Fachverband Physik der Hadronen und Kerne (HK)

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Übersicht der Hauptvorträge und Fachsitzungen

(Hörsäle HSZ-02, HSZ-101, HSZ-103, HSZ-105, HSZ-201, HSZ-204, HSZ-301, HSZ-304, HSZ-401, HSZ-403, HSZ-405, WIL-A221, WIL-C203, WIL-C205 und WIL-C207; Poster HSZ 1.-4.OG)

Plenarvorträge

PV I	Di	11:00–11:45	HSZ-01/02	**Neutrinomischung: 3 Winkel und mehr?** — •Caren Hagner
PV II	Di	11:45–12:30	HSZ-01/02	**Energy Systems: The Importance of Energy Storage** — •Ulrich Stimming
PV III	Di	20:00–21:30	HSZ-01	**Gravity: A Political History** — •David Kaiser
PV IV	Mi	8:30– 9:15	HSZ-01/02	**100 Jahre Massenspektrometrie - Präzisionsmassenmessungen an exotischen Nukliden früher und heute** — •Klaus Blaum
PV V	Mi	9:15–10:00	HSZ-01/02	**Entdeckung eines Higgs-artigen Teilchens am LHC** — •Karl Jakobs
PV VI	Mi	11:30–11:50	HSZ-01/02	**Natur- und Geisteswissenschaften: Drei Fallbeispiele** — •Werner Nahm
PV VII	Mi	12:10–12:50	HSZ-01/02	**Der Large Hadron Collider - Beginn einer neuen Ära der Grundlagenforschung** — •Rolf-Dieter Heuer
PV VIII	Mi	20:00–21:30	HSZ-01	**Das Higgs-Boson: Sind alle Rätsel gelöst? - Neues vom Teilchenbeschleuniger LHC** — •Arno Straessner
PV IX	Do	11:00–11:45	HSZ-01/02	**Ausgewählte Ergebnisse von ATLAS, CMS und LHCb** — •Christian Sander
PV X	Do	11:45–12:30	HSZ-01/02	**Hadron physics - achievements and future goals** — •Ulrich Wiedner
PV XI	Do	18:00–19:15	HSZ-03	**Pulsars and extreme physics** — •Jocelyn Bell Burnell

Hauptvorträge

HK 1.1	Mo	9:10–10:00	HSZ-02	**Reactor and Solar Neutrino Experiments: Recent Highlights and Future Opportunities** — •Karsten M Heeger
HK 1.2	Mo	10:00–10:40	HSZ-02	**Variety of Strangeness Physics with HADES** — •Eliane Epple
HK 26.1	Di	8:30– 9:05	HSZ-02	**Highlights from ALICE** — •Klaus Reygers
HK 26.2	Di	9:05– 9:40	HSZ-02	**Collective flow in a hot, dense, and strongly interacting medium** — •Björn Schenke
HK 26.3	Di	9:40–10:15	HSZ-02	**Strongly interacting matter in an external magnetic field** — •Pavel Buividovich
HK 60.1	Do	8:30– 9:10	HSZ-02	**Investigating the charge of the proton** — •Michael Kohl
HK 60.2	Do	9:10– 9:50	HSZ-02	**Hadronenphysik mit COMPASS** — •Jan Friedrich
HK 60.3	Do	9:50–10:30	HSZ-02	**The Mesa accelerator** — •Kurt Aulenbacher, Marco Dehn, Robert Heine, Hans-Jochen Kreidel
HK 84.1	Fr	8:30– 9:10	HSZ-02	**Erste Gammaspektroskopie-Experimente mit PRESPEC bei GSI** — •Jürgen Gerl
HK 84.2	Fr	9:10– 9:50	HSZ-02	**The Subnuclear Structure of Matter - Baryon Spectroscopy at ELSA** — •Ulrike Thoma
HK 84.3	Fr	9:50–10:30	HSZ-02	**Hypernuclear Spectroscopy at MAMI** — •Anselm Esser
HK 85.1	Fr	11:00–11:40	HSZ-02	**Matrix Elements for Fundamental Symmetries** — •Javier Menendez
HK 85.2	Fr	11:40–12:20	HSZ-02	**Nuclear reactions for astrophysics studied at LUNA and in the Dresden Felsenkeller** — •Daniel Bemmerer
HK 85.3	Fr	12:20–13:00	HSZ-02	**Nukleare Astrophysik an FRANZ** — •Kerstin Sonnabend

Plenarvorträge des fachübergreifenden Symposiums SYUM

Das vollständige Programm dieses Symposiums ist unter SYUM aufgeführt.

SYUM 1.1	Mi	14:00–14:35	HSZ-01/02	**The Higgs mechanism and beyond** — •Alex Pomarol
SYUM 1.2	Mi	14:35–15:10	HSZ-01/02	**The Higgs mechanism as a challenge for philosophy** — •Simon Friederich
SYUM 1.3	Mi	15:10–15:45	HSZ-01/02	**Majorana-Masses of Neutrinos: Origin and Phenomenology** — •Werner Rodejohann
SYUM 1.4	Mi	15:45–16:20	HSZ-01/02	**Hadrons and Nuclei: Mass without Higgs** — •Ulf-G. Meissner

Fachsitzungen

HK 1.1–1.2	Mo	9:10–10:40	HSZ-02	**Eingeladene Hauptvorträge**
HK 2.1–2.7	Mo	11:00–13:00	HSZ-105	**Hadronenstruktur und -spektroskopie**
HK 3.1–3.6	Mo	11:00–12:45	HSZ-201	**Schwerionenkollisionen und QCD Phasen**
HK 4.1–4.6	Mo	11:00–12:45	HSZ-204	**Schwerionenkollisionen und QCD Phasen**
HK 5.1–5.6	Mo	11:00–12:45	HSZ-301	**Struktur und Dynamik von Kernen**
HK 6.1–6.7	Mo	11:00–13:00	HSZ-304	**Hadronenstruktur und -spektroskopie**
HK 7.1–7.5	Mo	11:00–12:30	HSZ-401	**Astroteilchenphysik**
HK 8.1–8.6	Mo	11:00–12:45	HSZ-403	**Nukleare Astrophysik**
HK 9.1–9.6	Mo	11:00–12:45	HSZ-405	**Instrumentation**
HK 10.1–10.8	Mo	11:00–13:00	WIL-A221	**Instrumentation**
HK 11.1–11.7	Mo	11:00–13:00	WIL-C203	**Beschleunigerphysik I (SC, SC-Cavities)**
HK 12.1–12.8	Mo	11:00–13:00	WIL-C205	**Beschleunigerphysik II (PWA I)**
HK 13.1–13.8	Mo	11:00–13:00	WIL-C207	**Beschleunigerphysik III (Strahlinstabilitäten I)**
HK 14.1–14.8	Mo	14:00–16:15	HSZ-304	**Hadronenstruktur und -spektroskopie**
HK 15.1–15.8	Mo	14:00–16:00	WIL-C203	**Beschleunigerphysik IV (Polarisation)**
HK 16.1–16.9	Mo	16:45–19:15	HSZ-201	**Schwerionenkollisionen und QCD Phasen**
HK 17.1–17.9	Mo	16:45–19:00	HSZ-204	**Hadronenstruktur und -spektroskopie**
HK 18.1–18.8	Mo	16:45–19:00	HSZ-301	**Struktur und Dynamik von Kernen**
HK 19.1–19.8	Mo	16:45–19:00	HSZ-304	**Hadronenstruktur und -spektroskopie**
HK 20.1–20.8	Mo	16:45–19:00	HSZ-401	**Struktur und Dynamik von Kernen**
HK 21.1–21.7	Mo	16:45–18:45	HSZ-403	**Nukleare Astrophysik**
HK 22.1–22.8	Mo	16:45–19:00	HSZ-405	**Instrumentation**
HK 23.1–23.9	Mo	16:45–19:15	WIL-A221	**Instrumentation**
HK 24.1–24.9	Mo	16:45–19:00	WIL-C205	**Beschleunigerphysik V (Strahldiagnose I)**
HK 25.1–25.9	Mo	16:45–19:00	WIL-C207	**Beschleunigerphysik VI (Resonatoren, HF)**
HK 26.1–26.4	Di	8:30–10:35	HSZ-02	**Eingeladene Hauptvorträge**
HK 27.1–27.8	Di	14:00–16:15	HSZ-101	**Hadronenstruktur und -spektroskopie**
HK 28.1–28.7	Di	14:00–16:15	HSZ-103	**Fundamentale Symmetrien**
HK 29.1–29.7	Di	14:00–16:00	HSZ-201	**Schwerionenkollisionen und QCD Phasen**
HK 30.1–30.8	Di	14:00–16:15	HSZ-204	**Schwerionenkollisionen und QCD Phasen**
HK 31.1–31.8	Di	14:00–16:15	HSZ-301	**Struktur und Dynamik von Kernen**
HK 32.1–32.8	Di	14:00–16:15	HSZ-401	**Struktur und Dynamik von Kernen**
HK 33.1–33.8	Di	14:00–16:15	HSZ-403	**Nukleare Astrophysik**
HK 34.1–34.8	Di	14:00–16:15	HSZ-405	**Instrumentation**
HK 35.1–35.8	Di	14:00–16:15	WIL-A221	**Instrumentation**
HK 36.1–36.7	Di	14:00–15:45	WIL-C203	**Beschleunigerphysik IX (Diverses)**
HK 37.1–37.9	Di	14:00–16:15	WIL-C205	**Beschleunigerphysik VIII (PWA II)**
HK 38.1–38.9	Di	14:00–16:15	WIL-C207	**Instrumentation**
HK 39.1–39.8	Di	16:45–19:00	HSZ-201	**Schwerionenkollisionen und QCD Phasen**
HK 40.1–40.8	Di	16:45–19:00	HSZ-204	**Schwerionenkollisionen und QCD Phasen**
HK 41.1–41.6	Di	16:45–18:30	HSZ-301	**Struktur und Dynamik von Kernen**
HK 42.1–42.7	Di	16:45–18:45	HSZ-304	**Hadronenstruktur und -spektroskopie**
HK 43.1–43.6	Di	16:45–18:45	HSZ-401	**Astroteilchenphysik**
HK 44.1–44.8	Di	16:45–19:00	HSZ-403	**Hadronenstruktur und -spektroskopie**
HK 45.1–45.8	Di	16:45–19:00	HSZ-405	**Instrumentation**
HK 46.1–46.10	Di	16:45–19:15	WIL-A221	**Instrumentation**
HK 47.1–47.9	Di	16:45–19:00	WIL-C203	**Beschleunigerphysik VII (Strahldynamik/Simulation)**
HK 48.1–48.8	Di	16:45–18:45	WIL-C205	**Beschleunigerphysik X (Injektoren)**

HK 49.1–49.9	Di	16:45–19:00	WIL-C207	**Instrumentation**
HK 50.1–50.2	Mi	16:45–16:45	HSZ 1.OG	**Poster - Fundamentale Symmetrien**
HK 51.1–51.30	Mi	16:45–16:45	HSZ 1.OG	**Poster - Beschleunigerphysik**
HK 52.1–52.34	Mi	16:45–16:45	HSZ 2.OG	**Poster - Instrumentation I**
HK 53.1–53.12	Mi	16:45–16:45	HSZ 3.OG	**Poster - Instrumentation II**
HK 54.1–54.16	Mi	16:45–16:45	HSZ 3.OG	**Poster - Hadronenstruktur und -spektroskopie**
HK 55.1–55.6	Mi	16:45–16:45	HSZ 3.OG	**Poster - Schwerionenkollisionen und QCD Phasen**
HK 56.1–56.7	Mi	16:45–16:45	HSZ 4.OG	**Poster - Struktur und Dynamik von Kernen**
HK 57.1–57.12	Mi	16:45–16:45	HSZ 4.OG	**Poster - Nukleare Astrophysik**
HK 58.1–58.3	Mi	16:45–16:45	HSZ 4.OG	**Poster - Astroteilchenphysik**
HK 59.1–59.1	Mi	16:45–16:45	HSZ 4.OG	**Poster - Anwendungen physikalischer Methoden**
HK 60.1–60.3	Do	8:30–10:30	HSZ-02	**Eingeladene Hauptvorträge**
HK 61.1–61.8	Do	14:00–16:15	HSZ-105	**Hadronenstruktur und -spektroskopie**
HK 62.1–62.8	Do	14:00–16:15	HSZ-201	**Schwerionenkollisionen und QCD Phasen**
HK 63.1–63.8	Do	14:00–16:15	HSZ-204	**Schwerionenkollisionen und QCD Phasen**
HK 64.1–64.7	Do	14:00–16:00	HSZ-301	**Struktur und Dynamik von Kernen**
HK 65.1–65.7	Do	14:00–16:00	HSZ-304	**Hadronenstruktur und -spektroskopie**
HK 66.1–66.7	Do	14:00–16:00	HSZ-401	**Astroteilchenphysik**
HK 67.1–67.7	Do	14:00–16:00	HSZ-403	**Nukleare Astrophysik**
HK 68.1–68.9	Do	14:00–16:15	HSZ-405	**Instrumentation**
HK 69.1–69.8	Do	14:00–16:15	WIL-A221	**Instrumentation**
HK 70.1–70.7	Do	14:00–16:00	WIL-C203	**Beschleunigerphysik XI (Strahlinstabilitäten II)**
HK 71.1–71.9	Do	14:00–16:15	WIL-C205	**Beschleunigerphysik XII (Kurze Pulse)**
HK 72.1–72.9	Do	14:00–16:15	WIL-C207	**Beschleunigerphysik XIII (Synchrotronstrahlung/THz)**
HK 73.1–73.9	Do	16:45–19:15	HSZ-105	**Hadronenstruktur und -spektroskopie**
HK 74.1–74.8	Do	16:45–19:00	HSZ-201	**Schwerionenkollisionen und QCD Phasen**
HK 75.1–75.7	Do	16:45–19:00	HSZ-204	**Anwendungen kernphysikalischer Methoden**
HK 76.1–76.8	Do	16:45–19:00	HSZ-301	**Struktur und Dynamik von Kernen**
HK 77.1–77.8	Do	16:45–19:00	HSZ-304	**Hadronenstruktur und -spektroskopie**
HK 78.1–78.7	Do	16:45–19:00	HSZ-401	**Fundamentale Symmetrien**
HK 79.1–79.6	Do	16:45–18:45	HSZ-403	**Nukleare Astrophysik**
HK 80.1–80.8	Do	16:45–19:00	HSZ-405	**Instrumentation**
HK 81.1–81.8	Do	16:45–19:00	WIL-A221	**Instrumentation**
HK 82.1–82.9	Do	16:45–19:00	WIL-C203	**Beschleunigerphysik XIV (Strahldiagnose II)**
HK 83.1–83.7	Do	16:45–18:45	WIL-C205	**Beschleunigerphysik XV (Kontrolle, Strahlkühlung)**
HK 84.1–84.3	Fr	8:30–10:30	HSZ-02	**Eingeladene Hauptvorträge**
HK 85.1–85.3	Fr	11:00–13:00	HSZ-02	**Eingeladene Hauptvorträge**

Mitgliederversammlung des Fachverbands Physik der Hadronen und Kerne

Donnerstag 19:30–20:30 HSZ-02

- Bericht
- Wahl
- Verschiedenes

HK 1: Eingeladene Hauptvorträge

Zeit: Montag 9:10–10:40 Raum: HSZ-02

Hauptvortrag HK 1.1 Mo 9:10 HSZ-02

Reactor and Solar Neutrino Experiments: Recent Highlights and Future Opportunities — •Karsten M Heeger — University of Wisconsin, Madison, WI, USA

Neutrino mass and mixing are amongst the major discoveries of recent years and demand that we make the first revision of the Standard Model in decades. From the first observation of the antineutrino to the discovery of neutrino flavor change, reactor and solar neutrino experiments have played an important role in the history of neutrino physics. Recent solar neutrino measurements have made a precision measurement of the temperature of the Sun, detected the solar 7Be and pep neutrino fluxes, and tested the MSW effect. Reactor antineutrino experiments have observed the disappearance of electron antineutrinos over km-long baselines and made a precision measurement of the last neutrino mixing angle theta13. In the future, solar neutrinos may provide an important probe of the solar metallicity and luminosity constraint while reactor experiments may shed light on the possible existence of sterile neutrinos and probe the mass hierarchy. I will describe recent highlights and future scientific opportunities of reactor and solar neutrino experiments.

Hauptvortrag HK 1.2 Mo 10:00 HSZ-02

Variety of Strangeness Physics with HADES — •Eliane Epple for the HADES-Collaboration — Excellence Cluster "Universe", 85748 Garching

During the last years the HADES collaboration has produced a variety of physics results in the SIS energy regime connected to strangeness. Within this talk I will highlight what we have learned about strange particles produced in light and heavy systems.

In the reaction p+p (3.5 GeV) we have studied resonances like $\Lambda(1405)$, which reveals surprising properties. This resonance might serve as a doorway to a new field of investigation, including also the search for a kaonic nuclear bound state, the so-called ppK$^-$. As it decays into $p+\Lambda$, it is important to understand the final state p+K$^+$+Λ precisely.

To study the cold nuclear medium, we have compared p+p to p+Nb reactions at the same beam kinetic energy of 3.5 GeV. In the strangeness sector, we concentrate on the analysis of K^0_S and Λ's. We want to learn how the medium affects the particle properties. As we compare our data to transport models, effects such as in-medium potentials or in-medium scattering processes can be studied.

In our recent data of Au+Au (1.25 AGeV) I will show our first successes in reconstructing kaons and Λ's. Our future plans with HADES are measurements of pion-induced reactions on elementary and nuclear targets. Again, the focus is on the study of the interaction of strange particles with the ambient nuclear medium to quantify further the particle absorption and nuclear potentials.

HK 2: Hadronenstruktur und -spektroskopie

Zeit: Montag 11:00–13:00 Raum: HSZ-105

Gruppenbericht HK 2.1 Mo 11:00 HSZ-105

Feasibilty to search for new charmonium(-like) reasonances in $B^\pm \to \chi_{c1}\pi^+\pi^-K^\pm$ decays at Belle. — •Elisabeth Panzenboeck[1,2], Ariane Frey[1], Kenkichi Miyabayashi[2] und Vishal Bhardwaj[2] — [1]Georg August Universitaet, Goettingen — [2]Nara Women's University, Nara, Japan

The Belle experiment, located at KEK in Japan, has accumulated high statistics B meson data thanks to the highest luminosity in the world provided by the KEKB asymmetric-energy e^+e^- collider. The huge amount of data, corresponding to 772M B meson pairs, brings the opportunity to search for yet unestablished charmonium as well as exotic charmonium-like states. The outcome of this attempt will provide important information to determine the proper degree of freedom to describe these heavy-flavored hadrons.

In order to search for a new X(3872) decay mode or a still unseen $\chi_{c1}(2P)$, $B^\pm \to \chi_{c1}(1P)\pi^+\pi^-K^\pm$ is a suitable decay process. Using Monte Carlo simulation datasets, the method of signal reconstruction and background estimation are to be presented.

HK 2.2 Mo 11:30 HSZ-105

Heavy-light mesons in unitarized chiral perturbation theory — •Michael Altenbuchinger[1], Lisheng Geng[1,2], and Wolfram Weise[1,3] — [1]Physik Department, TU München, D-85747 Garching — [2]School of Physics and Nuclear Energy Engineering, Beihang Univ., Beijing 100191, China — [3]ECT*, Villazzano (Trento), Italy

We analyze the scattering amplitude of D (D^*) mesons off pseudo-Goldstone bosons in the framework of unitarized chiral perturbation theory. The S-wave scattering lengths and their light-quark mass dependence are investigated, and consistency with recent lattice QCD computations is explored. Possible bound states and resonances are discussed. Finally, we apply our results for heavy-light meson scattering off pseudo-Goldstone bosons in particular to $\bar{B}K$ and $\bar{B}^*K$ systems.

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

HK 2.3 Mo 11:45 HSZ-105

Observation of the rare decay $B^{\pm,0} \to J/\psi K^+K^-K^{\pm,0}$ at BaBar — •Elisabetta Prencipe — Institute for Nuclear Physics, Johannes Gutenberg-Universität Mainz

The experiment BaBar is an asymmetric e^+e^- collider which was located at SLAC (Stanford Linear Accelerator Center). In 9 year of data taking it collected 426 fb^{-1} integrated luminosity on-peak data at the energy in the center of mass of $\Upsilon(4S)$ (10.56 GeV), then few tens fb^{-1} data were collected even at the energy in the center of mass of $\Upsilon(3S)$ and $\Upsilon(2S)$. The goal of the BaBar project has been the measurement of the sides and the angles of the Unitarity Triangle; however, thanks to the high luminosity achieved, it became a good *charm*-factory for spectroscopy studies. The work here presented is the analysis of the rare decays $B^{\pm,0} \to J/\psi K^+K^-K^{\pm,0}$ and $B^0_d \to J/\psi\phi$, which are channels with hidden $s\bar{s}$ content. The goal of these analyses is the precise measurement of the Branching Fractions of these channels and the search for possible hybrid states in the invariant mass systems of $J/\psi\phi$ and $J/\psi K^0_s$. No evidence of a new resonant state was observed, but an interesting effect was investigated at the threshold of the invariant mass distributions $J/\psi\phi$ and $J/\psi K^0_S$. No evidence of signal for $B^0_d \to J/\psi\phi$ was found, in agreement with the theoretical predictions.

HK 2.4 Mo 12:00 HSZ-105

Pseudoscalar transition form factors at low and high energies — •Pere Masjuan — Institut für Kernphysik, Johannes Gutenberg Universtität Mainz

Pseudoscalar transition form factors are analyzed at low energies using the mathematical theory of Padé approximants. The theory provides a good and systematic description of the low-energy region in a model-independent way. At high energies, the form factor is described by the Pseudoscalar Distribution Amplitude. Considering different models for that Distribution Amplitude, both low- and high-energy regimes are match at some scale Q*. Using this description for the form factor, the impact on the hadronic light-by-light scattering contribution on the anomalous magnetic moment is also discussed.

HK 2.5 Mo 12:15 HSZ-105

A Partial-Wave Analysis of Centrally Produced Two-Pseudoscalar Final States in pp Reactions at COMPASS — •Alexander Austregesilo — Physik-Department E18, Technische Universität München

COMPASS is a fixed-target experiment at CERN SPS which investigates the structure and dynamics of hadrons. The experimental setup features a large acceptance and high momentum resolution spectrometer including particle identification and calorimetry and is therefore ideal to access a broad range of different final states. In 2008 and 2009,

COMPASS collected a world-leading data set with a 190 GeV/c hadron beam impinging on either liquid hydrogen or nuclear (Pb, Ni) targets. Spin-exotic meson as well as glueball candidates formed in both diffractive dissociation and central production are presently studied.

The double-pomeron-exchange process is believed to provide a gluon-rich environment, where the production of mesons without valence quark content (glueballs) is enhanced. The lightest glueball candidates are expected in the scalar sector, which is studied in $\pi^+\pi^-$ and K^+K^- decay channels. We introduce a model to describe the selected data in terms of partial waves. The spin-parity decomposition is complicated by mathematical ambiguities inherent to two-pseudoscalar final states. We present preliminary resonance parameters extracted from fits to the data and compare the results to previous experiments.

Supported by BMBF, MLL and the Cluster of Excellence Exc153 'Origin and Structure of the Universe'

HK 2.6 Mo 12:30 HSZ-105

An Evolutionary Algorithm for Model Selection — •Karl Bicker[2], Suh-Urk Chung[1], Jan Friedrich[1], Boris Grube[1], Florian Haas[1], Bernhard Ketzer[1], Sebastian Neubert[1], Stephan Paul[1], and Dimitry Ryabchikov[1] — [1]Technische Universität München — [2]CERN, Geneva, Switzerland

When performing partial-wave analyses of multi-body final states, the choice of the fit model, i.e. the set of waves to be used in the fit, can significantly alter the results of the partial wave fit. Traditionally, the models were chosen based on physical arguments and by observing the changes in log-likelihood of the fits. To reduce possible bias in the model selection process, an evolutionary algorithm was developed based on a Bayesian goodness-of-fit criterion which takes into account the model complexity. Starting from systematically constructed pools of waves which contain significantly more waves than the typical fit model, the algorithm yields a model with an optimal log-likelihood and with a number of partial waves which is appropriate for the number of events in the data. Partial waves with small contributions to the total intensity are penalized and likely to be dropped during the selection process, as are models were excessive correlations between single waves occur. Due to the automated nature of the model selection, a much larger part of the model space can be explored than would be possible in a manual selection. In addition the method allows to assess the dependence of the fit result on the fit model which is an important contribution to the systematic uncertainty. This work is supported by BMBF, MLL München and the DFG Cluster of Excellence Exc153.

