\beta$ experiments HdM and IGEX. In contrast to these the GERDA setup relies on a different concept of background suppression: operating the bare diodes in lAr with a large water buffer around, all located at the underground laboratory LNGS. Only screened high purity material after screening is used.

The setup will be completed and the measurements start in 2009.

This work is supported by the BMBF(05CD5VT1).

HK 29.2 Tu 14:30 H-ZO 70

Status des COBRA-Experimentes — •Tobias Köttig für die COBRA-Kollaboration — Lehrstuhl für Experimentelle Physik IV, TU Dortmund, D-44221

Das COBRA Experiment sucht nach neutrinolosen Doppel-Beta ($0\nu\beta\beta$) Zerfällen in Cd, Zn und Te Isotopen. Hierfür werden CdZnTe Halbleiterdetektoren eingesetzt. Der Nachweis des $0\nu\beta\beta$ Zerfalls würde nicht nur die Bestimmung der absoluten Neutrinomasse ermöglichen, sondern auch Aufschluss über die Natur des Neutrinos als Majorana- oder Dirac-Teilchens geben.

Da für $0\nu\beta\beta$ Zerfälle Halbwertszeiten jenseits von 10^{25} Jahren erwartet werden, ist ein extrem niedriger Untergrund nötig. Der aktuelle Stand des hierfür optimierten, am italienischen Untergrundlabor LNGS befindlichen experimentellen Aufbaus sowie die verwendeten CdZnTe Detektoren werden erläutert.

Aktuelle Grenzen auf Halbwertszeiten von verschiedenen Zerfällen werden präsentiert und ein Ausblick auf geplante Verbesserungen des experimentellen Aufbaus wird gegeben.

HK 29.3 Tu 14:45 H-ZO 70

Untergrundreduktion für das COBRA-Experiment — •Kathrin Schreiner für die COBRA-Kollaboration — Lehrstuhl für experimentelle Physik IV, TU Dortmund, D-44221

Das COBRA-Experiment sucht mit Hilfe von CdZnTe Detektoren nach extrem seltenen neutrinolosen Doppel-Beta Zerfällen ($0\nu\beta\beta$). Der von anderen Zerfällen erzeugte Untergrund, z.B. durch kosmische Strahlung, Neutronen, HF-Störungen, sowie Produkten aus natürlichen radioaktiven Zerfallsketten, muss daher möglichst gering gehalten werden.

Die industriell gefertigten Detektoren haben eine pigmenthaltige Passivierung, welche durch α-, β- und γ-Zerfälle zusätzlichen Untergrund erzeugt. Um diesen zu reduzieren, wurde die Passivierung durch zwei verschiedene pigmentfreie Passivierungen ersetzt.

Die Untergrundbeiträge dieser verschiedenen Passivierungen werden verglichen und die ersten Ergebnisse vorgestellt. Ausserdem werden Ergebnisse zur weiteren Reduktion des Untergrundniveaus im LNGS gezeigt, z.B. die Reduzierung von Radon als zusätzliche Untergrundquelle durch eine im Sommer 2008 dort angebrachte Stickstoffspülung.

HK 29.4 Tu 15:00 H-ZO 70

Modelling the Tritium Source of KATRIN — •Wolfgang Kaefer for the KATRIN-Collaboration — Forschungszentrum Karlsruhe GmbH, Institut für Kernphysik

The objective of the KArlsruhe TRItium Neutrino experiment KATRIN is the determination of the mass of the neutrino with a sensitivity of 200 meV by investigating the kinematics of the electrons from Tritium β decay. It is currently under construction at Forschungszentrum Karlsruhe.

A key component of the KATRIN experiment is the Windowless Gaseous Tritium Source (WGTS), in which Tritium decays with an activity of 10^{11} Bq. A precise understanding of the properties of the WGTS is mandatory for the neutrino mass determination. In particular the gas dynamics is crucial since the measured energy spectrum is influenced by inelastic scattering of the decay electrons with the Tritium molecules as well as Doppler broadening of the electron energy. Therefore parameters of the WGTS such as purity, temperature, density and velocity distributions of the Tritium gas and the magnetic field strength inside the WGTS have to be modelled in detail.

This talk gives an overview over the simulation and modelling program package currently in development which allows to study the influence of the WGTS parameters on the measured electron energy spectrum.

Supported by the BMBF with project number 05A08VK2 and by the DFG in SFB TR 27.

HK 29.5 Tu 15:15 H-ZO 70

A large air coil system and precision magnetic monitoring at the KATRIN main spectrometer — •Jan Reich for the KATRIN-Collaboration — Universität Karlsruhe (TH), Institut für Experimentelle Kernphysik

The aim of the KArlsruhe TRItium Neutrino experiment KATRIN is the determination of the absolute mass of the electron antineutrino with a sensitivity of 0.2 eV. The experiment will scan the endpoint region of the tritium beta decay spectrum with a spectrometer based on the MAC-E filter principle (Magnetic Adiabatic Collimation with an Electrostatic filter).

The magnetic field of the latter, especially in the analysing plane, has to fulfill certain criteria. The field gradually decreases over a length of 12 meters by a factor of 20000. Thus, in the analysing plane, the magnetic field is very low and the earth's magnetic field contributes a non-negligible part to it. By this influence the magnetic fluxtube is distorted. The axial symmetry and homogenity of the B-field is crucial to avoid background and achieve a high energy resolution.

For these reasons an external air coil system for compensating the earth's magnetic field as well as a low field correction coil system for fine tuning will be installed around the KATRIN main spectrometer in addition to a magnetic monitoring system.

Supported by the BMBF under contract 05A08VK2 and the DFG under SFB Transregio 27.

HK 29.6 Tu 15:30 H-ZO 70

Installation des Double Chooz-Myonenvetos — •Markus Röhling für die Double Chooz-Kollaboration — Kepler-Zentrum, Universität Tübingen, Deutschland

Ziel des Double Chooz-Experimentes ist es den Neutrinomischungswinkel Θ_{13} weiter einzugrenzen. Für diese Messung ist eine genaue Kenntnis des myoninduzierten Untergrundes unerlässlich. Aus diesem Grund wird das Double Chooz-Experiment ein aktives Myonenveto besitzen. In diesem Vortrag soll kurz die Installation des Myonenvetos des fernen Double Chooz-Detektors erläutert werden, die im Frühjahr 2009 stattfindet.

HK 29.7 Tu 15:45 H-ZO 70

KATRIN Vorspektrometer Status und Messungen — •Florian Fränkle für die KATRIN-Kollaboration — Universität Karlsruhe (TH), Institut für Experimentelle Kernphysik

Das **KA**rlsruher **TRI**tium **N**eutrino Experiment (KATRIN) verfolgt das Ziel der direkten Messung der Elektronantineutrinomasse aus der Kinematik des Tritium-β-Zerfalls mit einer bisher unerreichten Sensitivtät von 0.2 eV/c^2. Der Messaufbau setzt sich zusammen aus einer fensterlosen gasförmigen molekularen Tritiumquelle mit anschließender differentiell bzw. kryogen gepumpter Elektronen-Transportstrecke, einem elektrostatischen Tandemspektrometersystem, welches aus Vor- und Hauptspektrometer besteht, zur Analyse der Elektronenenergien und einer Detektoreinheit zum Nachweis der Zerfallselektronen. Die erforderliche Energieauflösung des Hauptspektrometers ist 0.93 eV bei 18.6 keV Elektronenenergie. Das Erreichen einer Sensitivität von 0.2 eV/c^2 auf die Neutrinomasse erfordert unter anderem ein sehr niedriges Untergrundniveau (<10mHz). In dem Vortrag werden der Status und aktuelle Ergebnisse der Messungen am KATRIN Vorspektrometer vorgestellt.

Dieses Projekt wird teilweise vom BMBF unter dem Kennzeichen 05A08VK2 und der DFG im Sonderforschungsbereich Transregio 27/TPA1 gefördert.

HK 30: Accelerators and Instrumentation I

Time: Tuesday 14:00–16:00 Location: H-ZO 80

Group Report HK 30.1 Tu 14:00 H-ZO 80

FPGA Based Compute Nodes for Trigger and Data Acquisition in HADES and PANDA — •Ming Liu[1], Johannes Lang[1], Zhen'an Liu[2], Hao Xu[2], Qiang Wang[1], Dapeng Jin[2], Sören Lange[1], Johannes Roskoss[1], Andreas Kopp[1], David Münchow[1], and Wolfgang Kühn[1] for the PANDA-Collaboration — [1]II. Physikalisches Institut, Universität Giessen, Germany — [2]IHEP Beijing, China

Modern experiments in hadron and nuclear physics such as HADES and PANDA at FAIR require high performance trigger and data acquisition solutions which - in the case of PANDA - can cope with more than 10^7 reactions/s and data rates in the order of 100 GB/s.

As an universal building block for such high performance systems, an ATCA compliant FPGA based Compute Node (CN) has been designed and built. Sophisticated online filtering algorithms can be executed on 5 XILINX Virtex-4 FX60 FPGAs. Each CN features up to 10 GBytes of DDR2 memory. Multiple CNs can communicate via optical links, GBit Ethernet and the ATCA Full Mesh backplane. The total bandwidth of a single CN exceeds 35 GB/s. The system is highly scalable ranging from small configurations in a single shelf to large multi-shelf solutions.

The talk will present the architecture as well as performance results for first algorithms, which have been implemented in the framework of the HADES trigger upgrade.

This talk has been supported in part by BMBF (06 Gi 179 & 180, Internationales Büro) and GSI

HK 30.2 Tu 14:30 H-ZO 80

The PandaRoot framework for simulation and analysis — •Stefano Spataro for the PANDA-Collaboration — II. Physikalisches Institut, Gießen, Germany

The Panda experiment at the future FAIR facility in Darmstadt will study anti-proton proton and anti-proton nucleus collisions with beam momenta up to 15 GeV/c.

To simulate the detector performance for the physics program (involving charm spectroscopy, electromagnetic form factors, hypernuclei, etc.) and to evaluate different detector concepts, a software framework is presently under development, called "PandaRoot".

The "PandaRoot"software is installed and tested on more than 20 platforms. It is mainly based on ROOT and Virtual Monte Carlo packages, and it runs on an Alien-based GRID infrastructure.

Several event generators and transport models can be used by changing few macro options. This allows an easy comparison and validation of results. Different algorithms for tracking and reconstruction are under development and optimization, to achieve the requirements of the experiment in terms of performances. Moreover, the analysis tools framework, Rho, has been implemented as well as a fast simulation code.

In this report a status of the current activities inside the PandaRoot framework will be presented, in terms of detector simulations, reconstruction algorithms and analysis of physics benchmark channels.

This work was supported in part by BMBF (06 GI 180, 06 MZ 225I), GSI (GIKÜH), University of Groningen and NWO 680-47-120.

HK 30.3 Tu 14:45 H-ZO 80

ALICE T2-Zentrum bei GSI — •Kilian Schwarz, Peter Malzacher, Victor Penso und Mykhaylo Zynovyev — GSI, Planckstr. 1, D-64291 Darmstadt

Bei GSI wird ein Tier2-Zentrum für das ALICE-Experiment betrieben. Die Hauptaufgabe eines Tier2-Zentrums sind Monte-Carlo-Simulation und individuelle Datenanalyse durch lokal ansässige Wissenschaftler. Hierzu müssen lokale Kopien von Daten aus dem Grid angelegt werden. Um diesen Aufgaben gerecht werden zu können, wird ein mit xrootd betriebener Fileserver - Cluster unterhalten, auf den Daten mit Grid-Methoden von außerhalb kopiert werden können. Für die lokalen Datenanalysen mit einer stationären PROOF-Farm oder in der GSI-Batchfarm dynamisch erzeugten PROOF-Clustern werden die Daten auf ein angeschlossenes Lustre-Cluster kopiert, welches den Vorteil einer POSIX-Schnittstelle vorweisen kann. Da die gleichen Maschinen sowohl mit interaktiven PROOF-Analysen sowie lokalen und aus dem Grid kommenden Simulationsjobs betrieben werden, müssen die Prioritäten entsprechend angepasst werden. Um schnell auf unerwartete Situationen reagieren zu koennen, werden alle essentiellen Dienste mit einem MonaLisa-basierten Monitoring-System überwacht. Der anwendungsbasierte Datenzugriff wird durch Testen und Optimieren der Netzwerkkonfiguration kontinuierlich verbessert.

Die im Rahmen der ALICE-Aktivitäten gewonnenen Erfahrungen werden für das FAIR-Projekt weiterverwendet werden.

HK 30.4 Tu 15:00 H-ZO 80

The PANDA Grid — •Paul Bühler for the PANDA-Collaboration — Stefan Meyer Institute, Vienna, Austria

In order to fulfill the computing demands of the future PANDA experiment at FAIR in Darmstadt a dedicated computing infrastructure will be required. A conceivable way of acquiring and managing the necessary computing power for simulations and data analysis is the Grid model. As an alternative to a centralized computing center this model allows to pool independent resources from multiple institutes or organizations.

Although PANDA is not expected to acquire data before the year 2016 the PANDA collaboration is already experimenting with the PANDA Grid. The PANDA Grid uses the AliEn middleware which is entirely built around Open Source components and has been developed by the ALICE collaboration at CERN. The PANDA Grid currently consists of 10 sites. Due to the optimized installation procedures and portability of the AliEn software it is easy to add new resources, allowing the Grid to be expanded without disturbing its continuous operation. AliEn provides tools to pool hardware resources but also to manage the installation of common software packages. This feature is exploited to distribute, install, and update the PANDA analysis soft-

ware (PandaRoot) on the different sites and with this to enable the PANDA Grid to perform PANDA related tasks. It is intended that PANDA Grid will provide in the order of 2-3000 CPUs by the end of 2008 and then constitute a powerful tool for upcoming PANDA detector design and physics case studies.

HK 30.5 Tu 15:15 H-ZO 80

Application of a versatile digital readout system for the PANDA Micro Vertex Detector — •Marius C. Mertens, James Ritman, and Tobias Stockmanns for the PANDA-Collaboration — Forschungszentrum Jülich GmbH, Institut für Kernphysik, Jülich

The Micro Vertex Detector (MVD) for the PANDA experiment at the Facility for Antiproton and Ion Research (FAIR) will be the innermost subdetector. Challenges include its triggerless readout and a high occupancy due to its proximity to the interaction point. Thus, the MVD design foresees hybrid silicon pixel sensors for the inner layers, silicon strip sensors for the outer layers and a custom frontend chip which can sustain high data rates for the readout. During the development of the MVD, a powerful and flexible system is needed to test detector electronics. Both the suitability of existing concepts and newly developed circuits have to be evaluated. Thus, we built a reconfigurable digital readout system based on a Virtex 4 FPGA in order to support a variety of frontend electronics. This is achieved by a modular design of hardware, firmware and software. Currently, the digital readout system interfaces to an Atlas pixel detector frontend chip (FE-I3) to assess its suitability for the PANDA MVD. A future step is the connection of a frontend chip specifically designed for the PANDA MVD (ToPiX), which is currently under development at INFN Torino. We will present the test setup based on the digital readout system with special focus on the application of prototype testing. Results from the readout of the Atlas FE-I3 will be shown, along with an outlook on tests with the ToPiX frontend chip. Supported in part by the EU and FZ-Jülich.

HK 30.6 Tu 15:30 H-ZO 80

A Sampling ADC Data Acquisition System for the Electromagnetic Calorimeters of COMPASS — •Alexander Mann, Heinz Angerer, Igor Konorov, Markus Krämer, and Stephan Paul — Physik-Department E18, Technische Universität München

For the readout of the two electromagnetic calorimeters of the two stage COMPASS spectrometer at CERN, a sampling ADC (SADC) based data acquisition system was developed. The shaped photomultiplier signals are continuously digitized with 80 MHz and processed within field programmable gate arrays (FPGAs). The FPGAs implement zero suppression, latency buffering and provide an option to derive online calorimeter trigger decisions. In total, 4704 calorimeter channels are currently read by two different SADC module types with 10 bit and 12 bit resolution, respectively. With modified FPGA firmware, the same modules are also used in other applications, e.g. for medical imaging (PET) and ultracold neutron experiments.

This work is supported by the BMBF, the Maier-Leibnitz-Labor Garching, the Cluster of Excellence Exc153 and FutureDAQ (EU I3HP, RII3-CT-2004-506078).

HK 30.7 Tu 15:45 H-ZO 80

Interaktive Datenanalyse mit stationären und dynamisch erzeugten PROOF-Clustern — •Kilian Schwarz, Peter Malzacher und Anar Manafov — GSI, Planckstr. 1, D-64291 Darmstadt

Alle vier LHC-Experimente haben erfolgreich zentral gesteuerte, über das Grid weltweit verteilte Monte-Carlo-Simulationen durchgeführt. Die mit der Analse der erzeugten Datenmengen verbundenen Herausforderungen (hunderte von individuellen Analysejobs im Grid, einfach zu handhabende Benutzerschnittstellen, Job-Scheduling, anwendungsspezifische Anforderungen an Datenzugriff, Netzwerk und CPU) werden im Rahmen des Hochenergiephysik Community Grids des D-Grid - Projekts bearbeitet.

Zu diesen Zweck wurde bei GSI ein Softwarepaket "PROOF on Demand" entwickelt, mit dessen Hilfe Benutzer PROOF - Cluster dynamisch dort generieren können, wo sie Daten analysieren wollen. Dies ist bereits jetzt zentrenübergreifend unter Verwendung der von allen LHC-Epxerimenten verwendeten Grid-Middleware gLite möglich. Implementationen für lokale Batch-Systeme (LSF) sowie fuer die ALICE-Grid - Middleware AliEn sind im Entstehen.

Fuer lokale Datenanalyse mit PROOF unterhält die GSI ein stationäres PROOF-Cluster, auf dem jeder einzelne Benutzer 160 PROOF-Prozesse starten kann. Die Datenspeicherung erfolgt auf einem an die Batch-Farm angebundenen Lustre Cluster. I/O und Netzwerkkonfiguration wird stetig optimiert.

HK 31: Accelerators and Instrumentation II

Time: Tuesday 14:00–16:00 Location: H-ZO 90

Group Report HK 31.1 Tu 14:00 H-ZO 90

Research on laser induced particle acceleration — •Natascha Raab[1], Markus Büscher[1], Oswald Willi[2], Ralph Jung[2], and Michael Seltmann[1,3] — [1]Institut für Kernphysik (IKP) and Jülich Center for Hadron Physics (JCHP), Forschungszentrum Jülich — [2]Institut für Laser-Plasma Physik (ILPP), Heinrich Heine Universität Düsseldorf — [3]FH Aachen

By directing a high-power, ultrashort laser pulse onto a thin foil, it is now possible to produce electron, proton and ion beams. However, for realizing reliable laser-driven accelerators one must still overcome fundamental and technological limitations. One current challenge is to continuously provide mass-limited targets into the laser focus in which its energy can be effectively converted into kinetic energy of the accelerated ions. IKP and ILPP have initiated a corresponding joint project based on a worldwide unique frozen pellet target that can provide a regular flux of frozen spheres of e.g. H2, N2, Ar and Xe, and the 100-TW laser system PULSAR at ILPP.

As a first step measurements are carried out with conventional gas and foil targets. These measurements include detector developement for fast particle detection and magnetic focusing of the particle beam as well as optical probing of the plasma itself, in order to better understand the ion-acceleration mechanisms.

The talk outlines the status of the research and the results of the first measurements.

HK 31.2 Tu 14:30 H-ZO 90

On the Way to High Dynamic Range Beam Profile Measurements — Jan Egberts[1], Carsten Welsch[2,3], and •Sayyora Artikova[1] — [1]Max Planck Institut für Kernphysik — [2]University of Liverpool — [3]Cockcroft Institute of Accelerator Science and Technology

A thorough understanding of halo formation and its possible control is highly desirable for essentially all particle accelerators. Particles outside the beam core are not only lost for further experiments, they are also likely to hit the drift chamber and thereby activate the beam pipe, which makes work on the accelerator costly and time consuming.

A well-established technique for transverse beam profile measurements is synchrotron radiation (SR) for high energy and high luminosity accelerators like the LHC or CTF3. At much lower beam energies, an alternative for transverse beam profile measurements based on the direct measurement of light is optical transition radiation (OTR) or the insertion of a luminescent screen. What applies for essentially all these light generation processes, is that the light intensity is over a wide range proportional to the particle density, which makes the optical analysis of such light an ideal tool for beam profile measurements.

A particular challenge, however, is to distinguish the particles in the tail regions of the beam distribution from the much more intense beam core. In this contribution, we present results from laboratory measurements on two different devices that might form the technical base of a future beam halo monitor: the novel SpectraCam XDR camera system and a flexible masking technique based on a DMD micro mirror array.

HK 31.3 Tu 14:45 H-ZO 90

Analyse der Orbit Response Matrix des Elektronen-Stretcherrings ELSA — •Oliver Preisner — Elektronen-Stretcher-Anlage ELSA, Physikalisches Institut, Universität Bonn

Im Rahmen des Sonderforschungsbereichs/Transregio 16 "Elektromagnetische Anregung subnuklearer Systeme" werden an der Beschleunigeranlage ELSA der Universität Bonn Doppelpolarisationsexperimente durchgeführt. Um einen möglichst hohen Polarisationsgrad der Elek-

tronen am Experiment zu gewährleisten, ist u.a. eine flache Gleichgewichtsbahn im Beschleunigerring notwendig. Hierfür verwendete Strahllagekorrekturverfahren sind umso effizienter, je besser die Fehler in der Magnetoptik bekannt sind.

Zur Detektion bislang unbekannter Fehlerquellen im bestehenden Lattice wurde die BPM-Orbit Response Matrix gemessen und mit der MATLAB-Toolbox LOCO (*L*inear *O*ptics from *C*losed *O*rbit) analysiert. Hierbei wird die theoretisch erwartete Orbit Response Matrix mit der gemessenen verglichen: Verschiedene Parameter der theoretischen Matrix – wie Aufstellungsfehler, Multipolbeiträge oder Kalibrationsfaktoren – werden so angepasst, dass diese im Rahmen der Messungenauigkeit des Strahllagemonitorsystems mit der experimentell ermittelten Matrix übereinstimmt.

In diesem Vortrag werden die Messungen der Orbit Response Matrix an ELSA sowie erste Resultate ihrer Analyse vorgestellt.

HK 31.4 Tu 15:00 H-ZO 90

Strahldiagnose mit Hochfrequenzresonatoren — •Thorsten Pusch — Elektronen-Stretcher-Anlage ELSA, Physikalisches Institut, Universität Bonn

In der externen Strahlführung des Elektronenbeschleunigers ELSA sollen während des Betriebs der Strahlstrom und die Strahllage gemessen werden, ohne den Strahl zu beeinflussen. Damit ist eine permanente Kontrolle beider Größen möglich, wodurch eine weitaus höhere Langzeitstabilität der Strahleigenschaften gewährleistet werden kann.

Als Monitore werden in die Strahlführung integrierte zylindrische Hohlraumresonatoren verwendet, in denen der Elektronenstrahl unterschiedliche elementare TM-Moden in Abhängigkeit der Stromstärke bzw. des Abstands von der Mittellage resonant anregt. Über eine Koppelvorrichtung wird dem gespeicherten Feld Energie entzogen und ein von der Lage bzw. Intensität abhängiges Signal extrahiert.

Im Fall der Lagemessung liegen die erwarteten Signalstärken unterhalb des Rauschniveaus und eine phasensensitive Verstärkung mit Hilfe von Lock-In-Verstärkern ist unabdingbar. Im Vortrag werden beide Diagnosesysteme beschrieben und erste Messergebnisse vorgestellt.

HK 31.5 Tu 15:15 H-ZO 90

Die ebene Gleichgewichtsbahn als Schlüssel zur wirksamen Kompensation depolarisierender Resonanzen — •Andreas Balling — Elektronen-Stretcher-Anlage ELSA, Physikalisches Institut, Universität Bonn

Den Schwerpunkt des hadronenphysikalischen Programms an ELSA im Rahmen des SFB/TR 16 bilden Doppelpolarisationsexperimente. Grundvoraussetzung für einen hohen Polarisationsgrad des extrahierten Elektronenstrahls ist eine mit hoher Präzision kontrollierte Gleichgewichtsbahn. Im schnell rampenden Stretcherring (bis zu 7.5 GeV/s bzw. 2 T/s) bedeutet dies wegen dynamischer Effekte während der Energierampe sowie vor dem Hintergrund der auftretenden depolarisierenden Resonanzen eine besondere Herausforderung. Das dazu in den vergangenen Jahren an ELSA durchgeführte Programm zur Orbitoptimierung umfaßt neben der geodätischen Feinjustierung der relevanten Komponenten in Verbindung mit einer thermischen Stabilisierung des Beschleunigertunnels und der Eliminierung von Feldfehlern auch Verfahren wie die strahlbasierte Kalibration der Positionsmonitore sowie eine dynamische, d.h energieabhängige, globale Korrektur von Störungen der Gleichgewichtsbahn auf Millisekunden-Zeitskala. Hierdurch wird im Standardbetrieb ein langzeitstabiler, reproduzierbarer Orbit mit Abweichungen unter 100 μm rms erreicht. Im Vortrag werden die angewandten Methoden erläutert sowie die Auswirkungen auf die Qualität des Nutzstrahls - ein zeitlich konstanter Polarisationsgrad von mehr als 60% am externen Target bei einer Strahlfleckstabilität von ca. 0.5 mm - präsentiert.

HK 31.6 Tu 15:30 H-ZO 90

Untersuchungen der nicht-linearen Strahldynamik im HESR — •Dominic Welsch, Andreas Lehrach, Bernd Lorentz, Rudolf Maier, Dieter Prasuhn und Raimund Tölle — Institut für Kernphysik, IKP-4, Forschungszentrum Jülich, Deutschland

Der Hochenergie-Speicherring HESR ist ein Teil der entstehenden Beschleunigeranlage FAIR (Facility for Antiproton and Ion Research) am Helmholtzzentrum für Schwerionenforschung (GSI) in Darmstadt. Der HESR wird Antiprotonen in einem Impulsbereich von 1,5 bis 15 GeV/c speichern und beschleunigen. Aufgrund der geringen Produktionrate von Antiprotonen und der Anforderungen des PANDA-Experiments an eine hohe Luminosität und eine gute Strahlqualität ist eine effektive Multipolkorrektur zur Vermeidung von Strahlverlusten wichtig.

Dazu wurde untersucht, wie sich Aufstellungs- und Feldfehler der strahlführenden Magnete auf die Stabilität des Antiprotonenstrahls auswirken. Es wurde ein Schema zur Chromatizitätskorrektur entwickelt, das die Effekte der nicht-linearen Felder der Sextupole auf ein Minimum reduziert. Die Auswirkung der nicht-linearen Felder des Elektronenstrahls im Elektronenkühler wurden in weiteren Untersuchungen berücksichtigt. Um den Einfluss der optischen Resonanzen zu simulieren, wurde der Arbeitspunkt variiert. Weiterhin wurde untersucht, wie Sextupole in den Geraden eine gezielte Manipulation der drittelzahligen Resonanzen zulassen.

Die hier vorgestellten Untersuchungen wurde mit Hilfe von symplektischem Teilchentransport, dynamischer Apertur Berechungen und Monte Carlo Methoden durchgeführt.

HK 31.7 Tu 15:45 H-ZO 90

Higher Order Modes in the Superconducting Cavities of the SPL — •Marcel Schuh[1,2], Frank Gerigk[1], and Carsten P. Welsch[2,3] — [1]CERN, Geneva, Switzerland — [2]MPI-K, Heidelberg, Germany — [3]University of Heidelberg, Germany

In this paper the influence of Higher Order Modes (HOM) on the operation of the superconducting linac section of the Superconducting Proton Linac (SPL), presently being designed at CERN for the LHC upgrade, is analysed. For this purpose, the characteristics of the HOMs in the 2 different beta families (0.65, 0.92 both at 704 MHz) of the SPL are calculated to estimate their effect on the cryogenic system and on the beam breakup (BBU). For both criteria the maximum external Q of the HOMs which can be accepted for reliable machine operation is defined. The results are then compared with values from similar projects. Finally, the need of HOM couplers for reliable operation of the SPL is discussed.

HK 32: Few-body physics

Time: Tuesday 14:00–15:45 Location: H-ZO 100

Group Report HK 32.1 Tu 14:00 H-ZO 100

Dynamics of 1S0 diproton formation in pp- and pd-collisions — •Yuriy Uzikov for the ANKE-Collaboration — JINR, LNP, Dubna, Russia

Quasi-binary reactions $AB \to \{pp\}_s C$ with formation of a proton pair at small excitation energy $E_{pp} = 0 - 3$ MeV, i.e. the $^1S_0$ diproton $\{pp\}_s$, at high transferred momenta can give more definite information on short-range NN-dynamics, as compared to very similar (in kinematics) reactions $AB \to dC$ with the final deuteron d. The reason is that the contribution of non-short range mechanisms related to excitation of the Δ-isobars in intermediate states is expected to be strongly suppressed for the $AB \to \{pp\}_s C$ reactions as compared to $AB \to dC$ due to isospin symmetry and conservation of angular momentum and parity. In contrast to the expected suppression of the $\Delta(1232)$, the cross sections of the reactions $pp \to \{pp\}_s \pi^0$ and $pp \to \{pp\}_s \gamma$ recently measured at ANKE-COSY in forward direction in the GeV region demonstrate prominent peaks in the Δ-isobar region. This observation would mean that the exected short-range effects (like high momentum component of the NN-wave function) are actually rather week in the reactions with the diproton. Calculations of the differential cross sections of the reactions $pd \to \{pp\}_s n$, $pp \to \{pp\}_s \pi^0$ and $pp \to \{pp\}_s \gamma$ are performed within the one-pion exchange model and are found to be in qualitative agreement with the ANKE-COSY data.

Supported by the DFG grant N^0 GZ:436 RUS 113/956/0-1

HK 32.2 Tu 14:30 H-ZO 100

Parity-violating effects in $A = 3,4$ systems — •Michele Viviani[1], Rocco Schiavilla[2], Alejandro Kievsky[1], Luca Girlanda[3], and Laura E. Marcucci[3] — [1]INFN, Sezione di Pisa, Pisa (Italy) — [2]ODU, Norfolk and JLAB, Newport News (USA) — [3]Phys. Dept., Pisa University, Pisa (Italy)

The parity-violating components of the nucleon-nucleon potential are studied in $A = 3, 4$ nucleon systems. In particular, we'll report the calculation of i) the neutron spin rotation in $\vec{n}$-d scattering, and ii) the longitudinal spin asymmetry in the reaction $\vec{n} + {}^3\mathrm{He} \to p + {}^3\mathrm{H}$. The scattering wave functions are obtained by means of the Kohn variational principle and the hyperspherical harmonic method. The calculations are performed using a number of different, latest-generation strong-interaction two- and three-nucleon potentials and the DDH or the new effective field theory models for the weak-interaction potential. These observables are expected to be dominated by the contribution of the long-range part of the parity-violating potential associated with pion exchange. Thus their measurements could provide a further constraint, complementary to that coming from measurements of the photon asymmetry in $\vec{n} - p$ radiative capture, on the strength of this component of the hadronic weak interaction.

HK 32.3 Tu 14:45 H-ZO 100

Study of three-nucleon force effects in $\vec{p} + d$ break-up at 135 MeV — •Mohammad Eslami-Kalantari — KVI, Groningen, The Netherlands — Yazd University, Yazd , Iran

Understanding the exact nature of the nuclear force is one of the long-standing questions in nuclear physics. Nowadays, the progress of exploring the nuclear force in both the theoretical and experimental fronts is remarkable. On the experimental side, high precision measurements provide large sets of data which allow a systematic study of physical phenomena such as the three-nucleon force (3NF), the Coulomb force, and relativistic effects for a large range of energies. From the theoretical side, different approaches such as Chiral-perturbation, partial wave analysis, and meson exchange potentials supply a detailed description of these phenomena.

High-precision measurements of the break-up proton-deuteron reaction have been performed in the past at KVI and elsewhere with the aim to study three-nucleon force effects. In the present work, we explored 3NF effects in the break-up scattering process by performing a measurement of vector analyzing powers and differential cross sections using a 135 MeV polarized-proton beam impinging on a liquid-deuterium target. For this study, we explored a new experimental set-up, Big Instrument for Nuclear-polarization Analysis, BINA, which covers almost the entire kinematic phase space of the break-up reaction. The results are interpreted with the help of state-of-the-art Faddeev calculations.

HK 32.4 Tu 15:00 H-ZO 100

A Study of all reaction channels in deuteron-deuteron scattering at 65 MeV/nucleon — •Ahmad Ramazani-Moghaddam-Arani — Kernfysisch Versneller Instituut, University of Groningen,Groningen, The Netherlands — Department of Physics, Faculty of Science, University of Kashan, Kashan, Iran

Few-nucleon systems can be used as fundamental laboratories for studying the details of the nuclear force effects. We performed a series of deuteron-deuteron scattering experiments at intermediate energies. The experiments exploited BINA and BBS experimental setups and polarized deuteron beams with kinetic energies of 65 and 90 MeV/nucleon. These experiments aim to measure differential cross sections, vector and tensor analyzing powers of all available reaction channels in deuteron-deuteron scattering. With these data we will provide a systematic database, which will be used to test present theoretical approximations and upcoming ab-initio calculations in four-nucleon system.

The analysis procedure along with the latest results of the elastic and three-body break-up channels will be presented.

HK 32.5 Tu 15:15 H-ZO 100

photodisintegration of ^3H in a three dimensional Faddeev approach — shahriar bayegan, •mehdi ahmadian shalchi, and mohammad reza hadizadeh — Department of Physics, University of Tehran, P.O.Box 14395-547, Tehran, Iran

An interaction of a photon with ^3H nuclei is investigated based on a three dimensional Faddeev approach. In this approach The three-nucleon Faddeev equations with two-nucleon interactions are formulated with consideration of the magnitudes of the vector Jacobi momenta and the angle between them with the inclusion of the spin-isospin quantum numbers, without employing a partial wave decomposition. In this calculation the two body t matrices and triton wave function with nd scattering are calculated in the three dimensional approach using AV18 potential. The standard single nucleon current and π-and ρ-like two-body currents have been used which fulfill the current continuity equation together with the corresponding parts of the AV18 potential. Finally the calculated observables are compared with the results of partial wave one and the experimental data.

[1] J. Golak et.al. Phys.Rept. 415 (2005) 89-205
[2] S. Bayegan et.al. Phys.rev.C77:064005,2008

HK 32.6 Tu 15:30 H-ZO 100

few-body bound states in a three dimensional approach — •Mohammadreza Hadizadeh and Shahriar Bayegan — Department of Physics, University of Tehran, P.O.Box 14395-547, Tehran, Iran

Recently the three dimensional (3D) approach has been successfully applied for three- and four-body bound states [1-4], where it greatly simplifies the numerical calculations without using the PW decomposition. The Faddeev-Yakubovsky equations with two- and three-nucleon interactions are formulated as a function of the vector Jacobi momenta. This formalism, according to the number of spin-isospin states that one takes into account, leads to only a strictly finite number of coupled three dimensional integral equations to be solved. The evaluation of the transition and permutation operators as well as the coordinate transformations due to considering the continuous angle variables instead of the discrete angular momentum quantum numbers is less complicated in comparison with partial wave representation. With respect to the partial wave representation the 3D formalism with the smaller number of equations leads to higher dimensionality of the integral equations.

[1] M. R. Hadizadeh and S. Bayegan, Few Body Syst. **40**, 171 (2007).
[2] M. R. Hadizadeh and S. Bayegan, Eur. Phys. J. A **36**, 201 (2008).
[3] S. Bayegan, M. R. Hadizadeh, and M. Harzchi, Phys. Rev. C **77**, 064005 (2008).
[4] S. Bayegan, M. R. Hadizadeh, and W. Glöckle, to appear in Progr. Theor. Phys. **120**, (2008). arXiv:0806.1520

HK 33: Heavy Ion Collisions and QCD phases

Time: Tuesday 16:30–19:00 Location: H-ZO 10

Group Report HK 33.1 Tu 16:30 H-ZO 10

A globally invariant chiral model with (axial-)vector mesons — •Francesco Giacosa[1], Susanna Gallas[1,2], Achim Heinz[1], Stefan Strüber[1], Denis Parganlija[1], and Dirk H. Rischke[1,2] — [1]Institute for Theoretical Physics, Goethe University, Max-von-Laue-Str. 1, Frankfurt am Main, D-60438 Germany — [2]Frankfurt Institute for Advanced Studies, Goethe University, Ruth-Moufang-Str. 1, Frankfurt am Main, D-60438 Germany

A model with linear realization of chiral symmetry and with the inclusion of vector and axial-vector mesons is presented in the two-flavor case. The nucleon and its chiral partner are introduced in the so-called mirror assignment. After a brief discussion about the motivation and the development of the model in the vacuum, the attention is focused on some hotly debated issues: (i) The nature of light scalar mesons and their role at nonzero temperature. (ii) The dependence of the ρ and the nucleon mass on the chiral condensate. (iii) An outlook on future research: inclusion of the scalar glueball, extension to three- and four-flavor cases and the quarkyonic matter at nonzero density. The aim is a simultaneous description of vacuum properties of hadrons, such as decays and scattering lengths, and the nonzero temperature and density behavior of a hadron gas.

Invited Group Report HK 33.2 Tu 17:00 H-ZO 10

Collective Phenomena in Heavy Ion Collisions — •Mihai Petrovici — National Institute for Physics and Nuclear Engineering, Bucharest

Detailed analysis of collective phenomena at baryonic level in highly central and mid-central heavy ion collisions and their sensitivity to the

Equation of State of hot and compressed baryonic matter will be presented. Results of the same type of analysis applied to experimental data at RHIC energies and Monte Carlo simulated data for ALICE at LHC will be shown. A summary of our contributions to ALICE experiment during the construction phase and CBM experiment at FAIR during R&D phase will substantiate the initiative for a network of excellence at the European level including small size research institutes.

HK 33.3 Tu 17:30 H-ZO 10

Decreasing elliptic flow at the CERN Large Hadron Collider: Calculations in a parton recombination approach — •Daniel Krieg and Marcus Bleicher — Institut für Theoretische Physik, Johann Wolfgang Goethe-Universität, Max-von-Laue-Str. 1, 60438 Frankfurt am Main, Germany

We apply the colinear parton recombination approach to study the energy dependence of the mean elliptic flow, v_2 in heavy ion collisions from AGS to LHC energies. The relevant input quantities (T, μ_B, η_T) at the various center of mass energies are obtained from fits to the available data, while η_T is the only relevant quantity for the LHC prediction. The model yields a good description of the integrated v_2 data for charged particles at midrapidity from AGS to RHIC energies. In stark contrast to the current expectations, we observe a decrease of the integrated v_2 values above the highest RHIC energy. Thus, we predict a decrease of v_2 at LHC energies compared to the RHIC results [Phys. Rev. C 78, 054903 (2008)]. This drop is attributed to negative v_2 values for the underlying parton distributions at low to moderate transverse momenta that develops if the transverse flow velocity is high enough. At energies above the LHC regime, the present approach predicts even negative values for the integrated v_2. These negative values seem to be a general feature of the employed blast-wave parameterization for parton distributions and they have also been experimentally observed by the NA49 collaboration. These results are supported by the recent preliminary data on J/ψ elliptic flow from PHENIX and our corresponding calculations [arXiv:0806.0736].

HK 33.4 Tu 17:45 H-ZO 10

Finite lifetime effects on the photon emission from a quark gluon plasma — •Frank Michler[1], Björn Schenke[1,2], and Carsten Greiner[1] — [1]Institut für theoretische Physik, Johann Wolfgang Goethe Universität Frankfurt am Main, Max von Laue Straße 1, 60438 Frankfurt am Main, Germany — [2]Department of Physics, McGill University, H3A 2T8, Montreal, Quebec, Canada

Photons play an important role as electromagnetic probes from a quark gluon plasma created in heavy ion collisions. After being once produced, the leave the medium undisturbed an thus provide direct insight into the early stage of the collision. Here the question arises how non equilibrium effects such as a finite creation time influences the resulting photon spectra. One main result has been the occurrence of first order contributions that dominate over higher order equilibrium contributions for large photon momenta.

Describing this phenomenon in the real time Keldysh formalism is mainly accompanied by two problems, namely the correct treatment of the virtual photon cloud in the vacuum and to get the resulting photon spectra convergent in the ultraviolet domain. We provide an ansatz allowing for the unambiguous identification and thus renormalization of the virtual photon cloud of the vacuum. Furthermore, it renders the spectrum of emitted photons UV-finite if the time evolution of the medium is simulated in a suitable manner.

HK 33.5 Tu 18:00 H-ZO 10

Scaling Analysis for the chiral Phase Transition in two-flavor lattice QCD — •Bertram Klein[1] and Jens Braun[2] — [1]Physik Department, Technische Universität München — [2]TRIUMF, Vancouver, Canada

The question of the exact nature of the phase transition in QCD with two flavors of quarks is still not settled. QCD lattice simulations will ultimately have to decide this question, but due to the presence of a finite quark mass, which breaks chiral symmetry, and due to the finite volume, phase transitions are difficult to analyze in such numerical simulations.

To establish the presence of scaling behavior and to determine the universality class of the corresponding phase transition a scaling analysis is required. Such a scaling analysis in turn relies on the knowledge of critical exponents, the scaling functions and the finite-size scaling functions for the different possible universality classes for the transition. As an additional problem, only dimensionless, universal quantities can be used in such an analysis. This can require the determination of non-universal normalization constants.

We use scaling functions for finite quark mass and finite volume obtained from Renormalization Group calculations to analyze lattice results for QCD with two flavors. We find that current lattice simulations are in a region where finite-size scaling effects remain small, and where corrections to scaling due to the large quark masses become large.

HK 33.6 Tu 18:15 H-ZO 10

Dilepton production at HADES energies — Katharina Schmidt, •Elvira Santini, and Marcus Bleicher — Institut für Theoretische Physik, Goethe Universität, Frankfurt am Main

Dilepton production in intermediate energies nucleus-nucleus and proton-proton collisions is analysed within the UrQMD transport model. Calculations for dilepton invariant mass spectra are compared with HADES data for C+C reactions at 1 and 2 AGeV and DLS data for proton-proton collisions at 1.04-4.88 GeV. We find that the experimental spectrum for C+C at 2 AGeV is slightly overestimated by the theoretical calculations in the region around the vector meson peak, but fairly described in the low mass region, where the data is satisfactorily saturated by the sources and parametrizations considered. On the contrary, an underestimation of the experimental data is found at 1 AGeV, pointing that at this energy the low mass region is not fully saturated by standardly parametrized Delta Dalitz decays alone. Predictions for dilepton spectra for proton-proton reactions at 1.25 GeV, 2.2 GeV and 3.5 GeV are presented.

HK 33.7 Tu 18:30 H-ZO 10

Reconstruction of π^0 and η mesons through photon conversions for *pp* data at LHC — •Kathrin Koch[1], Kenneth Aamodt[2], and Ana Marin[3] for the ALICE-Collaboration — [1]Univ. Heidelberg, Physik. Institut, Germany — [2]University of Oslo, Norway — [3]GSI Darmstadt, Germany

In 2009 the CERN LHC starts with a short run of *pp* collisions at the injection energy of $0.9TeV$ followed by a longer run of $10TeV$. First PbPb collisions at $\sqrt{s_{NN}} = 5.5TeV$ are expected at latest in 2010. The *pp* run provides important reference data for the heavy-ion runs. One of the most important observables in heavy-ion collisions are direct photons, because they give information about the high temperature and the high density phase. The main background for direct photons are photons from π^0 and η decays. Therefore, high precision measurements of their spectra are necessary to extract the direct photon spectrum. Independent from electromagnetic calorimeters this can be done with the reconstruction of photon conversions in the high resolution central tracking system. This method gives a very good mass resolution on the order of $5MeV$. Simulations show that one month of *pp* minbias collisions results in a p_t reach of $25GeV$ for π^0 and $12GeV$ for η assuming an integrated luminosity of $13nb^{-1}$. The statistics are comparable to that reached with the PHOtonSpectrometer (PHOS), and the method can also be used for PbPb collisions. In this talk an overview will be presented about the reconstruction method and the expected p_t spectra for different integrated luminosity scenarios.

HK 33.8 Tu 18:45 H-ZO 10

Perspectives for the measurement of the χ_c radiative decay in the ALICE experiment at the LHC — •Ana Marin[1], Pedro Gonzalez[2], Pedro Ladron de Guevara[2], Ernesto Lopez Torres[3], and Eulogio Serradilla[2] — [1]GSI, Darmstadt (Germany) — [2]CIEMAT, Madrid (Spain) — [3]CEADEN, Ciudad Habana (Cuba)

Heavy quarkonia are considered as very promising probes for the deconfinement of the hot and dense matter formed in relativistic heavy-ion collisions. J/ψ suppression in central heavy-ion collisions beyond expectations from a pure nuclear absorption scenario has been observed at CERN SPS and RHIC energies. Measuring the fraction of J/ψ resulting from χ_c and ψ' decays in *pp* and in heavy-ion collisions would help further understanding the mechanism for the suppression.

The LHC will provide *pp* (*PbPb*) collisions up to $\sqrt{s}$= 14 TeV ($\sqrt{s_{NN}}$= 5.5 TeV). The three experiments (ATLAS, CMS and ALICE) have a large program devoted to quarkonia measurements (J/Ψ, Ψ', Υ). Moreover, Monte Carlo studies demonstrate that, with the ALICE detector, it should be possible to reconstruct and separate the χ_{c1} and χ_{c2} in the radiative channel $J/\Psi+\gamma$, as two separated peaks. The low momentum photon from the decay is measured by reconstructing in the central barrel the e^+e^- pairs from photons converted mainly in the ITS material. The overall efficiency expected for χ_c reconstruction is about 0.9%. For *pp* collisions, the rate of observable χ_c's is expected to be 1.2×10^{-3} per second, assuming a luminosity of 10^{30} cm^{-2}s^{-1}

and a perfect trigger. An overview of the reconstruction method as well as expected results in *pp* collisions at LHC will be presented.

HK 34: Hadron Structure and Spectroscopy I

Time: Tuesday 16:30–19:00 Location: H-ZO 20

Invited Group Report HK 34.1 Tu 16:30 H-ZO 20

Chiral Perturbation Theory and Mesons — •Johan Bijnens — Lund University, Lund, Sweden

I will give a short introduction to and an overview of recent work in Chiral Perturbation Theory for Mesons. I will concentrate on the present status of higher order calculations in this field and possible future directions.

HK 34.2 Tu 17:00 H-ZO 20

Chiral logarithms tamed — Nikolai Kivel[1,2], Maxim Polyakov[1,2], and •Alexei Vladimirov[2,3] — [1]Petersburg Nuclear Physics Institute, Gatchina, St. Petersburg 188350, Russia — [2]Institute for Theoretical Physics II, Ruhr University Bochum, 44780 Bochum, Germany — [3]Bogolubov Laboratory of Theoretical Physics, JINR, 141980 Dubna, Russia

We derive non-linear recursion relations for the leading chiral logarithms (LLs). These relations provide not only very efficient method to compute LLs (e.g. the 33-loop contribution is calculated in dozens of seconds on a PC) but equip us with a powerful tool to sum up the LLs. Our method is not limited to the chiral perturbation theory, it is pertinent for any non-renormalizable effective feld theory such as, for instance, theory of critical phenomena, low-energy quantum gravity, etc.

In the present talk this method would be considered on the example of pion-pion scattering.

HK 34.3 Tu 17:15 H-ZO 20

Neutrino induced pion production at MiniBooNE and K2K within the GiBUU model — •Tina Leitner[1], Oliver Buss[1], Ulrich Mosel[1], and Luis Alvarez Ruso[2] — [1]Institut für Theoretische Physik, Universität Giessen, Germany — [2]Universidad de Murcia, Spain

The interest in neutrino nucleus reactions is driven by the discovery of neutrino oscillations where one now aims at a precise determination of neutrino oscillation parameters. This demands for an equally precise knowledge of the neutrino nucleus interaction process. Neutrino induced pion production is strongly influenced by nuclear effects. Their understanding is crucial since neutral current π^0 production is a major background in ν_e appearance experiments, while charged current π^+ production introduces a background to ν_μ disappearance searches.

We have investigated both, charged and neutral current neutrino induced pion production off nuclei, at MiniBooNE and K2K energies within the GiBUU transport model. Assuming impulse approximation, we treat the nucleus as a local Fermi gas of nucleons bound in a density and momentum potential. The outcome of the initial neutrino nucleon reaction undergoes complex hadronic final state interactions where in-medium spectral functions of the particles are taken into account. We present results for neutral current π^0 and charged current π^+ production and compare to first MiniBooNE and K2K data.
Work supported by DFG.

HK 34.4 Tu 17:30 H-ZO 20

One-pion production in neutrino-induced reactions — •Olga Lalakulich, Oliver Buss, Tina Leitner, and Ulrich Mosel — Institut für Theoretische Physik, Universität Giessen, Germany

We investigate neutrino interactions with nucleons and nuclei, paying special attention to one–pion production reactions. The elementary neutrino–nucleon cross section is presented as the sum of the leading Delta–pole diagram and several background diagrams calculated within the non-linear sigma–model. Neutrino interactions with nuclei are treated within the GiBUU transport model that takes into account various nuclear effects. The results, presented for several final states, are compared to the experimental data from several completed and running neutrino experiments.
Work supported by DFG.

HK 34.5 Tu 17:45 H-ZO 20

Photoproduction of pion pairs off ^{7}Li — •Yasser Maghrbi for the A2-Collaboration — Department of Physics, University of Basel

The photoproduction of $\pi^0\pi^0-$ and $\pi^0\pi^{+/-}-$ pairs off ^{7}Li has been studied at the Mainz MAMI accelerator for photon energies from threshold to 830 MeV. The experiment used the Glasgow photon tagging device and the combined Crystal Ball/TAPS electromagnetic calorimeter. The experiment was motivated by the much discussed in-medium properties of the σ-meson. Previous results indicated a shift of the strenght to small invariant masses for $\pi^0\pi^0$ but not for $\pi^0\pi^{+/-}$. However, comparisons to transport model calculations have shown that final state interaction (FSI) can produce similar effects. Therefore, in a new series of experiments with improved statistical quality, data was also taken for the light nucleus ^{7}Li, serving as a better reference point for FSI. Preliminary total cross sections and invariant mass distributions will be presented.

Supported by Schweizerischer Nationalfond, DFG, and EU/FP6.

HK 34.6 Tu 18:00 H-ZO 20

Radiative pion photoproduction in the region of the Delta(1232) resonance — •Evangeline J Downie for the A2-Collaboration — Institut fuer Kernphysik, Johannes Gutenberg Universitaet, Mainz, Germany

The Delta(1232) is perhaps the best-studied resonance in the nucleon excitation spectrum. From these studies, we have learned much about the nucleon-delta transition. However we have learned very little about the properties of the Delta itself, due to the exceedingly short lifetime of this strongly-decaying resonance. The Magnetic Dipole Moment of the Delta(1232) is predicted by many theories and models, ranging from the chiral limit to Lattice QCD (LQCD) calculations at unphysically high quark mass values. The experimental determination of this quantity in the physical mass region would provide both a strong test of the many models which operate within this region and an important constraint on the extrapolation between theoretical predictions at the chiral and LQCD quark mass limits.

The A2 Collaboration, of the Institut fuer Kernphysik at Johannes Gutenberg Universitaet in Mainz, Germany, are studying this property using radiative pion photo production. The experiment makes use of the tagged photon beam, produced by the Glasgow Photon Tagging Spectrometer from the MAMI electron beam. The reaction products, passing out of the liquid Hydrogen target, are detected using the powerful, large acceptance spectrometer combination of the Crystal Ball and TAPS. The talk will cover the method, data analysis and latest results from this experiment.

HK 34.7 Tu 18:15 H-ZO 20

Analysis of the $\eta \to e^+e^-e^+e^-$ decay — •Leonid Yurev for the WASA-at-COSY-Collaboration — Institut für Kernphysik and Jülich Center for Hadron Physics, Forschungszentrum Jülich, D-52425 — Joint Institute for Nuclear Research, Dzhelepov Laboratory of Nuclear Problems, 141980 Dubna, Russia

The decay $\eta \to e^+e^-e^+e^-$ is closely related to the channels with real photons: $\eta \to \gamma\gamma$, $\eta \to \pi^+\pi^-\gamma$, $\eta \to e^+e^-\gamma$ which are driven by the chiral anomaly of Quantum Chromodynamics. The extended interaction region of the electromagnetic processes of the η meson is parameterized by a so-called *transition form factor* – a scalar function of the invariant masses squared of the photons. The decay $\eta \to e^+e^-e^+e^-$ allows to study the form factor in the domain where there are two virtual photons with positive invariant masses squared.

We have recorded $10^7\eta$ events in the reaction $pd \to {}^3\mathrm{He}\eta$ at 1 GeV during a four weeks run in October 2008. The experimental method is similar to that used recently by the CELSIUS/WASA collaboration where two $\eta \to e^+e^-e^+e^-$ decay candidates were identified and an upper limit $BR(\eta \to e^+e^-e^+e^-) < 9.7 \cdot 10^{-5}$ (90% CL) was determined. Since the number of the η decays collected by the WASA-at-COSY collaboration is forty times larger, we expect to extract a statistically significant data sample of $\eta \to e^+e^-e^+e^-$ decays for the first time. In this presentation the status of the analysis of the $\eta \to e^+e^-e^+e^-$ decay channel and preliminary results will be discussed.

* Supported by FZ Jülich, BMBF, Wallenberg Foundation and

DAAD

HK 34.8 Tu 18:30 H-ZO 20

Vector-meson dominance from counting rules — •Stefan Leupold[1] and Matthias Lutz[2] — [1]Institut für Theoretische Physik, Universität Giessen, Germany — [2]Theory Division, GSI, Darmstadt, Germany

Recently a systematic flavour SU(3) framework has been proposed [1] to describe the strong and electromagnetic interactions of light pseudoscalar and vector mesons, with the latter represented by antisymmetric tensor fields. From the corresponding leading-order Lagrangian one can deduce for which processes vector-meson dominance applies and for which it does not. In particular, it turned out that at leading order the hadronic three-body and also the radiative decays of vector mesons are governed by vector-meson dominance. This allows to predict the hadronic three-body decays, once the parameters are determined from the radiative decays [2]. The obtained result for the three-pion decay of the omega meson agrees very well with experiment. The partial decay widths for the rare three-body decays of the K^* are predicted. Further examples are discussed where the leading-order Lagrangian does not lead to vector-meson dominance.

Work of S.L. supported by GSI.

[1] M.F.M. Lutz and S. Leupold, Nucl. Phys. A **813** (2008) 96, arXiv:0801.3821 [nucl-th].
[2] S. Leupold and M.F.M. Lutz, arXiv:0807.4686 [hep-ph].

HK 34.9 Tu 18:45 H-ZO 20

$\eta \to \pi^+\pi^-\pi^0$ decay with WASA-at-COSY — •Patrik Adlarson for the WASA-at-COSY-Collaboration — Department of Physics and Astronomy, Uppsala University, SE-751 21 Uppsala, Sweden

In the fall of 2008 a four week experiment was carried out with WASA-at-COSY with the purpose of studying η- decays. The ηs were produced in the $pd \to {}^3He\,\eta$ reaction at beam kinetic energy 1 GeV and in total approximately 10^7 of such events were collected. This data will be used to study the not so rare η decays involving charged pions, most notably $\eta \to \pi^+\pi^-\pi^0$. This decay proceeds mainly via a strong isospin violating contribution, where the decay width is proportional to the quark mass difference squared, $(m_d - m_u)^2$. Preliminary results of the analysis are presented.

Supported by BMBF, Wallenberg Foundation and Uddeholms Forskarstipendium.

HK 35: Hadron Structure and Spectroscopy II

Time: Tuesday 16:30–19:00 Location: H-ZO 30

Group Report HK 35.1 Tu 16:30 H-ZO 30

Towards polarized Antiprotons — •Frank Rathmann for the PAX-Collaboration — Institut für Kernphysik, Forschungszentrum Jülich, Germany

We present a short overview of the PAX physics case for polarized antiprotons. The recent measurement of the depolarizing pe cross section settled a long–standing controversy about the role of electrons in the polarization buildup of a stored beam by spin-filtering. The depolarization study sheds light on the ep spin–flip cross sections when the target electrons are unpolarized. The experimental finding rules out the practical use of polarized leptons to polarize a beam of antiprotons with present–day technologies. This leaves us with the only proven method to polarize a stored beam in situ, namely spin filtering by the strong interaction. At present, we are lacking a complete quantitative understanding of all underlying processes, therefore the PAX collaboration is aiming at high–precision polarization buildup studies with transverse and longitudinal polarization using stored protons in COSY. The polarized internal target required for these investigations is presently set up to be installed together with a large–acceptance detector system for the determination of target and beam polarizations in a dedicated low β section at COSY. In contrast to the pp system, the experimental basis for predicting the polarization buildup in a stored antiproton beam by spin filtering is practically non–existent. Therefore, it is of high priority to perform, subsequently to the COSY experiments, a series of dedicated spin–filtering experiments using stored antiprotons at the AD ring at CERN.

Group Report HK 35.2 Tu 17:00 H-ZO 30

Exclusive hadronic cross sections from BaBar — •Miriam Fritsch — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz, Germany

Measuring the inclusive hadronic cross section in e^+e^- is of major interest for the determination of the Standard Model prediction of the anomalous magnetic moment of the muon a_μ. The hadronic contribution $a_\mu^{\rm had}$ can be derived from measured total cross sections of exclusive hadronic reactions with the help of a dispersion relation. Decreasing the experimental uncertainties on these channels is of utmost importance to improve the Standard Model prediction. The reaction channel $e^+e^- \to \pi^+\pi^-$ has the biggest impact on the calculation.

This talk presents exclusive hadronic cross sections measured with the technique of Initial State Radiation (ISR). A huge dataset was taken with the BaBar detector at the B-factory PEP-II at SLAC (Stanford, USA), an electron-positron storage ring with fixed CM-energy of 10.58 GeV. Using the ISR method we get access to the energy range from the threshold up to 4.5 GeV. The first preliminary measurement of the $\pi\pi$-channel and other channels important for the the muon anomaly will be presented, as well as the measurement of time-like baryonic form factors.

HK 35.3 Tu 17:30 H-ZO 30

Search for Charmonium Resonances in $\gamma\gamma \to D\bar{D}$ at BaBar — •Torsten Schröder — Institut für Experimentalphysik I, Ruhr-Universität Bochum

We present the search for radially excited charmonium resonances at BaBar. The analysis is based on a data sample of 385 fb^{-1} taken with the BaBar detector at the asymmetric e^+e^- collider PEP-II (SLAC). The large available data set in combination with the instrumentation of the BaBar detector provides excellent conditions for meson spectroscopy.

The masses of the radially excited 2^3P_J-charmonium resonances ($\chi_{cJ}(2P)$) are predicted in the region around 4 GeV/c^2. The Belle collaboration has observed the $Z(3930)$ in two-photon production, which is a candidate for the $\chi_{c2}(2P)$ state. In this presentation, the results of the search for the $Z(3930)$ and other resonances above a mass of 3.7 GeV/c^2 in the process $\gamma\gamma \to Z(3930) \to D\bar{D}$ at BaBar are discussed.

Supported by bmb+f (06BO9041).

HK 35.4 Tu 17:45 H-ZO 30

$J/\psi \to 3\gamma$ as an ideal system to study high order QCD corrections — •Jorge Segovia, David R. Entem, and Francisco Fernandez — Universidad de Salamanca, E-37008 Salamanca, Spain

CLEO collaboration has recently measured the branching ratio of the $J/\psi \to 3\gamma$. A signal of 6σ significance was found with branching fraction $B_{3\gamma} = (1.2 \pm 0.3 \pm 0.2) \times 10^{-5}$ [1].

A thorough study of the 1^{--} resonances in the constituent quark model has been done in Ref [2]. In this work not only the meson masses, but electromagnetic, leptonic and strong width decays are succesfully reproduced. Using the model wave function for the J/ψ we obtain $B_{3\gamma} = 3.4 \times 10^{-5}$, almost three times the experimental value.

One loop QCD corrections include five diagrams which take into account vertex, self-energy and ladder, corrections and can be casted in the form $A(\frac{\alpha_s}{\pi})$. Using the value of $\alpha_s(m_c)$ provided by the model, this correction almost cancel the zeroth order approximation giving a theoretical prediction compatible with zero. Two loop corrections are more involved to handle. We made a naive estimation of the contribution at order α_s^2 obtaining a theoretical value of $B_{3\gamma} = 0.6 \times 10^{-5}$.

Our result shows that the precise mesure of the $J/\psi \to 3\gamma$ decay is very important to understand the role of the higher order QCD corrections although more theoretical work has to be done to obtain more accurate results.

[1] CLEO collaboration G. S. Adams *et al*, arXiv:0806.0671[hep-ex].
[2] J. Segovia, D. R. Entem, and F. Fernandez, accepted for publication in Phys. Rev. D.

HK 35.5 Tu 18:00 H-ZO 30

QCD Sum Rules for D and B mesons in nuclear matter — •Thomas Hilger, Ronny Thomas, and Burkhard Kämpfer — FZD, PF 510119, 01314 Dresden

We consider D and B mesons embedded in cold nuclear matter in view of future CBM and PANDA experiments at FAIR. QCD sum rules are applied to pseudoscalar currents with heavy-light quark contents. The impact of various condensates is discussed. The mass splitting of D - D-bar and B - B-bar mesons as a function of the nuclear matter density is quantified: extrapolated to saturation density it is in the order of 60 and 130 MeV, respectively, driven essentially by the condensates <q-adjoint q>, <q-adjoint g sigma G q> and <q-bar q>. The genuine chiral condensate <q-bar q>, amplified by heavy-quark masses, enters the Borel transformed sum rules for the mass splitting beyond linear density dependence. Including strange quark condensates reveals a numerically smaller and opposite effect for the D_s - D_s-bar mass splitting. Weinberg type sum rules for the difference of pseudoscalar and scalar spectral moments are discussed.

HK 35.6 Tu 18:15 H-ZO 30

recent results on mesonic weak decays of Λ-hypernuclei with FINUDA — •stefania bufalino for the FINUDA-Collaboration — INFN Sez. di Torino, via P. Giuria 1, Torino, Italy — Dip. di Fisica Sperimentale, Università di Torino, via P. Giuria, 1 Torino, Italy

Recent results obtained by analyzing the data collected up to now by the FINUDA spectrometer at the DAFNE complex at INFN-LNF in Frascati (Italy) will be presented, in particular the results on the weak π^--mesonic decay channel of p-shell Λ-Hypernuclei will be discussed.

The study is related to the spectroscopy of negative pions spectra emitted in the mesonic weak decay of ${}^{5}_{\Lambda}$He, ${}^{7}_{\Lambda}$Li, ${}^{9}_{\Lambda}$Be, ${}^{11}_{\Lambda}$B and ${}^{15}_{\Lambda}$N following the reaction: $K^-_{stop} + {}^{A}Z \rightarrow {}^{A}_{\Lambda}Z + \pi^-$

Exploiting both the target thinness and the good transparency of the FINUDA apparatus, pion momenta as low as 80 MeV/c have been analyzed with a dedicated version of the FINUDA reconstruction code, allowing to investigate for the first time the very low momentum region of negative pion spectra, populated through various mesonic decay mechanisms. Many-body and, when present, also two-body mesonic decay channels have been studied and the relative amplitudes, Γ_{π^-}–2body and Γ_{π^-}–tot, or branching ratios have been measured and will be presented. Comparison with existing experimental data [1] and theoretical predictions [2] will be showed.

[1] S. Kameoka et al., Nucl.Phys. A754 (2005),173. J. Sasao et al., Phys. Lett. B 579 (2004), 258.

[2] T. Motoba and K. Itonaga, Prog. Theor. Phys. Suppl. 117 (1994) 477.

HK 35.7 Tu 18:30 H-ZO 30

study of non mesonic weak decay of Λ– hypernuclei:recent results from FINUDA experiment — •stefania bufalino for the FINUDA-Collaboration — INFN Sez. di Torino, via P. Giuria 1, Torino, Italy — Dip. di Fisica Sperimentale, Università di Torino, via P. Giuria, 1 Torino, Italy

In free space, a Λ particle decays dominantly as $\Lambda \rightarrow N\pi$. In the case of Λ bound in a nucleus, a Λ hypernucleus, Λ is also able to couple with a nucleon as $\Lambda N \rightarrow nN$ (non-mesonic weak decay, NMWD). The FINUDA experiment is installed at one of the interaction regions of the DAFNE Φ-factory in Frascati and it is mostly dedicated to the high resolution spectroscopy of Λ hypernuclei and to the study of their weak decays. The aim of this work is to present the recent experimental results obtained from the study of the NMWD of ${}^{5}_{\Lambda}$He, ${}^{7}_{\Lambda}$Li, ${}^{9}_{\Lambda}$Be, ${}^{11}_{\Lambda}$B, ${}^{12}_{\Lambda}$C, ${}^{13}_{\Lambda}$C, ${}^{15}_{\Lambda}$N and ${}^{16}_{\Lambda}$O. Thanks to the excellent capabilities of the FINUDA detector (measurement of the proton spectra with magnetic analysis and production from very thin targets) the spectra feature a precision and low energy threshold (15 MeV) never reached in previous experiments. The measured spectra are quite different from the ones previously reported [1] as well as form the theoretical predictions [2](${}^{5}_{\Lambda}$He and ${}^{12}_{\Lambda}$C). Also the contribution of the Final State Interaction and/or two nucleon absorption processes [3] has been evaluated.

[1] S. Okada et al., PLB 597 (2004), 249. [2] G. Garbarino et al., PRC 69 (2004) 054603. [3] W.M. Alberico and G. Garbarino, Phys. Rep. 369 (2002), 1.

HK 35.8 Tu 18:45 H-ZO 30

Gamma Spectroscopy of Double Hypernuclei at PANDA — •Alicia Sanchez Lorente for the PANDA-Collaboration — Johannes Gutenberg-Universität Mainz, Institut für Kernphysik, D-55099 Germany

In the PANDA experiment at FAIR, bound states of Ξ hypernuclei will be used as a gateway to form double Λ hypernuclei. At PANDA the reactions $\overline{p} + p \rightarrow \Xi^-\overline{\Xi}^+$ and $\overline{p} + n \rightarrow \Xi^-\overline{\Xi}^0$ followed by re-scattering of the Ξ^- within the primary target nucleus will be employed to produce low momentum cascade hyperons. After stopping the Ξ^- in an external secondary target, the formed Ξ hypernuclei will be converted into double Λ hypernuclei.

For light nuclei even a relatively small excitation energy may be comparable with their binding energy. Thus we assume that the principal mechanism of de-excitation is the explosive decay of the excited nucleus into several smaller clusters. To describe this break-up process we have developed a model which is similar to the famous Fermi model for particle production in nuclear reactions. According to these calculations excited states in double and single hypernuclei are produced with significant probability. In this context, γ-ray spectra have been predicted for the planned PANDA experiment. We will present details of the simulation, the identification procedure of double hypernuclei and the suppression of background. A devoted experimental setup for this physics challenge consisting in a specific target system and a γ-detector will be introduced as well.

HK 36: Nuclear Structure and Dynamics I

Time: Tuesday 16:30–19:00 Location: H-ZO 40

HK 36.1 Tu 16:30 H-ZO 40

Short lived radioactive isotopes at TRIμP facility — •P.D. Shidling, G.S. Giri, K. Jungmann, W.L. Kruithof, M. Sohani, D.J. van der Hoek, O.O. Versolato, L. Willmann, and H.W. Wilschut — KVI, University of Groningen, The Netherlands

At TRIμP facility radioactive ion beam are produced and trapped for the study of fundamental symmetries and interaction in physics. The TRIμP magnetic separator is used for in-flight production and separation of different radioactive isotopes. Different radioactive ion beam have been produced, via charge exchange, stripping, projectile fragmentation and fusion evaporation reactions in inverse kinematics. The radioactive beam can be used directly or can be converted to a low energy beam using a thermal ionizer. In this talk we focus on ^{21}Na, ^{213}Ra which are trapped as atoms or ions. With the trapping of ^{21}Na we have completed the TRIμP facility. Details on some selected aspect will be discussed.

HK 36.2 Tu 16:45 H-ZO 40

Nuclei production in the spallation reaction ^{136}Xe (200 MeV/A)+^{1}H — •Carlos Paradela for the s184-FRS-Collaboration — Universidad de Santiago de Compostela,, Spain

For several years, an extensive research program in spallation reactions have carried out at GSI (Darmstadt, Germany) taking advantage of the relativistic heavy-ion beams and the high-resolution magnetic spectrometer (FRS)[1]. The measured cross sections are highly relevant for the validation of the existing nuclear codes in their low energy range. These codes are employed in the studies for radioactive beam facilities (RIBs) or accelerator-driven systems (ADS) dedicated to the radioactive waste incineration.

The study of ^{136}Xe on Hydrogen at 1000, 500 and 200 MeV/A is conceived as an extension of the previous experimental data in order to provide decisive information on the energy dependence of the spallation process, achieving the lowest primary beam energy ever studied at FRS for a projectile that present a behaviour close to the heaviest elements.

In this work, the reaction ^{136}Xe + p at 200 MeV/A has been studied by separating and identifying the produced fragments and determining their kinematical properties. The results obtained for the production cross section were compared to different codes describing the spallation process such as ISABEL, INCL4 or ABLA. The integral cross

section obtained is compatible with the value given by the optic-model computation from Karol [2].

[1] Charms web site http://www-w2k.gsi.de/charms/data.htm
[2] P.J. Karol, Phys. Rev. C 11, 1203 (1975)

HK 36.3 Tu 17:00 H-ZO 40

Even-odd effect in the yields from high-energy reactions — •M.Valentina Ricciardi[1], Karl-Heinz Schmidt[2], Aleksandra Kelic[1], Fanny Rejmund[2], and Christelle Schmitt[3] — [1]GSI, Darmstadt, Germany — [2]GANIL, Caen, France — [3]IPN, Lyon, France

In 2003, the analysis of experimental production cross-sections of the light products of the reaction ^{238}U+Ti at 1 A GeV, measured at the FRS, GSI, revealed a very strong even-odd staggering, which in some cases amounted to 50 percent, a magnitude comparable to even-odd effects found in low-energy fission. The origin of this effect was explained on the basis of the statistical model of nuclear reaction, by carefully considering the appropriate nuclear-structure effects in binding energies and level densities.

In the meantime, a large amount of new experiments on nuclear reactions at high energy were performed at the FRS. The cross sections of the produced nuclei, fully identified in mass and atomic number, and kinematically separated to disentangle the different contributing reaction-mechanisms, also showed to be modulated by a complex and very strong even-odd structure. The new systematic analysis of the even-odd effect over a large range of nuclear reactions and nuclear systems, on one hand confirmed the expected behaviors for the light residual nuclei produced in high-energy reactions, on the other, revealed new and unexpected tendencies of the even-odd phenomenon in regions of the production yields up to now unexplored. The new features are discussed and possible explanations offered.

HK 36.4 Tu 17:15 H-ZO 40

Isomeric ratios for nuclei with Z=62-67 and A=142-152 produced in the relativistic fragmentation of 208Pb — •Szymon Myalski[1], Adam Maj[1], and Zsolt Podolyak[2] for the RISING-IR-Collaboration — [1]IFJ PAN, Kraków,Poland — [2]Dept. of Physics, Univ. of Surrey, Guildford, UK

We have investigated isomeric states in a number of nuclei with Z=62-67 and A=142-152, produced by the fragmentation of the relativistic(1 GeV/u)^{208}Pb beam from the SIS-18 synchrotron of the GSI facility on a ^{9}Be target, and selected by the FRagment Separator(FRS). The selected nuclei of interest were implanted into the stopper, a block of plastic 7mm thick. The gamma-rays from the decay of isomeric states in the implanted nuclei were measured by the high purity germanium array, RISING. In total 22 nuclides were detected, isomeric states were observed in 9 of them:19^-in ^{152}Ho, $31/2^+$in ^{153}Ho, 27^+in ^{148}Tb, 10^+in ^{144}Gd, $49/2^+$in ^{147}Gd, $11/2^-$in ^{143}Eu, 8^-in ^{144}Eu, $11/2^-$ in ^{145}Eu, 10^+in ^{142}Sm and 7^-in ^{142}Sm. Of special interest is the 27^+ state in ^{148}Tb, the highest spin populated through the fragmentation reaction until present day. The aim of this work was the extraction of isomeric ratios(R) for these isomeric states. The R is the number of ions populated in a given isomeric state compared to the total number of ions populated for the selected nuclide. The R can provide information about the production reaction and nuclear structure. It was evaluated based on flight time, half-life, in-flight losses and by considering the finite measurement time. Results were compared with theoretical predictions, calculated using an abrasion-ablation approach.

HK 36.5 Tu 17:30 H-ZO 40

Production of medium-mass neutron-rich nuclei from fragmentation of ^{132}Sn nuclei — •David Pérez-Loureiro — Universidade de Santiago de Compostela, Spain

The extension of the nuclear chart towards the neutron-rich side is of utmost importance for nuclear structure and nuclear astrophysics. However, these investigations are limited because of the dificulties in producing neutron-rich nuclei. In the case of masses around $A \sim 130$ a two step reaction scheme was proposed to partially overcome this limitation [1]. Therefore, this experimental technique might be a tool for producing beams of extremely neutron-rich isotopes of refractory elements and short lived nuclei in future ISOL facilities [2].

The production cross sections of residual nuclei, were investigated in an experiment performed at the Fragment Separator (GSI). A 950 MeV/u, and 10^9 particles per spill, ^{238}U beam impinged onto a 650 mg/cm^2 Pb target at the entrance of the separator for producing fission fragments. Forward emitted fragments were isotopically identified in the first part of the FRS. These fully identified fission residues impinged onto a 2.6 g/cm^2 beryllium target located at the intermediate focal plane. The fragmentation products were also identified in the second section of the separator. In this contribution we will present the measured production cross sections of this two-step reaction residues that will be compared to direct production in ^{238}U fission and ^{136}Xe fragmentation, and with different model calculations.

[1] K. Helariutta et al., Eur. Phys. J. A, 17 (2003) 17
[2] EURISOL WEB page: `http://www.ganil.fr/eurisol`

HK 36.6 Tu 17:45 H-ZO 40

Transfer reactions with ^{8}Li — •Elisabeth Tengborn for the IS446-Collaboration — Subatomic Physics, Chalmers University of Technology, Sweden

Exotic light nuclei are being studied through a campaign of transfer-reaction experiments at REX-ISOLDE, CERN. The present aim is to investigate the structure of neutron-rich lithium isotopes. The scientific motivation for these studies is manifold. First, the isotopic chain of lithium ends in the emblematic two-neutron halo nucleus ^{11}Li. Second, spectroscopic factors for known and hitherto unobserved excited states are being predicted by *ab-initio* and shell model calculations and can thus be tested experimentally. Third, these loosely bound systems present a challenge to our modelling of reaction mechanisms.

The project described here is a benchmark experiment where a beam of ^{8}Li was impinging on a deuterated polypropylene target in inverse kinematics. This mainly gives information on ^{9}Li through a one neutron pick-up reaction, which in the inverse kinematics corresponds to a (d,p)-reaction. However, the reaction channels (d,d) and (d,t) can also be studied. The goal of the experiment is to study the reaction mechanism and the coupling to the continuum.

All steps (calibration of the detectors, background subtraction, acceptance corrections, excitation energies and simulations) leading up to angular distributions on an absolute scale have been performed. The angular distributions have been compared with theoretical models and the presentation will include a discussion about the reaction mechanism of direct versus compound reactions.

HK 36.7 Tu 18:00 H-ZO 40

Halo effects in the Scattering of 11Li on heavy target — •Olof Tengblad[1], Maria Jose Garcia Borge[1], Joaquin Gomez Camacho[2], and Ismael Martel Bravo[3] — [1]IEM-CSIC, Madrid, Spain — [2]Univ. Sevilla, Spain — [3]Univ. Huelva, Spain

Halo nuclei are composed by a core nucleus and one or two loosely bound neutrons. Due to the loosely bound structure, they should be easily polarizable. Thus, in the presence of a strong electric field, the nucleus will be distorted, so that, with respect to the centre of mass of the nucleus, the halo neutrons will move opposite to the electric field, while the positively charged core will move in the direction of the field. The B(E1) distribution is a measurement of the importance of polarizability.

The phenomenon of dipole polarizability affect strongly the elastic scattering of halo nuclei on heavy targets, even at energies below the Coulomb barrier, where the nuclear force should not be important. Two effects are relevant: First, Coulomb break-up will reduce the elastic cross sections. Second, the distortion of the wave function generated by the displacement of the charged core with respect to the centre of mass of the nucleus will reduce the Coulomb repulsion, and with it the elastic cross sections.

We report here on an experiment, performed in October 2008 at the ISAC-II facility at TRIUMF Vancouver Canada, measuring the elastic differential cross section of 11Li on 208Pb at 2.2 to 3.0 MeV/u laboratory energy. We have observed and quantified the reduction of the differential cross sections compared to the Rutherford cross section.

HK 36.8 Tu 18:15 H-ZO 40

Photo-induced fission at the S-DALINAC* — •Alf Göök[1,2], Roman Barday[1], Maksym Chernykh[1], Christian Eckardt[1], Ralph Eichhorn[1], Joachim Enders[1], Franz-Josef Hambsch[3], Peter von Neumann-Cosel[1], Andreas Oberstedt[2], Stephan Oberstedt[3], Yuliya Poltoratska[1], Achim Richter[1,4], and Markus Wagner[1] — [1]Institut für Kernphysik, Technische Universität Darmstadt, Germany — [2]Akademin för naturvetenskap och teknik, Örebro universitet, Sweden — [3]EC-JRC Institute for Reference Materials and Measurements, Geel, Belgium — [4]European Centre for Theoretical Studies in Nuclear Physics and Related Areas, Trento, Italy

In line with the ongoing photofission program at the superconducting Darmstadt linear electron accelerator S-DALINAC, whose ultimate goal is to study parity violation, experiments are taking place in Jan-

uary 2009. The purpose of these experiments will be the investigation of photo-induced fission of ^{238}U and ^{234}U. A twin Frisch grid ionization chamber will be used to determine fragment energy- and mass distributions via the 2E-technique. Status and preliminary results of these experiments will be presented.

*Supported by Deutsche Forschungsgemeinschaft through SFB634.

HK 36.9 Tu 18:30 H-ZO 40

Color transparency and short-range correlations in exclusive pion and nucleon removal reactions from nuclei — •Wim Cosyn — Ghent University, Ghent, Belgium

A relativistic and quantum mechanical framework to compute nuclear transparencies for pion and nucleon production reactions is presented [1-3]. Final-state interactions for the ejected pions and nucleons are implemented in a relativistic Glauber eikonal approach. The proposed model can account for the color-transparency (CT) phenomenon and short-range correlations (SRC) in the nucleus. Results are presented for kinematics corresponding to completed experiments for $A(\gamma,\pi^+n)$ and $A(e,e'\pi^-)$, $A(p,2p)$ and $A(e,e'p)$. The influence of CT and SRC on the nuclear transparency is studied. Both the SRC and CT mechanisms increase the nuclear transparency. The two mechanisms can be clearly separated, though, as they exhibit a completely different dependence on the hard-scale parameter. Recent $A(e,e'\pi^+)$ results [4] point towards the early onset of the CT phenomenon in pion production processes. The similarities in the trends and magnitudes of the computed nuclear transparencies compared to semi-classical models indicate that they are not subject to strong model dependences.

[1] W. Cosyn, M. C. Martínez, J. Ryckebusch, and B. Van Overmeire, Phys. Rev. C74, 062201(R) (2006) [2] W. Cosyn, M. C. Martínez, and J. Ryckebusch, Phys. Rev. C77, 034602 (2008) [3] B. Van Overmeire, W. Cosyn, P. Lava and J. Ryckebusch, Pys. Rev. C73, 064603 (2006) [4] B. Clasie et al. Phys. Rev. Lett. 99, 242502 (2007).

HK 36.10 Tu 18:45 H-ZO 40

Effect of spin-spin interactions on polarisation observables from nucleon-nucleus scattering — •Elizabeth Cunningham, Jim Al-Khalili, and Ronald Johnson — University of Surrey, Guildford, U.K.

With the new GSI/FAIR facility currently under construction there is a vital need for nuclear reaction theory calculations to make predictions of observables relevant to the proposed experiments. In order to do this for the exotic nuclear species planned to be created at FAIR, it is necessary to determine accurate optical models to describe nucleon elastic scattering from non-zero target spin, **I**.

The possible existence of a spin-spin interaction in nucleon-nucleus scattering was first proposed by Feshbach [1] who suggested the inclusion of a spherical $\mathbf{I}\cdot\sigma$ and tensor $\mathbf{S}_{12}$ term into the optical potential. The effects of these terms have since been the subject of much theoretical and experimental interest, but it was not until the work of McAbee [2] that a generalised spin-spin tensor was proposed.

In this work we evaluate the $\mathbf{I}\cdot\sigma$ term within the Distorted Wave Born Approximation and apply it to proton scattering from ^{10}B, for which relevant IUCF data exist. The effect on spin observables, specifically the polarisation transfer coefficient D_{NN} will be presented. New insight is obtained into the relationship between the spherical spin-spin interaction and D_{NN}.

[1] H. Feshbach, Ann. Rev. Nuclear Sci. 8, 49 (1958)
[2] T. L. McAbee et al., Nucl. Phys. A509 (1990) 39

HK 37: Nuclear Structure and Dynamics II

Time: Tuesday 16:30–19:00 Location: H-ZO 50

Invited Group Report HK 37.1 Tu 16:30 H-ZO 50

Two-proton radioactivity and nuclear structure — •Marek Pfützner — Institute of Experimental Physics, University of Warsaw, 00-681 Warszawa, Poland

The detailed decay study of two-proton (2p) emitter ^{45}Fe has been performed at the A1900 separator at NSCL/MSU. A novel type of a gaseous detector employing digital imaging has been used [1]. Clear images unambiguously identifying the two-proton radioactivity channel were obtained which allowed the full reconstruction of decay events in three-dimensions [2]. For the first time, the angular and energy correlations between two protons emitted from the nuclear ground state could be determined. Results were found to be in good agreement with a three-body model of the two-proton radioactivity [3] which predicts a sensitivity of angular correlation to the structure of the initial nuclear state. Moreover, the same value of a structure parameter consistently reproduces the p-p angular correlation as well as the partial 2p half-life value. Thus, the 2p radioactivity offers a new tool to investigate the structure of extremely neutron-deficient nuclei.

Current status of the 2p decay studies, improvements of our detection technique, and plans to investigate other 2p emitters in vicinity of ^{48}Ni will be discussed.

1. K. Miernik et al., Nucl. Instr. and Methods in Phys. Res. A581, 194 (2007). 2. K. Miernik et al., Phys. Rev. Lett. 99, 192501 (2007). 3. L.V. Grigorenko and M.V. Zhukov, Phys. Rev. C 68, 054005 (2003).

Group Report HK 37.2 Tu 17:00 H-ZO 50

Spectroscopy in the neighbourhood of ^{100}Sn [*] — •Ch. Hinke, M. Böhmer, K. Eppinger, T. Faestermann, R. Gernhäuser, R. Krücken, and L. Maier for the Sn100-Collaboration — Physik Department E12, TU München

The investigation of the shell structure far from the valley of stability is a major task in modern nuclear structure physics, especially close to the drip lines.

By fragmentation of a 1.0 A GeV ^{124}Xe beam from the GSI accelerators ^{100}Sn and neighbouring nuclei have been produced, separated in the FRS and identified by multiple deltaE, Brho and ToF measurements. The nuclei were stopped in an implantation detector with high spatial resolution in order to correlate implantations with succeeding decays. The device was surrounded by the "Stopped Beam"Rising array of 15x7 Ge-detectors in close geometry. In this configuration the setup enabled us to do nearly 4π spectroscopy of the emitted gamma and particle decay radiation.

In our contribution we focus on new results concerning the particle stability of exotic nuclides in the vicinity of ^{100}Sn. We also present the results of isomer spectroscopy in the ^{100}Sn region e.g. the first observation of the 6^+ to 4^+ transition from the already known ^{102}Sn isomer. A brief preliminary status of the ongoing ^{100}Sn beta-gamma decay analysis will also be given.

[*] supported by the MLL, BMBF (06MT238), DFG (EXC153), EPSRC, STFC (UK), and EURONS

HK 37.3 Tu 17:30 H-ZO 50

High-energy excited states in ^{98}Cd — •Norbert Braun[1], Andrey Blazhev[1], Plamen Boutachkov[3], Tim Brock[2], Magda Gorska[3], Hubert Grawe[3], Jan Jolie[1], Zhong Liu[4], B. S. Nara Singh[2], Stephane Pietri[3], and Robert Wadsworth[2] for the RISING S352-Collaboration — [1]Institut für Kernphysik, Universität zu Köln, Germany — [2]Department of Physics, University of York, York, UK — [3]GSI, Darmstadt, Germany — [4]University of Edinburgh, Edinburgh, UK

Studies of isomerism in the proton-rich $N \simeq Z$ nuclei around ^{100}Sn give important insights into the role of proton-neutron pairing and also serve as testing grounds for nuclear models. In summer 2008, an experiment on ^{96,97,98}Cd was performed using the FRS fragment separator and the RISING germanium array at GSI. These exotic nuclei of interest were produced using fragmentation of a 850 MeV/u ^{124}Xe beam on a 4 g/cm^2 ^{9}Be target and finally implanted into an active stopper consisting of 9 double-sided silicon strip detectors.

In ^{98}Cd, a new high-energy isomeric transition was identified. Preliminary results on ^{98}Cd will be presented and their implications for the high-excitation level scheme will be discussed.

HK 37.4 Tu 17:45 H-ZO 50

Sub-barrier Coulomb excitation of ^{104,102,100}Cd — Andreas Ekström, Joakim Cederkall, •Douglas DiJulio, and Claes Fahlander — Physics Department, Lund University, Sweden

Sub-barrier Coulomb excitation experiments in inverse kinematics have been carried out to measure the reduced transition probabilities from

the first excited 2_1^+ state to the 0^+ ground state in the neutron deficient ^{104,102,100}Cd isotopes at the REX-ISOLDE facility. Radioactive ion beams, containing either of the isotopes ^{104,102,100}Cd at an energy of about 2.9 MeV per nucleon, were used during the experiments. In addition the static quadrupole moment for the 2_1^+ state has been measured using different targets. De-excitation γ-rays were detected with the highly segmented Ge-array MINIBALL. A Double Sided Silicon Strip Detector (DSSSD) was used to detect the recoils and ejectiles. By combining the measurements from the different targets with results from previous lifetime measurements, new values for the B(E2) and the Q(2_1^+) values can be deduced. The Cd isotopes are only two proton-holes away from the proton shell closure at ^{100}Sn. The measurements are directed towards a better understanding of shell evolution in this region. Preliminary results from the experiment will be presented and discussed.

HK 37.5 Tu 18:00 H-ZO 50

Comparison of $T_z = \pm 1 \rightarrow 0$ Gamow-Teller Transitions for the study of Isospin Symmetry in pf-shell nuclei — •Francisco Molina[1], Yoshitaka Fujita[2], Berta Rubio[1], and William Gelletly[3] for the GSI-Leuven-Osaka-Valencia-Surrey-Collaboration — [1]Instituto de Física Corpuscular, CSIC-Universidad de Valencia, E-46071 Valencia, Spain — [2]Department of Physics, Osaka University, Toyonaka, Osaka 560-0043, Japan — [3]Department of Physics, University of Surrey, Guildford GU2 7XH, Surrey, UK

Gamow-Teller (GT) transitions are caused by the Weak interaction in nuclei. However, they can be studied in both β decay and charge-exchange (CE) reactions. If isospin is a good quantum number in nuclei, then the $T_z = -1 \rightarrow 0$ and $+1 \rightarrow 0$ GT transitions, are identical. Therefore, a comparison of the results from studies of β decay and CE should shed light on isospin symmetry in nuclei. Rapid technical development has greatly enhanced the production and detection efficiency of exotic nuclei. Thus we can now study the β decay of $T_z = -1$ pf-shell nuclei, ^{54}Ni, ^{50}Fe, ^{46}Cr, and ^{42}Ti, in both fragmentation and the classical ISOL technique. Two experiments were performed, one at the Louvain-la-Neuve ISOL facility and the other as part of the STOPPED beam RISING campaign at GSI. Although the Fermi function strongly reduces the β feeding to highly excited states, we could study the feeding to the states up to 5 MeV by measuring the β-delayed γ rays. The results are compared with the spectra from CE (^{3}He, t) measurements for the mirror $T_z = +1$ target nuclei studied in high resolution at RCNP, Osaka.

HK 37.6 Tu 18:15 H-ZO 50

New beta-delayed particle emission studies — •Ricardo Domínguez-Reyes[1], Nassima Adimi[2], María José García Borge[1], Beltran Blank[2], and Luis Mario Fraile[3] — [1]Instituto de Estructura de la Materia, Madrid, Spain — [2]Centre d'Etudes Nucléaires de Bordeaux-Gradignan (CENBG), Bordeaux, France — [3]Univ. Complutense de Madrid, Madrid, Spain

Beta delayed particle emission is a wonderfull tool to study nuclear structure near the drip-line. The main advantage of these studies is the higher detection efficiency of charged particles allowing us to characterize exotic nuclei with very low production.

New studies are motivated by the improvement of the facilities and/or the new generation of detectors.

These advances have allowed us to re-visit the beta-delayed proton and gamma emission in ^{33}Ar and ^{32}Ar with an improve proton-gamma coincidence spectrum that leads us to a better knowledge of the B(GT) distribution on a wider excitation energy range.The experiment made at IBE (GANIL) has allowed us to reassign some known p-transitions to higher excited states in ^{33}Cl due to good pγ coincidences.

Furthermore the β-decay of 17Ne was visited using ISOLDE's Si-Ball, studying βp and $\beta\alpha$ processes by Time-of-Flight techniques. ToF was used to separate both processes and to beta-clean the spectra. This study will allow us to determine wich process occurs first.

HK 37.7 Tu 18:30 H-ZO 50

Are spectroscopic factors in mirror states the same? — •Natalia Timofeyuk — Department of Physics University of Surrey Guildford Surrey GU2 7XH United Kingdom

The spectroscopic factors for a specific class of mirror pairs, where the proton-rich partner has one-proton decay threshold just below the two-proton decay threshold and both are lower than in usual nuclei, have been studied within a three-body model core+N+N. The choice of this model is justified by strong NN correlations between the two valence protons. It has been found that, because the core+p binding energy is small, the geometrical mismatch between the core+p two-body wave function, stretched towards the classically forbidden region, and the spatially confined three-body functions of the core+p+p reduces the norm of the <core+p|core+p+p> overlap. For mirror overlap <core+n|core+n+n>, this mismatch is much weaker. As a result, the spectroscopic factors in mirror core+p+p and core+n+n system may differ. For example, the spectroscopic factors in the mirror pair 9C-9Li this difference can reach 7%. For another mirror pair, 18Ne-18O, appart from this mismatch, the situation is complicated by different mixing between the configurations with different proton orbital momentum, l=0 and l=2. The resulting mirror symmetry breaking in large component is about 2-5% but can reach 25% in the small 1s component of the 0+ ground state in 18O-18Ne. Understanding mirror symmetry in spectroscopic factors is important for predicting astrophysically revelant cross sections using available information about mirror analogs.

HK 37.8 Tu 18:45 H-ZO 50

the 12C(16O,γ)28Si reaction: structural and statistical aspects of the gamma decay — •dorothee lebhertz[1], sandrine courtin[1], florent haas[1], david jenkins[2], and david hutcheon[3] — [1]IPHC, University of Strasbourg, CNRS, Strasbourg, France — [2]Department of Physics, University of York, York, UK — [3]TRIUMF, Vancouver, Canada

The 28Si nucleus is a microlaboratory where oblate, prolate and octupole shapes coexist at low excitation energies. At higher excitations, a 12C-16O cluster band has been observed in breakup experiments for which the band head should lie around 25 MeV. It is also around this energy that narrow (Γ around 200 keV) resonances were found in the radiative capture reaction to the 0+ and 2+ members of the g.s. band. The radiative capture is a powerful tool to study the interplay between reaction mechanisms and structural effects. The aim of our recent experiment performed at Triumf using the highly selective Dragon 0° spectrometer and its associated BGO array was to measure the complete γ-decay of the radiative capture 12C(16O,γ)28Si reaction. For the first time, we observed important feeding of doorway states around 11 MeV and also direct decay to the 3- octupole state at 6.9 MeV and to the 4+ member of the prolate band at 9.2 MeV. Results of this experimental programme will be presented, discussed in terms of an interplay between statistical and structural effects in 28Si and compared to similar results in the 12C+12C system.

HK 38: Nuclear Astrophysics

Time: Tuesday 16:30–18:45 Location: H-ZO 60

Invited Group Report HK 38.1 Tu 16:30 H-ZO 60

Photon-induced experiments for nuclear astrophysics* — •Kerstin Sonnabend — Institut für Kernphysik, Technische Universität Darmstadt, D-64289 Darmstadt, Germany

Photon-induced experiments play an important role in the solution of the puzzle about the production of the heavy elements in different nucleosynthesis scenarios. The most direct impact can be seen in the production of the so-called p nuclei by photodisintegration reactions like (γ,n), (γ,p), and (γ,α). Complete network calculations include several hundred mainly unstable isotopes with the corresponding reactions rates and, therefore, rely on theoretical predictions of these rates normally performed in the framework of Hauser-Feshbach theory. Thus, the reliability of these calculations should be tested experimentally for selected isotopes [1].

In addition, the knowledge of the photo-response of an isotope below the particle-emission thresholds yields worthwhile information on the according photon-strength function which is besides the level density and the particle-optical potentials the main input for predictions in the Hauser-Feshbach model. Photon-scattering and photon-absorption experiments are ideal tools to study the most important contributions of

the dipole strength functions [2].

Recent studies on astrophysically relevant isotopes below and above the neutron separation threshold will be presented.

*supported by DFG (SFB 634)

[1] J. Hasper *et al.*, Phys. Rev. C **77** (2008) 015803.
[2] U. Kneissl *et al.*, J. Phys. G **32** (2006) R217.

Invited Group Report HK 38.2 Tu 17:00 H-ZO 60

Nuclear physics aspects of the nucleosynthetic p process: where do we stand ? — •S. V. Harissopulos — TANDEM Lab, Inst. of Nuclear Physics, NCSR Demokritos, Athens, Greece

The study of capture reactions at energies well below the Coulomb barrier is quite challenging both in terms of scientific motivation and experimental approach. These reactions are interesting as they are associated with a long-standing astrophysical problem, i.e. how certain heavy-isotopes (p nuclei) observed, so far, only in the solar system, are formed in the Universe (p process). Moreover, p-nuclei abundances are the signatures of the creation mechanism(s)of our solar system, an issue that still remains open. Existing p-process models are still unable to reproduce the observed p-nuclei solar abundances and certain nuclear physics models describing global parameters entering the calculations are inaccurate and unreliable. It is therefore of paramount importance, on top of any astrophysical model improvements, to check the reliability of nuclear physics predictions related to the understanding of the p-nuclei abundance pattern. For this purpose, a new method (4π γ-summing) was developed by "Demokritos"and Bochum which enabled us to study more than 20 (p,γ) and (α,γ) reactions at energies well-below the Coulomb barrier. The paper presents a review of recent theoretical and experimental developments including first attempts to measure cross sections of capture reactions in inverse kinematics using the JUROGAM array. Finally, the question of whether there is sufficient experimental information to put constraints on the theory and draw final conclusions will be discussed.

HK 38.3 Tu 17:30 H-ZO 60

Constraining Nucleosynthesis in Type I X-Ray Bursts through Mass Measurements — •Anuj Parikh[1,2], Jordi José[2,3], Christian Iliadis[4,5], Fermin Moreno[2], and Thomas Rauscher[6] — [1]Physik Department E12, Technische Universität München, D-85748 Garching, Germany — [2]Departament de Física i Enginyeria Nuclear, EUETIB, Universitat Politècnica de Catalunya, E-08036 Barcelona, Spain — [3]Institut d'Estudis Espacials de Catalunya (IEEC), E-08034 Barcelona, Spain — [4]Department of Physics and Astronomy, University of North Carolina, Chapel Hill, NC 27599-3255, USA — [5]Triangle Universities Nuclear Laboratory, Durham, NC 27708-0308, USA — [6]Department of Physics, University of Basel, CH-4056 Basel, Switzerland

Type I X-ray bursts are explosive stellar events resulting from thermonuclear ignition in the H/He-rich envelopes of accreting neutron stars. Nucleosynthesis in these phenomena may involve up to several thousand nuclear processes. Those reactions with small Q-values (less than 1 MeV) are of particular interest in these environments as they may represent waiting points for a continuous abundance flow towards heavier-mass nuclei. We have performed a comprehensive series of post-processing calculations which examine the sensitivity of nucleosynthesis in type I X-ray bursts to uncertainties in both reaction rates and reaction Q-values. We discuss the relatively few critical masses for which measurements could better constrain the results of our studies. In particular, we stress the importance of measuring the masses of ^{65}As and ^{66}Se.

HK 38.4 Tu 17:45 H-ZO 60

Coulomb Dissociation experiments with proton rich isotopes at LAND/R^{3}B setup — •Christine Wimmer — Universität Frankfurt, Deutschland

After the implementation of the proton arm at the LAND/R^{3}B setup at GSI in Darmstadt it is possible to extend the experimental programme to proton rich nuclei of astrophysical relevance. Coulomb dissociation induced reactions with secondary ion beams consisting of short-lived proton-rich isotopes produced at the fragment separator (FRS) have been investigated. This contribution offers an overview over the application of this method to determine (p, γ) cross sections from (γ, p) reactions and presents analysis strategies at the example of the ^{27}Si(γ, p)^{26}P experiment.

HK 38.5 Tu 18:00 H-ZO 60

a new calculation for primordial li reaction rates — •gokhan kocak[1,2] and akif baha balantekin[2] — [1]erciyes university department of physics, kayseri, turkey — [2]wisconsin university department of physics, wisconsin, usa

in nuclear astrophysics, one of the most important problem is the difference between the theoretical standard big bang nucleosynthesis (sbbn) results and the observational values for primordial li abundance and reaction rate. to solve this problem, m. pospelov [1] has recently suggested to take into account the effect of using a negatively-charged particle in the calculations, which might be also a possible solution of li magnitude/abundance problem in bbn. in this study, we have calculated the s-factor and the reaction rates for 3he(4he,γ)7li system by using the optical model and these results are in very good agreement with the results of sbbn prediction. after that, we have included the effect of a negatively-charged particle for 3he(4he,γ)7li reaction and have investigated the s-factor and reaction rates. this effect have shown that the magnitude of the reaction rate for 3he(4he, γ)7li system has been increased 8 or 9 order, which is in a better agreement with the observational value.

[1] m. pospelov phys. rev. lett. 98 231301 (2007).

HK 38.6 Tu 18:15 H-ZO 60

Extended pool of stellar electron capture rates on nuclei — •Andrius Juodagalvis[1], Karlheinz Langanke[2], William R. Hix[3], Gabriel Martinez-Pinedo[2], and Jorge M. Sampaio[4] — [1]VU ITPA, Vilnius, Lithuania — [2]GSI, Darmstadt, Germany — [3]ORNL, Oak Ridge TN, USA — [4]CFNUL, Lisboa, Portugal

Nuclear physics input plays an important role in core-collapse supernova simulation. Nuclear shell model based methods reliably predict the capture rates, however, the feasibility cuts the method short. Earlier we reported on the extension of the pool of hybrid rates to 250 nuclei of pf+gds model space [1]. Here we present even more enlarged pool based on a schematic Fermi-Dirac approximation to the parent nucleus ground state occupation numbers. More than 2500 nuclei with Z = 28-70 and N = 40-160 are calculated within the schematic hybrid model. The NSE-averaged electron capture rate and the emitted neutrino spectra are calculated. The screening effects are taken into account both in calculation of the nuclear abundances and calculating the capture rates as well as neutrino spectra.

[1] A.Juodagalvis *et al*, Journ. Phys. G 35, 014031 (2008).

HK 38.7 Tu 18:30 H-ZO 60

A new and improved measurement of 8Li(4He,n)11B reaction at the EXCYT RIB facility: the cross section value at the Big-Bang temperature — •Marco La Cognata[1], Rosa Alba[1], Silvio Cherubini[1,2], Nicola Colonna[5], Luigi Cosentino[1], Vincenzo Crucillà[1,2], Antonio Del Zoppo[1], Alessia Di Pietro[1], Pierpaolo Figuera[1], Marisa Gulino[1,2], Livio Lamia[1], Agatino Musumarra[1,2], Maria Grazia Pellegriti[1,4], Rosario G. Pizzone[1], Sebastiana M. R. Puglia[1,2], Giuseppe G. Rapisarda[1,2], Claus Rolfs[3], Stefano Romano[1,2], Maria Letizia Sergi[1,2], Claudio Spitaleri[1,2], Salvatore Tudisco[1], and Aurora Tumino[1,2] — [1]INFN-Laboratori Nazionali del Sud, Catania, Italy — [2]Dipartimento di Metodologie Fisiche e Chimiche per l'Ingegneria, Università di Catania, Italy — [3]Institut fur Physik mit Ionenstrahlen, Ruhr-Universitaet Bochum, Germany — [4]Dipartimento di Fisica e Astronomia, Università di Catania, Italy — [5]INFN-Sezione di Bari, Italy

A new neutron-inclusive measurement of the 8Li(4He,n)11B at the energies relevant for astrophysics is presented. The radioactive 8Li beam was delivered by the EXCYT facility at LNS-Catania. The cross section was determined by a low-background measurement of the time correlation between the 8Li projectile arrival to the target and the neutron capture in a threshold-less 4pi thermalization counter. This new data confirm complementary inclusive 11B measurement and are consistent with a significant population of 11B levels at high excitation energy. A large experimental discrepancy between all the inclusive and the exclusive cross section shows up.

HK 39: Astroparticle Physics

Time: Tuesday 16:30–18:30 Location: H-ZO 70

Invited Group Report HK 39.1 Tu 16:30 H-ZO 70

Nuclear physics aspects of double beta decay — •Jouni Suhonen — Department of Physics, University of Jyväskylä, P.O. Box 35 (YFL), FIN-40014, Jyväskylä, Finland

Since the verification of the existence of the neutrino mass by the neutrino-oscillation experiments the decay processes related to detection of the absolute mass scale of the neutrino and the neutrino mass hierarchy have become increasingly important subjects of study both in neutrino physics and nuclear physics. The most intriguing of these processes is the nuclear double beta decay which not only can access the absolute mass scale and the hierarchy of the neutrinos but can also reveal if the neutrino is its own antiparticle, a so-called Majorana neutrino. Nuclear-structure calculations are in the focus of this search for a precise value of the neutrino mass.

HK 39.2 Tu 17:00 H-ZO 70

High resolution (^{3}He,t) reaction on ^{100}Mo and implications to double β decay — •Pia Heinrichs, Dieter Frekers, Eike W. Grewe, Peter Puppe, Tim Ruhe, and Jan H. Thies — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, 48149 Münster

A high-resolution ^{100}Mo(^{3}He,t)^{100}Tc measurement was performed at RCNP in Osaka (Japan) using the ^{3}He beam at an incident energy of 420 MeV and the high resolution WS course beam-line. An energy resolution of 29 keV was achieved. The measured data were used to extract the GT$^-$ strength in ^{100}Tc.
We observe that almost the entire low-energy (¡ 6 MeV) GT$^-$ strength is concentrated in the ground state. This has implications on the matrix element of the $2\nu\beta\beta$ decay of ^{100}Mo which will be discussed. In addition, the fact that the B(GT$^-$) strength is concentrated in the ground state allows one to consider ^{100}Mo as a detector for supernova and solar neutrinos, where such a detector (like NEMO-3 or MOON) may even be sensitive to the neutrino spectrum, resp. neutrino temperature. At high energies we find a double peaked Gamow-Teller Giant Resonance ($GTGR$) structure, which exhausts $\sim 50\%$ of the Ikeda sum rule.

HK 39.3 Tu 17:15 H-ZO 70

A photelectron-gun for the investigation of MAC-E filters — •Marcus Beck[1], Kathrin Valerius[1], Christian Weinheimer[1], Sebastian Streubel[1], Henrik Arlinghaus[1], Hendrik Hein[1], Hans-Werner Ortjohann[1], Helmut Baumeister[1], Miroslav Zboril[1], Beatrix Ostrick[1,2], and Jochen Bonn[2] — [1]Institut für Kernphysik, WWU Münster, Wilhelm-Klemm Str. 9, 48149 Münster — [2]Institut für Physik, Johannes Gutenberg-Universität Mainz, Staudingerweg 7, 55128 Mainz

The KATRIN experiment will measure the energy spectrum of electrons from the beta decay of Tritium close to its endpoint to search for the mass of the electron neutrino down to $0.2 eV/c^2$. For the energy analysis a MAC-E type filter is used. In order to investigate transmission and response of this filter we developed a pulsed, monoenergetic single electron source based on photoelectrons created with modern UV-LEDs. The emission of these electrons can be restricted to small angle intervals. This electron gun opens up the possibility to investigate the properties of MAC-E filters via time-of-flight studies and for defined emission angles.

We will present the experimental principle and results of measurements at the MAC-E filter at the former Mainz neutrino mass experiment, including a time-of-flight measurement of the transmission function.

This project is supported by BMBF under contract number 05A08PM1.

HK 39.4 Tu 17:30 H-ZO 70

Solid ^{83}Rb/^{83m}Kr source for the KATRIN experiment — •Miroslav Zbořil[1,3], Marcus Beck[1], Jochen Bonn[2], Otokar Dragoun[3], Jaromír Kašpar[3], Alojz Kovalík[5], Beatrix Ostrick[1,2], Ernst-Wilhelm Otten[2], Klaus Schlösser[4], Antonín Špalek[3], Thomas Thümmler[4], Drahoslav Vénos[3], and Christian Weinheimer[1] for the KATRIN-Collaboration — [1]IKP, WWU Münster — [2]IP, Mainz — [3]NPI ASCR, Řež/Prague, Czech Republic — [4]IK, FZK Karlsruhe — [5]DLNP, JINR Dubna, Russia

KATRIN investigates the endpoint region of the T_2-β-spectrum aiming for a sensitivity on the neutrino mass of 0.2 eV (90% C.L.). A spectrometer of the MAC-E filter type will be used for a total time of at least 5 years. An unrecognized shift of the filtering potential would influence the resulting neutrino mass. To continuously monitor the filtering potential the high voltage will be simultaneously applied to an additional MAC-E filter spectrometer. In this monitor spectrometer suitable electron sources based on atomic/nuclear standards will be utilised. As one of such monitoring tools the solid ^{83}Rb/^{83m}Kr source is intended. It provides conversion electrons from ^{83m}Kr which is continuously generated by ^{83}Rb. The monitoring task demands a long-term energy stability $\Delta E/E$ of the K-32 conversion electron line ($E = 17.8$ keV, $\Gamma = 2.8$ eV) of 3 ppm. The main features of the source and the results of the K-32 long-term stability test measurements at the Mainz MAC-E filter will be presented. This work is supported by DFG (BO1212/5-1 and BO1212/6-1), BMBF (05A08PM1) and Czech Science Foundation (LA318 and LC07050).

HK 39.5 Tu 17:45 H-ZO 70

A dedicated system for monitoring the tritium source in KATRIN — •Alan Poon for the KATRIN-Collaboration — Karlsruhe Institute of Technology, KCETA, Karlsruhe, Germany — Lawrence Berkeley National Laboratory, Berkeley, California, USA

KATRIN is a next-generation tritium beta decay experiment with a neutrino mass sensitivity of 0.2 eV. The tritium source is confined in a windowless cylindrical containment, and the source's "thickness", or "column density" is one of the dominant systematic errors in the experiment. This column density has a direct impact on the transmission of electrons from the source to the spectrometer. A system consists of an electron gun for testing the electron transmission and a detector system for determining the electron flux in the tritium source is being developed. In this talk, this system to be installed in the rear of the tritium source will be described.

HK 39.6 Tu 18:00 H-ZO 70

Das Reaktorneutrinoexperiment Double Chooz — •Daniel Greiner für die Double Chooz-Kollaboration — Kepler-Zentrum, Universität Tübingen, Deutschland

Eine lange Reihe erfolgreicher Experimente hat das Auftreten von Neutrinooszillationen bestätigt und nachgewiesen, dass zwei der sie beschreibenden Mischungswinkel groß sind. Für den dritten Mischungswinkel, Θ_{13}, ist vor allem aus dem Chooz-Experiment bisher nur eine Obergrenze bekannt. Die Größe von Θ_{13} ist somit eine der fundamentalsten momentan offenen Fragen in der Neutrinophysik und nimmt eine Schlüsselstellung für die Planung weiterführender Experimente ein.

Durch die Reduktion von statistischem und systematischem Fehler im Vergleich zum erwähnten ursprünglichen Chooz-Experiment sowie dem Einsatz zweier möglichst identischer Detektoren in unterschiedlichen Entfernungen von den Kernen des Chooz-B-Kernreaktors zielt das im Aufbau befindliche Double Chooz-Experiment auf eine Verbesserung der Sensitivität für $\sin^2(2\Theta_{13})2$ auf etwa 0,03 bei 90% C.L. ab, um Θ_{13} zu messen oder zumindest die Obergrenze deutlich abzusenken. Ende 2009 soll die etwa fünfjährige Datennahme mit dem zuerst fertig gestellten fernen Detektor beginnen.

HK 39.7 Tu 18:15 H-ZO 70

k-suryon effect — •Siva Prasad Kodukula — Qurter No.133-F;Sector-10;Ukkunagaram,Visakhapatnam,I N D I A,Pin-531163

When an electromagnetic radiation of *m* hertz*s Passes through an electromagnetic field created by a coil having a voltage of *V* volts and resistance of *R* ohms will be reduced to *n* hertz*s. Related by an equation m - n = K(V/R) where *K* = 5.922591x10ˆ-5 ohms / volt-sec. Here *K* is *K-Suryon Constant* derived by *K-Suryon Effect*. This reduction in the frequency is explained as the conversion of frequency in to mass surrounded by gravity field. Here the wave length will not be changed since the total energy of the wave is constant. This phenomenon is applicable in specified limits called elastic limit of the wave. A preliminary experimental set up has been suggested to prove this effect . Thus the experiment will explains the exchange of forces between gravity and electromagnetism through *K-Suryon Theory* . The *K-Suryon* is the most elementary particle

predicted by *K-Suryon* theory with mass 1.1542196x10ˆ-64 kgs and charge 2.03x10ˆ-53 coulombs.

References: 1. *Future Physics Lead Genetics?* By Siva Prasad Kodukula Web site:- http://www.lulu.com/content/1327365 2. *New cosmological constants* By Siva Prasad Kodukula http://ffp9.fisica.uniud.it*(Paper ID no. * 1) (9th International Conference -7-9 Jan2008, Italy) 3.*K-Suryon Theory* ID no.49 *National conference on Atomic and molecular Physics 10-13-Feb,2009, Inter University Accelerator Centre, Delhi ,I N D I A Web: http://www.iuac.res.in/atmol/MaKaC/conferenceDisplay.py?confId=0

HK 40: Accelerators and Instrumentation I

Time: Tuesday 16:30–19:00 Location: H-ZO 80

Group Report HK 40.1 Tu 16:30 H-ZO 80

The Micro-Vertex-Detector of the PANDA-Experiment — •Tobias Stockmanns for the PANDA-Collaboration — Institut für Kernphysik I, Forschungszentrum Jülich GmbH, Germany

The Micro-Vertex-Detector (MVD) is the key component of the PANDA experiment to identify open charm and strangeness by detecting secondary decays of particles displaced from the primary interaction point. These decay lengths vary from a few 100 *m for charmed mesons and baryons up to several cm for strange hadrons. In addition, the MVD significantly improves the momentum resolution of the large volume central tracker. To achieve the required resolution and to be operational in a harsh radiation environment the MVD is made of position sensitive silicon pixel and strip detectors, which are arranged in four barrel layers and six disk layers around the interaction point of the anti-proton beam and the target material. The total size of the MVD is 40 cm in length and 30 cm in diameter. With more than 10 million readout channels, a continuous untriggered readout and the highest requirements for spatial resolution and material budget within PANDA, the MVD faces many technological challenges. The presentation includes all technical aspects necessary to construct such a complex detector, starting from the physical requirements, the necessary simulation steps up to the first prototypes of subcomponents. This work is supported in part by BMBF, EU, FZ-Jülich

HK 40.2 Tu 17:00 H-ZO 80

A custom pixel detector for the PANDA experiment — •Daniela Calvo[1], Paolo De Remigis[1], Thanushan Kugathasan[1,2], Simonetta Marcello[1,2], Giovanni Mazza[1], Angelo Rivetti[1], and Richard Wheadon[1] — [1]INFN - Sezione di Torino, P. Giuria 1, 10100 Torino, Italy — [2]Universita' di Fisica, P. Giuria 1, 10100 Torino, Italy.

For the PANDA Collaboration

In the PANDA experiment, foreseen at the future FAIR facility at GSI, the Micro Vertex Detector (MVD), with a design involving both pixel and microstrip silicon sensors, is envisaged for the detection of secondary vertices from the decay of charmed mesons as well as those from kaons and hyperons.

The primary task of the MVD is the detection of charged particle hits with a resolution that yields an overall spatial accuracy better than the characteristic decay lengths of the involved particles, as D mesons. The MVD must also provide energy loss information to aid particle identification. The wide momentum spectra of the particles, which starts at only a few hundred of MeV/c put strong limits on the material budget and also the radiation hardness is an important issue. Besides the triggerless design asks for particular architecure design for the detector electronics. Therefore, custom solution of the pixel detector for both sensor and front-end chip based on the 130nm CMOS technology is underway.

Results concerning study and characterization of epitaxial silicon sensors and chips using time-over-threshold (TOT) approach will be presented.

HK 40.3 Tu 17:15 H-ZO 80

Design Optimisation for the Silicon Micro-Strip Part of the PANDA Micro-Vertex-Detector * — •Thomas Würschig, Ralf Kliemt, René Jäkel, and Kai-Thomas Brinkmann for the PANDA-Collaboration — Rheinische Friedrich-Wilhelms-Universität Bonn, HISKP, Nussallee 14-16, D-53115 Bonn, and Technische Universität Dresden, IKTP, Zellescher Weg 19, D-01069 Dresden (both Germany)

The PANDA experiment is one of the key projects at the future FAIR facility, which is under construction at GSI, Darmstadt. The Micro-Vertex-Detector (MVD) is the innermost detector part of the experiment. Silicon sensors are used for high precision tracking. The outer detector layers are equipped with double-sided silicon strip detectors. An optimisation has been accomplished for the layout of the MVD starting with the extraction of design parameters to qualify the physics performance of the detector. A clear definition of the requirements for the frontend electronics, and a precise description of the detector modules, the cooling system and the support structure are necessary to obtain realistic values concerning the material budget, the thermal load and space requirements. Altogether, this data can be taken as input for physics and engineering simulations. In parallel, prototypes for the detector modules and support structures are under development allowing the measurement of key parameters and the demonstration of the technical feasibility for the proposed concept. In consequence, the optimization process to be illustrated for the silicon micro-strip part of the MVD is based on both simulation results and experimental data. (* Supported by BMBF and EU.)

HK 40.4 Tu 17:30 H-ZO 80

Design of a test station for silicon strip sensors for PANDA* — •Felix Krüger, Kai-Thomas Brinkmann, Hans-Georg Zaunick, Robert Schnell, and Lars Ackermann — Universität Bonn, HISKP, Nussallee 14-16 and TU Dresden, IKTP, Zellescher Weg 19

At PANDA, which is being planned at the international accelerator facility FAIR in Darmstadt, silicon strip sensors will play an important role for the micro vertex detektor (MVD). The design of the microstrip sensor modules is a process of hardware and software development, which is combined with simulation studies to compare the results. Therefore a test station was set up and first module prototypes have been constructed and tested. Data from sensor modules with single and double sided readout are available to make first hit recognition and tracking analysis. Database structures have been developed to collect sensor and frontend characteristics for assembled sensor modules. (*Supported by BMBF and EU.)

HK 40.5 Tu 17:45 H-ZO 80

SiΛViO - Ein Trigger für Λ-Hyperonen — •Robert Muenzer, Martin Berger, Laura Fabbietti und Olaf Hartmann für die FOPI-Kollaboration — Technische Universität München

In einem dedizierten Experiment mit dem FOPI-Spektrometer am SIS-Beschleuniger der GSI soll die Produktion von gebundenen Kaon-Nukleon Zuständen (Kaonischen Clustern) (siehe [1]) in der Reaktion p+p $\rightarrow [ppK^-] + K^+$ untersucht werden. Dabei wird nach dem Zerfall der Cluster in Λ p gesucht.

Zur Selektion solcher Endzustände wurde das Detektorsystem SiΛViO (Silicon for Λ-Vertexing and Identification Online) als Trigger für Λ-Hyperonen gebaut. Dieses System besteht aus zwei Ebenen Silizium-Streifendetektoren auf welchen die Teilchenmultiplizität online gemessen wird. Die erste Ebene ist dicht hinter dem Target angebracht. Die Zweite befindet sich 9,5cm hinter dieser, so dass möglichst viele Λ-Hyperonen ($c\tau = 7.89cm$) zwischen beiden Ebenen zerfallen. Durch Multiplizitätsvergleich der beiden Ebenen wird ein Triggersignal erzeugt.

Der Vortrag beschäftigt sich mit dem Aufbau des Detektorsystems und der Diskussion der in verschiedenen Testexperimenten gesammelten Ergebnissen.

Diese Arbeit wird durch die HGF und dem Excellence Cluster of Universe unterstützt.

[1]Y.Akaishi und T.Yamazaki, PR C 76, 045201 (2007)

HK 40.6 Tu 18:00 H-ZO 80

The HERMES Recoil Detector — •Inti Lehmann for the HERMES-Collaboration — University of Glasgow, Glasgow, Scotland/UK

It was recently suggested that Generalised Parton Distributions (GPDs) have the potential to extend our description of the nucleon structure beyond standard parton distributions. The Recoil Detector

at the HERMES experiment at DESY, Hamburg has been installed to improve the capability to study hard exclusive processes in a kinematic region relevant to GPDs at HERMES.

I will detail the experimental set up consisting of three detector systems housed inside a solenoidal field of 1 T: two layers of silicon strip detectors inside the ring vacuum, two barrels of scintillating fibre detectors, and a photon detector. In addition, I will give an update on the detector performance and conclude with physics topics currently under study.

HK 40.7 Tu 18:15 H-ZO 80

The silicon tracking system of the CBM experiment at FAIR: Detector development and first in-beam applications. — •Anton Lymanets for the CBM-Collaboration — FIAS, University of Frankfurt

The CBM experiment will explore the QCD phase diagram at high net baryon densities and moderate temperatures. Its key component - the silicon tracking system STS - will reconstruct the trajectories of all charged particles created in collisions of heavy ions with a nuclear target, at typical beam energies of 25 GeV/nucleon. The central requirements of the STS are a particularly low-mass construction, imposed by the necessary momentum resolution of about 1%, as well as radiation hard sensors and a fast readout matching the high interaction rates of up to 10 MHz.

First silicon microstrip detectors have been developed that are compatible with a thin modular structure of the STS tracking stations. The characterization of the detectors in the laboratory and in-beam tests will be described. A demonstrator tracking station comprising a double-sided silicon detector prototype with 2 × 256 orthogonal strips of 50 μm pitch has been integrated into the beam tracker of the SVD-2 experiment at IHEP, Protvino, Russia. It was tested in a 50 GeV proton beam, yielding performance parameters as detector efficiencies, spatial resolution, cluster sizes and signal-to-noise ratios.

* Supported by EU-FP6 HadronPhysics

HK 40.8 Tu 18:30 H-ZO 80

Concept and simulation of the CBM-Micro Vertex Detector* — •Christina Dritsa for the CBM-Collaboration — GSI, Darmstadt, Germany — IKF, Frankfurt, Germany — IPHC, Strasbourg, France

The future CBM (Compressed Baryonic Matter) experiment aims to explore the properties of nuclear matter at high net baryonic densities. It will measure rare and penetrating probes such as open charm, which is produced close to the production threshold. The identification of open charmed particles is done by separating their displaced decay vertices from the event vertex. This approach calls for a performant micro vertex detector (MVD), which will consist of several layers of pixel sensors. Monolithic Active Pixel Sensors (MAPS) are currently considered to be the most promising sensor technology for the MVD as they provide an excellent single point resolution together with low material budget and appropriate radiation hardness and time resolution.

We will discuss the concept of the MVD. Hereafter, we will introduce the simulation tools used for the detector simulation. A focus will be laid on the digitizer for the MAPS. The simulated response of the MAPS will be compared with data obtained from beam tests at the CERN-SPS. *Supported by BMBF(06FY1731)

HK 40.9 Tu 18:45 H-ZO 80

Der COMPASS Recoildetektor 2008 — •Johannes Bernhard für die COMPASS-Kollaboration — Institut für Kernphysik, Johann-Joachim-Becher-Weg 45, 55099 Mainz

Ein Schwerpunkt des COMPASS-Experiments am CERN ist die Untersuchung des Spektrums von leichten Mesonen. Dazu wurden 2008 Daten mit einem 190GeV/c Hadronstrahl an einem lH$_2$-Target genommen. Der COMPASS Recoildetektor (RPD) selektiert als Element des Triggersystems langsame Rückstoßprotonen aus dem Target, die eine klare Signatur für diffraktive Streuung und zentrale Produktion sind. Im Vortrag soll auf die Rolle des RPD im Trigger sowie auf die Performance als Flugzeitdetektor eingegangen werden. Dazu sollen Kalibrationsmethoden und Analyse von elastischen und diffraktiven Prozessen diskutiert werden.

HK 41: Accelerators and Instrumentation II

Time: Tuesday 16:30–19:00 Location: H-ZO 90

Group Report HK 41.1 Tu 16:30 H-ZO 90

The Transition Radiation Detector for ALICE at LHC — •Thomas Dietel for the ALICE-TRD-Collaboration — IKP Münster

The Transition Radiation Detector (TRD) for the ALICE experiment at the Large Hadron Collider (LHC) identifies electrons and performs online tracking in the challenging high multiplicity environment of heavy-ion collisions. A trigger decision based on the excellent position resolution and pion rejection capability can be provided within 6.5 microseconds after the interaction.

The TRD consists of 540 Xe gas-filled pad readout drift chambers with radiators, arranged in 18 super-modules in barrel geometry in the central part of the ALICE detector. The large active area of roughly 700 m^2 is covered by almost 1.2 million readout channels.

For a period of six months, four installed super-modules of the detector were commissioned with cosmic radiation. A trigger on cosmics generated by the TRD at level 1 was implemented and successfully operated in conjunction with the other subdetectors of the central barrel. We will report on the performance and current understanding of the detector based on these data.

HK 41.2 Tu 17:00 H-ZO 90

Alignment and tracking efficiency of the ALICE transition radiation detector — •Sebastian Huber — GSI, Planckstr.1, 64291 Darmstadt

We present a study of the tracking efficiency of the ALICE transition radiation detector (TRD) with the emphasis on its dependence on the chamber misalignment. For that purpose we analyze data simulated with the PYTHIA event generator and reconstructed with AliROOT. The efficiency is determined via the tracks reconstructed in the ALICE time projection chamber (TPC) and in the TRD. This will allow in the future to apply the same procedure to experimental data. The robust and versatile method used to determine the efficiency and the impact of misalignment on the data quality will be presented.

HK 41.3 Tu 17:15 H-ZO 90

Development of a transition radiation detector for a high counting rate environment — •Mariana Petris for the CBM-Collaboration — NIPNE, 407 Atomistilor St.P.O.B.MG-6, Bucharest - Magurele, Romania

The development of a Transition Radiation Detector (TRD) for a high counting rate environment, required by the next generation of experiments in hadron physics, as CBM experiment at the future facility FAIR, GSI-Darmstadt is a major technical challenge. The expected particle rates for CBM-TRD subdetector used for identification of high energy electrons and tracking of all charged particles, in particular at small polar angles, are up to 10^5 particles$\cdot$cm$^{-2}\cdot$s^{-1} for 10^7 interactions$\cdot$s^{-1} of minimum bias Au+Au collisions at 25 A*GeV.

A first TRD prototype with high granularity for a high counting rate environment was designed, built and successfully tested. In order to increase the conversion efficiency of the transition radiation in a single TRD layer a second prototype with a new configuration was built and tested. Results of the in-beam investigations of the rate capability and electrons - pions rejection factor as a function of number of layers are presented. The performance of this new type of TRD recommends this architecture of TRD as a solution for high counting rate environments and high pion efficiency TRD with reduced number of channels and material budget, at a given granularity.

Based on these results, for small polar angles region, a real size prototype is proposed.

HK 41.4 Tu 17:30 H-ZO 90

Optimization of the ALICE-TRD Software in the High Level Trigger — •Theodor Rascanu for the ALICE-HLT-Collaboration — Goethe Universität, Frankfurt, Germany

The High Level Trigger (HLT) system of the ALICE experiment at LHC has a multi-functional design. Though its main application is the triggering and selection of rare physics processes it plays a key

role in the first online analysis of data and provides monitoring and quality assurance for the detectors. Due to the demands of an online system the HLT routines have to be both, precise and highly computing time efficient. The HLT has to instantly process a vast amount of data, implying high challenges on the computational infrastructure and framework as well as on the design of the data processing and analysis routines for the detectors.

We will review challenges and concepts in the implementation of the Transition Radiation Detector (TRD) in the ALICE-HLT. Limitations and advantages in a parallel software design for online and offline use will be discussed, concentrating on speed optimization and restrictions by the need for high precision offline routines. The versatility of the system will be demonstrated by introducing an HLT based TRD monitoring tool. The current status of the implementation and the strategy for first physics at the LHC will be presented.

HK 41.5 Tu 17:45 H-ZO 90

Analysis of ALICE - TRD test beam data — •Michael Kliemant for the ALICE-TRD-Collaboration — Johann Wolfgang Goethe-Universität, Frankfurt am Main, Deutschland

The Transition Radiation Detector (TRD) of the ALICE Experiment at the CERN-LHC is designed for high momentum electron identification in the central rapidity region. The measurement of electrons and positrons in Pb - Pb collisions is important for the analysis of quarkonia and heavy flavour production in the Quark Gluon Plasma (QGP). In November 2007 a test of one fully integrated TRD super module(final electronic and cooling set-up) at the CERN PS - accelerator with a mixed electron - pion beam (1, 2, 4 and 6 GeV/c) was performed. With this data set it is feasible to investigate the PID and tracking performance of the detector. The major aspect of this study is to improve the electron PID performance taking into account the correlations between the different detector layers due to Bremsstrahlung. Different PID - strategies will be discussed.

HK 41.6 Tu 18:00 H-ZO 90

Calibration of the ALICE Transition Radiation Detector with cosmic-ray data — •Bailhache Raphaelle for the ALICE-TRD-Collaboration — Institut für Kernphysik, Frankfurt, Deutschland

The ALICE Experiment is the dedicated heavy-ion experiment installed at the Large Hadron Collider (LHC). One of its detector systems, the Transition Radiation Detector (TRD), is a gas detector designed for electron identification and charged particle tracking. The charged particle ionizes the gas along its path and electrons drift in a uniform field of 700 V/cm over 3 cm before being amplified. We implemented procedures to calibrate the drift velocity of the electrons, the time-offset of the signal, the amplification factor and the width of the Pad Response Function (PDF) characterizing the sharing of the deposited charge over adjacent pads. The performances of the algorithms were tested on first real data taken with cosmic-rays in the ALICE setup. The calibration software was installed on the main ALICE data acquisition system at CERN and executed continuously during the cosmic-ray data taking in 2008, providing a first determination of the calibration constants. In this talk, we will discuss the implementation of the calibration software and the results obtained with the first four TRD supermodules installed in ALICE.

HK 41.7 Tu 18:15 H-ZO 90

Feasibility study on determining the effective radiation thickness of the Transition Radiation Detector of ALICE from PS data with a beam of tagged electrons and pions — •Robert Grajcarek for the ALICE-TRD-Collaboration — University of Heidelberg

The Transition Radiation Detector (TRD) of the ALICE experiment at LHC identifies electrons with momenta above 1 GeV/c and provides fast (6 μs) triggering capability for high transverse momentum charged particles ($p_T > 3$ GeV/c). The effective radiation thickness serves as an essential input for physics analyses relying on detailed Monte Carlo detector performance studies. When electrons cross matter, they are subject to energy loss due to Bremsstrahlung. By measuring the energy distribution of electrons after traversing the TRD, it is in principle possible to determine the effective radiation thickness. We report recent results from a testbeam at the Proton Synchroton at CERN (PS) with tagged electrons and pions impinging on one of the eighteen supermodules of the TRD in its final configuration. Beam momenta with 0.3, 0.6, 1.0, 1.5, 2.0, 3.0, 4.0 and 6.0 GeV/c were used. The resulting electron energy has been measured by a lead-glass cherenkov calorimeter. In order to fully decribe the data, detailed Monte Carlo simulations were performed, including all relevant details of the experimental setup.

HK 41.8 Tu 18:30 H-ZO 90

Alignment of ALICE TRD Modules Using Cosmic Rays — •Eva Sicking for the ALICE-TRD-Collaboration — Institut für Kernphysik, WWU Münster

The Transition Radiation Detector (TRD) is a central component of the heavy ion collider experiment ALICE at the LHC. The cylindrical detector consists of 18 super modules, which undergo final assembly in Münster. One super module contains 30 independent detector chambers. As part of the assembly process tracks of cosmic rays are recorded and reconstructed to perform a first calibration pass.
Due to limited accuracy during assembly the real position of the chambers can differ from their positions in the ideal geometry. To provide a high position resolution and thus a high resolution in transverse momentum, the geometry has to be corrected for these displacements.
We will present a first determination of these displacements using straight tracks of cosmic rays. These results allow for a survey of the chamber positioning during super module assembly and will be used during reconstruction.

HK 41.9 Tu 18:45 H-ZO 90

ALICE HLT Tracking — •Sergey Gorbunov for the ALICE-HLT-Collaboration — Kirchhoff-Institut für Physik, Heidelberg, Germany

A fast tracking algorithm has been developed for ALICE High Level Trigger. The algorithm reconstructs all kinds of data including physics p-p and Pb-Pb events, cosmics and laser calibration events. For the pattern recognition a Cellular Automaton method is used, while the track fit is performed with a Kalman filter. The algorithm shows high quality and speed. It performs all the calculations in parallel which allows one to use fast multiprocessor hardware for the HLT event reconstruction, thus increasing the speed of data processing by an order of magnitude. The reconstruction efficiency for heavy ion events is ˜96% and the speed is 1300 ms/event on a current CPU and only 140 ms/event on a modern GPU card. The algorithm is intended for on-line data processing in the High Level Trigger of the ALICE experiment.

HK 42: Few-body physics

Time: Tuesday 16:30–18:15 Location: H-ZO 100

Group Report HK 42.1 Tu 16:30 H-ZO 100

Current conservation and analytic determination of the magnetic moment of the Delta-resonances. — Amand Faessler[1] and •Alexander Machavariani[2] — [1]Institute für Theoretische Physik der Univesität Tübingen, Tübingen D-72076, Germany — [2]High Energy Physics Institute of Tbilisi State University, University str. 9, Tbilisi 380086, Georgia

The pion-nucleon bremsstrahlung $\pi + N = :\gamma' + \pi' + N'$ is studied within a new form of the Ward-Takahashi identities for the on shell amplitudes. Based on this current conservation it is shown, that the double Δ exchange diagram with the $\Delta - \gamma'\Delta'$ vertex cancel exactly against the appropriate longitudinal part of the external particle radiation diagrams. Consequently, a model independent relation between the magnetic dipole moments of the Δ resonances and the full magnetic moment of the proton μ_p and neutron μ_n is obtained. In particular, $\mu_{\Delta^+} = \frac{M_\Delta}{m_p}\mu_p$, $\mu_{\Delta^o} = \frac{M_\Delta}{m_o}\mu_n$ and $\mu_{\Delta^{++}} = \frac{3}{2}\mu_{\Delta^+}$, $\mu_{\Delta^-} = \frac{3}{2}\mu_{\Delta^o}$. This result is generalized within the field theoretical formulation with the quark degrees of freedom, where pions and nucleons are treated as the bound systems of quarks. It is shown that relations generated by current conservation for the on shell πN bremsstrahlung amplitude with composite nucleons and pions have the same form as in the usual quantum field theory without quark degrees of freedom. Consequently, the model independent relations for the magnetic dipole moments of the Δ resonances remain be the same in the quantum field theory with

the quark degrees of freedom.

HK 42.2 Tu 17:00 H-ZO 100

Halo nuclei in effective theory at next-to-leading order — •David L. Canham[1,2] and H.-W. Hammer[1,2] — [1]Helmholtz-Institut für Strahlen- und Kernphysik (Theorie), Universität Bonn — [2]Bethe Center for Theoretical Physics, Universität Bonn

An effective theory with separable s-wave interactions is used to explore the universal properties of Efimov states and three-body systems composed of two neutrons and a core. This effective potential is well suited to describe the short-range interactions of halo nuclei. To leading order, only one coupling constant is needed in the two-body effective potential, tuned to reproduce the scattering length. The effective range enters at next-to-leading order (NLO). We explore the NLO corrections to three-body states assuming a large scattering length as compared to the range of the interaction. One finds that the renormalization places certain constraints on the value of the effective range, known as the *Wigner Bound*.

HK 42.3 Tu 17:15 H-ZO 100

Three-boson bound states in finite volume with EFT — •Simon Kreuzer[1,2] and H.-W. Hammer[1,2] — [1]Helmholtz-Institut für Strahlen- und Kernphysik (Theorie), Universität Bonn — [2]Bethe Center for Theoretical Physics, Universität Bonn

The universal properties of a three-boson system with large scattering length are well understood within the framework of Effective Field Theory. They include a geometric spectrum of shallow three-body bound states called *Efimov states* and log-periodic dependence of scattering observables on the scattering length. We investigate the modification of this spectrum in a finite cubic box using a partial wave expansion. The dependence of the binding energies on the box size is calculated and the renormalization of the Effective Field Theory in finite volume is verified explicitly.

HK 42.4 Tu 17:30 H-ZO 100

The role of general symmetries in the three-alpha decay of ^{12}C resonances — •Oliver Kirsebom for the MAGISOL-Collaboration — Institut for Fysik og Astronomi, Aarhus Universitet, 8000 Århus C, Denmark

We use the Dalitz plot to study the decay of ^{12}C resonances into three alpha particles. The requirement of a symmetric three-alpha final state together with conservation of spin, parity and isospin forces the density to vanish in certain regions of the Dalitz plot thereby inducing general structures that do not in any way depend on the details of the interaction Hamiltonian except, of course, its ability to conserve spin, parity and isospin. The implications of this understanding is twofold. First, the observed density of the Dalitz plot can be used to determine or at least impose constraints on the spin and parity of the decaying ^{12}C resonance. Second, once the inevitable structures due to symmetries have been identified the remaining structures in the Dalitz plot can be understood as resulting from the dynamical interactions at play, thus allowing for an understanding of the decay mechanism. In this contribution I present experimental Dalitz plots extracted from complete kinematics studies of the ^{10}B(^{3}He, $p\alpha\alpha\alpha$) and the ^{11}B(^{3}He, $d\alpha\alpha\alpha$) reactions. I show how our measurements allow us to determine the spin and parity of ^{12}C states whose quantum numbers were hitherto unknown. Finally, I compare the measured Dalitz distributions to theoretical calculations and discuss the implications for our understanding of the decay mechanism, in particular the validity of the model of a sequential decay through the broad 2^+ resonance in ^{8}Be.

HK 42.5 Tu 17:45 H-ZO 100

Progress in the Quantum Monte Carlo approach to small- and medium-sized nuclei — Paolo Armani[1], Stefano Gandolfi[2], Pietro Faccioli[1], and •Francesco Pederiva[1] — [1]Dipartmento di Fisica and I.N.F.N., Universita' di Trento, via Sommarive, 14 I-38100 Trento, Italy — [2]S.I.S.S.A., International School for Advanced Studies, via Beirut, 2 I-34014 Trieste, Italy

Green's Function Monte Carlo methods have been successfully applied in the past to describe nuclei with masses up to A=12. In the last few years, the introduction of the Auxiliary Field Diffusion Monte Carlo method (AFDMC) of S. Fantoni and K. Schmidt allowed to compute properties of systems with larger masses due to a more efficient treatment of the spin- and isospin-dependent part of the nucleon-nucleon interaction.

We present recent calculations of the properties of nuclei up to ^{16}O with a potential including the tensor component. However, the treatment of spin-orbit and three body terms within AFDMC remains difficult. In this context we will then present the recent developments in the quest of a Diffusion Monte Carlo scheme based on Effective Field Theory Hamiltonians, in which the pionic degrees of freedom are treated explicitly, under the assumption of the conservation of the nucleon number and with the introduction of an explicit kinetic term for nucleons already at the leading order.

HK 42.6 Tu 18:00 H-ZO 100

implementation of low-momentum effective interaction in spin-isospin dependent 3D approach — Shahriar Bayegan and •Mehdi Harzchi — Department of Physics, University of Tehran, P.O.Box 14395-547, Tehran, Iran

The formulation of the low-momentum effective interaction in the model space Lee-Suzuki method is implemented in a spin-isospin dependent three-dimensional approach, based on helicity representation. In this approach the low-momentum effective interaction has been formulated as a function of the magnitude of momentum vectors and the angle between them. As an application the Bonn-B potential has been used into the model space Lee-Suzuki method and it has been shown that the low-momentum effective interaction reproduces the same two-body observables obtained by the bare potential.

[1] S. Bayegan, M. Harzchi, M.R Hadizadeh, Nucl. Phys. A814 (2008) 21.

[2] S.K. Bogner, T.T. S Kuo, A. Schwenk, D.R. Entem and R. Machleit, Phys. Let. B576 (2003) 265.

[3] K. Suzuki, Prog. Theor. Phys. 68 (1982) 246.

HK 43: Plenary V

Time: Wednesday 9:00–10:30 Location: Audi-Max

Invited Talk HK 43.1 We 9:00 Audi-Max

Determination of V_{ud} from mirror transitions and the role of atom and ion traps — •Oscar Naviliat-Cuncic — LPC-Caen, ENSICAEN, Université de Caen, IN2P3/CNRS, Caen, France

The V_{ud} element of the Cabibbo-Kobayashi-Maskawa quark mixing matrix has traditionally been determined from the analysis of data in three semileptonic processes, namely, nuclear superallowed $0^+ \rightarrow 0^+$ transitions, neutron decay and pion beta decay.

It has recently been shown that the value of $|V_{ud}|$ can independently be determined from the analysis of T=1/2 nuclear mirror transitions and that this value is more precise than the pion result, competitive with the neutron result and consistent with that from $0^+ \rightarrow 0^+$ transitions. The extraction of $|V_{ud}|$ from mirror transitions requires (like the neutron decay) the knowledge of the associated Gamow-Teller/Fermi mixing ratios which can directly be obtained from beta decay correlation measurements. Such measurements have recently been performed with high precision using atom traps.

We review here recent achievements obtained in beta decay correlation measurements using atom and ion traps and discuss their potential for the determination of GT/F mixing ratios in mirror transitions with the aim to further improve the extraction of $|V_{ud}|$.

Invited Talk HK 43.2 We 9:30 Audi-Max

Light Meson Experiments — •Tord Johansson — Uppsala University

There are many challenging and open questions in the light meson sector with respect to the production dynamics and the meson interactions and decays. Improvements of accelerator facilities and experimental set-ups, together with a better theoretical understanding, have led to a lively activity in this field. Recent experimental results involving light mesons obtained by using both electromagnetic and hadronic probes for their production will be reviewed, together with an outlook

for the field.

Invited Talk HK 43.3 We 10:00 Audi-Max
Nuclear Astrophysics at the Gran Sasso underground laboratory — •Heide Costantini — INFN-Genova Italy

The origin and build up of elements is one of the key questions for our understanding of the universe. Thermonuclear nucleosynthesis processes occurring in stellar and explosive scenarios are responsible for the production of the elements. The talk will focus on the experimental study of quiescent stellar H and He burning nuclear reactions which cross section measurements are hampered mainly by extremely low counting rate and cosmic background. Some of the main reactions of H-burning phase have been measured at the LUNA facility (Laboratory for Underground Nuclear Astrophysics) taking advantage of the very low background environment of the Underground Gran Sasso National Laboratory in Italy. An overview of the adopted experimental techniques will be given together with the main results obtained for the 14N(p,g)15O and 3He(4He,g)7Be reactions and the status of the ongoing experiments. Furthermore a brief summary of possible future studies that could be performed in a new underground facility, will be presented.

HK 44: Plenary VI

Time: Wednesday 11:00–13:00 Location: Audi-Max

Invited Plenary Talk HK 44.1 We 11:00 Audi-Max
Symmetries and phase transitions in nuclei — •Francesco Iachello — Yale University, New Haven, CT, USA

Quantum Phase Transitions (QPT) are phase transitions that occur as a function of a coupling constant in the quantum Hamiltonian describing the system. Atomic nuclei provide examples of quantum shape phase transitions. The phases of the system are different geometric structures of nuclei characterized by different dynamic symmetries, U(5), U(3) and SO(6), corresponding to spherical, axially deformed and so-called γ-unstable shapes. The shape phase diagram of nuclei will be discussed. It will be shown that the transition from spherical, U(5), to axially deformed, U(3), is first order, between spherical and γ-unstable, SO(6), is second order, and between axially deformed and γ-unstable is a crossover. Critical exponents and scaling behavior, i.e. dependence on the number of particles, N, will also be discussed. Recently, it has been found that at the critical value of a QPT, a new symmetry emerges, called "critical symmetry", and related to scale invariance. In the second part of this talk, this (unexpected) symmetry will be discussed and experimental examples shown. Finally, the role of supersymmetry in phase transitions in mixed systems of bosons and fermions will be mentioned. QPT in nuclei provide one of the best experimentally verified examples of phase transitions in physics.

Invited Plenary Talk HK 44.2 We 11:45 Audi-Max
ALICE at the dawn of LHC — •Kai Schweda for the ALICE-Collaboration — Physikalisches Institut, University of Heidelberg, Germany

A Large Ion Collider Experiment (ALICE) will study QCD-matter under extreme conditions of temperature and energy density. The current status of the experiment, its instrumentation and performance capabilities are presented. The ALICE physics potential is highlighted by discussing a few selected measurements scheduled for first proton collisions expected in the second half of 2009 and subsequent collisions of lead nuclei at LHC.

Invited Talk HK 44.3 We 12:30 Audi-Max
NuPECC: A New Long Range Plan for Nuclear Physics in Europe — •Guenther Rosner — Physics Dept., Univ. of Glasgow, Glasgow G12 8QQ, UK

A brief account will be given of the current activities of the Nuclear Physics European Collaboration Committee, NuPECC, which is the Nuclear Physics expert board of the European Science Foundation, ESF. The talk will concentrate on initiating the process of writing a new Long Range Plan for Nuclear Physics in the next decade by discussing procedures, content and timelines.

HK 45: Heavy Ion Collisions and QCD phases

Time: Wednesday 14:00–16:00 Location: H-ZO 10

Group Report HK 45.1 We 14:00 H-ZO 10
Saturation and geometric scaling at RHIC and LHC with polarized and unpolarized final states — •Andre Utermann[1], Daniel Boer[2] und Erik Wessels[2] — [1]Institut für Theoretische Physik, Universität Regensburg — [2]Department of Physics and Astronomy, Vrije Universiteit Amsterdam

A strong rise of the gluon distribution, as predicted by linear QCD evolution, is clearly observed at small x. At some saturation scale $Q_s(x)$, the gluons in the proton may interact with each other and non-linear corrections to the evolution equations become significant, taming the growth of the gluon distribution. Geometric scaling, i.e. the observed property that the small-x DIS cross section depends only on the combination $Q^2/Q_s^2(x)$, is seen as an indication for gluon saturation, since this property is expected asymptotically $x \to 0$ from QCD evolution. We show that the whole range of RHIC data for hadron production in d-Au collisions is compatible with geometric scaling as well. To establish the scaling violations, expected from the non-linear evolution equation at small but finite x, a larger kinematic range in transverse momentum and rapidity would be needed. We point out that the fall-off of the p_t distribution of produced hadrons at large p_t is a sensitive probe of small-x evolution especially at the LHC. Furthermore, we show that the transverse polarization of forward Λ hyperons produced in high-energy p-A collisions is expected to display an extremum at a transverse momentum around the saturation scale. Moreover, the measurement of Λ polarization over a range of x_F values actually provides a direct probe of the x dependence of the saturation scale.

HK 45.2 We 14:30 H-ZO 10
How sensitive are di-leptons from rho mesons to the high baryon density region? — •Sascha Vogel[1], Hannah Petersen[1], Katharina Schmidt[1], Elvira Santini[1], Christian Sturm[2], Jörg Aichelin[3], and Marcus Bleicher[1] — [1]Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Str. 1, 60438 Frankfurt am Main, Germany — [2]Institut für Kernphysik, Goethe-Universität Frankfurt, Max-von-Laue-Str. 1, 60438 Frankfurt am Main, Germany — [3]Subatech, Ecole des Mines de Nantes, 4 rue Alfred Kastler, F-44072 Nantes Cedex 03, France

We show that the measurement of di-leptons might provide only a restricted view into the most dense stages of heavy ion reactions. Thus, possible studies of meson and baryon properties at high baryon densities, as e.g. done at GSI-HADES and envisioned for FAIR-CBM and the low energy RHIC program, might observe weaker effects than currently expected in certain approaches. We argue that the strong absorption of resonances in the high baryon density region of the heavy ion collision masks information from the early hot and dense phase due to a strong increase of the total decay width because of collisional broadening. To obtain additional information, we also compare the currently used approaches to extract di-leptons from transport simulations - i.e. shining, only vector mesons from final baryon resonance decays and instant emission of di-leptons and find a strong sensitivity on the method employed in particular at FAIR and SPS energies.

HK 45.3 We 14:45 H-ZO 10
Thermodynamics of light front quantized QED$_{1+1}$ — •Stefan Strauss and Michael Beyer — Institute für Physik, Universität Rostock, 18051 Rostock, Germany

The thermodynamical properties of Quantum Electro Dynamics in 1+1

dimension are determined for various couplings using discrete light cone quantisation (DLCQ). For the computation of the partition function a large harmonic resolution is necessary and more accurate mass spectra and the bound state wave functions are obtained. The continuum and thermodynamical limits of the partition function and derived quantities are carefully considered. Error bounds and comparisons to the idealized gases are given.

HK 45.4 We 15:00 H-ZO 10

Strangeness fluctuations and MEMO production at FAIR — •Jan Steinheimer-Froschauer[1], Michael Mitrovski[1,2], Tim Schuster[1,2], Hannah Petersen[1,2], Marcus Bleicher[1], and Horst Stoecker[1,2,3] — [1]Institut für Theoretische Physik, Johann Wolfgang Goethe-Universität, Max-von-Laue-Str. 1, 60438 Frankfurt am Main, Germany — [2]Frankfurt Institute for Advanced Studies (FIAS), Johann Wolfgang Goethe-Universität, Ruth-Moufang-Str. 1, 60438 Frankfurt am Main, Germany — [3]GSI - Helmholtzzentrum für Schwerionenforschung mbH, Planckstr. 1, Darmstadt

We apply a coupled transport-hydrodynamics model to discuss the production of multi-strange meta-stable objects in Pb+Pb reactions at the FAIR facility. In addition to making predictions for yields of these particles we are able to calculate particle dependent rapidity and momentum distributions. We argue that the FAIR energy regime is the optimal place to search for multi-strange baryonic object (due to the high baryon density, favoring a distillation of strangeness). Additionally, we show results for strangeness and baryon density fluctuations. Using the UrQMD model we calculate the strangeness separation in phase space which might lead to an enhanced production of MEMOs compared to models that assume global thermalization.

HK 45.5 We 15:15 H-ZO 10

Kaons and Antikaons in Nuclear Matter: AA vs. pA Collisions — •Henry Schade[1,2] and Burkhard Kämpfer[1,2] — [1]Institut für Theoretische Physik, TU Dresden, 01062 Dresden, Germany — [2]Forschungszentrum Dresden-Rossendorf, PF 510119, 01314 Dresden, Germany

Kaon- and antikaon production near the threshold is studied within a transport approach of Boltzmann-Uehling-Uhlenbeck type with the aim of a concise understanding of medium modifications. The role of (i) the strangeness-exchange reaction $\pi Y \to K^- N$, (ii) the feeding of $\phi \to K^+K^-$ and (iii) different models of $K^\pm N$ potentials with momentum dependence is elaborated. We compare our transport model calculations to experimental phase space distributions of $K^\pm$ in the reactions p+C, p+Au, C+C and Ar+KCl (KaoS and HADES data).

HK 45.6 We 15:30 H-ZO 10

Centrality dependence of K_s^0 production in $40A$ and $158A$ GeV Pb+Pb collisions at the CERN SPS — •Julian Book[1], Hans Beck[1], Christoph Blume[1], Volker Friese[2], Marek Gazdzicki[1], Claudia Höhne[2], Dmytro Kresan[2], Michael Mitrovski[1], Moritz Pohl[1], Rainer Renfordt[1], Tim Schuster[1], Reinhard Stock[1], Herbert Ströbele[1], and Milica Utvić[1] for the NA49-Collaboration — [1]Fachbereich Physik der Universität, Frankfurt — [2]Helmholtzzentrum für Schwerionenforschung (GSI), Darmstadt

The NA49 experiment has measured strange hadron production in Pb+Pb collisions for different centralities and energies. Preliminary results on Λ, Ξ, $K^\pm$ have already been shown. In order to cross-check and complete these, K_s^0 production has been studied.
This analysis was based on data measured with the NA49 large acceptance hadron spectrometer. K_s^0 are identified via their decay topology and invariant mass determination.
Preliminary results on the centrality dependence of transverse mass and rapidity spectra as well as the total yields will be presented for $40A$ and $158A$ GeV. A comparison to the corresponding results for charged kaons measured via time of flight, energy loss and to various theoretical models will be shown.

HK 45.7 We 15:45 H-ZO 10

Charged kaon flow measurements in Ni+Ni collisions at 1.91A GeV with the FOPI detector — •tae im kang for the FOPI-Collaboration — GSI, Darmstadt, Germany — Korea University, Seoul, Korea

The FOPI collaboration studies bulk properties of nuclear matter as well as in-medium effects on hadrons in a hot and dense environment. The latter are assessed by the measurements of particle yields, momentum distributions, and the azimuthal emission pattern with respect to the reaction plane. Kaons have obtained particular interest. At SIS/GSI, kaons are produced in nucleus-nucleus collisions at subthreshold energies [1]. Theory suggest that in the medium the kaon effective masses change. These changes can be understood as a consequence of a density dependent kaon-nucleon potential. The measurement of charged kaon flow can provide important information on this in-medium potential [2].

To improve the charged kaon measurement, FOPI has successfully upgraded its apparatus with a novel Multi-strip Multi-gap RPC (MMRPC) Time-of-Flight detector system in 2007 [3]. In this presentation we show first results obtained with this new detector for charged kaon production in Ni+Ni collisions at 1.91A GeV.

This work was supported by EU/FP6 I3 HP, R113-CT-2004-506078; BMBF 06HD190i; DFG 446 KOR 113/216/0-1.

[1] K. Wiśniewski *et al.*, Eur. Phys. Journ. A **9**, 515, 2000.
[2] G. Q. Li *et al.*, Phys. Rev. Lett. **74**, 235-238, 1995.
[3] A. Schüttauf *et al.*, Nucl. Phys. B Proc. Supp. **158**, 52, 2006.

HK 46: Hadron Structure and Spectroscopy I

Time: Wednesday 14:00–16:00 Location: H-ZO 20

Invited Group Report HK 46.1 We 14:00 H-ZO 20

Overview of the MAMI facility in Mainz — •Achim Denig — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz, Germany

The Mainz Microtron MAMI, a racetrack accelerator operated by the Institute of Nuclear Physics, produces a high-quality polarised CW electron beam. The latest stage MAMI-C is in operation since 2007 and offers a maximum beam energy of 1.5 GeV, which allows a wide program of research in the field of nucleon structure (form factors, sum rules, polarisibilities), baryon spectroscopy, hypernuclear physics, as well as tests of fundamental symmetries in eta-decays.

Three major experimental setups are installed at MAMI and recent results of these experiments are presented. The A1-collaboration investigates electron scattering with large magnetic spectrometers. The A2-collaboration using the Crystal Ball and TAPS detectors performs measurements with real photons, which are generated by Bremsstrahlung. The A4-collaboration studies parity violating electron scattering with a fast photon calorimeter. Special emphasis is placed on results, which are possible due to the upgraded machine energy and an outlook for the future is given.

HK 46.2 We 14:30 H-ZO 20

Helicity asymmetries in double pion photoproduction off deuterium — •Markus Oberle for the A2-Collaboration — Department of Physics, University of Basel

Recently, the measurement of the beam helicity asymmetry of pion pairs off the proton, using circularly polarized photon beams, has revealed surprising deficiencies in most reaction models for double pion production. With the present experiment a first attempt was made to measure such asymmetries also for photoproduction off the neutron, using a deuteron target. It was done at the Mainz MAMI accelerator for photon energies from 400 MeV to 1.5 GeV, using the combined Crystal Ball and TAPS electromagnetic calorimeters. In a first step the data for quasi-free protons were compared to free proton data. Good agreement indicates that the measurement is not seriously disturbed by nuclear Fermi motion. Very preliminary results seem to indicate that in the studied energy range, the asymmetries for $n(\gamma, \pi^0\pi^0)n$ are rather similar to $p(\gamma, \pi^0\pi^0)p$.

Supported by Schweizerischer Nationalfond, DFG, and EU/FP6.

HK 46.3 We 14:45 H-ZO 20

Study of the $\eta \to \gamma e^+ e^-$ decay with the WASA-at-COSY* — •Malgorzta Hodana for the WASA-at-COSY-Collaboration — Institute für Kernphysik, 52428 Jülich, Germany — Nuclear Physics

Division Jagiellonian University, 30059 Cracow, Poland

In October 2008 the WASA-at-COSY collaboration has collected more than 10^7 events for the $pd \to {}^3He\eta$ reaction. One of the aims of currently conducted analyses is the determination of the invariant mass of the lepton pairs created in the Dalitz decay $\eta \to \gamma e^+e^-$. The shape of the e^+e^- invariant mass spectrum is directly related to the distribution of the four-momentum squared of the virtual photon from the $\eta \to \gamma\gamma^*$ process and hence it allows for the study of the transition form factors which in turn reflects the spatial structure of the decaying meson. Experimentally we endeavor to determine the transition form factor as a function of the momentum transfer in the time-like region, in particular we intend to establish the so-called form factor slope parameter for the $\eta \to \gamma e^+e^-$ process and to compare the results with the predictions based on the Chiral Perturbation Theory as well as Vector-Meson Dominance and Quark-triangle Loop models. The experimental methods used, the current status of the analysis of the data, and the physics motivations for the study of the Dalitz decay of the eta meson will be presented and discussed.

*Supported by BMBF and Wallenberg Foundation

HK 46.4 We 15:00 H-ZO 20

First Results on the ABC Effect from Kinematically Complete Measurements of the Double-Pionic Fusion to ^{4}He* — •Annette Pricking for the WASA-at-COSY-Collaboration — Physikalisches Institut der Universität Tübingen

The ABC effect – an intriguing low-mass enhancement in the $\pi\pi$ invariant mass spectrum – is known from inclusive measurements of two-pion production in nuclear fusion reactions to the few-body systems d, ^{3}He and ^{4}He. Its explanation has been a puzzle for 50 years.

In an effort to solve this long-standing problem by exclusive and kinematically complete high-statistics experiments, we have measured the fusion reactions to d, ^{3}He and ^{4}He with WASA at COSY. Here we report on the measurements of the double-pionic fusion reactions $dd \to {}^4$He $\pi^0\pi^0$ and $dd \to {}^4$He $\pi^+\pi^-$, which have been carried out at nine beam energy settings in the range T_p = 0.8 - 1.4 GeV covering thus the full energy region, where the ABC effect has been observed previously in inclusive reactions.

As a first result we find a strong low-mass enhancement in the $\pi\pi$-invariant mass in agreement with previous results. However, we do not observe the high-mass enhancement suggested by the inclusive data and predicted in conventional t-channel $\Delta\Delta$ calculations.But this finding is in support of a dibaryonic s-channel resonance as it is observed for the basic $pn \to d\pi^0\pi^0$ reaction. Further results from the analysis of these reactions will be discussed, in particular also with respect to the energy dependence of the observed ABC effect. * supported by BMBF, COSY-FFE, DFG (Eur. Graduate School) and Wallenberg Foundation

HK 46.5 We 15:15 H-ZO 20

Kaon photo- and electroproduction in a Regge-plus-resonance approach — •Pieter Vancraeyveld, Lesley De Cruz, Jan Ryckebusch, and Tim Van Cauteren — Department of Subatomic and Radiation Physics, Ghent University, Belgium

We present an effective-Lagrangian model describing electromagnetic production of $K^+\Lambda$ [1], $K^+\Sigma^0$ and $K^0\Sigma^+$ [2] off protons. These reaction channels are dominated by a non-resonant background, which complicates the task of extracting the resonance information. In our model we fix the non-resonant amplitude, modeled in terms of t-channel Regge-trajectory exchange, at high energies where the amplitude is devoid of resonant contributions. In a next step, this amplitude is extrapolated into the resonance region and enriched with N^* and Δ^* exchange in the s-channel, resulting in a hybrid "Regge-plus-resonance" (RPR) model. In the electromagnetic vertex, we have incorporated the running of the coupling constants by using form factors as computed in the Bonn constituent-quark model. The RPR model yields a unified description of kaon photo- and electroproduction [3] from threshold up to invariant masses of several GeV. It provides a satisfactory account of the world data, notwithstanding the small number of free parameters. Beside model comparison with polarization data, we will present predictions for kaon production observables off neutrons.

[1] T. Corthals et al., Phys. Rev. C 73, 045207 (2006).
[2] T. Corthals et al., Phys. Rev. C 75, 045204 (2007).
[3] T. Corthals et al., Phys. Lett. B 656, 186 (2007).