HK 2.7 Mo 12:45 HSZ-105

Messung der Strange-Quark-Beiträge zu den Vektor-Formfaktoren des Protons bei Q^2=0.1GeV/c^2 — •Boris Gläser — Institut für Kernphysik der Johannes Gutenberg-Universität Mainz, Deutschland

Die A4-Kollaboration untersucht die Strangeness-Beiträge zu der Vektor-Formfaktoren des Nukleons am Elektronenbeschleuniger MAMI der Johannes Gutenberg Universität-Mainz. Dies geschieht über die Messung der paritätsverletzenden Asymmetrie in der elastischen Streuung longitudinal polarisierter Elektronen an unpolarisierten Protonen mit Hilfe eines 1022 kanaligen PbF2-Kalorimeters. Das Kalorimeter ist rotierbar gelagert, um Messungen sowohl unter Vorwärts- als auch unter Rückwärtsstreuwinkeln zu ermöglichen. Hält man hierbei den Impulsübertrag konstant, können der seltsame elektrische und der seltsame magnetische Formfaktor unabhängig voneinander bestimmt werden.

Der Beitrag stellt den neuesten Datenpunkt, aufgenommen unter Rückwärtsstreuwinkeln bei einem Impulsübertrag von 0.1 GeV/c^2 vor.

HK 3: Schwerionenkollisionen und QCD Phasen

Zeit: Montag 11:00–12:45 Raum: HSZ-201

Gruppenbericht HK 3.1 Mo 11:00 HSZ-201

Heavy-flavour measurements in the semi-electronic decay channel in proton-proton and Pb–Pb collisions with ALICE at the LHC — •Markus Fasel for the ALICE-Collaboration — Physikalisches Institut, Ruprecht-Karls Universität Heidelberg, Im Neuenheimer Feld 226, 69120 Heidelberg

Heavy quarks are produced in initial hard scatterings and experience the full history of nuclear collisions. Thus they are a unique tool to study properties of the hot and dense medium produced in heavy-ion collisions. In particular the dependence of the partonic energy loss in the quark-gluon plasma phase on the quark mass can be addressed. In addition, the measurement of the elliptic flow of heavy quarks allows to study the degree of their thermalization with the hot and dense medium. In proton-proton (pp) collisions, the measurement of heavy-flavour production allows to test perturbative QCD. Furthermore, it provides a reference for heavy-ion studies. With ALICE, the measurement of heavy-flavour production can be performed in the semi-electronic decay channel at midrapidity down to $p_{\mathrm{T}} = 0.5$ GeV/c. Besides the particle identification capabilities provided by the experiment, the Inner Tracking System allows a separation of electrons from charm and beauty hadron decays. We report on the measurement of electrons from heavy-flavour hadron decays, at midrapidity in pp collisions at $\sqrt{s} = 2.76$ TeV and $\sqrt{s} = 7$ TeV. For Pb–Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 2.76$ TeV the suppression and the elliptic flow of electrons from semi-leptonic heavy-flavour hadron decays will be presented, and an outlook on measurements in p+Pb collisions will be given.

HK 3.2 Mo 11:30 HSZ-201

Measurement of B meson production in pp collisions at $\sqrt{s} = 2.76$ TeV and $\sqrt{s} = 7$ TeV via displaced electrons in ALICE — •Markus Heide for the ALICE-Collaboration — WWU Münster

Measurements of the production cross section of B mesons in pp collisions in ALICE are important in two respects. They allow to test perturbative quantum chromodynamics calculations, and they provide an essential reference for comparison with studies in heavy-ion collisions at high energies, in which a hot and dense medium, the quark-gluon plasma (QGP), is created. When passing through this medium, quarks lose energy via the strong interaction. Since the amount of energy loss is expected to depend significantly on the quark mass, beauty as the heaviest observable flavour is of particular interest for the exploration of QGP properties. The measurement of electrons from beauty hadron decays at mid-rapidity will be presented for $\sqrt{s} = 2.76$ TeV and $\sqrt{s} = 7$ TeV. First, the electron identification in the ALICE central barrel, using the Time Projection Chamber (TPC) and Time Of Flight (TOF) detector, will be outlined. An explanation of the selection of electrons from beauty hadron decays with a large impact parameter will be given. It makes use of the B mesons' larger decay length ($\approx 500\ \mu m$) in comparison to D mesons and other background sources. The remaining electron background in the selected sample is estimated based on calculations using ALICE measured p_t spectra. The resulting B meson p_t spectra measured in pp collisions at $\sqrt{s} = 7$ TeV in 2010 and at $\sqrt{s} = 2.76$ TeV in 2011 will be shown.

HK 3.3 Mo 11:45 HSZ-201

Background subtraction techniques for heavy-flavour electrons with ALICE at the LHC — •Christian Alberto Schmidt for the ALICE-Collaboration — TU Darmstadt - Institut für Kernphysik, Darmstadt, Germany

ALICE is the dedicated heavy-ion experiment at the LHC at CERN. The LHC delivers proton and heavy-ion beams with center-of-mass-energies of currently up to $\sqrt{s} = 8$ TeV for protons and $\sqrt{s_{NN}} = 2.76$ TeV for heavy ions.

The heavy-flavour (charm and beauty) production serves as an important test of perturbative Quantum Chromodynamics (pQCD) calculations. It is investigated via the measurement of semi-electronic decays of heavy-flavour hadrons. In heavy-ion collisions, the modifications of the heavy-flavour electron momentum distributions compared to the one in pp collisions presents a sensitive probe for the properties of the hot dense matter created in such interactions.

This measurement will only have success, if the background of the electron p_{T}-spectra is understood, estimated and subtracted. In this talk we present results of the cocktail subtraction method and the statistical photonic electron subtraction method. Both analysis require a good understanding of the non heavy-flavour electron background.

We will show results obtained from reconstructed pp collisions at $\sqrt{s} = 7$ TeV.

HK 3.4 Mo 12:00 HSZ-201

Trennung der Charm- und Beautyproduktion in pp- und Pb-Pb-Kollisionen mit ALICE — •Martin Völkl für die ALICE-Kollaboration — Physikalisches Institut Heidelberg

In Schwerionenkollisionen ist der Energieverlust schwerer Quarks eine interessante Größe, um die Eigenschaften des erzeugten Mediums - das Quark-Gluon-Plasma - zu erforschen. Schwere Quarks werden fast ausschließlich in den harten Partonstößen erzeugt und können so während der gesamten Entwicklung des Systems mit der umgebenden Materie wechselwirken. Aus den schweren Quarks bilden sich Hadronen, welche in Elektronen zerfallen können. Zugang zum Energieverlust der Teilchen im QGP bietet der Vergleich der Spektren solcher Elektronen aus Proton-Proton-Kollisionen mit denen aus Schwerionenkollisionen. Das genauere Verständnis der Daten ergibt sich aus dem Vergleich zur Theorie. Besonders interessant ist dabei die Möglichkeit zwischen beauty- und charm-Quarks experimentell zu unterscheiden um ihre unterschiedliche Charakteristik beim Energieverlust zu untersuchen. Dies kann durch statistische Trennung der Beiträge durch den Stoßparameter der Elektronen relativ zum Kollisionspunkt geschehen. Aufgrund ihrer großen Zerfallslänge ($c\tau \approx 500\mu$m) ergibt sich für Elektronen aus Hadronen mit beauty-Valenzquarks typischerweise ein größerer Stoßparameter. Eine reine Auswahl von Elektronen lässt sich durch die ausgezeichneten Teilchenidentifikationsfähigkeiten von ALICE erreichen. Hier sollen die bisherigen Ergebnisse der Studie in pp bei $\sqrt{s} = 7$TeV und in Pb-Pb bei $\sqrt{s_{NN}} = 2.76$TeV vorgestellt werden.

HK 3.5 Mo 12:15 HSZ-201

Open heavy flavor in ultra-relativistic heavy ion collisions — •Jan Uphoff[1], Oliver Fochler[1], Zhe Xu[2], and Carsten Greiner[1] — [1]Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Straße 1, D-60438 Frankfurt, Germany — [2]Department of Physics, Tsinghua University, Beijing, China

The production and space-time evolution of heavy quarks in the quark gluon plasma is studied within the partonic transport model Boltzmann Approach to MultiParton Scatterings (BAMPS). An updated version of BAMPS is presented which allows interactions among all partons: gluons, light quarks and heavy quarks. Heavy quarks, in particular, interact with the rest of the medium via binary and radiative scatterings with a running coupling and a more precise Debye screening which is derived from hard thermal loop calculations. We compare our results of the elliptic flow and nuclear modification factor not only to experimental data of heavy flavor electrons and D mesons at RHIC, but also to LHC data of heavy flavor electrons, muons, D mesons, and non-prompt J/psi. The latter two are in particular sensitive to the mass difference of charm and bottom quarks.
Supported by the Helmholtz Research School for Quark Matter Studies (H-QM) and HGS-HIRe.

HK 3.6 Mo 12:30 HSZ-201

b-Jet tagging in ALICE — •Linus Feldkamp for the ALICE-Collaboration — WWU Münster

Jets from heavy quarks (charm and beauty) are ideal probes for the strongly interacting medium (Quark Gluon Plasma) produced in heavy ion collisions. Color-charged heavy quarks, produced in the very early stage of the collision, lose energy while traversing the medium due to collisional and radiative processes, with the consequent quenching of the associated jets. The energy loss is expected to be smaller for heavy quarks than for light quarks and gluons. It has also been argued that the presence of the medium could modify the parton fragmentation process. Thus, the interaction with the medium can modify jet spectra as well as their properties. Several methods have been developed and used by experiments in high energy particle physics to differentiate jets originating from light and heavy quarks. Most of them exploit the relativly long lifetimes of heavy flavor hadrons, which result in a decay vertex displaced from the beam interaction point. We will give an overview of the of the on-going studies on b-jet tagging in pp collisions in the ALICE experiment at the LHC, and discuss their applicability to Pb-Pb collisions.

HK 4: Schwerionenkollisionen und QCD Phasen

Zeit: Montag 11:00–12:45 Raum: HSZ-204

Gruppenbericht HK 4.1 Mo 11:00 HSZ-204

Investigating the In-medium Effects of Strange Particles with the FOPI detector — •Victoria Zinyuk and Norbert Herrmann for the FOPI-Collaboration — Physikalisches Institut, Uni Heidelberg

Strangeness production sub- or close-to-production threshold energies is believed to provide an insight into equilibration and the change of hadron properties in a hot and dense nuclear medium. K-mesons are predicted to exhibit a change of their effective in-medium mass and thus are an unique tool to study the partial restoration of the chiral symmetry of QCD.
The FOPI detector at SIS 18 allows the identification of charged kaons and the reconstruction of neutral particles as K^0_S, Λ^0 and ϕ-mesons by their charged decay products in a wide range of phase space.
This presentation gives an overview of FOPI's recent results from a high statistic heavy-ion experiment (Ni+Ni @ 1.93 AGeV) aiming at investigating the in-medium modifications in hot and compressed nuclear matter and from pion-induced reactions (π^- @ 1.7 GeV/c) offering a reference at normal nuclear matter density.

This work was supported by BMBF 06HD7141I.

HK 4.2 Mo 11:30 HSZ-204

HADES at SIS-100 — •Jerzy Pietraszko for the HADES-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Planckstraße 1, 64291 Darmstadt, Germany

This paper presents the concept of study electron-positron pair production in the beam-energy range of 2-10AGeV by making use of the High-Acceptance Di-Electron Spectrometer (HADES), being now in operation at SIS18. The planned new FAIR Facility will provide for the first time the opportunity to perform dielectron measurements by HADES at SIS100 in a hitherto completely unexplored range of beam energies, characterized by a substantially larger compression of nuclear matter. Our simulations of such a scenario show promising results in terms of achievable dilepton acceptance and resolution. Parasitically, hadrons are accessible, too, thus providing a link to the AGS energy range. The recently conducted heavy ion experiment, Au+Au at 1.23 AGeV, at SIS18 confirmed that the spectrometer is ready to be used at higher energies. The efforts to transport the spectrometer and install it at FAIR SIS100 involve only moderate costs and manpower.

HK 4.3 Mo 11:45 HSZ-204

Dilepton production in heavy-ion collisions at SIS energies — •Janus Weil[1,2] and Ulrich Mosel[1] — [1]Institut für Theoretische Physik, Justus-Liebig-Universität Giessen, Heinrich-Buff-Ring 16, D-35392 Giessen, Germany — [2]Present address: Frankfurt Institute for Advanced Studies (FIAS), Ruth-Moufang-Str. 1, D-60438 Frankfurt

We investigate dilepton production at SIS energies in a transport approach. As a first step, we fix the elementary cocktail composition in vacuum via dilepton data from nucleon-nucleon and light nucleus-nucleus collisions, where particular attention is drawn to the contributions of baryonic resonances. Furthermore, we investigate the density and system-size dependence of dileptonic observables and discuss the influence of in-medium spectral functions on dilepton spectra from heavy-ion collisions.
Supported by the Hessian LOEWE initiative through the Helmholtz International Center for FAIR (HIC for FAIR) and HGS-HIRe.

HK 4.4 Mo 12:00 HSZ-204

Studies of dilepton production with the UrQMD transport model — •Stephan Endres[1,2] and Marcus Bleicher[1,2] — [1]Institut für Theoretische Physik, Universität Frankfurt, Max-von-Laue-Str. 1, D-60438 Frankfurt — [2]Frankfurt Institute for Advanced Studies (FIAS), Ruth-Moufang-Str. 1, D-60438 Frankfurt

We present our ongoing studies of dilepton production within the UrQMD transport approach, with focus on SIS energies. Resulting invariant mass, transverse momentum and rapidity spectra for elemen-

tary and heavy-ion collisions are compared to available data. Dilepton contributions from the different production channels and respective cross-sections are investigated in detail. A special focus is set on the ρ-meson properties and its production, as it is assumed to significantly change its spectral function in the medium. We also calculated dilepton spectra using thermal emission from a coarse grained version of UrQMD for heavy-ion collisions. For this we accumulate an ensemble of events, determine local temperature and chemical potential in small space-time cells and directly calculate thermal emission rates. By this we avoid some problems of the hadronic transport approach, as the restriction to two-particle processes and baryon resonance interactions in the medium with unknown cross-sections and branching ratios. The outcome is compared with the pure transport results.
Supported by BMBF and the Hessian LOEWE initiative through the Helmholtz International Center for FAIR (HIC for FAIR).

HK 4.5 Mo 12:15 HSZ-204

Reconstruction of rare hadronic signals in Au+Au at 1.23 A GeV with HADES — •Manuel Lorenz for the HADES-Collaboration — Goethe-Universität, Frankfurt am Main

In April 2012 the HADES collaboration collected data of the long planned heavy-ion experiment Au+Au. A gold beam with a kinetic energy of 1.23A GeV was impinged on a 15-fold-segmented target with an average intensity of about 10^6 ions per second. In total $7*10^9$ events corresponding to a raw data volume of 140 TB were collected with a peak data rate of 8 kHz. These numbers specify a totally new era for GSI heavy-ion experiments giving new demands on the analysis procedures and computing resources.

Besides dileptons, hadrons containing strangeness are promising probes of the hot and dense phase as they are produced below their free NN-threshold and hence have a steep excitation function. Preliminary results including signals of all relevant particles containing strangeness ($K^{+-}, K^0_s, \Lambda, \Phi$) which we will present in this contribution are very promising and well beyond our expectations.

Supported by BMBF (06FY9100I and 06FY7114), HIC for FAIR, EMMI, GSI and HGS-Hire

HK 4.6 Mo 12:30 HSZ-204

Symmetry Energy Dependence of Light Fragment Production in Heavy Ion Collisions — Malgorzata Zielinska-Pfabe[1], Piotr Decowski[1], Maria Colonna[2], Remi Bougault[3], and •Hermann Wolter[4] — [1]Smith Coll., Northhampton, Mass 01063, USA — [2]LNS, INFN, I-95123 Catania, Italy — [3]LPC Caen, F-14050 Caen Cedex, France — [4]Univ. Munich, D-85748 Garching, Germany

The nuclear symmetry energy depends both on the density and on momentum, expressed by the difference in neutron and proton effective masses. Both behaviors are not well known microscopically and are investigated in heavy ion collisions. Here we discuss sensitive observables in a region of densities around saturation density. Of interest has been the emission (yields, spectra) of neutrons and protons. We extend these investigations to light fragments, in particular to $t/^3He$ ratios. We perform stochastic transport calculations of collisons of different Xe+Sn isotopes in the energy range of 32-150 AMeV with variation of the symmetry energy potential and the effective masses, and compare to preliminary INDRA data. We find, in particular, that the spectra of single n/p and $t/^3He$ ratios are promising to disentagle the density and momentum dependence of the symmetry energy.

HK 5: Struktur und Dynamik von Kernen

Zeit: Montag 11:00–12:45 Raum: HSZ-301

Gruppenbericht HK 5.1 Mo 11:00 HSZ-301

Dipole response of ^{60}Ni below 10 MeV: A new experimental signature for the Pygmy Dipole Resonance — •Marcus Scheck — IKP, TU Darmstadt, Darmstadt, Germany

A campaign of photon-scattering experiments off the semi-magic nucleus ^{60}Ni has been performed. The nucleus was investigated using continuous bremstrahlung photons with end-point energies of 6.0, 8.0, and 9.9 MeV and quasi-monochromatic, fully-polarized, Compton-backscattered laser photons in the entrance channel of the (γ, γ') reaction. The corresponding measurements were conducted at the DHIPS setup located at the S-DALINAC accelerator in Darmstadt and the photon scattering setup at HI$\vec{\gamma}$S facility at TUNL.

The observed experimental quantities, such as for example, angular distribution ratios and scattering cross sections allowed to deduce a detailed picture of photo excited spin-1 states of positive and negative parity. A comparison with the previously studied isotope ^{58}Ni reveals the evolution of the E1 Pygmy Dipole Resonance (PDR) in these almost N=Z nuclei. Exploiting the quasi-monochromacy of the Compton-backscattered beams at TUNL a detailed picture of the decay behavior of the photo-excited spin-1 states can be drawn. A change of the integral branching ratios, together with the distribution of final levels of those decays to lower-lying levels with excitation energy is interpreted as a new signature for the wave functions of 1^- levels to be dominated either by PDR or Giant Dipole Resonance components.
Funding by the DFG within the SFB634 is gratefully acknowledged.

HK 5.2 Mo 11:30 HSZ-301

Zerfallsverhalten der tiefliegenden Dipolstärke im nichtmagischen Kern ^{94}Mo* — •Christopher Romig[1], Jacob Beller[1], Nadia Benouaret[1], Matthias Fritzsche[1], Johann Isaak[2,3], Norbert Pietralla[1], Vladimir Yu. Ponomarev[1], Deniz Savran[2,3], Marcus Scheck[1], Linda Schnorrenberger[1], Andreas Zilges[4] und Markus Zweidinger[1] — [1]Institut für Kernphysik, Technische Universität Darmstadt — [2]ExtreMe Matter Institute EMMI and Research Division, GSI, Darmstadt — [3]Frankfurt Institute for Advanced Studies, FIAS, Frankfurt am Main — [4]Institut für Kernphysik, Universität zu Köln

Die tiefliegende Dipolstärke des Kerns ^{94}Mo wurde mit Hilfe von Kernresonanzfluoreszenz-Messungen mit Bremsstrahlungsphotonen am S-DALINAC in Darmstadt, sowie mit linear polarisierten quasi-monoenergetischen Photonen an der High Intensity γ-Ray Source (HIγS) an der Duke University in Durham, NC, untersucht.
Aus den Messungen an HIγS wurden mittlere Verzweigungsverhältnisse in den Grundzustand für 300 keV breite Anregungsintervalle extrahiert. Die Verzweigungsverhältnisse weisen eine resonanzartige Erhöhung bei 6-7 MeV, also in der Energieregion der Pygmy Dipol Resonanz, auf. Sie werden mit Simulationen basierend auf dem statistischen Modell verglichen, die mit Hilfe des DICEBOX Codes durchgeführt wurden.
Die Verzweigungsverhältnisse sowie weitere Ergebnisse der Messungen werden vorgestellt und diskutiert.
* Gefördert durch die DFG im Rahmen des SFB 634.

HK 5.3 Mo 11:45 HSZ-301

$\pi(2p_{1/2} \rightarrow 2p_{3/2})$ **M1 Proton-Spin-Flip Übergang in ^{87}Rb** — •Christian Stahl[1], Jörg Leske[1], Philipp R. John[2,3], Norbert Pietralla[1] und Georgi Rainovski[4] — [1]Institut für Kernphysik, TU Darmstadt, Schlossgartenstr. 9, 64289 Darmstadt — [2]Dipartimento di Fisica e Astronomia, Universit degli Studi di Padova, 35122 Padova, Italien — [3]INFN Sezione di Padova, 35122 Padova, Italien — [4]Physics Faculty, St.Kliment Ohridski Univ., Sofia, Bulgarien

Im Experiment U246 wurde am UNILAC-Beschleuniger der GSI bei Coulomb-Schwellen-Energien Proton-Pick-up-Reaktionen eines ^{86}Kr-Strahls an einem Kohlenstofftarget mit hochauflösender Gammaspektroskopie mit HPGe-Cluster-Detektoren beobachtet. Wir haben die Lebensdauer des 845keV-Übergangs zum $3/2^-$ Grundzustand von ^{87}Rb mithilfe der Doppler-shift attenuation method (DSAM) zu 146^{+13}_{-16} fs bestimmt. Dies entspricht einer reduzierten Übergangswahrscheinlichkeit von $B(M1) \downarrow = 0.644^{+0.075}_{-0.053}\ \mu_n^2$. Der Vergleich mit dem in einem (γ, γ')-Experiment bestimmten Wert von $B(M1) \uparrow = 0.34(5)\ \mu_n^2$ [1] legt den Spin $J = 1/2$ des angeregten Zustands fest. Zusammen mit dem bekannten Bahndrehimpuls $l = 1$ kann der $1/2^- \rightarrow 3/2^-$ Übergang als der Proton $p_{1/2} \rightarrow p_{3/2}$ Spin-Flip Übergang identifiziert werden.
Gefördert durch das BMBF unter 05P09RDFN4 und 05P12RDFN8.

[1] L. Käubler et al., Phys. Rev. C 65, 054315 (2002)

HK 5.4 Mo 12:00 HSZ-301

Dipolstärkeverteilung und Quenching in ^{48}Ca aus Protonenstreuung unter extremen Vorwärtswinkeln — •Jonny

Birkhan[1], Hiroaki Matsubara[2], Peter von Neumann-Cosel[1], Norbert Pietralla[1], Iryna Poltoratska[1], Achim Richter[1] und Atsushi Tamii[2] — [1]Institut für Kernphysik, TU Darmstadt, Germany — [2]RCNP, Osaka University, Japan

Die inelastische Protonenstreuung unter extremen Vorwärtswinkeln stellt ein leistungsfähiges Verfahren dar, um $E1$- und $M1$-Anregungen mit hoher Energieauflösung zu untersuchen, wie kürzlich am ^{208}Pb gezeigt [1]. Daten aus einem ^{48}Ca(p, p′)-Experiment [2] im Energiebereich 5 - 26 MeV werden derzeit analysiert. Die Winkelverteilungen der Wirkungsquerschnitte werden nach $E1$-, $E2$- und $M1$-Beiträgen entfaltet. Die hierfür nötigen Übergangsamplituden liefern QRPA-Rechnungen. Aus der B(E1)-Verteilung wird die Polarisierbarkeit und daraus die Dicke der Neutronenhaut ermittelt. Diese Größen erlauben es zusammen mit dem Ergebnis für ^{208}Pb, zwischen verschiedenen Modellen zu unterscheiden, die eine Korrelation zwischen beiden Größen vorhersagen [1]. Darüber hinaus wird die $M1$-Stärke für den prominenten Spin-Flip Übergang bei 10,2 MeV bestimmt. Dies erlaubt die Klärung der widersprüchlichen Resultate aus (e,e')- und (γ,n)-Experimenten [3][4]. Gefördert von der DFG im Rahmen des Projekts NE 679/3-1. – [1] A. Tamii, et al., Phys. Rev. Lett. 107 (2011) 062502. [2] H. Matsubara, PhD thesis, Osaka University, Japan (2009). [3] W. Steffen, Dissertation, TU Darmstadt (1984). [4] J.R. Tompkins et al, Phys. Rev. C 84, 044331 (2011).

HK 5.5 Mo 12:15 HSZ-301

Inelastic Proton Scattering on ^{96}Ru — •Andreas Hennig[1], Michael Elvers[1,2], Janis Endres[1], Andreas Heinz[2], Desiree Radeck[1,2], Deniz Savran[3,4], Volker Werner[2], and Andreas Zilges[1] — [1]Institute for Nuclear Physics, University of Cologne — [2]Wright Nuclear Structure Laboratory, Yale University — [3]Extreme Matter Institute EMMI and Research Division, GSI Darmstadt — [4]Frankfurt Institute for Advanced Studies FIAS, Frankfurt

Low-lying collective excitations in near-spherical nuclei are usually interpreted in terms of multiphonon excitations. Especially for the coupling of a quadrupole and an octupole phonon, one expects a high degree of harmonicity compared to quadrupole-quadrupole and octupole-octupole couplings. In ^{96}Ru, a candidate for the $(2^+ \otimes 3^-)_{1^-}$ has been identified recently based on its energy [1] but experimental information of its decay properties are still sparse. Since in an inelastic proton scattering experiment the coincident detection of the scattered proton and the deexciting γ-ray yields additional information on the excitation energy, a ^{96}Ru(p,p′γ) experiment has been performed at WNSL, Yale, to investigate multiphonon excitations in ^{96}Ru. The level scheme could be significantly extended and new branching ratios have been determined. First experimental results will be presented and compared to the vibrational model.

Supported by the DFG (ZI-510/4-2) and US DOE Grant No. DE-FG02-01ER40609. A.H. is member of the Bonn-Cologne Graduate School of Physics and Astronomy.

[1] A. Linnemann *et al.,* Phys. Rev. C **72** (2005).

HK 5.6 Mo 12:30 HSZ-301

Puzzle of B(E2) strengths of the symmetric and mixed-symmetry 2^+ states in ^{94}Zr — •Abdulrahman Scheikh Obeid, Andreas Krugmann, Peter von Neumann-Cosel, Norbert Pietralla, Iryna Poltoratska, and Vladimir Ponomarev — Institut f"ur Kernphysik, TU Darmstadt, Germany

Recently, Elhami et al. [1] reported on a study of the low-spin structure of ^{94}Zr with the (n, n', γ) reaction. The author claimed observation of an anomalous situation where the E2 excitation strength of the mixed-symmetry 2_2^+ exceeds the strength of the symmetric 2_1^+ state. Those excitations of ^{94}Zr have been investigated with electron scattering at the S-DALINAC and a model-independent analysis of our (e, e') data has been performed. The extracted ratio of the E2 strengths, $B(E2, 0_1^+ \rightarrow 2_{\rm ms}^+)/B(E2, 0_1^+ \rightarrow 2_1^+)$ is less than the unity, which contradicts the (n, n', γ) results. The data Analysis the results will be presented. The same analysis has been applied to a set of electron scattering data on ^{94}Mo. The ratio of the of B(E2) strengths of the symmetric and mixed-symmetry 2^+ states in ^{94}Mo and their transition radius difference have been extracted for the first time.

[1] E. Elhami et al., Phys. Rev. C **78**, 064303 (2008).

HK 6: Hadronenstruktur und -spektroskopie

Zeit: Montag 11:00–13:00 Raum: HSZ-304

Gruppenbericht HK 6.1 Mo 11:00 HSZ-304

Measurement of charged decays of the η meson with WASA-at-COSY — •Daniel Coderre for the WASA-at-COSY-Collaboration — Forschungszentrum Jülich, Germany

The WASA-at-COSY experiment is a 4-π detector installed at the COSY storage ring at the Jülich Research Center. The detector is designed to measure decays of light mesons in hadronic interactions and is capable of measuring both charged and neutral decay products. This presentation will focus on a data sample of 3×10^7 η-mesons which were collected in the $pd \rightarrow {}^3He\eta$ reaction.

Precision studies of decays of the η meson allow probes of symmetry-breaking reactions as well as precise tests of theoretical calculations. The current analysis is focused on charged decays of the η, including the anomalous decays $\eta \rightarrow \pi^+\pi^-\gamma$ and $\eta \rightarrow \pi^+\pi^-e^+e^-$ as well as the leptonic reactions $\eta \rightarrow e^+e^-\gamma$ and $\eta \rightarrow e^+e^-e^+e^-$. The primary goal of the analysis is a precise and consistent measurement of the branching ratios of these channels. Additionally the electromagnetic transition form factor in the reaction $\eta \rightarrow e^+e^-\gamma$ and the dihedral angle in $\eta \rightarrow \pi^+\pi^-e^+e^-$, which is an observable for possible CP-violation outside the standard model, are measured. The C-violating reaction $\eta \rightarrow \pi^0e^+e-$ is also analyzed in an attempt to improve the experimental upper limit on its branching ratio. Results of these analyses will be presented.

This work is supported by COSY-FFE.

HK 6.2 Mo 11:30 HSZ-304

Messung des differentiellen und totalen Wirkungsquerschnitts der η'-Photoproduktion an MAMI — •Patrik Ott für die A2-Kollaboration — Institut für Kernphysik, Universität Mainz, Germany

Am Crystal-Ball (CB) Experiment am Elektronenstrahl-Beschleuniger MAMI in Mainz werden Nukleonen und weitere Hadronen mittels eines reellen Photonenstrahls untersucht. Mit der neuen Beschleunigerstufe, MAMI-C, steht ein intensiver polarisierter Strahl mit einer Energie von bis zu 1,604GeV zur Verfügung. Zur Energiemarkierung von Bremsstrahlungsphotonen mit den höchsten Energien wurde ein neues Spektrometer in Betrieb genommen (Endpunkt-Tagger). Damit konnte die η'-Photoproduktion von der Schwelle $E_\gamma = 1{,}447GeV$ bis $E_\gamma = 1{,}59GeV$ erstmals an MAMI studiert werden. Die η'-Mesonen wurden über den Zerfall $\eta' \rightarrow \eta\pi^0\pi^0 \rightarrow 6\gamma$ identifiziert. Ich präsentiere in diesem Vortrag vorläufige Ergebnisse der Messung des differentiellen und totalen Wirkungsquerschnitts der η'-Photoproduktion.

HK 6.3 Mo 11:45 HSZ-304

Narrow Structure in η-Photoducion off ^{2}H and ^{3}He — •Lilian Witthauer and Dominik Werthmüller for the A2-Collaboration — Department of Physics, University of Basel, Switzerland

Large efforts have been made in the last years to investigate the complicated excitation spectrum of the nucleons. Especially η-Photoproduction has been studied by many collaborations. Experiments at CBELSA/TAPS and GRAAL revealed a bump-like structure in the quasi-free η-Photoproduction on the neutron, which is not seen on the proton (I. Jaeglé et al., PRL 100 (2008), V.Kuznetsov et al., PLB 647 (2007)).

To examine this structure high statistics experiments using the A2 detector setup with the Crystal Ball calorimeter and the TAPS detector at the electron acceleration facility MAMI have been carried out. To exclude any possibility that the structure could arise from nuclear effects, η-photoproduction in coincidence with recoil nucleons has been measured on two different targets, namely ^{2}H and ^{3}He.

This talk gives an overview over the final results on quasi-free inclusive and exclusive η-Photoproduction off quasi-free protons and neutrons.

Supported by Swiss National Fund and DFG.

HK 6.4 Mo 12:00 HSZ-304

Measurement of $\sigma_{1/2}$ and $\sigma_{3/2}$ in Photoproduction of η and $2\pi^0$ Mesons off Protons and Neutrons — •Manuel Dieterle for the CBELSA/TAPS-Collaboration — Department of Physics, University of Basel, Klingelbergstrasse 82, 4056 Basel, Switzerland

The excitation spectrum of meson photoproduction consists of many broad and overlapping nucleon resonances. The identification of the relevant amplitudes and therefore of the quantum numbers of a prospective nucleon resonance requires the measurement of single and double polarisation observables. Due to the different isospin dependence of the electromagnetic interactions the resonance contributions to the cross sections on the proton differ from those on the neutron. Whereas in the case of the free proton the experimental programs are already well established, new programs using deuterated butanol as neutron targets are running in parallel at the electron accelerator facilities MAMI in Mainz and ELSA in Bonn.

We will present preliminary results of an experiment with the Crystal-Barrel/TAPS setup at ELSA using a longitudinally polarised deuterated butanol target and a circularly polarised tagged photon beam. The measurement of the helicity dependent cross sections $\sigma_{1/2}/\sigma_{3/2}$ (photon and target spin antiparallel/parallel), allows a first interpretation of the resonance contributions.

Supported by Swiss National Fund and DFG

HK 6.5 Mo 12:15 HSZ-304

Status of the Investigations of the $I(J^P) = 0(3^+)$ Resonance Structure in the Two-Baryon-System*. — •Mikhail Bashkanov for the WASA-at-COSY-Collaboration — Physikalisches Institut der Universität Tübingen

The double-pionic fusion reaction $pn \to d\pi^0\pi^0$ has been observed [1] to be dominated by a resonance structure at $\sqrt{s} = 2.37$ GeV with $\Gamma \approx 70$ MeV and $I(J^P) = 0(3^+)$, which is tightly correlated with the so-called ABC effect, an intriguing low-mass enhancement in the spectrum of the $\pi\pi$ inavriant mass. In order to reveal the nature of this structure we have measured its possible decay channels $d\pi^+\pi^-, pp\pi^0\pi^-, np\pi^0\pi^0, NN\pi$ and pn by pd collisions in the quasi-free reaction mode utilizing WASA at COSY.

The isospin decomposition of the $d\pi^+\pi^-$ data confirms that the resonance shows up in the isoscalar ($d\pi^0\pi^0$), but not in the isovector ($d\pi^+\pi^0$) fusion channel.

The $pp\pi^0\pi^-$ data are consistent with a decay branch also into this channel. The impact of this observation onto the vertex formfactor used in the description [1] of the $d\pi^0\pi^0$ channel will be discussed.

The pn decay channel, the *experimentum crucis*, as well as the $np\pi^0\pi^0$ channel have been meausred by use of vector-polarized deuterons in inverse kinematics. The data analysis of this beamtime is in progress, its status will be reported.

[1] P. Adlarson et al., Phys. Rev. Lett. **106** 242302 (2011)
*supported by BMBF and COSY-FFE (FZ Jülich)

HK 6.6 Mo 12:30 HSZ-304

Towards a measurement of the $\omega\pi$ transition form factor — •Farha Anjum Khan for the WASA-at-COSY-Collaboration — Forschungszentrum Juelich, Juelich, Germany

Experiments using the reaction pd→^{3}He ω have been performed with the WASA detector at COSY to determine the transition form factor for the $\omega \to \pi^0 e^+ e^- \to \pi^0\gamma^*$ decay. For the study of the background contributions, an analysis of the real photon case $\omega\to\pi^0\gamma$ and the decay $\omega \to \pi^0\pi^+\pi^-$ is being performed. Using selective conditions the multi-pion background has to be substantially reduced. The number of ω mesons is estimated and cross-checked with the branching ratio of $\pi^0\gamma$ relative to $\pi^0\pi^+\pi^-$. Kinematic fitting is used to improve background suppression. The analysis for the $\omega \to \pi^0 e^+ e^-$ decay is performed with the expectation of less than 40 $\omega \to \pi^0 e^+ e^-$ events after reasonable suppression of the multi-pion background and subtraction of the in-peak contributions from other ω decays. As an initial step towards a form factor measurement the branching ratio for $\omega \to \pi^0 e^+ e^-$ is estimated, providing a first hint at the size of the from factor.

HK 6.7 Mo 12:45 HSZ-304

Measuring the relative branching ratio and the E_γ-distribution of $\eta \to \pi^+\pi^-\gamma$ with WASA-at-COSY — Daniel Lersch[1] and •Frank Goldenbaum[1,2] — [1]Jülich Center for Hadron Physics, Forschungszentrum Jülich — [2]Bergische Universität Wuppertal, FB C

The decay channel $\eta \to \pi^+\pi^-\gamma$ provides the opportunity to study QCD anomalies at the chiral limit. The decay width and the shape of the E_γ-distribution of this channel are sensitive to the box anomly term which is part of the Wess-Zumino-Witten-(WZW) Lagrangian. However, the theoretically predicted decay width and E_γ-distribution do not agree with the experimental results, if final state interactions are not included by unitarized extensions of the WZW-Lagrangian. The experimental observables for testing these extensions are (i) the (relative) branching ratio (done by CLEO and KLOE) and (ii) the distribution of the photon energy E_γ.

In order to measure both observables in one experiment, the WASA-at-COSY collaboration has measured the reaction $pp \to pp[\eta \to \pi^+\pi^-\gamma]$. The status on reconstructing this channel will be presented together with results on the channel $\eta \to \pi^+\pi^-\pi^0$ which is a major component of the background to the channel of interest, and is needed to normalise the measured partial width. In this presentation the methods and preliminary results will be presented.

HK 7: Astroteilchenphysik

Zeit: Montag 11:00–12:30 Raum: HSZ-401

Gruppenbericht HK 7.1 Mo 11:00 HSZ-401

Statusbericht für das COBRA Experiment — •Jan Tebrügge für die COBRA-Kollaboration — Experimentelle Physik IV, TU Dortmund

Das COBRA Experiment sucht nach dem neutrinolosen doppel-beta Zerfall in CdZnTe Halbleiterdetektoren, insbesondere von Cd-116 und Te-130.

Der Nachweis dieses Zerfalls könnte klären, ob Neutrinos Dirac- oder Majorana-Teilchen sind, außerdem wäre die Bestimmung der effektiven Majorana-Masse der Neutrinos möglich.

Im Vortrag werden die beiden Detektortechnologien Coplanar Grid (CPG) und pixellierte Detektoren gezeigt, die parallel erforscht werden. Im aktuellen R&D Aufbau im Gran Sasso Untergrundlabor sind Coplanar Grid Detektoren seit längerem im Einsatz, außerdem sind verschiedene pixellierte Detektoren in Testaufbauten untersucht worden. Des Weiteren werden die Fortschritte des Experiments, u.a. der verbesserte Aufbau und die großen Potentiale der Untergrundreduktion bei Pixeldetektoren und durch Pulse Shape Analyse bei den CPG-Detektoren vorgestellt.

Abschließend werden in einem Ausblick die zu- künftigen Aktivitäten beschrieben.

HK 7.2 Mo 11:30 HSZ-401

Active volume studies with depleted and enriched BEGe detectors — •Katharina von Sturm for the GERDA-Collaboration — Eberhard Karls Universität Tübingen, Germany — Universitá degli Studi di Padova, Italy

The Gerda experiment is currently taking data for the search of the $0\nu\beta\beta$ decay in ^{76}Ge. In 2013, 30 newly manufactured Broad Energy Germanium (BEGe) diodes will be deployed which will double the active mass within Gerda. These detectors were fabricated from high-purity germanium enriched in ^{76}Ge and tested in the HADES underground laboratory, owned by SCK·CEN, in Mol, Belgium.

As the BEGes are source and detector at the same time, one crucial parameter is their active volume which directly enters into the evaluation of the half-life. This talk will illustrate the dead layer and active volume determination of prototype detectors from depleted germanium as well as the newly produced detectors from enriched material, using gamma spectroscopy methods and comparing experimental results to Monte-Carlo simulations. Recent measurements and their results will be presented and systematic effects will be discussed.

This work was partly supported by the German BMBF.

HK 7.3 Mo 11:45 HSZ-401

Computational studies of BEGe detectors — •Marco Salathe — Max Planck Institut für Kernphysik, Heidelberg, Germany

The GERDA experiment searches for the neutrinoless double beta decay within the active volume of germanium detectors. Simulations of the physical processes within such detectors are vital to gain a better understanding of the measurements. The simulation procedure follows three steps: First it calculates the electric potential, next it simulates the electron and hole drift within the germanium crystal and finally it generates a corresponding signal.

The GERDA collaboration recently characterized newly produced Broad Energy Germanium Detectors (BEGe) in the HADES underground laboratory in Mol, Belgium. A new pulse shape simulation library was established to examine the results of these measurements. The library has also proven to be a very powerful tool for other applications such as detector optimisation studies.

The pulse shape library is based on ADL 3.0 (B. Bruyneel, B. Birkenbach, http://www.ikp.uni-koeln.de/research/agata/download.php) and m3dcr (D. Radford, http://radware.phy.ornl.gov/MJ/m3dcr).

HK 7.4 Mo 12:00 HSZ-401

Consistency check of Pulse Shape Discrimination for Broad Energy Germanium Detectors using double beta decay data — •Heng-Ye Liao for the GERDA-Collaboration — Max-Planck-Institut für Physik, München

The Gerda (GERmanium Detector Array) experiment was built to study fundamental neutrino properties via neutrinoless double beta decay ($0\nu\beta\beta$). $0\nu\beta\beta$ events are single-site events (SSE) confined to a scale about millimeter. However, most of backgrounds are multi-site events (MSE). Broad Energy Germanium detectors (BEGes) offer the potential merits of improved pulse shape recognition efficiencies of SSE/MSE. They allow us to reach the goal of Phase II with a background index of 10^{-3} cts/(keV·kg·yr) in the ROI. BEGe detectors with a total target mass of 3.63 kg have been installed to the Gerda setup in the Laboratori Nazionali del Gran Sasso (LNGS) in July 2012 and are collecting data since. A consistency check of the pulse shape discrimination (PSD) efficiencies by comparison of calibration data and $2\nu\beta\beta$ data will be presented. The PSD power of these detectors is demonstrated.

HK 7.5 Mo 12:15 HSZ-401

Pulse shape discrimination studies of Phase I Ge-detectors — •Andrea Kirsch for the GERDA-Collaboration — MPI für Kernphysik, Saupfercheckweg 1, 69117 Heidelberg

The GERmanium Detector Array experiment aims to search for the neutrinoless double beta decay ($0\nu\beta\beta$) of ^{76}Ge by using isotopically enriched germanium crystals as source and detector simultaneously. The bare semiconductor diodes are operated in liquid argon at cryogenic temperatures in an ultra-low background environment.

In addition, Gerda applies different active background reduction techniques, one of which is pulse shape discrimination studies of the current Phase I germanium detectors. The analysis of the signal time structure provides an important tool to distinguish single site events (SSE) of the $\beta\beta$-decay from multi site events (MSE) of common gamma-ray background or surface events. To investigate the correlation between the signal shape and the interaction position, a new, also to the predominantly deployed closed-ended coaxial HPGe detectors applicable analysis technique has been developed.

A summary of the used electronic/detector assembly is given and will be followed by a discussion of the performed classification procedure by means of accurate pulse shape simulations of $0\nu\beta\beta$-like signals. Finally, the obtained results will be presented along with an evaluation of the relevance for the Gerda experiment.

HK 8: Nukleare Astrophysik

Zeit: Montag 11:00–12:45 Raum: HSZ-403

Gruppenbericht HK 8.1 Mo 11:00 HSZ-403

Nuclear Astrophysics at the R^{3}B/LAND setup* — •Tanja Heftrich for the R3B-Collaboration — Goethe-Universität Frankfurt a. M., Germany — GSI Helmholtzzentrum für Schwerionenforschung GmbH, 64291 Darmstadt, Germany

One aim of nuclear astrophysics is the understanding of the nuclear processes leading to the synthesis of elements. Isotopic abundances up to iron mainly result from fusion in stars, whereas heavier nuclei are synthesized by the slow and the rapid neutron capture processes. The synthesis of the rare p nuclei remains an interesting puzzle.
The nuclear physics of stellar nucleosynthesis can be studied using the R^{3}B/LAND setup. Important astrophysical reactions on radioactive nuclei can be constrained using Coulomb excitation at beam energies around 500 MeV/u. Furthermore, it is possible to determine the corresponding inverse reactions using the detailed balance theorem.
This contribution will present the experimental setup including the different detectors as well as the procedure of analysis of the kinematically complete measurements at the R^{3}B/LAND setup and some recent results relevant for different astrophysical scenarios.
*supported by Helmholtz International Center for FAIR, DFG (SO907/1-2), Helmholtz Graduate School for Hadron and Ion Research "HGS-HIRe for FAIR", Helmholtznachwuchsgruppe VH-NG-327 and BMBF (06FY71051)

HK 8.2 Mo 11:30 HSZ-403

Neutron-Capture Reactions with the R^{3}B-CaveC Setup — •Marcel Heine for the R3B-Collaboration — IKP, TU Darmstadt

Recent research has shown that the (n,γ) transition-rates on light nuclei can have an influence on the neutron-balance during the r-process. Especially neutron rich carbon isotopes play an important role in r-process nucleosynthesis network calculations which include light nuclei, since these nuclei are aligned along major flow-paths. In particular ^{18}C is of interest, because it can be interpreted as a waiting point. The ^{17}C(n,γ)^{18}C rate could so far only be estimated theoretically and has an uncertainty of a factor of ten [1]. At the R^{3}B-CaveC setup at GSI we have measured the (n,γ) time reversed reaction, i.e. ^{18}C(γ,n)^{17}C for the above mentioned nucleus, via the Coulomb-breakup of ^{18}C beam. The kinematically complete measurement allows extracting the energy dependent neutron-capture cross section with respect to the excitation energy by using the invariant-mass method. Results and the strategy for further analysis will be presented.

This work is supported by the HIC for FAIR project.
[1] T. Sasaqui et al., APJ 634 (2005) 1173

HK 8.3 Mo 11:45 HSZ-403

Proton-induced knockout reactions with light radioactive beams at R^{3}B — •Leyla Atar for the R3B-Collaboration — TUD, Schlossgartenstr.9, 64289 Darmstadt, Germany

Proton-induced knockout reactions are one of the main goal of the experimental program at the future R3B (Reactions with Relativistic Radioactive Bemas) Experiment at FAIR. It allows us to obtain spectroscopic information about valence and deeply bound single-nucleon states and to study their evolution over a large variation in isospin. Recent studies have shown that the occupancies of loosely bound valence nucleons in neutron- or proton-rich nuclei have a spectroscopic factor close to unity, whereas single-particle strength for deeply bound nucleons is suppressed in isospin asymmetric systems compared to the predictions of the many-body shell model. Further experimental and theoretical studies are needed for a qualitative and quantitative understanding. For this aim a series of measurements have been performed on the complete oxygen isotopic chain using the existing experimental setup LAND/R3B at GSI. We will present the main scientific goals, the concepts of the experiment and the preliminary results.
This work is supported by GSI F&E, HIC for FAIR and the BMBF project 06DA70471.

HK 8.4 Mo 12:00 HSZ-403

The ^{152}Sm(p,n) reaction measurements in inverse kinematics — •Moritz Pohl for the S405-Collaboration — Goethe Universität Frankfurt

Under stellar conditions, low-lying excited states in nuclei are in thermal equlibrium with the ground state. If those excited states undergo β-decays with a higher rate than the ground state, the β-decay half-life of this nucleus is dominated by the excited state. The corresponding life-times are extremly difficult to measure directly on earth, since the de-excitation occurs mostly via internal transition.

If the β-decay occurs via the Gamow-Teller transition, charge exchange reactions allow to investigate the decay strength. In order to verify the method of measuring the B(GT) strength of unstable heavy

nuclei via inverse kinematics, the reaction p(^{152}Sm,^{152}Eu)n was used as a test case. This measurement allows to set constraints on the temperature dependent electron capture of ^{152}Eu, which is an important s-process branching point. The s405 experiment took place at the R^{3}B/LAND setup at GSI. A newly developed Low Energy Neutron detector Array (LENA) was used to measure the recoil neutrons, which are emitted at large angles relatively to the incoming beam. To determine the detector response, a GEANT3 simulation was performed. Preliminary results will be presented. This project was supported by the Helmholtz International Center for FAIR, the Helmholtz Young Investigator Group VH-NG-327 and HGS-HIRE.