HK 46.6 We 15:30 H-ZO 20

Production of charged pions off nuclei at HARP within the GiBUU model — •Kai Gallmeister and Ulrich Mosel — Institut für Theoretische Physik, Universität Giessen, Germany

We compare calculations for the production of charged pions by pion or proton beams off nuclei calculated within our coupled channel transport model (GiBUU) with recent data of the HARP collaboration for beam energies from 3 up to 13 GeV. While originally designed for calibrating the flux for neutrino induced experiments, the data from this experiment represents a valuable check for hadronic final state models. Work supported by DFG.

HK 46.7 We 15:45 H-ZO 20

Use of the coherent $^{12}C(\gamma,\pi^0)$ reaction to measure photon polarisation — •Ian James Douglas MacGregor, Jamie Robinson, and Ken Livingston for the A2-Collaboration — University of Glasgow, Glasgow, UK

Photonuclear cross sections depend on numerous factors, some of which are masked in the unpolarized case, where sums and/or averages are performed over spin states. The use of linearly polarized photons allows investigation into the difference between parallel and perpendicular responses through photon asymmetry Σ measurements. Σ is particularly sensitive to angular momentum contributions to nuclear currents and to interference between contributions thus providing a more sensitive observable to test theories of nuclear interactions.

Accurate Σ measurements rely on an accurate determination of the degree of photon linear polarization. We present measurements of photon polarization performed using the highly segmented 4π Crystal Ball detector at Mainz. Coherent photoproduction of π^0 mesons from carbon is used as a polarimeter reaction while investigating the physics of two-nucleon emission in the $^{12}C(\gamma,pp)$ reaction. Since both the π^0 and the nucleus are spin zero, all information regarding the linear polarization of the photon is passed to the π^0 azimuthal distribution. The photon asymmetry $\Sigma(\gamma,\pi^0)$ equals 1 over the energies and angles of the experiment and thus photon polarization can be extracted directly from the azimuthal distribution of the emitted pion. This technique is used to determine photon polarization as a function of photon energy on a run by run basis.

HK 47: Hadron Structure and Spectroscopy II

Time: Wednesday 14:00–16:00 Location: H-ZO 30

HK 47.1 We 14:00 H-ZO 30

Infrared regularization for vector mesons and baryons — •Peter C. Bruns[1,2] and Ulf-G. Meissner[1,2,3] — [1]Helmholtz-Institut für Strahlen-und Kernphysik (Theorie), Universität Bonn, Nußallee 14-16, 53115 Bonn, Germany — [2]Bethe Center for Theoretical Physics, Universität Bonn, 53115 Bonn, Germany — [3]Institut für Kernphysik (Theorie) and Jülich Center for Hadron Physics, Forschungszentrum Jülich, 52425 Jülich, Germany

We show that the method of infrared regularization, invented in its original form by Becher and Leutwyler, can be extended to the case of explicitly included meson resonances. After a short review of the original formalism, the steps necessary for the generalization of the method will be discussed in detail. As an application, we will evaluate a contribution to the axial form factor of the nucleon employing the generalized infrared regularization scheme.

HK 47.2 We 14:15 H-ZO 30

A gauge-invariant chiral unitary framework for kaon photo- and electroproduction on the proton — Bugra Borasoy[1], •Peter C. Bruns[1,2], Ulf-G. Meissner[1,2,3], and Robin Nissler[1] — [1]Helmholtz-Institut für Strahlen-und Kernphysik (Theorie), Universität Bonn, Nußallee 14-16, 53115 Bonn, Germany — [2]Bethe Center for Theoretical Physics, Universität Bonn, 53115 Bonn, Germany — [3]Institut für Kernphysik (Theorie) and Jülich Center for Hadron

Physics, Forschungszentrum Jülich, 52425 Jülich, Germany

We present a gauge-invariant approach to meson photoproduction on nucleons within a chiral unitary framework. The interaction kernel for meson-baryon scattering is derived from the chiral effective Lagrangian and iterated in a Bethe-Salpeter equation. Data on kaon photoproduction from SAPHIR, CLAS and CBELSA/TAPS are analyzed in the threshold region. The importance of gauge invariance and the precision of various approximations utilized in earlier works are discussed.

HK 47.3 We 14:30 H-ZO 30

A Linear Sigma Model with Vector Mesons and Global Chiral Invariance — •Denis Parganlija[1], Francesco Giacosa[1], and Dirk H. Rischke[1,2] — [1]Institut für Theoretische Physik, Goethe-Universität, Max von Laue-Str. 1, D-60438 Frankfurt am Main, Germany — [2]Institut für Theoretische Physik and Frankfurt Institute for Advanced Studies, Goethe-Universität, Max von Laue-Str. 1, D-60438 Frankfurt am Main, Germany

We calculate low-energy meson decay widths in a two-flavour linear sigma model with global chiral symmetry exploring two different assignments for scalar $\bar{q}$-q states: (i) as $f_0(600)$ / $a_0(980)$ and (ii) as $f_0(1370)$ / $a_0(1450)$, respectively. We compare the consequences of each of those assignments with the experimental data. Results for pion-pion scattering lengths in both assignments are also discussed.

HK 47.4 We 14:45 H-ZO 30

Mesons and glueballs: the ground states — •Gurjav Ganbold — JINR, Dubna, Russia — Inst. Phys. Tech., Ulaanbaatar

The two-quark and two-gluon bound states have been studied within a relativistic quantum-field model based on analytic confinement. The ladder Bethe-Salpeter equation is solved for the meson and glueball spectra involving a minimal set of parameters (the quark masses, the coupling constant and the confinement scale). The model provides a reasonable framework to compute data simultaneously in three sectors of low-energy particle physics, namely, the lowest glueball mass, the conventional meson spectrum (in the mass range from 140MeV up to 9.5GeV), and the pion and kaon weak decay constants. The obtained results are in reasonable agreements with the recent experimental data.

HK 47.5 We 15:00 H-ZO 30

A method to measure the $\bar{K}N$ scattering length in lattice QCD — •Michael Lage[1,2], Ulf-G. Meissner[1,2,3], and Akaki Rusetsky[1,2] — [1]Helmholtz-Institut für Strahlen- und Kernphysik (Theorie), Universität Bonn — [2]Bethe Center for Theoretical Physics, Universität Bonn — [3]Institut für Kernphysik (Theorie), Forschungszentrum Jülich

As first shown by Lüscher, finite volume simulations of the energy levels of two-particle states can give access to scattering information in the infinite volume. However, for the extraction of the $\bar{K}N$ scattering length, a generalization of this scheme is called for since there is a strong channel coupling between $\bar{K}N$ and $\Sigma\pi$, the latter channel having its threshold about 100 MeV below the opening of the $\bar{K}N$ one. In addition, the appearance of the $\Lambda(1405)$ just between these two thresholds further complicates the picture. We propose a method to determine the (complex) $\bar{K}N$ scattering length in lattice QCD, using an appropriate modification of Lüscher's formula.

Work supported in parts by DFG (TR 16).

HK 47.6 We 15:15 H-ZO 30

The strangeness of the proton measured by the G0 parity violation experiment at Jefferson Laboratory — •Jean-sebastien Real for the G0-Collaboration — LPSC, Université Joseph Fourier Grenoble 1, CNRS/IN2P3, Institut Polytechnique de Grenoble

The strangeness content of the proton is related to the sea quarks contribution to the nucleon properties, as the spin, the mass or the current. In this context, the parity violation experiments measure this contribution to the electromagnetic (EM) current of the proton, through the strange electric and magnetic form factors. The full access to these quantities requires the measurement of weak form factors of the proton. They can be accessed by measuring the asymmetry in elastic scattering of longitudinally polarized electron on hydrogen and deuterium at two different electron angles (forward and backward). The parity violation asymmetry is of the order of 10-5 and is measured at 10-6 level of accuracy. The G0 experimental setup will be described in the two configurations and the results will be presents. The forward G0 experiment provides a linear combination of the electric and magnetic strange quark contribution over a wide kinematical range. The backward G0 experiment will provide the separate electric and magnetic strange quarks contribution at two kinematics Q2 ˜ 0.63 and 0.23 (GeV/c)2.

Group Report HK 47.7 We 15:30 H-ZO 30

Results in hadronic physics with the KLOE experiment in Frascati — •Stefan E. Müller for the KLOE-Collaboration — Institut für Kernphysik Universität Mainz, J.-J.-Becher-Weg 45, 55128 Mainz

The KLOE experiment at the DAΦNE e^+e^- collider in Frascati covers a wide spectrum of physics. Concerning hadronic physics, a new precise measurement of the pion form factor in the mass range between 0.35 and 0.95 GeV^2 has been published recently, selecting events in which the e^+ or the e^- emits a hard photon in the initial state. This "radiative return" to the ρ and ω resonances allows to access the energy region below the DAΦNE energy, which is fixed to $M_\phi \simeq 1.02$ GeV. In addition, new results have been obtained in the scalar sector, like an upper limit on the branching ratio for $\phi \to K_0\overline{K}_0\gamma$, which proceeds through $f_0(980)/a_0(980)\gamma$, and a high statistics result on the $\phi \to a_0\gamma$ decay. For η/η' physics, a final result for the $\eta \to \pi^+\pi^-e^+e^-$ branching ratio has been obtained, while the KLOE measurement of the gluonium content of the η' has been updated. Also, the cross section parameters for the processes $e^+e^- \to \pi^+\pi^-\pi^0\pi^0$ and $e^+e^- \to \pi^0\pi^0\gamma$, which both proceed through the $\omega\pi^0$ intermediate state, have been measured. In the talk, these new KLOE results will be presented, and a brief overview on ongoing KLOE analyses in hadronic physics will be given.

HK 48: Nuclear Structure and Dynamics I

Time: Wednesday 14:00–16:00 Location: H-ZO 40

HK 48.1 We 14:00 H-ZO 40

E0 Transition strengths from X(5) to the Rigid Rotor * — •A. Krugmann[1], J. Bonnet[1], N. Pietralla[1], and R. V. Jolos[2] — [1]Institut für Kernphysik, Technische Universität Darmstadt, Germany — [2]Joint Institute for Nuclear Research, Dubna, Russia

Relative and absolute $E0$ transition strengths $[\rho^2(E0)]$ on the transitional path between the X(5) solution and the Rigid Rotor Limit have been evaluated within the framework of the Confined β-Soft (CBS) rotor model. Relative $E0$ transition strengths between the β-vibrational band and the ground state band decrease with increasing angular momentum for a given potential stiffness. Absolute $E0$ transition strengths drop with increasing potential stiffness towards zero in the Rigid Rotor Limit. The Z-independent quantity $X \propto \rho^2(E0;0_2^+ \to 0_1^+)/B(E2;0_2^+ \to 2_1^+)$ has been traced between X(5) and the Rigid Rotor. It reaches the value $4\beta_M^2$ at the Rigid Rotor Limit, as previously derived by Rasmussen [1]. A new Inter-Band $E0-E2$ correlation observable $Y \propto \rho^2(E0;0_2^+ \to 0_1^+)/B(E2;0_2^+ \to 2_1^+)^2$ has been proposed [2], which is independent on the absolute nuclear deformation and solely depends on the nuclear stiffness. Available data for X and Y are in satisfactory agreement with the CBS model.

[1] J.O. Rasmussen, Nucl. Phys. **19** (1960) 85-93.

[2] J. Bonnet, A. Krugmann, J. Beller, N. Pietralla, R.V. Jolos, submitted to Phys. Rev. C.

* Supported by the DFG through SFB 634.

HK 48.2 We 14:15 H-ZO 40

Shape Phase Transitions in even and odd systems — •Lorenzo Fortunato[1], Andrea Vitturi[1], Clara Alonso[2], and Josè Arias[2] — [1]Dip. Fisica "G.Galiei", Università di Padova and INFN (Italy) — [2]Departamento FAMN, Universidad de Sevilla (Spain)

The onset of shape phase transitions in even as well as odd systems are reviewed. We discuss the case of an odd j = 3/2 particle coupled to an even-even boson core that undergoes a transition from spherical limit (U(5)) to the γ-unstable limit (O(6)). Energy spectrum and electro-

magnetic transitions, in correspondence of the critical point, display behaviors qualitatively similar to those of the even core and they agree qualitatively with the model based on the E(5/4) boson-fermion symmetry. Then we describe two-particle transfer reactions: the evolution of the transfer spectroscopic intensities within the interacting boson model is analyzed as a possible signature of shape-phase transitions. In correspondence to the critical points characterizing the phase transitions, the two-particle transfer matrix elements to both ground and excited 0^+ states display a rapid discontinuity that might help validating the experimental search for the critical point.

HK 48.3 We 14:30 H-ZO 40

Determination of absolute transition probabilities in ^{128}Xe via projectile Coulomb excitation — •M. Hackstein[1], A. Dewald[1], W. Rother[1], Th. Pissulla[1], H. Iwasaki[1], D. Mücher[1], N. Warr[1], A. Blazhev[1], J. Jolie[1], K.-O. Zell[1], and S. Harissopulos[2] — [1]IKP Köln, Germany — [2]INP, NCSR, Demokritos, Athens, Greece

Recently, lifetimes of low-lying excited states in ^{128}Xe were measured using the plunger technique after projectile Coulomb excitation. This experiment was performed at the JYFL, Jyväskylä using the JUROGAM Ge-detector array and the Cologne coincidence plunger device equipped with an array of 32 small Si-detectors. The Si-detectors were used to measure the reaction kinematics by registering target-like nuclei scattered in forward direction. In order to cross-check the results obtained from the recoil distance Doppler shift analysis an evaluation of the measured excitation cross-sections was performed with the computer code GOSIA. In addition deorientation effects were investigated and effort was made to extract absolute quadrupole moments. Details of the experiment and the calculations will be presented. The obtained results will be discussed. Supported by: DFG, contr.n. DE1516/1.

HK 48.4 We 14:45 H-ZO 40

New Interpretation of Pair Transfer Reactions Between Collective 0^+ States — •Linus Bettermann[1], Rod M. Clark[2], Richard F. Casten[3,1], and Ryan Winkler[3] — [1]Institut für Kernphysik, Universität zu Köln, Cologne, Germany — [2]Nuclear Science Division, Lawrence Berkeley National Laboratory, Berkeley, CA — [3]Wright Nuclear Structure Laboratory, Yale University, New Haven, Conneticut

It is experimentally known, that in nearly all cases ground state cross sections dominate in nucleon pair transfer reactions in collective nuclei. Exceptions of this behavior in which cross sections to excited 0^+ states are comparable to the ground state cross sections can be found in the phase transitional region. In this regions rapid changes from spherical to deformed nuclei appear. This has led to a correlation of the phase transitional region to large cross sections to excited 0^+ states in pair transfer reactions in the past. We performed IBM calculations throughout the entire symmetry triangel, which leads to a new, more general interpretation. This includes the experimentaly known small cross sections to excited 0^+ states in most regions of the nuclear chart and larger in transitional regions. Additionaly our interpretation predicts large cross sections in regions of large structural change that occur without passing through a phase transition. We will present results of the IBM calculations and show cases in which our predictions can be tested experimentally. Work supported in part by USDOE under grant No. DE-FG02-91ER-40609, DFG under grant No. Jo391/3-2 and through a Mercator Guest Professorship at University of Cologne.

HK 48.5 We 15:00 H-ZO 40

Study of ^{133}Ba with the $(\vec{d},p)$ reaction — •G. Suliman[1], D. Bucurescu[1], C. Rusu[2], R. Hertenberger[3], H.-F. Wirth[3], T. Faestermann[4], R. Krücken[4], T. Behrens[4], V. Bildstein[4], K. Eppinger[4], C. Hinke[4], M. Mahgoub[4], P. Meierbeck[4], M. Reithner[4], S. Schwertel[4], and N. Chauvin[5] — [1]IFIN-HH, Bucharest, Romania — [2]University of Texas at Dallas, USA — [3]LMU, Garching, Germany — [4]TUM, Garching, Germany — [5]CSNSM, Orsay, France

Shape phase transitions were mainly studied in even-even nuclei, and less in odd-mass nuclei where the structure is more complex. The Ba isotopes with N<80 form a transitional region from vibrators (U(5) IBM limit) to γ-soft nuclei (O(6) limit), with ^{134}Ba showing features of the E(5) symmetry, the critical point of the U(5) to O(6) transition. Studies of the odd-mass neighbors of ^{134}Ba are of interest to see how criticality is changed by the coupling of the odd particle. Different critical point solutions have been proposed for this region, like E(5/4) or E(5/12).

We present a study of the ^{133}Ba nucleus with the direct $(\vec{d},p)$ reaction at 24 MeV. The experiment was performed at the Munich tandem with polarized deuteron beam, and the Q3D spectrometer. A DWBA analysis of the measured angular distributions and analyzing powers provided unambiguous J^π assignments for most of the observed levels up to 2.2 MeV excitation. The results are discussed in comparison with the predictions of critical point models, IBFM, and spherical shell model calculations.

HK 48.6 We 15:15 H-ZO 40

Quantum chaos in the collective dynamics of nuclei — •Pavel Cejnar, Pavel Stransky, and Michal Macek — Institute of Particle and Nuclear Physics, Charles University, Prague, Czech Republic

Simple models of nuclear collective dynamics - the geometric collective model (GCM) and the interacting boson model (IBM) - exhibit very complex interplay of regular and chaotic motions [1,2]. The competition between both types of dynamics sensitively depends on control parameters as well as on energy. We present results of our recent analyses of classical and quantum signatures of chaos in both GCM and IBM [3-5]. Apart from standard measures of chaos we also study so-called Peres lattices [6], which provide a very efficient way to distinguish ordered and disordered parts of spectra and to reveal main ordering principles of quantum states. Correspondence with the classical dynamics is demonstrated.

References: [1] Y. Alhassid, N.Whelan, Phys. Rev. Lett. 67, 816 (1991). [2] P. Cejnar, P. Stransky, Phys. Rev. Lett. 93 (2004) 102502. [3] P. Stransky, M. Kurian, P. Cejnar, Phys. Rev. C 74 (2006) 014306. [4] M. Macek, P. Stransky, P. Cejnar, S. Heinze, J. Jolie, J. Dobes, Phys. Rev. C 75 (2007) 064318. [5] P. Stransky, P. Hruska, P. Cejnar, submitted to Phys. Rev. E. [6] A. Peres, Phys. Rev. Lett. 53 (1984) 1711.

HK 48.7 We 15:30 H-ZO 40

Lifetime measurement in ^{168}Yb using the Recoil Distance Doppler Shift (RDDS) Method — •Michael Reese[1], Alfred Dewald[2], Oliver Möller[1], Pavel Petkov[2,3], Norbert Pietralla[1], and Thomas Pissulla[2] — [1]TU Darmstadt, Germany — [2]Universität zu Köln, Germany — [3]INRNE, Bulgarian Academy of Sciences, Sofia

In the analysis of coincidence RDDS experiments one uses the Differential Decay Curve (DDC) Method to determine lifetimes of excited states. Experiments with small recoil velocities, thus small Doppler shifts, enforce the use of narrow coincidence gates to determine peak intensities. This results in a loss of statistics. As an alternative to the application of gates, we present the fit of 2-dimensional functions to the $\gamma\gamma$ coincidence data. This approach has been studied on data taken in a RDDS measurement for the ground state band of ^{168}Yb. The ^{18}O(^{154}Sm,4n)^{168}Yb* fusion evaporation reaction was induced by an 80 MeV ion beam of the tandem accelerator facility in Cologne. The target was mounted in the Cologne coincidence plunger device. Lifetimes from the 4_1^+ to the 10_1^+ states have been extracted. The method will be discussed and the results are compared to the CBS rotor model in the context of centrifugal stretching.

HK 48.8 We 15:45 H-ZO 40

The even-even nucleus ^{196}Hg and its relation to the "magical quartet" around ^{194}Pt — •Christian Bernards, Michael Albers, Christoph Fransen, Stefan Heinze, Jan Jolie, Désirée Radeck, and Tim Thomas — Institute for Nuclear Physics, University of Cologne

The investigation of ^{196}Hg – especially the determination of level spins and multipole mixing ratios of γ transitions between low-energy states – is of great interest for testing the existence of a relation between the nucleus ^{196}Hg and the so-called "magical quartet" around ^{194}Pt. Within the $U_\nu(6/12)\otimes U_\pi(6/4)$ extended supersymmetry, this quartet is supposed to be the supermultiplet being described the best. Similar to the quartet members ^{194,195}Pt and ^{195,196}Au, the nucleus ^{196}Hg can be described theoretically by seven IBA-2 particles to the shell closure, in particular by two $j = 3/2$ proton fermions and five *sd* neutron bosons as a two-fermions – five-bosons supermultiplet member.

In order to obtain experimental data on ^{196}Hg a $\gamma\gamma$ angular correlation experiment was performed at the Tandem accelerator of the Institute for Nuclear Physics in Cologne. Using a ^{4}He beam with an energy of 28 MeV impinging a ^{194}Pt target the reaction ^{194}Pt$(\alpha,2n)^{196}$Hg was induced. To analyze the γ decays of yrast and non-yrast ^{196}Hg states 13 high purity germanium detectors were mounted in the Horus cube γ-ray spectrometer, which allows the determination of level spins

and multipole mixing ratios by the analysis of $\gamma\gamma$ angular correlations. We will discuss first results of the experiment.

HK 49: Nuclear Structure and Dynamics II

Time: Wednesday 14:00–16:00 Location: H-ZO 50

Group Report HK 49.1 We 14:00 H-ZO 50

Hypernuclear Spectroscopy with Heavy Ion Beams: The HypHI project at GSI and towards FAIR — Take Saito, Sebastien Bianchin, Olga Borodina, Shizu Minami, Daisuke Nakajima, Banu Oezel, and •Christophe Rappold for the HypHI-Collaboration — GSI, Darmstadt, Germany

Until recently hypernuclei have been mainly studied via induced reactions of meson- or electron-beams on stable target materials, therefore the isospin of the produced hypernuclei is close to that of the target nucleus. In heavy ion collisions, hyperons are produced in the participant region and can be coalesced in the projectile fragment forming a hypernucleus in the projectile rapidity region. Isospin of the produced hypernucleus is widely distributed due to the nature of fragmentation reactions, therefore, this production method gives an opportunity to study neutron or proton rich hypernuclei. Furthermore, with this method, the produced hypernuclei can be separated and their magnetic moments can be measured for the first time.

The HypHI collaboration aims to perform precise hypernuclear spectroscopy with stable heavy ion beams and rare isotope beams at GSI and FAIR. We are currently preparing for the first experiment (Phase 0) planned in 2009 with ^{6}Li beams at 2 A GeV impinged on a carbon target to demonstrate the feasibility of the precise hypernuclear spectroscopy by identifying light hypernuclei mainly such as ${}^{3}_{\Lambda}$H, ${}^{4}_{\Lambda}$H and ${}^{5}_{\Lambda}$He. In the presentation, an overview of the HypHI project and the detail of the Phase 0 experiment will be discussed.

HK 49.2 We 14:30 H-ZO 50

Formation of hypernuclei in reactions induced by heavy-ion and hadron beams — •Theodoros Gaitanos, Horst Lenske, and Ulrich Mosel — Institut für Theoretische Physik, Universität Giessen, Germany

The formation of fragments with strangeness degrees of freedom (hypernuclei) within the GiBUU dynamical transport model combined with a statistical multifragmentation model (SMM) is investigated in reactions induced by high energy heavy-ion and hadron beams. Such reactions, which will be experimentally studied by the HypHI and PANDA collaborations at the FAIR facility at GSI, are especially well suited for the production of single and double strangeness hypernuclei allowing to study the nucleon-hyperon and hyperon-hyperon interactions. A detailed discussion on the applicability and limitations of the theoretical model are given. In particular, improvements of the present transport approach with respect to a better combination with statistical models of fragmentation and a better overall baryon dynamics at relativistic energies are investigated. Finally, theoretical predictions on spectra and inclusive cross sections of single ${}^{A}_{\Lambda}X$ and double ${}^{A}_{\Lambda\Lambda}X$ hypernuclei (X = H, He) in spectator fragmentation in reactions induced by light heavy-ion beams (^{12}C+^{12}C at 2AGeV) and high energy hadron beams are presented. The results are relevant for planning future experiments on hypernuclear physics at the new GSI- and J-PARC-facilities.

Work supported by BMBF.

HK 49.3 We 14:45 H-ZO 50

Pion induced production of hypernuclei — •Stefan Bender[1], Horst Lenske[1], Ulrich Mosel[1], and Radhey Shyam[2] — [1]Institut für Theoretische Physik, Universität Giessen, Germany — [2]Saha Institute of Nuclear Physics, Kolkata, India

We investigate strangeness production in coherent pion-nucleus reactions, in particular the production of Λ-hypernuclei. The interactions of the incoming and outgoing particles with the target nucleus are described by realistic pion-nucleus and kaon-nucleus potentials, respectively. We describe the transition to the $\bar{K}\Lambda$ channel with a field-theoretical resonance model, which has already been successfully applied to calculate proton induced production of hypernuclei. The Λ bound states as well as the in-medium interactions are calculated in fully relativistic models. Results for cross sections on various nuclear targets are discussed. Optical potentials are discussed and distortion effects are investigated by DWBA and eikonal methods. The characteristic dependence of the shape of the angular distribution on the angular momentum of the orbital which is populated by the Λ provides important information on the spectroscopy of the final hypernucleus.

HK 49.4 We 15:00 H-ZO 50

Dynamics of Nuclei with Antikaons — •Daniel Gazda[1], Jiří Mareš[1], Avraham Gal[2], and Eli Friedman[2] — [1]Nuclear Physics Institute, 25068, Řež, Czech Republic — [2]Racah Institute of Physics, The Hebrew University, Jerusalem 91904, Israel

We explore dynamical effects for $\bar{K}$ nuclear states using the relativistic mean-field approach [1]. Our main objective is to place lower limits on the width resulting from the $\bar{K}$ absorption in the nuclear medium. $\bar{K}$ absorption modes are included within an optical-model phenomenology, where the density ρ plays a dynamical role. A lower limit $\Gamma_{\bar{K}}$=50±10 MeV is placed on the widths of $\bar{K}$ nuclear states for binding in the range $B_{\bar{K}}$∼100-200 MeV [2]. Substantial polarization of the core nucleus is found in light kaonic nuclei, with central nuclear densities about twice higher than for the corresponding nuclei without $\bar{K}$. Calculations of multi-$\bar{K}$ nuclei indicate that the $\bar{K}$ separation energy, as well as the associated nuclear densities, saturate with the number of $\bar{K}$ mesons embedded in the nuclear medium. It is thus argued that multi-$\bar{K}$ nuclei do not compete with multihyperonic nuclei in providing the ground state of strange hadronic configurations and that kaon condensation is unlikely to occur in strong-interaction self-bound strange hadronic matter [3].

[1] J. Mareš, E. Friedman, A. Gal, Nucl. Phys. A 770, 84 (2006).
[2] D. Gazda, E. Friedman, A. Gal, J. Mareš, Phys. Rev. C 76, 055204 (2007); erratum - ibid. C 77 019904 (2008).
[3] D. Gazda, E. Friedman, A. Gal, J. Mareš, Phys. Rev. C 77, 045206 (2008).

HK 49.5 We 15:15 H-ZO 50

Annihilation cross-sections of verylow energy antiprotons on nuclei — Maurizio Corradini[1,2], Masaki Hori[3,4,5], Marco Leali[1,2], Evandro Lodi Rizzini[1,2], Valerio Mascagna[1,2], Aldo Mozzanica[1,2], Michela Prest[6,7], Erik Vallazza[6,7], •Luca Venturelli[1,2], and Nicola Zurlo[1,2] — [1]Dipartimento di Chimica e Fisica per l'Ingegneria e per i Materiali, Università di Brescia, I-25133 Brescia, Italy — [2]Istituto Nazionale di Fisica Nucleare, Gruppo Collegato di Brescia, I-25133 Brescia, Italy — [3]Max-Planck-Institut fur Quantenoptik, Hans-Kopfermann-Strasse 1, D-85748 Garching, Germany — [4]Department of Physics, University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan — [5]CERN, CH-1211 Geneva 23, Switzerland — [6]Dipartimento di Scienze Fisiche e Matematiche, Università di Como, I-22100 Como,Italy — [7]Istituto Nazionale di Fisica Nucleare, Sezione di Trieste, I-34127 Trieste, Italy

The nuclear physics program of the ASACUSA Experiment at CERN concerns measuraments of antiproton-nuclei cross sections at low energies from MeV down to keV region. The importance of the results lies in the possibility to contribute in the understanding of the dynamic of annihilation process and to shed ligth on the saturation effect seen by the OBELIX Collaboration at 1-2 MeV where the annihilation rates od antiprotons on light nuclei (H, D, He) appear to be independent from the sizes of the targets.

The measurements performed by ASACUSA in 2008 with 5 MeV antiprotons on solid targets are reported and the trend with the mass number discussed.

HK 49.6 We 15:30 H-ZO 50

Lambda-Sigma Mixing in Nuclear Matter — •Christoph Valentin, Andreas Fedoseew, Patrick Konrad, and Horst Lenske — Institut für Theoretische Physik, Universität Giessen, Germany

We study the mixing of Lambda and Sigma baryons in asymmetric nuclear matter. Starting with a relativistic energy-density functional Lambda-Sigma-Mixing occurs as a many-body effect in isospin asymmetric systems generated by a non-diagonal self-energy in the medium. We describe our system in a density dependent relativis-

tic hadron (DDRH) field theory with microscopically derived meson exchange interactions. For the hyperons we use coupling constants derived from NN-interactions by a scaling law. Our aim is to get a better understanding of the behavior of hyperons in asymmetric nuclear matter, neutron stars and finite nuclei. As an interesting result we find that the mixing is strongly enhanced with increasing asymmetry.

HK 49.7 We 15:45 H-ZO 50

Correlations in exotic nuclear matter — •Patrick Konrad and Horst Lenske — Institut für Theoretische Physik, Universität Giessen, Germany

We investigate short range correlations in asymmetric nuclear and hypernuclear matter. Self-energies due to short range correlations and their influence on the nucleon and Λ-hyperon spectral functions are described in an approach accounting for a realistic treatment of mean-field dynamics by a phenomenological Skyrme energy density functional. Landau-Migdal theory is used to derived the short range interaction from the Skyrme energy density functional, especially investigating short-range dynamics by subtracting the long range pionic contributions to the nucleonic spectral functions. The sensitivity of correlations on the parameters of underlying Skyrme energy density functional is discussed. Results on self-energies and spectral functions in asymmetric nuclear matter, hypermatter and β-stable (Λ, n, p, e)-neutron star matter are presented.
Work supported by GSI and BMBF.

HK 50: Nuclear Astrophysics

Time: Wednesday 14:00–16:00 Location: H-ZO 60

Group Report HK 50.1 We 14:00 H-ZO 60

The ^{12}C+^{12}C fusion reactions at astrophysical energies — •Frank Strieder[1], Hans-Werner Becker[1], Nicola DeCesare[2], Antonino Di Leva[1,2], Antonio D'Onofrio[2], Lucio Gialanella[2], Benedetta Limata[2], Claus Rolfs[1], Jeff Schweitzer[3], Tim Spillane[3], Oscar Straniero[4], Filippo Terrasi[2], and Jim Zickefoose[3] — [1]Ruhr-Universität Bochum, Germany — [2]INFN Napoli, Italy — [3]University of Connecticut, USA — [4]Osservatorio Astronomico di Teramo, Italy

The fusion reactions $^{12}C(^{12}C,\alpha)^{20}Ne$ and $^{12}C(^{12}C,p)^{23}Na$ are referred to as carbon burning in stars. In massive stars the ashes produced during helium burning become the fuel for further nuclear-burning processes, leading to the synthesis of most elements with mass numbers larger than 20. Consequently, these fusion reactions represent key processes since they influence not only the nucleosynthesis but also the subsequent evolution of a star. However, at the astrophysical relevant energies the reaction rate of these fusion reactions is not very well known and provided only by extrapolations of high energy data. The reactions have now been studied from $E = 1.5$ to 4.75 MeV by γ-ray and particle spectroscopy using thick carbon targets. The data reveal new resonances, in particular strong resonances at $E < 2.3$ MeV, which lie in the range of the Gamow peak for carbon burning in massive stars, which takes place at temperatures $T \approx (5-10) \times 10^8$ K. These resonances increase the present reaction rate significantly in this temperature range. The impact of the results on various astrophysical sites, e.g. supernovae progenitor stars, will be discussed.

HK 50.2 We 14:30 H-ZO 60

Elastic Scattering of ^{7}Be and ^{8}B on Pb and Liquid H_2 and He Targets — •Shawn Bishop for the RIKEN-Collaboration — Institute of Physical and Chemical Research, 2-1 Hirosawa, Wako, Saitama 351-0198, Japan

Elastic angular distributions from scattering of ^{7}Be and ^{8}B beams on Pb, liquid hydrogen and liquid helium targets have been acquired at 60.8 A MeV and 72.8 A MeV, respectively. These distributions have been analyzed within the framework of Woods-Saxon optical potential models yielding complete optical model parameter sets; additionally, the proton scattering distributions have also been analyzed using microscopic folding models employing various ground state density distributions for ^{7}Be and ^{8}B. Using a two-body model for ^{8}B consisting of a ^{7}Be core plus valence proton, our Woods-Saxon ^{7}Be + H and ^{7}Be + Pb optical potentials have been employed in folding calculations for the problem of ^{8}B elastic scattering on H and Pb. We find good agreement between these folding models and our ^{8}B elastic data and marked improvement over that obtained using global nucleon-nucleus optical parameter sets from the literature. A dissociation calculation using this two-body model for ^{8}B and employing our ^{7}Be + Pb potential is shown to reproduce the elastic reaction channel, demonstrating that these potentials can be directly employed for ^{8}B dissociation studies. These results will be shown, and a summary of their application for the analysis of a recent ^{8}B Coulomb Dissociation experiment will be outlined.

HK 50.3 We 14:45 H-ZO 60

Strength, decay branching ratios, and angular distribution of the 0.987 MeV resonance in the ^{14}N(p,γ)^{15}O reaction — •Michele Marta[1], Daniel Bemmerer[1], Roland Beyer[1], Carlo Broggini[2], Antonio Caciolli[2], Martin Erhard[1], Zsolt Fülöp[3], Eckart Grosse[1], György Gyürky[3], Roland Hannaske[1], Arnd Rudolf Junghans[1], Roberto Menegazzo[2], Chithra Nair[1], Roland Schwengner[1], Tamas Szücs[3], Erik Trompler[1], Andreas Wagner[1], and Dmitry Yakorev[1] — [1]Forschungszentrum Dresden-Rossendorf (FZD), Dresden, Germany — [2]INFN Sezione di Padova, Padova, Italy — [3]ATOMKI, Debrecen, Hungary

The ^{14}N(p,γ)^{15}O reaction controls the rate of the hydrogen burning CNO cycle. This reaction has recently been re-studied at $E < 500$ keV at different facilities, including LUNA. However, also data at higher energy play a role in determining the extrapolated cross section in the R-matrix framework. Here we report on a new measurement of the absolute strength, decay branching ratio, and angular distribution of the $E = 0.987$ MeV ($E_x = 8.284$ MeV) resonance carried out at the high-current FZD Tandetron. — This work has been supported in part by the European Union (FP6 AIM RITA 025646).

HK 50.4 We 15:00 H-ZO 60

Temperature dependence of β^- and β^+/ε decay branching ratio of embedded ^{74}As — •Janos Farkas[1], Gyorgy Gyurky[1], Caner Yalcin[1,2], Zoltan Elekes[1], Gabor G. Kiss[1], Zsolt Fulop[1], Endre Somorjai[1], Kalman Vad[1], Jozsef Hakl[1], and Sandor Meszaros[1] — [1]Institute of Nuclear Research (ATOMKI), H-4001 Debrecen, POB. 51, Hungary — [2]Kocaeli University, Dept. of Physics, TR-41380 Umuttepe, Kocaeli, Turkey

The branching ratio between the β^- and β^+/ε decays of ^{74}As has been measured recently in different environments at room temperature [1]. We extended the measurement to the temperature range of 250 mK – 300 K using Ge and Ta host materials. The performed experiment represents the first decay branching ratio measurement down to the millikelvin range. No significant dependence on the temperature or on the host materials has been found.
[1] Gy. Gyürky *et al.*, Europhys. Lett. **83**, 42001 (2008)

HK 50.5 We 15:15 H-ZO 60

Efficiency calibration of the ELBE nuclear resonance fluorescence setup using a proton beam — •Erik Trompler[1], Daniel Bemmerer[1], Roland Beyer[1], Carlo Broggini[2], Antonio Caciolli[2], Martin Erhard[1], Zsolt Fülöp[3], Eckart Grosse[1], György Gyürky[3], Roland Hannaske[1], Arnd Rudolf Junghans[1], Michele Marta[1], Roberto Menegazzo[2], Chithra Nair[1], Roland Schwengner[1], Tamas Szücs[3], Andreas Wagner[1], and Dmitry Yakorev[1] — [1]Forschungszentrum Dresden-Rossendorf (FZD), Dresden, Germany — [2]INFN Sezione di Padova, Padova, Italy — [3]ATOMKI, Debrecen, Hungary

The nuclear resonance fluorescence (NRF) setup at ELBE uses bremsstrahlung with endpoint energies up to 20 MeV. The setup consists of four 100% high-purity germanium detectors, each surrounded by a BGO escape-suppression shield and a lead collimator. The detection efficiency up to $E_\gamma = 12$ MeV has been determined using the proton beam from the FZD Tandetron and well-known resonances in the ^{11}B(p,γ)^{12}C, ^{14}N(p,γ)^{15}O, and ^{27}Al(p,γ)^{28}Si reactions. The deduced efficiency curve allows to check efficiency curves calculated with GEANT. Future photon-scattering work can be carried out with improved precision at high energy. — This work has been supported in

part by the European Union (FP6 AIM RITA 025646).

HK 50.6 We 15:30 H-ZO 60

Measurement of the total cross section of ^{3}He$(\alpha,\gamma)^7$Be with the recoil separator ERNA — •Antonino Di Leva for the ERNA-Collaboration — Institut für Experimentalphysik III Ruhr-Universität Bochum, Bochum, Germany — INFN Sezione di Napoli, Naples, Italy

The rate of ^{3}He$(\alpha,\gamma)^7$Be plays a key role in the production of ^{7}Li during the Big Bang Nucleosynthesis as well as in stellar hydrogen burning, where it has a strong influence on the high energy component of the solar neutrino spectrum.
In the last decades several experiments exploited either the detection of the prompt γ-rays or the off-line determination of the number of ^{7}Be atoms collected in the target, in few cases both. The results of such experiments show some inconsistency, which hampers a determination of the ^{3}He$(\alpha,\gamma)^7$Be cross section with the necessary precision and accuracy.
A new approach uses the recoil mass separator ERNA (European Recoil separator for Nuclear Astrophysics) for direct detection of the produced ^{7}Be recoils. The total cross section has been measured in the energy region $E_{\rm cm}$= 0.7 to 3.2 MeV. This approach is completely independent from previous techniques leading to substantially different systematic dependencies and, thus, independent information. In addition, off-beam activation and coincidence γ-ray measurements were performed at selected energies.
The experiment and its results, as well as the astrophysical consequences, are discussed.

HK 50.7 We 15:45 H-ZO 60

Direct Measurements of low energy resonances in ^{25}Mg(p,γ)^{26}Al — •Benedetta Limata for the LUNA-Collaboration — INFN Napoli, Italy

The direct observation of the 1.809 MeV γ-ray line following the β^+ and EC of ^{26}Al from COMPTEL and INTEGRAL instruments provides an evidence that ^{26}Al production is still active on a large scale. Stellar nucleosynthesis studies have not yet identified which one of the possible ^{26}Al sources could explain the observed evidences. Hence, solving the controversy for different astrophysical production sites of ^{26}Al demands a better understanding of the rates for the nuclear reaction ^{25}Mg(p,γ) ^{26}Al, which in turn is the slowest reaction of the Mg-Al cycle. The ^{25}Mg(p,γ) ^{26}Al reaction has been investigated down to the astrophysical relevant low energy resonances at E_R = 93, 130, and 189 keV at the 400 kV accelerator of the LUNA facility at the Laboratori Nazionali del Gran Sasso, Italy taking advantage of the strong suppression of cosmic-ray background in the underground lab. As a γ-ray detection system a six fold segmented 4π BGO detector was used. In addition to the high efficiency the segmented detector allows for detecting a full sum spectrum as well as single spectra from each of the six crystals which provides additional information on the decay scheme. The low energy resonance at E_R = 93 keV of the reaction ^{25}Mg(p,γ) ^{26}Al could be detected for the first time in a direct experiment. The results of the project will be presented and astrophysical consequences will be discussed as well as the potential of this experimental approach for future measurements in an underground lab.

HK 51: Fundamental Symmetries

Time: Wednesday 14:00–16:00 Location: H-ZO 70

Invited Group Report HK 51.1 We 14:00 H-ZO 70

Antihydrogen — •Jochen Walz for the ATRAP-Collaboration — Institut für Physik, Johannes Gutenberg-Universität Mainz, D-55099 Mainz

Future precision experiments with trapped cold antihydrogen promise to provide extremely stringent tests of the fundamental CPT symmetry in the hadron as well as in the lepton sector. Ultrahigh-resolution Doppler-free two-photon laser-spectroscopy of ordinary hydrogen and antihydrogen might be used to compare matter and antimatter at unprecedented levels of experimental accuracy. In addition, there is the fascinating prospect to directly observe the gravitational force on antimatter, because antihydrogen is a pure antimatter system which is both stable and electrically neutral.

Current antihydrogen experiments use the Antiproton Decelerator (AD) at CERN and this talk will review the status of the ATRAP experiment. An exciting new horizon is FLAIR, the Facility for Low-energy Antiproton and Ion Research. This is a next-generation low-energy antiproton source that will make use of the high flux of antiprotons at the upcoming international FAIR research center near GSI/Darmstadt.

HK 51.2 We 14:30 H-ZO 70

Anti-hydrogen Experiments at ATRAP — •Dieter Grzonka, Matthew George, Walter Oelert, Thomas Sefzick, and Marcin Zielinski for the ATRAP-Collaboration — Forschungszentrum Jülich, IKP, 52425 Jülich, Germany

The ATRAP experiment at the anti-proton decelerator of CERN aims for a precise test of CPT invariance by comparative spectroscopic studies of hydrogen and anti-hydrogen atoms. The trapping of neutral anti-hydrogen atoms is the prerequisite to achieve the required precision in these studies.

Anti-hydrogen is produced in a nested Penning-trap for positrons and anti-protons which is located within a magnetic gradient field for the trapping of anti-hydrogen. Since the trap depth is less than 1K, cold anti-hydrogen has to be produced in its ground state for a high trapping efficiency. With an improved apparatus - including a 1 K pot and an additional solenoid - anti-hydrogen production techniques are studied presently, which should result in low temperature anti-hydrogen.

The status of the experiment and further steps towards the precision spectroscopy will be outlined.

Supported in part by DFG and FZ-Jülich

HK 51.3 We 14:45 H-ZO 70

Test der Lorentzinvarinz mit Hilfe eines ^{3}He / ^{129}Xe Komagnetometers — •Kathlynne Tullney[1], Claudia Gemmel[1], Stefan Baessler[3], Martin Burghoff[2], Werner Heil[1], Wolfgang Kilian[2], Allard Schnabel[2], Frank Seifert[2], Yuri Sobolev[1], Lutz Thrams[2] und Christian Ludwig[1] — [1]Universität Mainz — [2]PTB-Berlin — [3]University of Virginia

Die Standard Modell Erweiterung (SME) beinhaltet Lorentz- und CPT verletzende Terme, die in Präzissionsexperimenten bei niedrigen Energien im Prinzip nachgewiesen werden können, z. B. durch Messung der periodischen Variation der Larmorfrequenz eines polarisierten Gases während eines siderischen Tages.
Wir verwenden zwei spinpolarisierte Gase (^{3}He / ^{129}Xe), die sich zur Eliminierung des Zeeman-Terms im gleichen Volumen befinden, so dass man nicht mehr auf Magnetfeldschwankungen empfindlich ist. Gemessen wird deren freie Spinpräzessionsfrequenz um ein homogenes Magnetfeld von ca. 400 nT, wozu LTc SQUID Detektoren verwendet werden mit einer Sensitivität von ca. 2 $\frac{fT}{\sqrt{Hz}}$. Die Apparatur befindet sich in einem magnetisch abgeschirmten Raum der PTB in Berlin. Um nach solch kleinen Effekten zu suchen bzw. eine neue Obergrenze angeben zu können, werden lange transversale Relaxationszeiten T_2 >10h und ein gutes Signal-zu-Rausch Verhältnis (SNR > $\frac{1000}{1}$) benötigt.
In diesem Vortrag werden die neuesten Ergebnisse präsentiert, Verbesserungen vorgestellt und die Empfindlichkeit unserer Messmethode mit anderen Messmethoden verglichen, etwa dem ^{3}He/^{129}Xe Maserexperiment der Gruppe von Ronald Walsworth.

HK 51.4 We 15:00 H-ZO 70

Electromagnetic corrections in $\eta \to 3\pi$ decays — •Christoph Ditsche[1], Bastian Kubis[1], and Ulf-G. Meissner[1,2] — [1]Helmholtz-Institut für Strahlen- und Kernphysik (Theorie) and Bethe Center for Theoretical Physics, Universität Bonn, D-53115 Bonn, Germany — [2]Institut für Kernphysik (Theorie) and Jülich Center for Hadron Physics, Forschungszentrum Jülich, D-52425 Jülich, Germany

We re-evaluate the electromagnetic corrections to $\eta \to 3\pi$ decays at next-to-leading order in the chiral expansion, arguing that effects of order $e^2(m_u - m_d)$ disregarded so far are not negligible compared to other contributions of order e^2 times a light quark mass. Despite the appearance of the Coulomb pole in $\eta \to \pi^+\pi^-\pi^0$ and cusps in $\eta \to 3\pi^0$, the overall corrections remain small.

HK 51.5 We 15:15 H-ZO 70

Results on the analysis of the $\eta \to 3\pi^\circ$ decay with WASA-at-COSY. — •Peter Vlasov for the WASA-at-COSY-Collaboration — Institut für Kernphysik and Jülich Center for Hadron Physics, Forschungszentrum Jülich, D-52425 Jülich, Germany

During the first production run of the WASA experiment at the COSY storage ring the $\eta \to 3\pi^\circ$ decay has been measured in proton-proton interactions at an excess energy of Q = 56 MeV. The goal of the experiment is the measurement of the $3\pi^\circ$ Dalitz plot density distribution which allows a precise test of chiral perturbation theory calculations.

The decay system was tagged by the WASA forward detector using the recoil protons. The η decay was reconstructed in the central detector by the subsequent $\pi^\circ \to \gamma\gamma$ decays. A kinematic fit with constraints was applied in order to optimally use the measured information. The constraints used in the fit are the masses of the subsequently decayed pions, as well as the mass of final state particles of in the eta-meson decay system.

We report on the final results of the analysis.

Supported by BMBF and Wallenberg Foundation.

HK 51.6 We 15:30 H-ZO 70

A Precision Measurement of the Hyperfine Structure of Antiprotonic Helium — •Thomas Pask[1], Daniel Barna[2], Andreas Dax[2], Sussane Friedreich[1], Ryugo Hayano[2], Masaki Hori[3], Dezso Horvath[4,5], Bertalan Juhasz[1], Johann Marton[1], Oswald Massiczek[1], Naoya Ono[2], Anna Soter[3,4], Eberhard Widmann[1], and Johann Zmeskal[1] — [1]Stefan-Meyer-Institut für subatomare Physik Boltzmanngasse 3, 1090 Vienna, Austria — [2]Department of Physics, University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan — [3]Max-Planck-Institut für Quantenoptik, Hans-Kopfermann-Strasse 1, D-85748 Garching, Germany — [4]Institute of Nuclear Research of the Hungarian Academy of Sciences, H-4001 Debrecen,PO Box 51, Hungary. — [5]Institute of Nuclear Research of the Hungarian Academy of Sciences, H-4001 Debrecen,PO Box 51, Hungary.

A precise measurement of the Antiprotonic helium *hyperfine structure* has been completed.

Due to its long life time this unique particle provides an ideal subject to test three-body Quantum Electrodynamic (QED) calculations and CPT theory. The new results yield a factor of 10 improvement over our previous measurements and, through comparison with theory, can be used to determine a new value for the spin magnetic moment of the antiproton.

HK 51.7 We 15:45 H-ZO 70

Studies of the rare eta-meson decay $\eta \to \pi^0 + e^+ + e^-$ at WASA-at-COSY — •Alexander Winnemöller, Alfons Khoukaz, Florian Bergmann, Annika Passfeld, and Tobias Rausmann — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, Wilhelm-Klemm-Str. 9, D-48149 Münster, Germany

One main focus of the experimental program of the WASA-at-COSY facility is the investigation of symmetries and symmetry breakings to get a better understanding of the strong interaction physics. Since violations of conservation laws are directly connected to symmetry breaking effects, studies of rare meson decays are of high importance. In this connection the η-meson is of paticular interest. Precision measurements of rare η decays can be used to get new limits on the breaking of the fundamental C, P, and T symmetries, or combinations thereof.

In this contribution we will present and discuss studies of the C-violating η decay $\eta \to \pi^0 + e^+ + e^-$ using the WASA-at-COSY facility. The dominant C conserving contribution to the decay is via $\pi^0 + \gamma^* + \gamma^*$ intermediate state with an expected branching ratio of approximately 10^{-8}. An observation of a significantly higher branching ratio would, therefore, be an indication of a C violation. The status of the analysis will be presented and discussed.

Supported by FZ Jülich, BMBF, and Wallenberg Foundation.

HK 52: Accelerators and Instrumentation I

Time: Wednesday 14:00–16:00 Location: H-ZO 80

Group Report HK 52.1 We 14:00 H-ZO 80

Development of a high-rate TPC based on GEM amplification — •Bernhard Ketzer for the GEM-TPC-Collaboration — Technische Universität München, Physik Department, James-Franck-Straße, D-85748 Garching, Germany

Future experiments at high-luminosity machines such as PANDA, an antiproton-proton annihilation experiment at FAIR, require high-resolution tracking detectors with good momentum resolution, which at the same time have a very small material budget in order to minimize secondary interactions. A TPC ideally fulfills these requirements, and in addition contributes to particle identification via the measurement of the specific energy loss. The high interaction rate at these machines, however, requires to run the TPC in a continuous mode, i.e. without a gating grid. Therefore GEM foils are used to limit the backflow of ions from the multiplication into drift region. A small triple GEM-TPC has been built and tested using cosmic muons as well as electrons from ELSA, Bonn. First results from these tests will be shown, which provide a valuable cross-check for Monte Carlo simulations of the performance of a TPC in PANDA. These simulations indeed indicate that the challenges of field distortions and event mixing can be overcome. Currently, a larger prototype TPC with a driftlength of 60 cm and a diameter of 30 cm is being built. This chamber is expected to be tested both in the FOPI experiment at GSI and at ELSA in the near future. The design and the present status of this prototype will be discussed.

This work is supported by the BMBF, the DFG cluster of excellence *Universe*, the MLL München, and the EU 6th Framework Program.

HK 52.2 We 14:30 H-ZO 80

New developments for the GEM-based TPC for PANDA — •Maxence Vandenbroucke for the GEM-TPC-Collaboration — Technische Universität München E18, Garching, Germany

The PANDA experiment is an internal target experiment at the High Energy Storage Ring (HESR) at the new Facility for Antiproton and Ion Research (FAIR) at Darmstadt. A TPC is proposed as the central tracker due to its good position and momentum resolution, its low material budget, and its particle identification capabilities via ionization measurements. The continuous nature of the antiproton beam makes the use of a traditional ion gate impractical and hence GEM foils are used for gas amplification, due to their intrinsic ion back flow suppression properties. A small prototype of this GEM-TPC (diameter 200mm, drift length 77mm) has been built and characterized with cosmic muons using a rectangular pad readout structure. The chamber has recently been upgraded with a new readout plane with hexagonal pads, and new front end electronics, based on the AFTER ASIC. The performance of the detector is expected to improve significantly and is currently being studied at a beam test at the ELSA accelerator at Bonn. Preliminary results will be presented in this talk.

HK 52.3 We 14:45 H-ZO 80

The status of the FOPI GEM-TPC * a precursor prototype for the PANDA-TPC — •Bernd Voss for the GEM-TPC-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

In 2007 the construction and building of a medium volume (Ø300mm x 650mm) Time Projection Chamber (TPC) based on Gaseous Electron Multipliers (GEM) as amplification stages has been started. The detector is foreseen to be integrated in several experiments e.g. at ELSA/Bonn as well as at FOPI/GSI. It serves as a precursor prototype for an even larger TPC (Ø840mm x 1500mm) to be incorporated in PANDA/FAIR as a central tracking device which will be built in the frame-work of a joint venture project of twelve institutions in Europe. The general design of the detector as well the current status of assembly and testing will be presented.

HK 52.4 We 15:00 H-ZO 80

Tracking upgrade of the Crystal Barrel experiment at ELSA — •Alexander Winnebeck for the GEM-TPC-Collaboration — Helmholtz-Institut für Strahlen- und Kernphysik, Nussallee 14-16, D-53115 Bonn

Double polarization photo-production experiments are performed with the Crystal Barrel experiment at ELSA in Bonn. The experimental set-up is dominated by an electromagnetic calorimeter, which is well

suited for the investigation of multi-photon final states.

Detecting charged particles extends the capability of the set-up, and opens the field of charged and semi-charged reactions. An ideal detector for this task is a TPC, because it detects charged particles, determines their sign of charge and the transverse momentum, when a magnetic field is present. Combining this with the measured dE/dx allows particle identification for momenta up to ≈ 1 GeV/c.

Therefore a TPC is developed for the Crystal Barrel experiment. At first, a prototype chamber was tested in order to study resolution and further properties using an electron beam at ELSA. For these measurements a tracking test bench was set up with silicon strip detectors and planar GEM trackers.

First results of a test beam time will be presented.

HK 52.5 We 15:15 H-ZO 80

The PixelGEM Tracking System for the COMPASS Experiment — Heinz Angerer, Alexander Austregesilo, Florian Haas, Bernhard Ketzer, Igor Konorov, Markus Krämer, Alexander Mann, Thiemo Nagel, Stephan Paul, Florian Schneider, and •Sebastian Uhl — Technische Universität München, Physik Department E18, 85748 Garching

For the COMPASS experiment at CERN a gas electron multiplier (GEM) detector with a novel readout type has been developed. With its combined pixel and strip structure it should provide precise spatial information for the tracking of charged particles and still stand the high intensities of muon and hadron beams with a particle rate of more than $2 \cdot 10^5 / \left(\mathrm{mm}^2\,\mathrm{s}\right)$. The low material budget of these detectors was an essential part in reducing the amount of multiple scattering and secondary interactions in the hadron beam used in the year 2008. Five detectors have been successfully set up in the COMPASS spectrometer. We will present results in hadron beams of low $(3.5 \cdot 10^3\ \pi^- / \left(\mathrm{mm}^2\,\mathrm{s}\right))$ and high $(2 \cdot 10^4\ \pi^- / \left(\mathrm{mm}^2\,\mathrm{s}\right))$ intensities.

This work is supported by the Maier-Leibnitz-Labor der LMU und TU München and the DFG Cluster of Excellence "Origin and Structure of the Universe"(Exc153).

HK 52.6 We 15:30 H-ZO 80

Calibration of the Straw-Tube-Tracker for COSY-TOF — •Pierre Voigtländer, James Ritman, Matthias Röder, and Peter Wintz for the COSY-TOF-Collaboration — Institut für Kernphysik I, Forschungzentrum Jülich GmbH, 52425 Jülich, Germany

The Straw-Tube-Tracker (STT) is a new detector for the time of flight spectrometer COSY-TOF with 3120 single straw tubes arranged in 15 double-layers. The straw tubes are filled with a gas mixture of Ar/CO_2 (90%/10%) at an absolute pressure of 1.2 bar. During a commissioning beam time in August 2008 we used a 3.1 GeV/c proton beam on a proton target to study the $pp \to pp$ and $pp \to d\pi^+$ reactions for calibration of the STT detector. In a first step the isochrone-time-relation was determined by the drift time spectra of the single straws. Using this information the trajectories of reaction particles were reconstructed and the position of the individual straw tubes was determined by iterative fitting. The calibration results were compared with simulations of single straws, using the Garfield package. The obtained spatial resolution and efficiency of the STT will be presented.

Supported in part by BMBF and FZ-Jülich.

HK 52.7 We 15:45 H-ZO 80

Commissioning of the Vacuum Straw Tracker for the COSY-TOF Spectrometer — •Matthias Röder, James Ritman, Pierre Voigtländer, and Peter Wintz for the COSY-TOF-Collaboration — Institut für Kernphysik I, Forschungszentrum Jülich GmbH, 52425 Jülich, Germany

The Straw-Tracker at COSY-TOF is a system of 3120 Straws arranged in 30 layers. These are operated at 1.2 bar driftgas pressure in the TOF vacuum so that they are self-supporting, despite their mylar wrapping being only 30 μm thick. As a result the total radiation length amounts to only 1 %. The operation with 1500 V anode voltage in medium vacuum at $\approx 5 \cdot 10^{-3}$ mbar imposes stringent demands on detector design and handling.

In this talk the system is introduced and it is reported on the commissioning during the year 2008. The emphasis is placed on vacuum operation and results on the efficiency and resolution under experiment conditions.

Supported by BMBF and FZ-Jülich.

HK 53: Accelerators and Instrumentation II

Time: Wednesday 14:00–16:00 Location: H-ZO 90

HK 53.1 We 14:00 H-ZO 90

Trigger Schemes of the ALICE TRD Global Tracking Unit — •Felix Rettig — Kirchhoff Institute for Physics, University of Heidelberg

The Transition Radiation Detector of the ALICE experiment is designed to provide a fast Level-1 trigger for different classes of signatures as well as full event information for offline reconstruction.
A total of 1.2 million analog channels is processed massively parallel in a two-stage approach to derive a trigger decision within 6 μs after the interaction. Pattern matching algorithms are employed in 65 000 FEE Multi-Chip Modules to parametrize up to 20 000 stiff track segments. The detector data is then transferred to the second stage, the Global Tracking Unit (GTU), via 1 080 optical fibres at an aggregate bandwidth of 2.7 TBit/s.
The GTU itself consists of 109 dedicated FPGA-based processing nodes forming a three-level hierachy. 90 Track Matching Units perform online 3D track reconstruction and momentum calculation within 1.2μs. Full track and momentum information of azimutal detector segments is then forwarded to one of the 18 Supermodule Units for trigger pre-computation. The top-level Trigger Generation Unit finally computes the overall TRD trigger decision.
This talk focuses on the current status of the GTU and the GTU-based cosmic trigger used for ALICE data taking and supermodule production during 2008. Developments for future trigger schemes in p-p operation, especially for specific decays (J/ψ, Y) involving online invariant-mass calculations as well as for jets, will be presented.

HK 53.2 We 14:15 H-ZO 90

Dynamic system management for the Alice HLT using the SysMES framework — •Timo Breitner and Camilo Lara for the ALICE-HLT-Collaboration — Kirchhoff Institut für Physik, Universität Heidelberg

The task of the ALICE High Level Trigger (HLT) is to reduce incoming detector data from 25 GB/s to at most 1.25 GB/s. This can be achieved by selecting, compressing and filtering the event data in a parallel pipelined chain of analysis processes. The data flow framework used for this purpose supports dynamic runtime reconfiguration of the analysis hierarchy.

System Management in the HLT is performed by the SysMES framework which manages both the computing infrastructure as well as the HLT analysis application. It is able to automatically reconfigure the chain of analysis processes with the following three techniques:

- Monitoring of the infrastructure and application components together with the most critical resources.
- Correlating the monitored values to detect local or global errors
- Execution of actions to return the application into a stable and correct state, in particular to avoid the loss of data. This includes moving, adding and removing processes as needed.

The first version of the HLT application management includes monitors for 18 critical resources and the possibility to react to failures by dynamically reconfiguring the HLT application. Future steps include the development of new more sophisticated rules based on experiences to be gained during the experiment's commissioning phases.

HK 53.3 We 14:30 H-ZO 90

An FPGA based preprocessor for the ALICE HLT — •Torsten Alt and Volker Lindenstruth for the ALICE-HLT-Collaboration — Kirchhoff Institute of Physics, University of Heidelberg, Germany

With more than 550.000 channels the Time Projection Chamber is the main tracking detector in ALICE. Particles traversing the TPC will create a track of primary ionized electrons which drift towards the read-out pads in the endcaps where they create a charge cloud which is then digitized. To achiev a better spatial resolution than the pad

size this charge cluster is spread over several pads. In order to reconstruct the particle trajectories the center of gravity of the clusters needs to be calculated before this information is passed to the tracking algorithms. In the ALICE High-Level-Trigger (HLT) this clusterfinding is done by an FPGA preprocessor. Raw data is received directly from the detector via optical links, unpacked and feed into the Fast-Cluster-Finder (FCF) processing unit which calculates the centers of gravity. The results are then transfered into the main memory of the HLT. The FCF algorithm has been optimized to take advantage of the FPGA resources allowing parallel processing of the data and pipelining resulting in a design speed of more than 150 MHz. First results with simulated data show that the 216 FCF processors in the HLT are able to process an event with about 7200 charged particles in less than 1 millisecond.

HK 53.4 We 14:45 H-ZO 90

Analog FEE for High Counting Rate Transition Radiation Detector — •Vasile Catanescu, Daniel Bartos, and Gheorghe Caragheorgheopol — National Institute for Physics and Nuclear Engineering, Bucharest, Romania

The first version of a front-end electronics (FEE) based on Application Specific Integrated Circuit (ASIC) for high counting rate transition radiation detectors developed at NIHAM-NIPNE for CBM experiment at FAIR will be presented. The new front-end electronics consists of eight analog channels for TRD signals processing. The ASIC is designed in CMOS 0.35 microns AMS technology. Each channel has two analog outputs, one fast output with a semi-Gaussian signal useful for fast sampling ADCs and a second output with a peak sens information. The mother board contains some level translators and buffers for interface with standard acquisition system. This front-end electronics could easily fit with other high counting rate experiments.

HK 53.5 We 15:00 H-ZO 90

FairRoot — Florian Uhlig and •Mohammad Al-Turany — GSI Darmstadt

FairRoot is a simulation, reconstruction and analysis framework developed at the GSI in Darmstadt for the upcoming FAIR experiments. Currently it is used by the CBM and Panda collaborations.

To achieve the flexibility to use different transport models (currently support for Geant3, Geant4 and Fluka) and different event generators (e.g. UrQMD, Pluto) FairRoot is based on Root and Virtual Monte Carlo. %to use already existing %and well tested software. The complete simulation/analysis process is steered using Root macros, which for example define the detector layout or the transport model. FairRoot uses the Root executable and loads during runtime all needed libraries for the simulation/analysis on the fly. FairRoot deliver also a generic event display based on ROOT and a generic track propagator based on the Geane code.

To provide Makefiles for many Linux flavors, Mac OS X and Solaris CMake is used to generate native Makefiles for the different platforms. To get a fast and comprehensive overview, the project is build on all of the supported platforms automatically on different clients. The produced results are send to a server for display.

HK 53.6 We 15:15 H-ZO 90

Intelligent Platform Management Controller (IPMC) for ATCA Compute Nodes * — •Johannes Lang[1], Ming Liu[1], Zhen'An Liu[2], Qiang Wang[2], Hao Xu[2], and Wolfgang Kühn[1] for the PANDA-Collaboration — [1]II. Physikalisches Institut, JLU Giessen — [2]Institute for High Energy Physics, Beijing

The PANDA experiment with its high data rate presents a significant challenge for the trigger and data acquisition system. Therefore a main building block of the data processing concept, the Compute Node, has been designed and is currently being tested. It will also be used for the upgrade of the HADES trigger system and comprises 5 FPGAs and high bandwidth connections (RocketIO, Gigabit Ethernet) taking advantage of a new shelf standard originating from the telecommunication sector (the Advanced Telecommunication Computing Architecture (ATCA)). This standard requires each supported module to feature a dedicated control unit, the IPMC.

An implementation of such a controller, a micro-controller utilizing add-on card will be presented. It can be plugged into the Compute Node and communicates with a shelf manager via the I2C bus. Applications include negotiation of power levels, reading of sensor data for temperature, voltages and current. In addition, status and configuration of the FPGAs on the Compute Node can be checked and changed. First experience with a prototype board will be reported.

* Work supported in part by: BMBF 06 Gi 180 & 179, GSI

HK 53.7 We 15:30 H-ZO 90

Dynamical Partial Reconfiguration for Data Acquisition — •Norbert Abel, Jano Gebelein, and Udo Kebschull for the CBM-Collaboration — KIP Heidelberg

Xilinx FPGAs like Virtex2, Virtex4 or Virtex5 provide the possibility to be reconfigured partially and dynamically. This means, that parts of the hardware can be exchanged while the rest of the circuit is running untouched. Nowadays, typical applications of dynamical partial reconfiguration (DPR) are streaming, low power, reconfigurable coprocessors and fault tolerance. Furthermore, DPR can help to increase design flexibility and scalability while the design itself becomes smaller at the same time. Regarding to the DAQ (data acquisition) in high energy physic experiments, all these topics are of interest. Unfortunately, today it is still very complex to use DPR, since the developer has to understand the reconfiguration techniques in detail to be able to use DPR. That causes a small usage of DPR in DAQ systems, yet. In the following we want to present a DPR framework that makes it possible to use the complete DPR techniques without going in detail with the underlying technology. Thus, our framework enables regular DAQ developers to use all the advantages coming with partial reconfiguration.

HK 53.8 We 15:45 H-ZO 90

Fault-tolerant Logics for FPGA Linux — •Jano Gebelein, Norbert Abel, and Udo Kebschull for the CBM-Collaboration — Kirchhoff-Institute for Physics, University of Heidelberg

The increasing use of SRAM-based reconfigurable architectures at important areas of research and development (like particle accelerators and space applications) brings new, currently partially unattended effects on top. An already well known, but nevertheless important problem of such systems is its susceptibility to radiation which increases in conjunction with particle flux and energy. Regarding to current knowledge, errors induced by Single Event Upsets (SEU) and Single Event Transients (SET) are handled exclusively in hardware by the use of spacial and temporal redundancy features. Our field of research is to extend conventional fault tolerance to multiple layers of embedded computer systems, starting with the FPGA bit layer and ending up in the software application layer to get a maximum of radiation tolerance in systems running FPGA Linux in radiation susceptible environments. Only a collaboration of all these layers is able to create an adequate amount of data security and process integrity.

HK 54: Nuclear Physics Applications

Time: Wednesday 14:00–16:00 Location: H-ZO 100

Invited Group Report HK 54.1 We 14:00 H-ZO 100

Beta decay measurements of importance for reactor heat calculations — •Alejandro Algora — IFIC (CSIC-Univ. Valencia), Valencia, Spain

Beta decay studies provide in many cases our primary information on the structure of unstable nuclei. These studies are in general complementary to in-beam studies and present different difficulties to the experimenter. In the case of beta decay one common experimental problem is the so-called "Pandemonium effect" [1] when decays with large Q values are studied. The solution to this problem is the application of the total abpsortion spectroscopy (TAS) technique.

In this contribution the results of recent beta-decay studies using the TAS technique will be presented. The main goal of these measurements was the study of nuclei that had been identified as important contributors to the decay heat in reactors [2]. The results of the analysis and their impact in reactor decay heat summation calculations will be presented.

[1] J. C. Hardy, L. C. Carraz, B. Jonson, P. G. Hansen, Phys. Letts

71B (1977) 307 [2] T. Yoshida, T. Tachibana, F. Storrer, K. Oyamatsu and J. Katakura, J. Nucl. Sci. Technol. 36 (1999) 135

Group Report HK 54.2 We 14:30 H-ZO 100

research on measurement of 126Sn by accelerator mass spectrometry — •HONG TAO SHEN, MING HE, and SHAN JIANG — Chian institute of Atomic Energy

126Sn is a long-lived beta emitting radionuclide with a half-life of (2.30*0.14)*105 years. Artificially produced 126Sn has entered our environment through nuclear weapons testing and releases from reprocessing plants and may locally lead to strongly enhanced 126Sn concentrations. So the long lived 126Sn may have implications on the nuclear pollution in our environment. Further more, in supernova explosions 126Sn is predominantly produced by rapid neutron capture (r process). The live 126Sn observed in primitive meteorites can imply that some live nuclear material was present at an early stage of the solar system formation. But the primary difficulty in the determination of the 126Sn concentration is the interference of the stable isobar 126Te. AMS is one of the most important methods to detect minute amounts of 126Sn .This work was carried out using the HI-13 tandem accelerator at CIAE National lab. SnF3- ions from the negative ion source were injected into the accelerator whose terminal voltage is 8.7 MV. Sn10+ ions were selected by an analyzing magnet and finally counted selectively using a ΔE-E gas ionization detector. A preliminary result of 126Sn/Sn=1.2*10-8 has been obtained for a 126SnO2 sample produced from spent U fuel. Further improvement is needed for the AMS measurement of 126Sn.

HK 54.3 We 15:00 H-ZO 100

First Measurements of Inelastic Neutron Scattering at nELBE — •ROLAND BEYER[1], EVERT BIRGERSSON[1], ECKART GROSSE[1,2], ROLAND HANNASKE[1], ARND R. JUNGHANS[1], ANDRIJA MATIC[1], RALF NOLTE[3], KLAUS-DIETER SCHILLING[1], RONALD SCHWENGNER[1], and ANDREAS WAGNER[1] — [1]FZ Dresden-Rossendorf, PF 510119, 01314 Dresden,Germany — [2]TU Dresden, 01062 Dresden, Germany — [3]PTB Braunschweig,Bundesallee 100, 38116 Braunschweig, Germany

At the nELBE facility [1] at Forschungszentrum Dresden-Rossendorf fast neutrons with kinetic energies of 0.1 to 10 MeV will be used to deliver nuclear data on neutron induced reactions necessary for the development of future nuclear transmutation facilities and new types of nuclear reactors. Electrons from the superconducting electron linac ELBE are shot onto a liquid lead target where they produce Bremsstrahlung which in turn liberates neutrons via (γ,n) reactions. The short pico-second pulse structure of the electron beam enables neutron time-of-flight experiments with very short flight paths of 4-7 meters obtaining energy resolutions of about 1 %.

First experiments on inelastic neutron scattering on ^{56}Fe where performed using a double time-of-flight setup based on proton recoil detectors [2] and an array of 42 BaF_2 crystals to detect the emitted photons and neutrons in coincidence. First results will be presented.

[1] E.Altstadt, C.Beckert, et al. Ann.Nucl.Energy 34 (2007) 39. [2] R.Beyer, E.Grosse, et al., NIM A 575 (2007) 449-455.

HK 54.4 We 15:15 H-ZO 100

Pulse shape comparison procedure to characterise position sensitive HPGe detectors — •NAMITA GOEL, CESAR DOMINGO PARDO, TOBIAS ENGERT, JUERGEN GERL, IVAN KOJOUHAROV, and HENNING SCHAFFNER — GSI Helmholtzzentrum fur Schwerionenforschung mbH, 64291,Darmstadt,Germany

A new tool to experimentally characterize 3D position sensitive HPGe detector based on pulse shape comparison procedure is proposed and implemented. It is a novel technique for measuring the HPGe detector pulse shapes as a function of the γ-ray interaction position inside the detector volume. The system also utilizes the principles of positron emission tomography to speed up the scanning time. An application of the Na-22 source emitting pairs of 511 keV gammas in back to back directions allows creating a "collimator-free"scanner, where pulse shapes for many lines across the detector or even the whole detector can be registered simultaneously. A position sensitive γ-ray scintillator detector (PSD) oriented towards the source is used for registration of 511 keV gammas in coincidence with the HPGe detector. This PSD is based on a crossed-wire anode position sensitive photomultiplier tube (PSPMT).The main difference with respect to similar existing devices is the individual multianode readout (IMAR) approach. The method allows to exploit better the intrinsic characteristics of the PSPMT, thus yielding better position linearity, improved spatial resolution of about 1 mm(FWHM) . This position sensitive γ-ray scintillator detector fulfills the requirements for its implementation in our scanning system.

HK 54.5 We 15:30 H-ZO 100

The Nucifer experiment : Reactor antineutrino detection for reactor monitoring — •FRÉDÉRIC YERMIA[1] and ALEXIS NUTTIN[2] for the Nucifer-Collaboration — [1]SUBATECH (CNRS/IN2P3 - University of Nantes - Ecole des Mines de Nantes), Nantes, France — [2]LPSC (CNRS-IN2P3/UJF/INPG), Grenoble, France

During the last decades, tremendous progresses have been achieved on the fundamental knowledge and detection of neutrinos which give new opportunities of applied neutrino physics. Among them, antineutrinos could be exploited for two nuclear reactor monitoring applications: the thermal power measurement and the control of the isotopic composition of the reactor fuel. This application arouses the International Atomic Energy Agency (IAEA) interest as a potential new safeguard tool.

The Nucifer detector, under development in France, will be dedicated to applied neutrino physics. The design of the detector takes advantage of the technical improvements performed for fundamental neutrino experiments such as Double Chooz. Nucifer will be tested within the next two years at the OSIRIS (Saclay-France) and the ILL (Grenoble-France) research reactors. After an brief overview on the worldwide effort in the field of reactor monitoring with antineutrinos, the Nucifer experiment will be presented, as well as Monte-Carlo PWR and CANDU reactor simulations and the method to compute the antineutrino energy spectrum using nuclear databases. The expected response of the Nucifer detector to diversion scenarios in PWR and CANDU reactors will be shown.

HK 54.6 We 15:45 H-ZO 100

Approach for uncertainties in nuclear data evaluations based on modelling — •HELMUT LEEB — Atominstitut der Österr. Universitäten, TU Wien, Wien, Austria

The design of new nuclear facilities, medical applications and dosimetry require the knowledge of all relevant nuclear cross sections and spectra. With regard to current developments in fusion and fission technologies an extension of nuclear data libraries up to 150 MeV and inclusion of covariance matrices for cross section uncertainties are requested. Because of the scarcity of experimental data beyond 20 MeV this extension is not trivial and the corresponding evaluations rely strongly on modelling. For such theory-based evaluations no well established procedures are available to estimate reliably the uncertainties. In this contribution we revisit currently studied methods and present a recently formulated evaluation procedure which is built upon fundamental Bayesian statistics. The feasibility and reliability of the method is successfully demonstrated for several isotopes. The work supported by the European Commission under the Contract of Association between EURATOM and the Austrian Academy of Sciences, was carried out within the framework of the European Fusion Development Agreement (EFDA). The views and opinions expressed herein do not reflect necessarily those of the European Commision.

HK 55: Heavy Ion Collisions and QCD phases

Time: Wednesday 16:30–19:00 Location: H-ZO 10

Group Report HK 55.1 We 16:30 H-ZO 10

Strangeness Production in Heavy Ion Collisions close to Threshold with HADES — •ALEXANDER SCHMAH for the HADES-Collaboration — Technische Universität München

For the first time, at SIS energies, the combined and inclusive identification of sub-threshold produced K^+, K^- and ϕ-mesons was carried out. These data refer to the reaction Ar+KCl at kinetic beam energy of 1.756 AGeV, measured by the HADES collaboration. It will be demon-

strated that the mesons are reconstructed with high purity. The same data also provide full phase space distributions for K_s^0-mesons and Λ-hyperons and an estimate of the not measured Σ-hyperons relying on strangeness balance. The result is compared to previous published data [1].
The transverse momentum distributions, rapidity distributions and multiplicities of the kaons (K^+, K^-) and ϕ-mesons are compared to previous measurement showing a nice agreement of the data with the available systematics [2]. The high statistics and quality of the K_s^0 data allows studying of the low momentum region, which is supposed to be sensitive to the kaon-nucleon potential. The data are compared with theoretical models.
Supported by HGF and Excellence Cluster Universe.
[1] A. Foerster et al., arXiv:nucl-ex 0701014v1.
[2] M. Merschmeyer et al., Phys. Rev. C 6 (2007) 145.

Invited Group Report HK 55.2 We 17:00 H-ZO 10

Hadronic matter at finite baryon densities - what do we know about it? — •Yvonne Leifels for the FOPI-Collaboration — GSI Darmstadt

Hadronic matter is a subject of intensive investigations both experimentally and theoretically over the last two decades. In the energy range of the Heavy Ion Synchrotron at GSI nuclear matter densities of 2 - 3 times normal nuclear matter density at relative moderate temperatures are created in relativistic heavy ion collisions. A multitude of phenomenons have been observed, i.e. collective flow, stopping and particle production, which have been confronted to the predictions of theoretical models to investigate the constraints on the bulk characteristics of nuclear matter. Strange particle production, in particular charged kaons, at energies close to the production threshold in NN-collisions is sensitive not only to the nuclear equation of state but also to the modification of hadron properties in the hot and dense medium. In trying to describe in addition the strangeness degree of freedom evidence was produced that strange particle properties are influenced by the surrounding baryonic medium.

The current status of understanding the bulk properties of hadronic matter and the in-medium modifications of the constituents will be discussed.

HK 55.3 We 17:30 H-ZO 10

Resonance phenomena in heavy nuclei collisions and structurization of positron spectrum — •Alexander Glushkov — Odessa University, P.O.Box 24a, Odessa-9, Ukraine, 65009 — Russian Academy of Sciences, Troitsk, Russia, 142090

A consistent unified quantum mechanics and QED approach is used for studying the electron-positron pair production (EPPP) process in the heavy nuclei collisions and treating the compound nucleus in an extreme electromagnetic field. The positron spectrum narrow peaks as a spectrum of the resonance states of compound super heavy nucleus are treated. To calculate the EPPP cross-section we use the modified versions of the relativistic energy approach, based on the S-matrix Gell-Mann and Low formalism [1]. The nuclear system dynamics is treated within the Dirac equation with an effective potential [2]. We present the calculation results for cross-sections at different collision energies, corresponding to energies of the resonances of the compound 238U+238U, 232Th+250Cf and 238U+248Cm nuclei. Calculation with 2-pocket nuclear potential is carried out and led to principally the same physical picture as 1-pocket one [1], besides an appearance of some new peaks. References: 1. A.Glushkov, L.Ivanov, Phys.Lett.A170,36 (1992);Preprint ISAN,N5, Troitsk,1992; A.Glushkov etal,Nucl. Phys.A.734S, 21 (2004); Europ.Phys.Journ.ST 160, 195 (2008). 2. V.Zagrebaev, V.Samarin, W.Greiner, Phys.Rev.C. 75, 035809 (2007);J.Phys.G.34,1 (2007).

HK 55.4 We 17:45 H-ZO 10

Proton-Lambda correlations in central Pb+Pb collisions at 158A GeV — •Hans Beck[1], Julian Book[1], Christoph Blume[1], Volker Friese[2], Marek Gazdzicki[1], Claudia Höhne[2], Dmytro Kresan[2], Michael Mitrovski[1], Moritz Pohl[1], Rainer Renfordt[1], Tim Schuster[1], Reinhard Stock[1], Herbert Ströbele[1], and Milica Utvić[1] for the NA49-Collaboration — [1]Fachbereich Physik der Universität, Frankfurt — [2]Helmholtzzentrum für Schwerionenforschung (GSI), Darmstadt

Proton-Lambda correlations at small momentum differences allow to extract source sizes in nuclear collisions. In contrast to pp correlations, which are widely used in heavy ion physics, the correlation function in the pΛ case is not influenced by Coulomb interactions and quantum correlations. Thus the short-range pΛ correlations are solely affected by the final-state strong interactions and therefore it has been suggested that they provide a higher sensitivity for larger source radii [1].