HK 8.5 Mo 12:15 HSZ-403

Die s-Prozess Verzweigung am Isotop ^{85}Kr* — •Benedikt Thomas[1], Jan Glorius[1], Alexander Koloczek[1], Ralf Plag[1], Marco Pignatari[2], Rene Reifarth[1] und Kerstin Sonnabend[1] für die NuGrid-Kollaboration — [1]Goethe Universität Frankfurt, Deutschland — [2]Universität Basel, Schweiz

Bei Nukleosyntheseprozessen in Sternen sind immer wieder Isotope beteiligt, die metastabile Zustände besitzen. Diese Isomere können die Bildungswahrscheinlichkeiten der nachfolgenden Isotope stark beeinflussen. In aktuellen Simulationen sind Isomere nicht oder nur sehr vereinfacht eingebaut. Dadurch können zum Teil große Fehler für die relativen Häufigkeiten der Isotope auftreten. Um solche Isomere zu implementieren, benötigt man zusätzliche Raten für die thermische Anregung und den internen Zerfall, sowie alle anderen Reaktionsraten, die das Isomer betreffen. Sind diese Raten bekannt oder können ermittelt werden, kann durch die entsprechende Programmierung dieser Raten die Genauigkeit der Simulation von Nukleosyntheseprozessen deutlich verbessert werden. Die Auswirkungen einer solchen Implementierung wird am Beispiel des Verzweigungskerns ^{85}Kr im s-Prozess und dessen Isomer ^{85m}Kr gezeigt.

*Diese Projekt wird gefördert durch das EuroGENESIS Projekt MASCHE, DFG (SO907/1-2), Helmholtz International Center for FAIR, die Helmholtznachwuchsgruppe VH-NG-327 und HGS-HIRe.

HK 8.6 Mo 12:30 HSZ-403

Sensitivitätsstudien für den s-Prozess — •Alexander Koloczek[1], Benedikt Thomas[1], Rene Reifarth[1], Kerstin Sonnabend[1], Marco Pignatari[2] und Christian Ritter[1] für die NuGrid-Kollaboration — [1]Goethe Universität Frankfurt a. M. — [2]Universität Basel

Um die Nukleosynthese während des s-Prozess zu simulieren, benötigt man einerseits Sternmodelle und andererseits ein vollständiges Reaktionsnetzwerk, das mit experimentellen Daten untermauert werden sollte. Die NuGrid Kollaboration hat Programme entwickelt, mit denen zuerst die Sternmodelle und nachträglich die Nukleosyntheseprozesse berechnet werden. Auf diese Weise wird der Rechenaufwand reduziert und der Einfluss unterschiedlicher Reaktionsnetzwerke leicht für das gleiche Sternmodell untersucht werden.

Hier werden systematische Sensitivitätsstudien präsentiert, welche die Auswirkungen von Änderungen des Reaktionsnetzwerks auf die Elementverteilung in Sternen zeigen. Dies hilft dabei entscheidende Reaktionsraten zu identifizieren, die mit hoher Priorität in zukünftigen Experimenten gemessen werden sollten.

Dieses Projekt wurde durch das Helmholtz International Center for FAIR und die Helmholtznachwuchsgruppe VH-NG-327 + HGS-HIRe unterstützt.

HK 9: Instrumentation

Zeit: Montag 11:00–12:45 Raum: HSZ-405

Gruppenbericht HK 9.1 Mo 11:00 HSZ-405

Prototyping the CBM Micro Vertex Detector — •Michal KOZIEL for the CBM-MVD-Collaboration — University of Frankfurt, Frankfurt am Main, Germany

For the reconstruction of Open Charm Hadrons with the CBM experiment a Micro Vertex Detector (MVD) with an excellent resolution of the secondary decay vertex (< 70 μm along the beam axis) is required. To achieve this vertex resolution a material budget of a few 0.1% X0 is mandatory for the individual detector stations positioned downstream in close vicinity to the target. To further reduce the multiple scattering the MVD operates in vacuum.

The need of prototyping and characterizing the CBM-MVD motivated the construction of an advanced device - a beam telescope - giving the opportunity to exercise the following aspects: handling and integration of ultra-thin CMOS sensors on advanced materials like CVD diamond, double sided sensor assembly for ultra-precise tracking, cooling, scalable readout and slow control, development of data analysis framework and first steps towards implementation of tracking algorithms into a FPGA-based hardware.

This group report aims to summarize the activity towards fabrication of the CBM-MVD prototype.

*supported by HIC for FAIR, the GSI Helmholtzzentrum für Schwerionenforschung, BMBF grants 06FY9100I and 06FY7114I, IPHC-Strasbourg

HK 9.2 Mo 11:30 HSZ-405

Recoil Detector Test for the Day-One Experiment at HESR — •Qiang Hu[1,2], Huagen Xu[2], and James Ritman[2] — [1]Institute of Modern Physics,CAS,730000 Lanzhou,China — [2]Forschungszentrum Juelich,52425 Juelich,Germany

The proposed day-one experiment at HESR is a dedicated measurement of antiproton-proton elastic scattering. The aim of the day-one experiment is to determine the elastic differential parameters (total cross section σ_T, the ratio of real to imaginary part of the forward scattering amplitude ρ, and the slope parameter B) by measuring a large range of 4-momentum transfer squared t (0.0008 - 0.1 GeV^2). The conceptual design of the day-one experiment is to measure the elastic scattered antiproton and recoil proton, by a tracking detector in the small polar angle range and by an energy detector near 90°, respectively. The recoil arm covers a maximum polar angle range from 71° to 90° and consists of two silicon strip detectors (76.8 (length)×50.0 (width)×1.0 (thickness) mm^3) and two germanium detectors (80.4 (length)×50.0 (width)×5.0 (11.0) (thickness) mm^3). All detectors are single sided structure with 1.2 mm pitch. The silicon detectors will be used to detect recoil protons with energy up to about 12 MeV and the germanium detectors will be used to detect protons with energy from 12 MeV to 60 MeV. At present, one recoil arm is being constructed and the test for the detectors with radioactive sources is on-going. Preliminary test results indicate that all detectors are operational and work properly. The latest test results of these detectors will be presented.

HK 9.3 Mo 11:45 HSZ-405

Quality Assurance of double-sided silicon strip sensors for Silicon Tracking System in the CBM experiment at FAIR — •Pavel Larionov and Pradeep Ghosh for the CBM-Collaboration — Goethe Universität, Frankfurt am Main

Silicon Tracking System (STS) is the central tracking detector of Compressed Baryonic Matter (CBM) experiment that aims to explore the QCD phase diagram in the region of high net baryonic densities and moderate temperatures.

STS consists of 8 tracking layers of double-sided silicon strip sensors with self-triggered read-out system. The challenge is to cope with high hit rates up to 10 MHz/cm^2, high tracking density, high radiation load up to 1×10^{14} n$_{eq}$/cm^2 and high momentum resolution for the physics case. Hence, the Quality Assurance (QA) procedures become important in the process of building up modules and stations of these sensors. This presentation describes the various QA tests and procedures that need to be performed to identify the viability, performance and efficiency of these sensors for tracking system in CBM experiment.In particular QA in CBM-STS includes visual inspection, bulk and interstrip parameters measurements, sensor efficiency and total signal to noise ratio tests, measurements of irradiated sensors, bonding, low temperature performance and current stability tests. Results of various QA tests of sensor prototypes will be shown.

Supported by HIC for FAIR, HGS-HIRe and H-QM.

HK 9.4 Mo 12:00 HSZ-405

Development of radiation-hard double-sided silicon microstrip sensors for the CBM silicon tracking system —

•Sudeep Chatterji for the CBM-Collaboration — GSI, Darmstadt

We give an overview of the prototypes microstrip sensors fabricated for the CBM Silicon Tracking System at CiS, Erfurt and Hamamatsu, Japan. The full-size sensors are double-sided with double metal and have strips oriented under a stereo angle of $\pm 7.5^0$. Also test structures were produced with orthogonal strips. The strip pitch is 58 μm. The radiation load in the detector is expected to not exceed 1×10^{14} $n_{eq}cm^{-2}$ in several years of operation, after which they would be replaced. The charge collection behaviour of the sensors has been studied in simulations using the TCAD Synopsys package. A design optimization has been worked out to reduce the Equivalent Noise Charge (ENC) and to maximize the breakdown voltage and Charge Collection Efficiency. Various isolation techniques have been explored and a detailed comparison has been studied to optimize the detector performance. An operating scenario for the CBM experimental run has been developed taking into account periods of shutdown, warm maintainance and cold maintainance. Transient simulations have been performed to estimate the charge collection performance of the irradiated detectors and simulations have been verified with experimental data. Supported by EU-FP7 HadronPhysics3 and BMBF.

HK 9.5 Mo 12:15 HSZ-405

Verbesserte ionisierende Strahlenhärte von CMOS Monolithic Active Pixel Sensors* — •Dennis Doering und Michael Deveaux für die CBM-MVD-Kollaboration — Goethe-Universität, Frankfurt

Die Strahlenhärte von monolithischen CMOS-Pixelsensoren (MAPS), wie sie im ILC, im Heavy-Flavour-Tracker von STAR, ITS-Upgrade von ALICE und Mikro-Vertex-Detektor von CBM verwendet werden sollen, ist im vergangenem Jahrzehnt stark verbessert worden. So konnte vor zwei Jahren unter Verwendung eines hochohmigen aktiven Volumens bereits die nichtionisierende Strahlenhärteanforderungen des CBM-Experimentes von $10^{13}n_{eq}/cm^2$ erfüllt werden. Die ionisierende Strahlenhärte von wenigen hundert krad blieb damit als limitierender Faktor offen. Denn pro Strahlendosis von $10^{13}n_{eq}/cm^2$ werden ebenfalls 1 $Mrad$ ionisierende Strahlenbelastung in den Experimenten erwartet. Vor kurzem jedoch wurde ein neuer Prozess verfügbar, der die Strukturgröße von 0.35 μm auf 0.18 μm verringert. Erwartet wird davon neben der Möglichkeit mehr Transistoren in ein Pixel zu integrieren vor allem auch eine verbesserte Strahlenhärte gegen ionisierende Strahlung.
Um dies zu überprüfen, sollen in diesem Beitrag die Ergebnisse der ersten in dem neuen 0.18 μm-Prozess hergestellten Prototypsensoren vorgestellt und ihre ionisierende Strahlenhärte bis zu einer Dosis von 3 $Mrad$ diskutiert werden.
*gefördert durch das BMBF (06FY9099I und 06FY7113I), HIC for FAIR und GSI.

HK 9.6 Mo 12:30 HSZ-405

Integration of the CBM Silicon Tracking System — •Ulrich Frankenfeld — GSI Helmholtzzentrum für Schwerionenforschung GmbH

The Silicon Tracking System of the CBM experiment will be installed into the superconducting dipole magnet, sharing the confined space of about 2 m^3 with the target and the micro-vertex detector, operating in a separate vaccum vessel, and the beam pipe. The STS stations will be surrounded by a thermal enclosure to minimize radiation damage to the silicon sensors.

For the system integration task, a top-down approach has been chosen, starting from the physics requirements of the CBM experiment: interaction rates, radiation environment, tracking aperture and detector segmentation. A functional plan of the STS and its surrounding structural components is being worked out from which the STS system shape is derived and the power need, cooling, the connector and cable space requirements, live span of components, and installation/ repair aspects etc. are determined. The presentation will outline the technological options under study and progress made with the system integration of CBM's central detector.

Supported by EU-FP7 HadronPhysics3, CRISP, BMBF, GSI, JINR and ROSATOM.

HK 10: Instrumentation

Zeit: Montag 11:00–13:00 Raum: WIL-A221

HK 10.1 Mo 11:00 WIL-A221

The CBM Time of Flight wall Free-streaming Readout — •Pierre-Alain Loizeau and Norbert Herrmann for the CBM-Collaboration — Physikalisches Institut der Universität Heidelberg

The Compressed Baryonic Matter (CBM) experiment is planned to start operating in 2018 at the Facility for Antiproton and Ions Research (FAIR) in Darmstadt, Germany. This fixed target experiment will start taking data with incident beams of 2 to 11 AGeV for Au and up to 29 GeV for protons. Due to the high interaction rate of up to 10MHz, triggered systems would face some limitations and most detectors will have a free-streaming readout. Charged hadrons identification is provided by a Time of Flight wall based on MRPC detectors with a free-streaming readout chain including data reduction and aggregation.

As all input signals need to be transported, the bandwidth between each pair of elements of the readout is important. Studies of input and data rates at different levels were done with realistic detector design.

Two recent hardware developments were made on the digitizer part of the readout chain. A free-streaming mode for the HADES TRB3 board is developed. This allows to use the advantages of FPGA TDC in terms of channels per chip and time resolution. The first iteration of the GET4 TDC chip is also now available and was tested in beam with RPC prototypes in November 2012 at GSI Darmstadt.

Results from this beamtime and later tests will be presented. This includes a comparison between data selection based on a synchronization with a triggered system and selection based on the data themselves.

Supported by EU/FP7 WP2 and BMBF 06HD9121I.

HK 10.2 Mo 11:15 WIL-A221

A Readout System for the PANDA MVD Trapezoidal Silicon Strip Sensors — •Dariusch Deermann[1], James Ritman[1], Tobias Stockmanns[1], Marius Mertens[1], Simone Esch[1], Robert Schnell[2], Hans-Georg Zaunick[2], and Sebastian Krah[3] for the PANDA-Collaboration — [1]IKP-1, Forschungszentrum Jülich, Wilhelm-Johnen-Straße, 52428 Jülich — [2]II. Physikalisches Institut, Justus-Liebig-Universität Gießen, Heinrich-Buff-Ring 16, 35392 Gießen — [3]Helmholtz-Institut für Strahlen- und Kernphysik, Rheinische Friedrich-Wilhelms-Universität Bonn, Nussallee 14-16, 53115 Bonn

The $\overline{\text{P}}$ANDA-experiment will be one of the main experiments inside the upcoming Facility for Antiproton and Ion Research (FAIR) at the GSI in Darmstadt. The fixed target experiment will explore $\overline{\text{p}}$p annihilation in the charm mass region with intense, phase space cooled beams with momenta between 1.5 and 15 GeV/c.

The innermost subdetector of $\overline{\text{P}}$ANDA will be the Micro Vertex Detector (MVD) and consists of silicon strip and pixel detectors.

In order to operate and test the first trapezoidal strip sensor prototypes of the MVD, a readout system has to be prepared. Therefore a supply board, an ADC-card and sensor board for the trapezoidal strip sensors are necessary to operate the sensors together with the existing Juelich Digital Readout System.

In this talk the adaption of the Juelich Digital Readout System for the trapezoidal silicon strip sensors will be presented.

HK 10.3 Mo 11:30 WIL-A221

Upgrade of the Juelich Digital Readout System for $\overline{\text{P}}$ANDA development — •Simone Esch, Marius C. Mertens, Tobias Stockmanns, and James Ritman for the PANDA-Collaboration — IKP Forschungszentrum Jülich

The $\overline{\text{P}}$ANDA detector is one of the main experiments at the upcoming Facility for Antiproton and Ion Research in Darmstadt (FAIR). The fixed target experiment will explore $\overline{\text{p}}$p annihilation with intense, phase space cooled beams with momenta between 1.5 and 15 GeV/c. For the development of the Micro Vertex Detector (MVD), the innermost tracking detector of $\overline{\text{P}}$ANDA, the evaluation of prototypes and detector parts is very important. Different prototypes of the pixel front-end chip ToPix (Torino Pixel) need to be tested and characterized under similar conditions to improve the development. To control these devices under test (DUT) and to save the collected data a suitable readout system is necessary. To have similar conditions for different

prototypes a modular concept of a readout system is required which can be adapted in a simple way to the specific interface of different types of electronics. To meet the requirements of an upcoming full size ToPix prototype and online analysis an upgrade of the Juelich Digital Readout System was developed. We will present the concepts and the upgrade of the FPGA based Jülich digital readout system and measurements of the recent MVD pixel front-end prototype ToPix3. First tests of the implementation of the radiation hard GBT transfer protocol are also shown.

HK 10.4 Mo 11:45 WIL-A221

Electronic Readout for THGEM detectors based on FPGA TDCs — Tobias Baumann, Maximilian Büchele, Horst Fischer, Matthias Gorzellik, Tobias Grussenmeyer, •Florian Herrmann, Philipp Jörg, Kay Königsmann, Paul Kremser, Tobias Kunz, Christoph Michalski, Sebastian Schopferer, and Tobias Szameitat — Physikalisches Institut der Universität Freiburg for the COMPASS-II RICH upgrade Group

In the framework of the RD51 programme the characteristics of a new detector design, called THGEM, which is based on multi-layer arrangements of printed circuit board material, is investigated. The THGEMs combine the advantages for covering gains up to 10^6 in electron multiplication at large detector areas and low material budget. Studies are performed by extending the design to a hybrid gas detector by adding a Micromega layer, which significantly improves the ion back flow ratio of the chamber.

With the upgrade of the COMPASS experiment at CERN a MWPC plane of the RICH-1 detector will be replaced by installing THGEM chambers. This summarizes to 40k channels of electronic readout, including amplification, discrimination and time-to-digital conversion of the anode signals. Due to the expected hit rate of the detector we design a cost-efficient TDC, based on Artix7 FPGA technology, with time resolution below 100ps and sufficient hit buffer depth. To cover the large readout area the data is transferred via optical fibres to a central readout system which is part of the GANDALF framework.

Supported by BMBF and EU FP7 (Grant Agreement 283286).

HK 10.5 Mo 12:00 WIL-A221

The GANDALF 128-channel Time-to-Digital Converter — Tobias Baumann, •Maximilian Büchele, Horst Fischer, Matthias Gorzellik, Tobias Grussenmeyer, Florian Herrmann, Phillip Jörg, Paul Kremser, Tobias Kunz, Christoph Michalski, Sebastian Schopferer, and Tobias Szameitat — Physikalisches Institut der Albert-Ludwigs-Universität Freiburg

In particle physics experiments, Time-to-Digital Converters (TDC) perform accurate time measurements, thus to allow for charged particle identification and tracking. We have developed within the GANDALF framework a 128-channel TDC, implemented in a Xilinx Virtex-5 FPGA. A time resolution better than 93 ps has been verified for all channels. In contrast to previous FPGA-based TDC, the design makes use of a shifted clock sampling algorithm. In this concept, the input signal is sampled with flip-flops driven by a set of equidistant phase-shifted clocks. The TDC register length depends only on the number of phase-shifted clocks and therefore permits to process a large number of channels in a very resource-efficient way.

As not only time measurements but also simultaneous rate measurements are required for many applications, we present a combination of 96 scaler and TDC channels implemented in the same FPGA on the GANDALF 6U-VME64x/VXS carrier board. In addition to the experiment trigger, an internal generated pseudo-random trigger is applied in order to produce two independent data streams. This may allow for online monitoring of the detector device. This project is supported by BMBF and EU FP7 (Grant Agreement 283286).

HK 10.6 Mo 12:15 WIL-A221

Performance of the HADES DAQ in Au+Au — •Jan Michel for the HADES-Collaboration — Goethe-Universität, Frankfurt

The High Acceptance DiElectron Spectrometer (HADES) is located at the SIS-18 accelerator at the GSI Helmholtz Center for Heavy Ion Research in Darmstadt. In April 2012 a five-week experimental run using a 1.23 AGeV gold beam focused on a 15-fold segmented gold target was conducted.

One major reason for this successful data taking was the upgraded data acquisition system. An optical network running a customized network protocol (TrbNet) connects the frontend modules with read-out nodes. Here the data stream is converted to Gigabit Ethernet packets which are subsequently transported to a server farm using commodity hardware. All electronic components are supervised using a new, web-based monitoring system making use of the inherent slow-control features of TrbNet. In total, the system comprises of 550 FPGA-based modules, 30 Gigabit Ethernet links, four multi-core servers and 150 TB of local disk storage. The whole system is able to record event data in heavy-ion collissions at rates of up to 30 kHz and 800 MByte/s. During the experiment, the mean rates were 8 kHz and 150 MByte/s respectively mainly due to detector constraints. As a result, $7.7 \cdot 10^9$ events with a total volume of 140 TB were recorded throughout the run. In this contribution the set-up, performance figures and the slow-control concept will be shown.

*This work is supported by BMBF (06FY9100I and 06FY7114), HIC for FAIR, EMMI, GSI and HGS-Hire.

HK 10.7 Mo 12:30 WIL-A221

Design concepts and measurements of the CBM DAQ network — •Frank Lemke and Sven Schatral for the CBM-Collaboration — Universität Heidelberg

In the context of the Compressed Baryonic Matter (CBM) experiment at the Facility for Antiproton and Ion Research (FAIR) in Darmstadt a hierarchical structured data acquisition (DAQ) network is used to readout particle detectors over synchronized bidirectional links. Interconnects operate with unified connections using one special protocol (CBMnet) in the whole readout. Thereby no protocol conversion is required. Communication modules provided for various hardware devices are easy to insert into new ASICs or FPGAs. Thus, more and more devices can be equipped with these modules. This saves design time and enables usage of existing structures optimized for CBM requirements. Besides multiple supported FPGA platforms, the first front-end ASIC, the SPADIC, was developed and it has been completely tested. A second front-end detector ASIC with CBMnet, the STSXYTER, was submitted at the end of October, expanding the usage of CBMnet to further readout chains. Unbalanced line handling enables higher data rates with reduced wiring overhead. The current implemented universal readout controller board using a Spartan 6 FPGA offers the ability to synchronize and readout up to four front-end boards. The synchronization mechanism based on deterministic and simultaneous arrival of deterministic latency messages (DLM) in all front-end devices works with accuracy better than 2ns. Not only the synchronization, but also all other communication classes have been tested successfully.

HK 10.8 Mo 12:45 WIL-A221

Technical commissioning of AGATA at GSI: coupling of the DAQ* — •Damian Ralet[1], Stephane Pietri[2], Hakan Johansson[3], Dino Balzzacco[4], Xavier Grave[5], Nikolaus Kurz[2], Yann Aubert[5], Nicolas Dosme[5], Amel Korichi[5], Eric Legay[5], Juergen Gerl[2], and Norbert Pietralla[1] for the AGATA-Collaboration — [1]Institut für Kernphysik, Technische Universität Darmstadt, Darmstadt, Germany — [2]GSI Helmholtzzentrum für Scherionenforschung GmbH, Darmstadt, Germany — [3]Chalmers University of Technology, Göteborg, Sweden — [4]Istituto Nazionale di Fisica Nucleare Sezione di Padova, Padova, Italy — [5]CSNSM Université Paris-Sud, Orsay, France

The PRESPEC experiment for high-resolution gamma-ray spectroscopy using radioactive ion beams at the FRagment Separator of GSI together with the LYCCA-1 calorimeter and the AGATA [1] detector array has been commissioned early 2012. Main goals of the commissioning were to test the new trigger logic using FPGA-based modules and to test the coupling of the two data acquisition systems, NARVAL for the AGATA detectors, and MBS for the FRS+LYCCA detectors. The performance of the DAQ coupling will be presented and various trigger configurations for background suppression will be discussed.

[1] AGATA–Advanced GAmma Tracking Array, Nucl. Instr. Meth. A 668, 26 (2012)

*Supported by the BMBF under Nos. 05P09RDFN4, 05P12RDFN8, and by the LOEWE center HIC for FAIR

HK 11: Beschleunigerphysik I (SC, SC-Cavities)

Zeit: Montag 11:00–13:00 Raum: WIL-C203

Gruppenbericht HK 11.1 Mo 11:00 WIL-C203

Optische Inspektion von supraleitenden Cavities — •Lea Steder und Marc Wenskat — DESY, Notkestrasse 85, 22607 Hamburg

Supraleitende Niob Cavities bilden die Beschleunigungsstrukturen für den im Bau befindlichen XFEL (X-ray Free Electron Laser) und sind auch für den International Linear Collider (ILC) geplant. Charakterisieren lassen sie sich durch den Beschleunigungsgradienten E_{acc} und die erreichte Güte Q_0, die beide stark von der Qualität der Oberfläche abhängen. Um eine möglichst hohe Beschleunigung mit hohem Q_0 zu erreichen, werden die Cavities im Fertigungsprozess einer Reihe von Oberflächenbehandlungen unterzogen. Im Verlauf der letzten Jahre konnten durch die Optimierung dieses Prozesses immer höhere Gradienten erreicht werden.