In this contribution pΛ correlations are analyzed using $2.6 \cdot 10^6$ central (23%) Pb+Pb collisions at 158A GeV registered by NA49 at the CERN SPS. Preliminary results on the measured correlation function have already been shown by the NA49 collaboration [2]. Here, we will report on results of an improved analysis. Comparisons to the former analysis of NA49, model predictions and other measurements (e.g. [3]) will be presented.
[1] F. Wang and S. Pratt, Phys. Rev. Lett. **83**, 3138 (1999).
[2] C. Blume et al. (NA49), Nucl. Phys. **A715**, 55 (2003).
[3] J. Adams et al. (STAR), Phys. Rev. **C74**, 64906 (2006).

HK 55.5 We 18:00 H-ZO 10

Heavy quark observables from first principles — •Marcus Tassler — Institute of Theoretical Physics, University of Muenster, Germany

The heavy-quark diffusion constant as well as the recently introduced real-time static potential, generalizing the concept of a static potential to a thermal medium, are discussed. A derivation of these quantities for a strongly anisotropic medium, as present in the initial phase of heavy ion collisions, is presented. The corresponding analytic results from first principles are supplemented by results obtained using real-time lattice techniques.

HK 55.6 We 18:15 H-ZO 10

Bridging Low and High Energy Processes:From Hadron-Nuclei to Relativistic Ions Collisions — •Sergey Eliseev — Joint Institute for Nuclear Research, 141980 Dubna, Russian Federation

A new model (a la Glauber) for hadron–nuclei interaction at intermediate energy is proposed. The main theoretical assumptions such as in the approaches of others authors describing J/Psi suppression in nuclear collisions and color transparency of nuclei at high energy is used. Yet, a number of new ingredients in the model: noneikonal corrections, correlations of nucleons in the nuclei is introduced, etc. The nuclear Fermi motion effect was taken into account. The relevant momentum distributions of the nucleons was taken from different models. To examine the nuclear interior, the K^+-meson (at intermediate energy, IE) is regarded as a unique probe due to its long mean free-path in the nuclear matter. A detailed analysis of the cross sections of K^+ - nuclei interactions at IE is presented. Our model improve the agreement between theory of others authors and data for the K^+ - nuclei scattering, but remain the "window"for some "exotics". The nature of that "exotics"(mass reduction, or "swelling"(etc.) will be discussed. In the conclusion, it is important to note that: 1. Our results have been obtained without fitting any new parameters. 2. The discrepancy between calculations and data on K^+ - nuclei scattering my be regarded as one of more probable signal of new physics in nuclear collisions. (It is just the contrary what was obtained for J/Psi suppression and color transparency.)

HK 55.7 We 18:30 H-ZO 10

A transport calculation with an embedded (3+1)d hydrodynamic evolution: Elliptic flow results from $E_{\rm lab} = 2-160A$ GeV — •Hannah Petersen[1,2], Jan Steinheimer[2], Marlene Nahrgang[2], Gerhard Burau[2], and Marcus Bleicher[2] — [1]Frankfurt Institute for Advanced Studies, Frankfurt, Germany — [2]Institut for Theoretical Physics, Frankfurt University, Frankfurt, Germany

The elliptic flow excitation function calculated in a full (3+1)d Boltzmann approach with an intermediate hydrodynamic stage for heavy ion reactions from GSI-SIS to the highest CERN-SPS energies is discussed in the context of the experimental data. Within this integrated dynamical approach different equations of state are explored without adjusting parameters. At higher SPS energies, where the pure transport calculation cannot account for the high elliptic flow values, the smaller mean free path in the hydrodynamic evolution leads to higher elliptic flow values. Event-by-event fluctuations are directly taken into account via event wise non-equilibrium initial conditions generated by the primary collisions and string fragmentations in the microscopic UrQMD model. Due to the more realistic initial conditions and the incorporated hadronic rescattering the results are in line with the experimental data almost over the whole energy range from $E_{\rm lab} = 2 - 160A$ GeV. This newly developed approach leads to a substantially different shape of the v_2/ϵ scaling curve as a function of $(1/SdN_{ch}/dy)$ which is now

in line with the experimental data compared to previous ideal hydrodynamic calculations. We also present predictions for the differential flow measurements in the RHIC low energy run.

HK 55.8 We 18:45 H-ZO 10

reconstruction of $D^{*+} \rightarrow D^0 + \pi^+$ in $p + p$ collisions at $\sqrt{s}$ = 10 TeV in the central barrel of ALICE — •YIFEI WANG for the ALICE-TRD-Collaboration — Physikalisches Institut, Heidelberg, Germany

Heavy quarks(c, b), due to their large mass, are excellent tools to study the degree of thermalization of the initially created matter in high energy nuclear collisions at LHC. Their masses remain heavy, even if chiral symmetry is restored in a QGP. Furthermore, theoretical predictions of heavy-quark production have large uncertainties due to the poorly known parton distributions in the low Feynman-x region relevant for LHC energies. Thus, measurements on charm production in $p + p$ and Pb+Pb collisions at LHC energy are essential.

We present the latest results of our performance studies on open-charm resonance production measurements in $p + p$ collisions at $\sqrt{s}$ = 10 TeV with the ALICE central barrel based on the measurement of D^{*+} mesons. The decay channel $D^{*+} \rightarrow D^0 + \pi^+$ (BR: 68%), where the D^0 mesons are reconstructed in the $D^0 \rightarrow K^- + \pi^+$ decay channel (BR: 4%), is investigated using events generated by PYTHIA and a full Monte Carlo simulation of the ALICE setup with all sub-detectors in the central barrel. The influence of single-track selection and topological cuts on the signal to background ratio are presented.

HK 56: Hadron Structure and Spectroscopy I

Time: Wednesday 16:30–19:00 Location: H-ZO 20

Invited Group Report HK 56.1 We 16:30 H-ZO 20

Recent results from the WASA-at-COSY experiment — •ANDRZEJ KUPSC for the WASA-at-COSY-Collaboration — Department of Physics and Astronomy, Uppsala University, Box 516, 75120 Uppsala, Sweden

WASA is a 4π multidetector system for studies of light meson production and decays in light ion collisions at the COSY storage ring. The facility allows the detection of both photons and charged particles and it is equipped with an internal hydrogen pellet target.

The primary objectives of the experimental program are studies of symmetry breaking patterns in η and η'-decays and in meson production reactions. Additional objectives include searches and further investigations of specific hadronic bound systems.

Since the startup of the routine operation in 2007 WASA-at-COSY has collected data for about 18 weeks. The experiments involve studies of η meson decays, isospin violation in the $dd \rightarrow \alpha\pi^0$ reaction, studies of the ABC effect and searches for bound states of η and light nuclei. For example, a recent six week run period in autumn 2008 was devoted to the studies of the η meson decays and a data sample of a few times 10^7 tagged events were collected.

I will give an overview of the main WASA-at-COSY activities and present some preliminary results.

Supported by BMBF, Wallenberg Foundation and Göran Gustafsson Foundation

HK 56.2 We 17:00 H-ZO 20

Cross section asymmetries of D- and K- Mesons produced in deep-inelastic scattering of polarized muons from polarized nucleons — ALEXANDER ZVYAGIN and •MARTIN FAESSLER for the COMPASS-Collaboration — Fakultaet Physik, LMU, Am Coulombwall 1, D-85748 Garching

One of the main goals of the COMPASS experiment at CERN has been to measure the gluon polarization in a polarized nucleon. The production of open charm (D) mesons via the photon-gluon fusion in deep inelastic scattering of polarized muons on polarized nucleons is the ideal, direct probe for the gluon polarization. The D0 is detected via its decay to Kpi. The invariant K-pi mass spectrum shows other K-pi resonances in addition to the D0(1865), in particular 2 narrow peaks, which can be attributed to K2(1430) and K*(890). The measured cross section asymmetries for the 2 relative polarizations of muon and nucleon are shown for the D- and K-mesons and the background.

HK 56.3 We 17:15 H-ZO 20

ω Photoproduction off Protons and Neutrons with CBELSA-TAPS* — •FRIDA HJELM for the CBELSA/TAPS-Collaboration — II Physikalisches Institut, Heinrich-Buff-Ring 16, 35392 Giessen

ω photoproduction off LH_2 and LD_2 targets has been studied with the tagged photon beam of the ELSA accelerator in Bonn. The combined setup of the Crystal Barrel and TAPS detector systems, which formed a 4π electromagnetic calorimeter, was used for detecting the ω meson via the $\omega \rightarrow \pi^0\ \gamma$ decay mode. The aim of this study is to determine the ω photoproduction cross section on the neutron, which has not been measured so far, and to compare it to the cross section on the free proton and on the bound proton in LD_2. The photoproduction cross section on the neutron is of particular importance with respect to model calculations of the ω-nucleus interaction. Preliminary results on both total and differential cross sections will be presented. In addition, the inclusive cross section for omega produced off LD_2 has been determined and is compared to the sum of the exclusive production channels.

* supported by the DFG (SFB/TR-16)

HK 56.4 We 17:30 H-ZO 20

Hadron production in muon-nucleon deep inelastic scattering at COMPASS — •JEAN-FRANCOIS RAJOTTE — Fakultät Physik LMU München, Am Coulombwall 1 Garching 85748, Deutschland

The COMPASS experiment at CERN is running since 2002. Its main goals are to improve our knowledge of the nucleon spin structure, using a polarized muon beam and a polarized target, and to contribute to hadron spectroscopy, using hadron beams and searching for "exotic" hadrons with constituent gluons. To reach these goals, the collaboration has built an open spectrometer to detect, with high precision, the incoming muon of 160GeV/c, the outgoing muon and the produced hadrons. The large amount of high quality data accumulated gives access to the (un)polarized parton distributions of the nucleon, and the hadronisation process.

Results will be presented on the absolute (unpolarized) inclusive cross section for the deep-inelastic muon-nucleon interaction, on the single-photon exchange cross section extracted from it, and on the nucleon structure function F2. The latter will be compared with the results from the earlier NMC experiment.

The subtle difference (asymmetry) between semi-inclusive differential cross sections has been predicted for the production of hadrons in polarized muon-nucleon interactions as a function of transverse momentum of hadrons. In this context, it is important to first compare predictions with the gross features of the unpolarized cross section. The unpolarized semi-inclusive cross sections will be shown. They can be used as benchmark for the reliability of theoretical calculations.

HK 56.5 We 17:45 H-ZO 20

Neutral decays of the η meson at MAMI — •MARC UNVERZAGT for the A2-Collaboration — Institut für Kernphysik, Universität Mainz, Johann-Joachim-Becher-Weg 45, 55099 Mainz, Germany

Neutral decays of the η meson were studied within the A2-collaboration at the MAMI accelerator in Mainz. The main emphases were the branching ratio of the $\pi^0\gamma\gamma$ decay and the Dalitz plot parameter of the isospin violating $3\pi^0$ decay, which are tests for chiral perturbation theory. Furthermore, the η photoproduction threshold off protons was investigated to precisely determine the η meson mass.

η mesons were produced in the $\gamma p \rightarrow \eta p$ reaction, using the high intensity tagged photon facility of MAMI and a liquid hydrogen target. The η decay products and recoil protons were measured with the Crystal Ball and TAPS large acceptance detectors, covering 94 % of the full solid angle.

Physical issues of the neutral η decays, the experimental set-up and recent results will be discussed.

HK 56.6 We 18:00 H-ZO 20

Precision Measurement of the η-Mass at COSY-ANKE — •PAUL GOSLAWSKI, ALFONS KHOUKAZ, MALTE MIELKE, MICHAEL PAPENBROCK, TOBIAS RAUSMANN, and ALEXANDER TÄSCHNER — Institut für Kernphysik, Westfälische-Wilhelms-Universität Münster, Münster,

Germany

Recent measurements on the η meson mass performed at different experimental facilities (i.e. COSY-GEM, MAMI, CLEO, KLOE, NA48) resulted in very precise data but differ partly by up to more than eight standard deviations, i.e. 0,5 MeV/c^2. In order to clarify this situation a new high precision measurement using the ANKE spectrometer at the COoler SYnchrotron - COSY - has been realised in March 2008. Using the two-body reaction dp $\rightarrow$ ^{3}Heη at low excess energies the η mass can be determined only from pure kinematics by the determination of the production threshold. To obtain a total uncertainty of $\Delta m_\eta < 50$ keV/c^2 on the η mass the beam momentum has to be determined with an accuracy of $\Delta p/p = 5 \cdot 10^{-5}$. This can be achieved by using an artificial spin resonance which can be induced by a horizontal rf magnetic field from a solenoid. With such a spin resonance a vector polarized deuteron beam can be depolarized depending on the revolution frequency and the beam momentum.
The method for determination of the η mass as well as preliminary results for the high precision beam momentum evaluation will be shown in this presentation.
Supported by the COSY-FFE program.

HK 56.7 We 18:15 H-ZO 20

The chiral partner of the nucleon in the mirror assignment with global symmetry — •Susanna Gallas[1,2], Francesco Giacosa[1], and Dirk Rischke[1,2] — [1]Institute for theoretical physics, Goethe University, Max-von-Laue-Str. 1, D-60438 Frankfurt am Main, Germany — [2]Frankfurt Institute for Advanced Studies, Goethe University, Ruth-Moufang-Str. 1, D-60438 Frankfurt am Main, Germany

We calculate the pion-nucleon scattering lengths $a_0^{(\pm)}$ and the mass parameter m_0, which describes the nucleon mass in the chirally restored phase for parity-doubled nucleons. This is done at tree-level in the framework of a linear sigma model with global chiral symmetry. We obtain $m_0 =$ 300-600 MeV when using the recent lattice results of T.Takahashi and T. Kunihiro. While $a_0^{(-)}$ is in fair agreement with experimental data, $a_0^{(+)}$ is too small because of the employed large mass of the sigma meson. This indicates the need of an additional scalar degree of freedom, such as a scalar tetraquark state with a mass of about 500 MeV. In this framework the very existence of a light tetraquark is responsible of the stability of nuclear matter.

HK 56.8 We 18:30 H-ZO 20

Spectroscopy of hadron resonances on the lattice — Gunnar Bali[1], Tommy Burch[1], Christian Ehmann[1], Christof Gattringer[2], Meinulf Göckeler[1], •Christian Hagen[1], Christian Lang[2], Markus Limmer[2], Daniel Mohler[2], and Andreas Schäfer[1] — [1]Institut für Theoretische Physik, Universität Regensburg, D-93040 Regensburg, Germany — [2]Institut für Physik, FB Theoretische Physik, Universität Graz, A-8010 Graz, Austria

The reproduction of the hadron mass spectrum from first principles is an important task for lattice QCD. While ground state spectroscopy, especially in the quenched approximation, is by now well understood, a clean extraction of excited hadron masses from a lattice QCD simulation still is a serious challenge. We discuss the relevant techniques for spectroscopy calculations on the lattice, in particular the variational technique which is needed for separating the different excited states from the ground state. Using this method we study three different sectors of the hadron spectrum. In the light quark sector we present hadron masses obtained from simulations with dynamical approximately chiral fermions, so-called Chirally Improved Fermions. For charmonium, we are able to extract masses for a number of excited states including ones with higher spin and exotic quantum numbers. The heavy-light hadron sector is investigated in the static-light approximation, i.e., the heavy quark is treated as infinitely heavy. Also here we are able to determine a large number of excitations.

HK 56.9 We 18:45 H-ZO 20

The heavy quark-antiquark potential from QCD and the quarkonium spectrum — •Alexander Laschka, Norbert Kaiser, and Wolfram Weise — Physik Department, Technische Universität München, D-85747 Garching, Germany

The quarkonium potential has been studied by lattice simulations as well as in perturbative QCD. It is an ideal object for exploring the interplay between perturbative and non-perturbative physics. However, the perturbative prediction is subject to ambiguities and tends to fail already at very small distances. We show how to derive a well-defined and stable short-distance potential that can be matched to results from lattice QCD simulations at intermediate distances. The static potential as well as quark mass dependent corrections are discussed and implications on the quarkonium spectrum are shown.

Work supported in part by BMBF, GSI and by the DFG Excellence Cluster “Origin and Structure of the Universe”.

HK 57: Hadron Structure and Spectroscopy II

Time: Wednesday 16:30–19:00 Location: H-ZO 30

HK 57.1 We 16:30 H-ZO 30

Precision spectroscopy of Kaonic Helium-3 $3d \rightarrow 2p$ **X-rays** — •Tomoichi Ishiwatari — Stefan-Meyer-Institut für subatomare Physik, Vienna, Austira

The E17 experiment measures the kaonic helium-3 X-rays using the large area silicon drift detectors (SDDs) in the new kaon beam line at the J-PARC facility in Japan.

The X-ray measurements of kaonic atoms give important information on the low-energy $\bar{K}N$ interaction. In particular, the determination of the shift and width of the kaonic ^{3}He and ^{4}He $2p$ states is a matter of the highest priority on the hadron physics. For example, the Akaishi-Yamazaki theory predicts the existence of the deeply bound kaonic nuclear states. Many experiments to observe such states have been progressed, but the measurements of the shift and width of the kaonic helium $2p$ states are also important values. The theory predicts a possible large shift of up to 10 eV. The first convinced result was obtained in the E570 experiment at KEK, which shows a shift of $+2 \pm 2 \pm 2$ eV. Together with the data on kaonic ^{4}He atoms, the data on kaonic ^{3}He atoms is a very important physical quantity to check the theoretical model.

In this talk, the status of the E17 experiment, in particular the working progress of the SDD system will be reported.

HK 57.2 We 16:45 H-ZO 30

Determination of the hadronic width of the ground state in pionic hydrogen — •Albert Hirtl — Stefan Meyer Institute for Subatomic Physics, Vienna, Austria

In a new high-precision experiment at the Paul Scherrer Institut (PSI), the hadronic shift (ϵ_{1s}) and width (Γ_{1s}) of the ground state of pionic hydrogen, which are directly connected to the pion-nucleon isospin scattering lengths, were remeasured (PSI-Experiment R-98-01). The results can be confronted with recent work of effective field theories defined in the low-energy limit of quantum chromodynamics (QCD), such as, e. g., chiral perturbation theory (ChPT). In addition, Γ_{1s} is connected to the pion-nucleon coupling constant $f_{\pi N}$. A precisely known value for $f_{\pi N}$ allows an accurate determination of the Goldberger-Treiman discrepancy, which constitutes a measure of chiral symmetry breaking. This contribution is mainly devoted to describe a method for an accurate extraction of the hadronic width from the π^-H data.

HK 57.3 We 17:00 H-ZO 30

Kaonic X-ray experiments at DAFNE — •M. Cargnelli[1], M. Bazzi[2], G. Beer[3], L. Bombelli[4], A.M. Bragadireanu[5,2], C. Fiorini[4], T. Frizzi[4], F. Ghio[6], B. Girolami[6], C. Guaraldo[2], R. Hayano[7], M. Iliescu[2,5], T. Ishiwatari[1], M. Iwasaki[8], P. Kienle[9], P. Lechner[10], P. Levi Sandri[2], A. Longoni[4], V. Lucherini[2], J. Marton[1], S. Okada[2], D. Pietreanu[2], T. Ponta[5], A. Romero Vidal[2], A. Scordo[2], He-Xi Shi[7], D.L. Sirghi[2,5], F. Sirghi[2,5], H. Soltau[10], L. Struder[11], H. Tatsuno[7], O. Vazquez Doce[2], E. Widmann[1], and L. Zmeskal[1] — [1]Stefan Meyer Inst., Vienna, Austria — [2]INFN, LNF, Frascati, Italy — [3]Univ. of Victoria, Canada — [4]Politec. di Milano, Italy — [5]IFIN-HH, Bucharest, Romania — [6]INFN Sez. di Roma, Italy — [7]Univ. of Tokyo, Japan — [8]RIKEN, Saitama,Japan — [9]Techn. Univ. München, Germany — [10]PNSensors, München, Germany — [11]MPI f. Extraterr. Phys., Garching, Germany

At the DAFNE collider of LN Frascati we are using the slow kaons

to investigate the K-nucleon interaction at rest in hydrogen and deuterium. We are using X-ray spectroscopy of kaonic atoms to measure the strong interaction induced shift and width of the ground state. From these the scattering lengths can be determined, which are essential for the understanding of chiral symmetry breaking in the strangeness sector. Within the project new X-ray detectors were developed: an array of large area silicon drift detectors (SDDs) having excellent energy resolution and good timing which results in a drastic suppression of background. With this technique the measurement of kaonic deuterium X-rays will be feasible for the first time.

HK 57.4 We 17:15 H-ZO 30

Status of kaonic nuclear state search at FOPI using proton induced reaction — •Ken Suzuki[1], Paul Buehler[1], Laura Fabbietti[2], Norbert Herrmann[3], Paul Kienle[1,2], Mladen Kis[4], Yvonne Leifels[4], Johann Marton[1], Eberhard Widmann[1], Toshimitsu Yamazaki[5], and Johann Zmeskal[1] — [1]Stefan Meyer Institute for Subatomic Physics, Austrian Academy of Sciences, Vienna, Austria — [2]Excellence Cluster Universe, Technische Universität München, Garching, Germany — [3]University of Heidelberg, Heidelberg, Germany — [4]Gesellschaft für Schwerionenforschung, Darmstadt, Germany — [5]Department of Physics, University of Tokyo, Tokyo, Japan and RIKEN Nishina Center, Saitama, Japan

We will report an updated status of the kaonic nuclear state (K^-pp) search program using $p + p \rightarrow K^+ + X$ reaction at $T_p = 3$ GeV. A production run takes place in the 2nd half of the year 2009. The report will focus mainly on the hardware development in Vienna and update of simulation which takes into account recent progresses on theory and new experimental observations.

HK 57.5 We 17:30 H-ZO 30

Search for η Mesic Nuclei — •Hartmut Machner — for the GEM Collaboration, Institut für Kernphysik, FZ Jülich, Jülich, Germany

There is a long standing interest whether η mesons can be bound to nuclei. We have performed two completely different experiments to search for such exotic states. First have studied the two nucleon transfer reaction p+^{27}Al→^{3}He+π^- + p+X. The experimental conditions were chosen that the ^{3}He emitted under zero degree carries all the beam momentum, and thus the remaining system $\pi^- + p$+X is at rest in the laboratory. The most probable intermediate system is η+^{25}Al with a second step $\eta + n \rightarrow N^*(1535) \rightarrow \pi^- + p$. A peak corresponding to a binding energy of 13 MeV and a FWHM of 10 MeV was found. The cross section for the peak is 150 pb. When the back-to-back condition for the $\pi^- + p$ system is released a smooth spectrum is obtained. There are indications that already ^{4}He is heavy enough to bind the η. We studied the $d + d \rightarrow \eta + \alpha$ reaction at $Q = 16.6$ MeV using a tensor polarised beam, by measuring angular distributions of cross section and analysing power. Other groups assumed that the s-wave strength is just the total cross section divided by 4π. This assumption is not appropriate at higher energies. The analysis of the present result shows that a possible p-wave is negligibly small and that there are two d-wave contributions. The s-wave amplitude can be factorised in a production amplitude and a final state enhancement factor depending on the scattering length. We show by comparing the present results with those for ^{3}He that the system is quasi-bound.
Supported in part by FZ Jülich, INB of BMBF and EU (FP6).

HK 57.6 We 17:45 H-ZO 30

Investigation of the ^{3}He η Final State in dp-Reactions at ANKE — •Tobias Rausmann, Paul Goslawski, Alfons Khoukaz, Timo Mersmann, Malte Mielke, Michael Papenbrock, and Alexander Täschner for the ANKE-Collaboration — Institut für Kernphysik, Westfälische Wilhelms-Universität, Münster, Germany

The reaction d+p→^{3}He+η has been investigated at the ANKE spectrometer with high precision in a ramped beam near threshold and at higher excess energies of Q = 20, 40 and 60 MeV. This kind of experiment is important for the open question of existance/non existance of η-mesic nuclei, which would be formed in the bound system. The ANKE spectrometer has a full geometrical acceptance and therefore high statistic data on this reaction have been obtained. Total and differential cross sections have been determined to investigate the final state interaction and contributions from higher partial waves. The results of these measurements at higher energies will be presented and compared with the results near threshold and from previous experiments at similiar energies.

Supported by the COSY-FFE program

HK 57.7 We 18:00 H-ZO 30

η photoproduction on ^{3}He : Search for η-mesic nuclei — •Francis Pheron for the A2-Collaboration — Department of Physics, University of Basel

Photoprodution of η-mesons off ^{3}He has been studied via the $\eta \rightarrow 2\gamma$ and $\eta \rightarrow 3\pi^0$ decay modes at the tagged photon beam of the Mainz MAMI accelerator using the combined 4π Crystal Ball/TAPS calorimeter. In a previous experiment, Pfeiffer et al. [1] had reported evidence (although at low statistical significance) for the formation of a quasi-bound η-nucleus state. The present experiment aimed at an improved statistical quality for the structure reported for coherent η -photoproduction as well as for the π^0-p back-to-back channel. Preliminary results will be presented. Moreover alternative ways for the search of η-mesic nuclei using coherent photoproduction of $\pi^0\eta$-pairs will be discussed.

[1] M.Pfeiffer *et al*, Phys. Rev. Lett. **92**, 252001 (2004)

Supported by Schweizerischer Nationalfond, DFG, and EU/FP6

HK 57.8 We 18:15 H-ZO 30

Search for the He $-$ η bound states with WASA-at-COSY — •Wojciech Krzemien — Institut für Kernphysik and Jülich Center for Hadron Physics, Forschungszentrum Jülich, D-52425 Jülich, Germany — Jagiellonian University, Cracow, Poland

We conduct a high sensitivity search for the He $-$ η bound state with WASA-at-COSY facility, via measurement of the excitation functions for the $dd \rightarrow {}^3\mathrm{He}p\pi^-$, $pd \rightarrow ppp\pi^-$, $pd \rightarrow pd\pi^0$, reactions where the outgoing nucleon-pion pairs originate from the absorption of the η meson on a nucleon inside the He nucleus. Precise determination of the profile of the expected Breit-Wigner distribution in the excitation curves will allow to determine the binding energy and the width of the He $-$ η bound state. In June 2008, first measurement of the excitation functions for the $dd \rightarrow {}^3\mathrm{He}p\pi^-$ reaction was performed. In the experiment we used slowly ramped COSY deutron beam scanning the range of momenta corresponding to the variation of the excess energy for the Heη system from - 60 MeV up to 20 MeV. Preliminary results from the ongoing analysis will be presented. Supported by BMBF and Wallenberg Foundation.

HK 57.9 We 18:30 H-ZO 30

Search for ω-mesic nuclei — •Karoly Makonyi — II Physikalisches Institut, Heinrich-Buff-Ring 16, 35392 Giessen

The existence and properties of ω-mesic nuclei are being studied with the tagged photon beam facility at the ELSA accelerator in Bonn. The combined setup of the Crystal Barrel and MiniTAPS detector systems, which form a 4π electromagnetic calorimeter, was used for detecting possible decay mode of ω mesic state ($\omega + p \rightarrow N^* \rightarrow \pi^\circ + p$). The recoiling proton of the $\gamma + p \rightarrow \omega + p$ reaction was identified with an aerogel Cherenkov detector and by energy and time information. A first experiment on a carbon target has been performed. The status of the analysis will be presented.
Funded by DFG (SFB/TR16)

HK 57.10 We 18:45 H-ZO 30

The search of antikaon nuclear bound states, recent results from FINUDA — •Alessandra Filippi for the FINUDA-Collaboration — INFN Torino, Torino, Italy

New data from the $K^-_{stop}A$ absorption reaction on light nuclei (^{6,7}Li, ^{9}Be and ^{12}C) have been collected by the FINUDA spectrometer, running at the DAΦNE ϕ-factory, in Laboratori Nazionali di Frascati (Italy).

Data on K^- nuclear absorption with the emission of hyperons together with nucleons are scarce. Further experimental studies on their possible correlations are awaited, in order to clarify the mechanism of kaon absorption on multibarionic systems and the possible existence of K^--nucleons aggregates.

According to a few recent theoretical calculations the existence of states where the kaon is bound to two or three nucleons, or even more, is foreseen. These systems are expected to be 20-30 MeV narrow, with binding energies as large as 50-100 MeV. Their observation has been a little elusive so far.

With FINUDA, the possibility to fully reconstruct all the particles coming from the decay of a possible bound kaonic system can be exploited, to study the existence of such states through their invariant mass spectra.

In this talk an overview of the most recent results obtained so far by FINUDA in the study of the existence of K-nuclear bound states

will be reported.

HK 58: Nuclear Structure and Dynamics I

Time: Wednesday 16:30–19:00 Location: H-ZO 40

Invited Group Report HK 58.1 We 16:30 H-ZO 40

Aspects of gamma spectroscopy in reactions induced by light ions — •Nicolae Marius Marginean — IFIN-HH, Bucharest-Magurele, Romania

The reactions induced by light ions give access to nuclear states not accessible from reactions involving heavy-ion collisions. Light and heavy-ion induced reactions provide complementary experimental information and constitute mandatory steps toward complete gamma spectroscopy of a given nucleus. Several gamma spectroscopy techniques used in reactions induced by light ions as alpha particles or 7Li will be discussed and illustrated with recent experimental results in the Sn-Te region obtained from experiments performed at the Tandem accelerator in Bucharest.

HK 58.2 We 17:00 H-ZO 40

One-phonon excitations of ^{92}Zr from electron scattering * — •A. Scheikh Obeid, C. Walz, O. Burda, M. Chernykh, A. Krugmann, I. Poltoratska, and N. Pietralla — Institut für Kernphysik, Technische Universität Darmstadt, Germany

Low-lying collective vibrational excitations in ^{94}Mo have previously been investigated with electron scattering experiments [1] at the 130 MeV superconducting electron accelerator S-DALINAC. The evaluation of the measured form factors as a function of momentum transfer had supported the one-phonon interpretation of symmetric and mixed-symmetric states (MSSs) which have been defined in the framework of IBM-2. In the neighbouring even-even isotone ^{92}Zr formed by N=52 neutrons with two valence neutrons and Z=40 with no protons occupying the $\pi(g_{9/2})$ sub-shell a stronger configurational isospin polarization of the one-phonon states than in ^{94}Mo is expected [2]. In order to verify this expectation, a new electron scattering experiment at the S-DALINAC has been performed. Our data and a comparison to the momentum-transfer dependence of the form factor of the 2^+ states will be presented. The E2 transition strength of the one-quadrupole phonon states and the E3 transition strength of the one-octupole phonon state have been extracted and will be compared to previously derived spectroscopic data on MSSs of ^{92}Zr [3].

[1] O. Burda *et al*, Phys. Rev. Lett. **99**, 092503 (2007).
[2] J. D. Holt *et al*, Phys. Rev. C **76**, 034325 (2007).
[3] C. Fransen *et al*, Phys. Rev. C **71**, 054304 (2005).

* Supported by the DFG through SFB 634.

HK 58.3 We 17:15 H-ZO 40

Yrast structure of 97Zr . — •Magdalena Matejska-Minda[1], Bogdan Fornal[1], Rafał Broda[1], M.P. Carpenter[2], R.V.F. Janssens[2], W. Królas[1], K. Mazurek[1], T. Pawłat[1], J. Wrzesinski[1], and S. Zhu[2] — [1]Institute of Nuclear Physics, Polish Academy of Sciences, Kraków — [2]Physics Division, Argonne National Laboratory, Argonne, IL, USA

The experiment performed at the ANL, USA, in which gamma rays emitted during reactions induced by a 48Ca beam on 208Pb and 238U targets were measured, showed that the process of fission of target-like nuclei populate relatively high-spin states in nuclei near 96Zr. One of the intense products was 97Zr for which information on higher lying yrast states was largely missing. We analyzed the spectra of gamma rays that were coincident with the beam pulse, and associated with subsequent detection of transitions deexciting the 7/2+ isomer. In this nucleus a series of gamma rays was displayed as candidates for higher lying transitions. Using those gamma rays as starting points, we identified lines preceding the isomer. These lines were used to extended the yrast states in 97Zr up to the excitation energy of 7294 keV and spin of approximately 33/2. In addition, the identification of high-spin excitations in 97Zr allowed to establish the states fed in the beta-decay branch of the 27/2- high-spin isomer in 97Y. The structure located in the present work will be discussed from the perspective of the shell model.

HK 58.4 We 17:30 H-ZO 40

Low-spin excitations in ^{98}Ru — •Désirée Radeck, Michael Albers, Christian Bernards, Christoph Fransen, Jan Jolie, and Dennis Mücher — Institut für Kernphysik, Universität zu Köln

In the context of collectivity in the A=100 mass region N=52 isotones were investigated in detail and phonon excitations - especially the mixed-symmetry (MS) states - were identified. In order to investigate how states with this MS character evolve with increasing valence neutron number N=54 isotones were studied. While in ^{96}Mo the one-phonon MS state $2^+_{1,\mathrm{ms}}$ was identified [1], ^{98}Ru shows a breakdown of vibrational structure above the two-phonon triplet and no candidate for the $2^+_{1,\mathrm{ms}}$ state was assigned [2]. The recently investigated N=54 isotone ^{100}Pd was explained well with an $U_{\pi\nu}(5)$ fit within the IBM-2. Furthermore, a candidate for the one-phonon MS $2^+_{1,\mathrm{ms}}$ state was determined [3]. To do further investigations on the N=54 isotone ^{98}Ru - in particular regarding the breakdown of vibrational symmetry and the one-phonon MS excitation - an experiment was performed at the Cologne Tandem Accelerator using the HORUS spectrometer. The nuclei were populated by the reaction ^{97}Mo(^{3}He,2n)^{98}Ru. By analysing the coincidence and $\gamma\gamma$ angular correlation data the level scheme was extended and clarified by determining spins, multipole mixing ratios and branching ratios. The low-energy excitations of positive parity will be discussed and compared to theoretical expectations. The results will be compared with those for other N=54 isotones. [1] S.R. Lesher et al., Phys. Rev. C 75, 2007. [2] R.B. Cakirli et al., Phys. Rev. C 70, 2004. [3] D. Radeck et al., submitted. Supported by DFG, grant Jo 391/3-2.

HK 58.5 We 17:45 H-ZO 40

Lifetime Measurements for non-yrast states in ^{118}Te — •C. Mihai[1], I. Cata-Danil[1], A.A. Pasternak[2], A.D. Efimov[2], L. Stroe[1], D. Filipescu[1], M. Ivascu[1], T. Glodariu[1], D. Bucurescu[1], G. Cata-Danil[3], N. Marginean[1], and N.V. Zamfir[1] — [1]National Institute for Physics and Nuclear Engineering "Horia Hulubei", Bucharest-Magurele, Romania — [2]Cyclotron Laboratory, A.F. Ioffe Physical Technical Institute,194021, St. Peterburg, Russia — [3]Physics Department, University "Politehnica", Bucharest, Romania

Lifetimes of excited states in ^{118}Te populated in the ^{115}Sn(α,n)^{118}Te reaction have been measured using the Doppler Shift Attenuation method (DSAM). A 15 pnA, 15 MeV ^{4}He2^+ beam delivered by the Bucharest FN-TANDEM impinged on a 3.72 mg/cm2 tin target, 56% enriched in ^{115}Sn. The non-selective character of the reaction allowed us to measure lifetimes of non-yrast states with spin up to 8^+, by lineshape analysis of the γ-ray spectra. The γ-rays emitted following the reaction were detected in 7 large volume HPGe detectors, 5 placed in a 37 degrees ring in the backward direction, one at 90 degree and one at various angles in the forward direction. Additionally, a NE213 liquid scintillator detector was used for the detection of neutrons emitted in the reaction in coincidence with γ-rays.

Lifetimes of the yrast states in ^{118}Te were previously measured in heavy ions reactions, both by DSAM and RDM methods. The new results obtained in this work for the non-yrast states together with the existing information on lifetimes in the ground state band of 118Te are discussed in the framework of the Interacting Bosons Model (IBM).

HK 58.6 We 18:00 H-ZO 40

New Nuclear Stability Islands of Octahedral and Tetrahedral Shapes — •Katarzyna Mazurek[1], Jerzy Dudek[2], Andrzej Gozdz[3], Dominique Curien[2], Maria Kmiecik[1], and Adam Maj[1] — [1]The Niewodniczański Institute of Nuclear Physics - PAN, ul. Radzikowskiego 152, PL-31-342 Kraków, Poland — [2]Institut de Recherches Subatomiques and Université Louis Pasteur, F-67037 Strasbourg Cedex 2, France — [3]Zakład Fizyki Matematycznej - Uniwersytet Marii Curie-Skłodowskiej, pl. Marii Curie-Skłodowskiej 1, PL-20031 Lublin, Poland

Large scale calculations based on the microscopic-macroscopic method with Woods- Saxon single particle potential guided by the use of the discrete point group symmetries allow us to find the new islands of nuclear stability. These new stability regions are the consequence of particularly strong shell effects which are obtained in the calculations

when the nuclear mean field is allowed to deform by respecting some special the so called high-rank symmetry-point groups. The underlying mechanism is illustrated together with the full chain of the symmetry-associated magic numbers.

HK 58.7 We 18:15 H-ZO 40

Low-lying collective states in the O(6)-like nucleus ^{126}Xe — •Laurent Coquard[1], Norbert Pietralla[1], Georgi Rainovski[2], Tan Ahn[3], Robert Janssens[4], and Michael Carpenter[4] — [1]Institut für Kernphysik, Technische Universität Darmstadt, 64289 Darmstadt, Germany — [2]Faculty of Physics, St. Kliment Ohridski University of Sofia, 1164 Sofia, Bulgaria — [3]WNSL, Yale University, New Haven, CT 06520, USA — [4]Argonne National Laboratory, 700 South Cass Avenue, Argonne, Illinois 60439, USA

Low-lying collective excited states in ^{126}Xe have been investigated via the ^{12}C(^{126}Xe,^{126}Xe*) Coulomb excitation reaction @ 85% of the Coulomb barrier (399MeV) at the Gammasphere Ge-detector array at the Argonne National Laboratory. Absolute E2 transitions strengths have been obtained from the COULEX cross sections that were deduced from the relative γ-ray yields as in [1]. These experimental values are then compared with the theoretical values calculated within the Interacting Boson Model [2,3] near the O(6) limit. The agreement between the measured B(E2) values and the ones predicted by the IBM, on an absolute scale, enables us to understand the decay of the low-lying collective states in terms of σ and τ selection rules for the O(6)-like nucleus ^{126}Xe.

[1] G. Rainovski *et al*, Phys. Rev. Lett. 96, 122501 (2006).
[2] A. Arima and F. Iachello, Phys. Rev. Lett. **40**, 385 (1978).
[3] F. Iachello and A. Arima, The Interacting Boson Model (Cambridge University Press, Cambridge, 1987).

HK 58.8 We 18:30 H-ZO 40

Monte Carlo optimization of the High Resolution Gamma Spectroscopy Germanium Array for DESPEC — •Maria Doncel[1], Begoña Quintana[1], Alejandro Algora[2], Felipe Lorenzo[1], and Pavel Detistov[1] — [1]Departamento de Física Fundamental. Universidad de Salamanca, 37008 Spain — [2]Instituto de Física Corpuscular. Universidad de Valencia, 46071 Spain

In this work, we present the results obtained by Monte Carlo simulations with Geant4 aimed to search the best response of the high resolution gamma spectroscopy germanium array for DESPEC (Decay Spectroscopy) that is going to be built at FAIR (GSI). This array will be based on the new concepts of the pulse shape analysis, γ-ray tracking and imaging. The technical proposal is based on planar germanium detectors due to for the new capabilities we want to develop, high position and energy resolution is needed, and in this terms planar detectors are better than coaxial detectors. In our study, we have optimized the value of the principal parameters that can affect the quality of the system and the best geometry for the experiments proposed for this array. Thinking in the capabilities of tracking and imaging, we have also considered different configurations of planar detectors with the objective of knowing which of them has the best specifications in terms of ϵ and P/T in a wide range of energies (from 100 keV to 8 MeV). In the simulations we take into account an extended source in the implantation plane therefore we obtain a map of the efficiency and P/T for all the possible emitting points.

HK 58.9 We 18:45 H-ZO 40

Simulations and first feasibility experiment for EXL — •Hossein Moeini[1] and Nasser Kalantar-Nayestanaki[2] — [1]KVI, Groningen, The Natherlands — [2]KVI, Groningen, The Natherlands

The EXL objective is mainly to focus on light-ion reactions in inverse kinematics using a universal detector system providing high resolution and large solid angle coverage in kinematically complete measurements. Hence one of the main parts of the project is the EXL Silicon Particle Array (ESPA) and EXL Gamma and Particle Array (EGPA). The analysis of the recoil detector data taken during the test run in 2005 has shown that having a comprehensive simulation package for the EXL setup is highly essential in order to fully understand the data. While there has been already some simulation activities going on for the EXL, we started with a Geant4 code to integrate all the necessary parts of the detection system in the simulations. These include ESPA, EGPA, forward detectors for high-energy particles, and the magnetic lattice of the ring leading to the heavy-ion detection systems. In this presentation, an overview of the simulations along with some results will be shown.

HK 59: Nuclear Structure and Dynamics II

Time: Wednesday 16:30–19:00 Location: H-ZO 50

Group Report HK 59.1 We 16:30 H-ZO 50

Studies of Light Unbound Nuclear Systems — •Yuliya Aksyutina for the LAND-s245-Collaboration — Gesellschaft für Schwerionenforschung(GSI), D-64291 Darmstadt

The results on an experiment at the SIS-FRS facility (GSI, Darmstadt, Germany) with relativistic beams of ^{8}He, ^{11}Li and ^{14}Be impinging on a liquid hydrogen target will be discussed. The experimental setup, consisting of the neutron detector LAND, the dipole spectrometer ALADIN and different types of tracking detectors, allows for a reconstruction of the momentum vectors of all reaction products in coincidence. Neutron(proton) knockout reactions lead to formation of unbound systems. Their properties are investigated by reconstructing the invariant-mass spectra as well as by studying the angular correlations between the reaction products. The observed systems are ^{7}He, ^{9}He, ^{10}He, ^{10}Li, ^{12}Li, ^{13}Li and ^{13}Be. The talk is devoted to a discussion of the obtained results for these unbound isotopes and the physics interpretation of the data.

HK 59.2 We 17:00 H-ZO 50

The Investigation of the Coulomb Breakup Effect on the 6-He Elastic Scattering — •Yasemin Kucuk[1], Ismail Boztosun[1], and Nicholas Keeley[2] — [1]Erciyes University, Department of Physics, Kayseri, Turkey — [2]The Andrzej Soltan Institute, Department of Nuclear Reactions, Poland

The elastic scattering of the halo nuclei from the heavier target exhibits a different behavior from the standart Fresnel-type diffraction at energies near the Coulomb barrier. In this paper, we have performed the CDCC calculations for 6-He elastic scattering from the different targets to investigate the effect of the Coulomb breakup coupling and we have observed that the deviation from the standard diffraction behavior due to strong breakup coupling starts at around ZT= 60.

HK 59.3 We 17:15 H-ZO 50

Microscopic cluster model of ^{5}H and ^{5}He ($T = 3/2$) — •Pierre Descouvemont and Abderrahim Adahchour — Physique Nucléaire Théorique, Université Libre de Bruxelles (ULB), B1050 Brussels, Belgium

We use the Generator Coordinate Method to investigate the ^{5}H and ^{5}He systems in the hyperspherical formalism. The microscopic wave functions are described by a ^{3}H+n+n cluster structure for ^{5}H, and by a mixing of ^{3}H+p+n and ^{3}He+n+n configurations for ^{5}He. The resonance properties are analyzed with the Analytic coupling in the Continuum Constant (ACCC) method. For ^{5}H, we find results consistent with the literature, but the ground-state width is lower than in previous works. The calculation suggests $J = 1/2^{+}$ and $J = 3/2^{+}$ states in ^{5}He which correspond to the isobaric analog states of low-lying levels in ^{5}H. A $J = 1/2^{+}; T = 3/2$ state is found near $E_x = 21.3$ MeV in ^{5}He, with a width of $\Gamma \approx 1$ MeV.

HK 59.4 We 17:30 H-ZO 50

The optical potential for the subbarrier elastic scattering of light weakly-bound deuteron-like nuclei — •Lesya Borowska[1,2], Kostyantyn Terenetsky[2], Volodymyr Verbitsky[2], and Stephan Fritzsche[3,4] — [1]Universität Bonn, Auf dem Hügel 20, D-53121 Bonn, Germany — [2]Institute for Nuclear Research, National Academy of Sciences of Ukraine, Nauky Prospekt 47, 03680 Kyiv, Ukraine — [3]Gesellschaft für Schwerionenforschung (GSI), Planckstrasse 1, D-64291 Darmstadt, Germany — [4]Frankfurt Institute for Advanced Studies, D-60438 Frankfurt am Main, Germany

The elastic scattering of light weakly-bound deuteron-like nuclei in the field of heavy targets has been studied for collision energies below and near the Coulomb barrier. Based on the assumption that the

deuteron-like nucleus follows the projectile adiabatically along its classical trajectory [1], an analytical expression for the optical potential is derived which describes both, the (electrical) polarization as well as the breakup of the projectile in the field of the target. Detailed computations with this optical potential have been carried out for the elastic scattering of ^{6}He + ^{208}Pb at energies 14 MeV and 16 MeV near to the Coulomb barrier. It is demonstrated that the polarization of the weakly-bound deuteron-like nucleus leads to a clear decrease of the (elastic) scattering cross section in excellent agreement with a recent measurement by Sanchez-Benitez *et al.* [Nucl. Phys. A **803**, 30 (2008)]

[1] L. Borowska, K. Terenetsky, V. Verbitsky, S. Fritzsche, Phys. Rev. C **76**, 034606 (2007)

HK 59.5 We 17:45 H-ZO 50

Breakup correlations and continuum spectroscopy of two-neutron halo nuclei — Jan S. Vaagen[1], •Sergey N. Ershov[2], and Boris V. Danilin[3] — [1]Department of Physics and Technology, University of Bergen, — [2]Joint Institute for Nuclear Research, 141980 Dubna, Russia — [3]Russian Research Center "The Kurchatov Institute", 123182 Moscow, Russia

Continuum spectroscopy implies a consistent analysis of a variety of exclusive and inclusive cross sections accessible in kinematically complete experiments. Theoretical analysis of experimental data on different energy correlations of the three fragments from breakup of ^{6}He on lead and carbon targets at collision energy 30 MeV/nucleon, obtained at GANIL, is presented. The applied theory is based on a microscopic four-body distorted wave approach to breakup reactions and uses the three-body model for the nuclear structure of the two-neutron Borromean halo projectile nucleus ^{6}He. The method of hyperspherical harmonics was used for consistent calculations of the ground state wave function and low-lying three-body continuum states including monopole, dipole and quadrupole excitations. Theoretical calculations reproduce quite well the low-lying excitation spectrum and fragment momentum correlations near breakup threshold. Dipole excitation dominates in the spectrum from fragmentation on the lead target, while for fragmentation on carbon excitation of the known 2^{+} three-body resonance is also important. The theory has previously been successfully tested on 240 MeV/nucleon energy data from GSI. The theory is also applicable to other Borromean nuclei: ^{11}Li, etc.

HK 59.6 We 18:00 H-ZO 50

Shape coexistence in the neutron-rich isotope ^{13}B with $N = 8$ studied by lifetime measurements of the excited states — •Hironori Iwasaki[1], Alfred Dewald[1], Christoph Fransen[1], Adrian Gelberg[1], Matthias Hackstein[1], Jan Jolie[1], Pavel Petkov[1,2], Thomas Pissulla[1], Wolfram Rother[1], and Karl-oskar Zell[1] — [1]IKP, Köln, Germany — [2]INRNE, Sofia, Bulgaria

The lifetime measurement for the excited states in the neutron-rich nucleus ^{13}B has been performed, at the FN tandem facility in the University of Cologne, by the Doppler-shift attenuation method with the ^{7}Li(^{7}Li,p)^{13}B reaction. Anomalously hindered strength was found for the transition between the second excited states at 3.53 MeV and the ground state. A comparison with the modern shell model calculations suggests the spin and parity (J^{π}) of $3/2^{-}$ for the 3.53-MeV state with the hindered transition strengths to the ground state with J^{π}=$3/2^{-}$, providing a consistent picture for the shape coexistence in the neutron-rich isotope ^{13}B with $N = 8$. Experimental results will be presented and discussed in terms of the shell evolution in the light neutron-rich nuclei around $N = 8$.

HK 59.7 We 18:15 H-ZO 50

Bestimmung der Kernladungsradien von ^{7,10}Be und dem Neutronen-Halokern ^{11}Be — •Dirk Tiedemann[2], Zoran Andjlkovic[1], Klaus Blaum[3], Marc Bissell[4], Radu Cazan[2], Christopher Geppert[1,5], Magdalena Kowalska[6], Jörg Krämer[2], Andreas Krieger[2], Rainer Neugart[2], Rodolfo Sanchez[1], Ferdinand Schmidt-Kaler[7], Monika Zakova[2], Deyan Yordanov[3], Claus Zimmermann[5] und Wilfried Nörtershäuser[1,2] — [1]GSI, Darmstadt — [2]Universität, Mainz — [3]MPI-Kernphysik, Heidelberg — [4]Universität Leuven, Belgien — [5]Universität Tübingen — [6]CERN, Genf, Schweiz — [7]Universität Ulm

Die Bestimmung der Kernladungsradien von neutronenreichen kurzlebigen Isotopen der leichten Elemente He, Li und Be ist für die Kernphysik von großem Interesse, da sie modernen ab-initio Rechnungen der Kernstruktur zugänglich sind und Isotope mit exotischer Kernstruktur - so genannte Halo-Kern - existieren. Der Ladungsradius kann über die Messung der Isotopieverschiebung bestimmt werden, stellt jedoch höchste Anforderungen an Experiment und Theorie. Um die Kernladungsradien zu extrahieren, müssen die Isotopieverschiebung und der Masseneffekt mit einer relativen Genauigkeit von 10^{-5} gemessen bzw. berechnet werden. Dies ist für den $2s_{1/2} \rightarrow 2p_{1/2}$ Übergang in Be-Ionen jetzt erreicht worden. Dazu wurden mit einem Frequenzkamm die Übergangsfrequenzen der Isotope in kollinearer und anti-kollinearer Geometrie an ISOLDE /CERN vermessen und daraus die Kernladungsradien mit einem relativen Fehler kleiner 1 Prozent extrahiert.

HK 59.8 We 18:30 H-ZO 50

Neutron knockout from Borromean halo: the target dependence — •Christoph Langer for the LAND-s245-Collaboration — Institut für Kernphysik, Universität Frankfurt, D-60438 Frankfurt am Main, Germany

The halo nuclei ^{11}Li, ^{8}He and ^{14}Be were studied at GSI Darmstadt. In the FRS-LAND setup a mixed secondary beam consisting of nuclei with similar A/Z ratio was impinging on targets made of carbon, polyethylene and liquid hydrogen in order to study their contributions to different knockout reactions. A spectroscopic analysis of the borromean halo system ^{6}He is presented. The one-neutron-breakup channel using a liquid hydrogen target was used to extract invariant mass spectra and a missing momentum distribution of the ^{5}He subsystem for an incoming beam at around 240 MeV/A. These results are compared with literature and an earlier experiment performed with a carbon and polyethylene target only. Here, the proton related cross sections were obtained by subtracting the carbon background from the polyethylene data. Furthermore it was possible to reconstruct the total cross section of the one-neutron-knockout channel of ^{6}He. *This project is supported by the HGF Young Investigators Project VH-NG-327*

HK 59.9 We 18:45 H-ZO 50

β decay studies of ^{11}Li, ^{11}Be and ^{8}B with an implantation technique — •Jeroen Büscher for the E1030 and P08 experiments-Collaboration — Katholieke Universiteit Leuven, Leuven, Belgium

The charged particle emission in the β decay of the halo nuclei ^{11}Li and ^{11}Be were studied at the ISAC facility at TRIUMF by implanting postaccelerated ^{11}Li ions into a segmented silicon detector. The high degree of pixelazation, the small active volume of the detector and the precise energy of the radioactive ion beam are the key features of the experimental setup. Among the advantages of the method are a good precision of the overall normalization and a reduction of the background due to β radiation. A precise branching ratio for both the deuteron and triton emission channel in the β decay of ^{11}Li was measured together with an energy spectrum of the emitted charged particles. The results provide important information on the decay and open up a new means to study the halo wave function of ^{11}Li. In addition to these results the charged particle emission in the β decay of the daughter nucleus ^{11}Be could be measured. We will also report on the first results of a recent experiment measuring the ^{8}B neutrino spectrum. This result is derived from the energy spectrum of the 2 α particles emitted in the β decay of ^{8}B. This measurement was performed using the same technique, implanting the ^{8}B ions at KVI in Groningen, The Netherlands.

HK 60: Nuclear Astrophysics

Time: Wednesday 16:30–18:45 Location: H-ZO 60

Invited Group Report HK 60.1 We 16:30 H-ZO 60

The r-process nucleosynthesis: a long-standing mystery in astrophysics — •Stephane Goriely — IAA-ULB, Campus de la Plaine CP226, 1050 Brussels, Belgium

The rapid neutron-capture process, or r-process, is known to be of fundamental importance for explaining the origin of approximately half of the A>60 stable nuclei observed in nature. In recent years nuclear astrophysicists have developed more and more sophisticated r-process

models, eagerly trying to add new astrophysical or nuclear physics ingredients to explain the solar system composition in a satisfactory way. The r-process remains the most complex nucleosynthetic process to model from the astrophysics as well as nuclear-physics points of view.

The identification of the astrophysical site and the specific conditions in which r-process nucleosynthesis takes place remain unsolved mysteries of astrophysics. The present contribution illustrates the complexity of the r-process nucleosynthesis by describing the nuclear mechanisms taking place during the neutrino-driven wind of supernova explosions and the decompression of neutron star matter, the two most-promising r-process sites. Future challenges faced by nuclear physics in this problem are discussed, particularly in the determination of the radiative neutron capture rates by exotic neutron-rich nuclei, as well as the need for more experimental information and improved global microscopic models for a reliable determination of all nuclear properties of relevance.

Group Report HK 60.2 We 17:00 H-ZO 60

Neutron-capture cross sections of Fe-peak seed nuclei — •I Dillmann[1], T Faestermann[1], G Korschinek[1], J Lachner[1], M Poutivtsev[1], G Rugel[1], F Käppeler[2], S Walter[2], C Domingo-Pardo[3], M Heil[3], R Reifarth[3], L Coquard[4], A Wallner[5], K Buczak[5], and C Lederer[5] for the CERN-nTOF-Collaboration — [1]Physik-Department and Excellence Cluster Universe, Technische Universität München — [2]Forschungszentrum Karlsruhe — [3]Gesellschaft für Schwerionenforschung — [4]Technische Universität Darmstadt — [5]VERA, Fakultät für Physik, Universität Wien

About 50% of the elements beyond iron are produced via the s process. In the vicinity of the Fe seed the resulting abundances are dominated by the weak s-process component. The neutron exposure here is not strong enough that the so-called local equilibrium is reached. Accordingly, the neutron capture rate of a nucleus, which experiences the entire mass flow, will affect also the abundances of all isotopes in the following reaction chain and hence the overall s-process efficiency as well.

Recently the neutron-capture cross sections of ^{54,58,60}Fe and ^{58,62,64}Ni were measured with the activation technique at kT= 25 keV. The number of produced ^{55}Fe, ^{59}Ni, and ^{63}Ni atoms were then determined with accelerator mass spectrometry.

For extrapolation to higher and lower temperatures an accurate knowledge of the energy dependence is required. A campaign to measure these cross sections with the time-of-flight technique is scheduled for 2009/10 at the CERN/n_TOF facility.

HK 60.3 We 17:30 H-ZO 60

R-process nucleosynthesis calculations with complete nuclear physics input — •Ilka Petermann[1,2], Almudena Arcones[1,2], Aleksandra Kelic[2], Karlheinz Langanke[2,1], Gabriel Martinez-Pinedo[2], Igor Panov[3], Thomas Rauscher[3], Karl-Heinz Schmidt[2], Friedrich-Karl Thielemann[3], and Nikolaj Zinner[4] — [1]IKP, TU Darmstadt, Germany — [2]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany — [3]Department für Physik und Astronomie, Universität Basel, Switzerland — [4]Department of Physics, Harvard University, Cambridge, MA 02138

Elements heavier than iron are known to be made partly by the r-process, a sequence of rapid neutron-captures and subsequent beta-decays in explosive scenarios with high neutron densities. Its astrophysical site has not yet been identified, but observations indicate at least two possible sites contributing to the solar system abundance of r-process elements and confirm a robust mechanism of the production of elements heavier than Z=56. From the nuclear-physics point of view the r-process requires the knowledge of a large number of reaction rates involving exotic nuclei. We have developed a complete database of reaction rates that besides neutron-capture rates and beta-decay half-lives includes all possible reactions that can induce fission (neutron-capture, beta-decay and spontaneous fission) and the corresponding fission yields. In addition, these reaction rates were implemented in a fully implicit reaction network. We have performed r-process calculations for the neutrino-driven wind scenario to explore whether or not fission can contribute to provide a robust r-process pattern.

HK 60.4 We 17:45 H-ZO 60

Co-Production of Light p-, s- and r-Process Isotopes in the High-Entropy Wind of Type II Supernovae — •Khalil Farouqi[1], James W. Truran[1], Karl-L. Kratz[2], Ulrich Ott[2], Bernd Pfeiffer[2], Yoav Kashiv[3], and Friedrich-K. Thielemann[4] — [1]Chicago — [2]Mainz — [3]Jerusalem — [4]Basel

The nucleosynthesis origin of the light trans-Fe elements in the Solar System (SS), historically believed to be composed of different fractions of the p-, s- and r-processes, has been a fascinating subject for nuclear astrophysicists since more than 50 years. However, even the most recent astrophysical models have major short-comings the one or other way. We have performed large-scale dynamical network calculations within the high-entropy wind (HEW) scenario of SNe II in order to constrain the astrophysical conditions for the nucleosynthesis of the light trans-Fe elements. We find that for electron fractions in the range $0.450 \leq Y_e \leq 0.495$, only minor amounts of Zn to Rb but high abundances of the classical p-, s- and r-process nuclei of Sr to Ru are co-produced at low entropies (S) after an α-rich freezeout. No initial abundances of p-, s- or r-process seeds need to be invoked; hence, all components are primary, rather than secondary. Taking the isotopic composition of Mo as a particularly interesting example, we show that HEW trajectories with $Y_e \simeq 0.46$ and $S \leq 50$ are able to reproduce the SS ratio of ^{92}Mo/^{94}Mo. Furthermore, for slightly higher Y_e and S trajectories, our nucleosynthesis results can also explain the anomalous abundances of the Mo isotopes recently measured in SiC grains of type X, which are likely SN condensates.

HK 60.5 We 18:00 H-ZO 60

Stellar (n,γ) cross sections of neutron-rich nuclei. — •Justyna Marganiec[1,2], Iris Dillmann[1,3], Cesar Domingo Pardo[1,2], and Franz Käppeler[1] — [1]Forschungszentrum Karlsruhe, Institut für Kernphysik, 76344 Eggenstein-Leopoldshafen, Germany — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Planckstraße 1, D-64291 Darmstadt, Germany — [3]Physik-Department E12, Technische Universität München, Garching, Germany

The neutron capture cross sections of neutron-rich nuclei are needed for nucleosynthesis studies of the heavy elements in the s and r processes. About half of the abundances between Fe and Bi are produced by the s process and the remaining part is due to the r process with a small contribution from the p process. The present results include the (n,γ) cross sections of ^{174,176}Yb, ^{184,186}W, ^{190,192}Os, ^{196,198}Pt, and ^{202,204}Hg. These data are important for the determination of the s-process abundances and for deriving the r-process contribution to the solar system abundances.

The measurements were carried at the Karlsruhe 3.7 MV Van de Graaff accelerator using the ^{7}Li$(p,n)^7$Be reaction for producing a quasi-stellar neutron spectrum. Activation in that spectrum allowed us to measure the Maxwellian averaged cross sections at a thermal energy of $kT = 25$ keV. The experimental results were extrapolated from $kT = 25$ keV to lower and higher temperatures.

HK 60.6 We 18:15 H-ZO 60

Photoactivation experiments at HIγS * — •A. Sauerwein[1], M. Fritzsche[1], N. Pietralla[1], C. Romig[1], G. Rusev[2], D. Savran[1], K. Sonnabend[1], A.P. Tonchev[2], W. Tornow[2], and H.R. Weller[2] — [1]Institut für Kernphysik, TU Darmstadt, Germany — [2]Triangle Universities Nuclear Laboratory, Duke University, Durham, NC, USA

The neutron capture cross section of the so-called s-process branching points determines the isotopic abundance ratio of several elements in the mass region above iron. Due to the instability of the branching point nuclei, a direct measurement of their neutron capture cross sections is experimentally challenging. Therefore, we perform the inverse (γ,n) reaction to verify theoretical predictions based on the Hauser-Feshbach formalism like TALYS [1] and NON-SMOKER [2]. The presented method was already used in various activation experiments at the High Intensity Photon Setup of the TU Darmstadt [3,4].

For the first time, photoactivation experiments on s-process branching point nuclei were performed at the High Intensity γ-Ray Source of the Duke FEL Laboratory. Naturally composed Cerium targets have been irradiated to investigate the branching point nucleus ^{141}Ce. The experimental method is presented and preliminary results are discussed.

* supported by the DFG (SFB 634)

[1] A. J. Koning *et al.* AIP Conf. Proc. **769**, (2005) 1154
[2] T. Rauscher *et al.*, At. Data Nucl. Data Tab. **88**, (2004) 1
[3] J. Hasper *et al.*, Phys. Rev. C **77** (2008) 015803
[4] K. Sonnabend *et al.*, Astroph. J. **583** (2003) 506

HK 60.7 We 18:30 H-ZO 60

Properties of the first $1/2^+$ state in ^{9}Be from electron scattering and astrophysical implications* — •Oleksiy Burda, Peter von Neumann-Cosel, and Achim Richter — Institut für Kernphysik,

Technische Universität Darmstadt, Germany

The low-energy level structure of the ^{9}Be nucleus has long been a matter of interest, in particular with respect to the strength of three-body $\alpha + \alpha + n$ cluster configurations. This nucleus has the lowest neutron threshold (S_n = 1.6654 MeV) of all stable nuclei. Already the first excited $J^\pi = 1/2^+$ state lies at an excitation energy of several tens of keV above the ^{8}Be + n threshold. Parameters of this resonance are of great astrophysical importance since it is believed to provide an important route for the production of carbon and subsequently heavier nuclei triggering the r-process in core-collapse supernovae. Due to its closeness to the neutron threshold the resonance has a strongly asymmetric line shape but despite a large number of different experiments there still exist discrepancies between the various deduced resonance parameters [1]. We present high-resolution inelastic electron scattering experiments on ^{9}Be performed at the S-DALINAC. The resonance parameters of the first excited $1/2^+$ state in ^{9}Be are derived in a one-level R-matrix approximation from the present and older (e, e') data [2]. The astrophysically relevant $\alpha(\alpha n, \gamma)^9$Be reaction rate is extracted and discussed.

[1] F. C. Barker, Aust. J. Phys. 53 (2000) 247.
[2] G. Kuechler *et al.*, Z. Phys. A 326 (1987) 447.

*Supported by the DFG through SFB 634.

HK 61: Fundamental Symmetries

Time: Wednesday 16:30–18:45 Location: H-ZO 70

Group Report HK 61.1 We 16:30 H-ZO 70

TRIμP facility for the study of fundamental interaction and symmetries — P.D. Shidling, G.S. Giri, K. Jungmann, W.L. Kruithof, M. Sohani, D.J. van der Hoek, O.O. Versolato, L. Willmann, and •H.W. Wilschut — KVI, University of Groningen, The Netherlands

Rare and short lived radioactive isotopes provide unique possibility for the study of fundamental interaction and symmetries. At TRIμP different radioactive isotopes are produced in inverse kinematics mode. Dual magnetic separator is used for separating fast radioactive isotopes of interest from the primary beam. For example, ^{21}Na are produced with a yield of 10^4/s/pnA(of primary beam) in the ^{20}Ne (^{2}H, n)^{21}Na reaction. Produced fast radioactive isotopes are converted into low energy ion beams in thermal ionizer. This allows one to collect efficiently and transport the ions into magneto-Optical Trap (MOT) and ions are neutralized in MOT chamber. We will measure β-ν energy and angular correlation measurement in β decay for ^{21}Na. From this measurement, deviation from the weak interaction (V-A type) can be studied. One of the other measurements which are of our particular interest is search of permanent electric dipole moment, and to improve the value for parity non conservation in Ra. Different radium isotopes have been produced in inverse kinematics. ^{213}Ra has been produced with a typical yield of 10^3 /s/pnA (Pb beam) in ^{206}Pb (^{12}C, 5n) ^{213}Ra reaction. A procedure to trap Ra effectively has been successfully developed by the first time trapping of Ba. Details on the facility and new technological approaches for several units of the TRIμP facility will be presented.

HK 61.2 We 17:00 H-ZO 70

Wigner and Serber symmetries for Nucleon-Nucleon Interactions and the large N_c limit. — •Alvaro Calle Cordon and Enrique Ruiz Arriola — Universidad de Granada, Granada, Spain

Wigner symmetry in nuclear physics provides a unique example of a non-perturbative long distance symmetry, a symmetry strongly broken at short distances. We analyse the consequences of such a concept within the framework of One Boson Exchange Potentials in NN scattering and keeping the leading N_c contributions. Phenomenologically successful relations between singlet $^1S_0$ and triplet $^3S_1$ scattering phase shifts are provided in the entire elastic region. We establish symmetry breaking relations among non-central phase shifts which are successfully fulfilled by even-L partial waves and strongly violated by odd-L partial waves, in full agreement with large N_c requirements. The Serber force has relative orbital parity symmetry and requires the vanishing NN interactions in partial waves with odd angular momentum. We illustrate how is well fulfilled for spin triplet states and violated for even singlet states. We show that interpreted as a long distance symmetry this feature can be made plausible from a large N_c perspective. A prerequisite for this is the identity of the scalar and vector meson resonance masses. While these masses arise as poles on the Second Riemann in $\pi\pi$ scattering, we find that within the large N_c expansion the corresponding Yukawa masses correspond instead to their location as Breit-Wigner resonances.

HK 61.3 We 17:15 H-ZO 70

Bau und Test eines ^3He-Magnetometer — •Kai Lenz — Institut für Physik, Mainz, Deutschland

Die mögliche Existenz eines Elektrischen Dipol Moments (EDM) des Neutrons wäre ein direkter Beweis für eine flavourerhaltende CP-Verletzung. Ziel der $n2EDM$ Kollaboration ist es, die Messempfindlichkeit um das sechzigfache gegenüber der bisherigen Obergrenze von $\delta d_n \leq 3 \cdot 10^{-26} e \cdot cm$ [1] zu steigern. Von zentraler Bedeutung ist die Kontrolle kleinster Magnetfeldfluktuationen ($\delta B \approx 1 fT$) während eines Ramsey-Zyklus von ca. 200s. Bisher verwendete Magnetometer haben nur eine Sensitivität von $\delta B \approx 200 fT$ [2]. Bei dem vorgeschlagenen ^3He-Magnetometer handelt es sich um einen flachen zylindrischen Glasbehälter in den polarisiertes ^3He bei einem Druck von ca. 1 mbar eingefüllt wird. Das Signal der zu Präzession angeregten Spins kann mit einem hochempfindlichen SQUID-System gemessen werden. Über die Bestimmung der Frequenz des Präzessionssignals kann man auf das angelegte Magnetfeld zurück schließen Messungen mit dem Prototyp an der PTB in Berlin zeigten, dass sich Spin-Präzessionzeiten von 2000s realisieren lassen bei einem Signal-zu-Rausch Verhältniss von $\geq 1000 : 1$. Im Vortrag werden die Testmessungen vorgestellt und die erreichten Empfindlichkeiten diskutiert.

[1] P.G. Harris, C.A. Baker, K. Green, et al., Phys. Rev. Lett. 82(1999), 904
[2] K. Green, P.G. Harris, P. Iaydjiev , et al., Nucl. Instr. and Meth. A 404(1998), 381

HK 61.4 We 17:30 H-ZO 70

Measurement of the cross section $e^+e^- \to \pi^+\pi^-\pi^0\pi^0$ via Radiative Return at BaBar — •Andreas Hafner, Miriam Fritsch, and Achim Denig — Universität Mainz

We present a measurement of the cross section of the exclusive hadronic reaction $e^+e^- \to \pi^+\pi^-\pi^0\pi^0$ with the Babar detector at PEP-II, an e+e- collider running at the fixed CMS energy of 10.6 GeV. Events with photon emission in the initial state (ISR) are used, lowering the effective CMS energy of the hadronic system and allowing for a measurement of the entire energy range < 4.5 GeV (so-called Radiative Return). The preliminary precision of the measurement has a systematic uncertainty of ca. 8% and will be further reduced in near future. The measurement is also interesting from the hadron spectroscopy point-of-view, we see a dominance of the $\omega\pi^0$ and $a1(1260)\pi$ intermediate states and we can extract for the first time the branching ratio of the $J/\Psi \to \pi^+\pi^-\pi^0\pi^0$ decay. Cross section measurements of this kind are needed as input for a precise theoretical prediction of the anomalous magnetic moment of the muon. A comparison of the theory prediction with the direct measurement of the muon anomaly allows a unique precision test of the Standard Model of particle physics.

HK 61.5 We 17:45 H-ZO 70

Investigations of the Charge Symmetry conserving break-up reaction dd $\to$ ^{3}Henπ^0 **with WASA-at-COSY** — •Pawel Podkopal for the WASA-at-COSY-Collaboration — Nuclear Physics Division, Jagiellonian University, Cracow

One of the primary objectives of the experimental program with the WASA at COSY detector is the determination of p-wave contribution to the Charge Symmetry breaking amplitude in the reaction dd $\to \alpha\pi^\circ$ at 1.2 GeV/c beam momentum. As a first step the Charge Symmetry conserving break-up reaction dd $\to$ ^{3}Henπ^0 was measured to provide missing parameters for the theoretical analysis in the framework of Chiral Pertubation Theory. For example, the reaction can be used to gain information on the deuteron-deuteron initial state interaction for s- and p-wave pion production as necessary input for the theoretical description of the CSB reaction. Moreover, total as well as differential

cross sections will serve as a testing ground for the calculation of the Charge Symmetry conserving channel.

The status of the analysis of data collected at the end of 2007 will be presented.

* Supported by FZ Jülich, EU FP6, BMBF, and Wallenberg Foundation.

HK 61.6 We 18:00 H-ZO 70

The Charge Symmetry Breaking in $dd \to \alpha\pi^\circ$ reaction with WASA-at-COSY — •Tytus Smolinski for the WASA-at-COSY-Collaboration — Institut für Kernphysik and Jülich Center for Hadron Physics, Forschungszentrum Jülich, Jülich

The $dd \to \alpha\pi^\circ$ reaction violates isospin and - in particular also charge-symmetry (CS).On the quark level, these symmetries are broken due to the quark mass differences and electromagnetic interaction. Therefore, an experimental determination of the value of the total cross section for the $dd \to \alpha\pi^\circ$ process, which constitutes a direct measure of the charge symmetry breaking (CSB), provides an opportunity for studies of the quark masses.

Based on existing data close to threshold a consistent description of CSB effects in the framework of Chiral Pertubation Theory is currently being developed. As a first result this analysis will provide a prediction of the p-wave contribution at higher energies. In order to verify this prediction a dedicated experimental program is underway using the WASA-at-COSY facility. In June/July 2008 a first experimental run was successfully completed. In the talk a status of the on-going data analysis will be presented.

* Supported by FZ Jülich, EU FP6, BMBF, and Wallenberg Foundation.

HK 61.7 We 18:15 H-ZO 70

A new measurement of the electric dipole moment of 129-Xe — Peter Fierlinger[1], •Florian Kuchler[1], Klaus Kirch[2], Ralph DeVoe[3], Marlon Horras[2], and Gerd Petzold[2] — [1]TU München / Excellence-Cluster 'Universe', Garching, Germany — [2]Paul Scherrer Institut, Schweiz — [3]Stanford University, USA

Since the 1950's people search for electric dipole moments (EDM) of fundamental systems, an unambiguous manifestation of parity (P) and time reversal (T) symmetry violation. Although the Standard Model (SM) predicts very small values for EDMs, extentions of the SM (eg. Supersymmetry) require large EDMs, which are within the reach of next generation experiments. Besides the neutron as the most prominent example of an EDM search, diamagnetic atoms like 199-Hg set strong limits d_Hg $<$ 2.1E-28 ecm. We present a novel approach to measure the EDM of the diamagnetic atom 129-Xe by a novel method, based on liquid hyper-polarized 129-Xe droplets condensed in a microfabricated structure. Due to the large density of the liquid, the size of the experiment can be minimized. This enables a conceptually new stratey to measure an EDM by applying rotating electric fields in the spin-precession plane. This method, where the EDM and the Larmor-precession are independent effects, can be used in addition to the 'conventional' Ramsey technique. Due to the small size also stability and gradients of the magnetic field can be controlled on an unprecedented level, using low-temperature SQUID magnetometry. Systematic effects, in particular motional effects, are controlled by performing an array of experiments in parallel on the same chip with different conditions.

HK 61.8 We 18:30 H-ZO 70

Feasibility studies for the measurement of $\eta' \to \pi^+\pi^-\pi^0$ decays in pp interactions — •Marcin J. Zielinski for the WASA-at-COSY-Collaboration — Institut für Kernphysik and Jülich Center for Hadron Physics, 52425 Jülich, Germany — Institut of Physics, Jagiellonian University, 30-059 Cracow, Poland

One of the objectives of the physics programme with the recently commissioned WASA-at- COSY facility is the study of fundamental symmetries via the measurement of η and η' meson decays. Of particular interest are isospin-violating hadronic decays into 3π systems. These are driven by a term of the QCD Lagrangian that depends on the $u-d$ quark mass difference. At COSY-Jülich the η and η' mesons can be produced with sizable cross sections in pp interactions. However, in such hadronic reactions the signal from the decays may be obscured by prompt meson production. In this presentation we will estimate the upper limit of the background from prompt pion production to the $\eta' \to 3\pi^0$ and $\eta' \to \pi^+\pi^-\pi^0$ decays. Using pp data from the COSY-11 experiment we have deduced differential cross sections for multi-meson production with an invariant mass in the vicinity of the η' meson. We obtain parameterisations of the total η' production cross section as well as of the prompt $\pi^+\pi^-\pi^0$ production. We discuss in detail the feasibility of the planned WASA-at-COSY measurements on η' decays into $\pi^+\pi^-\pi^0$.

HK 62: Accelerators and Instrumentation I

Time: Wednesday 16:30–19:00 Location: H-ZO 80

Group Report HK 62.1 We 16:30 H-ZO 80

Installation and commissioning of the Kaos spectrometer at MAMI — •Patrick Achenbach for the A1-Collaboration — Institut für Kernphysik, Joh. Gutenberg-Universität, Mainz

At the Institut für Kernphysik in Mainz, Germany, the microtron MAMI has been upgraded to 1.5 GeV electron beam energy and can now be used to study strange hadronic systems. In recent years the compact magnetic spectrometer Kaos was installed in the existing spectrometer facility operated by the A1 collaboration. Kaos is especially suitable for the detection of kaons. Since September 2008 measurements of kaon production on hydrogen have been successfully performed. The identification of Λ and Σ^0 hyperons in the missing mass has demonstrated the capability of the extended facility to perform strangeness electro-production spectroscopy. Kaons in the angular range of 21-43° and momentum range of 400-600 MeV/c were detected with a survival probability of around 10% and identified by their time-of-flight. In 2009, the Kaos spectrometer will cover simultaneously electron scattering angles close to 0° and kaon scattering angles around 5° up to 15° in order to extract dynamical information from the K^+ angular distribution.

Group Report HK 62.2 We 17:00 H-ZO 80

Performance of the CBELSA/TAPS Experiment — •Christoph Wendel for the CBELSA/TAPS-Collaboration — Helmholtz-Institut für Strahlen- und Kernphysik, Universität Bonn

To perform double polarisation experiments at the electron accelerator ELSA in Bonn (aiming at a good understanding of the hadron spectrum), the experimental setup of the Crystal-Barrel-Experiment was subject to several modifications.

They include the relocation to a different experimental hall, a longitudinal polarised target, a new photon tagging system, the refurbishment of the 30° forward angle of the Crystal-Barrels CsI(Tl) calorimeter, a modular gas/aerogel Cerenkov detector and modifications to the TAPS BaF_2 calorimeter wall.

The talk will cover these modifications and extensions of the setup and discuss the performance of the experiment.

Supported by the DFG (SFB/TR 16)

HK 62.3 We 17:30 H-ZO 80

A Sampling ADC readout for the Crystal Barrel calorimeter at ELSA — •Steffen Schaepe for the CBELSA/TAPS-Collaboration — Helmholtz - Institut für Strahlen- und Kernphysik, Nußallee 14-16, 53115 Bonn, Germany

The CBELSA/TAPS experiment is a photoproduction experiment specialized for hadron spectroscopy investigating reactions with multi photon final states. Its central component is the Crystal Barrel calorimeter with a nearly 4π coverage. With its 1320 CsI(Tl) crystals it offers excellent detection capabilities and good energy resolution. Due to the scintillating characteristics of CsI(Tl) and electronic hardware designed for best energy resolution it does not offer any timing or fast triggering capabilities for most of the 4π solid angle yet.

In an upgrade scheduled for the near future it is planned to add these features to the experiment. Therefore sensors and/or readout of the crystals are to be exchanged. It is studied how the use of fast sampling ADCs with feature extraction could improve the readout in terms of timing and pulse shape analysis without degrading the current per-

formance in energy resolution, either with existing signal processing electronics or with new hardware.
This work is supported by DFG (SFB/TR16).

HK 62.4 We 17:45 H-ZO 80

Status of the endpoint tagger at the CB experiment — •Leyla Akasoy for the A2-Collaboration — Institut für Kernphysik, Mainz

The A2 Collaboration at the Mainz Microtron makes experiments with real photons using the Glasgow-Mainz tagged photon facility. The usable energies of tagged photons are restricted to up to 1.4 MeV at 1.508 MeV electron beam energy. Since some yet only scarcely investigated resonances lie very closely above this upper energy limit it is planned to increase it by building a second tagging facility for high energy photons.

Status and outlook for this project shall be discussed in this talk.

HK 62.5 We 18:00 H-ZO 80

Drift Chamber Tests for the B1-Spektrometer at ELSA* — •Daniel Hammann for the CBELSA/TAPS-Collaboration — Physikalisches Institut, Bonn

At the Bonn electron accelerator ELSA photoproduction of mesons is studied at energies up to $E_\gamma = 3.5$ GeV. Presently, a new experimental setup is beeing installed. To detect mixed charged final states, the BGO-Ball of the former GRAAL-Experiment is combined with an open magnetic spectrometer in forward direction. The spectrometer utilizes scintillating fibers for tracking in front of the magnet and large drift chambers behind the magnet. A prototype drift chamber has been tested for efficiency and position resolution. Testing of the full size chambers has started. Test results shall be presented.

* supported by DFG SFB/TR16.

HK 62.6 We 18:15 H-ZO 80

Polarimetry in Meson Photoproduction Reactions at MAMI — •Mark Sikora, Dan Watts, and Derek Glazier — University of Edinburgh, Edinburgh, UK

Accurately establishing the spectrum and properties of the excited states of the nucleon has proven to be elusive. Many states have poorly established properties and many resonances predicted by theoretical models of nucleon structure do not reveal themselves in the current experimental data. This could be because the data is not sensitive to these resonances or because the states do not exist.

Most attempts to address this situation utilise meson photoproduction from the nucleon. Such reactions can be described by 4 complex helicity amplitudes which include all the information on the process, including the excitation spectrum. Consequently, there are 16 experimental observables, of which 8 must be determined to fully constrain the amplitudes. This has led to major programmes of measurements exploiting polarised photon beams and polarised targets at the major electromagnetic beam facilities such as ELSA, JLAB and MAMI. However, the goal of a complete measurement cannot be achieved without measurements including recoil nucleon polarisation. With this aim the Edinburgh group has developed a novel design for a large aceptance recoil nucleon polarimeter for use in meson photoproduction reactions with the Glasgow/Mainz polarised photon beam and the Crystal Ball at MAMI. Preliminary measurements of double-polarisation observables in neutral pion photoproduction will be presented and compared with the various current partial wave analyses of the reaction.

HK 62.7 We 18:30 H-ZO 80

Detector system for spin-filtering experiments — •Christian Weidemann — Institut für Kernphysik (IKP) and Jülich Center for Hadron Physics (JCHP), Forschungszentrum Jülich

The spin-filtering experiments at COSY and AD-CERN within the framework of the **P**olarized **A**ntiproton E**X**periments (PAX) want to clarify the polarization build-up of an initially unpolarized stored proton (antiproton) beam by multiple passage through a polarized gas target.

One necessity is the determination of the polarizations of beam and target. While the target polarization could be determined with a Breit-Rabi Polarimeter, a system for beam polarization measurements based on the silicon recoil detectors of the HERMES-Experiment is under development. 8 modules from HERMES together with 8 already ordered PAX TTT silicon microstrip detectors from Micron Technology will form the PAX detector system for spin-filtering experiments. One module (Demetrius) consisting of 2 double-sided detectors with an active area of 97,3 mm× 97,3 mm and 128+128 strips has been equipped with new UHV-compatible readout electronics. Further preparations for detector tests including a specially designed coolable support and a test bench were finished.

The status of the detector system for spin-filtering experiments and the results of first detector tests will be presented.

HK 62.8 We 18:45 H-ZO 80

Eine neue externe Strahlführung für Detektortests an ELSA — •Stefan Patzelt — Elektronen-Stretcher-Anlage ELSA, Physikalisches Institut, Universität Bonn

An der Elektronenbeschleuniger-Anlage ELSA wird zurzeit neben der bereits bestehenden externen Strahlführung für Mittelenergieexperimente eine weitere für Detektortests entwickelt und aufgebaut.

Primäres Ziel dieser neuen Strahlführung ist es, die Strahlparameter wie Strahlstrom und -breite über einen großen Bereich variieren zu können. Die im Speicherring mit einer maximalen Energie von 3,5 GeV umlaufenden Elektronen werden mittels Arbeitspunktverschiebung auf eine drittelzahlige Resonanz langsam extrahiert, sodass dem Testplatz ein externer Strahlstrom von 1 - 100 pA zur Verfügung gestellt werden kann. Mit Fertigstellung des Einzelpulsbetriebs kann der Strahlstrom nochmals signifikant verringert werden. Wesentlicher Vorteil ist die variable Dimensionierung der Strahlbreite, die von 1,5 mm bis zu 20 mm beliebig verändert werden kann. Aufgrund des hohen Tastverhältnisses von über 95% wird dem Testplatz während nahezu der gesamten Testzeit ein Strahl mit gleichbleibenden Eigenschaften bereitgestellt.

Der Vortrag gibt einen Überblick über die Simulation der Parameter der Strahlführung mit MAD-X und greift die wesentlichen Punkte wie Konzeption, Strahldiagnose und Strahlenschutz in Rahmen der räumlichen Gegebenheiten der Anlage auf.

HK 63: Accelerators and Instrumentation II

Time: Wednesday 16:30–19:00 Location: H-ZO 90

Group Report HK 63.1 We 16:30 H-ZO 90

Status of the development at the S-DALINAC* — •Tobias Weilbach[1], Asim Araz[1], Wolfgang Ackermann[2], Uwe Bonnes[1], Jens Conrad[1], Ralf Eichhorn[1], Sylvain Franke[1], Joel Fuerst[3], Michael Hertling[1], Florian Hug[1], Christian Klose[1], Peter Kneisel[4], Martin Konrad[1], Thorsten Kürzeder[1], Clemens Liebig[1], Wolfgang F. O. Müller[2], Norbert Pietralla[1], Markus Platz[1], Achim Richter[1], Christian Röder[1], Felix Schlander[1], Sven Sievers[1], Bastian Steiner[2], and Thomas Weiland[2] — [1]Institut für Kernphysik, TU Darmstadt — [2]Institut für Theorie Elektromagnetischer Felder, TU Darmstadt — [3]Argonne National Laboratory, Argonne — [4]Jefferson Laboratory, Newport News

The superconducting electron accelerator S-DALINAC delivers a beam with a maximum energy of 130 MeV and beam currents up to 60 μA which is used for experiments in nuclear and astrophysics. In this talk an overview of the actual status and the latest upgrades is given.

To increase the injector energy up to 14 MeV and the current up to 150 μA new cavities and couplers for rf power up to 2 kW have been built and a new cryostat module has been designed.

To decrease the energy spread of the beam a non-isochronous recirculating scheme is planned and first results of the simulations are presented.

In order to reach the design Q factor one of our cavities was sent to Jlab for preparation and measuring of the maximum reachable Q value after a standard CEBAF treatment.

*Supported by DFG through SFB 634

Group Report HK 63.2 We 17:00 H-ZO 90

The new position sensitive triple cluster detector for AGATA — •P. Reiter[1], B. Birkenbach[1], B. Bruyneel[1], J. Eberth[1], H. Hess[1], D. Lersch[1], G. Pascovici[1], A. Wiens[1], and H.G. Thomas[2] for the AGATA-Collaboration — [1]IKP, University Cologne — [2]CTT,

Montabaur

The Advanced Gamma Tracking Array will be based on the novel principle of γ-ray tracking and will be built from encapsulated, 36-fold segmented HPGe detectors. Equipped with fully digital electronics, AGATA will provide an optimal energy resolution and a very high efficiency combined with a position sensitivity of a few millimetres. In its final configuration AGATA will consist of 60 detectors and the first triple cluster detectors are successfully assembled. All 111 energy channels are equipped with cold FETs for enhanced energy resolution. The energy range was extended up to 200 MeV by applying a time over threshold technique with new preamplifiers. Energy resolution for high energetic γ-rays above 8 MeV is measured to be comparable with values obtained with the standard technique. A very low cross talk level was determined which compares well with the expected calculated contributions. The results of a new correction method to eliminate the influence of cross talk will be presented. The scanning results of AGATA crystals are reproduced by pulse shape simulations based on Ge crystal properties, electric field distributions and charge carrier mobility. The first triple cluster detectors are operated at INFN Legnaro and IKP Cologne for commissioning of the demonstrator sub-array. Supported by the German BMBF(06 KY205I)

HK 63.3 We 17:30 H-ZO 90

Recent developments for the future Penning trap mass spectrometer MATS — •Daniel Rodríguez[1], Klaus Blaum[2], Stefan Stahl[3], and Marta Ubieto-Diaz[2] for the MATS-Collaboration — [1]University of Huelva, Avda. de las Fuerzas Armadas s/n 21071 Huelva, Spain — [2]Max-Planck-Institute for Nuclear Physics, 69029 Heidelberg, Germany — [3]Stahl-Electronics, Kellerweg 23, 67582 Mettenheim, Germany

The applications of very precise mass measurements (δm/m $\leq 10^{-8}$) on exotic short-lived nuclei have opened up an attractive research realm which will be present also at the future international facility FAIR (Facility for Antiprotons and Ion Research) with MATS. The MATS Penning trap facility comprises several key elements: a Radio Frequency Quadrupole (RFQ) buncher for beam preparation, an Electron Beam Ion Trap (EBIT) for charge breeding, and two Penning trap systems, one for preparation and spectroscopy and one for mass measurements. The conceptual design of these elements is almost ready. One feature of the MATS facility will be the manipulation of highly charged ions and the monitoring of their cooling process using a novel cryogenic broadband Fourier Transform-Ion Cyclotron Resonance (FT-ICR) detection system. A prototype of this system is currently under commissioning at the Max-Planck-Institute for Nuclear Physics in Heidelberg. It will be used at first in the beam line of the Karlsruhe Tritium Neutrino experiment (KATRIN). In this contribution the layout of the MATS facility will be presented underlining the recent highlights obtained with this novel FT-ICR system.

HK 63.4 We 17:45 H-ZO 90

Photon Tagger NEPTUN* — •L. Schnorrenberger[1], M. Elvers[2], J. Endres[2], J. Glorius[1], J. Hasper[2], K. Lindenberg[1], N. Pietralla[1], D. Savran[1], V. Simon[1], K. Sonnabend[1], C. Wälzlein[1], and A. Zilges[2] — [1]Institut für Kernphysik, TU Darmstadt, Germany — [2]Institut für Kernphysik, Universität zu Köln, Germany

For various experiments in nuclear physics and astrophysics as well as for technical applications, monoenergetic photon beams are demanded. The low energy photon tagger NEPTUN at the Superconducting DArmstadt electron LInear ACcelerator S-DALINAC can provide tagged photon beams in the energy range from 6 MeV to 20 MeV at a resolution of 25 keV at 10 MeV.
Photons are produced by relativistic electrons impinging on a thin radiator target. The energy of the scattered electrons is analysed by a magnetic spectrometer. Knowing the difference in energy between the primary beam and the scattered electrons, the energy of each corresponding photon can be determined [1,2].
Recent experiments have shown that a mean resolution of about 35 keV can be obtained for energies between 2 MeV and 12 MeV. Ongoing further improvements on the electron beam will lead to an even better resolution. The analysis of first (γ,γ ') experiments is in progress.
* supported by the DFG under contract SFB 634
[1] M. Elvers *et al.*, J. Phys. G **35** (2008) 014027.
[2] K. Lindenberg, PhD Thesis, TU Darmstadt, 2008.

HK 63.5 We 18:00 H-ZO 90

Production of scintillation fiber combinations for the NEPTUN photon tagger * — •Cathrin Wälzlein[1], Janis Endres[2], Jan Glorius[1], Norbert Pietralla[1], Deniz Savran[1], Linda Schnorrenberger[1], Kerstin Sonnabend[1], and Andreas Zilges[2] — [1]Institut für Kernphysik, Technische Universität Darmstadt — [2]Institut für Kernphysik, Universität zu Köln

At the S-DALINAC, the low-energy photon tagger NEPTUN has been constructed. An array of thin scintillation fibers is used to detect scattered electrons in the focal plane of the spectrometer. These fibers are connected to light guides to transmit the scintillation light to photomultiplier tubes. Connection methods were improved to reduce losses at the coupling areas. Additionally, the light yield is increased by using combinations of two scintillation fibers. A detection efficiency of nearly 100% is achieved. A report on the production process of the fibers and on their performance tests will be given.

* supported by the DFG (SFB 634)

HK 63.6 We 18:15 H-ZO 90

Development and construction of a detector array for (γ,n) experiments at NEPTUN* — •Vanessa Simon, Bastian Loeher, Norbert Pietralla, Linda Schnorrenberger, Deniz Savran, and Kerstin Sonnabend — Institut für Kernphysik, Technische Universität Darmstadt, Germany

The low-energy photon tagger NEPTUN [1] has been built at the superconducting electron accelerator S-DALINAC at TU Darmstadt. This spectrometer generates a tagged photon beam in an energy range between 6 MeV $< E_\gamma <$ 20 MeV.

For (γ,n) experiments a neutron detector array will be designed in a 4π-geometry consisting of 17 detectors. Each detector contains liquid scintillators so that pulse shape discrimination methods can be applied. Four of the detectors are in addition loaded with 5% ^{10}B to further discriminate between neutrons and photons via the capture reaction $^{10}\mathrm{B}(n,\alpha)^7\mathrm{Li}$. The special conditions, as well as initial developments and construction work is shown. Furthermore, first experiments and efficiency measurements are presented.

* supported by the DFG (SFB 634)

[1] K. Lindenberg, PhD Thesis, TU Darmstadt, 2008.

HK 63.7 We 18:30 H-ZO 90

Determination of pulse shape starting time using neural networks — •Michael Schlarb, Roman Gernhäuser, and Reiner Krücken — Physik-Department E12, TU München

The Advanced Gamma Tracking Array (AGATA) which is currently being built, is a 4 π- detector of highly-segmented germanium crystals. For the purpose of a full reconstruction of the interaction locations within the detector a pulse shape analyis is performed, using a direct comparison between experimental and simulated signal. A prerequisite to achieve the necessary position resolution is a precise knowledge of the signals starting time t_0. It is preferable to have t_0 determined before the actual pulse shape analysis is conducted since it significantly simplifies the task of the latter. The influence an imprecise knowledge of t_0 has on the attainable position resolution is presented. Furthermore we investigated the use of neural networks to properly determine the starting time and generally achieved good results.
* funded by BMBF(06MT238),EURONS(T-J02-3), DFG (Exz-Clust 153-Universe)

HK 63.8 We 18:45 H-ZO 90

Analysis of the polarization sensitivity of the DAGATA polarimeter — •Babak Alikhani[1], Philpp Rudolf John[1,2], Jörg Leske[1], Oliver Möller[1], and Norbert Pietralla[1] — [1]Technische Universität Darmstadt TUD,Germany — [2]Middle East Technical University METU, Ankara, Turkey

Besides the energy and the spin of an excited nuclear state the determination of its parity is of crucial importance for instance for the interpretation of results from Nuclear Resonance Fluorescence experiments (NRF). For this purpose the sensitivity of the Compton Effect is used to measure the linear polarization of emitted photons. In comparison to standard Compton Polarimeters the DAGATA (Darmstadt GAmma-ray Tracking Assembly) polarimeter will significantly enhance the sensitivity for gamma rays above 4 MeV making use of its large volume 36-fold segmented HPGe AGATA crystal and the resulting superior position resolution. Results from Monte Carlo Simulations will be presented as well as approaches for data analysis to further improve the sensitivity. Application limits and realistic simulated spectra will be compared to results from existing polarimeters.

HK 64: Nuclear Physics Applications

Time: Wednesday 16:30–18:15 Location: H-ZO 100

Group Report HK 64.1 We 16:30 H-ZO 100

Cubic boron nitride- a new material for ultracold neutron application — •Thorsten Lauer[1], Yury Sobolev[2], Yury Borisov[3], Manfred Daum[4], Nicolas du Fresne[2], Leonard Göltl[8], Gabriele Hampel[1], Werner Heil[2], Andreas Knecht[4,5], Martin Keunecke[6], Jens Volker Kratz[1], Thomas Lang[2], Michael Meister[2], Christian Plonka Spehr[1], Yuri Pokotylovski[7], Peter Reichert[1], Ullrich Schmidt[8], Thomas Krist[9], Norbert Wiehl[1], and Johannes Zennere[2] — [1]Institut für Kernchemie, Universität Mainz — [2]Institut für Physik, Universität Mainz — [3]PNPI Gatchina, Russland — [4]PSI, Paul Scherrer Institut, Villigen, Schweiz — [5]Universität Zürich, Schweiz — [6]Frauenhofer Institut IST, Braunschweig — [7]JINR, Dubna, Russland — [8]Physikalisches Institut, Universität Heidelberg — [9]Hahn Meitner Institut, Berlin

For the first time, the Fermi potential of cubic boron nitride (cBN) was measured at the ultra cold neutron source at the TRIGA reactor, Mainz using the time of flight method (TOF). The investigated samples have a Fermi potential of about 300 neV. Because of its good dielectric characteristics, cubic boron nitride could be used as suitable coating for insulator in storage chambers of future EDM projects. This talk will present recent results and an outlook on further investigations.

Group Report HK 64.2 We 17:00 H-ZO 100

Production and performance of ultracold neutron guides for the next generation UCN sources — •Peter Reichert[1], Michael Meister[2], Gabriele Hampel[1], Werner Heil[2], Jens Volker Kratz[1], Thorsten Lauer[1], Christian Plonka[1], Yury Sobolev[2], and Johannes Zenner[2] — [1]Institut für Kernchemie, Universität Mainz — [2]Institut für Physik, Universität Mainz

Recently, a new coating facility for the production of ultracold neutron guides started its operation at the Physics Institute University Mainz. With the use of magnetron sputtering it is possible to coat inner surfaces of glass tubes with diameters down to 50mm and a maximal length of 1.5m. By optimizing the coating parameters and due to the low surface roughness we expect higher transmission of ultracold neutrons compared to the so far existing polished stainless steel tubes. This talk will give an overview about the facility, its possibilities and first results of transmission measurements performed at the Ultracold Neutron facility at the TRIGA Mainz.

HK 64.3 We 17:30 H-ZO 100

Comparison of solid hydrogen and solid deuterium as UCN converter with the TOF method — •Yury Sobolev[1], Thorsten Lauer[2], Gabriele Hampel[2], Werner Heil[1], Jens Volker Kratz[2], Christian Plonka Spehr[2], and Johannes Zenner[1] — [1]Institut für Physik, Universität Mainz — [2]Institut für Kernchemie, Universität Mainz

At the reactor TRIGA, Mainz the working principle of a superthermal Ultracold Neutron Source based on solid deuterium was succesfully demonstrated in 2006. Besides deuterium, other converter materials like methane and oxygen has been investigated all over the world. This talk will present recent time- of- flight measurements using a superthermal UCN source based on solid hydrogen and give ideas for further developments of UCN sources at high flux reactors.

HK 64.4 We 17:45 H-ZO 100

Systematic study of EC decays in the ^{146}Gd region relevant for a Monoenergetic Neutrino Beam Facility — •Maria Esther Estevez Aguado[1], Alejandro Algora[1], Berta Rubio[1], Jose Bernabeu[1], Enrique Nacher[1], Jose Luis Tain[1], Andres Gadea[1], Daniel Cano[2], Karlheinz Burkard[3], Joachim Doering[3], Michal Gierlik[3], Wilfried Hueller[3], Reinhard Kirchner[3], Ivan Mukha[3], Cristina Plettner[3], Ernest Roeckl[3], Jose Javier Valiente[4], and Leonid Batist[5] — [1]IFIC (CSIC-UV), Valencia, Spain — [2]CIEMAT, Madrid, Spain — [3]GSI, Darmstadt, Germany — [4]INFN, Legnaro (Padova) Italy — [5]PNPI, Gatchina, Russia

The availability of a monochromatic neutrino source with adjustable energy could be an invaluable tool for the study of Charge-Parity (CP) violation in the leptonic sector in the frame of the Electroweak Theory of the Standard Model. It has been proposed [1] to use as a neutrino source nuclei that decay by means of the electron capture (EC) process inside a storage ring. A systematic study of candidate nuclei in the ^{146}Gd region has been carried out.

In this contribution we show the results of the experimental study of the beta decay of two possible candidate nuclei (^{152}Yb and ^{150}Er) using the Total Absortion Gamma Spectroscopy (TAGS) technique. A comparison of these results with earlier high resolution measurements will be discussed.

[1] J. Bernabeu *et al*, JHEP12 (Dec.2005) 014.

HK 64.5 We 18:00 H-ZO 100

Control techniques for complex detectors based on digitized pulse shape analysis — Mohammad Babai[1], Muhsin Harakeh[1], Nasser Kalantar[1], Pim Lubberdink[1], Catherine Rigollet[1], Peter Schakel[1], Haik Simon[2], •Victor Stoica[1], Matjaž Vencelj[3], and Heinrich Wörtche[1] — [1]Kernfysisch Versneller Instituut, Groningen, The Netherlands — [2]Gesellschaft für Schwerionenforschung, Darmstadt, Germany — [3]Jožef Stefan Institute, Lubljana, Slovenia

In the framework of the NUSTAR project at FAIR we have to develop controls systems which integrate automated calibration, optimization and adaptive stabilization consisting basically of the characteristics of intelligent sensors and cognitive systems. In the controls concept for the NUSTAR experiments we investigate the condition of the hardware structure, the initialization and monitoring of the system also the optimization and calibration of the detectors. Based on the digitized detector signal/pulses online feedback will be provided based on our controls techniques which support a strong correlation between signal characteristics and detector settings.

During the talk I will present a status of our present work: basline follower techniques, dynamic threshold determination and first results on self sustained calibration and optimisation loops.

HK 65: Plenary VII

Time: Thursday 9:00–10:30 Location: Audi-Max

Invited Talk HK 65.1 Th 9:00 Audi-Max

Hypernuclear Physics — •Tullio Bressani for the FINUDA-Collaboration — Dipartimento di Fisica Sperimentale Torino, Torino Italy — I.N.F.N., Sezione di Torino, Italy

Hypernuclear Physics, born more than fifty years ago, is experiencing today a strong boost both from the experimental and theoretical sides. This is due mainly to the operation, in the last decade, of powerful detectors that allowed a substantial step forward on many aspects, showing interesting and sometimes unexpected phenomena. In the contribution the latest experimental results will be presented and discussed. For Hypernuclear Spectroscopy they are the good mapping of the level structure of p-shell Hypernuclei by Gamma Ray Spectroscopy, that allowed for the first time the extraction of the parameters of the Lambda-Nucleon interaction and the clear evidence for core excited states by high resolution magnetic spectrometry. For Weak Decays they are the first measurement of the negative pion spectra from mesonic decay and the first high resolution measurement of the proton spectra from non-mesonic decays. This last measurement allowed to confirm the importance of the Lambda-two nucleons weak interactions. This observation is perhaps linked to the observation of the large contribution of multi-nucleon processes in K- absorption at rest by nuclei. An outlook to future facilities will finally be given.

Invited Talk HK 65.2 Th 9:30 Audi-Max

Neutrino Mass and Oscillations — •Christian Weinheimer — Institut für Kernphysik, University of Münster, Germany

Experiments with atmospheric, solar, reactor and accelerator neutrinos

have clearly demonstrated, that neutrinos from one flavor eigenstate can oscillate into another flavor eigenstate on the way from the neutrino source to the detector. Recently, new evidence came from the experiments BOREXINO with solar neutrinos and from MINOS with accelerator neutrinos. The origin of these neutrino oscillations are non-zero neutrino masses and non-trivial neutrino mixings, similar to the quark mixing described by the CKM-matrix. These neutrino properties beyond the Standard Model of particle physics do not play only an important role in nuclear and particle physics (e.g. in differentiation between theories beyond the Standard Model) but also in astrophysics (e.g. in super novae explosions) and cosmology (e.g. in structure formation). Two out of three neutrino mixing angles are determined to be maximum or large, respectively. Currently, one main focus is, whether the third mixing angle θ_{13} is non-zero, which allows CP violation in the lepton sector. The other main focus is the determination of the neutrino mass scale. Since oscillation experiments can only determine differences between squared neutrino masses, this has to be done by direct neutrino mass experiments (KATRIN, MARE) or the search for the neutrinoless double beta decay (e.g. GERDA, CUORE, NEMO). In this talk the recent results from neutrino oscillation experiments and the status of direct neutrino mass and neutrinoless double beta decay experiments will be presented.

Invited Talk HK 65.3 Th 10:00 Audi-Max

The QCD phase diagram from lattice simulations — •Owe Philipsen — Institut für Theoretische Physik, Universität Münster, Germany

The QCD phase diagram tells us the different forms in which nuclear matter exists as a function of temperature and baryon chemical potential, as well as the location of phase transitions between them. Because of the so-called sign problem of lattice QCD, first principles calculations at finite baryon chemical potential are impossible and simulations have to use detours which are valid for small densities only. I review recent simulation results. Because of strong discretization effects, it is not yet possible to draw conclusions for the continuum phase diagram.

HK 66: Plenary VIII

Time: Thursday 11:00–13:00 Location: Audi-Max

Invited Talk HK 66.1 Th 11:00 Audi-Max

Precision experiments with cold and ultracold neutrons — •Klaus Kirch — Paul Scherrer Institut, Villigen PSI, Switzerland

The neutron is a composite particle, but a rather fundamental one. It is the experimentally easiest accessible, electrically neutral spin-1/2 particle. Neutrons take part in all known interactions: They are massive, have magnetic moments, interact strongly and decay weakly. Thermal and cold ("slow") neutrons can be guided to experiments because they are totally reflected from suitable material surfaces under grazing angles of incidence. Critical angles for total reflection depend on neutron velocity. Sufficiently slow neutrons are called ultracold when they are totally reflected under all angles of incidence.

Slow neutrons are particularly useful to test the fundamental interactions and symmetries of nature. They allow for long observation times and are relatively easy to polarize. Most neutron decay correlation studies make use of cold neutron beams which provide large decay statistics and today allow for almost complete neutron polarization. Other experiments, like the measurement of the neutron beta-decay lifetime or the search for an electric dipole moment of the neutron benefit from using stored, ultracold neutrons. Especially in these experiments, considerable progress can be expected due to increasing the available ultracold neutron intensity. To that end, the Paul Scherrer Institut in Switzerland, but also various other projects around the world, aim at providing larger intensities and densities of ultracold neutrons.

Invited Talk HK 66.2 Th 11:30 Audi-Max

Spectroscopy with Belle, BaBar, BES, PANDA. — •Diego Bettoni — INFN, Sezione di Ferrara, Ferrara, Italy

The study of hadron spectroscopy is of fundamental importance for a better, quantitative understanding of QCD. Precision measurements are needed to distinguish between the different theoretical approaches and identify the relevant degrees of freedom. Experimental studies of hadron spectroscopy can be performed in e^+e^- and $\overline{p}p$ annihilations. In e^+e^- direct formation is only possible for states with the quantum numbers of the photon, while all states can be reached by means of other production mechanisms. In $\overline{p}p$ all non-exotic quantum numbers can be formed directly, whereas exotic and non-exotic states can be studied in production. Both experimental techniques have proven very successful. The potential of the e^+e^- experiments is illustrated by the recent discovery by Belle and BaBar of many new states, whose nature is still unclear and for which a conventional interpretation as quark-antiquark bound states as well as more exotic possibilities (hybrids, multiquarks, molecules) are being considered. On the other hand the capability of $\overline{p}p$ experiments to carry out high-precision spectroscopy has been shown by the E760 and E835 experiments at Fermilab and will be exploited by the PANDA experiment at the future FAIR facility in Darmstadt. In this talk we will present an overview of the most significant results achieved by the Belle, BaBar and BES experiments and we will discuss the physics prospects of PANDA.

Invited Talk HK 66.3 Th 12:00 Audi-Max

Density Functionals in Nuclear Structure Physics — •Dario Vretenar — Physics Department, University of Zagreb, Croatia

Among the microscopic approaches to the nuclear many-body problem, energy density functionals (EDF) provide the most complete and accurate description of ground states and collective excitations over the whole nuclide chart. One of the principal objectives of modern nuclear structure theory is to develop a universal EDF framework, in the sense that the same functional is used for all nuclei, with a universal set of parameters determined from low-energy data or, eventually, from two-nucleon and three-nucleon interactions. The current generation of EDFs, with parameters adjusted to empirical properties of nuclear matter and bulk properties of finite nuclei, has achieved a high level of accuracy in the description of ground states and properties of excited states in arbitrarily heavy nuclei, exotic nuclei far from beta-stability, and in systems at the nucleon drip-lines.

In addition to recent advances, future challenges for nuclear EDFs will be discussed. Arguably the most important is a fully microscopic, low-energy QCD-based foundation of the EDF framework. When considering applications, equally important is to develop EDF-based structure models that go beyond the lowest order approximation - the static nuclear mean field. Excitation spectra and transition rates can only be calculated by including dynamical correlations through restoration of broken symmetries, and configuration mixing of symmetry-breaking mean-field states.

Invited Talk HK 66.4 Th 12:30 Audi-Max

Two-proton radioactivity as a tool of nuclear structure — •Bertram Blank — CEN Bordeaux-Gradignan, Chemin du Solarium, F-33175 Gradignan Cedex, France

Two-proton radioactivity is the latest nuclear decay mode discovered. It consists of the emission of a pair of protons from a nuclear ground state.

In pioneering experiments at GANIL and GSI, this new radioactivity was discovered in 2002 [1,2] and meanwhile 45Fe and 54Zn [3] are established 2p emitters, with a possible third nucleus, 48Ni [4]. These results allowed a detailed comparison with the theoretical models.

The latest step in the investigation of 2p radioactivity was the use of time-projection chambers to study the decay dynamics via measurements of the individual proton energies and the relative proton-proton emission angle. A first experiment at GANIL [5] and an experiment performed at MSU [6] allowed to gain first insights into the decay characteristics.

The talk will review the experimental results on ground-state two-proton radioactivity and compare these results with theoretical predictions. Future studies with 2p emitters will be discussed as well.

[1] J. Giovinazzo et al., Phys. Rev. Lett. 89 (2002) 102501
[2] M. Pfützner et al., Eur. Phys. J. A14 (2002) 279
[3] B. Blank et al., Phys. Rev. Lett. 94 (2005) 232501
[4] C. Dossat et al., Phys. Rev. C72 (2005) 054315
[5] J. Giovinazzo et al., Phys. Rev. Lett. 99 (2007) 102501
[6] K. Miernik et al., Phys. Rev. Lett. 99 (2007) 192501

HK 67: Poster Session

Time: Thursday 14:00–16:00 Location: Audi-Max

HK 67.1 Th 14:00 Audi-Max

Spectroscopy of Exotics at PANDA — •Bernhard Roth — Ruhr-Universität Bochum, 44780 Bochum

With the PANDA experiment at the future facility FAIR in Darmstadt $\bar{p}p$ annihilations will be investigated with very high luminosity and highest precision over a wide $\bar{p}$ momentum range of $1.5-15\mathrm{GeV}/c$. One of the main topics of the physics program is the spectroscopy of hadrons including the search for exotic matter. Exotic glue ball states are predicted by QCD based models and lattice QCD calculations. The $f_0(1500)$, observed in $\bar{p}p$ annihilation by the Crystal Barrel Collaboration at LEAR and others, is debated to be an admixture of the glue ball ground state and conventional $\bar{q}q$ states. Motivated by this observation it is believed that gluon rich processes in $\bar{p}p$ annihilation events are a good source for the production of glue balls. In conjunction with the ability of the PANDA detector to reconstruct final states including charged and neutral particles with good coverage of the solid angle, this offers excellent opportunities for the search for glue balls. In particular higher mass states are accessible with PANDA. Here the results of Monte Carlo studies of the production of glue balls in the mass range of $2400-3700\mathrm{MeV}/c^2$ decaying to $\phi\phi$ in exclusively reconstructed $\bar{p}p \to \phi\phi\pi^0$ and $\bar{p}p \to \phi\phi\eta$ events are presented.
This work is funded by the bmb+f and the European Union.

HK 67.2 Th 14:00 Audi-Max

Simulation of the $p\bar{p} \to D_s^{\pm} D_s^*(2317)^{\mp}$ reaction within the pandaroot framework — •Vishwajeet Jha, Albrecht Gillitzer, and Jim Ritman for the PANDA-Collaboration — IKP, Forschungszentrum, Jülich, Germany

The discovery of the surprisingly light and narrow open charm meson states, such as $D_s^*(2317)$ and $D_s(2460)$, have questioned the vailidity of the "naive quark potential model"to describe these states. The intrinsic width of these states are small enough, so that only the upper limits have been measured ($\Gamma \leq 4.6$ MeV and $\Gamma \leq 5.5$ MeV for the $D_s^*(2317)$ and $D_s(2460)$, respectively). The PANDA experiment at FAIR will provide a suitable environment to measure the width of these states with much higher precision because of the high quality phase space cooled antiproton beam.

Simulations have been performed for the reaction, $p\bar{p} \to D_s^{\pm} D_s^*(2317)^{\mp}$, within the PANDAROOT framework. Due to the low formation cross section, full reconstruction of the event is not experimentally feasible with sufficient statistics in a resonable time. Instead, by reconstructing the D_s meson in the $D_s^{\pm} \to \phi\pi^{\pm}(\phi \to K^+K^-)$ decay mode, and tagging only some of the decay products of $D_s^*(2317)$, a sufficiently precise measurement of the width can be performed. We perform a study of possible background channels due to the decay of the binary product D_s and also the generic background due to other $p\bar{p}$ reactions.
This work has been supported in part by grants from the Indo-German bilateral agreement and FZ jülich.

HK 67.3 Th 14:00 Audi-Max

Overview of the PANDA Grid — •Rene Dosdall[1], Dan Protopopescu[2], and Kilian Schwarz[3] — [1]IKP, Forschungszentrum Juelich — [2]University of Glasgow — [3]GSI Darmstadt

PANDA is one of the main experiments at the new FAIR facility and will investigate the properties of hadrons in the charm quark mass region produced in antiproton annihilation reactions.

The PANDA experiment will produce a large amount of data (˜1 PByte/year) and the analysis will require the continuous use of several hundred CPUs. To accomplish this Grid Computing (distributed Analysis/Storage of Data) is needed.

The PANDA Grid provides access to the required computing infrastructure for large scale simulations during the detector development phase and later for the data analysis. Access to the Grid is realized with the middleware AliEn which is developed at CERN.

For testing two data challenges of one week each and up to 10 institutions participating have taken place.

This report will present the structure and performance of the PANDA Grid system.

Supported in part by the EU and FZ-Juelich

HK 67.4 Th 14:00 Audi-Max

Multimeson Production in Proton-Proton Collisions with WASA-at-COSY [∞] — •Benedykt R. Jany for the WASA-at-COSY-Collaboration — Institute of Physics, Jagiellonian University, PL-30059 Cracow, Poland — Institut für Kernphysik and Jülich Center for Hadron Physics, D-52425 Jülich, Germany

The direct multimeson production channels in the region of narrow mesonic states (like ω, η') cause the main background contribution for studies of meson production and decays. For a meaningful investigation of those, it is essential to know the cross sections and dynamics of such processes, especially since such multi-meson background processes are not yet well investigated both experimentally and theoretically.

Preliminary results on $3\pi^0$ and $2\pi^0\eta$ final states measured in proton-proton collisions at a proton incident energy $T = 2.54$ GeV by the WASA-at-COSY detector will be presented.

[∞] Supported by FZ Jülich, BMBF and Wallenberg Foundation

HK 67.5 Th 14:00 Audi-Max

Strangeness production with WASA-at-COSY* — •Anna Kowalczyk for the WASA-at-COSY-Collaboration — Institute of Physics, Jagiellonian University, PL-30059 Cracow, Poland — Institute für Kernphysik and Jülich Center for Hadron Physics, D-52425 Jülich, Germany

The hyperon spectrum is still not understood in detail. In particular the $\Lambda(1405)$ state has received increased attention recently, since its nature is debated heavily and controversely. Various theoretical investigations predict for this possibly dynamically generated state even a two-pole structure. This calls for detailed investigations of the production cross sections and the decay channels as a function of the excitation energy.

To this aim we have started a feasibility study for measurements of the production and the decay of hyperon states with WASA at COSY. The project starts with the investigation of ground state Σ production in the reaction channel $pp \to p\Sigma^+(1189)K^0$, with the mostly neutral final state involving 3 pions: $pp \to p\Sigma^+K^0 \to p(p\pi^0)(\pi^0\pi^0)$.

The current status of the analysis of data collected in 2008 will be presented.

* Supported by FZ Jülich, BMBF, and Wallenberg Foundation.

HK 67.6 Th 14:00 Audi-Max

Complete electric dipole response in ^{120}Sn: a test of the resonance character of the pygmy dipole resonance — •Anna Maria Heilmann for the EPPS0-Collaboration — Institut für Kernphysik, Technische Universität Darmstadt, Germany

In high-resolution (p,p′) experiments under 0° the complete B(E1) strength distribution can be studied in stable nuclei. At RCNP Osaka, Japan, angular distributions including 0° and polarization transfer observables for E1 excitations in ^{120}Sn were measured in an excitation energy range of 5–25 MeV. The systematics of the pygmy dipole resonance in stable Sn isotopes has been recently studied at the S-DALINAC[1]. From this study it was conclused that knowledge of the complete E1 response would be important to differentiate between relativistic an nonrelativistic QRPA models predicting largely different properties of the pygmy dipole resonance. Data analysis and first results on the E1 strength will be presented.
[1] B.Özel, Ph.D. Theses, University of Cukurova (2008).
* Supported by the DFG through SFB 634 and 446JAP 113/267/0-2.

HK 67.7 Th 14:00 Audi-Max

EGoS - an observable for centrifugal stretching — •Jacob Beller[1], Norbert Pietralla[1], and Thomas Pissulla[2] — [1]IKP TU Darmstadt — [2]IKP Koeln

A systematic investigation of the ground-state bands of deformed nuclei using EGoS-plots (E_γ over Spin $= E_\gamma(J \mapsto J-2)/J$) has been done. Many nuclei show a maximum in the EGoS-plot, which is neither expected for rigid rotors nor for vibrational nuclei. Therefore, two potentials within the geometric collective model, namely the Confined-β-Soft rotor model (CBS) [1] and the Davidson-potential [2], were used to describe the data. Good agreement between the CBS and experimental data is achieved for all nuclei, while the Davidson-potential and the data differ near the critical point solution X(5) [3]. Here the wavefunc-

tions obtained from the Davidson-potential show stronger centrifugal stretching than the CBS-wavefunctions in disagreement with the data.

We conclude that EGoS-plots show a particular and easy-to-obtain sensitivity to the phenomenon of centrifugal stretching.

[1] N. Pietralla and O.M. Gorbachenko, Phys. Rev. C **70**, 011303(R) (2004)

[2] P.M. Davidson, Proc. R. Soc. London, Ser. A **135**, 459 (1932)

[3] F. Iachello, Phys. Rev. Lett. **85**, 3580 (2001)

HK 67.8 Th 14:00 Audi-Max

The simulation software for the Panda MVD — •Ralf Kliemt[1,2], Tobias Stockmanns[3], Kai-Thomas Brinkmann[1,2], Rene Jäkel[1,2], and Oscar Reinecke[1,2] for the PANDA-Collaboration — [1]IKTP, Technische Universität Dresden, Germany — [2]HISKP, Rheinische Friedrich-Wilhelms-Universität Bonn, Germany — [3]Forschungszentrum Jülich, Germany

The Micro-Vertex-Detector (MVD) is the innermost detector part of the PANDA experiment, one of the key projects at the future FAIR facility at GSI, Darmstadt. A flexible software simulation inside the PandaRoot framework has been set up to support the ongoing hardware and detector design developments for the MVD. Aside from the application of particle transport codes like Geant it features a realistic detector emulation and reconstruction code which is supposed to be applied on real detector data later on. This includes the detailed description of the detector geometry, the expected data formats, sophisticated clustering algorithms and the integration of the MVD reconstruction algorithms in the track reconstruction. (Supported by BMBF and the EU)

HK 67.9 Th 14:00 Audi-Max

SU(3) classification of baryon states — •Maxim Polyakov — Institut für Theoretische Physik II, Ruhr-Universität Bochum

We review the spectrum of all baryons with the mass less than approximately 2000-2200 MeV using methods based on the approximate flavor SU(3) symmetry of the strong interaction. The application of the Gell-Mann–Okubo mass formulae and SU(3)-symmetric predictions for two-body hadronic decays allows us to successfully catalogue almost all known baryons in twenty-one SU(3) multiplets. This classification allows us to make predictions for new baryonic states and excludes some of claimed in the literature baryons.

HK 67.10 Th 14:00 Audi-Max

Search for $a_0/f_0(980)$ production in $pd \to {}^3\mathrm{He}\pi^0\eta/\pi^0\pi^0$ reactions with WASA-at-COSY — Markus Büscher[1], Pavel Fedorets[1,2], and •Chuan Zheng[1,3] for the WASA-at-COSY-Collaboration — [1]Institut für Kernphysik and Jülich Center for Hadron Physics, Forschungszentrum Jülich, D-52425 Jülich, Germany — [2]Institute for Theoretical and Experimental Physics, Bolshaya Cheremushkinskaya 25, 117218 Moscow, Russia — [3]Institute of Modern Physics, Chinese Academy of Sciences, 730000 Lanzhou, China

The WASA-at-COSY facility is well suited to detect both strong ($\pi\eta$ and $\pi\pi$) and radiative (γV, with V being a vector meson) decays of the light scalar mesons $a_0/f_0(980)$. As a first test measurement, and in order to determine the light-scalar production cross sections in the $pd \to {}^3\mathrm{A}X$ process, the $pd \to {}^3\mathrm{He}(4\gamma)$ reaction has been measured. At a beam momentum of P_p=2.935 GeV/c masses M_X of up to 1.2 GeV/c^2 could be produced. We report on the status of the data analysis, in particular for the reaction channels $pd \to {}^3\mathrm{He}\ a_0 \to {}^3\mathrm{He}(\pi^0\eta)$ and $pd \to {}^3\mathrm{He}\ f_0 \to {}^3\mathrm{He}(\pi^0\pi^0)$.

*Supported by FZ Jülich, BMBF, Wallenberg Foundation, CSC and HGF

HK 67.11 Th 14:00 Audi-Max

Fast signal analysis for the PANDA Electromagnetic Calorimeter — •Elmaddin Guliyev, Myroslav Kavatsyuk, and Herbert Löhner for the PANDA-Collaboration — Kernfysisch Versneller Instituut, Zernikelaan 25, 9747 AA Groningen, The Netherlands

Antiproton-proton annihilations at the future FAIR facility at Darmstadt, Germany, will allow testing the theory of strong interactions, QCD, in the non-perturbative regime. The PANDA detector will be installed in the antiproton storage ring HESR providing an intense high-resolution antiproton beam with dense internal targets. The Electromagnetic Calorimeter (EMC) is a crucial component to provide high sensitivity for studies of charm-quark mesons, glue-balls and hybrid states. The EMC employs fast bright PWO scintillation crystals with Large-Area Avalanche Photo Diodes (LAAPD) as photo sensors. Low-noise low-power preamplifiers were developed suitable for the expected high rates and the required large dynamic range of photon energy deposition between 1 MeV and 12 GeV. Measurements were performed on signals from cooled PWO crystals equipped with LAAPD and either discrete or ASIC preamplifiers, recorded by a fast sampling ADC. Sampling rate and ADC resolution have been determined for achieving the required energy and timing performance. The concept of the EMC front-end electronics will be discussed, including a fast feature extraction algorithm. Results of recent prototype studies will be presented.

HK 67.12 Th 14:00 Audi-Max

Non-Singlet spin structure function in valon model — •fatemeh taghavi shahri[1] and firooz arash[2] — [1]School of Particles and Accelerators,IPM(Institute for Studies in Theoretical Physics and Mathematics), P.O.Box 19395-5531, Tehran, Iran — [2]department of physics,tafresh University,Tafresh

We present a Next-to-leading order QCD calculation of non-singlet spin structure function $g_1^{NS}(x,Q^2)$, of the nucleon in the so-called the valon representation. The structure of the valon itself develops through the perturbative dressing of a valence quark in QCD, which is independent of the hosting hadron. The results of this calculations are in excellent agreement with the experimental data from HERMES collaborations for the entire measured range of x. It also provides an acceptable agreement with the older data from SMC, E143 and E155 experiments. We have further compared our results with those from AA, BB, GRSV, and DNS global fits.

HK 67.13 Th 14:00 Audi-Max

Proton scattering at ^{92}Zr and the investigation of a possible g-boson configuration — •Christopher Walz, Oleksiy Burda, Peter von Neumann-Cosel, and Norbert Pietralla — IKP, TU Darmstadt, Germany

The concept of fully symmetric (FS) and mixed-symmetric (MS) quadrupol phonons as building blocks of low-energy structure in spherical nuclei has been investigated in recent years. The nucleus ^{92}Zr is a well studied example and candidates for the FS and MS quadrupol one-phonon states with $J^\Pi = 2^+$ have already been established [1]. High-resolution-^{92}Zr(p,p') experiments at 200 MeV were performed at the iThemba LABS in order to study the excitations of low-spin states. The evaluation of the measured cross sections as a function of momentum transfer had supported the one-phonon interpretation of symmetric and mixed-symmetric 2^+ states. In addition the measured momentum-transfer dependence of (p,p') cross sections permits a test of the nature of the 4_1^+ and 4_2^+ states as candidates of possible g-boson configuration with preclominant FS and MS character. Comparisons to QPM and shell model calculations is presented.

[1] C.Fransen *et al*, Phys. Rev. C 71, 054304 (2005)

HK 67.14 Th 14:00 Audi-Max

Search for new Charmonium(-like) States and Anti-Nuclei at Belle — Sabrina Darmawi, Martin Galuska, Wolfgang Kühn, Stephanie Künze, •Jens Sören Lange, Thomas Sander, and Matthias Ullrich for the Belle-Collaboration — II. Physikalisches Institut, Justus-Liebig-Universität Giessen

At the Belle experiment at KEK, Tsukuba, Japan, e^+e^- collisions at center-of-mass energies from $\sqrt{s}$=9.46 to 10.86 GeV are investigated. Results from searches for new charmonium and charmonium-like states will be presented, in particular *(a)* search for the Y(4260) state in B meson decays, *(b)* search for the $^3D_2$ (L=2) charmonium state, and *(c)* search for the η_b in Upsilon(3S,4S,5S) decays. Furthermore, preliminary results of the search for anti-deuterons and anti-tritons will be presented, which - as events with 6 or 9 anti-quarks, respectively - are rare events in e^+e^- collisions.

HK 67.15 Th 14:00 Audi-Max

Coupled-Channel Dynamics For Quarkonium Systems — •Ying Cui, Alexander Laschka, and Wolfram Weise — Institut für Theoretische Physik T39, Technische Universität München, D-85747 *Garching, Germany

We investigate charmonium ($c\bar{c}$) and bottomonium ($b\bar{b}$) coupled to the meson-meson system ($D\bar{D}$ and $B\bar{B}$). Using the bound state wavefunctions computed with a $Q\bar{Q}$ potential derived from perturbative and lattice QCD, we calculate the corrections to the binding energies of charmonium and bottomonium states arising from their coupling to the two-meson continuum. The interaction vertex between the mesons and the heavy-light states is obtained from heavy quark effective field

theory. This is different from the $^3P_0$ model, which assumes that the light quark pair is created from the vacuum. We also study the decay widths and wavefunction renormalization factors of heavy quark-antiquark bound states.
Work supported in part by BMBF and GSI.

HK 67.16 Th 14:00 Audi-Max

Diffractive Dissociation into 3 Pion Final States at COMPASS — Suh-Urk Chung[1,2], Jan Friedrich[1], Stefanie Grabmüller[1], •Florian Haas[1], Bernhard Ketzer[1], Sebastian Neubert[1], Stephan Paul[1], Dimitry Ryabchikov[1,3], and Quirin Weitzel[1] for the COMPASS-Collaboration — [1]Technische Universität München, Physik Department E18, 85748 Garching, Germany — [2]Brookhaven National Laboratory, Upton, NY 11973, USA — [3]Institute for High Energy Physics, 142284 Protvino, Russia

Diffractive dissociation reactions at the COMPASS experiment, CERN, provide access to the meson resonance spectrum. During a pilot run in 2004, using a pion beam on a lead target, a competitive number of $\pi^-\ \pi^-\ \pi^+$ final state events with masses below 2.5 GeV/c^2 were recorded. After COMPASS had finished its muon program in 2007, it used in 2008 again a pion beam, but now a liquid hydrogen target, and gathered during several weeks a unique high statistics. A full partial wave analysis of the 2004 data has been performed, with the focus on the kinematic range of a large momentum transfer (0.1 GeV^2/c^2 $\leq$ t' $\leq$ 1.0 GeV^2/c^2). In addition first results of the adjacent analysis with 2008 data will be presented.

HK 67.17 Th 14:00 Audi-Max

A pattern recognition analysis for particle identification with PANDA — •Vanniarajan Suyam jothi for the PANDA-Collaboration — KVI, Groningen, Netherlands

The PANDA project at the future Facility for Antiproton and Ion Research, FAIR, Darmstadt, will study hadronic excitations in the charmonium-mass range exploiting antiproton-proton annihilations. A compact multi-purpose detector will be employed which is capable of measuring the scattering angles, momenta, and energies of charged and neutral particles. In addition, the detector will be able to separate the different particle types and perform high-quality Particle IDentification (PID). A pattern-recognition tool based on a set of multi-variate analysis techniques has been developed and used to optimize the quality and performance of PID. The tool is part of the simulation and analysis framework carrying the name PandaRoot, which is presently being developed for physics-benchmark and detector-design studies. This paper will present first results of the analysis which are based on a Monte-Carlo simulation describing the complete detector setup.

HK 67.18 Th 14:00 Audi-Max

Compton scattering sum rules for electromagnetic moments of higher-spin targets — •Jan Pieczkowski, Vladimir Pascalutsa, and Marc Vanderhaeghen — Institut für Kernphysik, Johannes-Gutenberg-Universität, 55099 Mainz

In 1965, a sum rule for the anomalous magnetic moment of nucleons in doubly-polarized Compton scattering was derived by Gerasimov and by Drell and Hearn (GDH). It is a fundamental relation in dispersion theory of QCD, based on properties of the amplitude, such as analyticity and crossing symmetry. For the derivation, the low-energy theorem by Low, and Gell-Mann and Goldberger, as well as the optical theorem is applied. For $S \geq \frac{1}{2}$ particles higher order anomalous moments become relevant. In this work, we focused on massive $S = 1$ particles. Using a generalized decomposition of the polarized forward Compton scattering amplitude for arbitrary spin S, we were able to obtain sum rules for anomalous magnetic and quadrupole moments. The method of derivation of arbitrary spin is discussed, as well as an approach to verifying our result.

HK 67.19 Th 14:00 Audi-Max

Study of the Measurement of Quarkonia in Different ALICE Central Barrel Detector Configurations — •Anna Bernhard for the ALICE-TRD-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt, Germany

The measurement of quarkonia is a very promising observable for the study of the quark gluon plasma. The central barrel detectors of ALICE (ITS, TPC, TRD) will reconstruct heavy $q\bar{q}$ pairs, both in heavy ion collisions and in p+p collisions as reference, via their decay into an electron-positron pair.

The TRD subdetector provides excellent electron identification. However, in the first periods of data taking at the LHC the TRD will not yet be completely installed. The expected performance for the measurement of quarkonia in $\sqrt{s}$ =14 TeV minimum bias p+p collisions via their decay into e^+e^- has been studied. Fast simulations have been performed, using the event generator PYTHIA and a parameterization of the detector response. We present the results for different scenarios: A fully installed TRD and various incomplete setups including the projected TRD configuration for the first run. Invariant mass spectra are shown for different p_T regions as well as the main sources for combinatorical and physical background. Expected yields for one year of data taking are given.

HK 67.20 Th 14:00 Audi-Max

Looking for phase transitions of strongly interacting matter applying new method on basic of Random Matrix Theory — •Mais Suleymanov[1] and Ehtiram Shahaliev[2] — [1]CIIT, Islamabad, Pakistan — [2]HEPL, JINR, Dubna, Russia

Over the last 25 years a lot of efforts have been made to search for new phases of strongly interacting matter. Heavy ion collisions are of great importance since they open a way to reproduce these phases in the Earth laboratory. But in this case the volume of information increases sharply as well as the background information.

The Ref. [1] introduced a method on the basic of Random Matrix Theory to study the fluctuations of neutron resonances in compound nuclei [1] **which doesn't depend on the background of measurements**. To analyze the energetic levels of compound nuclei the function of distances between two energetic levels $p(s_i)$ is defined as the general distributions for probability of all kinds of ensembles. At values of the index of universality $\nu = 0$ it will change to Poisson type distributions pointing to absence of any correlations in the system and at the values of $\nu = 1$ it will change to Wigner type behavior directing to some correlation in the studying ensemble.

We discuss that the experimental study of the behavior of $p(s_i)$ distribution for secondary particles could give a signal on the phase transitions.

References

1. C. E. Porter, Statistical Theories of Spectra: Fluctuations (Academic, New York, 1965)

HK 67.21 Th 14:00 Audi-Max

On the stability of fragments formed in heavy ion collision using microscopic binding algorithm — •supriya goyal and rajeev k. puri — physics department, panjab university, chandigarh-1600 14, india

The multi fragmentation phenomenon in heavy ion collisions has attracted a lot of attention in recent years. The last gem has also been linked with the liquid gas phase transition. This may also be used to pin down the nuclear equation of state. The phase space obtained with event generators has to be clusterized and often one also needs after burners to de-excite the fragments. One of the most popular clusterization algorithm is based on the spatial distance between nucleons. The serious problem with such simple algorithm is that we donot have control over the stability of the fragments, thus created. We here extend this algorithm to include the microscopic binding energy for each fragments using modified mass formula. We check the binding energy of each such fragment whether it is neutron rich/deficient at microscopic level and all fragments who fail to fulfill the check are treated as free nucleons. Our preliminary results show that 1. This new algorithm (named as Minimum Spanning Tree- Micro bound) enables us to filter all unstable fragments. 2. For the central reactions of Au-Au, the results are closer to experimental data indicating the need of microscopic binding energy for fragmentation.

HK 67.22 Th 14:00 Audi-Max

Trigger Particle Correlations in the First Collisions at ALICE — •Jason Glyndwr Ulery for the ALICE-TRD-Collaboration — Institut für Kernphysik, Frankfurt

Trigger particle correlations can provide interesting insights into jet physics. These correlations can be used in pp collisions to study jet fragmentation which is not calculable in pQCD. The angular and transverse momentum, p_T, distributions of the associated particles are of particular interest in this study. Trigger particle correlations in pp collisions can also be used as a reference for heavy-ion collisions. In previous experiments, these correlations have shown medium modification in heavy-ion collisions relative to pp collisions. In ALICE trigger particle correlations can be done at much higher p_T then has been done at SPS and RHIC due to the greatly increased cross section for high

energy jets at the LHC. Results will be shown for simulated *pp* collisions at LHC energies from the PYTHIA event generator. These events have been passed though a geometrical model for the ALICE detector and reconstructed by the ALICE reconstruction software. It can be demonstrated that trigger particle correlations can be performed with triggers of p_T ≈10 GeV/c with one day of data taking.

HK 67.23 Th 14:00 Audi-Max

Decay Rate and Photodetachment Cross Section Measurement of the Negative Positronium Ion† — •Stefan Gärtner[1], Hubert Ceeh[2], Frank Fleischer[3], Christoph Hugenschmidt[2], Klaus Schreckenbach[2], Dirk Schwalm[4], and Peter Thirolf[1] — [1]Ludwig-Maximilians-Universität München, Garching, Germany — [2]Technische Universität München and FRM II, Garching, Germany — [3]University of Washington, Seattle, USA — [4]Max-Planck-Institut für Kernphysik, Heidelberg, Germany

The preparations of a new decay rate measurement of the Ps^- ion ($e^+e^-e^-$) at the NEPOMUC high flux positron source (≈ 10^9 moderated positrons per second) at the FRM II reactor in Garching are shown. The setup, which was previously mounted in Heidelberg, utilizes ≈ 5 nm thin Diamond Like Carbon (DLC) foils for the Ps^- production as well as for stripping off the electrons, which takes place immediately after the acceleration across a variable length gap. The aim is to improve the most accurate decay rate measurement [1] of $\Gamma = 2.089(15)\,\mathrm{ns}^{-1}$ by a factor of 5–10, thus allowing to test QED [2] for this fundamental leptonic three-body system. In a further step the photodetachment cross section of Ps^- will be measured at the two energies provided by the fundamental and second harmonic mode of a high power Nd:YAG laser for the first time. A photodetachment rate of the order of $40\,\mathrm{s}^{-1}$ and $4 \cdot 10^4\,\mathrm{s}^{-1}$ for continuous and Q-switched laser light, respectively, is expected. [1] F. Fleischer *et al.*, Phys. Rev. Lett. **96**, 063401 (2006). [2] M. Puchalski *et al.*, Phys. Rev. Lett. **99**, 203401 (2007). †Supported by DFG under contract HA1101/13-1.

HK 67.24 Th 14:00 Audi-Max

Near-Threshold Pion Photproduction at MAX-lab — •Jason Brudvik — for the MAX-Tagg Collaboration MAX-lab, Lund University, Sweden

Near-threshold pion photoproduction is an elementary process involving an explicit rearrangement of the quarks in the nucleon. It is thus a direct probe of the quark structure of the nucleon. At energies below the Delta resonance, pion photoproduction also provides a stringent test of chiral symmetry as a result of accurate predictions from chiral effective field theory. Precision sub-Delta measurements of the angular distribution and the total cross section for pion photoproduction are thus of fundamental importance. Surprisingly, aside from the $\gamma p \to p\pi^0$ channel which has been thoroughly studied at MAMI-B and SAL, few data exist in this crucial near-threshold region. MAX-lab in Sweden is the one photonuclear facility worldwide whose energy range is perfectly tuned to such experiments. As such, a comprehensive program of near-threshold pion photoproduction experiments has recently been initiated. These experiments include measurements of the angular distribution for π^+ photoproduction in the *p*-wave energy region for both the proton and heavier targets and the total cross section for π^- photoproduction close to threshold using a deuterium target. In this poster, an overview of the pion photoproduction program at MAX-lab will be presented. This overview will include preliminary results from commissioning runs for the previously mentioned experiments together with a look at future plans.

HK 67.25 Th 14:00 Audi-Max

Investigation of the Deuteron Breakup on Protons in the Forward Angular Region — •Izabela Ciepal — for JU/USl/KVI and GEM Collaborations

The system composed of three nucleons (3N) is the simplest nontrivial environment in which various models of nucleon-nucleon (NN) interaction can be investigated. Experimental studies of the ^{1}H(d,pp)n breakup reaction in a large phase space region, performed at KVI at the deuteron beam energy of 130 MeV, showed that the Coulomb interaction introduces an important contribution to the reaction dynamics. In contrast to the elastic scattering process, particular configurations of the breakup reaction are characterized by small relative energies of the outgoing charged particles (pp pairs in this case), therefore revealing an enhanced sensitivity to the Coulomb repulsion. The largest effects are observed in the domain of the smallest studied polar angles.

In order to investigate this problem in more details, a dedicated experiment was performed at FZ Jülich for the same reaction and energy, with the use of the GeWall detector. In this experiment a region of small polar angles (4°-14°) has been explored, not attainable in any other laboratory and crucial to investigate action of the Coulomb force. The results obtained for selected kinematical configurations are compared with various theoretical predictions, in particular with properly averaged calculations including Coulomb force effect.

HK 67.26 Th 14:00 Audi-Max

Nucleon – nucleon scattering phase shifts and the realistic potentials — •Marius Kaminskas and Gintautas Kamuntavicius — Vytautas Magnus University, Vileikos st. 8, LT-44404, Kaunas, Lithuania

The recent realistic nucleon – nucleon (NN) potentials are defined as set of functions v_{p}(r), present in expression:

V(r,Ω)=*_{p}v_{p}(r)O_{p}(Ω),

where r is a radial variable and Ω marks the set of angular variables and spin – isospin degrees of freedom of two interacting nucleons. The sum over p in this equation is restricted because the set O_{p}(Ω) consists of no more than 14 charge–independent operators. The main idea of paper is based on expression of NN potential in terms of orthogonal projectors P_{j^{π}t}(Ω) to different two – nucleon channels j^{π}t:

V(r,Ω)=*_{j^{π}t}V^{j^{π}t}(r)P_{j^{π}t}(Ω).

The narrow set of operators O_{p}(Ω) causes the problems with necessary number of NN phase shifts description. As a result, this produces very short set of two – nucleon channels j^{π}t, for which the independent NN potentials V^{j^{π}t}(r) can be constructed. From another side, the microscopic description of atomic nuclei requires the NN potentials, defined for large enough set of two - nucleon channels j^{π}t. May be, namely this shortage of operators O_{p}(Ω) causes well – known problems with lightest nuclei description.

HK 67.27 Th 14:00 Audi-Max

Nucleon – nucleon scattering phase shifts and the realistic potentials — •Marius Kaminskas and Gintautas Kamuntavicius — Vytautas Magnus University, Vileikos st. 8, LT-44404, Kaunas, Lithuania

The recent realistic nucleon – nucleon (NN) potentials are defined as set of functions $v_p(r)$, present in expression:

$V(r,\Omega) = \sum_p v_p(r) O_p(\Omega)$

where r is a radial variable and Ω marks the set of angular variables and spin – isospin degrees of freedom of two interacting nucleons. The sum over p in this equation is restricted because the set $O_p(\Omega)$ consists of no more than 14 charge–independent operators. The main idea of paper is based on expression of NN potential in terms of orthogonal projectors $P_{j^\pi t}(\Omega)$ to different two – nucleon channels $j^\pi t$:

$V(r,\Omega) = \sum_{j^\pi t} V^{j^\pi t}(r) P_{j^\pi t}(\Omega)$

The narrow set of operators $O_p(\Omega)$ causes the problems with necessary number of NN phase shifts description. As a result, this produces very short set of two – nucleon channels $j^\pi t$, for which the independent NN potentials $V^{j^\pi t}(r)$ can be constructed. From another side, the microscopic description of atomic nuclei requires the NN potentials, defined for large enough set of two - nucleon channels $j^\pi t$. May be, namely this shortage of operators $O_p(\Omega)$ causes well – known problems with lightest nuclei description.

HK 67.28 Th 14:00 Audi-Max

Beam-Spin Asymmetry Measurements at CLAS — •Mher Aghasyan[1], Marco Mirazita[1], Patrizia Rossi[1], and Harut Avakian[2] — [1]LNF-INFN, Via E. Fermi 40, Frascati, Italy — [2]JLAB, 12000 Jefferson Ave, Newport News, VA, 23606, USA

The single-spin asymmetries (SSA) that have been reported recently in semi-inclusive DIS by HERMES, COMPASS and CLAS, have emerged as a powerful tool to access the orbital motion of partons.

SSAs could arise in the fragmentation of polarized quarks (Collins effect) and from the interference of wavefunctions with different orbital angular momentum (Sivers effect). The two mechanisms produce different kinematical dependences and their contributions could be separated in measurements of different beam and target single-spin asymmetries.

This contribution presents recent results from Jefferson Lab's CLAS detector on beam SSAs in single neutral pion electroproduction off an unpolarized hydrogen targets in the DIS regime. The measured kinematical dependences are compared with model predictions.

HK 67.29 Th 14:00 Audi-Max

Progress in Pseudo-Scalar Meson Photoproduction Experiments at MAMI-C in Mainz. — John R M Annand, David

J Hamilton, David Howdle, Ken Livingston, •Ian James Douglas MacGregor, Joe Mancell, Eilidh McNicoll, Jamie Robinson, and Günther Rosner — Department of Physics and Astronomy, University of Glasgow, Glasgow UK

Since its upgrade in 2007, the Glasgow-Mainz spectrometer has provided a state-of-the-art photon tagger for a series of photo-production experiments at electron beam energies from 200 to 1508 MeV. We report on the operational status of the tagging spectrometer, refitted with a new focal-plane detector to extend its rate capability and improve its timing resolution by a factor 2. This complements the Crystal Ball and TAPS calorimeters, which provide almost 4π detection of both neutral and charged particles. These systems have very high detection efficiency for multi-photon final states. Measurement of pseudo-scalar-meson photo production on the nucleon is a major component of the experimental programme. We have data on π^0, π^+,η, η', K^0, K^+ (single and multiple-meson) final states for ^{1}H and ^{2}H targets. The eventual goal is to make *complete* measurements of the helicity amplitudes, which require at least 8 observables chosen properly from unpolarised, single-spin and double-spin possibilities. The possibilities in Mainz will extend when polarised targets become available in 2009. In December 2008 the maximum MAMI-C energy was raised to 1557 MeV and data taken with an open trigger at tagged-photon energies from 80 to 1447 MeV. We show some first analyses of these tests.

HK 67.30 Th 14:00 Audi-Max

The AMADEUS experiment and the KLOE data analysis for K-He interactions — •Vazquez Doce Oton — LNF-INFN

The AMADEUS experiment [1] will perform the first complete experimental study of the case of the so-called deeply bound kaonic nuclear states. Such a study has deep consequences in a still open sector of the strangeness hadronic/nuclear physics: how the hadron masses and hadron interactions change in the nuclear medium with consequences on the structure of cold dense hadronic matter. AMADEUS will perform exclusive - full acceptance - measurements, all particles in the formation and decay processes of deeply bound nuclear clusters will be detected.

Preliminary results from the analysis of KLOE experiment data in the search for the kaonic clusters will be presented as well.

[1] AMADEUS Phase-1: Physics, Setup and Roll-in Proposal, LNF preprint, LNF-07/24(IR), November 2007

HK 67.31 Th 14:00 Audi-Max

extraction of the magnetic formfactor and structure function of the n from inclusive lepton scattering data — •Avraham Rinat and Morton Taragin — Weizmann Institute of Science, Rehovot, Israel

We consider the reduced magnetic form factor α_n of the n, extracted from QE inclusive lepton scattering, which requires the separation of the QE (NE) and inelastic parts (NI) of structure functions $F_2^A(x, Q^2)$ for the Bjorken variable $x \approx 1$.The latter dominates, except around the QEP. Previous JLab data [1] primarily on D showed $\alpha_n(Q^2)$ to decrease from 1to about 0.78 for $Q^2 \approx 1.5 - 10$ GeV^2 [2]. Analysis of recent inclusive data on various targets [3] appear to be incompatible with the oldJLab data and can not be used to extract α_n [4].

We therefore turned to data on F_2^D for fixed Q^2 [5]. Although scatter is apparent in the above data, we could assemble sufficient data points to determine suitable averages for $\alpha_n(Q^2)$. For the available range $Q^2 \lesssim 5.7$ GeV^2 we confirm the previously observed decrease of α_n.

An alternative source of information for α_n is the ratio of semi-inclusive cross sections $e(D,p)e, n/e(D,n)e, p$. A recent experiment shows a flat behaviour for $Q^2 \lesssim 3.2$ GeV^2, followed by data points with appreciable scatter out to $Q^2 = 5$ GeV^2 [6].

Inclusive scattering data also contain information on F_2^n. An extraction method, which has been applied before [7] for the data of Ref. (1), has also been used for those of Ref. (5). Determination of higher twist corrections in $F_2^{p,D}$ constitute alternative input for the construction of F_2^n [8].

HK 67.32 Th 14:00 Audi-Max

Superscaling predictions for quasielastic neutrino-nucleus scattering — •Cristina Martinez — Nuclear Physics Department, Complutense University of Madrid

The possibility of applying superscaling ideas to predict neutral-current (NC) quasielastic (QE) neutrino cross sections for beams of a few GeV is investigated. Results obtained within the relativistic impulse approximation (RIA) using the same relativistic mean field potential (RMF) for both initial and final nucleons — a model that has been capable of reproducing the experimental (e, e') scaling function — are used to illustrate the ideas involved. While NC reactions, where the final neutrino is not detected, are apparently not well suited for scaling analyses, to a large extent the predictions of the RIA-RMF model do exhibit superscaling. Independence of the scaled response on the nuclear species is very well fulfilled. The RIA-RMF NC superscaling function is in good agreement with the one obtained using (e, e') data. Guided by the results for the RIA-RMF, the idea that electroweak processes on nuclei can be described with a universal scaling function, provided that some mild restrictions on the kinematics of the NC reactions are assumed, is shown to be a good one.

HK 67.33 Th 14:00 Audi-Max

Isovector pairing effect on the particle-number projection two-proton separation energy — •Djamila Mokhtari[1], Slimane Kerrouchi[1], Mohamed Fellah[1,2], and Nassima-Hosni Allal[1,2] — [1]Laboratoire de physique théorique, Faculte de Physique, USTHB BP32, el Alia-16111, Bab ezzouar, ALgiers, Algeria — [2]Centre de Recherche Nucléaire d'Alger, Comena, 2Bd, Algiers, Algeria

The two-proton separation energy is studied by performing a particle-number projection with [1] and without [2] inclusion of the isovector neutron-proton (np) pairing correlations. It is numerically evaluated for even-even rare-earth nuclei such that the np pairing parameter is non-zero.

It is shown that the two-proton separation energy values calculated using the two approaches join, for almost all the considered elements, for the highest values of (N-Z).

However, the results including the np pairing correlations are closest to the experimental data when available.

Moreover, the two methods lead to the same prediction of the two-proton drip-line position, except for the Dysprosium and the Tungsten.

[1]N.H. Allal, M. Fellah, M.R. Oudih and N. Benhamouda, Eur. Phys. J. A27, s01(2006)301. [2]M.Fellah, T.F. Hammann and D.E. Medjadi, Phys. Rev. C8(1973)1585.

HK 67.34 Th 14:00 Audi-Max

Continuum Random Phase Approximation based on Point Coupling RMF Lagrangian. — •Ioannis Daoutidis and Peter Ring — Physik-Department der Technischen Universität München, D-85748 Garching, Germany

Relativistic Continuum Random Phase Approximation (CRPA) is used to investigate collective excitation phenomena in several spherical nuclei along the periodic table. For the ground state, we perform point Coupling RMF calculations with the parameter set PC-F1. Using a residual interaction, derived from the same RMF approach, we solve the RPA equations in order to produce the isoscalar monopole, isovector dipole and isoscalar quadrupole resonances. Finally, we compare their properties, such as centroid energies and strengths, with those of the well studied discrete RPA approaches. Experimental data are also given for comparison.

HK 67.35 Th 14:00 Audi-Max

Influence of the isovector pairing effect on the nuclear statistical quantities — •Mohamed Belabbas[1], Ismahane Ami[2,3], Naziha Benhamouda[3], Mohamed Fellah[3,4], and Nassima-Hosni Allal[3,4] — [1]Faculté des Sciences et des Sciences de l Ingénieur, Université Hassiba Ben Bouali, BP151, 02000 Chlef, Algeria — [2]Institut des Sciences et de la Technologie, Université Yahia Fares de Médéa, Aïn-D heb, 26000 Médéa, Algeria — [3]Laboratoire de Physique Théorique, Faculté de Physique, USTHB, BP32, El-Alia, 16111 Bab-Ezzouar, Alger, Algeria — [4]Centre de Recherche Nucléaire d Alger, COMENA, BP 399 Alger-Gare, Alger, Algeria

Temperature-dependent isovector pairing gap equations have been recently established using a path integral approach [1]. In the present work, the expressions of the main usual statistical properties, that is, the energy, the entropy and the heat capacity are established within the same model. These expressions generalize the Finite Temperature BCS (FTBCS) ones for the pairing between like-particles. Numerical calculations are carried out within the one-level model. The obtained results are compared to those of the usual FTBCS approach for the pairing between like-particles.

[1] M. Fellah, N.H. Allal, M. Belabbas, M.R. Oudih and N. Benhamouda, Phys. Rev. C76, 047306(2007).

HK 67.36 Th 14:00 Audi-Max

Photoresponse of ^{94}Mo at energies up to 8.6 MeV* — •Christopher Romig[1], M. Fritzsche[1], K. Lindenberg[1], N. Pietralla[1], G. Rusev[3], D. Savran[1], K. Sonnabend[1], A. P. Tonchev[3], W. Tornow[3], H. R. Weller[3], and A. Zilges[2] — [1]Institut für Kernphysik, Technische Universität Darmstadt, Germany — [2]Institut für Kernphysik, Universität zu Köln, Germany — [3]Triangle Universities Nuclear Laboratory, Duke University, Durham, NC, USA

The isotope ^{94}Mo was investigated in nuclear resonance fluorescence [1] experiments at the High Intensity Photon Setup (HIPS) at the S-DALINAC in Darmstadt using bremsstrahlung photons with energies of 7.65 and 8.6 MeV, respectively, and at the High Intensity γ-ray Source (HIγS) at Duke University using photons from Laser Compton backscattering. Thereby over 60 excitations were found which could be assigned to ^{94}Mo due to the highly enriched sample. In the energy region between 5.4 and 8 MeV many transitions could be classified as dipole transitions and cross sections, angular momentum quantum numbers, half-lifes and transition strengths were determined. At HIγS the parity quantum numbers of 40 exitations between 5.5 and 7.0 MeV could be determined.
The methods and results will be presented.
* Supported by DFG (SFB 634)
[1] U. Kneissl, N. Pietralla, A. Zilges, J. Phys. G: Nucl. Part. Phys. **32** (2006) R217

HK 67.37 Th 14:00 Audi-Max

The two-fermions – four-bosons nucleus ^{198}Hg within the extended supersymmetry description — •Christian Bernards, Christoph Fransen, Stefan Heinze, Jan Jolie, and Désirée Radeck — Institute for Nuclear Physics, University of Cologne

Low-energy excitations of heavy even-even nuclei can be described well using the Interacting Boson Model (IBM) [1]. The supersymmetric extension of the IBM uses a symmetry between fermions and bosons and has already been successfully applied to describe low-energy excitations in the Au-Pt mass region.

Using the Interacting Boson Fermion Fermion Model (IBFFM) predictions for ^{198}Hg have been derived in [2], considering two $j = 3/2$ proton fermions and four neutron bosons with respect to the ^{208}Pb shell closure. Referring to [3], this IBFFM configuration should describe excited two-quasiparticle and not low-lying ^{198}Hg states. We show that an equivalent description for ^{198}Hg can be achieved within the IBM-2 and that new experimental data shows quite a good matching to the theoretical predictions – also for the low-energy states.

[1] F. Iachello and A. Arima. *The Interacting Boson Model*. Cambridge University Press, 1987.
[2] J. Jolie. *The Interacting Boson-Fermion Model: Bose-Fermi Symmetries and Supersymmetries*. PhD thesis, University of Gent, 1986.
[3] F. Iachello and P. Van Isacker *The Interacting Boson Fermion Model*. Cambridge University Press, 1991.

HK 67.38 Th 14:00 Audi-Max

Fission Half-Lifes of Superheavy Elements in a Microscopic-Collective Model — •Jochen Erler, Nils Schindzielorz, and Paul-Gerhard Reinhard — Institut für Theoretische Physik II, Universität Erlangen-Nürnberg

Spontaneous fission is one of the dominant decay modes of superheavy elements (SHE). We present a large scale survey of barrier heights and life-times for spontaneous fission in the regime of SHE, i.e. nuclei with Z=104-122. This is done on the basis of the Skyrme-Hartree-Fock model which yields the input for a microscopic description, the Generator Coordinate Method (GCM), of the collective phenomenon fission. The actual tunneling probability is estimated by the WKB approximation. To calculate the necessary ingredients namely the collective masses and the corrected potential energy surface self-consistent cranking is used. To explore the possible sensitivity of the fission life-times to the parameterization of the Skyrme force, sufficiently different parameterizations are considered.

These fission life-times are compared with the life-times τ_α of the α-decay which is a competing decay channel for many SHE. The τ_α are calculated from the Q_α reaction energies using an estimate based on the Viola systematics. Finally, we compare with the β-decay rates of the SHE.

HK 67.39 Th 14:00 Audi-Max

Constraint Skyrme-Hartree-Fock calculations in 3D — •Nikolaus Löbl[1], Joachim Maruhn[1], and Paul-Gerhard Reinhard[2] — [1]Goethe Universität, Frankfurt — [2]Friedrich-Alexander-Universität, Erlangen-Nürnberg

We implemented several multipole constraints into a full 3D Skyrme-Hartree-Fock (SHF) code. The used algorithm was already successfully tested in axial SHF and relativistic mean-field(RMF)approaches. In a first step we added the constraints linearly to the energy functional, i.e. $\lambda < \hat{Q} >$. The second step was to connect the added quantity to meaningful physical observables. Of course the $< \hat{Q} >$ should be the expectation value of a multipole operator, therefore the Lagrange-multiplier λ had to be adapted by iteration. It was a challenging task to reach suitable convergence in 3D. After a period of parameter optimization we were able to obtain deformation energy curves with a constraint on the Q_{20} mass quadrupole moment. With an additional Q_{22} constraint it was also possible to prepare triaxial states. Applications to be presented: cluster configurations in ^{16}C and fission barriers in the actinide region.

HK 67.40 Th 14:00 Audi-Max

Optimization of the recoil-shadow projection method for the investigation of short-lived fission isomers* — •M. Helmecke, P.G. Thirolf, D. Habs, E. Gartzke, V. Kolhinen, C. Lang, J. Szerypo, and L. Trepl — Fakultät f. Physik, LMU München, Germany and Maier-Leibnitz Laboratory, Garching, Germany

Spectroscopic studies of super- and hyperdeformed actinide nuclei offer the possibility to gain insight into the multiple-humped fission barrier landscape. With the identification of deep third minima in ^{234}U and ^{236}U the systematics of fission isomers in light actinides was revisited, especially searching for isomers in light uranium isotopes with half-lives in the pico-second range. Using the recoil-shadow projection method [1] and solid state nuclear track detectors, an experimental search for their observation has been started. This well-established detection technique nowadays benefits from an efficient analysis technology based on a PC-controlled auto-focus microscope and a CCD camera together with pattern recognition software. The flatness and the definition of the shadow edge of the target is the critical point of this method: Due to the energy loss of the beam the target carrier foil (1μm Ni) may develop thermal distortions in the μm range, leading to misinterpretations of isomeric fission fragments. Therefore the flatness of the target foil is continuously monitored via a capacitance measurement. First results applying this method to the search of a fission isomer in ^{234}U via the ^{232}Th(α,2n) reaction will be presented.
[1] Metag et al., Nucl. Instr. Meth. 114 (1974) 445.
*supported by DFG Cluster of Excellence UNIVERSE

HK 67.41 Th 14:00 Audi-Max

Collective dipole response of proton-rich nuclei ^{32}Ar and ^{34}Ar. — •Olga Lepyoshkina[1] and Christoph Langer[2] for the LAND-S327-Collaboration — [1]Physik Department TU München, Garching — [2]Institut für Kernphysik, Universität Frankfurt, Frankfurt am Main, Germany

The earlier observation of low-lying dipole strength in neutron rich nuclei and its interpretation with respect to basic nuclear properties (symmetry energy, skin thickness) initiated the investigation of this phenomenon in proton-rich nuclei. Macroscopically this strength could be explained with the resonant dipole oscillation of a proton skin against the isospin-symmetric core. For nuclei like ^{32}Ar the occurrence of pronounced dipole strength is predicted in the low-energy region between 8-10 MeV excitation energy. For the ^{34}Ar the pygmy strength is expected to drop sharply and vanish entirely for the N=Z nucleus ^{36}Ar.

The experiment S327 has been performed in August 2008 at the GSI Darmstadt in Cave C using the LAND reaction setup. Fragmentation of a 800 A MeV primary ^{36}Ar beam on a Be target was used to produce the radioactive isotopes ^{34}Ar and ^{32}Ar. After passing the FRS (Fragment Separator) the ions impinged on a Pb target. The dipole response is observed using the Coulomb excitation method in inverse kinematics. The concept and the experimental method will be shown in the context of the underlying physics case in ^{32,34}Ar.

This work was supported by GSI F&E and BMBF.