Zur Qualitätskontrolle der Oberfläche werden optische Inspektionssysteme genutzt. Am DESY wurde dafür OBACHT (Optical Bench for Automated Cavity inspection with High resolution and short Timescales) entwickelt. Das Gerät und die Bildanalyse werden in diesem Beitrag vorgestellt. Ziel der Analyse ist eine quantitative Beschreibung der Oberfläche sowie eine Defekterkennung, um Vorhersagen für E_{acc} und Q_0 der Cavity machen zu können und nötige Behandlungen der Oberfläche zu identifizieren und damit die Cavity zu verbessern.

HK 11.2 Mo 11:30 WIL-C203

Systematische Verdrängung von eingefrorenem Fluss in supraleitendem Niob — •Julia Vogt, Oliver Kugeler und Jens Knobloch — Helmholtz-Zentrum Berlin

Die Güte supraleitender Kavitäten ist umgekehrt proportional zum Hochfrequenz-Oberflächenwiderstand des supraleitenden Materials, welcher sich aus dem physikalischen BCS-Widerstand und dem sog. Restwiderstand zusammensetzt. Verschiedene Faktoren beeinflussen den Restwiderstand - materialspezifische, wie z.B. die Reinheit aber auch externe, wie die Effizienz der magnetischen Abschirmung.

Wir denken, dass auch der bisher wenig untersuchte Temperaturgradient während des supraleitenden Übergangs einen solchen externen Faktor darstellt: Die Bedingungen dieser Gradient beeinflussen die Menge des eingefrorenen Flusses und damit den Restwiderstand und die Güte der Kavität. Wir haben einen Teststand konstruiert, mit dem das Verhalten von stabförmigen Niobproben untersucht werden kann. Die Temperatur des Stabs konnte präzise kontrolliert werden. In den Experimenten wurde der supraleitende Stab langsam bis kurz unterhalb der Sprungtemperatur erwärmt. Der Stab blieb währenddessen immer supraleitend. Trotzdem war eine Änderung der Menge des eingefrorenen Flusses messbar. Die Prozedur wurde mehrfach wiederholt, was zu einer weiteren Verringerung des eingefrorenen Flusses führte.

Eine ähnliche Prozedur könnte verwendet werden um eingefrorenen magnetischen Fluss in supraleitenden Kavitäten zu minimieren. Dies würde den Oberflächenwiderstand deutlich vermindern und damit signifikant höhere Güten ermöglichen.

HK 11.3 Mo 11:45 WIL-C203

Simulation of a Quadrupole Resonator — •Raphael Kleindienst — Helmholtz Zentrum Berlin, Deutschland

Modern particle accelerators often rely on superconducting radio frequency (SRF) technology for accelerating cavities. In particular in CW operation, very high quality factors up into the high range are desirable, since one of the main cost drivers of such an accelerator, the cryogenic refrigeration plant, is inversely proportional to Q_0.

Present day superconducting cavities are generally made of solid Niobium. A possibility to increase the quality factor as well as accelerating fields is to use thin film coated cavities. Apart from Niobium thin films, other superconducting materials, such as MgB_2 ,NbN and Nb_3Sn are promising candidates. Measuring and understanding the RF-properties of superconducting thin films, specifically the surface resistance, is needed to drive forward this development.

Currently only few facilities exist capable of measuring the surface resistance of thin films samples with a resolution in the nano-ohm range at the operating frequency of typical cavities(e.g. L-band). A dedicated test stand consisting of a quadrupole resonator is therefore being constructed at the Helmholtz Zentrum Berlin.

This system is based on the 400MHz quadrupole resonator at CERN, with the design adapted to 433 MHz (making available the higher harmonic mode at 1,3GHz) and optimized with respect to resolution and maximum achievable fields using simulation data obtained with CST Microwave Studio as well as ANSYS. The simulated design is being manufactured. An outlook for future physics runs is given.

HK 11.4 Mo 12:00 WIL-C203

Aufbau und Erprobung eines neuen Beschleunigerkryostaten für den S-DALINAC* — •Thorsten Kürzeder[1], Jens Conrad[1], Ralf Eichhorn[2], Florian Hug[1], Norbert Pietralla[1], Achim Richter[1] und Sven Sievers[1] — [1]Institut für Kernphysik, Technische Universität Darmstadt, Darmstadt, Germany — [2]Cornell University, Ithaca, NY, USA

Der Injektor des supraleitenden Darmstädter Elektronen-Linearbeschleunigers S-DALINAC liefert Strahlenergien bis zu 10 MeV und Strahlströme bis zu 60 μA im Dauerstrichbetrieb. Mit Hilfe eines neu konstruierten Beschleunigerkryostaten wird es in Zukunft möglich sein, diese Parameter auf 14 MeV und 250 μA zu erhöhen. Wie bei den bisherigen Kryostatmodulen werden dabei zwei 20-zellige Beschleunigungsstrukturen aus Niob bei 3 GHz und einer Temperatur von 2 K betrieben. Die notwendige Hochfrequenzleistung von 2 kW wird durch eine eigens entwickelte Hohlleiterverbindung bis zu den Einkopplern in den Heliumtank geführt.

Wir berichten über die Herstellung des Kryostatmoduls und präsentieren Ergebnisse aus einem ersten Abkühlen.

*Gefördert durch die Deutsche Forschungsgemeinschaft im Rahmen des SFB 634.

HK 11.5 Mo 12:15 WIL-C203

Activation and conditioning of field emitters on flat niobium surfaces — •Stefan Lagotzky and Günter Müller — University of Wuppertal, D-42097 Wuppertal, Germany

Systematic investigations of the enhanced field emission (EFE) from flat (linear roughness < 0.5 μm) and clean polycrystalline niobium (Nb) surfaces revealed an exponential increase of the emitter number density N with the applied electric field and also strong activation effects on particles or surface irregularities. Three possible origins of this emitter activation effect were observed so far: Activation due to high electric fields, due to high temperature, and due to a micro-discharge on the surface [1]. Improved understanding of these processes is important since EFE is one of the main field limitations of superconducting accelerating structures like the XFEL and the ILC. Therefore, we have started a systematic test series with actual large-grain and single crystal Nb samples based on correlated field emission scanning microscopy (FESM) and high-resolution SEM investigations. The EFE properties of these samples were measured before and after controlled in-situ heating at temperatures (times) between 120°C (24h) and 400°C (2h). A successive increase of N with the heat treatments (HT) was observed at surface field up to 160 MV/m, i.e. up to 19 emitters/cm^2 after HT at 400°C. Moreover, activated emitters finally showed onset fields down to 40 MV/m. The influence of the HT on the natural oxide layer of Nb and on EFE activation will be discussed.

[1] A. Navitski et. al, submitted to PRSTAB 2013

Ackn. to D. Reschke, J. Ziegler DESY; funded by BMBF 05H12PX6

HK 11.6 Mo 12:30 WIL-C203

Centrifugal barrel polishing of 1.3 GHz Nb cavities — •Yegor Tamashevich[1,2], Aliaksandr Navitski[1], Lea Steder[1], Eckhard Elsen[1], and Brian Foster[1,2] — [1]DESY, 22607 Hamburg, Germany — [2]University of Hamburg, 20146, Germany

Superconducting radio-frequency (SRF) cavities are the key components of particle accelerators such as the European X-ray Free Electron Laser (XFEL, under construction) and the planned future International Linear Collider (ILC). Steady progress in surface treatment techniques of SRF cavities in both the achievable quality factor Q and the accelerating electric field Eacc makes new accelerators and ambitious projects feasible. One of the alternative surface preparation techniques which is actually being explored is centrifugal barrel polishing (CBP) pioneered at KEK in Japan in mid-nineties by T. Hiuchi et al. CBP is a mechanical polishing of cavities and results in around 10x smaller surface roughness and mirror-like surface as compared to chemistry alone. Q and Eacc are expected to be at least as high as for chemically treated cavities. CBP eliminates the bulk chemistry and has the potential to completely replace the chemistry. The Univer-

sity of Hamburg is installing a CBP machine to study it as a cavity preparation and repair technique for 9-cell 1.3 GHz SRF cavities at the Deutsche Elektronen-Synchrotron (DESY). The setup and first commissioning tests will be presented and discussed.

HK 11.7 Mo 12:45 WIL-C203

Systematische Vermessung der Pumpeigenschaften kryogener Oberflächen — •Frederic Chill, Oliver Kester, Peter Spiller und Lars Bozyk — GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt

Kryogene Oberflächen sind in der Lage, Restgas bis zu einem von den Dampfdruckkurven vorgegebenen Druck durch *Kryokondensation* zu binden. Bei geringer Oberflächenbedeckung kann Restgas auch durch *Kryosorption* gebunden werden. Dies erlaubt es, Wasserstoff ab dem Unterschreiten von 18K zu einem deutlich tieferen Endruck zu pumpen, als die Dampfdruckkurve angibt.

Die Pumpeigenschaften kryogener Oberflächen lassen sich mittels zweier Parameter beschreiben: Dem *Stickingparameter*, der beschreibt, mit welcher Wahrscheinlichkeit ein Restgasteilchen an der Wand haften bleibt und der *mittleren Verweildauer* der Teilchen an der Wand. Beide Parameter hängen von der Oberflächentemperatur und -bedeckung ab.

Zur Bestimmung dieser Größen wird derzeit ein Experiment mit einer kaltkopfgekühlten Kammer aufgebaut. An diesem werden zwei unterschiedliche Messungen möglich sein: Zuerst wird die kalte Kammer einem exakt dosierten Gaszustrom ausgesetzt. Der resultierende Druckanstieg hängt dabei nur vom Stickingparameter ab. Im zweiten Schritt wird der Gaszustrom gestoppt. Der sich einstellende Gleichgewichtsdruck hängt dann zusätzlich noch von der mittleren Verweildauer ab. Mit den Ergebnissen kann die Voraussagegenauigkeit des bei GSI entwickelten Simulationsprogramms für das dynamische Vakuum in kalten Beschleunigerabschnitten weiter verbessert werden.

HK 12: Beschleunigerphysik II (PWA I)

Zeit: Montag 11:00–13:00 Raum: WIL-C205

HK 12.1 Mo 11:00 WIL-C205

Design und Optimierung der Elektronenstrahlführung für den Laser-Wakefield-Beschleuniger in Jena - Teil 2 — •Bastian Härer, Veronica Afonso Rodriguez, Tilo Baumbach, Axel Bernhard, Peter Peiffer, Robert Rossmanith, Walter Werner und Christina Widmann — KIT, Germany

Laser-Wakefield-Beschleuniger (LWFA) erzeugen kurze Elektronenpakete, haben aber eine große Energiebandbreite und Divergenz. Deshalb gestaltet sich der Transport dieser Elektronenpakete schwierig.

Für eine Diagnostik-Beamline am LWFA in Jena muss der Elektronenstrahl vom Beschleuniger zu einem Undulator geführt werden. Eine dispersive Schikane spaltet die Elektronen nach ihrer Energie auf. Diese Aufspaltung wird an die x-abhängige Magnetfeldamplitude des nicht-planaren Undulators angepasst. Auf diese Weise ist die Erzeugung monochromatischer Undulatorstrahlung möglich. Die Herausforderung beim Design der Strahlführung besteht darin, die für den Undulator notwenigen Strahlparameter für ein großes Energieintervall zu gewährleisten. In linearer Näherung ist die Strahlführung bereits optimiert. Zur Fokussierung werden starke Quadrupolfelder benötigt. Wegen der daraus resultierenden hohen chromatischen Fehler ist der Einsatz von Sextupolen unverzichtbar.

In diesem Vortrag wird das Design der Strahlführung mit Combined-Function-Magneten unter Berücksichtigung der chromatischen Korrektur vorgestellt. Außerdem wird die Stabilität der Strahlführung hinsichtlich der Positionier- und Feldfehler der Magnete diskutiert.

Gefördert durch das BMBF unter der Nummer 05K10VK2.

HK 12.2 Mo 11:15 WIL-C205

Laser-Based Discharge Ignition for Capillary Waveguides — •Lars Goldberg[1], Lucas Schaper[2], Tobias Kleinwächter[2], Jan-Patrick Schwinkendorf[2], Matthias Schnepp[1], and Jens Osterhoff[2] — [1]Universität Hamburg — [2]DESY Hamburg

Highly energetic electron beams are required for various applications such as free-electron lasers and particle colliders. Nowadays these beams are almost exclusively produced in conventional radiofrequency-cavities, which are limited to typical acceleration gradients below 50MV/m. Hence long machines on the order of 100m are required to reach the desired energies. Laser-wakefield accelerators in plasma on the other hand are capable of providing acceleration gradients well above 10GV/m, thereby allowing for much more compact devices on scales of centimeters.

Currently, plasma-based devices are rapidly evolving and improving, but still suffer from instabilities in the generated electron-beam properties, largely due to shot-to-shot variations of laser and plasma parameters. In order to minimize possible sources for these fluctuations, a novel, more stable technique for shaping the transverse plasma-density profile in a plasma accelerator based on laser triggering and ignition of capillary discharge waveguides is presented.

HK 12.3 Mo 11:30 WIL-C205

Prompt pre-thermal laser ion sheath acceleration with ultra-short laser pulses — •Karl Zeil, Michael Bussmann, Thomas Cowan, Thomas Kluge, Stephan Kraft, Josefine Metzkes, and Ulrich Schramm — Helmholtz-Zentrum Dresden-Rossendorf, Germany

Recent laser-ion acceleration experiments performed at the 150 TW Draco laser in Dresden, Germany, have demonstrated the importance of a precise understanding of the electron dynamics in solids on an ultra-short time scale. For example, with ultra-short laser pulses a description based purely on the evolution of a thermal electron ensemble, as in standard TNSA models, is not sufficient anymore. Rather, non-thermal effects during the ultra-short intra-pulse phase of laser-electron interaction in solids become important for the acceleration of ions when the laser pulse duration is in the order of only a few tens of femtoseconds. While the established maximum ion energy scaling in the TNSA regime goes with the square root of the laser intensity, for such ultra short pulse durations the maximum ion energy is found to scale linear with laser intensity, motivating the interest in such laser systems. Investigating the influence of laser pulse contrast, laser polarization and laser incidence angle on the proton maximum energy and angular distribution, we present recent advances in the description of the laser interaction with solids, focusing on the implications of intra-pulse non-thermal phenomena on the ion acceleration.

HK 12.4 Mo 11:45 WIL-C205

Simulating electromagnetic radiation from laser-wakefield acceleration plasmas — •Richard Pausch, Alexander Debus, René Widera, and Michael Bussmann — Helmholtz-Zentrum Dresden-Rossendorf, Dresden, Germany

Measuring the transient plasma density structures of Laser-wakefield accelerators (LWFA) that are shorter than the drive laser on a μm-fs-scale is experimentally challenging, which complicates comparisons the of these results with numerical models from 3D-PIC simulations. Radiation spectra from LWFA plasmas on the other hand are straightforward to measure, but hard to calculate in realistic detail because it is computationally expensive (both CPU and memory) to calculate the radiation emitted by a complete PIC simulation. However, it would be very useful to know where to look for "good" radiation signatures that show quantitative details on the electron dynamics at electron injection.

Here we present a highly-scalable, classical radiation code based on Liénard-Wiechert potentials, which runs on high-performance computing clusters using GPUs. The memory and disk-space footprint is reduced by directly integrating into the 3D-PIC code PicOnGPU. With this new code, it is possible to calculate logarithmic-scaled spectra from IR to X-ray wavelengths in arbitrary observation directions. In this talk we put the emphasis on the code architecture, the verification of the physics and on some first results.

HK 12.5 Mo 12:00 WIL-C205

Two Screen Dipole Spectrometer for Laser Wake Field Accelerators — •Paul Winkler, Andreas Maier, and Florian Grüner — Institut für Experimentalphysik, Universität Hamburg, Hamburg, Germany

Today's Laser-plasma-accelerators have high shot to shot energy spread, divergence and pointing fluctuations, but the mean beam en-

ergy is one of the most important parameters of any accelerator experiment. It has major impact on many accelerator applications and has to be well known in order to understand further results. An initial deflection angle of the beam from the design axes can yield a big error in energy measurement using a usual (one screen) dipole spectrometer. Two-screen-Dipole-Spectrometers (TSDS) enable to measure the mean beam energy and initial deflection angle separately by using a second screen in order to measure the beam position and direction of momentum behind the dipole.

The talk aims to demonstrate methods to describe particle trajectories through TSDS' of relativistic particles that enter the dipole with initial deflection angles. In particular, optimal screen arrangements, that result a maximum resolution in energy and deflection angle measurement, shall be presented. Furthermore, TSDS' enable separate energy spread and divergence measurement for sufficient resolution in energy and deflection angle measurement.

HK 12.6 Mo 12:15 WIL-C205

PIConGPU - A Highly-Scalable Particle-in-Cell Implementation for GPU Clusters — •Michael Bussmann[1], Heiko Burau[1], Alexander Debus[1], Axel Hübl[1], Thomas Kluge[1], Richard Pausch[1], Nils Schmeisser[1], Benjamin Schneider[1,2], Klaus Steiniger[1], Rene Widera[1], Nikolai Wyderka[1], Ulrich Schramm[1], Thomas Cowan[1], Felix Schmitt[3], Sebastian Grottel[2], Stefan Gumhold[2], Guido Juckeland[2,4] und Wolfgang Angel[2,4] — [1]HZDR, Dresden — [2]TU Dresden — [3]NVIDIA, Austin — [4]ZIH, Dresden

PIConGPU can handle large-scale simulations of laser plasma and astrophysical plasma dynamics on GPU clusters with thousands of GPUs. High data throughput allows to conduct large parameter surveys but makes it necessary to rethink data analysis and look for new ways of analyzing large simulation data sets. The speedup seen on GPUs enables scientists to add physical effects to their code that up until recently have been too computationally demanding. We present recent results obtained with PIConGPU, discuss scaling behaviour, the most important building blocks of the code and new physics modules recently added. In addition we give an outlook on data analysis, resiliance and load balancing with PIConGPU.

HK 12.7 Mo 12:30 WIL-C205

High-intensity lasers for particle physics — Markus Büscher[1], Mirela Cerchez[3], •Ilhan Engin[1], Paul Gibbon[2], Patrick Greven[1], Astrid Holler[1], Anupam Karmakar[2], Giorgi Kukhalashvili[1], Andreas Lehrach[1], Toma Toncian[3], and Oswald Willi[3] — [1]Institut für Kernphysik (IKP) and Jülich Center for Hadron Physics (JCHP), Forschungszentrum Jülich — [2]Jülich Supercomputing Center (JSC), Forschungszentrum Jülich — [3]Institut für Laser-Plasma Physik (ILPP), Heinrich Heine Universität Düsseldorf

The physics of laser driven particle sources has undergone dramatic developments in recent years. However, it is yet an untouched issue whether laser-induced particle acceleration can be used to realize polarized particle sources. Due to the huge magnetic field gradients during the exposure to laser light (hundreds of Megagauss per micrometer), a coupling to the magnetic moments of the accelerated particles and, thus, an alignment or selection of certain spin states seems feasible.

First polarization measurements of laser-accelerated particles have been carried out at the 300 TW Düsseldorf ARCturus laser facility, where few-MeV protons were produced in thin foil targets. The spin dependence of the differential cross section in a hadronic scattering reaction gives access to the degree of polarization of the laser-accelerated protons. Further target concepts, *e.g.* ^{4}He and polarized ^{3}He gas jets or a H_2 cluster-gas mixture, will be applied in order to optimize the degree of polarization as well as the energies of laser-accelerated particle beams.

HK 12.8 Mo 12:45 WIL-C205

Status of a Cylindrical Superconducting Undulator for the Laser Wakefield Accelerator in Jena — •Veronica Afonso Rodriguez[1], Axel Bernhard[1], Andreas Grau[1], Bastian Härer[1], Peter Peiffer[1], Robert Rossmanith[1], Marc Weber[1], Christina Widmann[1], Malte Kaluza[2], Maria Nicolai[2], Thorsten Rinck[2], Alexander Sävert[2], Oliver Jäckel[3], and Maria Reuter[3] — [1]KIT, Karlsruhe, Germany — [2]Friedrich Schiller University Jena, Jena, Germany — [3]Helmholtz Institute Jena, Jena, Germany

Laser-Wakefield accelerators (LWFA) produce electron bunches with several 100 MeV energy within a few millimeters acceleration length, however, with a relatively large energy spread (a few percent). Undulators provide monochromatic radiation with high brilliance. The working principle of undulators requires a small energy spread of the electron beam in the order of 0.1 %. To produce monochromatic undulator radiation with LWF accelerated electrons, a novel iron-free cylindrical superconducting undulator (SCU) is under development at the KIT. This talk will give an overview about the design and the optimisation of the SCU tailored to the particular beam properties of the JETI-LWFA at the University of Jena. In addition a short model test and the construction status of the full scale undulator will be shown. Acknowledgment: this work is funded by the German Federal Ministry for Education and Research under contract no. 05K10VK2 and 05K10SJ2.

HK 13: Beschleunigerphysik III (Strahlinstabilitäten I)

Zeit: Montag 11:00–13:00 Raum: WIL-C207

HK 13.1 Mo 11:00 WIL-C207

Investigation of microbunching-instability in energy recovery linacs — •Stephanie Rädel and Atoosa Meseck — Helmholtz Zentrum Berlin für Materialien und Energie GmbH, Berlin, Germany

In an energy recovery linac (ERL), a Photo-injector produces electron bunches with very low emittance und energy spread to feed a superconducting linac section. After the acceleration in the linac, the bunches pass through a transport loop, which for example can include undulators to produce high-brilliance radiation. After the passage through the loop, the bunches pass the linac a second time with a phase shifted by a 180 degree, in this case the linac decelerates the bunches gaining back the energy. The spend bunches are deflected by a dipole magnet to a beam dump. Maintaining the low emittance and energy spread is of major importance in an ERL. Therefore, deep understanding and control of effects which can degrade the emittance and energy spread such as space charge effects are of interest. The microbunching caused by the longitudinal space charge forces can lead to an increase in emittance and energy spread in the arcs of the loop. In this contribution, the impacts of the microbunching instability on the beam quality and its implication for an ERL are discussed.

HK 13.2 Mo 11:15 WIL-C207

Analyse von transversalen Beamtransferfunktionen für intensive Ionenstrahlen. — •Paul A. Görgen[1], Oliver Boine-Frankenheim[1] und Wolfram Fischer[2] — [1]Institut für Theorie Elektromagnetischer Felder, Darmstadt — [2]Brookhaven National Laboratory, Upton, NY, USA

Es werden Beamtransferfunktionen (BTF) von Ionenstrahlen im Relativistic Heavy Ion Collider (RHIC) unter dem Einfluss des Beam-Beam-Effektes sowie der im Aufbau befindlichen Elektronenlinse beschrieben. Dazu wird ein einfaches analytisches Modell der Beamtransferfunktion unter Einfluss der beiden Effekte entwickelt. Im analytischen Modell wird der Beam-Beam-Effekt bzw. die Elektronenlinse als gleichmäßig über den Ring verteilte betatronamplitudenabhängige Tuneabweichung angenommen. Desweiteren werden numerische Simulationen mithilfe eines Particle-in-Cell (PIC) Codes vorgestellt. Im PIC-Code wird der Beam-Beam Effekt durch eine zweidimensionale Interaktion approximiert. Die Speicherringgeometrie wird durch die lineare Transfermatrix des Rings miteinbezogen. Chromatizität ist als impulsabhängiger Betatronphasenvorschub implementiert. Die Simulation der Beamtransferfunktion erfolgt analog zum Experiment durch Anregung mit einem periodischen Signal bei verschiedenen Anregungsfrequenzen um die Betatronfrequenz und Beobachten der antwortenden Oszillation des Ladungszentrums des Strahls. Die numerischen Ergebnisse werden mit Messdaten sowie mit den analytischen Ergebnissen verglichen. Die BTF-Implementierung im Simulationscode wurde zuvor gegen analytisch bekannte BTF validiert.