HK 67.42 Th 14:00 Audi-Max

Towards optical access to the lowest nuclear transition in ^{229m}Th† — •P.G. Thirolf[1], M. Bussmann[1,3], D. Habs[1], J. Neumayr[1], T. Schaetz[2], H. Schmitz[1,2], J. Schreiber[1,4], J. Szerypo[1], L. Trepl[1], and H.-F. Wirth[1] — [1]LMU München, Garching, Germany — [2]MPI für Quantenoptik, Garching, Germany — [3]FZ

Dresden, Dresden, Germany — [4]Imperial College, London, UK

^{229m}Th exhibits the lowest-lying nuclear excitation with an excitation energy of only 7.6(5) eV (163(11) nm) and an isomeric lifetime of $\sim 10^4$ s, giving rise to an extremely sharp relative line width of the ground state transition of $\sim 10^{-20}$. This transition qualifies as an extremely sharp frequency standard, allowing to build a nuclear clock with unprecedented accuracy. Moreover, theoretical calculations predict an enhancement of the sensitivity to time dependent variations of fundamental constants like the fine structure constant α by about 10^6. Laser excitation of the 7.6 eV transition requires a precise knowledge of the transition energy. Therefore the ^{229m}Th isomers are populated via α decay from ^{233}U in a buffer gas cell, from where they are selectively extracted and collected. The UV fluorescence photons are then collimated via a MgF_2 lens and sharp filters onto an MCP detector and secondary electrons are registered on a phosphorous screen by a CCD camera. In order to prepare for subsequent sympathetic laser cooling in a $^{24}Mg^+$ Coulomb crystal, a laser setup consisting of an Yb fibre laser and a frequency quadrupling stage is presently under construction.

†Supported by the DFG Cluster of Excellence MAP (Munich-Centre for Advanced Photonics).

HK 67.43 Th 14:00 Audi-Max

Measurement of the $g(2_1^+)$-factor in ^{140}Ba with the "Recoil-in-Vacuum"method — •Christopher Bauer, Norbert Pietralla, and Jörg Leske — Institut für Kernphysik, Technische Universität Darmstadt, 64289 Darmstadt, Germany

The "Recoil-in-Vacuum"method as described recently in [1][2] is used to determine the unknown magnetic moment of the 2_1^+ state in the neutron-rich nucleus ^{140}Ba. A Coulomb excitation experiment in inverse kinematics was performed at REX-Isolde (CERN) in 2007. Beams of ^{140,142}Ba were impinging on a 0.9mg/cm^2 ^{96}Mo target and a 1 mm Cu stopper. Gamma rays were detected by the MINIBALL array, a DSSSD was used for particle identification.

The microscopic structure of the 2_1^+ state is investigated by the magnetic moment, which is sensitive to the composition of the wave function regarding proton and neutron configurations, and is compared to predictions from various calculations.

[1] N. J. Stone et al., Phys. Rev. Lett. **94**, 192501 (2005)
[2] A. E. Stuchberry and N. J. Stone, Phys. Rev. C **76**, 034307 (2007)

HK 67.44 Th 14:00 Audi-Max

Octupole vibrations in rare-earth nuclei — •Marc André Büssing, Michael Elvers, Janis Endres, Jens Hasper, and Andreas Zilges — Institut für Kernphysik, Universität zu Köln, D-50823 Köln

The systematics of octupole vibrations in the region of rare-earth nuclei are still not well understood.

First test measurements have been carried out at the FN Tandem accelerator of the University of Cologne. The gamma-ray spectroscopy was performed at the highly-efficient HORUS spectrometer which consists of 16 High-Purity Germanium detectors. The nucleus ^{158}Dy has been investigated via the reactions ^{156}Gd(α,2n) and ^{149}Sm(^{12}C,3n), furthermore the nucleus ^{154}Dy was studied via the reaction ^{144}Nd(^{14}N,4n). In addition measurements with the (p,p$'$) reaction were carried out on the nuclei ^{142}Nd and ^{172}Yb.

First results of these measurements are shown in the context of existing data for this mass region.

HK 67.45 Th 14:00 Audi-Max

Nuclear moments and hyperfine structure parameters for heavy isotopes within QED and relativistic mean field theory — •Olga Khetselius — Odessa University, P.O.Box 24a, Odessa-9, Ukraine, 65009

Consistent calculation of the nuclear electric quadrupole moments Q and hyperfine structure parameters for heavy elements is carried out within the gauge-invariant QED [1]perturbation theory and relativistic mean field approach [2]. The results of calculating the nuclear moments and hfs constants are presented for 201Hg, 207Pb, 223Ra. For element 201Hg we have received Q= 380,5 mbarn. It is agreed the best of all with experimental value, received by group Ulm etal (general interval of the experimental values is 300-600 mb). For element of 223Ra our value is Q=1,22 barn. It is in the limits of last experimental measurements values by Wendt group (ISOLDE Collaboration). The role of the nuclear effects contribution (core-polarization ones, which are induced by valent protons of a nucleus), temporal distribution of magnetization in a nucleus (effect of Bohr-Weisskopf) and non-accounted high order QED corrections is analyzed.

References [1] A. Glushkov, O.Khetselius, et al, Nucl.Phys.A. 734S, 21 (2004); J.Phys.CS. 35 430 (2006); Recent Adv. In Theory of Phys. and Chem Systems (Springer). 15, 285 (2006); Europ.Phys.Journ.ST. 160,195 (2008); Proc.MENU-08, SLAC (2008). [2] T.Nagasawa, A.Haga, M.Nakano, Phys.Rev.C.69,0934322 (2004).

HK 67.46 Th 14:00 Audi-Max

Relativistic calculation of the beta decay probabilities in the optimized Dirac-Kohn-Sham atom model and a chemical environment effect — •Alexander Glushkov[1,2], Olga Khetselius[1], Yuliya Dubrovskaya[1], and Ludmila Lovett[3] — [1]Odessa University, P.O.Box 24a, Odessa-9, 65009, ukraine — [2]Russian Academy of Sciences, Troitsk, Moscow reg., 142090, Russia — [3]UK National Academy of Sciences and Bookdata Co., London SW1Y 5AG, UK

New theoretical scheme for calculating the beta decay characteristics and an account for chemical environment effect on the beta decay ones is developed. As method of calculation of the relativistic fields and electron wave functions, the gauge invariant Dirac-Fock and Dirac-Kohn-Sham approaches are used [1,2]. The results of calculating the decay probabilities for the beta decays: 33P-33S, 35S-35Cl, 63Ni-63Cu, 241Pu-241Am are presented. Comparison of the Fermi function values is carried out for different approximations of an exchange effect account, calculation with using wave functions on the boundary of the charged spherical nucleus and with using squires of the amplitudes of expansion of these functions near zero. References. A.V.Glushkov etal, In: New Projects and New lines of research in Nuclear Physics, eds.Fazio G., Hanappe F. (World Sci.. Singapore,2003); Nucl.Phys.A. 734S,21 (2004). 2. A.V.Glushkov et al, Int. Journ. Quant.Chem. 99, 936 (2004); 104, 512 (2005); J.Phys.CS.35,425 (2005); Recent Adv. in Theory of Phys.and Chem.Syst.(Springer) 15, 285 (2006); In: Low Energy Antiproton Phys.(AIP)796, 206,211(2005).

HK 67.47 Th 14:00 Audi-Max

TRIGA-Laser: Collinear laser spectroscopy on short-lived fission products and heavy elements at the research reactor TRIGA Mainz — •Jörg Krämer[1], Klaus Blaum[2], Klaus Eberhardt[1], Christopher Geppert[3], Andreas Krieger[1], and Wilfried Nörtershäuser[1,3] — [1]Mainz, Institut für Kernchemie, Mainz, Germany — [2]Max-Planck-Institut für Kernphysik, Heidelberg, Germany — [3]Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

At the TRIGA research reactor at the University of Mainz a collinear laser spectroscopy experiment is currently being installed, which serves as a prototype for the LaSpec collaboration within FAIR at GSI Darmstadt. This setup at the TRIGA reactor allows to study short-lived fission products created near the reactor core by neutron induced fission. A variety of fissionable actinide isotopes are available as target materials up to ^{249}Cf which give access to different regions of the nuclear chart. A special gas-jet transport system will be used to guide the nuclei towards an ion source, where ion beams of a large variety of elements up to refractory elements will be produced and after mass separation be guided either to the collinear beamline of TRIGALASER for laser spectroscopic studies or to TRIGATRAP for high-accuracy mass measurements. In the first phase of the experiment a purely optical detection system with photomultipliers is planned. We will present the technical outline of the experiment, the results of ion optics performance tests making use of a surface ion source and give a status report of laser spectroscopy test measurements with Rb atoms.

HK 67.48 Th 14:00 Audi-Max

Two-phonon γ-vibrational states in ^{170}Er — •Douglas DiJulio, Joakim Cederkall, Claes Fahlander, Pavel Golubev, Dirk Rudolph, Andreas Ekström, Emma Johansson, and Edana Merchan — Physics Department, Lund University, Sweden

Two phonon γ-vibrational states in the nucleus ^{170}Er have been investigated by Coulomb excitation. The experiments were carried out at the Laboratori Nazionali di Legnaro (LNL) using the GASP array coupled to the new Lund Silicon Array (LuSiA) detector system for charged particle detection. LuSiA consists of four square double-sided silicon-strip detectors mounted in a box surrounding the target position. The two-phonon γ-vibrational states were populated using the ^{32}S +^{170}Er reaction at a "safe"beam energy of 117 MeV. Along with the excitation energies of the states, of particular interest is the B(E2) ratio between the transitions from the two-phonon and one-phonon states which is predicted to have a specific value at the critical point Y(5). Preliminary results from the experiment will be presented.

HK 67.49 Th 14:00 Audi-Max

Characterization of Detector Systems for Photofission Studies† — •P.G. Thirolf[1], M. Csatlos[2], L. Csige[2], M. Fujiwara[3], J. Gulyas[2], D. Habs[1], A. Krasznahorkay[2], N. Pietralla[4], D. Savran[4], and T. Tajima[1] — [1]LMU München, Garching, Germany — [2]Inst. Nucl. Res. of the Hungarian Acad. of Sciences, Debrecen, Hungary — [3]Res. Center f. Nucl. Phys., Osaka University, Japan — [4]IKP, TU Darmstadt, Germany

A brilliant source of photon beams in the X-ray - MeV range can be realized by (coherent) Compton backscattering of laser photons off a dense relativistic electron mirror generated from thin (few nm) diamond-like carbon foils [1]. Highly monochromatic photon beams can be expected with unprecedented photon flux intensities of up to 10^{12} photons/pulse at 8 MeV photon energy, operated at a laser repetition rate of 10 Hz. Such photon beams will offer new perspectives for photon-induced nuclear structure studies, e.g. in the second and third minima of actinides. Preparing for photofission studies in actinides, Parallel Plate Avalanche gas detector (PPAC) arrays have been commissioned, each equipped with a stack of 15-25 large area fissile actinide targets (^{235,238}U, ^{232}Th), where the actinide targets simultaneously act as detector electrodes. Properties of the detector systems will be presented, which will be included in first experiments at the Darmstadt NEPTUN tagger facility or the NEW SUBARU facility in Osaka.

[1] D. Habs et al., Appl. Phys. B93 (2008) 349.

†Supported by the DFG Cluster of Excellence MAP (Munich-Centre for Advanced Photonics).

HK 67.50 Th 14:00 Audi-Max

Evidence for an isomeric $3/2^-$ state in ^{53}Co — Dirk Rudolph[1] and •Robert Hoischen[1,2] for the RISING S244-Collaboration — [1]Department of Physics, Lund University, S-22100 Lund, Sweden — [2]Helmholtzzentrum für Schwerionenforschung GmbH, D-64291 Darmstadt, Germany

The fragmentation of a 550 MeV/u primary beam of ^{58}Ni on a ^{9}Be target has been used to measure time- and energy-correlated γ decays following the implantation of event-by-event discriminated secondary fragments into a ^{9}Be stopper plate. A new isomeric γ decay with $T_{1/2} = 14(^{6}_{4})$ ns and $E_\gamma = 646.2(2)$ keV is observed and attributed to the decay of the yrast $3/2^-$ state in $^{53}_{27}$Co$_{26}$. This short-lived isomeric state has been populated by means of nuclear reactions during the stopping process of the secondary fragments. The experimental findings are discussed in the framework of large-scale spherical shell-model calculations in conjunction with isospin symmetry breaking residual interactions for the $A = 53$, $T_z = \pm 1/2$ mirror nuclei ^{53}Co and ^{53}Fe.

HK 67.51 Th 14:00 Audi-Max

Experimental Setup for Conversion Electron Spectroscopy of Shape Isomers in ^{239}Pu† — •P.G. Thirolf[1], D. Habs[1], C. Lang[1], T. Morgan[1], W.C. Parker[2], and W. Schwerdtfeger[1] — [1]LMU München, Garching, Germany — [2]Univ. of Arizona, Tuscon, USA

Investigating shape isomers in odd-A actinide nuclei probes the nuclear single-particle structure of heavy nuclei at large deformations, thus allowing to refine nuclear models. Besides γ-spectroscopic studies, conversion electron spectroscopy is an indispensable tool to complement the experimental spectroscopic information. Fission isomers in ^{239}Pu were populated via the ^{238}U(α, 3n) reaction (E_α = 33 MeV) at the Garching Tandem accelerator. A recoil shadow technique was used to selectively detect only fission fragments from shape isomeric decays at backward angles. For the detection of conversion electrons three Mini-Orange spectrometers (i.e. magnetic transport and filter systems with a toroidal magnetic field from permanent magnet wedges in conjuction with lN_2-cooled Si(Li) detectors) were used at forward angles. Due to the long lifetime of 8 μs of the fission isomer in ^{239}Pu an annular catcher foil was placed behind the target to stop the recoiling isomers prior to their isomeric fission decay. In order to optimize the solid angle coverage for delayed fission fragment detection, a large array of silicon solar cells (15 modules, each 4x2 cm^2) was used at backward angles. Delayed fission fragments were detected in coincidence with electrons detected in the Si(Li) detectors of the Mini-Orange spectrometers.

†Supported by the DFG Cluster of Excellence UNIVERSE and by DAAD via the RISE program.

HK 67.52 Th 14:00 Audi-Max

Measurements for astrophysical calculations at ISOLTRAP — •Martin Breitenfeldt — Ernst-Moritz-Arndt-Universität, Greifswald, Germany

With ISOLTRAP at ISOLDE/CERN mass measurements on exotic nuclides are performed down to a precision of $\delta m/m = 8 \cdot 10^{-9}$. The mass as a fundamental ground state property finds applications in many theoretical calculations, especially in nuclear physics and astrophysics. In the last years part of the measurements at ISOLTRAP focussed on nuclides relevant for nucleosynthesis studies. Several measurement campaigns in 2005-2008 were dedicated to the mass determination of neutron rich nuclides close to the proton shell $Z = 50$ and the pathway of the r-process. The masses of $^{112,114,116-121,123}$Ag and ^{114,120,124,126,128}Cd were determined. In addition to the neutron-rich isotopes, the masses of the neutron-deficient nuclides $^{99-109}$Cd have been determined. The mass of ^{99}Cd has been measured directly for the first time, giving a mass value close to the doubly magic ^{100}Sn and the end-point region of the rp-process. An overview of the results and their impact on the astrophysical calculations will be presented.

HK 67.53 Th 14:00 Audi-Max

Temperature-dependent nuclear moment of inertia including neutron-proton pairing correlations — •Ismahane Ami[1,2], Mohamed Belabbas[3], Naziha Benhamouda[2], Mohamed Fellah[2,4], and Nassima-Hosni Allal[2,4] — [1]Institut des Sciences et de la Technologie, Université Yahia Fares de Médéa, Aïn-D heb, 26000 Médéa, Algeria — [2]Laboratoire de Physique Théorique, Faculté de Physique, USTHB, BP32, El-Alia, 16111 Bab-Ezzouar, Alger, Algeria — [3]Faculté des Sciences et des Sciences de l Ingénieur, Université Hassiba Ben Bouali, BP151, 02000 Chlef, Algeria — [4]Centre de Recherche Nucléaire d Alger, COMENA, BP 399 Alger-Gare, Alger, Algeria

Expressions of the temperature-dependent parallel and perpendicular nuclear moments of inertia including neutron-proton pairing correlations have been established. The latter have been derived using the cranking method as well as the isovector temperature-dependent gap equations [1]. They generalize the expressions of the usual finite-temperature BCS (FTBCS) method. The model has been applied to the schematic Richardson model. The obtained results are compared to those of the usual FTBCS approach for the pairing between like-particles.

[1] M. Fellah, N.H. Allal, M. Belabbas, M.R. Oudih and N. Benhamouda, Phys. Rev. C76, 047306(2007).

HK 67.54 Th 14:00 Audi-Max

Lifetime measurements of intermediate spin states in ^{133}Sb by fast-timing technique — •Dan Gabriel Ghita[1], Henryk Mach[2,3], Ulli Koester[4], and Gary Simpson[4] — [1]Horia Hulubei National Institute for Physics and Nuclear Engineering, Magurele, Ilfov 077125, Romania — [2]Institute for Structure and Nuclear Astrophysics, University of Notre Dame, Notre Dame, Indiana 46616, USA — [3]Department of Nuclear and Particle Physics, Uppsala University, P. O. Box 535, S-75121 Uppsala, Sweden — [4]Institut Laue Langevin, Grenoble, France

Recent developments of the fast-timing setup at Lohengrin ILL Grenoble, by using high performance $LaBr_3$(Ce) scintillators and a new ionisation chamber, significantly improved the precision of lifetime measurements. In the present work we investigate the ^{133}Sb nucleus, by employing the new experimental setup. The ^{133}Sb nucleus has just one proton outside the doubly magic ^{132}Sn and it is an excellent test ground for the nuclear shell model. A 17 microsecond isomer was previously observed in this nucleus. Measurements of the lifetimes of the states below this isomer allows not only to verify the multipolarity of the transitions, but also to establish the level scheme. Furthermore, the lifetimes extracted from our experiment allows to test various shell model calculations which should be able to accurately predict lifetimes of the states for this simple nucleus.

HK 67.55 Th 14:00 Audi-Max

Nuclear structure research with thePenningtrap mass spectrometer ISOLTRAP at CERN — •Dennis Neidherr for the ISOLTRAP-Collaboration — Johannes Gutenberg-Universität Mainz, Germany

At the double-Penning-trap mass spectrometer ISOLTRAP [1] at ISOLDE/CERN the cyclotron frequency of short-lived radionuclides is measured in order to determine their mass with a relative uncertainty in the order of 10^{-8} and below. This ground state property plays an important role in many fields of modern physics from nuclear-structure research to nuclear astrophysics and tests of the weak interaction of the Standard Model. An example for the first one is the evolution of the nuclear shape as a function of the number of neutrons and protons. In 2008 the masses of $^{223-229}$Rn and $^{143-146}$Xe were measured for the first time directly, whereas ^{229}Rn was even discovered by our

Penning trap based experiment. With this mass values one can study the proton-neutron interaction and therefore get information about the nuclear structure like collectivity, the onset of deformation or the geometrical shapes in atomic nuclei [2]. The experimental results as well as the impact on the theoretical models will be presented.

[1] M. Mukherjee *et al.*, Eur. Phys. J. A 35, 1-29 (2008).
[2] R.B. Cakirli *et al.*, Phys. Rev. Lett. 94, 092501 (2005).

HK 67.56 Th 14:00 Audi-Max

Quarks confinement and the nucleon-nucleon interaction — •Agne Masalaite[1], Gintautas Kamuntavicius[1], Mindaugas Lekaveckas[2], and Saulius Mickevicius[1] — [1]Department of Physics, Faculty of Natural Sciences, Vytautas Magnus University, Vileikos 8, Kaunas LT-44404, Lithuania — [2]Faculty of Science, P.O. Box 44 (Jyrängöntie 2), FI-00014 University of Helsinki, Finland

Recently many studies have been devoted for understanding the nucleon-nucleon interaction and the atomic nuclei structure starting from quark models. The way for this problem solution selected by us is based on a nontraditional consideration of the confinement of valence quarks in cases when two, three or more nucleons approach each other and the corresponding confinement potentials come into contact and vanish. The overlap of wave-functions of valence quarks, trapped in different nucleons, causes correlations thus giving the possibility to understand the peculiarities of the nucleon-nucleon interaction and corresponding potential modifications in case, when interacting nucleons are present in atomic nucleus. The investigated systems of double-, triple- and larger number of confining harmonic oscillator wells opens new possibilities for recent realistic nucleon-nucleon potentials modifications taking into account the substructure of interacting nucleons. Nucleons entering the interaction area change due to the intrinsic structure modification. These changes are dependent on the presence of "spectator" nucleons in vicinity of interacting ones. This observation can serve as alternative of three nucleon potential necessary for lightest nuclei description.

HK 67.57 Th 14:00 Audi-Max

Coulomb Excitation of ^{148}Sm — •Thomas Möller[1], Tan Ahn[2], Michael Carpenter[3], Laurent Coquard[1], Robert Janssens[3], Jörg Leske[1], Norbert Pietralla[1], and Georgi Rainovski[4] — [1]Institut für Kernphysik, TU Darmstadt — [2]WNSL, Yale University, New Haven, CT, USA — [3]Argonne National Laboratory, Argonne, IL, USA — [4]Faculty of Physics, St. Kliment Ohridski University Sofia, Bulgaria

The isovector one-phonon quadrupole excitation of the valence shell, the $2^+_{1,\mathrm{ms}}$ mixed-symmetry state, is a fundamental excitation mode of vibrational-type nuclei [1]. In order to investigate the evolution of the $2^+_{1,\mathrm{ms}}$ state in the chain of Sm isotopes, Coulomb-excitation experiments in inverse kinematics on ^{148}Sm and ^{154}Sm have been performed at Argonne National Laboratory. Beams of these isotopes were accelerated by the ATLAS accelerator and shot onto a ^{12}C target with energies of 550 MeV and 570 MeV, respectively, corresponding to approximately 85% of the Coulomb barrier. Deexcitation gamma rays have been detected by the Gammasphere spectrometer. Lifetimes of excited states could be calculated from observed Coulomb excitation cross sections. For the $2^+_{1,\mathrm{ms}}$ state in ^{148}Sm the $M1$ strength for its decay to 2^+_1 could be deduced and compared to previous measurements [2]. Results of the analysis of ^{148}Sm will be presented. [1] N. Pietralla et al., Prog. Part. Nucl. Phys. **60**, 225 (2008); [2] T. C. Li et al., Phys. Rev. C **71**, 044318 (2005); Supported by the DFG

HK 67.58 Th 14:00 Audi-Max

Long-lived isomeric states in neutron-deficient thorium isotopes? — •Johannes Lachner, Iris Dillmann, Thomas Faestermann, Gunther Korschinek, Mikhail Poutivtsev, and Georg Rugel — Technische Universität München

In a recent publication Marinov et al. (Phys. Rev. C 76, 021303(R), 2007) reported that isomeric states should exist in the neutron-deficient thorium-isotopes ^{211}Th, ^{213}Th, ^{217}Th and ^{218}Th. These isotopes were found by use of a conventional mass spectrometer in abundances of 10^{-11} relative to ^{232}Th in a natural sample of thorium. Therefore they should be of primordial origin and have minimum half-lives of several 100 million years. This is surprising, as the ground-states of these α-emitters have lifetimes shorter than seconds and are surrounded by other short-lived α-emitting nuclei. So their production and half-life can not be explained within current models of nuclear and astrophysics. With the method of Accelerator Mass Spectrometry (AMS) at the Maier-Leibnitz-Laboratory in Munich this search could be repeated with higher sensitivity and complete reduction of background due to molecules. Hereby none of the four neutron-deficient thorium isotopes could be detected, the new upper limit for their abundance is an order of magnitude below the postulated value. The work was supported by DFG through EXC 153.

HK 67.59 Th 14:00 Audi-Max

Quasifree scattering with electrons at ELISe/FAIR experiment — •Javier R. Vignote[1] and Haik Simon[2] — [1]Instituto de Estructura de la Materia, CSIC, Serrano 123, E-28006, Madrid, Spain — [2]GSI Helmholtz Centre for Heavy Ion Research GmbH, Planckstrasse 1, D-64291, Darmstadt, Germany

An electron-ion scattering experiment ELISe is a part of the installations envisaged in the new experimental storage ring at the international facility for antiproton and ion research (FAIR) in Darmstadt, Germany. It offers the worldwide unique opportunity to use electrons as probe particle in investigations of the structure of exotic nuclei.

The use of electrons as a probe particle provides a powerful tool for examining nuclear structure. The most reliable evidence how nuclei look like originates from electron scattering. Up to now, the scattering of electrons is still restricted to stable isotopes. ELISe aims at an extension of this powerful method to nuclei beyond the valley of stability. ELISe will be a unique and unprecedented tool for precisely measuring nuclear charge distributions, transition current matrix elements and spectroscopic factors. In this talk I will present a review of the electro-nuclear coincidence experiments from a theoretical point of view and I will focus my attention to the inverse or beam to beam kinematics set up that will be used at the ELISe experiment.

HK 67.60 Th 14:00 Audi-Max

The scientific program of EAGLE campaign on the beam of the Warsaw Cyclotrone — •Julian Srebrny — Heavy Ion Laboratory, University of Warsaw, Poland

(on behalf of the EAGLE collaboration)

The scientific program of the EAGLE collaboration (central European Array for Gamma Levels Evaluation)will be presented. The EAGLE collaboration was formed by 8 Polish Institutes of Nuclear Physics and CEA Saclay, Lund University, University of Sofia, University of Brighton and ATOMKI Debrecen.

The new multidetectors array for γ-ray spectroscopy in Warsaw will be described and shown.

The main studies will be concentrated on:

1. DSAM and RDDSAM picosecond life-time measurements for systematic studies of chiral symmetry breaking as a new dynamic variable important for the structure of odd-odd nuclei

2. the detailed experimental study of weakening of the K-forbidness due to the triaxialityin the A *130 region by gamma-gamma and electron-gamma coincidences

3. hyperfine interaction and g-factor measurements combined with RDDSAM

4. COULEX and others

HK 67.61 Th 14:00 Audi-Max

Self-Consistent Covariant Descriptions of Spin-Isospin Resonances — •Haozhao Liang[1,2], Nguyen Van Giai[1], and Jie Meng[2] — [1]Institut de Physique Nucléaire, 91406 Orsay, France — [2]School of Physics, Peking University, Beijing 100871, P.R. China

Spin-isospin excitations in nuclei become one of the central topics in nuclear physics and astrophysics. Basically, a systematic pattern of the energy and collectivity of these resonances could provide direct information on the spin and isospin properties of the in-medium nuclear interaction. Furthermore, the neutron skin thickness can be determined indirectly by the sum rule of spin-dipole resonances (SDR) or the excitation energy difference between isobaric analog states (IAS) and Gamow-Teller resonances (GTR). More generally, spin-isospin resonances allow one to attack other kinds of problems outside the realm of nuclear structure, like the β-decay of nuclei which lie on the r-process path of stellar nucleosynthesis, and so on.

In this work, a fully self-consistent charge-exchange relativistic random phase approximation (RPA) based on the relativistic Hartree-Fock (RHF) approach is established. The self-consistency is verified by the so-called IAS check. The excitation properties and the non-energy weighted sum rules of the GTR and SDR are well reproduced in the doubly magic nuclei ^{48}Ca, ^{90}Zr and ^{208}Pb without any readjustment of the particle-hole residual interaction. Furthermore, the

importance of exchange diagram contributions is demonstrated.

Reference: H. Liang, N. Van Giai, J. Meng, Phys. Rev. Lett. 101, 122502 (2008).

HK 67.62 Th 14:00 Audi-Max

Nonperturbative renormalization group for many fermion systems: from cold atoms to hadron matter — •BORIS KRIPPA — University of manchester, manchester, m13 9pl

The application of the nonperturbative renormalisation group to many-fermion systems with a short-range attractive force is studied. Assuming an ansatz for the effective action with fermions and effective bosons, describing pairing effects, a set of approximate flow equations for the effective coupling including boson and fermion loop contribution has been derived. The phase transition to a state with broken symmetry is found at a critical value of the running scale. Both BEC and BCS regimes as well as crossover between them are identified and studied. The known mean-field results in both regimes are recovered if boson-loop effects are omitted. The developed approach is applied to the variety of many fermion systems such as nuclear/neutron/quark matter and cold fermionic atoms.

HK 67.63 Th 14:00 Audi-Max

Coulomb dissociation reactions on Mo isotopes for astrophysial applications — •OLGA ERSHOVA for the LAND-S287-S295-Collaboration — Institut für Kernphysik, Johann Wolfgang Goethe-Universität Frankfurt am Main, Frankfurt a. M., Germany

Photo-dissociation reactions are important for explaining abundances of the nuclei produced via the so-called p-process, which takes place in Type II supernova explosions. Theoretical calculations of the isotopic p-nuclei abundances require a huge reaction network linking thousands of isotopes, where most of the reaction rates have to be derived from theory. However, it's important that as many rates as possible are measured experimentally to provide pivot points for the calculations. In all present models, a significant underproduction of Mo and Ru p-nuclides is observed. At the same time, ^{92}Mo has one of the highest cosmic abundances of all p-nuclei.

At the SIS/FRS/LAND facility at GSI (γ,n) reactions on the stable ^{92,94,100}Mo and the unstable ^{93}Mo isotopes were studied. The experiment was performed in inverse kinematics using the Coulomb dissociation method. The setup provides a possibility to identify the outgoing nucleus with respect to A and Z. Together with a neutron hit in the LAND detector, it allows to tag the proper reaction channel. Gamma-rays emitted by the de-exciting nucleus were measured with the 2π CsI gamma spectrometer. Current status of the analysis, with a focus on the gamma detection, will be presented.

This project is supported by the HGF Young Investigators Project VH-NG-327.

HK 67.64 Th 14:00 Audi-Max

The ^{15}N(p,γ)^{16}O reaction studied at LUNA — •DANIEL BEMMERER for the LUNA-Collaboration — Forschungszentrum Dresden-Rossendorf (FZD), Dresden, Germany

The ^{15}N(p,γ)^{16}O reaction lies at the intersection of the first and second CNO cycle of hydrogen burning. Recent R-matrix extrapolations suggest that its cross section may be lower by about a factor two with respect to previous work. Here we show new, direct experimental data on this reaction obtained at the LUNA 400 kV accelerator deep underground in the Gran Sasso laboratory in Italy.

HK 67.65 Th 14:00 Audi-Max

α-decay half-lives for neutral atoms and bare nuclei — •F. FARINON for the E073-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany — Justus-Liebig-Universität, Gießen, Germany

The influence of the bound electron cloud on the α-decay constant λ has been discussed theoretically since the late 50s. Precise Q-values and α-decay half-lives of fully stripped ions are important to obtain an unambiguous determination of the electron screening energy, thereby deducing reliable reaction rates in stellar environments. Recently, the measurements of α-decay half-lives are feasible also for highly-charged radioactive nuclides. Using a ^{238}U beam at relativistic energies at the present FRS-ESR facility at GSI it is possible to produce, efficiently separate and store highly charged α-emitters. Few candidates have been selected for the proposed investigations and will be studied by using the Schottky Mass Spectrometry technique. In order to establish a solid reference data set, lifetime measurements of the corresponding neutral atoms have been performed directly at the FRS by implanting the separated ions into an active silicon stopper. These results will be reported.

HK 67.66 Th 14:00 Audi-Max

Simulation und Entwicklung eines Monitordetektors zur Messung der Intensität der fensterlosen Tritiumquelle am KATRIN-Experiment — •DETLEF MAUREL für die KATRIN-Kollaboration — Universität Karlsruhe (TH), Institut für experimentelle Kernphysik

Ziel des Karlsruher Tritium-Neutrinoexperimentes (KATRIN) ist die direkte und modellunabhängige Bestimmung der Neutrinomasse aus der Kinematik des Tritiumzerfalls mit einer Sensitivität von $m_\nu < 0.2\,\mathrm{eV}$. KATRIN basiert auf einer fensterlosen gasförmigen Tritiumquelle und einem System aus zwei Spektrometern nach MAC-E-Filter-Prinzip. Im rückwärtigen Abschnitt der Tritiumquelle befindet sich eine goldbeschichtete Endplatte, die zugleich das elektrostatische Potential der Quelle definiert. Die Quellaktivität von 10^{11} Bq soll mittels der rückwärtig emittierten Zerfallselektronen während der Messung mit einem Monitor-Detektor überwacht werden. Eine Möglichkeit liegt im Nachweis der Brems- und Röntgenstrahlung, die von den Elektronen in der Endplatte erzeugt wird. Inhalt des Posters sind Simulation und experimentelle Untersuchung verschiedener Endplattentypen und Nachweismethoden.

Gefördert vom Sonderforschungsbereich Transregio 27 („Neutrinos and Beyond“) Teilprojekt A2.

HK 67.67 Th 14:00 Audi-Max

Measurement of the low energy secondary electron emission rate induced by cosmic rays. — •HENRIK ARLINGHAUS, MARCUS BECK, CHRISTIAN WEINHEIMER, HANS-WERNER ORTJOHANN, VOLKER HANNEN, and HELMUT BAUMEISTER — Institut für Kernphysik, Universität Münster

The KATRIN (KArlsruhe TRItium Neutrino) experiment intends to determine the mass of the electron antineutrino to within 0.2 eV/c^2 (90% C.L.) via a measurement of the endpoint region of the tritium beta-decay spectrum. This requires a background rate of some few millihertz. In order to understand this background, a GEANT4 simulation of the electron background in the main spectrometer was written. The low energy secondary electron emission rate induced by cosmic muons in stainless steel, was determined experimentally, and used in the simulation.

We will present the design and results of an experiment at the University of Münster which we used to measure the number of electrons which were ejected by cosmic muons passing through a stainless steel electrode. Using plastic scintillators, the incident muon angle of the triggering muons was varied. The ejected electrons were accelerated and focused onto a silicon PIN detector, and their energy as well as arrival time distribution was recorded.

Preliminary results show a secondary electron production rate of under 5% for all measured angles.

This project is supported by BMBF under contract number 05A08PM1.

HK 67.68 Th 14:00 Audi-Max

Atomic Parity Violation in one Single Trapped and Laser Cooled Radium Ion: A Probe of Electroweak Running — •G.S. GIRI, O. BOELL, K. JUNGMANN, B.K. SAHOO, R.G.E. TIMMERMANS, O.O. VERSOLATO, L.W. WANSBEEK, and L. WILLMANN — KVI, University of Groningen, The Netherlands

One single-trapped and laser cooled radium ion is an ideal candidate to investigate atomic parity non-conservation (APNC). APNC can serve as a low energy test of the Standard Model of particle physics. We aim for a precision measurement of the electroweak mixing angle, by probing the differential light shift of the 7S and 6D Zeeman sublevels. This shift is caused by the interaction of the ion with an off-resonant laser light field. With precision RF spectroscopy and subsequent electron shelving, the differential splitting can be determined to sub-Hertz accuracy. Recent calculations show that Ra^+ is a superior candidate for probing APNC [1]. With an almost identical set-up and using the electron shelving technique, ultra-narrow transitions in this ion can be exploited for an all optical, high stability frequency standard clock. We have succeeded in the production and subsequent slowing down of radium isotopes around ^{213}Ra. Further progress has been made in the development of ion traps and the necessary high precision optical laboratory. Laser spectroscopy of Ra^+ and the first ever trapping of this particle are being prepared.

[1] L.W. Wansbeek et al. Phys. Rev. A 78, 050501 (2008)

HK 67.69 Th 14:00 Audi-Max

Charge Symmetry Breaking in dd collisions with WASA-at-COSY* — •Wojciech Wglorz — Institut für Kernphysik and Jülich Center for Hadron Physics, Forschungszentrum Jülich, D-52425 Jülich, Germany — Nuclear Physics Department of the University of Silesia, Katowice

Charge symmetry is a special case of isospin symmetry defined as an invariance under the rotation of 180^o around the second axis in isospin space. The isospin symmetry is broken on the QCD level due to the up and down quark mass difference and electromagnetic interactions. In contrast to isospin violation the Charge Symmetry Breaking (CSB) is not dominated by electro-magnetic interactions and, thus, well suited to study the QCD quark mass term.

Based on the recent high-precision measurements of CSB in np $\rightarrow d\pi^0$ at TRIUMF and dd $\rightarrow \alpha\pi^0$ at IUCF significant progress in a common understanding of CSB within the framework of effective field theory has been achieved. Moreover, certain parameters have been identified necessary for a further theoretical analysis, like dd interactions in initial state state or p-wave contributions in dd $\rightarrow \alpha\pi^0$. This has motivated a program on CSB in dd collisions at WASA-at-COSY. First experiments have been carried out since the end of 2007. A general outline of the program and the current status will be presented.

*Supported by FZ Jülich, BMBF, and Wallenberg Foundation

HK 67.70 Th 14:00 Audi-Max

Studying the Unruh Effect using high-power, short-pulse lasers* — •C. Lang[1], P.G. Thirolf[1], D. Habs[1], A. Henig[1], D. Jung[1], D. Kiefer[1], J. Schreiber[1,2], and R. Schuetzhold[3] — [1]LMU München — [2]Imperial College, London/UK — [3]Univ. Duisburg-Essen

Understanding the quantum vacuum is one of the key challenges of fundamental physics. Electrons accelerated in the strong fields of high intensity lasers will experience a large acceleration granting access to the Unruh effect, where an accelerated electron will create entangled pairs of Unruh photons via non-inertial scattering of virtual photons from vacuum fluctuations. Using laser accelerated low-energy electrons ($\approx$ 1 MeV) and counter-propagating brilliant X-rays ($\approx$ 20 keV) acting as an undulator will accelerate the electrons such that entangled Unruh photon pairs of ca. 160 keV each will be created. The X-rays will be produced via Compton backscattering of optical photons off dense electron sheets, acting as relativistic mirrors [1]. About 10^3 Unruh photons/s are expected with a ratio between Unruh photon pairs and background from classical Larmor radiation of ≈ 0.004 [2]. Detection of the Unruh photons will be performed via Compton polarimetry using a 2D segmented planar Ge detector (20 mm thick) and a segmentation of 64 x 64 strips (width 1 mm). Unruh photons will be identified according to their specific energy, polarization and angular characteristics.

*Supported by the DFG Cluster of Excellence MAP (Munich-Centre for Advanced Photonics).

[1] D. Habs et al., Appl. Phys. B 93, 349 (2008).
[2] P.G. Thirolf et al., subm. to Eur. Phys. Journ. D (2008).

HK 67.71 Th 14:00 Audi-Max

Search for Symmetry Breaking Patterns with WASA-at-COSY — •Christian Pauly for the WASA-at-COSY-Collaboration — Institut für Kernphysik and Jülich Center for Hadron Physics, D-52425 Jülich, Germany

Key issues of the WASA-at-COSY physics program are the study of symmetries and symmetry breaking patterns in low energy hadronic processes within the non-perturbative regime of QCD. High statistic measurements of η and $\eta\prime$ meson decays are used to search for violations of isospin symmetry, and to test conservation of fundamental C, P and CP symmetries. A precise measurement of charge symmetry breaking in the isospin violating process $dd \rightarrow \alpha\pi^0$ is another important part of the physics program.

During the last year data have been obtained on several of the WASA key experiments. In particular, in fall 2008, a large data sample of $\geq 10^7$ η-decays was produced in the reaction $pd \rightarrow {}^3He\ \eta$. The reaction allows for the tagging of the produced η mesons merely by identification of the ^3He particle, covering all η decay channels. A second η production run on $pp \rightarrow pp\ \eta$ focused on the study of η decays into charged particles, especially $\eta \rightarrow \pi^+\pi^-e^+e^-$, which allows to search for an unconventional form of flavour conserving CP violation.

We present an overview of the experiment and status of the analysis.

— supported by BMBF, DAAD and Wallenberg Foundation

HK 67.72 Th 14:00 Audi-Max

Fundamental symmetries in ^{21}Na decay — •D.J. van der Hoek, R. Hoekstra, K. Jungmann, W.L. Kruithof, C.J.G. Onderwater, M. Sohani, L. Willmann, and H.W. Wilschut — KVI, University of Groningen, Groningen, The Netherlands

The β-ν correlations in β-decay allows searching for contributions that go beyond the V-A description of the Standard Model for the electroweak interaction. We are developing an experimental setup to measure correlations in the β-decay of ^{21}Na. By trapping the radioactive atoms, the recoiling nucleus (kinetic energy < 230 eV) can be measured in a reaction microscope in coincidence with the emitted β particle. The first step is to study β-ν correlations that allows to set limits on scalar and tensor contributions. By polarizing the parent nucleus it becomes possible to search for time reversal violation. The production and trapping of ^{21}Na has been accomplished. Details of the setup and the status of this phase of the program will be described.

HK 67.73 Th 14:00 Audi-Max

Tracking Simulations for the WITCH Experiment — •Jonas Mader[1], Marcus Beck[1], Peter Friedag[1], Christian Weinheimer[1], Nausikaa Geeraert[2], Nathal Severijns[2], Michael Tandecki[2], Emil Traykov[2], Simon van Gorp[2], Frederik Wauters[2], Alexander Herlert[3], and ISOLDE Collaboration[3] — [1]Institut für Kernphysik, WWU Münster, Wilhelm-Klemm Str. 9, 48149 Münster, Germany — [2]Instituut voor Kern- en Stralingsfysica, K.U.Leuven, Celestijnenlaan 200D, B-3001 Leuven, Belgium — [3]CERN, CH-1211 Geneve 23, Switzerland

The WTICH experiment will measure the energy spectrum of recoil ions after a beta decay. From such a recoil energy spectrum the beta-neutrino angular correlation, which is sensitive to exotic interactions, will be extracted. For a precise determination of the beta-neutrino angular correlation coefficient a with $\Delta a < 0.5\%$ the systematic uncertainties have to be understood in detail. To this end we perform particle tracking simulations from the source to the detector. The simulation package was originally developed for electrons and used in the KATRIN experiment. We adapted it for ions and use it to understand the transmission and reponse of the WITCH set-up, to investigate the effect of modifications of the set-up, to determine suitable configurations of the electrode potentials at WITCH and to analyse the data.

We will present the simulation package, show its functions using some select examples and give an outlook on the planned simulations.

This project is supported by BMBF under contract number 06MS270.

HK 67.74 Th 14:00 Audi-Max

Towards high-precision polarimetry for an EDM search on the deuteron — •Marlene da Silva e Silva, Klaus Jungmann, Wilbert Kruithof, Gerco Onderwater, Oscar Versolato, Hans Wilschut, and Lorenz Wilmann — KVI and University of Groningen, Groningen, The Netherlands

A finite Electric Dipole Moment (EDM) in any fundamental system would constitute a signal for New Physics. The deuteron presents itself as an optimal candidate due to its high sensitivity for CP odd parts of nuclear forces, together with being easily polarizable and having a small anomalous magnetic moment. A new storage ring technique is being developed, for which a small change in the vertical polarization would be a signal of a non-zero EDM. A novel polarimeter concept is under investigation. Besides being highly efficient, this polarimeter allows for continuous monitoring of the beam polarization, guaranteeing optimal sensitivity. Detailed studies on systematic error control, in addition to the measurement of cross sections and analyzing powers, were carried out at KVI-Groningen. Efficiency measurements were conducted at COSY-Jülich yielding a high efficiency up to 1.5%. The (statistics limited) ability to track changes in polarization at the level of a few hundred parts-per-million has been demonstrated. Further studies and developments to meet the final goal of sub-part-per-million sensitivity are in progress.

HK 67.75 Th 14:00 Audi-Max

Efficiency determination of the neutron detector ball at the S-DALINAC* — •Maksym Chernykh, Anna Maria Heilmann, Peter von Neumann-Cosel, and Achim Richter — Institut für Kernphysik, Technische Universität Darmstadt

Nuclear incompressibility (k_∞) is a fundamental quantity defining the

equation of state of nuclear matter. It can be determined by studying isoscalar giant monopole and dipole resonance using coincidence inelastic electron scattering of the type (e,e′n). For that purpose a neutron detector ball was newly designed and built at the S-DALINAC [1]. It consists of 13 BC501A scintillation cells and covers a solid angle up to 1.3π. Before the first experiments start, the properties of the new detector need to be determined. This work represents the neutron efficiency determination of the scintillation cells. For the measurements a ^{252}Cf source with a well known neutron energy distribution was used. The neutron energy was determined using the neutron time of flight relative to the fission fragments. The obtained results have been compared with Monte Carlo simulations using the NRESP code.

[1] M. Chernykh, Doctoral thesis D17, TU Darmstadt (2008).

*Supported by the DFG through SFB 634.

HK 67.76 Th 14:00 Audi-Max

Surface characterisation and surface protection of Germanium detectors — •Tobias Engert[1], Ivan Kojouharov[1], Thomas Krings[2], and Jürgen Gerl[1] — [1]GSI, 64291 Darmstadt, Germany — [2]SEMIKON Detector GmbH, 52428 Juelich, Germany

Abstract: The project includes the characterization of the surfaces of Ge detectors through all necessary processing steps, from the raw crystal to the final detector diode. The aim is to improve the mechanical structure and to reduce surface contaminations, by applying optimized treatment methods. Moreover, a methodology for the design of high purity Germanium detectors is presented. It is motivated by the need for a new mechanical treatment procedure with manufacturing methods for better quality Germanium surfaces and increased cost-efficiency. For the characterisation small Germanium detectors with different surface quality have been prepared and investigated with a Scanning Tunnelling Microscope, an Atomic Force Microscope and a Profiler.

HK 67.77 Th 14:00 Audi-Max

Characterization of LN2 Cooled APDs for Single Photon Counting Applications — Denis Anielski[1], Wladimir Buglak[1], Daniel Hampf[2], Volker Hannen[1], •Raphael Jöhren[1], and Christian Weinheimer[1] — [1]Institut für Kernphysik, Universität Münster — [2]Institut für Experimentalphysik, Universität Hamburg

Avalanche Photo Diodes (APDs) operated near LN2 temperature are one of the technologies under investigation for the detection of low levels of fluorescence light produced in the laser spectroscopy experiment SPECTRAP at GSI. Measurements of hyperfine transitions in highly charged ions require single photon detection capabilities from the UV to the near infrared. With high quantum efficiencies in the visible and NIR region (up to 1020 nm), APDs are a possible candidate for measurements of the hyperfine transitions e.g. in $^{207}Pb^{81+}$. Problems arise due to large dark count rates of the APDs when operated at room temperature or with modest cooling only. To characterize dark current, gain and signal to noise ratio of the detectors as a function of temperature and bias voltage, a LN2 cooled cryogenic test bed has been set up at the nuclear physics institute in Münster. To minimize the noise contribution from external sources a low noise preamplifier board tailored to operation at low temperatures inside the vacuum has been developed based on the AMPTEK A250 chip. We will present results regarding the performance of the preamp design and the temperature behavior and photon detection efficiency of the tested APDs.
This work is supported by an R&D contract with GSI.

HK 67.78 Th 14:00 Audi-Max

Dose and Shielding Calculation of Galactic Cosmic Ray Using FLUKA Mont Carlo Code — Hamide B. jalali[1], •Golamreza Raisali[2], Amirhosein Feghhi[3], and Alireza Babazade[2] for the Alborz-Collaboration — [1]Physics department, university of Qom, Qom, Iran — [2]Radiation Applications Research School, Nuclear Science and Technology Research Institute, Atomic Energy Organization of Iran, Tehran, Iran — [3]Physics and Nuclear engineering department, Amirkabir University, Tehran, Iran

Astronauts* exposure to space radiation is a limiting factor for long-term missions. Therefore shielding is a critical issue in space mission success. In this work the FLUKA Monte Carlo code has been coupled with simple models of the spacecraft and equivalent phantom to calculate skin averaged doses due to exposure to Galactic Cosmic Rays (GCR) beyond various thicknesses of aluminum and polyethylene shields. Simulations have been performed for the most abundant elements including H, He, C and Fe ions. The spectra of these ions have been taken from Badhwar-O*Neill*s model, and LET distribution of the ions and electrons calculated using SRIM and ESTAR computer programs, respectively. It has been observed that GCR absorbed dose behind the shields remained approximately constant with increasing shield thicknesses, but dose equivalent shows a slight decrease. It is also found that although polyethylene is a more effective GCR shield than aluminum as indicated in the results of similar investigations, but the practical thicknesses of polyethylene are still insufficient to shield high energy GCR ions encountered in long-term space missions.

HK 67.79 Th 14:00 Audi-Max

Exploring the Radiation Hardness of Lead Glass Detectors used in the COMPASS Experiment — •Daniel Chaberny — Institut für Kernphysik, Universität Mainz, Johann-Joachim-Becherweg 45, 55099 Mainz

In order to study the influence of possible radiation damage on the performance of the lead glass detectors used in the electromagnetic calorimeters of the COMPASS spectromter at CERN, lead glass modules were irradiated. irradiated with gamma-rays from a 60Co source and high energy electrons delivered by the MAMI accelerator. Two different lead glass types (TF1 and SF57) were investigated. We measured the thermoluminescence after irradiation and determined the natural recovery from radiation damage at room temperature as well as the recovery induced by optical bleaching. We will also discuss consequences for the operation of this detector in future runs of COMPASS with high beam intensities.

supported by BMBF under the contract 06MZ224

HK 67.80 Th 14:00 Audi-Max

Actinides AMS measurements at CIRCE in Caserta (Italy) — •Mario De Cesare[1,3], Nicola De Cesare[2,3], Antonio D'Onofrio[1,3], Lucio Gialanella[3], Yonjing Guan[1,4], Antonio Petraglia[1], Francesca Quinto[5], Vincenzo Roca[3,6], Detlef Rogalla[1,3], Carlo Sabbarese[1], and Filippo Terrasi[1,3] — [1]CIRCE, INNOVA, and DSA (SUN), Caserta, Italy — [2]CIRCE, INNOVA, and DSV (SUN) , Caserta, Italy — [3]INFN Sezione di Napoli, Napoli, Italy — [4]ICTP, Trieste, Italy — [5]Institut für Isotopenforschung und Kernphysik, Universität Wien, Vienna, Austria — [6]DSF, Università Federico II , Napoli, Italy

Nuclear Weapons (NW) use the destructive effects of supercritical chain reactions while Nuclear Power Plants (NPP) convert nuclear energy in electric power by thermal one. These operations lead to the release in the environment a wide range of radioactive nuclides that are present in environmental samples at ultra trace levels. Their detection requires the resolution of mass spectrometric techniques, but only AMS allows the sensitivity needed. In order to perform the isotopic ratio measurements of actinides, e.g. 236U/238U and xPu/239Pu, an upgrade of the CIRCE accelerator in Caserta, Italy, has been planned. The main difficulty of the AMS measurement of 236U and of xPu isotopes is the intense neighbouring beam of 238U. We report the results of simulations aimed to define the best ion optics and to understand the origin of background ions and test measurements are shown. A high resolution TOF-E detector system is described, designed to identify the rare isotopes and the unsuppressed interfering ions.

HK 67.81 Th 14:00 Audi-Max

Conceptual Design of a Luminosity Monitor for the $\bar{\text{P}}$ANDA Experiment using Elastic Antiproton-Proton Scattering — •Tsitohaina Randriamalala, James Ritman, and Tobias Stockmanns for the PANDA-Collaboration — Institute for Nuclear Physics, Forschungszentrum Jülich, Germany

The $\bar{\text{P}}$ANDA experiment requires a very precise measurement of both the absolute and relative the luminosity. This will be achieved by luminosity monitor by measuring the elastic $\bar{\text{p}}$p scattering process at low momentum transfer. Taking the detector and the accelerator system geometry into consideration, the detector will measure the forward outgoing antiproton. As a result, it will be located at about 10m downstream of the target. At this position the luminosity monitor measures particles emitted at 3-8mrad with respect to the beam axis. The detector consists of a sequence of four planes of double sided silicon strip detectors. The planes are separated by 20 cm along the beam direction. Each plane consists of 4 wafers 2cm x 5cm x 300μm, with 50 μm pitch arranged radially to the beam axis and together placed in the vacuum. Simulations have been done in order to reconstruct the angle of the scattered antiprotons. Most of the charge deposited in one sensor is collected by no more than two strips. After smearing the charge deposited, the reconstruction of the mean position of the hit in the cluster were carried out. Position resolutions of about 15μm

for strip multiplity one and about 3μm for strip multiplicity two are achieved.

Supported in part by the DAAD and FZ-Jülich

HK 67.82 Th 14:00 Audi-Max

Study of transmission and light yield of an n=1.07 silica aerogel — •L. Debenjak[1], S. Sirca[1], and P. Achenbach[2] for the A1-Collaboration — [1]Jožef Stefan Institute, Ljubljana, Slovenia — [2]Institut für Kernphysik, Johannes Gutenberg-Universität, Mainz

The large momentum acceptance of the Kaos spectrometer at the Mainz Microtron MAMI requires the discrimination between kaons and pions for momenta $\geq 1\,\mathrm{GeV}/c$. Silica aerogel with refractive index $n \sim 1.07$ has been chosen as a Čerenkov radiator for pion suppression. The area to be covered by the aerogel ($H \times W \sim 40 \times 200\,\mathrm{cm}^2$) is governed by the focal plane of the magnetic spectrometer.

A prototype detector with two aerogel tiles of $d = 2\,\mathrm{cm}$ thickness and $20 \times 10\,\mathrm{cm}^2$ total area was designed, built and tested. Modifications to the basic geometry of the prototype were tried, e.g. different kinds of polished aluminum faces were used in the interior in order to improve the reflection of photons towards the PMTs.

The behaviour of the prototype has been simulated by using Litrani, a C++/ROOT-based program. Different parameters of the aerogel (absorption and scattering) have been measured and used as input data to the simulation code. The characteristic lengths were of the order of 10 cm in the wavelength range of the produced Čerenkov photons.

During two beam-times in Oct. and Nov. 2008 at MAMI the performance of the prototype was measured with electrons, pions, and protons. The absorption and scattering losses in the aerogel tiles lead to a very low number of deteced photons. Detection efficiencies were determined at different threshold settings and particle momenta.

HK 67.83 Th 14:00 Audi-Max

The new readout electronics for the HADES RICH detector* — •M. Böhmer, J. Friese, R. Gernhäuser, P. Huck, M. Jurkovič, L. Maier, and M. Weber — Technische Universität München, Physik-Dept. E12, 85748 Garching

A multiwire proportional chamber with CsI photocathode is used for Cherenkov photon detection in the RICH of the dielectron spectrometer HADES at GSI, Darmstadt. Within the ongoing upgrade of the HADES data acquisition system we have developed a new readout chain for the 28500 pads of the photon detector. It is based on frontend amplifier cards utilizing the APV25 chip with operation parameters adopted for gaseous detectors. The analog output data is digitized and further processed by new FPGA controlled ADCM cards with connectivity to the TRB Net[1]. The new electronics is designed for a readout rate of 100kHz (peak) and 20kHz (sustained) for the whole detector system. We will present the concept and show first results of full system tests.

[1] I. Fröhlich *et al.*, IEEE Trans. Nucl. Sci. 55 (2008) 59.

* supp. by BMBF(06MT238), GSI, DFG (Exc.-Clust. 153-Universe)

HK 67.84 Th 14:00 Audi-Max

Development of online event selection in CBM — •Ivan Kisel — (for CBM Collaboration) — GSI, Planckstr. 1, 64291 Darmstadt

Large track densities together with the presence of a non-homogeneous magnetic field make the online reconstruction and selection of events in the CBM experiment complicated.

Track finding in the silicon tracker is based on a cellular automaton. To achieve a high track finding efficiency a Kalman filter fitting algorithm is intensively used within the track finder.

After a significant memory optimization and a comprehensive numerical analysis, the Kalman filter based track fitting algorithm has been vectorized using inline operator overloading to be flexible with respect to any CPU family used for data reconstruction. Because of all these changes the SIMDized Kalman filter based track fitting algorithm takes 1 us per track that is 10000 times faster than the initial version. Porting the algorithm to a Cell Blade computer gives another factor of 10 of the speedup.

The cellular automaton track finder of the CBM experiment has been also significantly reworked in order to be SIMDized. The SIMDized Kalman filter based fitting routines have been included into the track finder. The SIMDized cellular automaton track finder shows 1000 times increase of the reconstruction speed with respect to the initial scalar version running on the same Pentium 4 based computer. Such significant speed-up of the track finder has also demonstrated the possibility of on-line data selection at the expected input rate of 10^7 events per second.

HK 67.85 Th 14:00 Audi-Max

Development for PRESPEC : New front end electronic for Multi Sampling Ionization Chambers of the GSI-fragment separator — •Stephane Pietri, Juergen Gerl, Nik Kurz, Chiara Nociforo, Henning Schaffner, and Haik Simon — GSI, Planckstrasse 1, 64291 Darmstadt, Germany

To study detailed structure effects during in-beam gamma spectroscopy experiments at the GSI fragment separator high particles rates are needed at the final focal plane. The use of new position detector (TPC [1]) having higher rate capability than the previous Multi-Wire Proportional Counter put the ionization chambers (MUSICs) used for the delta-E measurement as the limiting factor. The current electronics used for those detector does not allow to sustain rates of up to 100 kHz that the coming experimental program will request. Indeed at those rates the analog electronic is not able to disentangle pile-up events and thus give a wrong Z identification for the incoming nucleus. The ongoing work on new digital electronic and on signal characterization to allow higher rates capability of those detectors will be presented.

[1] : V. Hlinka et al. NIMA 419 (1998) 503

HK 67.86 Th 14:00 Audi-Max

New Readout Concept for the Calorimeter of the Crystal Barrel Experiment at ELSA — •Christian Honisch for the CBELSA/TAPS-Collaboration — HISKP, Nußallee 14-16, 53115 Bonn

The Crystal Barrel experiment at ELSA in Bonn is a double polarized photo-production experiment for hadron spectroscopy. Its EM-calorimeter is build-up of 1380 CsI crystals.

At present the CsI signals are read out with a PIN photodiode. Triggering on the calorimeter is not possible in this set-up, because the signals from the charge sensitive amplifier are slow. In the upgrade of the experiment the read-out eletronics is to be extended by a 1$^{\mathrm{st}}$ level trigger for the CsI crystals. While providing fast timing signals, the new read-out system has to achieve at least the same energy resolution as the existing one.

The large risetime of the CsI crystals forces a trade-off between time resolution and latency. Avalanche photodiodes, silicon photomultipliers and the existing PIN-photodiodes, together with new read-out electronics, have been tested to generate low latency timing signals.

In this poster, results from the three sensors will be presented and compared.

HK 67.87 Th 14:00 Audi-Max

Der Myonen-Detektor des CBM Experiments bei FAIR — •Anna Kiseleva[1,2], Andrey Lebedev[1,3] und Dipanwita Dutta[1] für die CBM-Kollaboration — [1]GSI, Darmstadt, Deutschland — [2]PNPI, Gatchina, Russland — [3]JINR, Dubna, Russland

Eine der Herausforderungen des CBM Experiments ist die Messung von Myonenpaaren aus Zerfällen von Vektormesonen (ρ, ω, ϕ, J/ψ, ψ'), die in Schwerionenstößen erzeugt werden. Die Multiplizität der Myonenpaare variiert zwischen 10-3 und 10-9 pro zentralem Au+Au Stoß, wobei in jeder Reaktion bis zu 1000 geladene Hadronen emittiert werden. Die Unterdrückung der Hadronen und der Nachweis der Myonen werden durch ein aktives Absorbersystem erreicht, das aus mehreren Lagen Eisen und Detektorebenen besteht und die Spuren aller geladenen Teilchen rekonstruiert. Die Nachweis-Effizienzen und die Signal-zu-Untergrund Verhältnisse werden in Simulationsrechnungen untersucht, die auf realistischen Annahmen bezüglich der Teilchenmultiplizitäten und der Detektoreigenschaften basieren. Die Ergebnisse der Simulationen für FAIR Energien von 8 bis 35 AGeV, eine Triggerstudie und die Optimierung des Detektor-Absorber Systeme werden vorgestellt. * Supported by EU-FP6 HadronPhysics

HK 67.88 Th 14:00 Audi-Max

GEANT4 Simulations for the R^{3}B Calorimeter Prototypes — •Douglas DiJulio, Joakim Cederkall, Pavel Golubev, and Bo Jakobsson — Physics Department, Lund University, Sweden

One of the main detectors of the R^{3}B experiment at FAIR will be a total gamma ray absorption calorimeter. The detector will consist of about 5000 crystals which surround the target position. One demonstrator of the detector, which consists of a cluster of 5x3 CsI(Tl) crystals, has been constructed at Lund University. Proton and γ-ray in beam tests of this demonstrator are planned for 2009. In order to prepare for these tests, GEANT4 simulations have been carried out to

understand the response of the crystals. The total energy deposited, the crystal multiplicities, and energy deposition distributions in the array have been calculated. The light collection in a single CsI(Tl) crystal has also been investigated experimentally with low energy γ-rays from radioactive sources and will be compared with GEANT4 simulations.

HK 67.89 Th 14:00 Audi-Max

Simulations of nuclear reactions for a future HIE-ISOLDE Spectrometer — •Gry Tveten[1,3], Joakim Cederkall[2,3], and Yorick Blumenfeld[3] — [1]University of Oslo, Norway — [2]Lund University, Sweden — [3]CERN, Switzerland

The planned High Intensity and Energy (HIE) upgrade of the radioactive beam facility ISOLDE will enable post-acceleration of radioactive beams up to an energy of about 10 MeV/u, thus opening the door to nuclear reaction studies. In the case of transfer reactions in inverse kinematics a recoil separator is often well suited or even needed to tell recoils and beam apart and to select the exit channel or to do spectroscopic studies.

Two different types of spectrometer designs are being considered for HIE-ISOLDE, namely a recoil mass separator or a ray-tracing type of spectrometer. A set of nuclear transfer reactions in inverse kinematics have been simulated using realistic parameters for HIE-ISOLDE. The performance of the two types of spectrometer designs is compared and their scientific possibilities and limitations discussed based on the simulation results. To evaluate the validity of the simulations a data set from PRISMA at LNL is also compared with simulation results and a comparison between simulations and these data will be presented.

HK 67.90 Th 14:00 Audi-Max

Die Ausleseelektronik des PANDA GEM-TPC Prototypen — •Matthias Danner, Igor Konorov, Laura Fabbietti und Alexander Schmah — Technische Universität München

Das Proton-Antiproton Experiment PANDA wird an der zukünftigen Beschleunigeranlage FAIR in Darmstadt im Hochenergie Speicherring (HESR) installiert. Als zentraler Spurverfolgungsdetektor ist, konkurrierend zueinander, entweder eine GEM-TPC oder ein straw tube Array vorgesehen. Um die hohen Anforderungen an den Detektor und die Ausleseelektronik zu testen, ist ein Prototyp der GEM-TPC geplant. Es ist u.a. vorgesehen, diesen Prototyp im FOPI-Spektrometer an der GSI einem Langzeittest zu unterziehen.
Für die Front-End-Auslese stehen alternativ zwei ASICs zur Verfügung: Der selbstgetriggerte n-XYTER [1] und der extern getriggerte APV Nachfolger T2K. Letzterer wird Mitte Dezember 2008 in einem ersten Strahltest am ELSA Beschleuniger in Bonn die Auslese des neuen GEM-TPC Prototypen gewährleisten. Die beiden Varianten der Ausleseelektronik als auch erste Ergebnisse der Teststrahlzeit werden vorgestellt. Diese Arbeit wird durch die HGF sowie von Excellence Cluster Universe unterstützt.
[1] C. J. Schmidt et al., *The n-XYTER Reference Manual*

HK 67.91 Th 14:00 Audi-Max

Emittance Measurements at the Darmstadt Source of Polarized Electrons — •Christoph Ingenhaag, Roman Barday, Christian Eckardt, Joachim Enders, Alf Göök, Yuliya Poltoratska, and Markus Wagner — Institut für Kernphysik, Technische Universität Darmstadt, Germany

Emittance measurements for low-energy (100 keV) electron beams are presented. Data was acquired at the teststand of the source of polarized electrons which is being developed for future implementation at the superconducting Darmstadt electron linear accelerator S-DALINAC. Polarized electrons are produced by laser irradiation of a strained-superlattice GaAs cathode. The emittance was determined by measuring the beam profile as a function of the focusing strength of a solenoid for various operation modes (intensity, laser spot size, laser wavelength, pulsed vs. DC laser operation) of the electron source.

Supported by Deutsche Forschungsgemeinschaft through SFB 634.

HK 67.92 Th 14:00 Audi-Max

A DCS-Offline Communication Framework for the ALICE TRD — •Frederick Kramer for the ALICE-TRD-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt, Germany

The transition radiation detector (TRD) of the CERN-LHC experiment ALICE is designed to provide excellent electron identification, tracking and a level-one trigger on different event signatures. To meet these requirements, the front-end electronics of the TRD performs complex data processing like online reconstruction, particle identification and a fast evaluation of trigger conditions. The detector control system (DCS) is used for operating and monitoring this electronics. For the purpose of data reconstruction and quality assurance the configuration, operation status and various run-specific counters of each TRD module are to be stored in the ALICE offline calibration database.

A procedure for the readout of the above data and for the communication between the systems involved has been implemented and is presented. Tools for online and offline data monitoring have been developed and are discussed as well.

HK 67.93 Th 14:00 Audi-Max

Energy dependence of pulse shapes in liquid scintillators* — •D. Savran[1], J. Glorius[1], B. Löher[1], M. Miklavec[2], N. Pietralla[1], V. Simon[1], K. Sonnabend[1], and M. Vencelj[2] — [1]Institut für Kernphysik, — [2]Institut Jožef Stefan,

In (γ, n) experiments, e.g. at the NEPTUN photon tagger system at the S-DALINAC, the neutron spectroscopy has to be realized in an enviroment of high photon background and therefore an effective discrimination between photons and neutrons is mandatory. Liquid scintillators like BC501A allow a separation of neutrons and photons based on a pulse shape analysis of the subsequent photomultiplier pulses. However, the quality of this separation is not constant, but varies with the incident neutron energy. The energy dependence of the pulse shapes and the resulting separation is studied in detail using digital pulse shape analysis. First results will be presented.

* Supported by DFG (SFB 634)

HK 67.94 Th 14:00 Audi-Max

The Upgrade of the Multiwire Drift Chamber Readout of the HADES Experiment at GSI: the Optical End Point Board. — •Attilio Tarantola[1,2], Ingo Froehlich[1], Burkhard Kolb[2], Jan Michel[1,2], Christian Muentz[1,2], Marek Palka[4,2], Herbert Stroebele[1], Joachim Stroth[1,2], Michael Traxler[2], and Joern Wuestenfeld[3] for the HADES-Collaboration — [1]Institut für Kernphysik, Goethe-Universität, Frankfurt, Germany — [2]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany — [3]Institut für Strahlenphysik, Forschungszentrum, Dresden-Rossendorf, Germany — [4]Smoluchowski Institut of Physics, Jagiellonian University, Krakow, Poland

One of the goal of the HADES upgrade project is the realization of a new data acquisition scheme for the 24 Multiwire Drift Chambers (MDCs), which allows to increase the readout speed of the 40.000 TDC channels. On the existing MDC Front End Electronic (FEE) side an Optical End Point Board (OEPB) has been designed to control configuration and readout of the chamber's TDCs. The OEPB uses Plastic Optical Fibres (POF) for data transmission, which results in total electromagnetic immunity, amazing simplicity in handling and low power consumption. The employment of a Lattice ECP2/M FPGA with SERDES manages serial data transmission and its large resources allow for the storage of several events close-to-front-end. As 400 OEPBs will be located in the detector acceptance, dedicated FPGA hardware is used to detect Single Event Upsets (SEUs).

HK 67.95 Th 14:00 Audi-Max

Umsetzung eines MAPS Demonstrators — •Christoph Schrader[1], Samir Amar-Youcef[1], Michael Deveaux[1], Ingo Fröhlich[1], Johann Heuser[2], Christian Müntz[1], Jan Michel[1], Selim Seddiki[1], Joachim Stroth[1], Tobias Tischler[1], Christian Trageser[1] und Bernhard Wiedemann[1] — [1]IKF, Goethe Universität Frankfurt — [2]GSI, Darmstadt

Die Identifikation von D-Mesonen in Schwerionenreaktionen mittels der Rekonstruktion ihres sekundären Zerfallsvertex erfolgt beim CBM Experiment (SIS300/FAIR) mit Hilfe des Mikro-Vertex-Detektors (MVD). Für diese Aufgabe muss er über eine einzigartige Kombination in Bezug auf hohe Strahlenhärte, Zeit- und Ortsauflösung und einem besonders geringen Materialbudget der Detektorstationen verfügen. Am Technologielabor des IKF wird ein Demonstrationsaufbau dieses auf MAPS-Sensoren (IPHC, Strassburg) basierenden Detektorsystems entwickelt, mit dem grundlegende Eigenschaften der elektronischen und mechanischen Integration erprobt werden sollen. Dieser umfasst speziell für MAPS Sensoren entwickelte Auslesekarten, die leistungsfähige Software und Hardware zur Verarbeitung der Daten der Sensoren in Echtzeit enthalten. Darüber hinaus wurden spezielle Trägerstrukturen für die MAPS-Chips konzipiert, die bei minimalem Materialbudget eine Kühlung der Sensoren in Vakuum sicherstellen

sollen. Das Konzept des Demonstrationsaufbaus und der Status der einzelnen Komponenten wird vorgestellt. *gefördert durch das BMBF (06FY173I), die GSI und Helmholtz Research School (Frankfurt)

HK 67.96 Th 14:00 Audi-Max

A new Testing Scheme for DCS- and Readout-Electronics of the ALICE Transition Radiation Detector — •Philipp Lüttig for the ALICE-TRD-Collaboration — Institut für Kernphysik Frankfurt

With the start of the LHC at CERN, one of the four main experiments, ALICE, starts its operation. ALICE is built for exploring the properties of hot and dense matter formed in heavy-ion-collisions, and especially for studying a possible transition to the quark-gluon-plasma (QGP). The ALICE Transition Radiation Detector (TRD) can separate electrons and pions with high precision, and can track the emitted particles after a collision. The TRD consists of 18 supermodules with 30 read-out chambers in each supermodule. The supermodules are arranged radially around the beam axis. At the Institut für Kernphysik Frankfurt the read-out chambers are equipped with Front-end electronics and cooling units, followed by a detailed testing procedure.
In this talk we discuss the test infrastructure and the different hardware and software components implemented in the testing process. Based on a modified data format, optimized for the testing, the noise characteristics in different test configurations are reviewed. New Graphical User Interfaces customized for process visualization and the analysis of test data will be presented.

HK 67.97 Th 14:00 Audi-Max

Reliable On-line Storage in the ALICE High-Level Trigger — •Sebastian Kalcher and Volker Lindenstruth for the ALICE-HLT-Collaboration — Kirchhoff Institute of Physics, University of Heidelberg, Germany

The on-line disk capacity within large computing clusters such as used in the ALICE High-Level Trigger (HLT) is often not used due to the inherent unreliability of the involved disks. With currently available hard drive capacities the total on-line capacity can be significant when compared to the storage requirements of present high energy physics experiments. In this talk we report on ClusterRAID, a reliable, distributed mass storage system, which allows to harness the (often unused) disk capacities of large cluster installations. The key paradigm of this system is to transform the local hard drive into a reliable device. It provides adjustable fault-tolerance by utilizing sophisticated error-correcting codes. To reduce the costs of coding and decoding operations the use of modern graphics processing units as co-processor has been investigated. Also, the utilization of low overhead, high performance communication networks has been examined. A prototype set up of the system exists within the HLT with 90 TB gross capacity.

HK 67.98 Th 14:00 Audi-Max

Development of a versatile digital readout system — •Marius C. Mertens, James Ritman, and Tobias Stockmanns for the PANDA-Collaboration — Forschungszentrum Jülich GmbH, Institut für Kernphysik, Jülich

During the research and design phase of new detector electronics, development of a suitable test environment takes a significant amount of time. Most existing systems are specifically designed for certain frontend electronics and cannot be reused for future developments. Thus, our approach is to build a flexible test environment with state-of-the-art hardware, which can be reconfigured to support various frontend electronics. This is achieved by deploying a modular design concept, which is followed in both hardware and software. Key features of the hardware platform are the gigabit optical connection to the PC, the powerful FPGA (Virtex 4), and consequent separation of analog and digital parts of the readout. Via firmware updates, arbitrary communication protocols can be implemented and the external connectors of the readout board can be freely configured. This is accompanied by a modular software framework written in C++ which declares different communication layers for easy hardware access as well as a generic storage structure for simple data handling. These levels of abstraction make it easy to add support for changed or completely new devices. The implementation of the digital readout system as well as its modular firmware and software design will be presented and its key features will be explained in detail. Supported in part by the EU and FZ-Jülich.

HK 67.99 Th 14:00 Audi-Max

Determination of the Gas Amplification in the ALICE Transition Radiation Detector — •Patrick Reichelt for the ALICE-TRD-Collaboration — Institut für Kernphysik Frankfurt

The Transition Radiation Detector (TRD) of the ALICE experiment at the LHC provides excellent electron/pion discrimination. The measurement principle is based on the recognition of high charge deposition mostly caused by the TR-signal produced by the electron. The initially produced charges are multiplied near the anode wires of the TRD-chamber. This gas amplification factor can be determined by using a γ-source of known power and comparing the calculated primary ionization to the measured anode-current. A systematic study of the gas gain will be presented.

Since the TRD will work at 1 mbar above atmospheric pressure, which is subject to continuous change, the pressure dependency of the gas gain has been studied. The effect of the differential pressure on chamber geometry and gas gain will be compared to design specifications in the Technical Design Report of the TRD.

HK 67.100 Th 14:00 Audi-Max

A drift chamber combined with a GEM stage for particle-identification and tracking studies — •Valeriy Serdyuk[1,2], Willi Erven[1], Pawel Kulessa[1,3], Henner Ohm[1], Krzysztof Pysz[1,3], and Peter Wüstner[1] — [1]FZ-Juelich — [2]JINR Dubna — [3]IFJ PAN, Krakow

Gaseous tracking detectors play a key role in existing and planned hadron and particle physics experiments. A universal tracking device has been set up for optimizing the performance of existing trackers (ANKE@COSY, WASA@COSY) and for developing new concepts (PANDA@FAIR). The setup consists of a drift gap followed by a GEM amplification stage and a stack of drift chambers. Additional scintillators above and below the setup give time reference signals for cosmics measurements. Data are read out with 160 MHz flash ADCs and with F1-TDCs. The setup will be described. Results on tracking resolution, cluster formation along cosmics tracks, gas amplification for various mixtures will be presented. The implication for particle identification based on the energy loss for e.g. straw detectors will be discussed.

Supported by FFE of FZ-Juelich

HK 67.101 Th 14:00 Audi-Max

A FPGA tracking algorithm for PANDA — •David Münchow for the PANDA-Collaboration — II. Physikalisches Institut, Heinrich-Buff-Ring 14, 35392 Gießen, Germany

The PANDA experiment at the future FAIR facility at GSI, Darmstadt, will investigate proton-antiproton collisions. The central detector might contain a straw tube tracker (STT) consisting of 15 double layers of straws. A tracking algorithm for the STT is being developed and will operate in several steps to (a) guarantee a good momentum resolution and (b) find tracks of an secondary vertex. Perpendicular to the beam direction the algorithm is using a conformal space transformation from circular tracks to straight lines. In order to find the tracks a Hough transformation and peak search are used. The algorithm will be implemented on an FPGA and be used as a trigger.

This poster was supported by BMBF and GSI
grant-no.:06 GI 180

HK 67.102 Th 14:00 Audi-Max

Design and setup of a trigger system for Moeller polarimetry to determine the electron beam polarisation at MAMI-C — •Peter-Bernd Otte — Institut für Kernphysik, Mainz, Germany

The "Crystal Ball (CB) Collaboration" at the "Institut fuer Kernphysik" in Mainz carries out experiments with real photons, which are produced via the Bremsstrahlung process from accelerated electrons coming from the accelerator MAMI (Mainz Microtron). In 2007 the new accelerator stage MAMI-C became operational and delivers up to 1.558 GeV in cw-mode. The energy-tagged photons induce reactions in nucleons and nuclei which are studied using the CB/TAPS 4π-calorimeter.

The helicity dependence of Moeller scattering can be used to measure the beam polarisation. To select these events in the tagging spectrometer, a specially adapted trigger system was developed. In the poster, the setup, experimental method and details of the FPGA-based trigger electronics will be presented.

HK 67.103 Th 14:00 Audi-Max

A position-sensitive gaseous detector for studies of laser-induced particle acceleration — •Qi Zhang[1,2], Markus Büscher[1], Istvan Császár[1,3], Md. Mosaddek Hossain[1,4], Ralph Jung[1,5], Pawel Kulessa[1,6], Henner Ohm[1], Gilbert Oswald[1,3], Va-

leriy Serdyuk[1,7], and Oswald Willi[1,5] — [1]FZ-Jülich — [2]RWTH Aachen — [3]FH Merseburg — [4]FH Aachen-Jülich — [5]U Düsseldorf — [6]IFJ PAN, Krakow — [7]JINR Dubna

The interaction of terawatt laser pulses with suitable gas or foil targets can yield bunches with up to 10^12 particles (e.g. protons) in the MeV region. For studies of these processes a position sensitive detector has been developed which is capable of detecting single charged particles as well as extremely intense bunches. The detector consists of an ionization chamber with a position-sensitive pad anode-plane and an additional proportional-chamber stage with a multi-wire anode plane. A Camac-based DAQ system is under preparation. First data taken using a laser-induced plasma as a particle source at the Institute for Laser and Plasma Physics at the University of Düsseldorf, are presented and discussed.

Supported by FFE of FZ-Jülich

HK 67.104 Th 14:00 Audi-Max

High Flux Experimental Setup for (γ, γ') and photoactivation experiments — •Simela Aslanidou, Matthias Fritzsche, Norbert Pietralla, Deniz Sarvan, and Kerstin Sonnabend — Institut für Kernphysik, Technische Universität Darmstadt

Performing NRF experiments is an established way to explore and prove basic nuclear properties. The standard method [1] uses a continuous-energy photon spectrum produced by bremsstrahlung.

In order to perform NRF and photoactivation experiments in the region above 10 MeV a new experimental setup is to be constructed at the superconducting linear accelerator S-DALINAC in Darmstadt. The construction focussed on a high photon flux combined with a low neutron background. Therefore, a thick multi-layer aluminum target was implemented such that the incoming electrons are completely stopped. The neutron background is kept low due to the high neutron separation threshold of aluminum of 13.1 MeV.

In order to monitor fluctuations in the energy of the incoming electron beam, the method of the partial charge deposition in the radiator layers is adopted [2].

[1] U. Kneissl, N. Pietralla, A. Zilges *J.Phys. G 32 (2006) R217-R252*
[2] Matthias Fritzsche, *Diploma Thesis, TU-Darmstadt* (2007)

HK 67.105 Th 14:00 Audi-Max

New Trigger-Algorithms for the HADES-DAQ-Upgrade — •Johannes Roskoss, Andreas Kopp, Ming Liu, and Wolfgang Kühn for the HADES-Collaboration — II. Physikalisches Institut, JLU Giessen, Heinrich-Buff-Ring 16, 35392 Gießen

For the upgrade of the HADES experiment, high data rates and sophisticated real time processing are foreseen. Thus, general purpose Compute Nodes based on FPGAs and modern network technologies have been designed. With these one is able to implement faster and more efficient algorithms for di-electron recognition designed in VHDL for the HADES META, MDC and RICH detectors.

In this contribution we focus on trigger algorithms for the sectorwise subevents from RICH, MDC, Shower and TOF. For the selection of electrons two new trigger algorithms are being implemented into the Compute Nodes: *(a)* a matching algorithm with the Shower and the TOF detectors and *(b)* a modified ring finder for the RICH detector. Results of the software simulation of the trigger algorithm and the status of the hardware implementation will be reported.

This work was supported in part by BMBF 06 GI 179 and GSI GIKÜH.

HK 67.106 Th 14:00 Audi-Max

A Start Detector for the new CBELSA/TAPS TPC — •Tim Odenthal for the CBELSA/TAPS-Collaboration — Helmholtz-Institut für Strahlen- und Kernphysik, Universität Bonn, Nußallee 14-16, 53115 Bonn

As one of the upgrades to the Crystal-Barrel-Experiment at the electron accelerator ELSA (Bonn), a new inner tracking detector will be built. The present setup with its two electromagnetic calorimeters consisting of 1320 CsI(Tl) and 216 BaF_2 crystals respectively, is very well suited to measure photons. The inner scintillating fibre detector presently used for charged particle identification will be replaced by a **T**ime **P**rojection **C**hamber. To provide a time reference for the TPC, a start detector is under development. Due to the very limited space of only a few mm between the TPC and the polarised target, different design concepts for the start detector and its readout are under consideration. The poster will show the latest test results obtained. Plastic scintillating bars and fibres being read out by photomultipliers and SiPM are presently tested. This work is supported by the DFG (SFB/TR16).

HK 67.107 Th 14:00 Audi-Max

Simplified Radio Frequency Quadrupoles with a Linear Axial Field Based on Highly Resistive Electrodes — •Arno Becker[1], Timo Dickel[1], Hans Geissel[1,2], Martin Petrik[1], Wolfgang R. Plass[1,2], Christoph Scheidenberger[1,2], and André Simon[1] — [1]II. Physikalisches Institut, Justus-Liebig-Universität Gießen, Germany — [2]GSI, Darmstadt, Germany

Radio Frequency Quadrupoles (RFQs) are used in different fields of science. In nuclear physics, RFQs are employed for highly efficient transport, storage and cooling of exotic nuclei for precision experiments. In addition to the quadrupole field, which confines the ions in the radial direction, an axial field is required for the ion transport in a buffer gas filled environment.

Generating this axial field is a technical challenge. A novel and convenient method for the creation of an axial field is based on four highly resistive plastic rods. In addition to the RF voltage for the confining quadrupole field, different DC potentials are applied to the two ends of each rod. The voltage drop along the electrodes generates a linear axial field.

This method allows for a simplified construction and a reduced number of power supplies and electrical connections. Applications include cooler quadrupoles, curved RFQs as ion guides or for beam distribution, and diagnosis modules that alternatively transmit or identify ions. The design and experimental results of such RFQ systems will be presented.

HK 67.108 Th 14:00 Audi-Max

Design, Construction and Commissioning of an RF Trap System for a Multiple-Reflection Time-of-Flight Isobar Separator and Mass Spectrometer — •Christian Jesch[1], Timo Dickel[1], Wolfgang R. Plass[1,2], Arno Becker[1], Ulrich Czok[1], Hans Geissel[1,2], Martin Petrick[1], and Christoph Scheidenberger[1,2] — [1]Justus-Liebig-Universität Gießen — [2]GSI, Darmstadt

A multiple-reflection time-of-flight isobar separator and mass spectrometer (MR-TOF-MS) has been developed, which can be used for isobar separation, broadband mass spectrometry and high-accuracy mass measurement of very short lived nuclei with half-lives on the order of milliseconds. The start of the time-of-flight measurement in the MR-TOF-MS is given by the injection of ions from an RF trap. The performance of the mass spectrometer is significantly determined by the characteristics of the injected ion population.

The newly developed injection trap system provides cooled ion bunches of low emittance. It consists of three stages for fast ion cooling, while avoiding collisional losses during ion ejection. A fast-switching square wave RF source was developed. It allows to switch off the RF during ejection in order to reduce mass selective ion energies. The system was set up and commisioned. Time-of-flight peak widths of < 5 ns have been measured, enabling a mass resolving power of the MR-TOF-MS of 10^5 after a flight time of 1 ms. Cooling times of down to 1 ms and a high transmission efficiency have been achieved. The design of the trap system and first experimental results will be presented.

HK 67.109 Th 14:00 Audi-Max

New tracking detectors in the LAND/R^{3}B setup at GSI — •Ralf Plag for the R3B-Collaboration — GSI, Darmstadt, Germany — Goethe Universität Frankfurt, Germany

The LAND/R^{3}B setup at GSI in Darmstadt is a powerful facility to perform Coulomb dissociation experiments. These kinematically complete measurements require the identification of all incoming and outgoing particles with an extensive set of detectors.

Recently, two proton drift chambers and several double-sided silicon microstrip detectors (DSSD) have been added to the setup enabling the simultaneous tracking of protons and residual fragments.

The well established data analysis framework 'land02' is currently being upgraded in order to determine charge, energy, and trajectory of particles traversing these detectors. The current status of the analysis algorithm will be presented.

This project is supported by the HGF Young Investigators Project VH-NG-327.

HK 67.110 Th 14:00 Audi-Max

Occupancy study of the Micro-Vertex Detector for the Compressed Baryonic Matter experiment * — Deveaux Michael[1], Fröhlich Ingo[1], Müntz Christian[1], •Seddiki Selim[1,2], Stroth

Joachim[1], and Trageser Christian[1] for the CBM-Collaboration — [1]IKF, Frankfurt, Germany — [2]IPHC, Strasbourg, France

The Compressed Baryonic Matter experiment (CBM) is aiming at the study of dense and hot hadronic matter by means of relativistic heavy ion collisions. One important subsystem of CBM is the Micro-Vertex Detector (MVD) which is intended for detecting open charmed particles by reconstructing their displaced decay vertex. The MVD is located close to the collision point. We expect therefore very high occupancies and data rates due to the high multiplicity environment of the heavy ion collisions.

In the work presented here we simulated the occupancy of the MVD. A focus was laid on the substantial amount of delta-electrons produced in the target of the experiment by the passage of beam particles. Their contribution to the detector occupancy has been investigated with GEANT3 and GCALOR for Au beam ions crossing the Au target material. Moreover, strategies to reduce the number of hits caused by those delta-electrons were evaluated. * supported by BMBF(06FY1731)

HK 67.111 Th 14:00 Audi-Max

Random Telegraph Signal in mit nicht-ionisierender Strahlung bestrahlten Monolithic Active Pixel Sensoren* — •Dennis Doering[1], Samir Amar-Youcef[1], Alex Büdenbender[1], Michael Deveaux[1], Ingo Fröhlich[1], Christian Müntz[1], Joachim Stroth[1] und Franz M. Wagner[2] — [1]IKF, Goethe Universität Frankfurt — [2]Forschungsneutronenquelle Heinz-Maier-Leibnitz (FRM II), Technische Universität München

Monolithic Active Pixel Sensoren (MAPS) sind hochgranulare Sensoren für die Messung geladener Teilchen. Aufgrund ihrer guten Ortsauflösung und ihres sehr geringen Materialbudgets sollen sie im Vertexdetektor verschiedener Experimente der Kern- und Teilchenphysik (CBM, STAR, ILC) zum Einsatz kommen. Um den in diesen Experimenten auftretenden Strahlendosen begegnen zu können, ist ein detailliertes Verständnis der Auswirkungen von Strahlenschäden in MAPS erforderlich. Hierbei ist auch das durch nicht-ionisierende Strahlung verursachte Random Telegraph Signal (RTS) der Pixel von Bedeutung, das bisher nur unzulänglich untersucht wurde. Dieses RTS manifestiert sich als Modulation des Dunkelsignals der Pixel zwischen mehreren wohldefinierten Niveaus, die als Teilchensignal fehlinterpretiert werden können. Im Rahmen der vorgestellten Arbeit wurde das RTS von MAPS systematisch als Funktion von Temperatur und nichtionisierender Strahlendosis untersucht. Die Messverfahren und die Ergebnisse bezüglich der Zahl der betroffenen Pixel und der Zahl der falschen Hitanzeigen werden vorgestellt. *gefördert durch das BMBF (06FY1731) und GSI.

HK 67.112 Th 14:00 Audi-Max

PandaGrid - a Tool for Physics — •Kilian Schwarz[1] and Dan Protopopescu[2] — [1]GSI, Planckstr. 1, D-64291 Darmstadt — [2]University of Glasgow, G12 8QQ, Scotland, UK

PandaGrid is based on the AliEn middleware and contains currently 18 sites on 3 continents. PandaGrid provides the physicist not only with computing resources but with a complete suite of tools and services, freeing the user from the overhead of software installation, configuration, data storage and job management. Consequently, the user can focus solely on the physics to be studied. This is made possible by the support structure within the PandaGrid, where, besides computing infrastructure, expert teams provide middleware and experiment-specific software support, monitoring, rapid prototyping and fast problem solving.

HK 68: Heavy Ion Collisions and QCD phases

Time: Thursday 16:30–19:00 Location: H-ZO 10

Group Report HK 68.1 Th 16:30 H-ZO 10

The Compressed Baryonic Matter experiment at FAIR: Progress with feasibility studies and detector developments. — •Johann M. Heuser for the CBM-Collaboration — GSI Darmstadt

The CBM experiment is being planned at the international research center FAIR, under realization next to the GSI laboratory. Its physics programme addresses the QCD phase diagram in the region of highest net baryon densities. Of particular interest are the expected first order phase transition from partonic to hadronic matter, ending in a critical point, and modifications of hadron properties in the dense medium as a signal of chiral symmetry restoration.

Laid out as a fixed-target experiment at the synchrotrons SIS100/300, the detector will record both proton-nucleus and nucleus-nucleus collisions at beam energies up to 45 AGeV. Hadronic, leptonic and photonic observables have to be measured with large acceptance. The interaction rates will reach 10 MHz to measure extremely rare probes like charm near threshold. Two versions of the experiment are being studied, optimized for either electron-hadron or muon identification, combined with silicon detector based charged-particle tracking and micro-vertex detection.

The CBM physics requires the development of novel detector sytems, trigger and data acquisition concepts as well as innovative real-time reconstruction techniques. Progress with feasibility studies of the experiment and the development of its detector systems will be discussed.

* Supported by EU-FP6 HadronPhysics

HK 68.2 Th 17:00 H-ZO 10

Study of J/ψ production in $p+p$ collisions at $\sqrt{s} = 10$ TeV with the Transition Radiation Detector of ALICE using full simulations. — •Dirk Krumbhorn for the ALICE-TRD-Collaboration — Physikalisches Intitut, Heidelberg, Deutschland

The performance of J/ψ-production in $p+p$ collisions at $\sqrt{s} = 10$ TeV with the central barrel detectors in ALICE was studied. In particular, the decay channel $J/\psi \rightarrow e^+ + e^-$ (BR: 6%) with the electron and positron identified by the Transition Radiation Detector (TRD) using full Monte Carlo simulations was examined. Influences of different cuts on reconstructed single tracks as well as the software framework for particle identification with the TRD were carefully studied. We report on the overall J/ψ reconstruction efficiency at mid-rapidity, the J/ψ mass resolution and compare to results from earlier studies using fast simulations. An estimate of the combinatoric background from mis-identified particles and expectations for first year of data taking with ALICE is given.

HK 68.3 Th 17:15 H-ZO 10

Open charm measurement in the CBM experiment — •Vassiliev Iouri for the CBM-Collaboration — Kirchhoff-Institut für Physik, Heidelberg, Germany

One of the major experimental challenges of the CBM experiment is to trigger on the displaced vertex of the Open charm particle decays via hadronic decay modes in the environment of a heavy-ion collision. This task requires fast and efficient track reconstruction algorithms and high resolution secondary vertex determination. Particular difficulties in recognizing the displaced vertex of the rare D-meson and Λ_c decays are caused by weak K^0_S and Λ decays which produce displaced vertices 1 cm downstream the target, very low multiplicity of the D-meson production, low branching ratios and multiple scattering in the beam pipe and detectors.

The primary and secondary vertices have been reconstructed with high accuracy (5 μm and 50 μm respectively) from the tracks fitted in the STS with a non-homogeneous magnetic field by the Kalman filter procedure.

Two open charm trigger configurations have been proposed: Detached Kaon Trigger and Detached Vertex Trigger.

Progress with feasibility studies of the open charm measurements in the CBM experiment will be discussed.

* Supported by EU-FP6 HadronPhysics

HK 68.4 Th 17:30 H-ZO 10

Event-by-event particle yield ratio fluctuations in NA49 and the future CBM experiment — •Dmytro Kresan for the NA49 CBM-Collaboration — Gesellschaft für Schwerionenforschung (GSI)

Non-statistical event-by-event fluctuations are considered as an important signal for the critical endpoint of the QCD phase diagram. Event-by-event fluctuations of different observables are thus investigated in detail in current experiments but are also an important observable to be studied at the future CBM experiment at FAIR. In this contribution we present the energy and centrality dependence of event-by-event fluc-

tuations of particle yield ratios measured by the NA49 experiment in Pb+Pb collisions at 20 - 158 AGeV. Systematic studies of the influence of the dE/dx resolution on the particle identification and the centrality bin size were performed. Results can be compared to event-by-event fluctuations measured by NA49 for different observables such as <pt> or the mean charged particle multiplicity. In future, the CBM experiment at FAIR will investigate the intermediate region of the QCD phase diagram in great detail searching for the first order phase transition line and the expected critical endpoint. It is therefore important to closely investigate its sensitivity towards particle ratio fluctuations in Au+Au collisions at 10-45 AGeV beam energy. Detailed simulation studies will be presented.

HK 68.5 Th 17:45 H-ZO 10

Heavy flavor electrons in pp collisions at 10 TeV with ALICE — •Raphaelle Bailhache[1] and Hongyan Yang[2] for the ALICE-TRD-Collaboration — [1]Institut für Kernphysik, Universität Frankfurt, Germany — [2]Physikalisches Institut, Universität Heidelberg, Germany

In nucleus-nucleus collisions, the formation time of heavy quarks (charm and beauty) is approximately $1/M_Q$ (0,1 fm/c for c and 0,02 fm/c for b), much smaller than the expected lifetime of the QGP at LHC (about 10 fm/c). Therefore heavy quarks are uniquely suited to probe the QGP over its whole lifetime. The $c\bar{c}$ and $b\bar{b}$ production in pp collisions serves as an important baseline for the nucleus-nucleus studies and allows to test pQCD calculations. The cross-sections can be measured indirectly with semi-electronic decays of heavy flavor hadrons. Compared to the direct measurements of heavy flavor hadrons via their hadronic decay channels the large branching ratios are an advantage. We present the expected performance of the measurement of the electrons from heavy-quark decays in pp collisions at 10 TeV with the first data planned to be collected at LHC in 2009 with the ALICE detector. Electrons are identified using both the Time Projection Chamber and the Transition Radiation Detector. The good resolution of the Inner Tracking System allows one to select electrons from B meson decays. The electron background, mainly from photon conversion and Dalitz decays of neutral light mesons, is also investigated.

HK 68.6 Th 18:00 H-ZO 10

A parton cascade calculation of heavy quark production and collective flow effects in the QGP — •Jan Uphoff, Oliver Fochler, Zhe Xu, and Carsten Greiner — Institut für Theoretische Physik, Goethe-Universität, Frankfurt am Main

We investigate heavy quark production and space-time evolution in heavy-ion collisions at RHIC energy with the partonic transport model BAMPS. The heavy quark yield from primary hard collisions between partons of the nuclei is obtained using the Monte Carlo event generator PYTHIA, comparing various parton distribution functions. Secondary production via $g + g \rightarrow c + \bar{c}$ and the evolution of heavy quarks are studied within a fully dynamic BAMPS simulation for central Au+Au collisions at RHIC energy. We estimate kinetic and chemical equilibration times in box calculations and then compare them to the relevant time scales in the QGP. Furthermore, we throw a first glance on collective flow and energy loss of heavy quarks.

HK 68.7 Th 18:15 H-ZO 10

Lattice simulation of a center symmetric three-dimensional effective theory for SU(2) Yang-Mills — •Dominik Smith[1], Stefan Schramm[1], and Adrian Dumitru[2] — [1]Universität Frankfurt, Institut für theoretische Physik, Germany — [2]Baruch College, Dept. of Natural Sciences, New York, USA

We perform simulations of an effective theory of SU(2) Wilson lines in three dimensions. Our action includes a kinetic term, the one-loop perturbative potential for the Wilson line, a non-perturbative "fuzzy-bag" contribution and spatial gauge fields. We determine the phase diagram of the theory and confirm that, at moderately weak coupling, the non-perturbative term leads to eigenvalue repulsion in a finite region above the deconfining phase transition.

HK 68.8 Th 18:30 H-ZO 10

QCD thermodynamics and Monte-Carlo simulations with the PNJL model — •Marco Cristoforetti, Thomas Hell, Bertram Klein, and Wolfram Weise — Technische Universität München, James-Franck-Str. 1, D85747 Garching

Results of QCD thermodynamics from lattice computations can be reproduced surprisingly well within the Polyakov Nambu Jona-Lasinio model at the mean field level. The quasiparticle PNJL model combines the spontaneous breaking of chiral symmetry with the dymanics of the Polyakov loop as an order parameter for the confinement-deconfinement transition.

A deeper understanding of these results requires the investigation of quantum fluctuations in the PNJL model. This can be done by numerical simulations of the thermodynamic partition function using standard Monte-Carlo techniques. We present how, in the PNJL approach, the inclusion of fluctuations of the bosonic fields permits one to reproduce accurately lattice results (such as mixed quark susceptibilities) that vanish in the mean field approximation.

Work supported in part by BMBF, GSI, the DFG Excellence Cluster Origin and Structure of the Universe

HK 68.9 Th 18:45 H-ZO 10

Functional renormalization group approach to isentropes in chiral effective theory — •eiji nakano — GSI, Darmstadt, Germany

The isentropic trajectories in the QCD phase diagram are examined in the functional renormalization group (FRG) approach, where higher momentum modes of the fluctuation fields are integrated out, thus an low-energy effective potential is generated. In particular we compute the isentropes on the T-μ plane, near the anticipated critical end point (CEP) within the quark-meson model, which belongs to the same universality class as QCD. The numerical solution of the flow equations yields the thermodynamic pressure p, the entropy density s and the net baryon density n.

Contours of constant s/n in the T-μ plane correspond to trajectories of ideal hydrodynamic evolution of the interaction region in ultra relativistic heavy-ion collisions. We have especially examined the behavior of the isentropes near the CEP and close to the crossover line of the chiral transition. We find that the strong changes in s/n in the transition region, typically found in mean-field calculations, are removed by fluctuations. Only a very smooth behavior remains, which does not exhibit focussing towards the CEP.

The isentropes near the CEP do not exhibit a universal behavior. This is supported by arguments based on the scaling functions of the 3-d Ising model, to which the QCD CEP belongs. Since s and n both remain finite at the CEP, in contrast to the divergent susceptibilities, the smooth background (non universal) contribution may dominate.

HK 69: Hadron Structure and Spectroscopy I

Time: Thursday 16:30–19:00 Location: H-ZO 20

Invited Group Report HK 69.1 Th 16:30 H-ZO 20

Probing resonance matter with virtual photons — •Tetyana Galatyuk for the HADES-Collaboration — Institut für Kernphysik, Goethe-Universität, Frankfurt am Main, Germany

The HADES experiment, installed at GSI, Darmstadt, has measured di-electron production in ^{12}C+^{12}C, ^{40}Ar+^{39}KCl, $p + p$, $d + p$ and p+^{93}Nb collisions. The results of the ^{12}C+^{12}C data taken at a kinetic beam energy of 1 GeV/u and 2 GeV/u suggest that a substantial fraction of electron pairs with masses larger than 0.15 GeV/c^2 stem from Dalitz decays of baryonic resonances. For a better understanding of the dielectron production in heavy ion collisions HADES has therefore studied elementary $p + p$ and $d + p$ interactions at $E_{kin} = 1.25$ GeV/u. The main interests here are the investigation of iso-spin effects in baryonic resonance excitation and the off-shell production of vector mesons. We observe indeed a large difference in dielectron production in $p + p$ and $d + p$ reactions measured at the same beam energy.

The production of e^+e^- pairs in ^{40}Ar+^{39}KCl collisions at a beam energy of 1.75 GeV/u was measured in August 2005. Results of these data will be discussed and compared to results of the ^{12}C+^{12}C runs.

In May 2007 data with high statistics were taken for p+p interactions

at $E_{kin} = 3.5$ GeV. We use this data to study ω meson production, in particular its free line shape. Precise ω reconstruction in this reactions will serve as a reference for studies of the ω line shape in $p+^{93}Nb$ reactions. Dielectron production in $p+^{93}Nb$, was recently measured with HADES to search for medium effects at nuclear ground state density. Preliminary results of the data analysis will also be reported.

Group Report HK 69.2 Th 17:00 H-ZO 20

The η' meson structure, width and interaction with nucleons investigated at the COSY–11 facility — •Eryk Czerwiński[1,2], Paweł Moskal[1,2], Joanna Klaja[1,2], and Paweł Klaja[1,2] for the COSY–11-Collaboration — [1]Institut für Kernphysik and Jülich Center for Hadron Physics, Forschungszentrum Jülich, D-52425 Jülich, Germany — [2]Jagiellonian University, Cracow, Poland

Recent results of studies on the properties of the η' meson with the COSY–11 facility will be presented and discussed. In particular, new results on the isospin dependence of the η' production cross section in nucleon-nucleon collisions will be discussed in view of the η' meson structure. Next, the results of comparative analysis of the invariant mass distributions for the $pp \to pp\eta'$ and $pp \to pp\eta$ reactions will be shown in the context of the proton-eta and proton-eta-prime interaction. Finally, the value of the total width of the η' meson will be reported as derived directly from the measurement of the mass distribution. The presentation of the results will include an explanation of the experimental technique used on order to achieve a precision about an order of magnitude better then former experiments.

Supported in part by FZ-Jülich.

HK 69.3 Th 17:30 H-ZO 20

Coherent photoproduction of multiple mesons off the deuteron — •Igal Jaegle for the CBELSA/TAPS-Collaboration — Department of Physics, University of Basel

The coherent photoproduction of $\eta\pi^o$-pairs, $\omega\pi^o$-pairs, $\pi^o\pi^o\pi^o$-triplets and $\eta\pi^o\pi^o$-triplets have been measured for the first time at a tagged photon beam of the Bonn ELSA electron accelerator with the combined Crystal Barrel - TAPS electromagnetic calorimeter for incident photon energies up to 2.5 GeV. A clear identification of the coherent signal is possible by detecting the mesons in coincidence with the recoil deuterons. This coherent productions may lead to novel approaches for the search of mesic nuclei. For example, in the reaction $\gamma d \to \eta\pi^o d$, the η-mesons are emitted with very small kinetic energies, so that it can be used as a tool to study the much discussed η-nucleon, η-deuteron interaction at small relative momenta. Furthermore, the inclusive measurement (i.e. without detecting the recoil deuterons) of the coherent photoproduction of multiple mesons is also possible. This development might open a new possibility for the observation of in medium effects in heavy nuclei. Funded by the Swiss National Fund and the DFG (TR16).

HK 69.4 Th 17:45 H-ZO 20

Photon- and pion asymmetry in near-threshold ω photoproduction * — •Frank Klein for the CBELSA/TAPS-Collaboration — Physikalisches Institut, Universität Bonn, Germany

The photoproduction of ω mesons off protons has been studied from threshold to E_γ=1700 MeV in the reaction $\vec{\gamma}p \to \omega p$. The photon-beam asymmetry, Σ, and, for the first time, the pion asymmetry Σ_π related to the $\omega \to \pi^0\gamma$ decay have been measured [1].

The experiment was performed at the tagged photon beam of the ELSA electron accelerator of the University of Bonn. Using electron beams of E_0=3.2 GeV linearly polarized photons were produced by coherent bremsstrahlung. The ω meson was identified through it's neutral decay mode into $\pi^0\gamma$. The corresponding three decay photons and the proton were detected in a combined setup of the Crystal Barrel and the TAPS calorimeters. Large photon asymmetries Σ in excess of 50 % were obtained. The pion asymmetries Σ_π were found close to zero. This provides a new indication that, on top of t-channel exchange processes, baryonic s-channel resonances play an important role in ω photoproduction. The photoproduction of ω mesons thus continues to be a promising channel to find so far undetected baryonic resonances predicted by current quark models. Ongoing measurements at ELSA of further double polarization observables will be indispensable to fully disentangle the process.

[1] arXiv:0807.0594 [hep-ex]

* supported by DFG (SFB/TR 16).

HK 69.5 Th 18:00 H-ZO 20

COMPASS Measurements with Hadron Beams — •Jan Michael Friedrich for the COMPASS-Collaboration — Physik Department E18, Technische Universität München, 85748 Garching

Muon and hadron beams from the CERN Super Proton Synchrotron are used in the COMPASS experiment for high-energy scattering reactions off fixed targets, aiming at measurements of non-perturbative aspects of quantum chromodynamics.

With pion beams, the meson spectrum can be examined via diffractive dissociation, where the existence of hybrid or exotic states is a much discussed issue. The double-diffractive process of central production, which can be measured also with a proton beam, is a promising approach for the search for glueballs. At extremely small momentum transfer, electromagnetic processes are accessible via the Primakoff effect and aim at the determination of QCD low energy constants as the pion polarisability and the chiral anomaly.

The muon program, focused on deep inelastic scattering, took place in the years 2002 to 2007. During this time, in autumn 2004, also a first pilot run with a pion beam was taken with the focus on diffractive and Primakoff measurements. Preliminary results and conclusions are presented.

Data taking with a pion beam was resumed in 2008, where large statistics for diffractive scattering was collected. First insights, also in view of the findings of previous experiments, are presented, as well as the planning for continuation of data taking in 2009.

HK 69.6 Th 18:15 H-ZO 20

Measurement of the double polarization asymmetry G in π^0 and η photoproduction — •Annika Thiel for the CBELSA/TAPS-Collaboration — Helmholtz-Institut für Strahlen- und Kernphysik, Nußallee 14-16, D-53115 Bonn

The excitation spectrum of the proton consists of several overlapping resonances, which are difficult to disentangle. To determine the exact contributions and identify the resonances, a solution of the partial wave analysis has to be found. For a complete experiment, which leads to an unambiguous solution, at least 8 well chosen single and double polarization observables are needed. With the new Crystal-Barrel/TAPS experiment at ELSA, the measurement of double polarization parameters like E and G in different reactions is possible by using a circularly or linearly polarized photon beam on a longitunally polarized butanol target. The Crystal-Barrel/TAPS setup provides a nearly 4π angular coverage and a high detection efficiency for neutral states, which gives an ideal condition for the study of final state comprising neutral mesons. In this talk the first results of the G asymmetry measurement in the reactions $\vec{\gamma}\vec{p} \to p\pi^0$ and $\vec{\gamma}\vec{p} \to p\eta$, which utilizes linearly polarized photons in combination with the longitudinally polarized target, will be presented.

Supported by the Deutsche Forschungsgemeinschaft (SFB/TR 16).

HK 69.7 Th 18:30 H-ZO 20

Atomic target mass dependence of ϕ-meson production in proton-nucleus collisons. — •Andrey Polyanskiy for the ANKE-Collaboration — Institut für Kernphysik, Forschungszentrum Jülich GmbH — Jülich Center for Hadron Physics

The modification of the vector meson properties in a strongly interacting environment is currently a hot subject in terms of spontaneous chiral symmetry breaking and partial restoration of this symmetry in nuclear matter. The dropping of the vector-meson mass by about 20% has been predicted already at normal nuclear density. However, according to theoretical investigations the ϕ-meson mass shift in matter is small and the main medium effect on the ϕ is a sizable increase of its width up to an order of magnitude compared to the vacuum value of 4.4 MeV/c^2. The in-medium width of a meson is related to the imaginary part of the nuclear optical potential which is responsible for the meson absorption in nuclear matter. Therefore, information about the ϕ-meson width can be obtained by analysing the target mass dependence of the ϕ-meson production cross sections. An ANKE experiment aimed at the measurement of the ϕ width in the nuclear matter of normal density in proton-nucleus collisions at maximum COSY energy of 2.83 GeV. The ϕ-mesons were detected in the K^+K^- decay channel. The total amount of ϕ's collected from carbon, cooper, silver and gold targets is about 15000. In the talk the measured A-dependence of the ϕ production cross sections will be compared with available theoretical predictions.

Supported by the COSY-FFE program.

HK 69.8 Th 18:45 H-ZO 20

Linearly Polarized Photons at ELSA* — •Holger Eberhardt

for the CBELSA/TAPS-Collaboration — Physikalisches Institut der Universität Bonn

To investigate the nucleon resonance regime in meson photoproduction, double polarization experiments are currently performed at the electron accelerator ELSA in Bonn. The experiments make use of a polarized target and circularly or linearly polarized photon beams. Linearly polarized photons are produced by coherent bremsstrahlung from an accurately aligned diamond crystal. The orientation of the crystal with respect to the electron beam is measured using the *Stonehenge-Technique*. Both, the energy of maximum polarization and the plane of polarization, can be deliberately chosen for the experiment. The linearly polarized beam provides the basis for the measurement of azimuthal beam asymmetries, such as Σ (unpolarized target) and G (polarized target). These observables are extracted in various single and multiple meson photoproduction channels.

*supported by the DFG (SFB/TR-16)

HK 70: Hadron Structure and Spectroscopy II

Time: Thursday 16:30–19:00 Location: H-ZO 30

Invited Group Report HK 70.1 Th 16:30 H-ZO 30

Superscaling analyses, lepton scattering and nucleon momentum distributions in nuclei — •Anton Antonov — Institute of Nuclear Research and Nuclear Energy, Bulgarian Academy of Sciences, Sofia BG-1784, Bulgaria

A scaling function $f(\psi')$ for inclusive electron scattering from nuclei was constructed within the Coherent Density Fluctuation Model (CDFM) that is a natural extension to finite nuclei of the Relativistic Fermi Gas (RFG) model. The approach was used to calculate the total, longitudinal and transverse scaling functions built up from the hadronic tensor and the corresponding response functions in the RFG model. The results are in good agreement with the experimental data for the scaling functions, showing superscaling (independence on the transverse momentum q and the mass number A) for negative values of ψ' including those in the region $\psi' < -1$, whereas the RFG model result for this region is $f_{\rm RFG}(\psi') = 0$. The CDFM scaling functions are used to calculate the cross sections of electron scattering in the quasielastic (QE) region for nuclei from $12 < A < 208$ in comparison with the available experimental data, as well as to calculate charge-changing and neutral current neutrino (antineutrino) scattering on ^{12}C in the QE and the Δ-resonance regions at energies from 1 to 2 GeV. It was shown that superscaling is due to the high-momentum tail of the momentum distributions and the form of its general power-law asymptotics similar for all nuclei which is known to be caused by the short-range and tensor nucleon-nucleon correlations.

Invited Group Report HK 70.2 Th 17:00 H-ZO 30

Overview of recent HERMES results — •Charlotte Van Hulse for the HERMES-Collaboration — Gent University - Department of Subatomic and Radiation Physics-Proeftuinstraat 86, 9000 Gent - Belgium

In the last decade, the HERMES experiment has expanded its program of measuring the quark spin contribution to the nucleon spin, towards forming three dimensional pictures of the partonic structure of the nucleon. These are described in terms of transverse momentum distributions and generalized parton distributions. The former distributions can be accessed by analyzing azimuthal asymmetries in the semi-inclusive deep-inelastic cross section, while the latter can be constrained by the analysis of azimuthal asymmetries in exclusive reactions.

An overview will be given on recent HERMES results on such asymmetries in exclusive real photon and meson production as well as in inclusive and semi-inclusive deep-inelastic scattering. This overview will be supplemented by results on the strange quark distribution and polarization.

HK 70.3 Th 17:30 H-ZO 30

The HERMES measurement of transverse single-spin asymmetries — •Markus Diefenthaler for the HERMES-Collaboration — DESY

In 2005 the HERMES collaboration published first evidence for azimuthal single-spin asymmetries in the semi-inclusive production of charged pions on a transversely polarised hydrogen target. Significant signals for both the Collins and Sivers mechanisms were observed in data recorded during the 2002–2003 running period of the HERMES experiment. In the conference contribution a preliminary analysis of the full data set with transverse target polarisation is presented for π-mesons and charged K-mesons. These results contribute substantially to the global analysis of the transversity distribution and provide clear evidence for the naive time reversal odd Sivers distribution function.

The published results on single-spin asymmetries in semi-inclusive dihadron production provide an independent experimental constraint on the transversity distribution. Thereby first evidence is found for a non-zero naive time reversal odd chiral-odd dihadron fragmentation function $H_{1,q}^{\sphericalangle}$.

HK 70.4 Th 17:45 H-ZO 30

Selected HERMES Results on Deeply Virtual Compton Scattering — •Caroline Riedl for the HERMES-Collaboration — DESY/Zeuthen

The HERMES experiment has collected a rich data set for the analysis of Deeply Virtual Compton Scattering (DVCS), employing different settings of the beam helicity, the beam charge, the target polarization (both longitudinal and transverse) and the target type (H, D and heavier nuclei).

The azimuthal asymmetries measured for the exclusive DVCS reaction allow to access the imaginary and/or real part of certain Generalized Parton Distributions (GPDs). Those GPDs are of great theoretical interest as they embody both spatial and momentum density information of quarks and gluons. Moreover, in a certain kinematic limit, certain moments of the quark (gluon) GPDs E and H deliver the total angular momentum carried by quarks (gluons) in the nucleon.

Until the year 2005, the recoiling target nucleon from the DVCS reaction was not detected by HERMES. Exclusivity was ensured indirectly by a missing-mass-technique. Data with a new Recoil Detector were taken in the last two years of HERA running. The Recoil Detector can identify the recoiling target nucleon and the particles from underlying background processes and can thus be used to directly tag exclusive events and to reject competing background channels. Selected DVCS results will be shown and an outlook to results from the HERMES Recoil Detector will be presented.

HK 70.5 Th 18:00 H-ZO 30

Structure functions of nucleons and nuclei — •Wolfgang Bentz[1], Ian Cloet[2], Takuya Ito[1], Anthony Thomas[3], and Koichi Yazaki[4] — [1]Department of Physics, Tokai University, Kanagawa, Japan — [2]Department of Physics, University of Washington, Seattle, USA — [3]Jefferson Lab, Newport News, VA, USA — [4]RIKEN, Wako-shi, Saitama, Japan

We use an effective chiral quark theory to calculate the quark distributions and structure functions of nucleons and nuclei. The description of the single nucleon is based on the Faddeev framework, and nuclear systems are described in the mean field approximation. Particular amphasis is put on the prediction of the polarized EMC effect in nuclei, and on applications to deep inelastic neutrino-nucleus scattering. Concerning the polarized EMC effect, we discuss the quenching of the quark spin sum in nuclei and its implications for the spin dependent nuclear structure functions, and present results for several nuclei where an experimental observation is feasible. Concerning the case of deep inelastic neutrino-nucleus scattering, we estimate the effect of medium modifications of the quark distribution functions on the measured cross sections, and discuss an interesting resolution of the so called NuTeV anomaly. Finally, we discuss extensions of our model to describe fragmentation functions for semi-inclusive processes. The connection between our effective quark model description and the jet model of Field and Feynman is discussed.

HK 70.6 Th 18:15 H-ZO 30

Transverse quark charge densities — •Cédric Lorcé — Johannes Gutenberg-Universität Mainz

Transverse quark charge densities have recently been studied since they provide a well founded interpretation of the particle structure

and shape. We will review shortly the results obtained for spin-1/2 (e.g. nucleon), spin-1 (e.g. deuteron) and spin-3/2 (e.g. Delta) systems. An educated guess allows one to generalize to any spin and leads to definite values for the "natural" electromagnetic moments, i.e. the ones associated to a structureless particle in leading order of the electromagnetic coupling and for real photons.

HK 70.7 Th 18:30 H-ZO 30

First Results of exclusive ρ^0 Production from the Recoil Detector at HERMES — •Roberto Perez-Benito for the HERMES-Collaboration — II. Phys. Institut, Univ. Giessen, Giessen, Germany

The HERMES experiment (HERa MEasurement of Spin) at DESY was designed to study the spin structure of the nucleon by semi-inclusive deep inelastic scattering. Here, we report on hard exclusive processes that can be understood in terms of Generalised Patron Distributions (GPDs). The accumulated HERMES data offer access to GPDs in different combinations of beam charge and beam helicity asymmetries. The ratio of the cross-sections of ρ^0 meson production between hydrogen and deuterium will provide an insight into the relative contribution to the nucleon cross-section from quarks and gluons.

In January 2006 a Recoil Detector was installed that surrounded the internal gas target of the HERMES experiment. The HERMES Recoil Detector consisted of three components: a silicon strip detector inside the vacuum, a scintillating fiber tracker and the photon detector with three layers of tungsten and scintillator bars in three different orientations. All three detectors were located inside a solenoidal magnet which provided a 1T longitudinal magnetic field. The detector improves the selection of exclusive events by a direct measurement of the recoiling target nucleon in an intermediate momentum range from 0.1 to 1.4 GeV/c as well as by rejecting non-exclusive background.

HK 70.8 Th 18:45 H-ZO 30

Experiment E06007 at Jefferson Lab — •Guido Maria Urciuoli — Instituto Nazionale di Fisica Nucleare, Sezione Roma 1

Experiment E06007 at Jefferson Lab measured cross sections for the $(e, e'p)$ reaction at constant $(\mathbf{q}, \omega)$ for $Q^2 = 0.81$ GeV^2 over a wide range of missing momenta. At missing momentum $p_m = 0$ MeV/c cross sections were also measured at $Q^2 = 1.4$ GeV^2 and 1.97 GeV^2. E06007 experiment addresses several issues concerning our understanding of the nuclear structure. The role of relativity in the description of nuclei is clarified thanks to the measurement of the asymmetry A_{TL} in the cross section, measured forward or backward of the three momentum transfer q. This asymmetry is a distinctive signature of dynamical relativistic effects in the nucleon wave function. The role of the correlations on the strength of high momentum components of single nucleon states is also investigated by the measurement of the cross sections for missing momenta from 300 MeV/c to 500 MeV/c for the ^{208}Pb(e,e'p) reaction going to the low lying states of ^{207}Tl. Furthermore a possible dependence of the spectroscopic factors on Q^2 suggested by previous experimented is studied. To achieve all these goals a very good energy resolution was needed. The experiment made use of the two High Resolution Spectrometer (HRS) located in experimental Hall A at Jefferson Lab and of the high monochromatic, small emittance, JLab electron beam. A special effort was involved to optimize the optical performances of HRS. The preliminary results of E06007 and their comparison to theoretical predictions will be shown.

HK 71: Nuclear Structure and Dynamics I

Time: Thursday 16:30–19:00 Location: H-ZO 40

Invited Group Report HK 71.1 Th 16:30 H-ZO 40

The GDR strength function in exotic nuclei measured with gamma decay — •Angela Bracco — Università di Milano e INFN sez. Milano

The study of the gamma decay from the giant dipole resonance (GDR) in nuclei far from stability both at zero and finite temperature is a powerful tool to obtain information on the nuclear properties, such as shape and isospin effects. In particular, two specific problems related to isospin effects will be discussed.

The first problem is that of the possible restoration of the isospin symmetry at finite temperature. The problem of determining isospin mixing in N=Z nuclei has been addressed both at zero and finite temperature T up to Z=N=32 (with the mixing found to increase with Z). In addition at T=2 and T=0 the isospin mixing are similar. Thus the combination of data at T=0 and T>0 provide important information on this problem. A new exclusive experiment on the GDR at T= 2 MeV in the unexplored region N=Z=40 was made using the GARFIELD-HECTOR set up at LNL. Preliminary results will be presented.

The second topic that will be discussed is the search of the pygmy resonance in the exotic 68Ni nucleus using Coulomb excitation at 600 A MeV and the RISING array at the FRS of GSI. The gamma decay of 68Ni isotopes was measured in BaF2 and HpGe detectors. A peak at approximately 11 MeV was observed. This is the first measurement of the gamma decay of the Pygmy Resonance with radioactive beams. Discussion will be made on the interest in relating these states with the oscillation of the neutron skin.

Group Report HK 71.2 Th 17:00 H-ZO 40

Systematic studies of the Pygmy Dipole Resonance by means of the $(\alpha,\alpha'\gamma)$ reaction* — •Janis Endres[1], Peter Butler[2], Muhsin N. Harakeh[3], Rolf-Dietmar Herzberg[2], Reiner Krücken[4], Norbert Pietralla[5], Lucia Popescu[6], Deniz Savran[5], Marcus Scheck[2], Felix Siebenhühner[5], Kerstin Sonnabend[5], Sotirios Harissopulos[7], Anastasios Lagoyannis[7], Heinrich Wörtche[3], and Andreas Zilges[1] — [1]IKP, Universität zu Köln — [2]Department of Physics, Liverpool, England — [3]KVI, University of Groningen, The Netherlands — [4]Physik-Department E12, TU München — [5]IKP, TU Darmstadt — [6]SCK-CEN, Mol, Belgium — [7]I.N.P. NCSR Demokritos, Athen, Greece

In the last years investigations have been made to study the electric Pygmy Dipole Resonance (PDR), mainly in semi-magic nuclei. Therefore (γ,γ') photon scattering experiments have been performed systematically [1]. In $(\alpha,\alpha'\gamma)$ coincidence experiments at $E_\alpha = 136$ MeV a comparable energy resolution and a high selectivity of E1 transitions can be obtained by using the Big-Byte Spectrometer at KVI [2]. We give an overview about systematic studies on the nuclei ^{140}Ce, ^{138}Ba, ^{124}Sn and ^{94}Mo. In comparison to the (γ,γ') reaction a structural splitting of the PDR could be observed which is possibly connected to the different isospin natures of the two groups. There is a low energy part which can be found in $(\alpha,\alpha'\gamma)$ as well as in (γ,γ') reactions and a high energy part which can only be observed in (γ,γ'). * Supported by EURONS and the DFG (SFB 634). [1] U. Kneissl et al., J. Phys. G 32 (2006) R1 [2] D. Savran et al., Phys. Rev. Lett. 97 (2006) 172502

Group Report HK 71.3 Th 17:30 H-ZO 40

Complete dipole response in ^{208}Pb from high-resolution polarized proton scattering at 0°* — •Iryna Poltoratska for the EPPS0-Collaboration — Institut für Kernphysik, Technische Universität Darmstadt, Germany

In proton scattering at angles close to 0° one can selectively study dipole modes which, apart from the isovector giant dipole resonance, are poorly understood. Recent experimental progress at RCNP Osaka, Japan [1], allows measurements with intermediate-energy polarized beams at very forward angles including 0° combined with high energy resolution of the order $\Delta E/E \approx 8 \cdot 10^{-5}$. This new experimental opportunity was applied to study soft electric dipole modes such as Pygmy Dipole Resonance (PDR) and the so-called toroidal mode. The preliminary data analysis indicates that at very forward angles 1^- states are strongly excited via Coulomb interaction. The extracted B(E1) transition strengths are in a good agreement with data obtained from a nuclear resonance fluorescence experiment [2]. E1/M1 contributions are separated based on multipole decomposition of a cross section angular distributions and utilizing spin-transfer observables.
[1] A. Tamii et al.,Nucl. Phys. A 788 (2007) 53c.
[2] N. Ryezayeva et al., Phys. Rev. Lett. 89, 272502 (2002).
* Supported by DFG contracts SFB 634 and 446 JAP 113/26710-2.

HK 71.4 Th 18:00 H-ZO 40

Electromagnetic excitation of nickel nuclei at LAND/R^{3}B — •Dominic Rossi for the LAND-S287-S295-Collaboration — Institut für Kernchemie, Johannes Gutenberg-Universität Mainz, D-55128 Mainz, Germany

The dipole response of stable and unstable nickel isotopes has been investigated at GSI in Darmstadt. Relativistic secondary beams of $^{57-72}$Ni, with energies of approximately 500 MeV/u, have been produced in the projectile FRagment Separator (FRS) and subsequently excited by heavy-ion-induced Coulomb excitation at the LAND/R^{3}B setup. Due to the possibility to perform kinematically complete measurements with this setup, the excitation energy distributions can be determined by reconstructing the invariant mass. Measurements with Pb and C targets allow extraction of pure electromagnetic excitation data, enabling the access to the dipole strength distribution in the continuum. Cross sections for selected isotopes will be presented.

HK 71.5 Th 18:15 H-ZO 40

Wavelet Analysis and Characteristic Scales of Dipole and Quadrupole Giant Resonances in ^{28}Si, ^{40}Ca, ^{48}Ca and ^{166}Er * — •Inna Pysmenetska, Peter von Neumann-Cosel, and Achim Richter — Institut für Kernphysik, TU Darmstadt, Germany

Modern experiments allow to study the fine structure of giant resonances even in heavy nuclei. A novel method using continuous and discrete wavelet transforms provides extraction of characteristic energy scales of the giant resonances and a nearly model-independent determination of level densities. This technique is applied to diverse (e,e′) and (p,p′) data studying the magnetic quadrupole resonances in ^{48}Ca, electric dipole and quadrupole resonances in ^{28}Si , ^{40}Ca and ^{166}Er and various model calculations attempting to describe the fine structure.

HK 71.6 Th 18:30 H-ZO 40

Time-dependent-Hartree-Fock-Bogoliubov monopole response in even-even superfluid spherical nuclei — •Sara Fracasso and Paul D. Stevenson — University of Surrey, Guildford, Surrey, GU27XH (UK)

The monopole linear response has been investigated in even-even spherically symmetric systems, such as Oxygen and Calcium isotopes, by means of a radial Time-dependent-Hartree-Fock-Bogoliubov (TDHFB) approach, based on a Skyrme functional complemented with a zero-range density dependent pairing force [1]. A new code (TDHFBrad) has been developed to perform the time evolution of the HFB solutions, currently obtained with HFBRAD [2].

Our calculations, the first of their kind and which follow the recent TDHFB predictions for the pairing-vibrations [3], are compared with the available experimental data. Consequences of the complex character of the anomalous densities are in particular discussed.

A comparison with results from the self-consistent HFB+QRPA of [4] has also been performed. Besides the inclusion of both the residual spin-orbit and Coulomb terms in QRPA, the same energy density functional in both the normal and the anomalous sector has been implemented in the two models, whose parameters have been tuned to allow a reasonable comparison. These features allow us to draw quite robust conclusions.

[1] S. Fracasso et al., in preparation; [2] K. Bennaceur et al., Comp. Phys. Comm. 168, 96 (2005); [3] B. Avez et al., Phys. Rev. C 78, 044318 (2008); [4] J. Li et al., Phys. Rev. C 78, 064304 (2008).

HK 71.7 Th 18:45 H-ZO 40

Low-energy dipole and quadrupole states related to neutron skins — •Nadia Tsoneva[1,2] and Horst Lenske[1] — [1]Institut für Theoretische Physik, Universität Giessen, Germany — [2]Institute for nuclear research and nuclear energy, Sofia, Bulgaria

We present investigations on dipole and quadrupole excitations in skin nuclei, in particular in the N=50, 82 isotones and Z=50 isotopes. We explore their connection to the thickness of the neutron(proton) skin, respectively. Our theoretical method relies on density functional theory which provides us with a proper link between nuclear many-body theory of the nuclear ground state and its phenomenological description [1]. For the calculation of the nuclear excited states we apply QPM theory. From QPM calculations in these nuclei we observe low-energy dipole strength located below the particle emission threshold and related to the size of the neutron(proton) skin [1]. The genuine character of the PDR mode as a skin vibration is confirmed by the shape and structure of the transition densities. The spectral distributions are in a good agreement with the available experimental data [1]. In addition, quadrupole states are investigated along isotopic chains. By analysing their state vectors and transition densities a clear separation between collective isoscalar, isovector and mixed symmetry states is achieved. A new quadrupole mode related to PQR [2] in tin isotopes is suggested.

Work supported by DFG project Le 439/1-7.

[1] N. Tsoneva, H. Lenske, Phys. Rev. C **77**, 024321 (2008).
[2] N. Tsoneva and H. Lenske, CGS13 Conf. Proc, to be publ.

HK 72: Nuclear Structure and Dynamics II

Time: Thursday 16:30–19:00 Location: H-ZO 50

Group Report HK 72.1 Th 16:30 H-ZO 50

^{14}C Dating Beta Decay with Chiral Effective Field Theory — •Jeremy Holt, Norbert Kaiser, and Wolfram Weise — Technische Universität München, München, Germany

The anomalously long beta-decay lifetime of ^{14}C, which is essential for the science of radiocarbon dating, has long been a challenge for nuclear structure theory. Here we present a shell model calculation of this decay, treating the initial and final nuclear states as two p-holes in an ^{16}O core. Employing the low-momentum nucleon-nucleon (NN) interaction V_{low-k} only, we find that the Gamow-Teller transition matrix element is too large to describe the known lifetime of ^{14}C. As a novel approach to this problem, we invoke the chiral three-nucleon force (3NF) at leading order and derive from it a density-dependent in-medium NN interaction. After including these in-medium contributions, we find that the Gamow-Teller matrix element vanishes at a nuclear density close to that of saturated nuclear matter. The genuine short-range part of the 3NF is identified as the most important contribution leading to the observed suppression, and we find that although individual terms arising from the long- and medium-range parts of the chiral 3NF can be large, they significantly cancel. Work supported in part by BMBF, GSI, and by the DFG cluster of excellence: Origin and Structure of the Universe.

HK 72.2 Th 17:00 H-ZO 50

Quasi-free Scattering in Inverse Kinematics with the Proton-Dripline Nucleus ^{17}Ne — •Felix Wamers for the LAND-S318-Collaboration — Gesellschaft für Schwerionenforschung, 64291 Darmstadt, Germany

^{17}Ne is a proton-dripline nucleus that has raised special interest in nuclear structure physics in recent years. It has a half life of 109.2 ms and a low two-proton separation energy of 950 keV. It's a (^{15}O-p-p) 3-body borromean system, i.e. all its 2-body subsystems (p-p, ^{16}F-p) are unbound. ^{17}Ne is considered to be a potential 2-proton-halo nucleus, yet lacking final and concluding experimental evidence about its structure.

The S318-LAND collaboration has studied reactions of 500 AMeV ^{17}Ne secondary beams at GSI. One focus was put on employing quasi-free scattering in inverse kinematics at these relativistic energies. In other words, the ^{17}Ne(p,2p)^{16}F $\rightarrow$ ^{15}O+p proton knockout reaction on hydrogen atoms in a paraffin (CH_2) target was studied with a kinematically complete measurement. Recoil protons have been detected with Si-Strip detectors and the surrounding 4 π NaI spectrometer "Crystal Ball".

In a preliminary analysis, events with ^{17}Ne and ^{15}O in initial and final state, respectively, together with 2 coincident protons in the Crystal Ball have been observed. Angular and energy correlations of these scattered protons have been obtained and will be discussed.

HK 72.3 Th 17:15 H-ZO 50

Isospin symmetry in the A=12 system using both beta decay and M1 gamma decays — •martin alcorta[1] and the 12C-kvi collaboration[2] for the MAGISOL-Collaboration — [1]Instituto de Estructura de la Materia, CSIC, Madrid, Spain — [2]KVI Rijksuniversiteit Groningen, Zernikelaan 25 9747 AA Groningen, the Netherlands

The A=12 isobars provide an excellent system for testing isospin symmetry. The Gamow-Teller strength to states in ^{12}C populated in the β decays of ^{12}B and ^{12}N can be directly compared. By using the parallels between the Gamow-Teller operator and the operator for M1

γ transitions this isospin symmetry can also be tested in the T_3=0 member of this isospin triplet.

We have precisely measured the branching ratios to unbound states in ^{12}C populated in the β decay of both ^{12}B and ^{12}N by implanting these nuclei in a segmented Si detector at KVI, Groningen. By studying the ^{10}B(^{3}He,p$\alpha\alpha\alpha$) reaction in complete kinematics we were able to observe M1 γ decay of the 15.11 MeV T=1 IAS of the ^{12}B and ^{12}N ground states to the same unbound states populated in the β decays. This allows us to improve the values of the overall branching ratios of the γ decay of the T=1 15.11 MeV state. The results from these two experiments gives us a complete picture of branching ratios of the decay from the A=12 isospin triplet leading to an improved test of the isospin symmetry. In this contribution we will present our results on the γ branching intensities from the 15.11 MeV state and the β decay transition rates of ^{12}B and ^{12}N and compare these to state-of-the-art calculations.

HK 72.4 Th 17:30 H-ZO 50

Reaction study of ^{11}Li on ^{208}Pb target at energies close the Coulomb barrier — •MARIO CUBERO[1], MARIA JOSE BORGE[1], OLOF TENGBLAD[1], MARTIN ALCORTA[1], MIGUEL MADURGA[1], JOAQUIN CAMACHO[2], ISMAEL MARTEL[3], and PAT WALDEN[4] — [1]Instituto de Estructura de la Materia, Madrid, Spain — [2]Departamento de Física Atómica, Molecular y Nuclear, Universidad de Sevilla, Sevilla, Spain — [3]Departamento de Física Aplicada, Universidad de Huelva, Huelva, Spain — [4]TRI-University Meson Facilities, University of British Columbia, Vancouver Canadá

In the past 20 years there has been interest among the nuclear physics community to study the exotic properties observed in halo nuclei such as ^{11}Li. Recent theoretical calculations predicted a deviation of the elastic cross section from the standard Rutherford formula, expected due to the dipole structure formed by the ^{9}Li core and the halo neutrons when passing near the strong Coulomb produced by the Pb target. To explore this effect, the scattering and breakup reactions of the two-neutron halo nucleus ^{11}Li were measured at ISACII-TRIUMF. Data was obtained at energies around, below and above the Coulomb barrier, 2.7MeV/u. We used a set of four telescopes with PAD silicon detectors behind in order to clearly identified all fragments in the full detection angles covering 10-140 degree.In this contribution we will present the analysis of the ^{9}Li scattering data that it is needed to understand the effect on the ^{11}Li cross sections. We will also present preliminary results of the ^{11}Li scattering.

HK 72.5 Th 17:45 H-ZO 50

Microscopic study of Neon isotopes, including the two-proton halo ^{17}Ne — •THOMAS NEFF and HANS FELDMEIER — GSI Helmholtzzentrum für Schwerionenforschung GmbH, 64291 Darmstadt, Germany

Fermionic Molecular Dynamics (FMD) is a many-body approach that uses Gaussian wave-packets localized in phase-space as single-particle states. The wave-packet basis is very flexible and includes harmonic oscillator and localized cluster states. The width of the wave-packets is a variational parameter which helps to describe extended nuclear halos. The intrinsic many-body basis states are projected on parity, angular momentum and linear momentum. The Hamiltonian is finally diagonalized in a set of many-body states. In this talk I will present calculations for the Neon isotopes $^{17-22}$Ne. The calculated charge radii describe very well recent experimental results from the COLLAPS collaboration. The calculations show that ^{17}Ne (^{18}Ne) can be considered as ^{15}O (^{16}O) plus two protons in either s^2 or d^2 configurations. In ^{17}Ne we find an extended s^2-component with about 40% contribution explaining the very large charge radius. In ^{18}Ne the s^2-component is only 15% corresponding to a smaller radius. In ^{19,20}Ne again very large charge radii are observed which are due to the admixture of ^{3}He and ^{4}He cluster configurations into the ground states.

[1] W. Geithner, T. Neff, et al., accecpted for publication in Phys. Rev. Lett.

HK 72.6 Th 18:00 H-ZO 50

One-nucleon knockout reactions from proton-rich carbon isotopes — •VASILY VOLKOV for the S341-Collaboration — Institut für Kernphysik, Technische Universität Darmstadt, Germany

We present selected results of one-nucleon knockout reactions from relativistic proton-rich carbon beams performed at the fragment separator FRS at GSI within experiment S341. Beams of ^{9,10,11,12}C were produced in fragmentation reactions. The secondary beam impinged on a beryllium target at the second focus (S2) of the FRS. To maximize transmission, the reaction residues were measured at the third focus (S3) of the FRS. We will show preliminary cross sections for one-nucleon removal reactions. We aim at a quantitative understanding of absolute spectroscopic factors that appear to be quenched for deeply bound nucleons [1-3].

[1] B. A. Brown et al., Phys. Rev. C 65, 061601 (R) (2002)
[2] A. Gade et al., Phys. Rev. Lett. 93, 042501 (2004)
[3] A. Gade et al., Phys. Rev. C 77, 044306 (2008)

Supported in part by GSI Research and Development Contract DA PIET.

HK 72.7 Th 18:15 H-ZO 50

Two-nucleon removal cross sections from ^{11}C — •MATTHIAS HOLL for the S341-Collaboration — Institut für Kernphysik, Technische Universität Darmstadt, Germany

The removal of two well-bound nucleons has been identified as a direct reaction process [1,2]. We report on preliminary results obtained at GSI's fragment separator FRS for the two-nucleon removal reactions from relativitstic radioactive ^{11}C. The FRS was operated in a high-acceptance mode with the reaction residues being detected at the third focus (S3) of the FRS.

[1] D. Bazin et al., Phys. Rev. Lett. 91, 012501 (2003)
[2] J. A. Tostevin, B. A. Brown, Phys. Rev. C 74, 064604 (2006)

Work supported in part by GSI Research and Development Contract DA PIET.

HK 72.8 Th 18:30 H-ZO 50

Study of 15F energy levels — •FLORENCE DE GRANCEY and FRANÇOIS DE OLIVEIRA — GANIL, CEA/DSM-CNRS/IN2P3, Caen, France

Energy levels of ^{15}F have been studied by resonant elastic scattering in inverse kinematic. A 84MeV ^{14}O radioactive ions beam was produced by SPIRAL facility with an intensity of 10^5 particles per second and was sent onto a thick 150 um polypropylene target. Energy calibration was obtained using resonances from resonant elastic scattering measurement of ^{14}N stable beam.

The two lowest resonances in ^{15}F were seen at 1.35 MeV and 2.78 MeV resonant energies, consistent with previous measurements. Moreover, a destructive resonance has been measured at an resonant energy of 4.78 MeV, which correspond to the second excited. Its total width has been estimated at 80keV. At this energy, this state is located 160 keV below 13N+2p threshold, opening the channel for diproton decay.

Several events of diproton decay coming from this second excited state have been observed and interpreted as sequential decay via a virtual state in ^{14}O. Experimental width for this diproton emission has been estimated at 12eV.

Analysis is still in progress.

HK 72.9 Th 18:45 H-ZO 50

Importance-Truncated No-Core Shell Model for Ab-Initio Nuclear Structure Calculations — •ROBERT ROTH — Institut für Kernphysik, Tech. Univ. Darmstadt, Darmstadt, Germany

Ab-initio methods for the solution of the nuclear many-body problem play a crucial role for the development of a consistent QCD-based theory of nuclear structure and reactions. Many of the established ab-initio methods, like the no-core shell model (NCSM), are limited to light nuclei or very small $N_{\max}\hbar\Omega$, simply because the model spaces become prohibitively large. In this talk an adaptive importance-truncation scheme is presented, which employs an a priori selection of the important basis states via perturbation theory and thus reduces the model-space dimension to a tractable size. The major elements and properties of this importance-truncated no-core shell model (IT-NCSM) are discussed. Results for ground and excited states of closed and open-shell nuclei up to mass $A \approx 40$ are presented and compared to full NCSM calculations. The properties of the IT-NCSM are contrasted with those of coupled-cluster approaches. An outlook to reaction calculations using IT-NCSM wave functions is given.

HK 73: Nuclear Astrophysics

Time: Thursday 16:30–18:00 Location: H-ZO 60

Group Report HK 73.1 Th 16:30 H-ZO 60

A Supernovae Equation of State with Light and Heavy Clusters — •Stefan Typel[1,2], Gerd Röpke[3], Thomas Klähn[4], David Blaschke[5], and Hermann Wolter[6] — [1]Excellence Cluster Universe, TU München — [2]GSI Darmstadt — [3]Uni Rostock — [4]Argonne National Laboratory — [5]Uni Wrocław — [6]LMU München

The equation of state of dense matter is an essential ingredient in astrophysical models of supernovae and compact stars. At densities below nuclear saturation and not too high temperatures, many-body correlations have a considerable impact on the thermodynamical properties. The appearance of light and heavy clusters changes the chemical composition of the system. Combining a relativistic mean-field model with density-dependent couplings and a generalized Beth-Uhlenbeck approach, it is possible to describe the dissolution of the clusters with increasing density and temperature in a microscopic, self-consistent model. The parameters can be constrained by properties of finite nuclei, neutron stars and heavy-ion collisions. Particular attention is paid to the thermodynamical consistency and the construction of phase transitions.

HK 73.2 Th 17:00 H-ZO 60

A Statistical Model for Supernova Matter — •Matthias Hempel[1] and Jürgen Schaffner-Bielich[2] — [1]Institut für Theoretische Physik, Goethe-Universität, Max-von-Laue-Str. 1, 60438 Frankfurt am Main, Germany — [2]Institut für Theoretische Physik, Ruprecht-Karls-Universität, Philosophenweg 16, 69120 Heidelberg, Germany

The equation of state and the composition of hot hadronic matter is described by an ensemble of nuclei and interacting nucleons in nuclear statistical equilibrium. A relativistic mean field model is applied for the nucleons. The masses of the nuclei are taken from nuclear structure calculations which are based on the same nuclear Lagrangian. For known nuclei experimental data is used directly. To achieve a good description of the transition to uniform nuclear matter a thermodynamic consistent model is developed which implements excluded volume effects. The model is suitable for the entire range of conditions (T, n_B, Y_p) in core-collapse supernovae and a complete equation of state table is presented. Good agreement with other commonly used models based on the single nucleus approximation is found. Regarding the composition the importance of the statistical treatment and the nuclear distributions is illustrated. The role of shell effects is investigated. Special emphasis is put on the light clusters which are only poorly represented by alpha particles under certain conditions. As a first application the equation of state is used to study the evolution of cooling proto-neutron stars.

HK 73.3 Th 17:15 H-ZO 60

Signals of the QCD phase transition in core-collapse supernovae — Irina Sagert[1], Matthias Hempel[1], •Giuseppe Pagliara[2], Jurgen Schaffner-Bielich[2], Tobias Fischer[3], Anthony Mezzacappa[4], Friederich Karl Thielemann[3], and Matthias Liebendorfer[3] — [1]Institut für Theoretische Physik, Goethe Universität, *Max-von-Laue-Str. 1, 60438 Frankfurt am Main, Germany — [2]Institut für Theoretische Physik, Ruprecht-Karls-Universität,*Philosophenweg 16, 69120 Heidelberg, Germany — [3]Department of Physics, University of Basel, Klingelbergstr. 82, 4056 Basel, Switzerland — [4]Physics Division, Oak Ridge National Laboratory, Oak Ridge, TN 37831

We explore the implications of the QCD phase transition during the postbounce evolution of core-collapse supernovae. Using the MIT bag model for the description of quark matter and assuming small bag constants, we model phase transitions that occur during the early postbounce evolution. We show that the phase transition produces a second shock wave which triggers a delayed supernova explosion. If such a phase transition happens in a future galactic supernova, its existence and properties should become observable as a second peak in the neutrino signal that is accompanied by significant changes in the energy of the emitted neutrinos. In contrast to the first neutronization burst, this second neutrino burst is dominated by the emission of anti-neutrinos.

HK 73.4 Th 17:30 H-ZO 60

Nuclear pasta with a touch of quantum — •Klaas Vantournhout, Natalie Jachowicz, and Jan Ryckebusch — Department of Subatomic and Radiation Physics, Ghent University, Proeftuinstraat 86, B-9000 Gent, Belgium

At densities of about 10^{14}g/cm^3, neutronrich matter arranges itself in a variety of complex shapes. It is suggested that these slab and rod-like structures, dubbed nuclear pasta, appear in the crust of neutron stars as well as in the centre of core-collapse supernovae, thereby influencing the dynamics of the process. For the study of these low-energy excitations, classical molecular dynamic techniques (CMD) are used [1,2].

Fermionic molecular dynamics (FMD), a formalism used to model nuclei and heavy-ion collisions, rises the description of nuclear matter to a quantum mechanical level by adding antisymmetrisation, spin, isospin and probability distributions to a CMD-like formalism [3]. The technique presented here is an extension of FMD to model bulk fermionic matter. Through the use of block-Toeplitz matrices and Jacobi-Theta functions it becomes feasible to describe infinite dimensional fermion systems [4]. In practice this is achieved by importing periodic boundary conditions into FMD giving rise to a quantum dynamical description of nuclear matter. Results illustrating the behaviour of free Fermi gases and alpha clustering will be presented.

[1] G. Watanabe et al., Phys. Rev. C **69**, 055805 (2004).
[2] C.J. Horowitz et al., Phys. Rev. C **72**, 035801 (2005).
[3] H. Feldmeier and J. Schnack, Rev. Mod. Phys **72**, 655-688 (2000).
[4] K. Vantournhout et al. (in preparation)

HK 73.5 Th 17:45 H-ZO 60

Beta decay and muon capture rates in a self-consistent relativistic framework — •Tomislav Marketin[1], Nils Paar[1], Tamara Nikšić[1], Dario Vretenar[1], and Peter Ring[2] — [1]Physics Department, Faculty of Science, University of Zagreb, Croatia — [2]Physik-Department der Technischen Universität München, D-85748 München, Germany

A fully consistent calculation of muon capture and beta decay rates is presented, based on a microscopic theoretical framework describing the semileptonic weak interaction processes. Nuclear ground state is determined using the Relativistic Hartree-Bogoliubov (RHB) model with density dependent meson-nucleon coupling constants, and transition rates are calculated via proton-neutron relativistic quasiparticle RPA using the same interaction as in the RHB equations. Muon capture rates are calculated for a wide range of nuclei along the valley of stability, from ^{12}C to ^{244}Pu, with accuracy of approximately 30%, using the interaction DD-ME2[1]. Previous studies of beta decay rates have only taken into account Gamow-Teller transitions[2]. We extend this approach by including forbidden transitions and systematically study their contribution to decay rates of exotic nuclei along the r-process path, which are important for constraining the conditions in which nucleosynthesis takes place.

[1] T. Marketin, N. Paar, T. Nikšić and D. Vretenar, submitted to Phys. Rev. C (2008) (*arXiv:nucl-th\0812.1947*).
[2] T. Marketin, D. Vretenar and P. Ring, Phys. Rev. C 75, 024304 (2006).

HK 74: Fundamental Symmetries

Time: Thursday 16:30–18:30 Location: H-ZO 70

Group Report HK 74.1 Th 16:30 H-ZO 70

aSPECT - Measuring the proton spectrum in neutron decay — •Martin Simson[1,2], Fidel Ayala Guardia[3], Stefan Baessler[4], Michael Borg[3], Ferenc Glück[5], Werner Heil[3], Igor Konorov[2], Gertrud Konrad[3], Raquel Muñoz Horta[3], Kent Leung[1,2], Yury Sobolev[3], Torsten Soldner[1], Hans-Friedrich Wirth[6], and Oliver Zimmer[1,2] — [1]Institut Laue-Langevin, Grenoble, France — [2]Physik-Department E18, TU München — [3]Institut für Physik, Universität Mainz — [4]University of Virginia, Charlottesville, VA, USA — [5]IEKP, Universität Karlsruhe (TH) — [6]Fakultät für Physik, LMU München

With the aSPECT spectrometer we measure the proton recoil spectrum in the decay of the free neutron. Its shape depends on the angular correlation between the momenta of the antineutrino and electron for kinematic reasons. A precision measurement of this correlation coefficient a allows to test the unitarity of the CKM matrix and provides limits on the existence of scalar and tensor currents.

aSPECT is a retardation spectrometer, i.e. the proton recoil spectrum is measured by counting all decay protons that overcome a potential barrier. By varying the height of the barrier the shape of the proton spectrum can be reconstructed. After the barrier the protons are accelerated to $\sim 15\,\mathrm{keV}$ and detected by a silicon drift detector.

In the last beam time a statistical accuracy of about 2 % per 24 hours measurement time was reached, the total error is expected to be well below 5 %. Details of the spectrometer setup as well as the status of the ongoing data analysis will be presented in the talk.

HK 74.2 Th 17:00 H-ZO 70

Unexpected asymmetry in B(E1) strengths of mirror nuclei ^{67}As and ^{67}Se — •Riccardo Orlandi[1,2], Giacomo de Angelis[1], and Pier Giorgio Bizzeti[3] — [1]Laboratori Nazionali di Legnaro, Legnaro, Italy — [2]The University of the West of Scotland, Paisley, United Kingdom — [3]INFN Sezione di Firenze and Universita' di Firenze, Italy

Discrepancies revealed in a recent measurement of the E1 transition rates of mirror transitions in $^{67}_{33}As_{34}$ and $^{67}_{34}Se_{33}$ can be interpreted to indicate a large isoscalar component in the reduced E1 transition strengths. Neither the explicit inclusion of higher order terms in the transition operator, nor the the mixing with close-lying levels suffice to yield an effect of comparable size. On the other hand, coherent contributions with higher-lying states, via the Isovector Giant Monopole Resonance (IVGMR), would induce an isoscalar term sufficiently large to account for the asymmetries observed in the experiment.

HK 74.3 Th 17:15 H-ZO 70

Search for a two-photon exchange signal at HERMES — •Alejandro Lopez Ruiz for the HERMES-Collaboration — HERMES. DESY. Notkestrasse, 85. 22607 Hamburg. Germany.

Recent extractions of the elastic proton form factors have shown the importance of corrections beyond the one-photon exchange approximation or Born level in electromagnetic processes. A significative contribution that has been identified is the two-photon exchange process, and the need has been made clear to explore its role by measuring quantities sensitive to it. One such observable would be an asymmetry in the number of leptons scattered off a nucleon polarized normal to the scattering plane, which is forbidden at Born level, and therefore a non-zero measurement would give a clear indication of two-photon exchange. Such an asymmetry has been searched for in inclusive deep inelastic lepton- nucleon scattering (DIS) at HERMES, in the range $0.004 < x < 0.9$, and with Q^2 between 0.1 and 20 GeV^2, using unpolarized electron and positron beams with an energy of 27.6 GeV and a transversely polarized proton target. Both in the DIS region and for $Q^2 < 1\ GeV^2$, the asymmetries were found to be consistent with zero within the uncertainties, to the order of 10^{-3}.

HK 74.4 Th 17:30 H-ZO 70

Search for scalar interaction with the WITCH experiment - status & outlook — •Peter Friedag[1], Marcus Beck[1], Jonas Mader[1], Christian Weinheimer[1], Nausikaa Geraert[2], Nathal Severijns[2], Michael Tandecki[2], Emil Traykov[2], Simon van Gorp[2], Frederik Wauters[2], and Alexander Herlert[3] — [1]Institut für Kernphysik, WWU Münster, Wilhelm-Klemm Str. 9, 48149 Munster, Germany — [2]Instituut voor Kern- en Stralingsfysica, K.U.Leuven, Celestijnenlaan 200D, B-3001 Leuven, Belgium — [3]CERN, CH-1211 Geneve 23, Switzerland

The WITCH experiment examines the nuclear beta decay of ions stored in a penning trap using a retardation spectrometer. With this experiment we measure the recoil spectrum, from which one can derive the beta neutrino angular correlation a. This allows us to search for a scalar interaction contribution in the weak interaction. The goal is to measure a with a precision of $\Delta a < 0.5\%$.

In 2008 and 2009 various enhancements of the experimental setup have been carried out. Therefore many components of the system were modified and upgraded. In support of this, we performed tracking simulations and field calculations, that were also used for a further analysis of the measurement from 2006. This talk reviews the current status of the simulations as well as the experiment and gives an outlook for this year.

This project is supported by BMBF under contract number 06MS270.

HK 74.5 Th 17:45 H-ZO 70

Pion form factor measurements at KLOE via Radiative Return method — •Paolo Beltrame for the KLOE-Collaboration — Institut für Kernphysik, J.Gutenberg Universität Mainz, J-J-Becher-Weg, 45 55099 Mainz

The KLOE experiment at the ϕ factory DAΦNE is using ISR to measure $\sigma(e^+e^- \to \pi^+\pi^-\gamma)$ with an absolute normalisation obtained from Bhabha scattering.

$\pi\pi\gamma$ events are obtained with two different selection criteria: (a) requiring photon emission at small angles (SA) (b) tagged photons detected in the calorimeter (LA). With the two samples we cover the complete range of $2m_\pi < \sqrt{s'} = M_{\pi\pi} < m_\phi$. Using a theoretical radiator function H(s) we extract the pion form factor $|F_\pi|^2$ and obtain the two-pion contribution to a_μ^{had}. Results to be presented come from the analysis of 240 pb^{-1} collected in 2002, with very small statistical error ($\sim 0.1\%$) and improved systematic uncertainties ($\sim 1\%$).

Furthermore, using a run of 200 pb^{-1} of data taken at $\sqrt{s} = 1$ GeV, we can minimize the contribution of resonant background processes.

HK 74.6 Th 18:00 H-ZO 70

Analysis of $\eta \to \pi^+\pi^-\gamma$ measured with WASA-at-COSY — •Christoph Florian Redmer for the WASA-at-COSY-Collaboration — Institut für Kernphysik and Jülich Center for Hadron Physics, D-52425 Jülich, Germany

The decay $\eta \to \pi^+\pi^-\gamma$ is driven by the box anomaly of the chiral Lagrangian. Precise studies of the two pion system allow for tests of Chiral Pertubation Theory and its unitarized extensions, as e.g. VMD or the chiral unitary approach. Moreover, this decay channel also provides a test for C-violation in electromagnetic interactions of strongly interacting particles and even a test for a possible flavor-conserving CP-violation.

WASA-at-COSY collected data in October 2008, producing η mesons in the reaction $pd \to {}^3\mathrm{He}\eta$. About $10^7\eta$ mesons have been recorded, tagged only by the registration of the ^{3}He ions which allows also for the determination of absolute branching ratios.

In this presentation the analysis of these data with respect to the $\eta \to \pi^+\pi^-\gamma$ decay will be discussed.

— Supported by BMBF, DAAD and Wallenberg Foundation

HK 74.7 Th 18:15 H-ZO 70

Search for Tensor Type Weak Currents by Measuring the Beta Asymmetry Parameter in Nuclear Beta Decay — •Frederik Wauters[1], Nathal Severijns[1], Emil Traykov[1], Simon Van Gorp[1], Michael Tandecki[1], Ilya Kraev[1], Peter Herzog[2], and Dalibor Zakoucky[3] — [1]Katholieke Universiteit, Leuven, Belgium — [2]Helmholtz-Institut fur Strahlen- und Kernphysik, Universität Bonn, Germany — [3]Nuclear Physics Institute, Rez, Czech Republic

Measuring the beta-asymmetry parameter A for pure Gamov-Teller nuclear decays is sensitive to a tensor component in the weak interaction if it is determined at the 1 % precision level. We will present a new method to measure this parameter and competitive with the best results available in literature. The low temperature nuclear orientation technique is used to orient an ensemble of polarize an ensemble of radioactive nuclei. The beta decay is observed by semiconductor

detectors operating at temperatures of about 10K looking directly to the sample. In previous measurements the precision was limited to a few percent by scattering of the beta particles and deflection by he magnetic field. We have developed a method based on GEANT4 Monte-Carlo simulations to gain control over these effects. First results were obtained with 114In and 60Co. The precision is currently at the 1,5% level which is better then the current literature values. The method is further being improved to push the precision and new data is under analysis. Our goal is to reach the 1% level or better.

HK 75: Accelerators and Instrumentation I

Time: Thursday 16:30–19:00 Location: H-ZO 80

Group Report HK 75.1 Th 16:30 H-ZO 80

The Electromagnetic Calorimeter of PANDA at FAIR — •Aleksandra Biegun for the PANDA-Collaboration — KVI, University of Groningen, Groningen, The Netherlands

Antiproton-proton annihilations at the future FAIR facility at Darmstadt, Germany, will allow sensitive tests of QCD, the theory of strong interactions, in the regime of strong coupling. The PANDA detector aims at precision studies of charm-quark mesons, glue-balls, and mesons involving strong glue components. For these studies the electromagnetic calorimeter is one of the crucial detector components. The overall concept presented in the Technical Design Report [1] has been approved recently. The barrel part and the two end-caps of the calorimeter comprise more than 15000 PWO scintillation crystals of high quality with respect to optical performance and radiation hardness. Operation at low temperature and photo sensors, which are insensitive to strong magnetic fields, provide high light yield, optimum resolution and high count-rate capability. The performance of mass-produced PWO crystals and the quality of newly developed photosensors will be presented. The technical challenge of electronic developments and the prototype detector performance will be discussed. Performance characteristics have been incorporated in detailed large-scale simulations. Simulated results for specific reaction channels, e.g. the charmonium h_c decay into 7 photons, will be presented to demonstrate the sensitivity to specific final states of charm-quark and hybrid meson states.

[1] TDR for PANDA EMC (2008), arXiv:0810.1216v1

HK 75.2 Th 17:00 H-ZO 80

A Prototype for the Electromagnetic Calorimeter of PANDA — •Christof Motzko for the PANDA-Collaboration — Ruhr-Universität-Bochum, Germany

An electromagnetic calorimeter (EMC) consisting of about 16000 lead-tungstate crystals (PWO-crystals) will be build for the PANDA experiment located at the antiproton storage ring of the planned accelerator facility FAIR in Darmstadt. The kinetic energy range of the antiprotons will be 0.83 to 14.1 GeV. To increase the light yield of PWO the EMC will be operated at -25 °C. Large area avalanche photodiodes and vacuum phototriodes are developed for the photo detection.

The presentation will discuss the full scale prototype of the forward endcap EMC. The prototype consists of 192 crystals of 20 cm length forming the inner part of the detector. We are going to test the cooling and the mechanical stability as well as the mounting procedure of the EMC endcap. In addition the prototype allows to test different readout options and to study the long term stability of the EMC.

In this presentation the status of the development of the endcap prototype will be dicussed.

Supported by the BMBF and the EU.

HK 75.3 Th 17:15 H-ZO 80

Beam test of Lead Tungstate Crystals at ELSA, Bonn — •Florian Feldbauer for the PANDA-Collaboration — Ruhr-Universität Bochum, Germany

An electromagnetic calorimeter (EMC) consisting of about 16000 lead tungstate (PWO) crystals is developed for the PANDA experiment at the antiproton storage ring HESR at the future accelerator facility FAIR at Darmstadt. The high density and short decay time of lead tungstate allows the construction of a very compact calorimeter for high luminosity operation at PANDA. At the runtime of PANDA the crystals will be exposed to up to 30 mGy/h. The most common radiation damage is due to color center formation. Color centers affect the light transparency of the crystals, resulting in reduced light output. Therefore a precise study of possible radiation damage effects is mandatory. At the electron stretcher facility ELSA in Bonn PWO crystals of the latest generation are irradiated with high energetic electrons at count rates comparable to the highest expected rates in the PANDA calorimeter. The loss of crystal transparency is monitored with LED-Pulsers. The corresponding reduction in crystal light yields is recorded by measuring the energy loss spectrum of cosmic muons passing the crystals.

Supported by BMBF and EU.

HK 75.4 Th 17:30 H-ZO 80

New avalanche photo diode readout of the Crystal-Barrel-Experiment at ELSA — •Friedemann Zenke for the CBELSA/TAPS-Collaboration — Helmholtz-Institut für Strahlen- und Kernphysik, Nußallee 14-16, 53115 Bonn, Germany

The Crystal-Barrel-Experiment at ELSA in Bonn is a photo production experiment in hadron spectroscopy. The setup features nearly 4π-coverage with electromagnetic calorimeters and is optimized for the detection of multi-photon final states to measure double polarization observables.

One main aspect of the upcoming upgrades of the Crystal Barrel Experiment is concerned with extending the 1^{st} level trigger capability from the forward direction to the whole calorimeter. This step will significantly widen the trigger acceptance for neutral reaction channels and substantially help to suppress electromagnetic background.