HK 13.3 Mo 11:30 WIL-C207

Numerische Berechnung von Strahlkoppelimpedanzen im Frequenzbereich — •Uwe Niedermayer und Oliver Boine-Frankenheim — TEMF, TU-Darmstadt, Schloßgartenstr. 8, 64289 Darmstadt

Die transversale Impedanz von Ferrit-Kickermagneten stellt eine Ursache von Strahlinstabilitäten im geplanten SIS100 Synchrotron für FAIR dar. Die longitudinale Impedanz von Ferrit-Komponenten trägt unter anderem zur strahlinduzierten Erwärmung dieser Komponenten bei, was insbesondere im LHC ein Problem darstellt. Im Hochfrequenzbereich können diese Impedanzen mit kommerziellen Codes wie z.B. CST Particle Studio im Zeitbereich berechnet werden. Für niedrige Frequenzen ist dies jedoch wegen der langen Teilchen-Flugstrecken nicht möglich. Wir zeigen den Fortschritt in der Entwicklung eines Frequenzbereichs-Lösers auf Basis der FIT (Finite Integrations Technik) Methode. Die Implementierung basiert auf dem PETSc (Parallel, Extensible Toolkit for Scientific computation) Paket in C++. Der Code wird auf den Testfall eines zylindrischen induktiven Einsatzes und auf den SIS18 sowie SIS100 Kicker angewandt. Ein anderer Beitrag unserer Gruppe beschäftigt sich mit der Vermessung des SIS18 Kickers mit der Draht-Methode.

HK 13.4 Mo 11:45 WIL-C207

High density plasma instabilities in intense laser irradiation — •Thomas Kluge[1], Josefine Metzkes[1], Martin Dommert[1], Michael Bussmann[1], Christian Gutt[2], and Thomas E. Cowan[1] — [1]Helmholtzzentrum Dresden-Rossendorf e.V. — [2]DESY Hamburg

Recent experimental results on the filamentation of laser accelerated proton beams at high laser irradiation intensities are compared to particle-in-cell simulations. In simulations, several qualitatively different mechanisms of filamentation of electrons can be observed. Depending on the specific laser and target parameters such as flatness or density, the relative role of individual electron instabilities can be actively controlled. It is demonstrated how filamentation of electron currents going into the target and heating the rear surface can translate into ion filamentation which consequently exhibit strong correlation with the front side laser-electron instability physics. The impact on ion energy scaling are discussed.

Experimental observation of proton filamentation can thus be a valuable diagnostics of the laser-electron interaction at the foil front surface. We moreover propose and discuss other more direct techniques for probing spatio-temporal electron density and ionization.

HK 13.5 Mo 12:00 WIL-C207

Numerical Studies of Designs of Clearing Electrodes for Ion Clearing in an ERL — Eden Tafa Tulu[1], •Gisela Pöplau[1], Atoosa Meseck[2], and Ursula van Rienen[1] — [1]Universität Rostock — [2]HZB, Berlin

Energy Recovery Linacs (ERLs) are the most promising candidates for next-generation light sources now worldwide under active development. An optimal performance of these machines requires the preservation of the high beam brightness generated in the injector. For this, the impact of the ionized residual gas on the beam has to be avoided as it causes instabilities and emittance growth.

Typical measures to reduce the effect of ion clouds are clearing electrodes. In this paper we present simulation studies for several designs of clearing electrodes that are in use at the Metrology Light Source (MLS) and under discussion for ion clearing in the Berlin Energy Recovery Linac Project - BERLinPro. The software tools we applied are CST Particle Studio and our in-house code MOEVE PIC Tracking.

HK 13.6 Mo 12:15 WIL-C207

Numerical wakefield calculations for electro-optical measurements — •Benjamin Kehrer, Andrii Borysenko, Edmund Hertle, Nicole Hiller, Vitali Judin, Sebastian Marsching, Anke-Susanne Müller, Michael J. Nasse, Marcel Schuh, and Markus Schwarz — Karlsruhe Institute of Technology, Karlsruhe, Germany

The usage of electro-optical measurement techniques allows precise and single-shot measurements of the length and shape of an electron bunch. At the ANKA storage ring such a setup for near-field measurements has recently been installed. The installation of such a setup changes the impedance of the storage ring and the corresponding effects have to be studied carefully. By using numerical codes it is possible to simulate the wakefields induced by the setup. In this presentation, first results obtained with the wakefield solver implemented in the CST studio suite are shown. [funded by BMBF under contract number 05K10VKC]

HK 13.7 Mo 12:30 WIL-C207

Electron Cloud Effects in Hadron Beams — •Fedor Petrov, Oliver Boine-Frankenheim, and Thomas Weiland — TU-Darmstadt, Institut für Theorie Elektromagnetischer Felder ,Schloßgartenstr. 8 64289 Darmstadt, Deutschland

Accelerators operating with intense positively charged beams can suffer from the electron cloud phenomenon. For example, it is the intensity limiting factor in CERN LHC and SPS. In past decades a lot of progress in understanding the electron cloud effects was made worldwide. Methods to suppress or weaken the electron cloud phenomenon were proposed. Theories governing the bunch stability in presence of the electron cloud were developed. Recently the theory was introduced to describe the bunch energy loss due to the electron cloud. However, most of the publications concern the single bunch electron cloud effects. In reality bunches are packed into trains. A disturbance of the cloud caused by the bunch in the beginning of the train affects the subsequent bunches. We present a further investigation of single-bunch electron cloud effects and planned activities to study the phenomenon in case of multiple bunches.

HK 13.8 Mo 12:45 WIL-C207

Phase error reduction in superconductive undulators using Induction Shimming — •Elisabeth Drayer, Axel Bernhard, Veronica Afonso Rodriguez, Andreas Grau, Peter Peiffer, Christina Widmann, and Tilo Baumbach — KIT, Karlsruhe, Germany

The reduction of field errors in superconductive undulators is more demanding than in room temperature permanent magnet undulators. Various basic concepts exist but most of them have the disadvantage that they require field measurements at liquid-Helium temperature and modifications of the undulator coils at room temperature. Thus one or more thermal cycles are needed for an iterative improvement of the field quality.

In order to avoid such a procedure it was proposed to cover the undulator coils with a thin layer of coupled superconductive loops which passively compensate the field errors via induction of persistent correction currents. In previous measurements this concept proved to work in principle and conclusions on an optimised shim configuration and field measurement setup could be drawn.

In this paper we present the results of new measurements using one 12-period superconductive undulator short model and applying an optimised induction shim configuration. Due to further improvements of the field measurement setup these experiments for the first time give a quantitative indication of the phase error reduction efficiency of induction shimming.

HK 14: Hadronenstruktur und -spektroskopie

Zeit: Montag 14:00–16:15 Raum: HSZ-304

Gruppenbericht HK 14.1 Mo 14:00 HSZ-304

Messung von Doppelpolarisationsobservablen mit dem CBELSA/TAPS-Experiment — •Jonas Müller für die CBELSA/TAPS-Kollaboration — HISKP, Universität Bonn

Ein wichtiger Schritt zum Verständnis der Baryonen ist eine präzise Kenntnis ihrer Anregungszustände und deren Zerfälle. Aufgrund der kurzen Lebensdauer der entsprechenden Resonanzen sind die zu einer Reaktion beitragenden Resonanzen breit und überlappen in den Daten meist stark. Um sie zu identifizieren und genauer zu untersuchen, muss eine Partialwellenanalyse durchgeführt werden. Um eine eindeutige Lösung zu erhalten, ist neben der Messung von differentiellen Wirkungsquerschnitten die Messung von Einfach- und Doppelpolarisationsobservablen unabdingbar.

Das Crystal-Barrel/TAPS-Experiment am Elektronenbeschleuniger ELSA eignet sich durch seine Raumwinkelabdeckung von nahezu 4π

und seiner hohen Detektionseffizienz für Photonen besonders gut zur Untersuchung der Photoproduktion von neutralen Mesonen am Nukleon. Die Verfügbarkeit eines linear oder zirkular polarisierten Strahls und eines longitudinal oder transversal polarisierten Targets macht es möglich, Doppelpolarisationsobservablen über einen weiten Energiebereich zu messen. Dabei werden Resonanzen mit Massen von bis zu 2.5 GeV zugänglich.

In diesem Vortrag werden aktuelle Ergebnisse der am CBELSA/TAPS-Experiment gemessenen Doppelpolarisationsobservablen präsentiert.

Gefördert durch die Deutsche Forschungsgemeinschaft (SFB/TR 16).

HK 14.2 Mo 14:30 HSZ-304

Measurement Of The Proton Spin Polarisabilities — •Duncan Middleton for the A2-Collaboration — Mt. Allison University, New Brunswick, Canada — Institut für Kernphysik, Universität Mainz, Germany

Nucleon polarisabilities are fundamental structure observables related to the nucleon's internal dynamics. Although the two scalar polarisabilities, α_{E1} and β_{M1}, are reasonably well understood for the proton, very few experiments have attempted to extract the spin polarisabilities and none have managed to separate all four. First attempts to extract all four of these spin polarisabilities independently have begun at MAMI with two measurements, the first of the beam asymmetry, Σ_3, and the second of the beam-target asymmetry, Σ_{2x}.

The measurements took place in the real photon hall of the A2 collaboration at the Mainzer Mikrotron, MAMI. The first measurement used a beam of circularly polarised photons which were incident upon a polarised Butanol target. The second measurement used linearly polarised photons which were incident upon a liquid hydrogen target. In both measurements the retarded electrons from the Bremsstrahlung process were detected in the Glasgow-Mainz photon tagging spectrometer. The scattered photons and ejected protons from the Compton reaction were detected in the Crystal Ball and TAPS detector systems which covered a solid angle of $\sim 96\%$ of 4π steradians.

Preliminary experimental asymmetries will be presented compared to predictions of the Σ_{2x} asymmetry as well as first results from the Σ_3 measurement.

HK 14.3 Mo 14:45 HSZ-304

Measurement of the spin correlation coefficients $A_{x,x}$ and $A_{y,y}$ in the $pn \to \{pp\}_s\pi^-$ reaction near the threshold at ANKE-COSY — •Vera Shmakova for the ANKE-Collaboration — DLNP, JINR, Joliot-Curie 6, 141980 Dubna, Moscow region, Russia — Institut für Kernphysik, Forschungszentrum Jülich, 52425 Jülich, Germany

A double polarization measurement of the spin correlation coefficients $A_{x,x}$ and $A_{y,y}$ of the $pn \to \{pp\}_s\pi^-$ process near the threshold has been performed at the ANKE-COSY spectrometer (Jülich). These results will facilitate further development of χPT in the $NN \to NN\pi$ sector.

The transversely vector polarized deuteron beam and the hydrogen internal polarized ANKE target were used in the experiment. The $pd \to d\pi^0$ process data were recorded concurrently and used for beam and target polarimetry. To increase the target thickness, the polarized target was equipped with a storage cell, and the beam interaction with the cell was the main source of background events. Dedicated expositions with no gas in the cell and with the cell filled with N_2 gas, were taken to study the backgrounds. The results of the experiment and the data analysis procedure and will be presented. The future experimental program aiming to study the $pN \to \{pp\}_s\pi$ reaction with the use of longitudinally polarized beams will be discussed.

Supported by the COSY-FFE program.

HK 14.4 Mo 15:00 HSZ-304

Messung von Polarisationsobservablen in der $2\pi^0$-Photoproduktion mit transversal polarisiertem Target — •Tobias Seifen für die CBELSA/TAPS-Kollaboration — Helmholtz-Institut für Strahlen- und Kernphysik, Nussallee 14-16, 53115 Bonn

Ein Ziel des Crystal-Barrel/TAPS-Experimentes am Elektronenbeschleuniger ELSA in Bonn ist die Untersuchung des Anregungsspektrums der Baryonen. Um die Beiträge einzelner Resonanzen mittels einer Partialwellenanalyse eindeutig aus den Daten extrahieren zu können, ist die Messung von Polarisationsobservablen unabdingbar.

Aufgrund der hohen Detektionseffizienz für Photonen und der nahezu vollständigen Raumwinkelabdeckung ist das Crystal-Barrel/TAPS-Experiment besonders gut dazu geeignet die Photoproduktion von neutralen Mesonen zu untersuchen. Mittels linear oder zirkular polarisierter Photonen und eines longitudinal oder transversal polarisierten Butanoltargets werden aktuell Doppelpolarisationsmessungen durchgeführt.

Im Vortrag werden Ergebnisse für die Reaktion $\vec{\gamma}\vec{p} \to p\pi^0\pi^0$ aus den Messungen mit transversal polarisiertem Target vorgestellt.

Gefördert durch die Deutsche Forschungsgemeinschaft (SFB/TR16).

HK 14.5 Mo 15:15 HSZ-304

Two photon exchange and transverse spin asymmetries in the A4 experiment — •David Balaguer Rios — Institut für Kernphysik, Mainz, Deutschland

The A4 collaboration at the MAMI facilities has measured the transverse spin asymmetry in the elastic and quasi-elastic scattering of transverse polarized electron on proton and deuteron, respectively, at backward angles and at a four momentum transfer of $Q^2 = 0.10$ $(GeV/c)^2$, $Q^2 = 0.23$ $(GeV/c)^2$ and $Q^2 = 0.35$ $(GeV/c)^2$. This beam transverse spin asymmetry is sensitive to the imaginary part of the two photon exchange amplitude in the elastic-nucleon scattering. These measurements are compared with the model calculation of the imaginary part of the two photon exchange amplitude that includes all the intermediate hadronic states using the unitary isobar model for pion photo- and electroproduction on the nucleon to evaluate the transition amplitudes, called MAID.

HK 14.6 Mo 15:30 HSZ-304

First results on the longitudinal double spin asymmetry A_1^p and g_1^p from the 2011 COMPASS data — •Malte Wilfert — for the COMPASS collaboration —Institut für Kernphysik, Johannes Gutenberg-Universität Mainz, Johann-Joachim-Becherweg 45, 55099 Mainz

The COMPASS experiment at the M2 beamline of the CERN SPS has taken data with a polarized muon beam scattering of a polarized NH_3 target in 2011. The beam energy has been increased to 200 GeV compared to 160 GeV in 2007. With the increased beam energy it is possible to reach higher values of Q^2 and lower values of x_{Bj}, compared to our first measurement in 2007. We will present our results on the longitudinal double spin asymmetry A_1^p and the spin-dependent structure function g_1^p from the 2011 data taking. This results will be compared to our previously released results from 2007 and SMC.

Supported by BMBF under the contract 05P12UMCC1 and GRK Symmetry Breaking (DFG/GRK 1581)

HK 14.7 Mo 15:45 HSZ-304

Einfach- und doppelpolarisierte Photoproduktion neutraler Pionen im Schwellenbereich — •Peter-Bernd Otte für die A2-Kollaboration — Institut für Kernphysik, Mainz

In diesem Vortrag gebe ich einen Überblick und physikalische Motivation über die Photoproduktion neutraler Pionen im Schwellenbereich. Hierzu wurden zwei neue Experimente am Elektronenbeschleuniger MAMI mit dem hermetischen CB-TAPS-Detektorsystem durchgeführt. Das erste Experiment verwendete einen linear polarisierten Photonenstrahl zusammen mit einem unpolarisierten Wasserstoff-Target. Dies erlaubt erstmals eine modellunabhängige Bestimmung der s- und p-Partialwellenamplituden. Beim zweiten Experiment kamen zirkular polarisierte Photonen und ein transversal polarisiertes Butanol-Target (Mainz-Dubna Frozen-Spin-Target) zum Einsatz. Es werden neue Ergebnisse zu transversalen Target-Asymmetrien (T, F) gezeigt und mit aktuellen Vorhersagen im Rahmen der Chiralen-Strörungstheorie und effektiver Feld-Theorie verglichen. Insbesondere wird auf die drei unterschiedlichen Vorgehensweisen bei der Datenextraktion eingegangen.

HK 14.8 Mo 16:00 HSZ-304

Polarization Observables T and F in Single π^0-Photoproduction off Quasi-Free Protons and Neutrons — •Thomas Strub for the A2-Collaboration — Departement of Physics, University of Basel, CH-4056 Basel, Switzerland

The study of the nucleons' excitation spectrum produced by meson photoproduction is indispensable in order to test QCD in the non-pertubative regime where effective quark models and lattice QCD become essential. The decomposition of overlapping resonances can only be done knowing their J^P configuration which is linked to the polarization observables through partial wave analysis. Furthermore, to understand the isospin decomposition of excited states it is necessary to measure on both the proton and the neutron.

Single π^0-photoproduction off a transversally polarized D-Butanol

target has been measured with high statistics using circularly polarized bremsstrahlung photons produced by the MAMI-C electron microtron with incident energies up to 1.5 GeV. The nearly 4π acceptance of the combined Crystal Ball/TAPS setup of the A2 collaboration is used to extract the double polarization observable F and the target asymmetry T for the polarized, quasi-free proton and neutron over a wide invariant mass and theta range. Preliminary results for the polarization observables will be presented.

HK 15: Beschleunigerphysik IV (Polarisation)

Zeit: Montag 14:00–16:00 Raum: WIL-C203

HK 15.1 Mo 14:00 WIL-C203

Simulation des Spintransports für die Polarisationsmessung am ILC — •Moritz Beckmann[1,2], Jenny List[1] und Anthony Hartin[1] — [1]DESY, 22603 Hamburg — [2]Universität Hamburg, Inst f. Exp.-Physik, Luruper Chaussee 149, 22761 Hamburg

Am geplanten International Linear Collider (ILC) soll die Polarisation der kollidierenden Leptonen mit einer bisher unerreichten Präzision bestimmt werden. In den Compton-Polarimetern 1 650 m vor bzw. 150 m hinter dem Kollisionspunkt wird eine systematische Unsicherheit von $\Delta P/P = 0{,}25\,\%$ anvisiert. Für die Analyse der Kollisionsdaten wird die luminositätsgewichtete mittlere Polarisation am e^+e^--Wechselwirkungspunkt (IP) benötigt, für die ein Langzeit-Mittelwert direkt aus e^+e^--Kollisionsdaten bestimmt werden kann.

Anhand einer Simulation des Spintransports zwischen den Polarimetern und dem IP werden die Einflüsse verschiedener Störfaktoren auf die Bestimmung der longitudinalen Polarisation am IP untersucht. Dazu gehören u. a. Bodenbewegungen, die Korrektursysteme, die deren Einflüsse kompensieren sollen, und die Depolarisation durch die Strahl-Strahl-Wechselwirkung am IP. Die Messung in den Polarimetern wird ebenfalls simuliert.

Ziel der Studie ist, die Anforderungen an die Genauigkeit der Korrektursysteme zu ermitteln sowie Kalibrationsstrategien für die Polarimeter zu entwickeln. Im Vortrag werden die Ergebnisse der Studie vorgestellt.

HK 15.2 Mo 14:15 WIL-C203

Spin tracking at the International Linear Collider — •Valentyn Kovalenko[1], Gudrid Moortgat-Pick[1,2], Sabine Riemann[3], Andriy Ushakov[1], Mathias Vogt[2], and Andrzej Wolski[4] — [1]University of Hamburg, Hamburg, Germany — [2]DESY, Hamburg, Germany — [3]DESY, Zeuthen, Germany — [4]Cockcroft Institute, Warrington, Cheshire, UK

In the baseline design for the International Linear Collider an helical undulator-based positron source has been chosen that can provide positrons with a polarization of 60% as an upgrade option motivated by physics reasons. But even the baseline configuration would already provide about 30%. In order to match the high precision requirements from physics and to optimize the physics outcome one has to control systematic uncertainties to a very high level and a precise spin tracking in the whole beamline is required as well as the option to run in an unpolarized mode for crosschecking. In our study we present our recent results on resonant depolarization technique at the damping ring.

HK 15.3 Mo 14:30 WIL-C203

Die Spindynamik-Simulation *pole* — •Jan Schmidt, Oliver Boldt und Wolfgang Hillert — Elektronen-Stretcher-Anlage ELSA, Physikalisches Institut, Universität Bonn

An der Beschleunigeranlage ELSA im Physikalischen Institut der Universität Bonn werden polarisierte Elektronen auf eine Energie von typischerweise 2,4 GeV beschleunigt. Während der schnellen Energierampe im Kreisbeschleuniger wirken Magnetfelder resonant auf den Spin und verursachen so depolarisierende Resonanzen.

Deren Einfluss auf die Polarisation hängt vom Lattice des Beschleunigers, Fehlaufstellungen der Magnete, der Strahldynamik und dem zeitlichen Verlauf der Magnetstärken ab. Um gezielte Untersuchungen dieser Faktoren zu ermöglichen, wurde die Software *pole* zur Simulation der Spindynamik entwickelt. Das Programm importiert alle Magnetfeld-Informationen sowie die Teilchenbahn aus MAD-X, so dass die Berechnung der Spinbewegung für viele Beschleuniger sehr leicht möglich ist. Dadurch können Modifikationen, beispielsweise Kickwinkel von Korrektormagneten, direkt in MAD-X vorgenommen werden. In diesem Beitrag werden *pole* sowie Beispiele der Simulationen vorgestellt.

HK 15.4 Mo 14:45 WIL-C203

Entwicklung eines neuen Polarimeters zur Messung von permanenten elektrischen Dipolmomenten — •Fabian Hinder für die JEDI-Kollaboration — III. Physikalisches Institut B, RWTH Aachen University

Um die offensichtlich existierende Materie-Antimaterie-Asymmetrie unseres Universums zu erklären sind zusätzlich zu der im Standardmodell vorhandenen CP-Verletzung weitere CP-verletzende Effekte erforderlich. Diese könnten sich in permanenten elektrischen Dipolmomenten von Elementarteilchen manifestieren.

Ziel der JEDI (Jülich Electric Dipole moment Investigations) Kollaboration ist die Suche nach permanenten elektrischen Dipolmomenten von geladenen Baryonen (p, d, ^{3}He) in Speicherringen. Das zu messende EDM-Signal zeigt sich in einer vertikalen Polarisation des gespeicherten Strahls. In diesem Vortrag werden erste Voruntersuchungen eines neuen Polarimeters zur Messung dieser Polarisation vorgestellt.

HK 15.5 Mo 15:00 WIL-C203

Simulation of spin dynamics to measure Electric Dipole Moments in storage rings — •Marcel Rosenthal and Andreas Lehrach for the JEDI-Collaboration — Institut für Kernphysik, Forschungszentrum Jülich, Germany

CP violation in the baryon sector, which is predicted by the Standard Model of Particle Physics, is too small to explain the matter and antimatter asymmetry in our universe. Permanent Electric Dipole Moments (EDMs) violate both P and T symmetries and are therefore, through the CPT theorem, also CP violating. No direct EDM measurements for protons, deuterons and light nuclei have been performed up to now.

The JEDI collaboration at Forschungszentrum Jülich (FZJ) and the BNL-EDM collaboration at Brookhaven National Laboratory (BNL) pursue the goal to measure the EDMs of these particles in dedicated storage rings. Therefore different approaches are studied to reach an ultimate sensitivity of 10^{-29} e·cm. A first direct measurement of the proton and deuteron EDM at a sensitivity level of 10^{-24} e·cm will be performed in the existing conventional storage ring at FZJ, the Cooler Synchrotron COSY.

Particle tracking simulations to explore the motion-correlated spin dynamics are a crucial part of feasibility studies of the planned storage ring EDM experiments. In a first step, a benchmarking of simulation codes with measurements at the Cooler Synchrotron COSY is performed.

HK 15.6 Mo 15:15 WIL-C203

Analyse der Spin Kohärenzzeit von Deuteronen am COSY-Teilchenbeschleuniger — •Dennis Eversmann für die JEDI-Kollaboration — 3. Physikalisches Institut, RWTH Aachen

Eine notwendige Bedingung für die Entstehung der Baryonenasymmetrie im Universum während der Baryongenese ist die CP Verletzung. Experimentell wurde diese schon z. B. beim Zerfall neutraler Kaonen beobachtet, wobei dort das CP verletzende Moment nicht ausreicht, um die große Dominanz der Materie gegenüber der Antimaterie zu erklären. Daher wird nach weiteren CP-Invarianz verletztenden Effekten gesucht, die sich in permanenten elektrischen Dipolmomenten (EDM) von Elementarteilchen bemerkbar machen könnten. Ziel der JEDI Kolaboration (Jülich Electric Dipole moment Investigations) ist, die Stärke des elektrischen Dipolmoments von Proton, Deuteron und Helium-3 in einem Speichering zu vermessen. Bei Elementarteilchen ist das EDM, wie auch das magnetische Moment, immer in Richtung der Spinachse des Teilchens orientiert. Dementsprechend besteht eine entscheidende Herausforderung darin, eine präzise Messung der Polarization der Teilchen durchzuführen, als auch ein großes Zeitintervall zu gewährleisten, in dem der Spin aller Teilchen eines Enesembles kohärent ist. Dieses Zeitintervall (Spin Coherence Time SCT) wurde in einem Beschleuniger-Experiment am COSY im Jülicher Forschungszentrum für Deuteronen vermessen, wobei versucht wurde die SCT zu

maximieren, da diese Observable im direkten Zusammenhang mit der möglichen Präzision der Vermessung des EDMs steht. In diesem Vortrag werden die Ergebnisse dieses Experiments vorgestellt und erörtert.

HK 15.7 Mo 15:30 WIL-C203

Vector polarimetry at MAMI — •Fabian Nillius and Kurt Aulenbacher — Instituts für Kernphysik, Johannes Gutenberg-Universität Mainz

Electron/photon tensor-correlation coefficients may allow to design a polarimeter that can measure all components of beam polarisation simultaneously ("vector polarimeter"). Besides its purpose as a beam diagnostic device this would also allow to test theoretical predictions for the correlation coefficients at energies between 1 and 3.5 MeV. As a first step we have set up a measurement of the helicity transfer to the photon as a function of energy which is based on the Compton absorption method. Apparative developments in order to measure photon emission asymmetries caused by transverse and longitudinal electron polarisation are presented. This work was supported by the Deutsche Forschungsgemeinschaft through SFB 443.

HK 15.8 Mo 15:45 WIL-C203

EDM searches at storage rings with Wien filters — •Artem Saleev[1] and Kolya Nikolaev[2] for the JEDI-Collaboration — [1]Institut für Kernphysik, Forschungszentrum Jülich, Germany — [2]Landau Institute, Chernogolovka, Russia

Future searches of an EDM of protons and deuterons at COSY storage ring in Juelich, envision the use of Wien filter acting as spin rotator. Crucial idea is that Wien filter produces spin kicks which give a growth of the EDM signal. In all approaches one starts with the injection of the vertically polarized beam. Radiofrequency Wien filter modulates spin tune of stored particles. If EDM is non-zero this modulation conspires with the EDM-induced rotation of the spin in the motional electric field in the ring and generates the EDM signal – the in-plane horizontal polarization. We discuss the duality between RF spin flipper and RF Wien filter and we argue why spin coherence time is equal for two devices. Another case is static Wien filter with constant fields. Behavior of spin vector is the same, but the machine is operated exactly at imperfection resonance (for protons, $G\gamma = 2$), which drastically decreases spin coherence time. Last case is more promising but it needs supercompensated magnetic lattice, an option which has to be studied further.

HK 16: Schwerionenkollisionen und QCD Phasen

Zeit: Montag 16:45–19:15 Raum: HSZ-201

Gruppenbericht HK 16.1 Mo 16:45 HSZ-201

Jet Reconstruction in Pb-Pb and pp collisions with the ALICE experiment — •Oliver Busch for the ALICE-Collaboration — Universität Heidelberg, Physikalisches Institut

Jets are defined in QCD as cascades of consecutive emission of partons from an initial hard scattering. The process of parton showering and subsequent hadronization is broadly known as fragmentation. High energy nucleus-nucleus collisions allow us to probe parton fragmentation within a QCD medium and the properties of this medium via the modification of the jet spectrum and jet structure. Jet reconstruction in pp collisions provides an elementary baseline and allows to investigate perturbative and non-perturbative aspects of particle production.

The Large Hadron Collider (LHC) at CERN delivered in 2010 and 2011 heavy-ion collisions (Pb-Pb) with collision energy per nucleon pair of $\sqrt{s_{NN}} = 2.76$ TeV and pp collisions at $\sqrt{s} = 7$ TeV. ALICE at the LHC is a general-purpose heavy ion experiment designed to study the physics of strongly interacting matter and the Quark-Gluon-Plasma, combining excellent charged particle reconstuction over a wide momentum range with electromagnetic calorimetry. We present measurements of jet production cross sections, jet structure and jet fragmentation for charged particle jets and full jets in Pb-Pb and pp collisions. The results are confronted with theory predictions.

HK 16.2 Mo 17:15 HSZ-201

Jet fragmentation into strange hadrons in Pb-Pb collisions with ALICE at the LHC — •Alice Zimmermann for the ALICE-Collaboration — Physikalisches Institut, Universitaet Heidelberg, Germany

The ALICE experiment at the LHC aims at studying ultra-relativistic heavy-ion collisions, where quarks and gluons are expected to be deconfined and to form the so-called Quark-Gluon Plasma. The measurement of particle jets, stemming from hard-scattering of partons in the colliding nuclei, allows to study parton energy-loss in the medium and correspondingly to constrain theoretical models. Production in jets of strange particles, like K^0_s, Λ and $\overline{\Lambda}$ particles, gives insight into fragmentation mechanisms and baryon-to-meson ratio in jets. These particles are reconstructed via their V0-decay topology.

In this talk, first results on K^0_s and Λ production in jets are presented for Pb-Pb collisions at $\sqrt{s_{NN}} = 2.76$ TeV. Based on their V0-decay topology, these particles can be reconstructed within jets at mid-rapidity, over a wide range of transverse momentum (from p_T(V0)= 0.2 to 10 GeV/c).

HK 16.3 Mo 17:30 HSZ-201

Momentum asymmetry of reconstructed jets in ultra-relativistic heavy-ion collisions — •Florian Senzel[1], Jan Uphoff[1], Oliver Fochler[1], Zhe Xu[2], and Carsten Greiner[1] — [1]Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Straße 1, D-60438 Frankfurt, Germany — [2]Department of Physics, Tsinghua University, Beijing, China

Recent experimental data measured in $\sqrt{s} = 2.76\,A$TeV Pb+Pb collisions by ATLAS and CMS showed a significant imbalance in the transverse momenta of the two reconstructed jets with the highest transverse momenta. This momentum imbalance is assumed to be caused by the different energy and momentum loss of the di-jets by scatterings within the created medium. To investigate this momentum loss we extended the transport model BAMPS which solves the full 3+1D Boltzmann equation for partons based on pQCD cross sections. One feature of BAMPS is the stochastic modeling of 2→2 as well as 2↔3 scattering processes. We will show our results for the momentum asymmetry A_J and have a closer look at the role of further recoil scattering processes of the initial shower partons on the momentum loss of the reconstructed jets. For this investigation it is crucial to carefully consider the subtraction of the soft underlying background medium. Therefore we use a subtraction method which is orientated on the established experimental methods.

Supported by the Hessian LOEWE initiative through the Helmholtz International Center for FAIR (HIC for FAIR) and HGS-HIRe.

HK 16.4 Mo 17:45 HSZ-201

Forward Central Jets Correlations — •Pedro Cipriano, Hannes Jung, Albert Knutsson, and Thomas Schörner-Sadenius — Desy, Hamburg, Germany

The azimuthal correlation between forward and central jets has been measured in pp collisions with the CMS detector at the LHC at the centre-of-mass energy of 7 TeV. The forward jet is required to be reconstructed in the hadronic forward calorimeter, within the pseudo-rapidity $3.2 < |\eta| < 4.7$, while the central jet is limited to $|\eta| < 2.8$. Both jets are required to have transverse momentum, pt > 35 GeV. The measurement of the azimuthal angle between the jets is performed for different separations in pseudo-rapidity between the jets, with the largest separation being 7.5 units. The measurement is repeated for two subsamples of events, one in which an additional jet is required between the forward and the central jet, and one where the additional jet is vetoed. The measurement is compared to several different Monte Carlo models and tunes.

HK 16.5 Mo 18:00 HSZ-201

A temperature-dependent jet-medium coupling at RHIC and LHC — •Barbara Betz — Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Straße 1, D-60438 Frankfurt, Germany

The nuclear modification factor and the elliptic flow for high-p_T particles up to 300 GeV are calculated for various collision energies, ranging from the low-energy runs at the Relativistic Hadron Collider (RHIC) to the high-energy collisions at the Large Hadron Collider (LHC), considering a specific class of jet energy independent models of energy

loss that feature a temperature dependent jet-medium coupling. Here, the focus is on non-perturbative models, such as the Shuryak-Liao (SL) model of magnetic monopoles, in which the jet is assumed to be strongly enhanced in the vicinity of the QCD cross-over temperature. It can be shown that an assumed factor of three enhancement of the coupling near the critical temperature is sufficient to simulateously account for the p_T, centrality, and $\sqrt{s}_{NN}$ dependence of both the elliptic flow and the nuclear modification factor.

HK 16.6 Mo 18:15 HSZ-201

Correction of detector effects with the HBOM method in event background fluctuations — •Markus Zimmermann[1,2] and Christian Klein-Bösing[1] for the ALICE-Collaboration — [1]Institut für Kernphysik, WWU Münster — [2]CERN

An important aspect of the ALICE analysis of the Quark-Gluon Plasma with hard probes are jets, which are an accumulation of particles. In heavy ion collisions, a reconstructed jet always contains particles from the background which are not generated by the initially scattered particles. The energy of this particles has to be subtracted to get the real jet energy. These background energy is different for each event and furthermore fluctuates from region to region inside each event.

Besides this, detector effects complicate the energy estimation of the jets. The used detectors only have a restricted efficiency to detect a particle and this leads to a significant amount of missing charged particles in the events. To get the real value of a measured observable it has to be corrected for these detector effects.

The background fluctuations can be corrected for the efficiency part of their detector effects with a new method, the HBOM method. In this method the detector effects are applied a few times more on the data. Than the observables are back-extrapolated to a detector effect of zero. This method does not need the knowledge about correlations in the event. Only the measured data and the detector effects which should be corrected have to be known.

HK 16.7 Mo 18:30 HSZ-201

Triggering on Jets with the ALICE TRD — •Jochen Klein for the ALICE-Collaboration — Physikalisches Institut, University of Heidelberg

The fragmentation of partons originating from hard interactions results in jets. In pp collisions jet evolution is well described by vacuum parton showers. In PbPb collisions modifications arise from the dense and strongly interacting medium. The comparison of data from PbPb, pPb, and pp data allows conclusions on medium properties.

Jets with high transverse momenta can be better separated from the high background in PbPb collisions. To collect events with such jets in pp and pPb a trigger is required. The ALICE TRD at the LHC (CERN) can provide fast hardware-based triggers about 7 μs after an interaction. We will report on the performance of the TRD jet trigger in the pp run 2012 and show prospects for the future.

HK 16.8 Mo 18:45 HSZ-201

Zwei-Teilchen-Korrelationen und die Untersuchung des Ridge in einer partonischen Kaskade — •Benjamin Linnik und Carsten Greiner — Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Straße 1, D-60438 Frankfurt, Germany

Die am RHIC und am LHC gemessenen langreichweitigen Korrelationen (ridge etc.) sind nicht hinreichend gut verstanden und weisen auf ein grundlegendes Verständnisproblem der Vorgänge in der frühen Phase einer Schwerionenkollision hin. Die experimentellen Aussagen deuten darauf hin, dass Korrelationen über grösse Rapiditätsskalen beobachtet werden und somit eine besonders starke Wechselwirkung in der frühen Phase der Kollision vorliegt. Diese frühe Phase ist besonders interessant, da dort der im frühen Universum vermutete Materiezustand des Quark-Gluon-Plasmas (QGP) erwartet wird.

Wir diskutieren die experimentellen Ergebnisse des RHIC und LHCs, erläutern unser Modell zur Simulation einer Schwerionenkollisionen, berechnen im Rahmen des Modells unter verschiedenen Anfangsbedingungen Korrelationen und vergleichen diese mit den experimentellen Daten.

Gefördert durch Land Hessen.

HK 16.9 Mo 19:00 HSZ-201

Übergang von idealen zu viskosen Machkegeln in einem kinetischen Transportmodell — •Ioannis Bouras[1], Andrej El[1], Oliver Fochler[1], Harri Niemi[2], Zhe Xu[3] und Carsten Greiner[1] — [1]Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Straße 1, D-60438 Frankfurt, Germany — [2]Department of Physics, P.O. Box 35(YFL), FI-40014 University of Jyvaskyla, Finnland — [3]Department of Physics, Tsinghua University, Beijing, China

Mithilfe eines mikroskopischen Transportmodells untersuchen wir die Evolution von Kegelstrukturen, welche durch ein ultrarelativistisches Projektil erzeugt wird. Dieses durchquert die heiße und dichte Materie von Gluonen, welche in Schwerionenkollisionen erzeugt wird. Unter Zuhilfenahme verschiedener Szenarien für den Energieverlust des Projektiles im Medium und verschiedener Transporteigenschaften des Mediums selber untersuchen wir die Formation von Machkegeln. Weiterhin wird eine Winkelabhängigkeit des Machkegels beobachtet, welche von der Energiedeposition des Projektils abhängt. Die erzeugten Zweiteilchenkorrelationen werden im Detail untersucht und mit analytischen Resultaten verglichen.

Gefördert durch Land Hessen und HGS-HIRe.

HK 17: Hadronenstruktur und -spektroskopie

Zeit: Montag 16:45–19:00 Raum: HSZ-204

HK 17.1 Mo 16:45 HSZ-204

The $\omega \to \pi^0\gamma^*$ and $\phi \to \pi^0\gamma^*$ transition form factors in dispersion theory — •Sebastian Philipp Schneider — Helmholtz-Institut für Strahlen- und Kernphysik, Universität Bonn, Nussallee 14-16, 53115 Bonn

We present a dispersion-theoretical approach to the $\omega \to \pi^0\gamma^*$ and $\phi \to \pi^0\gamma^*$ electromagnetic transition form factors. The study relies solely on a previous dispersive analysis of the corresponding three-pion decays and the precisely known pion vector form factor. Our numerical results are compared to recent measurements of the $\omega \to \pi^0\mu^+\mu^-$ decay spectrum by the NA60 collaboration. We strongly encourage experimental investigation of the Okubo–Zweig–Iizuka-forbidden $\phi \to \pi^0\ell^+\ell^-$ decays in order to understand the strong deviations from vector-meson dominance found in these transition form factors.

HK 17.2 Mo 17:00 HSZ-204

Investigating in-medium properties of the ω meson via the $\omega \to \pi^0\gamma$ decay — •Janus Weil[1,2], Ulrich Mosel[1], and Volker Metag[3] — [1]Institut für Theoretische Physik, Justus-Liebig-Universität Giessen, Heinrich-Buff-Ring 16, D-35392 Giessen, Germany — [2]Present address: Frankfurt Institute for Advanced Studies (FIAS), Ruth-Moufang-Str. 1, D-60438 Frankfurt — [3]II. Physikalisches Institut, Justus-Liebig-Universität Giessen, Heinrich-Buff-Ring 16, D-35392 Giessen, Germany

We investigate the feasibility of studying in-medium properties of the ω meson in photoproduction experiments via the decay $\omega \to \pi^0\gamma$. We use the GiBUU transport model to compare different methods of obtaining in-medium information, such as the invariant mass spectrum, transparency ratio, excitation function and momentum spectrum. We show that the final-state interaction of the pion poses a major obstacle for the interpretation of the invariant mass spectrum. We also demonstrate that the other three observables are fairly independent of final-state interactions and thus can give access to the ω in-medium properties.

Work supported by HIC-for-FAIR, HGS-HIRe and DFG under TR16.

HK 17.3 Mo 17:15 HSZ-204

π^0 and η production in proton-induced reactions measured with HADES* — •Malgorzata Gumberidze for the HADES-Collaboration — Technische Universität Darmstadt — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt

The HADES experiment at GSI studies dielectron radiation as well as strangeness production in various proton, deuteron and heavy-ion induced reactions. In this contribution we will present results from a 4-lepton analysis of 3.5 GeV p+p and p+Nb collisions providing information on π^0 and η production. To do so, we exploit the ability of

HADES to also detect e^+e^- pairs from external conversion of real photons, thus allowing for a full reconstruction of the decays $\pi^0, \eta \to \gamma\gamma \to e^+e^-e^+e^-$. Differential production cross sections will be shown and discussed. We will further demonstrate how these results provide constraints for transport models (e.g. UrQMD, IQMD, HSD, GiBUU) used to interpret the dielectron yields measured by HADES. Note that the method can be applied to heavy-ion reactions as well.

*Work supported by BMBF (06FY9100I and 06FY7114), HIC for FAIR, EMMI, GSI, and HGS-HIRe.

HK 17.4 Mo 17:30 HSZ-204

J/ψ measurements in pp collisions with the ALICE apparatus at the LHC — •Jan Wagner for the ALICE-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

The study of quarkonium production with the ALICE detector is pursued in pp and heavy-ion collisions at the Large Hadron Collider (LHC). J/ψ, a $c\bar{c}$ vector meson, is a probe of deconfinement expected to be reached in heavy-ion collisions. The measurements in pp collisions provide data to test (perturbative) QCD models of quarkonium production and serve as a reference for measurements in nucleus-nucleus collisions. Results of the J/ψ production cross section in pp collisions at $\sqrt{s} = 7$ TeV will be presented. Measurements of J/ψ polarization at central rapidity and forward rapidities will be discussed.

HK 17.5 Mo 17:45 HSZ-204

Produktion von Λ-Hyperonen und ϕ-Mesonen in Reaktionen von p (@3.5 GeV)+Nb. — •Christian Wendisch für die HADES-Kollaboration — Helmholtz-Zentrum Dresden-Rossendorf

Neben Schwerionenkollisionen bieten elementare Nukleon-Nukleon sowie Nukleon-Kern-Reaktionen eine wesentliche Grundlage zum Verständnis des Verhaltens der Kernmaterie. Besonders Strangeness enthaltene Teilchen sind sensitive Sonden zur Untersuchung der Wechselwirkung und von Produktionsmechanismen von Hadronen im Kernmedium. Dazu stellen wir eine detaillierte Analyse von Λ-Hyperonen und ϕ-Mesonen vor, die mit dem High Acceptance Di-Electron Spectrometer (HADES) rekonstruiert wurden. Aus ca. 4×10^9 aufgezeichneten Reaktionen von p($E_{kin} = 3,5$ GeV) mit Niob-Kernen werden Phasenraumverteilungen dieser Hadronen extrahiert und mit verschiedenen Transportmodell-Rechnungen verglichen, um die Produktionsmechanismen der Strangeness tragenden Teilchen zu identifizieren.
Diese Arbeit wurde unterstützt durch BMBF.

HK 17.6 Mo 18:00 HSZ-204

Production and interaction of neutral kaons in proton-proton and proton-nucleus reactions at 3.5 GeV beam energy — •Kirill Lapidus and Jia-Chii Berger-Chen for the HADES-Collaboration — Excellence Cluster 'Universe', Boltzmannstr. 2, 85748, Garching, Germany

Results on the inclusive K^0-meson production in proton-proton and proton-niobium collisions will be presented. The high-statistics ($\sim 10^4$ kaons) data were measured by the HADES experiment (GSI Helmholtzzentrum), employing a proton beam with a kinetic energy of 3.5 GeV. Differential cross sections, reconstructed in $p + p$ collisions, are compared with predictions of a resonance model for kaon production. The GiBUU transport code, which includes the resonance model, is used for the interpretation of the data, obtained in $p+^{93}$Nb reactions. On the basis of GiBUU simulations, the sensitivity of the measurements to the in-medium kaon-nucleon scattering and the repulsive kaon-nucleus potential will be discussed.

Supported by BMBF and the Excellence Cluster "Universe".

HK 17.7 Mo 18:15 HSZ-204

Low-mass dielectron measurement for pp collisions with ALICE — •Markus K. Köhler for the ALICE-Collaboration — Research Division and ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung, Planckstraße 1, 64291 Darmstadt, Germany

Dileptons are an important probe for the medium, which can be created in heavy-ion collisions at high energies. Thereby, proton-proton collisions provide a reference measurement for a medium free environment.
We report on the latest results of dielectron measurements in proton-proton collisions at $\sqrt{s} = 7$ TeV with the ALICE detector system. Contributions from known hadronic sources will be compared to the data. We demonstrate that the hadronic cocktail is consistent with our data.

HK 17.8 Mo 18:30 HSZ-204

Wilson-Koeffizienten von Vier-Quark-Kondensaten zur Beschreibung von Medium-Modifikationen von qQ-Mesonen — •Thomas Buchheim[1,2] und Burkhard Kämpfer[1,2] — [1]Helmholtz-Zentrum Dresden-Rossendorf — [2]Technische Universität Dresden

Zur Evaluierung mediumabhängiger spektraler Eigenschaften von qQ-Mesonen wird die Methode der QCD-Summenregeln bei nichtverschwindenden Baryonendichten und/oder Temperaturen angewendet. Die IR-divergenzfreie Operatorproduktentwicklung (OPE) für qQ-Mesonen im Medium bis zur Massendimension 5 wird dabei durch Vier-Quark-Kondensate bis zur Massendimension 6 erweitert. Ein vollständiger Katalog von Vier-Quark-Kondensaten im qq- und qQ-Sektor wird angegeben. Die Berechnung der zugehörigen Wilson-Koeffizienten aus Diagrammen auf Baumgraphenniveau wird für die Ströme $\bar{q}\Gamma Q$ mit den Dirac-Strukturen $\Gamma = 1$, $i\gamma_5$, γ_μ und $\gamma_5\gamma_\mu$ vorgenommen. Auftretende Kondensate, welche neben Feldoperatoren leichter Quarks (q) auch Feldoperatoren schwerer Quarks (Q) enthalten, werden in Potenzen der inversen schweren Quark-Masse entwickelt. Die Hinzunahme der kompletten Vier-Quark-Kondensatbeiträge zur OPE im Medium geht über bisherige Auswertungen von D-Meson-Summenregeln hinaus. Da von der Mediumabhängigkeit der Vier-Quark-Kondensate ein großer Einfluss auf die Eigenschaften von Mesonen erwartet wird, ist mit Blick auf die geplanten Experimente bei FAIR, wo diese Mediumabhängigkeiten experimentell zugänglich sein werden, die Bestimmung der Vier-Quark-Kondensatbeiträge von großem Interesse.

Gefördert durch BMBF.

HK 17.9 Mo 18:45 HSZ-204

Charmonium production in $\bar{p}$-nucleus reactions at low energies — •Alexei Larionov[1,2], Markus Bleicher[1,3], Albrecht Gillitzer[4], and Mark Strikman[5] — [1]Frankfurt Institute for Advanced Studies (FIAS), Ruth-Moufang-Straße 1, D-60438 Frankfurt — [2]National Research Center "Kurchatov Institute", 123182 Moscow, Russia — [3]Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Straße 1, D-60438 Frankfurt — [4]Institut für Kernphysik, Forschungszentrum Jülich, D-52425 Jülich — [5]Pennsylvania State University, University Park, PA 16802, USA

The $J/\Psi(1S)$, $\Psi'(2S)$ and $\chi_{c1}(1P)$ production near threshold in antiproton-nucleus reactions is calculated within a Glauber model. The model takes into account the antiproton (pre)absorption, proton Fermi motion, and charmonium formation length. The realistic proton and neutron density profiles are included in our calculations. We confirm earlier prediction that the charmonium production in $\bar{p}A$ collisions at $p_{\rm lab} = 3 - 10$ GeV/c is not influenced by formation length effects and is very well suited to determine the genuine charmonium-nucleon dissociation cross sections. However, we demonstrate that the detailed structure of the proton and neutron density profiles have to be taken into account, if one wants to extract information on the $J/\Psi N$ dissociation cross section from J/Ψ transparency ratios. The possibility to test the polarization-dependent $\chi_{c1}N$ cross sections is discussed. These studies are relevant for the upcoming PANDA experiment at FAIR.
Supported by the Hessian LOEWE initiative through the Helmholtz International Center for FAIR (HIC for FAIR)

HK 18: Struktur und Dynamik von Kernen

Zeit: Montag 16:45–19:00 Raum: HSZ-301

Gruppenbericht HK 18.1 Mo 16:45 HSZ-301

Isospin symmetry in the *sd* shell Coulomb excitation of ^{33}Ar and the new 'Lund-York-Cologne-Calorimeter' — •Andreas Wendt and Peter Reiter for the S377-Kollaboration-Collaboration — Institut für Kernphysik, Universität zu Köln

The 'Lund-York-Cologne-Calorimeter' (LYCCA) is the first operational NUSTAR device for the HiSpec experiment at FAIR. LYCCA is a high efficient ToF-ΔE-E detector array for identification and tracking of exotic nuclei. After testing and commissioning of LYCCA the successful operation of LYCCA was achieved in first in-beam γ-ray spectroscopy experiments at GSI. A Coulomb excitation experiment using a relativistic, radioactive ^{33}Ar beam was performed employing LYCCA. The ^{33}Ar beam, produced by impinging a primary ^{36}Ar beam on a ^{9}Be target, hit onto a secondary ^{197}Au target with an energy of approximately 145 MeV/u. γ-rays were observed by the Ge Cluster detectors of the PreSpec setup. LYCCA was employed to track the outgoing ions and to reject all nuclear reaction channels. $B(E2)$ values for excited states in ^{33}Ar have been determined. These first experimental values for proton-rich $T_z = -\frac{3}{2}$ *sd* shell nuclei are used to test effective interactions for new shell model calculations, describing excitation energies of sd shell mirror pairs.