Currently several different approaches are evaluated one of which is a new readout via avalanche photo diodes (APDs). In this approach a dual readout is the favoured solution. One readout branch provides a fast timing signal for trigger decisions while the other branch is optimized for energy resolution. The energy branch is fed into a flash ADC for digital feature extraction.

In this talk the current status and first results from a test beam time will be presented.

This work is funded by DFG (SFB/TR16).

HK 75.5 Th 17:45 H-ZO 80

APD development for the $\bar{\text{P}}$ANDA EMC — •Andrea Wilms for the PANDA-Collaboration — GSI Darmstadt, Darmstadt, Germany

The $\bar{\text{P}}$ANDA experiment is the part of the experimental program of the Facility for Antiproton and Ion Research (FAIR) with highest priority. The electromagnetic calorimeter will consist of nearly 16.000 lead tungstate (PWO) crystals read out with Avalanche Photodiodes which have an internal gain depending on the applied bias voltage. To increase the LY of the scintillator crystals the whole calorimeter will operate at a temperature of $T = -25°C$.

Each crystal of the calorimeter will be read out via two APDs so that a screening procedure for nearly 40.000 APDs has to be build up to ensure the correctness of the required device properties before their mounting on the rear side of the PWO crystals. The screening procedure includes the measurement of the main APD parameters like gain-bias dependence, dark current dependence on the applied voltage, surface uniformity of the gain, etc. To ensure a proper calibration during detector operation all measurements, including the test of radiation hardness, have to be done temperature dependent. The results of the screening of the first large area APDs with rectangular shape (active area: $(7 \times 14)\, mm^2$) will be compared to the results of the first APDs with quadratic shape used in the R&D process for the $\bar{\text{P}}$ANDA EMC readout concept.

This work is supported by EU contract number 506078 Hadron Physics.

HK 75.6 Th 18:00 H-ZO 80

Large volume PWO crystals in PANDA geometry provided by SICCAS — •Markus Moritz, Tobias Eissner, Werner Döring, and Rainer Novotny for the PANDA-Collaboration — 2nd Physics Institute, University Giessen

For the first time, full size tapered PbWO4 crystals in PANDA-geometry have been produced by SICCAS at Shanghai (China) and compared to the PWO-II quality as required for the electromagnetic target calorimeter of the PANDA detector. The report describes in detail the different test procedures on optical transparency, scintillation yield, homogeneity and kinetics of the scintillation processes at different temperatures. The investigations focus in particular on the radiation hardness at the operating temperature of T=-25°C. These measurements are performed at the ^{60}Co irradiation facility at Giessen. The report compares the achieved quality parameters with the specification limits of the EMC and discusses the results with respect to the growing technology and further improvements.

HK 75.7 Th 18:15 H-ZO 80

Quality of PWO Crystals for the PANDA-EMC — •Tobias Eissner, Markus Moritz, Rainer Novotny, and Werner Döring — 2^{nd} Physics Institute, University Giessen

The electromagnetic calorimeter of the target spectrometer of PANDA relies on the high quality of Scintillator material $PbWO_4$. In collaboration with the manufacturer BTCP at Bogoroditsk (Tula district, Russia) a new standard PWO-II was developed. After the approval of the Technical Design Report the final mass production for the forward endcap and part of the barrel has been started immediatley. The first stage of quality control, which covers the geometrical dimensions, optical and scintillation properties, is performed similar to the CMS/ECAL project exploiting the semi-automatic robot ACCOS at CERN. The radiation hardness is tested for each crystal at the ^{60}Co irradiation facility at Giessen to guarantee the optimum performance at the final operating temperature of $T = -25°C$. The report describes in detail the test procedures and summarizes the achieved quality in comparison to the required specification limits for PANDA.

HK 75.8 Th 18:30 H-ZO 80

Measurements of Photon Response and Light Yield Homogeneity with PbWO4 Crystals for PANDA — •Sophie Grape for the PANDA-Collaboration — Uppsala University

The dynamic range for the crystals of the PANDA calorimeter is foreseen to span from 10 MeV to 15 GeV in order to make reconstruction of channels with both low and high energy photons possible. The synchrotron facility MAX-Lab in Lund, Sweden, provides a unique opportunity to measure response function of crystals at energies in the low energy regime. The photon energy resolution for an array of PbWO4 crystals has been measured in the range of 10 MeV to 100 MeV.

Another important feature is the homogeneity of the light yield response along the crystals. Results from these energy resolution and homogeneity measurements will be reported.

HK 75.9 Th 18:45 H-ZO 80

Linearity and Energy Resolution of Lead Glass Modules in the Electromagnetic Calorimeter of COMPASS — •Domagoj Ćotić — Institut für Kernphysik, Universität Mainz, Johann-Joachim-Becherweg 45, 55099 Mainz

The electromagnetic calorimeter at the COMPASS experiment at CERN are partly equipped with lead glass blocks of type TF1 (GAM) as Cherenkov light emitter. In order to determine the linearity and the energy resolution of these detectors, the performance of 5x5 matrix was studied at the H2-testbeam/CERN with a positron beam. The beam energy was varied between 12.5 and 90 GeV. The results of these test measurements aim an an improved energy calibration of the electromagnetic calorimeter.

supported by BMBF under the contract 06MZ224

HK 76: Accelerators and Instrumentation II

Time: Thursday 16:30–19:00 Location: H-ZO 90

Group Report HK 76.1 Th 16:30 H-ZO 90

Status Report of the Darmstadt Polarized Electron Source at the S-DALINAC* — •Christian Eckardt[1], Roman Barday[1], Uwe Bonnes[1], Marco Brunken[1], Ralf Eichhorn[1], Joachim Enders[1], Alf Göök[1], Wolfgang F.O. Müller[2], Markus Platz[1], Yuliya Poltoratska[1], Markus Roth[1], Markus Wagner[1], and Thomas Weiland[2] — [1]Institut für Kernphysik, Technische Universität Darmstadt, Germany — [2]Institut für Theorie elektromagnetischer Felder, Technischer Universität Darmstadt, Germany

A source of polarized electrons has been designed and constructed for the superconducting Darmstadt electron linear accelerator S-DALINAC. The source has been set up in a separate test stand for commissioning.

A laser beam stimulates photoemission electrons from a negative electron affinity strained superlattice GaAs cathode. The electron beam is preaccelerated to 100 keV, focused and redirected to the horizontal plane. A Wien filter and Mott polarimeter in the beam line are used to manipulate and measure the polarization. For beam diagnostics wire scanners, fluorescent screens and a coaxial Faraday cup are installed.

Recent results on operation parameters and plans for future development are presented.

*Supported by Deutsche Forschungsgemeinschaft through SFB 634.

Group Report HK 76.2 Th 17:00 H-ZO 90

The PARIS project — •Adam Maj for the PARIS-Collaboration — IFJ PAN Krakow, Poland

The measurement of high energy gamma rays with good energy resolution has always been experimentally challenging, with the best resolution obtainable from a scintillator detector being around 10% from sodium iodide. The novel scintillator material LaBr3(Ce) promises a step-change in what is achievable using scintillator detectors with an unprecedentedly high resolution of <3%. The PARIS array [1] is intended to comprise a double shell of this novel material and more conventional scintillator material. The array could be used in a standalone mode or in conjunction with an inner particle detection system (GASPARD, FAZIA), or with high-purity germanium arrays such as EXOGAM or AGATA. Initial designs and simulations for PARIS will be discussed as well as the potential Physics opportunities. The latter will focus on aspects such as the study of giant resonances, or of low- and intermediate-energy fragmentation and Coulomb excitations. The host laboratory for PARIS will be GANIL, nevertheless dedicated campaigns elsewhere (for example FAIR, RIKEN, Poland) are envisaged.

[1] http://paris.ifj.edu.pl

HK 76.3 Th 17:30 H-ZO 90

Timing measurements at ELBE on multigap resistive plate chamber prototypes for NeuLAND — •Dmitry Yakorev[1], Tom Aumann[2], Daniel Bemmerer[1], Konstanze Boretzky[2], Tom Cowan[1], Michael Elvers[3], Jörg Hehner[2], Michael Heil[2], Jens Volker Kratz[4], Wawrczek Prokopowicz[2], René Reifarth[2], Dominic Rossi[4], Gerhard Schrieder[2], Daniel Stach[1], Andreas Wagner[1], and Andreas Zilges[3] for the R3B-Collaboration — [1]Forschungszentrum Dresden-Rossendorf (FZD), Dresden — [2]Gesellschaft für Schwerionenforschung (GSI), Darmstadt — [3]Universität zu Köln — [4]Johannes-Gutenberg-Universität, Mainz

The NeuLAND detector for fast neutrons (0.2-1 GeV) at the R3B experiment at FAIR aims for high time and spatial resolutions (σ_t<100 ps, $\sigma_{x,y,z}$<1 cm). The detector will consist of about 60 sequences of a stacked structure from iron converter material and multigap resistive plate chambers (MRPC's). The secondary charged particles stemming from hadronic interactions of the high energetic neutrons in the converter will be detected in the MRPC's, with excellent timing properties. As part of the ongoing development of the NeuLAND detector, MRPC prototypes designed for this application have been studied at the superconducting electron linac ELBE in Dresden with its picosecond time structure. The ELBE experiments show that the prototypes studied so far have efficiency ≥90% for minimum ionizing particles in a 2x2 gap structure and fulfill the called for time resolution. — Supported by BMBF (06DR134I) and GSI (FuE DR-GROS).

HK 76.4 Th 17:45 H-ZO 90

Studies on multigap resistive plate chamber prototypes for the new NeuLAND detector at the R3B experiment at FAIR — •Michael Elvers[1], Tom Aumann[2], Daniel Bemmerer[3], Konstanze Boretzky[2], Janis Endres[1], Jörg Hehner[2], Michael Heil[2],

Jens Volker Kratz[4], Wawrczek Prokopowicz[2], René Reifarth[2], Dominic Rossi[4], Gerhard Schrieder[2], Daniel Stach[3], Andreas Wagner[3], Dmitry Yakorev[3], and Andreas Zilges[1] for the R3B-Collaboration — [1]IKP, Universität zu Köln — [2]Gesellschaft für Schwerionenforschung (GSI), Darmstadt — [3]Forschungszentrum Dresden-Rossendorf (FZD), Dresden — [4]Johannes-Gutenberg-Universität, Mainz

The NeuLAND detector is part of the R3B experiment at FAIR and will detect neutrons between 0.2 and 1 GeV. The high energy neutrons are converted to charged particles, mainly protons, which are detected by Multigap Resistive Plate Chambers (MRPC).
For the detector, a time resolution of $\sigma_t < 100\,\mathrm{ps}$ and a position resolution of $\sigma_{x,y,z} \approx 1\,\mathrm{cm}$ is required for given flight paths in the range from 10 to 35 m. An active area of $2 \times 2\,\mathrm{m}^2$ of the neutron detector at a distance of 12.5 m to the target will match the angular acceptance of ± 80 mrad for the neutrons defined by the gap of the superconducting dipole magnet.
The salient features of the prototypes will be described, as well as electrical measurements and studies with cosmic rays.

HK 76.5 Th 18:00 H-ZO 90

Test of prototype DSSDs for EXL — •le xuan chung[1], ruud borger[2], thomas davinson[3], peter egelhof[1], vladimir eremin[4], nasser kalantar[2], jens volker kratz[5], manfred mutterer[1,6], norbert pietralla[6], catherine rigollet[2], mirko von schmid[6], branislav streicher[1,5], and philip woods[3] — [1]GSI Darmstadt — [2]KVI Groningen, The Netherlands — [3]The University of Edinburgh, UK — [4]PTI St. Petersburg, Russia — [5]Universität Mainz — [6]TU Darmstadt

Prototype double-sided silicon strip detectors (DSSD) of 300 μm thickness produced at the PTI St. Petersburg (Russia) were tested for the use as position sensitive ΔE and E detectors for tracking and particle identification in the EXL (EXotic nuclei studied in Light-ion induced reactions) setup at the FAIR (Facility for Antiproton and Ion Research) project at GSI. We describe the characteristics of detectors with 16 x 16 strips of 300 μm pitch size and 7.0 x 7.0 mm2 chip dimension, and also with 64 x 64 and 64 x 16 strips of 300 μm and 1250 μm pitch size, respectively, and 21.2 x 21.2 mm2 chip dimension. The response of these detectors for 241Am α particles injected either from the p+ or n+ side was examined. The test measurements were performed partially at GSI and the University of Edinburgh. The results reveal good spectroscopic properties of these detectors. Our work will continue with 100 μm thick detectors and larger active area, up to 65 x 65 mm2.

HK 76.6 Th 18:15 H-ZO 90

The LYCCA detector module — •Andreas Wendt[1,2], Peter Reiter[1], Kerstin Geibel[1], Christoph Goergen[1], Gheorghe Pascovici[1], Dirk Rudolph[3], Pavel Golubev[3], Jürgen Gerl[4], and Robert Hoischen[4] — [1]Institut für Kernphysik, Universität zu Köln, Germany — [2]Frankfurt Institut for Advanced Studies (GP-HIR@FIAS), Germany — [3]Department of Physics, Lund University, Sweden — [4]GSI, Darmstadt, Germany

The Lund-York-Cologne Calorimeter Array LYCCA will be employed for future PRESPEC and HISPEC γ-ray spectroscopy experiments at the GSI/FAIR accelerator facility for reaction product identification after a secondary target at the focal plan of the FRS/SUPER-FRS.

The modular array will comprise plastic or diamond detectors for TOF measurement and ΔE-E telescopes of DSSSD and CsI detectors. The individual modular detector consists of 32x32 Si strip detectors and 9 CsI scintillators. A new developped preamplifier is used for energy measurement up to 5 GeV and fast timing in the subnanosecond time range. These new preamplifiers achieve an electronic energy-resolution of 10keV and obtain fast signal rise times below 20ns. Expected energy-resolution in combination with DSSSD is about 45-50 keV at 5-6 MeV alpha-energies.

First test results from two detector units were obtained using alpha-sources and protons from the Cologne tandem accelerators.

Supported by the German BMBF (06KY205I).

HK 76.7 Th 18:30 H-ZO 90

Characterization of lanthanum-chloride detectors for prompt fission γ-ray measurements — •Andreas Oberstedt[1], Stephan Oberstedt[2], and Wouter Geerts[2] — [1]Örebro University, S-70182 Örebro — [2]EC-JRC IRMM, B-2440 Geel

A particular challenge for the modelling of new generation reactor neutron kinetics is the calculation of the γ-heat deposition in e. g. steel and ceramics reflectors without UO_2 blankets, which is required to be known with an uncertainty as low as 7.5%. A major difficulty in measuring the competition between neutron and γ-ray emission during fission fragment deexcitation is the suppression of background γ-rays induced by prompt fission neutrons in the γ-detector. A common method is to distinguish between γ-rays and neutrons by their respective different time-of-flight, which however is limited by the timing resolution of the detector (not better than 5 ns for NaI). A promising approach seems to be the use of recently developed cerium-doped lanthanum halide crystal scintillation detectors. We will present results of the characterization of coaxial $1.5'' \times 1.5''$ $LaCl_3 : Ce$ detectors in terms of energy conversion and resolution, linearity, dynamical range, intrinsic efficiency, timing resolution and intrinsic radioactivity.

HK 76.8 Th 18:45 H-ZO 90

Ultra-Fast Timing with Plastic Scintillators — •Robert Hoischen[1,2], Stephane Pietri[2], Wawrzyniec Prokopowicz[2], Henning Schaffner[2], Jürgen Gerl[2], Dirk Rudolph[1], Hans Jürgen Wollersheim[2], and Nikolaus Kurz[2] — [1]Department of Physics, Lund University, S-22100 Lund, Sweden — [2]Helmholtzzentrum für Schwerionenforschung GmbH, D-64291 Darmstadt, Germany

Fast timing detectors for time-of-flight measurements are essential identification tools for isotopes studied at fragment seperators at major heavy-ion research facilities. While today's standard technique of utilizing a plastic scintillator read out by few photomultiplier tubes proofs to be efficient, it does not provide the required time resolution for future key experiments at, for example, the Super-FRS at FAIR. A common present-day approach is to use diamond detectors instead. While they do provide a better time resolution compared to scintillators, they are more difficult to use and far more expensive. Results from tests using a new design approach with standard materials will be presented. This leads to a much improved performance, but remains both cost-efficient, compact, and reliable. The design goals and how to accomplish them will be exemplified by the LYCCA (Lund-York-Cologne CAlorimeter) detector aiming for fast-beam experiments at HISPEC within NUSTAR.

HK 77: Nuclear Physics Applications

Time: Thursday 16:30–18:00 Location: H-ZO 100

Invited Group Report HK 77.1 Th 16:30 H-ZO 100

Modern ion-beam techniques for material science and for preserving cultural heritage — •Milko Jaksic — Rudjer Bošković Institute, Zagreb, Croatia

Accelerated ion beams of the low MeV energy range have been used for decades in many different applications. These are in particular techniques for materials analysis, as well as techniques for materials modification. Modern developments of ion beam techniques increased their impact to other fields of research which can be noticed today in two quite different fields, in material science and in preservation of cultural heritage objects.

Development of single ion techniques for materials modification expanded significantly in recent years. Unique property of fast heavy ions that can transfer a significant amount of energy to nanosized volumes became the basis of techniques for nanotechnology. Our recent results showed that even heavy ions with energies below 0.5 MeV/u can be successfully used for nanostructuring using single ion tracks. Furthermore, single ions have been shown to be a valuable tool for probing electronic transport properties (IBIC).

Among numerous examples of IBA (ion beam analysis) and cultural heritage research, the story of Apoxiomenos, an ancient bronze sculpture of athlete, being recovered after 2 millenniums from the bottom of the Adriatic Sea, could not be told without the nuclear physics. Here, AMS provided results to determine the age of sculpture, while

microanalysis of alloy composition and studies of the isotope ratios suggested its provenance.

HK 77.2 Th 17:00 H-ZO 100

Die Dortmund Low Background Facility — •Holger Gastrich, Claus Gössling, Jennifer Jentzsch, Daniel Muenstermann, Till Neddermann und Oliver Schulz — Experimentelle Physik IV, TU Dortmund

An der Technischen Universität Dortmund wird eine oberirdische Messanlage im Low-Background-Bereich aufgebaut, um für den Aufbau und Erfolg von Low-Background-Experimenten (z.B. COBRA am LNGS-Untergrundlabor in Italien) eine notwendige Materialauswahl bezüglich geringer Radioaktivität treffen zu können.
Die Dortmund Low Background Facility (DLB) besteht aus einem Germaniumdetektor in Ultra-Low-Background-Ausführung, der durch eine mehrschichtige Abschirmung vor der Umgebungs- und kosmischen Strahlung geschützt wird. Dafür sind u.a. 2,7t Blei, ein Neutronenmoderator, 43t Eisen und 325t Barytbeton verbaut worden, woraus eine Überdeckung von mehr als 10 Meter Wasseräquivalent resultiert. Zusätzlich wurde ein aktives Myonenveto installiert.
Es werden das Konstruktionsschema der Messanlage, Messergebnisse bezüglich der Reduktion des Myonenflusses und der Umgebungsstrahlung sowie der momentane Stand des Aufbaus vorgestellt.

HK 77.3 Th 17:15 H-ZO 100

Hochspannungskalibration durch kollineare Laserspektroskopie an ISOLDE/CERN — •A. Krieger[1], M. Bissell[3], K. Blaum[4], G.W. Drake[5], Ch. Geppert[1,2], R. Sanchez[2], D. Tiedemann[1], M. Kowalska[6], J. Krämer[1], R. Neugart[1], F. Schmidt-Kaler[7], Z.C. Yan[8], Y. Yordanov[6], M. Zakova[1], C. Zimmermann[9] und W. Nörtershäuser[1,2] — [1]Institut für Kernchemie, Universität Mainz,Germany — [2]Gesellschaft für Schwerionenforschung, 64291 Darmstadt Germany — [3]Instituut voor Kern- en Stralingsfysica, KU Leuven, Belgium — [4]Max-Planck Institut für Kernphysik, 69117 Heidelberg, Germany — [5]Department of Physics, University of Windsor, Windsor, Canada, N9B 3P4 — [6]CERN, CH-1211 Geneva 23, Switzerland — [7]Institut für Quanteninformationsverarbeitung, Universität Ulm,Germany — [8]Department of Physics, University of New Brunswick, Fredericton, NB, Canada — [9]Institut für Physik, Universität Tübingen, Germany

Den Einsatz der kollinearen Laserspektroskopie zur Hochspannungsmessung schlug Poulsen im Jahre 1982 vor. Diese Technik wurde in Kombination mit einem präzisen Frequenzkamm-stabilisierten Lasersystem an dem on-line Isotopenseparator ISOLDE eingesetzt. Die Messungen der Beschleunigungsspannung von Be^+-Ionen deckten dabei eine Fehlkalibration der an ISOLDE installierten Hochspannungsteiler ASTEC 1 und ASTEC 2 auf. Kollineare und anti-kollineare Laserspektroskopie ermöglichten die Bestimmung der Beschleunigungsspannung der Ionen mit einer relativen Genauigkeit besser als $2 \cdot 10^{-5}$. Dadurch konnte eine relative Abweichung von 10^{-4} festgestellt werden.

HK 77.4 Th 17:30 H-ZO 100

Production of light and intermediate mass residual nuclides by proton induced reactions at medium energies — •Mihaela Tutuc[1], Rolf Michel[1], Sylvie Leray[2], and Jean-Christophe David[2] — [1]Zentrum für Strahlenschutz und Radioökologie, Leibniz Universität Hannover, Herrenhäuserstr. 2, 30419, Hannover, Germany — [2]CEA/Saclay, DAPNIA/SPhN, 91191 Gif-sur-Yvette, Cedex, France

A systematic survey was done for the production of intermediate mass fragments by proton induced reactions. Our study covers all previous available and new data for the production of residual nuclides with masses between 3 and 30, over an energy range extending from thresholds up to 2.6 GeV with targets spreading over the entire chart of nuclides.

Cross sections for the production of residual nuclides are a key issue for medium energy applications. Due to the large range of relevant target elements and the amount of product nuclides it will not be possible to measure all the cross sections needed. One will have to rely widely on models and codes to calculate the required data. In this context, the capabilities of some available codes, Talys and INCL4+ABLA, to predict cross sections for the production of residual nuclides in thin target experiments are tested and a comparison between experiment and theory is made.

This work was performed as a contribution to the NUDATRA work package 5.4 for the EUROTRANS Programme.

HK 77.5 Th 17:45 H-ZO 100

Measurement of neutron-induced fission cross sections of Pb-nat and Bi-209 up to 1 GeV — •Diego Tarrío[1], Ignacio Durán[1], Carlos Paradela[1], and Laurent Tassan-Got[2] for the CERN-nTOF Phase1-Collaboration — [1]Universidade de Santiago de Compostela (Spain) — [2]Centre National de la Recherche Scientifique/IN2P3-IPN, Orsay (France)

Lead and bismuth are widely proposed as candidate materials for the spallation source to be used in ADS fast reactors. On the other hand, Bi-209 fission cross section has been proposed as a new standard for neutron-induced fission in the subactinides region. Despite their importance for such applications, available data on fission about these elements are very scarce mainly due to its small cross section, of the order of tens of mb, while for the actinides is of the order of few barns. So, new and more precise measurements have been required by the international organizations (IAEA, OECD-NEA...)

The n_TOF facility at CERN provides a unique very-intensive and high energy resolution neutron beam, from 1 eV to 1 GeV. Fission Fragments in temporal coincidence were measured using a dedicated reaction chamber, developed at IPNO, based on PPAC detectors. Pb-nat and Bi-209 fission cross-sections have been measured using samples of U-235 and U-238 as references.

In this work, we present the n_TOF results about the cross sections of Pb-nat and Bi-209 from fission threshold up to 1 GeV.

HK 78: Plenary IX

Time: Friday 9:00–10:30 Location: Audi-Max

Invited Talk HK 78.1 Fr 9:00 Audi-Max

The Strongly Coupled Quark Gluon Plasma Produced at RHIC (exchanged with HK 2.1) — •Axel Drees — Stony Brook University, Stony Brook, New York

Matter created in collisions of heavy ion at high energy is opaque, strongly interacting and surprisingly close to a perfect fluid. Data has now been accumulated for almost a decade of experiments at the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory (BNL) and the conclusions emerge more and more clearly: (i)initial energy densities reached in the collisions are at least 10 to 100 times nuclear matter density, (ii) the matter created is opaque to probes with color charge, even to heavy flavor, (iii) the matter behaves collectively very much like a fluid with minimal viscosity. In my talk I will review the relevant experimental observations and discuss their consequences.

Invited Talk HK 78.2 Fr 9:30 Audi-Max

Field Theory in Hadron Physics — •Marc Vanderhaeghen — Institut fuer Kernphysik, Univ. Mainz, Germany

This talk gives an overview of recent progress in hadron structure from a field theoretic perspective.

Recent experimental data in elastic electron-nucleon scattering both at low and large momentum transfers will be discussed. The current precision measurements on the nucleon electromagnetic form factors will be used to map out the transverse charge densities in proton and neutron. The framework will be extended to map out charge densities in higher spin systems, such as the deuteron and nucleon resonances. It will be shown how a field theoretic consistent picture emerges both of densities and of the shape of a relativistic many body system.

Subsequently, a comprehensive framework for describing the quark and gluon structure of hadrons, based on the concept of Generalized Parton Distributions (GPDs), will be reviewed. It will be discussed how the GPDs describe correlations between the momentum and spatial distributions of quarks, which are revealed in exclusive processes at large momentum transfers, such as the deeply virtual Compton scattering process. The first dedicated experiments in the field of hard exclusive processes, performed over the past few years, will be reviewed and the theoretical progress and experimental perspectives will be dis-

cussed.

Poster Prize

HK 79: Heavy Ion Collisions and QCD phases

Time: Friday 11:00–12:45 Location: H-ZO 10

Group Report HK 79.1 Fr 11:00 H-ZO 10

Dynamic parton rearrangement within the UrQMD transport approach — •Gunnar Gräf, Hannah Petersen, Gerhard Burau, and Marcus Bleicher — Institut für Theoretische Physik, Goethe-Universität, Max-von-Laue-Str. 1, 60438 Frankfurt am Main

We have implemented a mechanism for locally density-dependent dynamic parton rearrangement and fusion into the Ultra-relativistic Quantum Molecular Dynamics (UrQMD) approach. The same mechanism has been previously built in the Quark Gluon String Model (QGSM) [1, 2]. This rearrangement and fusion approach based on parton coalescence ideas enables the description of multi-particle interactions, namely $3 \rightarrow 3$ and $3 \rightarrow 2$, between (pre-)hadronic states in addition to standard binary interactions. The UrQMD model (v2.3) [3, 4] extended by these additional processes allows now to investigate the implications of multi-particle interactions on the reaction dynamics of ultra-relativistic heavy-ion collisions. We will present first results of this investigation, e.g. implications on the kinetic equilibration time due to the change of the mean free path and on measurable observables like spectra of final hadrons. (This work is supported by GSI and the Helmholtz International Center for FAIR within the framework of the LOEWE program launched by the State of Hesse.)

[1] J. Bleibel *et al.*, Phys. Rev. C 76 (2007) 024912.
[2] J. Bleibel *et al.*, Phys. Lett. B 659 (2008) 520.
[3] S. A. Bass *et al.*, Prog. Part. Nucl. Phys. 41 (1998) 255.
[4] M. Bleicher *et al.*, J. Phys. G 25 (1999) 1859.

Group Report HK 79.2 Fr 11:30 H-ZO 10

Recent Results from WA98 — •Christoph Baumann for the WA98-Collaboration — Westfälische Wilhelms-Universität Münster, Institut für Kernphysik, Wilhelm-Klemm-Str. 9, 48149 Münster

WA98 has published results on the production of neutral pions and direct photons in Pb+Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 17.4$ GeV. We have shown, that the available p+C and p+Pb data measured at $\sqrt{s_{\mathrm{NN}}} = 17.3$ GeV can be employed as a replacement for a p+p reference. With the p+A data, the nuclear modification factor of the neutral pion production was computed and a suppression in the most central collisions was observed. We will report on these results and compare them to most recent results from PHENIX in Cu+Cu collisions at $\sqrt{s_{\mathrm{NN}}} = 22.4$ GeV. From the direct photon results for Pb+Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 17.4$ GeV published by WA98, the initial temperature of the created state could be constrained to temperatures between 200 and 400 MeV. The spread of these temperatures arises from the uncertainty in the relative amount by which photons from hard scattering processes and thermally produced photons contribute to the photon excess. In this talk, results on the direct photon production in p+Pb and p+C data also measured by WA98 at $\sqrt{s_{\mathrm{NN}}} = 17.4$ GeV are presented and implications for the different production mechanisms in Pb+Pb collisions are discussed.

HK 79.3 Fr 12:00 H-ZO 10

Relativistic shocks in viscous gluon matter — •Ioannis Bouras, Zhe Xu, Etele Molnar, Carsten Greiner, Dirk Rischke, Oliver Fochler, and Andrej El — Institut für theoretische Physik, Universität Frankfurt

Considering the relativistic Riemann problem with a discontinuity of pressure in viscous gluon matter, we investigate the existence of relativistic shock waves at RHIC. Calculations employing the parton cascade BAMPS demonstrate for the first time the transition from viscous to ideal shocks by varying the shear viscosity to the entropy density ratio η/s from infinity towards zero. We show that if the η/s ratio of the medium is larger than 0.2, relativistic shocks will be hardly observed. Comparisons with viscous hydrodynamic calculations using vSHASTA confirm our findings. Moreover, on the contrary to the parton cascade, the recent version of vSHASTA fails to create shocks in a strong dissipative medium. The Knudsen number in the shock front is a proper quantity to understand the break down of hydrodynamics in an out of equilibrium state.

HK 79.4 Fr 12:15 H-ZO 10

Static quark-antiquark pairs at finite temperature — Nora Brambilla[1], •Jacopo Ghiglieri[1], Peter Petreczky[2], and Antonio Vairo[1] — [1]Technische Universität München, Physics Department T30f, James-Frank-Str. 1, 85747 Garching, Germany — [2]RIKEN-BNL Research Center & Physics Department Brookhaven National Laboratory, Upton, NY 11973, USA

In a framework that makes close contact with modern effective field theories for non-relativistic bound states at zero temperature, we study the real-time evolution of a static quark-antiquark pair in a medium of gluons and light quarks at finite temperature, obtaining the potential and decay widths in different temperature regions, with new results in the $1/r >> T$ regime.

HK 79.5 Fr 12:30 H-ZO 10

Flavour off diagonal susceptibilties in the PNJL model — •Simon Rössner, Thomas Hell, Nino Bratovic, and Wolfram Weise — Physik Department, TU München, 85748 Garching, Germany

We present an investigation of flavour sensitive quark number susceptibilities based on the 2-flavour Polyakov loop extended Nambu and Jona-Lasinio (PNJL) model [1]. This calculation features the two most important non-perturbative effects of QCD at temperatures below the 1 GeV-scale, spontaneous chiral symmetry breaking and confinement. The astonishingly good agreement of the equation of state with full lattice QCD calculations [2] persists for finite isovector chemical potentials. As a central result, finite up-down quark number susceptibilities are found even in the absence of explicit colour and flavour mixing terms in the model Lagrangian.

The PNJL model study suggests that the up-down quark number susceptibilities are intertwined with the Polyakov loop degrees of freedom. This observation can be understood with a simple model which features a coupling of both up and down quark densities to a flavour-blind degree of freedom. It remains an open issue, however, to what extend the modelled mechanism is at work in full QCD.

Work supported in part by BMBF, GSI, the DFG Excellence Cluster "Origin and Structure of the Universe", and the Elitenetzwerk Bayern.

[1] S. Rößner, T. Hell, C. Ratti, and W. Weise, Nucl. Phys. A**814**, 118 (2008).
[2] S. Rößner, C. Ratti, and W. Weise, Phys. Rev. D**75**, 034007 (2007).

HK 80: Hadron Structure and Spectroscopy I

Time: Friday 11:00–12:45 Location: H-ZO 20

HK 80.1 Fr 11:00 H-ZO 20

Simulations of Antihyperon-hyperon Physics for PANDA — •Erik Thome for the PANDA-Collaboration — Uppsala University

At high energies the strong force is well described using quarks and gluons as degrees of freedom, while at lower energies hadronic degrees of freedom are more adequate. The PANDA energy regime is in the transition region between these two descriptions. $\mathrm{p\bar{p}} \rightarrow \mathrm{Y\bar{Y}}$ is a good reaction to test models based on these two alternative viewpoints. The weak decay of the hyperons gives direct access to spin degrees of freedom in their production process, which in turn, can be related to the role of spin in the creation of strangeness.

We present results of simulations that show that PANDA is very suitable for doing this kind of studies. If data exist for these reactions, at all, PANDA will exceed the previous measurements by orders of

magnitude in statistics. Many hyperons channels for which there are no experimental data will be accessible.

HK 80.2 Fr 11:15 H-ZO 20

Study of the pp→$K^+n\Sigma^+$ reaction near threshold — •Yury Valdau for the ANKE-Collaboration — Forschungszentrum Jülich, Leo-Brandt-Straße, 52428 Jülich

Three different hyperon channels Λ, Σ^0 and Σ^+ are contribute to the K^+ production in pp interactions close-to-threshold. While there are a lot of data exist on the Λ and Σ^0 total production cross sections, there are only few measurements of the third hyperon reaction channel $pp \to K^+n\Sigma^+$.

At ANKE-COSY the energy dependence of the Σ^+ production total cross section was studied at four different proton beam energies between reaction threshold and 2.15 GeV. Our analysis of the Σ^+ reaction channel is based on a simultaneous measurement of three experimental observable: K^+ inclusive spectra, K^+p missing mass spectra and individual particle momentum spectra from the $K^+\pi^+$ correlation events. Below the $pp \to K^+n\Lambda\pi^+$ reaction threshold ($\sim$ 2.02 GeV) the only source of the $K^+\pi^+$ correlations can be Σ^+ production. Thus, identification of $K^+\pi^+$ allows us to identify Σ^+ reaction channel unambiguously below $\sim$ 2.0 GeV, and estimate total cross section. Extracted Σ^+ production total cross sections should allow to describe K^+ inclusive and K^+p correlation spectra using known Λ and Σ^0 total cross sections.

The status of the analysis as well as preliminary experimental results will be presented.

Supported by the COSY–FFE program.

HK 80.3 Fr 11:30 H-ZO 20

Hyperon production in the reactions $pp \to K^+\Lambda p$ and $pn(p) \to K^0\Lambda p(p)$ — •Martin Krapp, Wolfgang Eyrich, Cecilia Pizzolotto, Wolfgang Schroeder, and Andreas Teufel for the COSY-TOF-Collaboration — Universität Erlangen-Nürnberg

The near threashold production of hyperons by using a liquid hydrogen target is one of the main topics studied at the time-of-flight spectrometer COSY-TOF. Up to now the reactions $pp \to K^+\Lambda p$, $K^0\Sigma^+p$ and $K^+\Sigma^0p$ have been investigated in detail and led to an essential information gain about the reaction mechanism. In order to achieve more complete information about hyperon production near threshold in nucleon-nucleon reactions, the investigation has been extended to pn reactions by using a liquid deuterium target. The current status of the analysis of the reaction channel $pn(p) \to K^0\Lambda p(p)$ will be presented, as well as reconstruction techniques and first results. Moreover the data of the reaction $pp \to K^+\Lambda p$, which are now available with high statistical precision, are discussed. In this context especially the influence of N^*-resonances on Dalitz-plots is investigated.

supported by BMBF and FZ Jülich.

HK 80.4 Fr 11:45 H-ZO 20

Transverse Λ and $\overline{\Lambda}$ polarization with a transversely polarized proton target at COMPASS* — •DONGHEE KANG — Institut für Kernphysik, Johannes Gutenberg Universität Mainz, Germany

The measurement of the transverse quark distribution functions $\Delta_T q(x)$ is an important part of the physics program of the COMPASS experiment at CERN. The transversity distributions, being chiral-odd objects, are not directly accessible in inclusive deep-inelastic scattering (DIS), but require the presence of another chiral-odd object. They can be measured in semi-inclusive deep-inelastic scattering (SIDIS), where this additional object is provided by the transversely polarized fragmentation functions $\Delta_T D_q^h(z)$. The most promising channels for the measurement of the transversity distributions in SIDIS are the Collins effect, the azimuthal asymmetries in two hadrons production and the transverse Λ polarization. The transverse Λ and $\overline{\Lambda}$ polarization can be studied by measuring the acceptance corrected angular distribution of its decay products. At COMPASS, new data on the Λ and $\overline{\Lambda}$ hyperons produced in SIDIS processes have been collected in 2007, using a beam of 160 GeV/c polarized μ^+ scattering off a NH_3 target. The preliminary results on the transverse Λ and $\overline{\Lambda}$ polarization as a function of x_{Bj} and z will be presented.

* This work is supported by the BMBF.

HK 80.5 Fr 12:00 H-ZO 20

A Regge-plus-resonance approach to radiative kaon capture processes using crossing symmetry — •Tim Van Cauteren and Pieter Vancraeyveld — Ghent University, Dept. Subatomic and Radiation Physics, Proeftuinstraat 86, B-9000 Gent, Belgium

Over the last years, we have developed a Regge-plus-resonance (RPR) model for describing cross sections and polarization observables of kaon photo- and electroproduction from the proton. In our model, the background arises from the exchange of two kaon Regge-trajectories in the t-channel. A limited set of nucleon resonances is added to explain the broad structures seen in kaon production observables. Crossing symmetry can be used to relate the amplitude for $\gamma(p,K)Y$ reactions to the amplitude for radiative kaon capture processes. This amounts to interchanging s- and u-channel, while the t-channel remains unaffected. Therefore, we can apply the background description from our RPR model for kaon production to the radiative kaon capture processes. Hyperon resonances can be added to explain possible structure. We present our results for $K^-p \to \gamma Y$ ($Y = \Lambda, \Sigma$) cross sections for kaon momenta $|\vec{p}_K|$ between 514 and 750 MeV/c, which were measured by the Crystal Ball collaboration at BNL.

HK 80.6 Fr 12:15 H-ZO 20

$p\bar{p} \to \Lambda\bar{\Lambda}$ production cross section in a constituent quark model — •Pablo Garcia, David R. Entem, and Francisco Fernandez — Universidad de Salamanca, E-37008, Salamanca Spain

In recent years the interest in the $N\bar{N}$ system has been renewed due to the observation of a near threshold enhancement in the $J/\psi \to \gamma p\bar{p}$ decay which was interpreted as a possible $N\bar{N}$ bound state or as a FSI effect in the $N\bar{N}$ system. Also the construction of the antiproton facility FAIR and its low energy facility FLAIR will provide new and precise data for reactions involving antiproton beams which motivates the theoretical study of such reactions.

In Ref. [1] a chiral constituent quark model was used to study the $N\bar{N}$ interaction. We now apply this model to study the $\Lambda\bar{\Lambda}$ production reaction. This reaction has been traditionally explained with kaon exchange in meson models and with gluon annihilation in quark models. The chiral constituent quark model used includes both mechanisms. The kaons are generated as pseudogoldstone bosons of the spontaneous chiral symmetry breaking and gluons as perturbative contributions from QCD.

We perform a coupled channel calculation which allows us to study the FSI and ISI approximations. The optical potential is modified to describe the $p\bar{p}$ total cross section data in the $\Lambda\bar{\Lambda}$ production energy range. We find that the kaon contribution dominates and we need to increase g_{ch} in the strange sector to describe the data. We also study polarization observables for the $p\bar{p} \to p\bar{p}$ and $p\bar{p} \to \Lambda\bar{\Lambda}$ reactions.

[1] D.R. Entem, and F. Fernandez, Phys. Rev. C **73**, 045214 (2006).

HK 80.7 Fr 12:30 H-ZO 20

The Qweak experiment - A search for new physics at the TeV scale — •Klaus Grimm — Louisiana Tech University, Ruston, LA 71272, USA

The Q_{weak} experiment is a new precision measurement of the weak charge of the proton, $Q_p^W = 1 - 4\sin^2(\theta_W)$, using parity violation in electron scattering from the proton at very low Q^2 and forward angles and is in the final stages of preparation for execution at Jefferson Laboratory (JLab). The Standard Model makes a firm prediction of Q_p^W, based on the running of the weak mixing angle $\sin^2(\theta_W)$ from the Z_0 pole down to lower energies. Because the electroweak radiative corrections which give rise to the running depend not only on known particles, but on particles which have not yet been discovered, a difference between the calculated and measured weak charges may signal new physics where Q_{weak} will be sensitive to new physics at the few TeV scale. Any significant deviation of $\sin^2(\theta_W)$ from the Standard Model prediction at low Q^2 would be a signal of new physics, where as agreement would place new and strict constraints on possible Standard Model extensions. In the absence of new physics Q_{weak} will provide a 0.3% determination of $\sin^2(\theta_W)$, making this a very competitive stand-alone measurement of the weak mixing angle indeed.

The experiment plans to measure the predicted parity violating asymmetry of -0.3 ppm with a combined statistical and systematic uncertainty of 2.2%, corresponding to a total uncertainty of 4% in Q_p^W.

HK 81: Hadron Structure and Spectroscopy II

Time: Friday 11:00–12:45 Location: H-ZO 30

HK 81.1 Fr 11:00 H-ZO 30

The Strange Quark Polarisation from Inclusive and Charged Kaon Spin Asymmetries — •Regine Panknin for the COMPASS-Collaboration — Physikalisches Institut, Nussallee 12, 53115 Bonn

The polarisation of the strange quark in the nucleon, $\Delta s(x)/s(x)$, is - in leading order - derived from the spin asymmetry of charged kaons and the inclusive asymmetry A_1^d. The strange quark polarisation has been determined from the full sample of deeply inelastic scattering events on polarized deuterons collected at the COMPASS experiment at CERN from 2002 to 2006. These data made possible an extension of the $\Delta s(x)/s(x)$ analysis into the region of small x, down to $x = 0.004$. It will be shown that the significance of these results depends critically on the ratio of the s and u quark to kaon fragmentation functions, $\int D_s^{K+}(z)\mathrm{d}z$ / $\int D_u^{K+}(z)\mathrm{d}z$.

HK 81.2 Fr 11:15 H-ZO 30

azimuthal asymmetries of the unpolarized cross-section at HERMES — •francesca giordano — INFN sez. ferrara, ferrara, italy

in unpolarized semi-inclusive deep inelastic scattering azimuthal $cos\phi$ and $cos2\phi$ modulations of the hadron distributions originate from quark intrinsic transverse momentum and transverse spin.

these azimuthal modulations are extracted from data of the HERMES experiment corrected for instrumental and radiative contributions by a multidimensional (x,y,z,$P_{h\perp}$) unfolding procedure.

to access flavor dependent informations about quark intrinsic transverse momenta and spin-orbit correlations, results are presented for hydrogen and deuterium targets and separately for positive and negative hadrons. this flavor sensitivity of the results enhances the discrimination power between the theoretical models in the HERMES kinematical regime.

HK 81.3 Fr 11:30 H-ZO 30

HERMES measurements of the strange parton distribution and strange quark helicity distribution — •Polina Kravchenko for the HERMES-Collaboration — PNPI, St.Petersburg, Russia

The helicity density of the strange quark sea in the proton has been extracted from measurements of polarized semi-inclusive production of charged kaons in deep inelastic scattering of positrons from a plarized deuteron target. The isoscalar nature of the deuteron target (assuming isospin symmetry) and lack of isospin for strange quarks allows the deuteron target to be used independently without relying on fragmentation models or other experimental data. In the region of measurement of x>0.02 the helicity density is zero within experimental error and the measured first moment of the density is 0.006+/-0.029(stat)+/-0.007(sys)/. The first moment of the axial charge in the measured region is substantially less than that inferred from hyperon semi-leptonc decays.

HK 81.4 Fr 11:45 H-ZO 30

A-dependence of the Lambda polarization — •Yury Naryshkin for the HERMES-Collaboration — PNPI RAS Gatchina, Leningrad district 188300, Russia.

The HERMES experiment has measured transverse polarization of Λ and $\bar{\Lambda}$ hyperons produced inclusively at positron beam energy 27.6 GeV in quasi-real photon interaction with series of nuclei in a wide range of atomic numbers A (^1H,^2D, ^3He, ^4He, ^{14}N, ^{20}Ne, ^{84}Kr and ^{131}Xe). Dependence of the Lambda polarization on A is studied.

HK 81.5 Fr 12:00 H-ZO 30

Generalized Parton Distributions in Chiral Perturbation Theory — •Nikolai Kivel, Maxim Polyakov, and Aleksey Vladimirov — Ruhr Universitet, Bochum

We used χPT approach to study the small$-t$ behavior of the Generalized Parton Distributions (GPDs). We demonstrate that in the region of Bjorken $x_{\rm Bj} \sim m_\pi^2/(4\pi F_\pi)^2$ and/or $x_{\rm Bj} \sim |t|/(4\pi F_\pi)^2$ the standard χPT for the pion GPDs is not sufficient and one must perform all order resummation of χPT. We develop the technique in order to sum the problematic contributions with the leading logarithmic accuracy. We apply this approach for the pion GPDs and compute their behavior at the region of small-$x_{\rm Bj}$. Explicit resummation allows us to reveal novel phenomena – the form of the leading chiral correction to pion PDFs and GPDs depends on the small x asymptotic of the pion PDFs. In particular, if the pion PDF in the chiral limit has the Regge-like small x behaviour $q(x) \sim 1/x^\omega$, the leading large impact parameter ($b_\perp \to \infty$) asymptotics of the quark distribution in the transverse plane has the form ($m_\pi = 0$) $q(x, b_\perp) \sim 1/x^\omega \ \ln^\omega(b_\perp^2)/b_\perp^{2(1+\omega)}$. This result is model independent and it is controlled completely by the all order resummed χPT.

HK 81.6 Fr 12:15 H-ZO 30

Vector meson form factors on the lattice — •Martin Gürtler and Philipp Hägler — TU München

We compute form factors of vector mesons in lattice QCD. We use the QCDSF gauge field configurations with two dynamical flavors of non-perturbatively improved Wilson fermions.

In contrast to, e.g., the physical rho-meson, the vector mesons are stable on the lattice in the parameter ranges (pion masses and volumes) we consider.

Nevertheless, the results are examplary for form factors of spin-1 particles, and can be compared to results for pion and nucleon form factors.

We will present results for the electromagnetic form factors that allow to derive the charge radius and the g-factor of the rho meson, and also the quadrupole moment, which describes deviations from the spherical shape of the meson.

We also present first results for axial vector form factors.

HK 81.7 Fr 12:30 H-ZO 30

The GDH Experiment on the Deuteron at MAMI — •Oliver Jahn for the A2-Collaboration — Institut für Kernphysik, Mainz

The GDH sum rule connects ground state properties of the nucleon with helicity dependent cross sections. To investigate these cross sections on the deuteron, experiments have been carried out in the A2-Collaboration at the Mainz Microtron, Germany, in 1998 and in 2003, using circularly polarised photons on a polarised d-butanol target. The latest analysis results and the status of the new GDH experiment with the Crystal Ball detector are reported.

HK 82: Nuclear Structure and Dynamics I

Time: Friday 11:00–12:45 Location: H-ZO 40

Group Report HK 82.1 Fr 11:00 H-ZO 40

Systematics of electric dipole strength in the stable even-mass Mo isotopes — •R. Schwengner[1], G. Rusev[1,2], F. Doenau[1], S. Frauendorf[1,3], S.Q. Zhang[1,4], R. Beyer[1], M. Erhard[1], E. Grosse[1], A.R. Junghans[1], K. Kosev[1], C. Nair[1], K.D. Schilling[1], and A. Wagner[1] — [1]Forschungszentrum Dresden-Rossendorf, 01314 Dresden — [2]Duke University, Durham, NC 27708, USA — [3]University of Notre Dame, IN 46556, USA — [4]Beijing University, Beijing 100871, China

Photoabsorption cross sections σ_γ up to the neutron-separation energy S_n were measured for the stable even-mass isotopes $^{92-100}$Mo in photon-scattering experiments at the ELBE accelerator. As a consequence of the high level density at excitation energies close to S_n a huge number of resolved transitions and in addition an even greater intensity portion in an unresolved continuum have been observed. Simulations of γ-ray cascades were performed to estimate the intensity distribution of inelastic transitions to low-lying levels and, hence, to deduce intensities and branching ratios of the ground-state transitions needed for the determination of σ_γ. The combination of the present data with (γ, n) data allows us to obtain σ_γ in the energy range from about 4

MeV up to the giant dipole resonance.

The experimental cross sections are compared with predictions of a new approach called Instantaneous Shape Sampling that calculates dipole strengths by means of QRPA for instantaneous shapes of the nucleus with probabilities obtained from IBA. The calculated σ_γ reproduce very well the experimental values around S_n.

HK 82.2 Fr 11:30 H-ZO 40

Decay of isoscalar giant resonances* — •Felix Siebenhühner[1], P. Butler[2], P. Dendooven[3], J. Endres[4], M.N. Harakeh[3], S. Harissopulos[5], J. Hasper[4], R.-D. Herzberg[2], R. Krücken[6], A. Lagoyannis[5], N. Pietralla[1], L. Popescu[7], D. Savran[1], M. Scheck[2], K. Sonnabend[1], V. Stoica[3], H.J. Wörtche[3], and A. Zilges[4] — [1]Institut für Kernphysik, TU Darmstadt — [2]Department of Physics, University of Liverpool, UK — [3]Kernfysisch Versneller Instituut, Rijksuniversiteit Groningen, Netherlands — [4]Institut für Kernphysik, Universität zu Köln, Germany — [5]I.N.P. NCSR Demokritos, Athens, Greece — [6]Physik-Department E12, TU München, Germany — [7]SCK-CEN, Mol, Belgium

At the KVI in Groningen, NL, several $\alpha - \gamma$ coincidence experiments [1] were performed. In these experiments the decay of the excited nucleus can be studied in great detail, using HPGe detectors for high resolution gamma spectroscopy. At excitation energies above the neutron separation threshold in the region of isoscalar giant resonances the degree of population of excited states in the daughter nucleus after particle emission can be studied as a function of the excitation energy. Preliminary results from the analysis of the experiments on ^{124}Sn and ^{140}Ce are presented and discussed. A strong dependance of the population of excited states on the excitation energy is observed.

*Supported by DFG under contract SFB 634 and by the EU under EURONS Contract no. RII3-CT-2005-506065

[1] D.Savran *et al.*: Nucl. Instr. Meth. Phys. Res. A564(2006) 267

HK 82.3 Fr 11:45 H-ZO 40

Dipole strengths in $^{235}U(\gamma,\gamma')$ - reaction up to 3.5 MeV * — •Olena Yevetska, Joachim Enders, Matthias Fritzsche, Peter von Neumann-Cosel, Norbert Pietralla, Achim Richter, Christopher Romig, Deniz Savran, and Kerstin Sonnabend — Institut für Kernphysik, Technische Universität Darmstadt, Germany

The $^{235}U(\gamma,\gamma')$ reaction was studied at 3.5 MeV endpoint energy of the incident bremsstrahlung spectrum at the superconducting Darmstadt electron linear accelerator S-DALINAC in November 2008. The aim of this experiment was to extend the data from recent experiment with endpoint energy 2.2 MeV [1] and search for the magnetic dipole scissors-mode in an odd-mass actinide.

First results will be presented.

[1] W. Bertozzi et al., Phys. Rev. **C85** (2008) 041601(R).

*Supported by the DFG through SFB 634.

HK 82.4 Fr 12:00 H-ZO 40

Investigation of the Pygmy Dipole Resonance in ^{60}Ni* — •Matthias Fritzsche[1], Norbert Pietralla[1], Christopher Romig[1], Gencho Rusev[2], Deniz Savran[1], Kerstin Sonnabend[1], Anton P. Tonchev[2], Werner Tornow[2], Henry R. Weller[2], and Andreas Zilges[3] — [1]Institut für Kernphysik, Technische Universität Darmstadt, Germany — [2]Triangle Universities Nuclear Laboratory, Duke University, Durham, NC, USA — [3]Institut für Kernphysik, Universität zu Köln, Germany

At the High Intensity Photon Setup (HIPS) at S-DALINAC in Darmstadt ^{60}Ni was investigated with unpolarized bremsstrahlung with energies up to 8.0 MeV and 9.9 MeV, respectively. Determination of spin and parity quantum numbers and absolute transition strengths was possible, using HPGe detectors placed under different angles. To assign also parity quantum numbers, the polarized photon beam of the High Intensity Gamma Source (HIγS) at Duke University was used. With the combined results, evidence of the Pygmy Dipole Resonance in ^{60}Ni was found.

*Supported by DFG (SFB 634)

HK 82.5 Fr 12:15 H-ZO 40

Nuclear Resonance Fluorescence of ^{203,205}Tl — •Fabian Pfeifer[1], Mathias Fritzsche[1], Norbert Pietralla[1], Gencho Rusev[2], Deniz Savran[1], Anton P. Tonchev[2], Werner Tornow[2], Henry Weller[1], Andreas Zilges[3], and Markus Zweidinger[1] — [1]Institut für Kernphysik, Technische Universität Darmstadt, Germany — [2]Triangle Universities Nuclear Laboratory, Duke University Durham, USA — [3]Institut für Kernphysik, Universität zu Köln, Germany

In order to investigate the dipole strength distribution in Thalium isotopes we have studied Nuclear Resonance Fluorescence of a sample composed of natural Thalium (consisting of 30% ^{203}Tl and 70% ^{205}Tl). Unpolarized bremsstrahlung with photo energies up to 7.5 MeV was used at the High Intensity Photon Setup (HIPS) at S-DALINAC at the IKP Darmstadt. 24 fluorescent γ-ray transitions were observed, 19 of them for the first time. For the assignment of the polarity[1] of two prominent γ-ray transitions, one at 4.7 MeV and one at 4.9 MeV, the polarized photon beam of the High Intensity γ-ray Source (HIγS) at Duke University was used. The experiment at HIγS revealed the existence of a photo-excited state of ^{205}Tl at an excitation energy of 4.971 MeV that exhibits a transition to the first excited state at 203 keV. The data will be presented and discussed

[1] N. Pietralla et al., Phys. Rev. Lett. 88, 012502 (2002)

HK 82.6 Fr 12:30 H-ZO 40

Skyrme-RPA Description of Giant Resonances in Spherical and Deformed Nuclei — •Jan Kvasil[1], Valentin O. Nesterenko[2], Wolfgang Kleinig[2,3], Petr Vesely[1], and Paul G. Reinhard[4] — [1]IPNP, Charles University, CZ-18000, Prague, Czech Republic — [2]BLTF, Joint Institute for Nuclear research, Dubna, 141980 Russia — [3]Technical University, D-01062, Dresden, Germany — [4]University of Erlangen, D-91058, Erlangen, Germany

Ability of the time-dependent density functional theory (TDDFT) with Skyrme forces to describe electric and magnetic resonances (GR) is scrutinized within the separable RPA (SRPA) method recently developed by our group [1]. The method is fully self-consistent and does not need additional parameters. Due to the factorization of the residual interaction, the SRPA drastically reduces the computational effort while keeping the accuracy of involved RPA method. This feature becomes crucial for systematic study of collective dynamics in complex nuclei with their huge configuration space. Both spherical and axially deformed nuclei can be covered. The isovector E1(T=1) and M1 GR is analysed in detail in rare-earth, actinide and superheavy nuclei, including long isotopic chains approaching drip-lines [1]. A special attention is paid to the role of the time-odd current in the Skyrme functional and its influence on the GR properties [1]. We discuss relation of the current with the effective masses and propose a tentative classification of Skyrme forces, based on the description of isovector modes [1].

1. W. Kleinig, V.O. Nesterenko, J. Kvasil, P.-G. Reinhard and P. Vesely, Phys. Rev. C78, 044313 (2008)

HK 83: Nuclear Structure and Dynamics II

Time: Friday 11:00–12:45 Location: H-ZO 50

Group Report HK 83.1 Fr 11:00 H-ZO 50

Density Dependent Hadron Field Theory and its Applications — Urnaa Badarch, •Andreas Fedoseew, Walter Heupel, Horst Lenske, and Anika Obermann — Institut für Theoretische Physik, Universität Giessen, Germany

In-medium NN interactions are derived in an ab initio approach by Dirac-Brueckner theory. Within the density dependent relativistic hadron (DDRH) field theory we obtain a fully covariant and thermodynamically consistent density functional theory with interaction vertices described as Lorentz-scalar functionals of the field operators. Nuclear matter results from our ab initio description are compared to calculations with phenomenological input. Employing this model, the properties of isospin asymmetric nuclear matter and neutron stars are studied. The symmetry energy is found to be affected significantly by the $\delta/a_0(980)$ scalar-isovector channel. Landau-Migdal parameters are derived. They enter into quasi-free response functions. Dirac-RPA results for different spin-isospin channels reproduce available data on longitudinal and transverse response functions quite well. As an inter-

esting case we examine the properties of neutron stars, serving also as a test for the high-density behavior of the theory. Neutron star matter in beta-equilibrium including the appearance of hyperons in the core of compact stars is investigated. Results for the mass-to-radius relation show an interesting dependence on the strength of density dependence of the symmetry energy.
This work is supported by the European Graduate School "Complex Systems of Hadrons and Nuclei".

Group Report HK 83.2 Fr 11:30 H-ZO 50

Nuclear Structure Calculations in the UCOM Framework — •Heiko Hergert, Anneke Günther, Panagiota Papakonstantinou, Sabine Reinhardt, and Robert Roth — Institut für Kernphysik, TU Darmstadt

The Unitarity Correlation Operator Method and the Similarity Renormalization Group [1,2] are powerful techniques for the derivation of effective interactions from current realistic NN potentials like Argonne AV18 or the chiral N3LO forces, which are suitable for a wide range of many-body methods, including Hartree-Fock(-Bogoliubov) (HF/HFB), Many-Body Perturbation Theory, RPA & quasi-particle RPA. We discuss nuclear structure calculations based on these interactions, including three-body forces via contact terms or corresponding density-dependent two-body forces.

We primarily focus on open-shell nuclei and the treatment of pairing phenomena in an HFB framework, discussing pairing gaps in isotopic and isotonic chains. The systematic connection to the free NN problem offers new insight into open questions regarding nuclear superfluidity, e.g., the importance of surface vibrations. The impact of pairing correlations on collective excitations is addressed in a QRPA framework, and tentative results are shown, for instance, for the supposed Pygmy dipole resonances in the tin isotopes.

Work supported by the DFG (SFB 634).

[1] R. Roth et al., Phys. Rev. **C73** (2006) 044312
[2] H. Hergert, R. Roth, Phys. Rev. **C75** (2007) 051001(R)

HK 83.3 Fr 12:00 H-ZO 50

Landau parameters with effective nucleon-nucleon interactions — •Haris Djapo[1], Robert Roth[1], Bernd-Jochen Schaefer[2], and Jochen Wambach[1,3] — [1]Institut für Kernphysik, TU Darmstadt, Schloßgartenstr. 9, D-64289 Darmstadt,Germany — [2]Institut für Physik, Karl-Franzens-Universität Graz, Universitätsplatz 5, A-8010 Graz, Austria — [3]Gesellschaft für Schwerionenforschung mbH, Planckstr. 1, D-64291 Darmstadt, Germany

Using recently developed effective nucleon-nucleon interactions we investigate properties of nuclear matter. A comparison of basic properties of effective low momentum potential $V_{\text{low k}}$ and a potential constructed with unitary correlation operators V_{UCOM} in uniform nuclear matter is presented. Energy per particle, single-particle potentials, nucleon effective masses and Landau parameters are calculated and analyzed as a function of density for both nuclear and neutron matter. By introducing the density-dependent force we mimic the missing influence of higher order interactions to the properties of nuclear matter.

HK 83.4 Fr 12:15 H-ZO 50

Isospin Dependent Pairing Interactions and BCS-BEC crossover — •J. Margueron[1,2], H. Sagawa[2], and K. Hagino[3] — [1]IPN, Universite Paris-Sud, IN2P3-CNRSF-Orsay Cedex, France — [2]University of Aizu, Aizu-Wakamatsu, Fukushima, Japan — [3]Tohoku University, Sendai, Japan

We propose new types of density dependent contact pairing interaction which reproduce the pairing gaps in symmetric and neutron matters obtained by a microscopic treatment based on the nucleon-nucleon interaction. The BCS-BEC crossover of neutrons pairs in symmetric and asymmetric nuclear matters is studied by using these contact interactions. It is shown that the bare and screened pairing interactions lead to different features of the BCS-BEC crossover in symmetric nuclear matter. We perform Hartree-Fock-Bogoliubov (HFB) calculations for semi-magic Calcium, Nickel, Tin and Lead isotopes and N=20, 28, 50 and 82 isotones using these density-dependent pairing interactions. Our calculations well account for the experimental data for the neutron number dependence of binding energy, two neutrons separation energy, and odd-even mass staggering of these isotopes. Especially the interaction IS+IV Bare without the medium polarization effect gives satisfactory results of all the isotopes.

HK 83.5 Fr 12:30 H-ZO 50

Three-body contributions to the density-dependent NN-interaction — •Abdul Ahad Ataie and Horst Lenske — Institut für Theoretische Physik, Universität Giessen, Germany

We study a non-relativistic energy density functional theory to describe nuclear matter, nuclei and hyper-nuclei. The interaction density functionals are derived from Brueckner G-matrix calculation for the baryon-baryon in-medium forces from which we extract density dependent interaction vertices. The realistic description of the nuclear EOS requires additional density dependent three-body interactions which are shown to act predominantly as additional density dependent vertex corrections. The momentum dependence of self-energies and their modifications by the three-body terms are investigated. Results for the EOS of symmetric and asymmetric nuclear matter are discussed.
Work supported by DFG.

HK 84: Accelerators and Instrumentation I

Time: Friday 11:00–12:45 Location: H-ZO 80

HK 84.1 Fr 11:00 H-ZO 80

Diamonds as fast timing detectors for MIPS: The HADES proton-beam monitor/start detector — •Wolfgang Koenig and Jerzy Pietraszko for the HADES-Collaboration — GSI, Darmstadt, Germany

Position sensitive mono-crystalline diamond detectors were used successfully as start/beam-monitoring detectors for proton beams (1.2 GeV - 3.5 GeV) at rates of up to $3{\cdot}10^6$/s/10mm^2. Two different detector sizes of 3.5×3.5 mm^2 (4 segments) and 4.7×4.7 mm^2 (8 segments) were used with thicknesses of 300 μm and 500 μm, respectively. Utilizing dedicated fast amplifiers directly attached to the diamond segments, a time resolution of about 100ps could be achieved with a signal base width of about 8-10 ns and $\geq$95% detection efficiency. The signal/RMS-noise ratio amounted to 22 (300 μm) and 26 (500 μm) at rise times of 1.2 ns and 1.3 ns, respectively. The measured time resolution is about a factor of two worse than expected from the signal/noise ratio. A significant variation of rise times was observed which most likely results from rather inhomogeneous intrinsic fields (upcharging effects due to charge trapping). Furthermore, at high rates unreasonably large leakage currents appeared for some detectors which eventually resulted in sudden discharges, tripping the detector bias. These effects seem to depend strongly on the metallization procedure. An optimization of this procedure is currently investigated.

HK 84.2 Fr 11:15 H-ZO 80

Performace studies of the new Multiwire Drift Chambers for HADES using the new Readout system — •Jörn Wüstenfeld[1], Kathrin Göbel[3], Burkhardt Kämpfer[1], Roland Kotte[1], Lothar Naumann[1], Marek Palka[2,4], Attilio Tarantola[2,3], and Michael Traxler[2] — [1]Institut für Strahlenphysik, Forschungszentrum Dresden - Rossendorf, Dresden, Germany — [2]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany — [3]Institut für Kernphysik, Goethe Universität, Frankfurt, Germany — [4]Smoluchowski Institute of Physics, Jagiellonian University, Krakow, Poland

Seven new Multiwire Drift Chambers of plane 1 for the High - Acceptance Di - Elektron Spectrometer (HADES) are assembled in the Detector Workshop of the Forschungszentrum Dresden - Rossendorf. We present the results of test performed on the first chamber in comparison with the main design parameters .
End of 2008 one detector was completely equipped with the new generation of the readout system designed for the high multiplicity environment as provided in collisions of heavy systems at HADES @ FAIR. The chamber was investigated with cosmic rays and β (^{90}Sr) source. The obtained results show that the new design fulfills the requirements with respect to efficiency, accuracy and rate capability. These chambers will be installed in 2009 to be armed for the upcoming heavy ion program.

HK 84.3 Fr 11:30 H-ZO 80

Optimierung von Multigap Resistive Plate Chamber (MRPC) für CBM — •Ingo M. Deppner für die FOPI-Kollaboration — Physikalisches Institut, Universität Heidelberg

Im FOPI-Experiment wurde 2007 ein großflächiges MRPC-Detektorsystem erfolgreich in Betrieb genommen und dabei das Zeitauflösungsvermögen soweit verbessert, dass Kaonen mit einem Impuls bis zu 1 GeV/c über eine Flugstrecke von 1,5 m identifiziert werden können.

Die Daten, die im April 2008 während einer Meßstrahlzeit gewonnen wurden, werden im Hinblick auf die Leistungscharakteristik des MRPCs ausgewertet und präsentiert. Das beobachtete Verhalten fließt unter anderem in die Entwicklung von Prototyp-Zähler für das CBM-Experiment ein. Das CBM-Experiment soll einen Flugzeitdetektor mit 80 ps Systemauflösung und einer Fläche von 100 m^2 bekommen. Die Elektrodengeometrie erhält im Bezug auf Cross-Talk, Clustergrösse und nicht zuletzt auf die begrenzte Anzahl von 60000 Kanälen große Bedeutung. Erste Untersuchungen von speziellen CBM-Prototypen sind im Gange und werden hier diskutiert.

Unterstützt von UE/FP6 HadronPhysics contract nr. RII3-CT-2004-506078 und BMBF 06HD190i.

HK 84.4 Fr 11:45 H-ZO 80

Development of radiation hard silicon sensors for the CBM Silicon Tracking System using Simulation approach — •Sudeep Chatterji for the CBM-Collaboration — GSI, Darmstadt

The very intense radiation environment of the planned Compressed Baryonic Matter (CBM) experiment at the international research center FAIR makes radiation hardness the most important issue for the Silicon Tracking System (STS). STS will consist of eight stations of double sided strip detectors at a distance between 25 cm to 100 cm downstream of the target. It is expected that the total integrated fluence will reach 1×10^{15} cm^{-2} 1 MeV neutrons equivalent which is more than expected at LHC at CERN. The major macroscopic effect of radiation damage in determining the viability of long-term operation of silicon sensors is the change in the effective charge carrier concentration (N_{eff}), leading to type inversion. For the safe operation over full CBM life time, detectors are required to sustain very high voltage operation, well exceeding the bias voltage needed to fully deplete the heavily irradiated sensors. Thus, the main effort in the development of silicon sensors is concentrated on a design that avoids p-n junction breakdown at operational biases.

Simulations are carried out to study the effect of change in N_{eff}, as well as crucial geometrical parameters, on the breakdown performance using the PISCES code. Process simulation has also been performed using SUPREM-4 for studying the annealing behaviour of implanted dopant.

* Supported by EU-FP6 HadronPhysics

HK 84.5 Fr 12:00 H-ZO 80

The ALICE muon spectrometer — •martino gagliardi — Università di Torino, Italy — INFN Torino, Italy — CERN, Genève, Switzerland

The ALICE experiment at the Large Hadron Collider was designed to study the properties of nuclear matter at extreme energy density, with particular regard to the transition to the Quark Gluon Plasma (QGP) phase.

The ALICE muon spectrometer will analyse the production of beauty and charmed mesons in heavy ion collisions at $\sqrt{s}$= 5.5 TeV per nucleon pair, through their muonic decays. In particular, the expected quarkonia suppression by QGP will be assessed. Data will also be taken in p-p collisions at 14 TeV, which will provide both a reference for the analysis and an insight on the quarkonia production mechanism.

The muon spectrometer was designed to achieve a mass resolution as good as 100 MeV/c^2 at the Υ mass. It consists of a set of absorbers, 5 tracking stations and a trigger system, all of which are now installed in the ALICE cavern. Intense commissioning is ongoing, including data-taking with cosmic rays.

A detailed description of the muon spectrometer will be presented, together with the results from the commissioning phase and the expected performance for a few physics topics.

HK 84.6 Fr 12:15 H-ZO 80

Commissioning of the PHOS detector at ALICE/LHC — •Øystein Djuvsland for the ALICE-PHOS-Collaboration — Department of Physics and Technolgy, University of Bergen, Norway

The Photon Spectrometer (PHOS) is an homogeneous electromagnetic calorimeter designed to detect and measure the energy of neutral particles produced in hadron (p-p and Pb-Pb) collisions at the LHC accelerator. To distinguish photons from the different processes and measure the spectra an excellent energy resolution and high statistics are required. An extensive commissioning process to calibrate and tune the performance of the detector has been undertaken to fulfil these requirements. The first PHOS module was installed ready for data taking for the start up of LHC in the fall of 2008, and for the restart a total of 3 modules will be installed and commissioned. Calibration and equalisation of the gains of the Avalanche Photo Diodes (APDs) used for detection of scintillating light is especially important to acquire the desired energy resolution. One of the possible methods to achieve this before first collisions is to take advantage of the known energy deposits of muons produced in cosmic events.

Experiences and results from the commissioning of the first PHOS module will be presented.

HK 84.7 Fr 12:30 H-ZO 80

Particle Identification with the ALICE TPC — •Alexander Kalweit — Institut für Kernphysik TU Darmstadt, Schlossgartenstr. 9, 64289 Darmstadt

We present a study of the particle identification capabilities of the ALICE Time Projection Chamber (TPC). The particle identification (PID) plays an important role for the overall performance of the experiment. Charged particles traversing the TPC gas lose a certain amount of energy per unit path length depending on their momentum and rest mass. By this, pions, kaons, protons, deuterons, electrons and muons can be identified over a broad momentum range after a precise gain calibration with radioactive Krypton gas. Results from Monte-Carlo studies with PYTHIA-generated events and from the cosmic runs in 2008 show that the PID works according to specifications and that the mean energy loss per unit path length can be described with a parameterization of the Bethe-Bloch curve.

HK 85: Accelerators and Instrumentation II

Time: Friday 11:00–12:45 Location: H-ZO 90

HK 85.1 Fr 11:00 H-ZO 90

Erzeugung eines spinpolarisierten Elektronenstrahls für die Beschleunigeranlage ELSA — •Dominik Heiliger — Physikalisches Institut der Universität Bonn, Deutschland

Spinpolarisierte Elektronen werden durch Bestrahlung einer lokal gitterverzerrten Mehrschichten-Photokathode (strained layer superlattice crystal) mit zirkular polarisiertem Laserlicht erzeugt. Bei geeigneter Bedampfung der Oberfläche der Photokathode lässt sich eine sogenannte negative Elektronenaffinität erzeugen und die Elektronen können den Kristall verlassen. Ein Elektronenstrahl wird durch Beschleunigung auf 50kV mittels einer invertiert aufgebauten Elektrodenanordnung erzeugt. Die Verschmutzung der Kristalloberfläche wird durch einen Betrieb der Anordnung im extremen Ultrahochvakuum unterdrückt. Dieses wird durch einen geeiget aufgebauten Transferkanal vom moderaten Vakuum des Linearbeschleunigers getrennt. Der Transferkanal ist so konzipiert, dass eine möglichst verlustfreie Transmission sowie eine Drehung des Spinvektors in eine zur Flugrichtung des Elektronenstrahls transversale Richtung möglich ist. Durch Diagnosestationen können Strahllage und Strahlprofil innerhalb des Transferkanals bestimmt werden. Im Vortrag werden die Funktionsweise der Quelle für polarisierte Elektronen erläutert sowie Messungen des erreichbaren Emissionsstroms und des Strahlprofils vorgestellt.

HK 85.2 Fr 11:15 H-ZO 90

Using NEG-pumping near a high density internal target — •Alexander Gruber[1], Johann Marton[1], Eberhard

Widmann[1], Johann Zmeskal[1], and Herbert Orth[2] for the PANDA-Collaboration — [1]Stefan Meyer Institut für subatomare Physik, ÖAW — [2]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt

The universal detector PANDA will be constructed at the future high-energy antiproton storage ring HESR at FAIR (Facility for Antiproton and Ion Research, GSI/Darmstadt). It will use antiproton beams (1.5 to 15 GeV/c) for hadron physics in the charmonium region.

The Stefan Meyer Institut (SMI) contributes to major parts of the PANDA detector like the hydrogen cluster-jet target and the vacuum system of the antiproton - target interaction zone.

To ensure low background, the residual gas load in the interaction zone and in the antiproton beam-pipe has to be minimised. Most of the gas load will come from the high density internal hydrogen target. As the detector will cover almost the full solid angle, the installation of pumps near the interaction zone is impossible. Therefore the use of NEG (non-evaporative-getter) coated beam pipes has been considered as an alternative.

Two setups with NEG coated tubes have been installed at SMI as prototypes of the PANDA interaction zone. General parameters of the NEG-film, its outgassing behaviour, the pumping speed and the pumping capacity for hydrogen have been tested.

The results of the studies on the PANDA-interaction region will be presented.

HK 85.3 Fr 11:30 H-ZO 90

Prototype of a High Density Cluster-Jet-Target for PANDA — •Alexander Täschner, Alfons Khoukaz, Esperanza Köhler, Hans-Werner Ortjohann, and Tobias Rausmann — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, Wilhelm-Klemm-Str. 9, D-48149 Münster

Cluster-jet-targets are operated successfully since many years as internal targets for storage ring experiments. In order to utilize these targets for upcoming 4π-detectors like the PANDA detector at FAIR, cluster-jet sources have to be improved with respect to the maximum target thickness to allow for highest luminosities in combination with larger distances between the cluster source and the interaction region. At the University of Münster the prototype of the cluster-jet target station for PANDA has been built which allows for systematic studies on the production and the properties of high-density cluster-jet beams.

In this contribution we will discuss recent results on the achieved target density. Furthermore we will present recent measurements on the velocity and the mass distribution of the produced cluster beams and studies on the target integration into the PANDA detector.

Supported by EU (RII3-CT-2004-506078) and BMBF (06MS253I).

HK 85.4 Fr 11:45 H-ZO 90

Performance of the WASA-at-COSY Pellet Target — •Florian Bergmann[1], Alfons Khoukaz[1], Guido D'Orsaneo[2], Annika Passfeld[1], Tobias Rausmann[1], Dirk Spölgen[2], and Alexander Winnemöller[1] — [1]Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, Wilhelm-Klemm-Str. 9, D-48149 Münster, Germany — [2]Institut für Kernphysik and Jülich Center for Hadron Physics, Forschungszentrum Jülich, D-52425 Jülich, Germany

After several years of operation at the CELSIUS ring in Uppsala, the experimental setup WASA has been moved to the COSY synchrotron of the FZ Jülich and is operated since 2006 as the WASA-at-COSY facility. One important part of this experimental installation is the pellet target device, which is the first and only one operated at storage rings. It provides high effective areal target beam densities of $\rho \approx 5 \cdot 10^{15} \frac{\text{atoms}}{\text{cm}^2}$ and is operated with hydrogen and deuterium as target material. Thus luminosities above $L = 10^{31}\ \text{cm}^{-2}\text{s}^{-1}$ can be achieved, allowing e.g. precision measurements on rare meson decays. Since the quality of the obtained data crucially depends on the perfomance of the pellet target, special efforts have been undertaken to provide high quality pellet beams. Of particular importance are the vacuum conditions in the scattering chamber, the regularity of the pellet flow or the long term stability of the complete target system.

In this contribution we will present the performance of the pellet target, which will also be of interest for future experimental facilities.

Supported by FZ Jülich, BMBF, and Wallenberg Foundation.

HK 85.5 Fr 12:00 H-ZO 90

The Liquid Hydrogen Target of the Crystal-Barrel/TAPS-Experiment at ELSA — •Christian Hammann for the CBELSA/TAPS-Collaboration — Helmholtz-Institut für Strahlen- und Kernphysik, Nußallee 14-16, D-53115 Bonn

The Crystal-Barrel/TAPS-experiment at the electron-accelerator ELSA is a photoproduction experiment investigating the spectrum and the properties of hadrons. The experiment features an electromagnetic calorimeter with nearly 4π angular coverage. The setup is especially suited for the detection of multi-photon final states.

For measurements on the nucleon a liquid hydrogen/deuterium target is available. The target is build such that the amount of material around the target cell is minimized to avoid conversion of photons, the loss of low energy protons and the production of electromagnetic background.

As the center of the Crystal Barrel detector is only accessible horizontally along the beam axis the target must have a rather long horizontal support pipe. This required the usage of two liquid hydrogen systems connected by a heat exchanger. An advantage for the operation with liquid deuterium is that only the smaller gas system needs to be filled with deuterium.

In this talk the liquid hydrogen target which was successfully used in several beamtimes will be presented.

Supported by the Deutsche Forschungsgemeinschaft (SFB/TR16).

HK 85.6 Fr 12:15 H-ZO 90

Online control package for COSY-TOF experiment — •Ekaterina Borodina[1,2], Eduard Roderburg[1], and James Ritman[1] for the COSY-TOF-Collaboration — [1]Institute fuer Kernphysik I, Forschungszentrum Juelich GmbH, 52325, Juelich, Germany — [2]Moscow State Institute of Electronics and Mathematics, Russia

The new Straw Tube Tracker and Quirl Microstrip detectors have been installed at the TOF (Time Of Flight) experiment at the COSY accelerator in IKP FZ-Juelich. These new detectors increase the number of channels of the COSY-TOF detector by about a factor of 3. Therefore, a new control package to adjust electronic parameters and for control the proper functionality of all channels is being developed.

The online controlling based on visualization of key parameters of detectors plays an important role. The concept and the techniques of the online software package are developed for the COSY-TOF experiment. It consists of conversion software, which transforms a binary data stream from the DAQ to detector oriented event format, methods of IPC (Inter-Process Communications), and GUI (graphical user interface). To achieve data transfer through the network and real time data performance the IPC tools - sockets and shared memory are used. A special GUI, TOF-ONLINE has been developed, based on ROOT. The GUI allows the detectors, plotting spectra, resetting data, etc., to be selected in an intuitive way. Examples of the visualization and the results of the first beam time will be introduced. Supported in part by FZ-Juelich.

HK 85.7 Fr 12:30 H-ZO 90

Studies on SiPM radiation hardness and low light level detection — •Salvador Sanchez, Patrick Achenbach, and Josef Pochodzalla for the A1-Collaboration — Institut für Kernphysik, Johannes Gutenberg-Universität, Mainz

A tracking detector based on two meters long scintillating fibers read out by silicon photomultipliers (SiPM) is being developed for the Kaos spectrometer at the Mainz Microtron MAMI. Low light level detection is challenging for these devices due to their high dark count rate. A relatively large cross-section of $4\,\text{mm}^2$ has been chosen as the optimum value for a minimal particle trajectories disturbance and a maximum detection efficiency. 100% detection efficiencies has been measured with an experimental prototype read out by a SSPM-0606BG4MM-PCB Photonique device at accidental coincidence rates of only a few Hertz. Because of the detectors close proximity to the intense electron beam a study of noise and radiation damage has been performed. SiPM have been irradiated with 14 MeV electron and exposed to mixed radiation in the experimental area. It is shown that the first noticeable damage consists of an increase in the rate of dark pulses and the loss of uniformity in the pixel gains. Realistic amounts of shielding have been tested and found to have only a relatively poor performance. Annealing has been proved to be only partially effective for SiPM recovery.