Supported by the German BMBF (06KY9136 TP7+TP1) and by the HGS-HIRe.

HK 18.2 Mo 17:15 HSZ-301

Coulomb Anregung von ^{26}Na an REX-ISOLDE — •Burkhard Siebeck[1], Peter Reiter[1], Michael Seidlitz[1], Richard Altenkirch[1], Christopher Bauer[2], Hilde De Witte[3], Thorsten Kröll[2], Janne Pakarinen[4], Fabian Radeck[1], Marcus Scheck[2], David Schneiders[1], Christophe Sotty[4,5], Didier Voulot[4], Nigel Warr[1] und Fredrik Wenander[4] — [1]IKP, Universität zu Köln — [2]IKP, TU Darmstadt — [3]IKS, K.U. Leuven — [4]CERN, Genf — [5]CSNSM, Orsay

Angeregte Kernzustände in ^{26}Na wurden im Rahmen eines Coulombanregungsexperimentes an REX-ISOLDE mit einem radioaktiven ^{26}Na Strahl bei einer Energie von 2,82MeV/u untersucht. Die bei der Abregung entstehende γ-Strahlung wurden mit dem MINIBALL-Spektrometer in Koinzidenz zu vorwärts gestreuten Strahlkernen in einem DSSSD detektiert. Übergangswahrscheinlichkeiten der angeregten Zustände aus ^{26}Na bei 233keV und 407keV wurden erstmals experimentell bestimmt. Diese Werte werden mit theoretischen Vorhersagen aus aktuellen USD-Schalenmodellrechnungen verglichen. Durch die neuen Rechnungen werden zudem konsistente Ergebnisse zur Spinabfolge in ^{26}Na erzielt.

Unterstützt durch BMBF (Fördernummer 06KY2051) und ENSAR (Projektnummer 26201)

HK 18.3 Mo 17:30 HSZ-301

Bestimmung des B(E2)-Wertes des 2_1^+-Zustandes von ^{140}Nd und ^{142}Sm mittels Coulomb-Anregung an REX-ISOLDE * — •Robert Stegmann[1], Christopher Bauer[1], Norbert Pietralla[1], Georgi Rainovski[2] und Sabine Bönig[1] für die IS496-Kollaboration — [1]Technische Universität Darmstadt, Darmstadt, Deutschland — [2]University of Sofia, Sofia, Bulgarien

Zur Untersuchung des Effekts der „shell stabilization“ gemischtsymmetrischer Zustände [1], sind Identifikation und Vermessung gemischt-symmetrischer Zustände in den N=80-Isotonen geplant. Eine notwendige Voraussetzung für den Experimentierplan in diesem Vorhaben ist die Kenntnis der E2-Übergangsstärke des ersten 2^+-Zustandes. Radioaktive ^{140}Nd- und ^{142}Sm-Ionen wurden dazu an REX-ISOLDE, mit einer Energie von 2,85 MeV/u auf Targets aus ^{48}Ti, ^{64}Zn und ^{94}Mo geschossen. Gammastrahlung aus dem Zerfall der Coulomb-angeregten Zustände wurden von MINIBALL gemessen, die Kerne mittels DSSSD identifiziert. Die Anregungsstärke vom 2_1^+-Zustand konnte so vorläufig zu 34 (3) W.u. (^{140}Nd) und 30 (2) W.u. (^{142}Sm) bestimmt werden. Die B(E2)-Werte weichen von QPM-Rechnungen [2] ab, während sie sich teilweise mit „large-scale shell model“-Rechnung [3] decken.

[1] G. Rainovski et al., Phys. Rev. Lett. 96, 122501 (2006)
[2] N. Lo Iudice et al., Phys. Rev. C 77, 044310 (2008)
[3] D. Bianco et al., Phys. Rev. C 85, 034332 (2012)
* Gefördert vom BMBF unter 05P09RDCI6, 05P12RDCIB

HK 18.4 Mo 17:45 HSZ-301

Level lifetimes and quadrupole moments from Coulomb excitation in the Ba chain * — •Christopher Bauer[1], Giulia Guastalla[1], Jörg Leske[1], Thomas Möller[1], Norbert Pietralla[1], Darek Seweryniak[2], Christian Stahl[1], Robert Stegmann[1], Johannes Wiederhold[1], and Shaofei Zhu[2] for the IS411-Collaboration — [1]Institut für Kernphysik, TU Darmstadt, Germany — [2]Argonne National Lab, Chicago, Illinois, U.S.A.

The chain of Barium isotopes enables us to study experimentally the evolution of nuclear quadrupole collectivity from the shell closure at N=82 towards neutron-deficient or neutron-rich deformed nuclei. The TU Darmstadt group has investigated several nuclei from stable ^{130,132}Ba up to radioactive ^{140,142}Ba with the projectile-Coulomb excitation technique including the use of the Doppler-shift attenuation method (DSAM). Lifetimes of quadrupole-collective states of ^{132}Ba and ^{140}Ba were obtained for the first time as well as the static electric quadrupole moments Q(2_1^+) for ^{130,132}Ba and ^{140,142}Ba. The results are compared to Monte Carlo shell model [1] and Beyond-Mean-Field calculations [2].

[1] N. Shimizu et al., Phys. Rev. Lett. 86, 1171-1174 (2001)
[2] C. Bauer et al., Phys. Rev. C 86, 034310 (2012)
* supported by the DFG under Grant No. Pi393/2-2 and the BMBF (05P09RDCI6,05P12RDCIB)

HK 18.5 Mo 18:00 HSZ-301

The ^{11}C(p,2p) and ^{11}C(p,pn) Reactions in Inverse Kinematics — •Matthias Holl for the R3B-Collaboration — Institut für Kernphysik, Technische Universität Darmstadt, Germany

Quasi-free scattering of relativistic ^{11}C has been studied in inverse kinematics during experiment S393 at the R3B-LAND setup. In this experiment, a radioactive beam coming from the fragment separator FRS was used to induce secondary reactions with a CH_2 target. The incoming beam as well as the reaction products were detected in kinematically complete measurements. The study is aimed at a quantitative understanding of absolute spectroscopic factors that appear to be quenched for deeply bound nucleons. Preliminary results for the ^{11}C(p,2p) and 11C(p,pn) reactions will be shown and compared to results obtained for knockout reactions from these isotopes. Supported by BMBF (06DA9040I), the State of Hesse (LOEWE Centre HIC for FAIR), and through the GSI-TU Darmstadt cooperation agreement.

HK 18.6 Mo 18:15 HSZ-301

Protonenstreuung an ^{56}Ni in inverser Kinematik am internen Target des ESR — •M. von Schmid für die EXL E105-Kollaboration — Institut für Kernphysik, TU Darmstadt

EXL, „**EX**otic nuclei studied in **L**ight-ion induced reactions“, ist ein Projekt innerhalb von NUSTAR bei FAIR. Der Detektor für targetähnliche, leichte Rückstoßionen wird am zukünftigen NESR („**N**ew **E**xperimental **S**torage **R**ing“) eingesetzt werden, um dort direkte Reaktionsexperimente mit radioaktiven Strahlen an einem internen Target in inverser Kinematik durchzuführen.

Im vergangenen Jahr wurde am existierenden ESR („**E**xperimental **S**torage **R**ing“, GSI) im Rahmen des laufenden EXL-Experimentierprogramms (E105) mit der Reaktion ^{56}Ni(p,p)^{56}Ni zum ersten Mal erfolgreich eine Kernreaktion mit gespeicherten, exotischen Schwerionen untersucht. Das Ziel der Messung ist die Bestimmung des differentiellen Wirkungsquerschnitts für elastische Protonenstreuung, woraus sich die radiale Dichteverteilung der Kernmaterie von ^{56}Ni gewinnen lässt. Der Vortrag wird den aktuellen Stand der Analyse diskutieren und vorläufige Ergebnisse präsentieren.

Gefördert durch BMBF (06DA9040I und 05P12RDFN8) und HIC for FAIR.

HK 18.7 Mo 18:30 HSZ-301

Transfer-Reaktionen und Coulomb Anregung mit T-REX in der Region um ^{68}Ni an ISOLDE — •Stefanie Klupp[1], Dennis Mücher[1], Roman Gernhäuser[1] und Reiner Krücken[1,2] für die Is510-Kollaboration — [1]Technische Universität München — [2]TRIUMF, Vancouver

Bis heute ist noch nicht vollständig geklärt, inwiefern es sich bei ^{68}Ni um einen doppelt magischen Kern handelt. ^{68}Ni weist z.B. einen hochliegenden 2_1^+-Zustand auf, der über den Paritätswechsel der fp- und der

g9/2-Schale erklärt werden kann. Diese zugrunde liegende Schalenstuktur scheint auch für das ungewöhnliche Verhalten der ersten angeregten 0^+-Zustände benachbarter gg-Kerne verantwortlich zu sein.

Diese Punkte wurden an REX-ISOLDE mit zwei komplementären Methoden (Neutronen-Transfer-Reaktionen und Coulomb-Angregung) genauer beleuchtet.

2011 wurde mit dem Si-Array T-REX und MINIBALL der 2n-Transfer von ^{72}Zn nach ^{74}Zn studiert. Das Ziel dieses Experiments war den unbekannten 0_2^+-Zustand in ^{74}Zn zu identifizieren.

2012 wurde die mehrfache Coulomb-Anregung von ^{72}Zn mit einem neuen Setup beobachtet. Dieser besteht aus einem verschiebbaren CD-Detektor in Vorwärtsrichtung, sowie erstmals aus zusätzlichen Detektoren in Rückwärtsrichtung, die es auch erlauben Quadrupolmomente zu bestimmen.

Im Rahmen dieses Vortrages werden die ersten Ergebnisse der beiden Messungen präsentiert. Diese Arbeit wird gefördert durch BMBF (06MT9156), DFG (EXC 153) und ENSAR.

HK 18.8 Mo 18:45 HSZ-301

Coulomb excitation of ^{123}Cd — •Anna-Lena Hartig[1], Thorsten Kröll[1], Stoyanka Ilieva[1], Sabine Bönig[1], Michael Thürauf[1], Gary Simpson[2], Georgi Georgiev[3], Nele Kesteloot[4], Andrea Jungclaus[5], Andrés Illana Sisón[5], Kasia Wrzosek-Lipska[4], Floriane Drouet[2], Mourad Ramdhane[2], Dimiter Balabanski[6], Nigel Warr[7], Didier Voulot[8], Fredrik Wenander[8], and Bruce Marsh[8] — [1]IKP, TU Darmstadt, Germany — [2]LPSC, Grenoble, France — [3]CSNSM, Orsay, France — [4]KU, Leuven, Belgium — [5]CSIC, Madrid, Spain — [6]INRNE-BAS, Sofia, Bulgaria — [7]IKP, Univ. zu Köln, Germany — [8]CERN, Schweiz

On the neutron-rich side of the valley of stability in the vicinity of the double magic nucleus ^{132}Sn one can find the ^{123}Cd isotope. Surprisingly the neutron-rich even-A Cd isotopes in this region are showing signs of collectivity beyond that calculated by modern shell-model predictions. In order to gain a deeper insight in this phenomenon we started to extend these studies to odd-A Cd isotopes. As first isotope the exotic nucleus ^{123}Cd was produced for safe Coulomb excitation by the ISOLDE facility at CERN and post-accelerated by REX-ISOLDE. The γ-decay from excited states was detected with the MINIBALL array. A report on the status of the ongoing analysis will be given.
This project is supported by BMBF (06DA9036I, 05P12RDCIA), HIC for FAIR and ENSAR (262010).

HK 19: Hadronenstruktur und -spektroskopie

Zeit: Montag 16:45–19:00 Raum: HSZ-304

Gruppenbericht HK 19.1 Mo 16:45 HSZ-304

The neutron-proton charge-exchange amplitudes measured in the $dp \to ppn$ reaction at ANKE/COSY — •David Mchedlishvili for the ANKE-Collaboration — Institut für Kernphysik, Forschungszentrum Jülich GmbH, 52425 Jülich, Germany — High Energy Physics Institute, Tbilisi State University, 0186 Tbilisi, Georgia

The unpolarised differential cross section and the two deuteron tensor analysing powers A_{xx} and A_{yy} of the $\vec{d}p \to \{pp\}_s n$ charge-exchange reaction have been measured with the ANKE spectrometer at the COSY storage ring. Using deuteron beams with energies 1.2, 1.6, 1.8, and 2.27 GeV, data were obtained for small momentum transfers to a $\{pp\}_s$ system with low excitation energy. The results at the three lower energies are consistent with impulse approximation predictions based upon the current knowledge of the neutron-proton amplitudes. However, at 2.27 GeV, where these amplitudes are far more uncertain, agreement requires a reduction in the overall double-spin-flip contribution, with an especially significant effect in the longitudinal direction. These conclusions are supported by measurements of the deuteron-proton spin-correlation parameters $C_{x,x}$ and $C_{y,y}$ that were carried out in the $\vec{d}\vec{p} \to \{pp\}_s n$ reaction at 1.2 and 2.27 GeV. The values obtained for the proton analysing power A_y^p also suggest the need for a radical re-evaluation of the neutron-proton elastic scattering amplitudes at the higher energy. Such measurements can provide a valuable addition to the neutron-proton database in the charge-exchange region.

Supported by the COSY-FFE program.

HK 19.2 Mo 17:15 HSZ-304

Results for the $\vec{p}p \to pK^+\Lambda$ Reaction Measured at COSY-TOF with a Polarized Proton Beam of 2.70 GeV/c — •Florian Hauenstein for the COSY-TOF-Collaboration — Universitaet Erlangen-Nuernberg, Erlangen, Deutschland

The COSY-TOF detector setup was recently upgraded with a new tracking system including a Straw Tube Tracker (STT). This upgrade increases the reconstruction efficiency and the precision of the event reconstruction significantly. Together with the polarized beam it allows to determine the spin triplet $p\Lambda$ scattering length. Additionally the production mechanism of the $\vec{p}p \to pK^+\Lambda$ reaction can be studied from polarization observables and the Dalitz plot. The latter can also be used to determine contributions of N^* resonances.

In 2011 a measurement was performed with a polarized proton beam of 2.70 GeV/c momentum. In this talk preliminary results on the Dalitz plot, angular distributions and polarization observables will be presented. It will be shown that the $N\Sigma$ cusp effect in the reaction is less strong than in other COSY-TOF measurements at higher beam momenta. In addition the behaviour of the kaon analyzing power and Λ polarization is compared to a previous measurement at 2.95 GeV/c. The latter changes its sign at 2.70 GeV/c compare to higher beam momenta.

HK 19.3 Mo 17:30 HSZ-304

Chiral effective field theory for hyperon-nucleon interactions — •Stefan Petschauer[1], Johann Haidenbauer[2], Norbert Kaiser[1], Ulf-G. Meissner[2], and Wolfram Weise[1] — [1]Physik-Department, Technische Universität München, D-85747 Garching, Germany — [2]Institute for Advanced Simulation, Forschungszentrum Jülich, D-52425 Jülich, Germany

We calculate hyperon-nucleon interactions within the framework of chiral effective field theory. The irreducible potentials in momentum space are derived from the chiral SU(3) Lagrangian and include contributions from one- and two-meson exchange as well as contact terms up to next-to-leading order. Effects from intermediate decuplet baryons are considered as well. With these chiral baryon-baryon potentials a systematic study of hyperon-nucleon scattering and light hypernuclei is possible. Calculations for hyperon-nucleon cross sections have been performed using a regularized Lippmann-Schwinger equation and a good description of all the available data is achieved.

Work supported in part by DFG and NSFC (CRC110).

HK 19.4 Mo 17:45 HSZ-304

The ABC effect in $dp \to {}^3\mathrm{He}\,\pi^+\pi^-$ at ANKE* — •Malte Mielke, Christopher Fritzsch, Paul Goslawski, Alexander Täschner, Michael Papenbrock, Daniel Schröer, and Alfons Khoukaz for the ANKE-Collaboration — Westfälische Wilhelms-Universität, Münster, Germany

The ABC effect is a phenomenon which appears in double pionic fusion reactions as a low-mass enhancement in the two pion invariant mass spectrum. It has been a matter of research since many years and was lately even linked with the appearance of an exotic resonance, which should decay via two Δ baryons into the observed particles.
Complementary to the approach of other experiments it is also of high interest to investigate influences of other possible production mechanisms on the invariant mass distributions. The high momentum resolution, which is needed for this task, can be achieved with the ANKE spectrometer at the COoler SYnchrotron - COSY, where data of the reaction $dp \to {}^3\mathrm{He}\,\pi^+\pi^-$ was recorded in an excess energy range of 265 to 285 MeV. The use of kinematically complete events allows for a detailed analysis of the invariant mass distributions with respect to different involved production channels.
Recent results will be presented and discussed.
*Supported by the COSY-FFE program.

HK 19.5 Mo 18:00 HSZ-304

Investigation of the tensor analyzing power t_{20} in the reaction $\vec{\mathbf{d}}$+p $\to {}^3$He+η — •Michael Papenbrock, Christopher Fritzsch, Paul Goslawski, Alfons Khoukaz, Malte Mielke, Daniel Schröer, and Alexander Täschner for the ANKE-Collaboration — Westfälische Wilhelms-Universität, Münster, Germany

Previous measurements on the reaction $d + p \rightarrow {}^3He + \eta$ with the ANKE spectrometer at the COoler SYnchrotron - COSY - of the Forschungszentrum Jülich provided strong indications for the existence of a quasi-bound state of the $\eta - {}^3He$ system. In order to gather more evidence for this possible quasi-bound state, measurements with a polarized deuteron beam have been performed at ANKE on the reaction $\vec{d} + p \rightarrow {}^3He + \eta$. Hence, the investigation of the energy dependence of the tensor analyzing power t_{20} allows to study in more detail the role of the final state interaction in the strong enhancement of the total cross section.

Recent results will be presented and discussed. Furthermore, a brief outlook on the upcoming measurement on the reaction $p + n \rightarrow d + \eta$ in the context of η-mesic nuclei will be given.

Supported by the COSY-FFE program.

HK 19.6 Mo 18:15 HSZ-304

Data analysis with the BGO-OD experiment — •Thomas Jude for the BGO-OD-Collaboration — Physikalisches Institute, Universität Bonn

The new BGO-OD experiment at the ELSA accelerator facility, Bonn, consists of the highly segmented BGO calorimeter with a particle tracking magnetic spectrometer at forward angles. This allows the investigation of final states of mixed charge with nearly 4π acceptance, with very high precision at forward angles for charged particles. An extensive physics programme using an energy tagged bremsstrahlung photon beam is employing this unique setup, with measurements planned for associated strangeness, vector meson and pseudoscaler meson photoproduction.

Analysis of data from the first data taking beam time, and comparison with simulated data is presented. This includes particle momentum reconstruction with the BGO and the forward spectrometer. Highlights include a new method of K^+ identification via the time delayed decay in the BGO crystals, greatly increasing the acceptance region for K^+ and vector mesons.

HK 19.7 Mo 18:30 HSZ-304

Resonance Multiplets in the Two-Baryon System — Dibaryons revisited*. — •Heinz Clement and Mikhail Bashkanov — Physikalisches Institut der Universität Tübingen

After Jaffe's note on the possible existence of a bound six-quark system, the H-dibaryon denoting asymptotically a bound $\Lambda\Lambda$ system, numerous theoretical investigations appeared predicting a vast number of states in the system of two baryons. In the subsequent experimental hunt for dibaryons many claims have been announced, however, none survived careful experimental investigations. The interest in dibaryons revived recently, when two groups announced that lattice QCD calculations provide evidence for a bound H-dibaryon. Also recently it has been noted that the double-pionic fusion reaction $pn \rightarrow d\pi^0\pi^0$ proceeds dominantly via a resonance structure observed in the total cross section at $\sqrt{s} = 2.37$ GeV with $\Gamma \approx 70$ MeV and $I(J^P) = 0(3^+)$ [1]. Since its decay proceeds dominantly via an intermediate $\Delta\Delta$ system, this putative resonance constitutes asymptotically a $\Delta\Delta$ system bound by nearly 100 MeV. In recent years also another resonance got established by SAID phase shift analyses, which resonates in the ${}^1D_2$ pp partial wave at $\sqrt{s} = 2.15$ GeV with $\Gamma \approx 120$ MeV. Since it resides just at the $N\Delta$ threshold, it is assumed to be a loosely bound (molecular) ΔN configuration. None of the many dibaryon predictions can predict both resonances at the proper energies – with the exception of Dyson's multiplet prediction. The consequences will be discussed.

[1] P. Adlarson et al., Phys. Rev. Lett. **106** 242302 (2011)

*supported by BMBF and COSY-FFE (FZ Jülich)

HK 19.8 Mo 18:45 HSZ-304

Preliminary results from the commissioning experiment of the polarized deuterium gas target at ANKE/COSY — •Boxing Gou for the ANKE-Collaboration — Institut für Kernphysik, Forschungszentrum Jülich, Germany — Institute of Modern Physics, Chinese Academy of Sciences, 509 Nanchang Road, Lanzhou, 730000, P.R.China

By using the deuteron as a quasi-free neutron target at ANKE/COSY, many important observables can be investigated in polarized nucleon-nucleon collisions. The difference between the pp and np elastic scattering amplitude can be directly measured by investigating the np charge exchange reaction. This has already been successfully studied up to a nucleon energy of 1.1 GeV by using the polarized deuteron beam incident on polarized/unpolarized hydrogen targets. Using instead a polarized deuterium cell target it would be possible to extend the charge exchange studies up to the highest COSY proton beam energy of 2.8 GeV. In order to test the performance of the polarized deuterium gas target and the feasibility of continuing the charge exchange studies, a commissioning experiment was conducted in June 2012. Nuclear reactions with large and well-known cross sections and analyzing powers that fell within the ANKE acceptance were used to measure the target vector (Q_y) and tensor (Q_{yy}) polarizations.

The physics case for using a polarized deuterium gas target at ANKE/COSY will be presented, as well as the preliminary results regarding the pn charge exchange studies.

Supported by CSC program.

HK 20: Struktur und Dynamik von Kernen

Zeit: Montag 16:45–19:00 Raum: HSZ-401

Gruppenbericht HK 20.1 Mo 16:45 HSZ-401

Strangeness dynamics in $\bar{p}$-induced reactions — •Theodoros Gaitanos[1], Alexei Larionov[2], Horst Lenske[1] und Ulrich Mosel[1] — [1]Institut für Theoretische Physik, Universität Gießen — [2]Frankfurt Inst. for Adv. Studies, J.W. Goethe-Universität, Frankfurt, Germany

The investigation of the hyperon-nucleon interactions at regions of high densities beyond ordinary nuclei is crucial for our understanding of nuclear astrophysics. For instance, the high-density equation of state (EoS), which dominates the dynamics of neutron stars, can be affected by the presence of hyperons in a dense matter. The in-medium interactions between nucleons and hyperons are still little understood. A promising tool to investigate not only the hyperon-nucleon, but also the hyperon-hyperon interactions is provided by multi-strange hypernuclei. Single- and double-Λ hypernuclei can be produced in reactions induced by heavy-ions and particularly in reactions induced by $\bar{p}$-beams, which are one of the main tasks (HypHI and PANDA collaborations) at the future FAIR facility at GSI. Here we present calculations concerning the in-medium dependences of hyperon-nucleon scattering, which result as the solution of the in-medium Bethe-Salpeter equation. For the first time, transport calculations predicting the formation and production of single- and double-Λ hypernuclear systems on a quantitative level in reactions relevant for FAIR are presented and discussed in detail.

HK 20.2 Mo 17:15 HSZ-401

Ab-initio description of p-shell hypernuclei — •Roland Wirth, Angelo Calci, Joachim Langhammer, and Robert Roth — Institut für Kernphysik, Technische Universität Darmstadt

Tremendous progress is being made on the experimental study of hypernuclei, especially on the spectroscopy of p-shell hypernuclei. Their theoretical description, however, is limited to phenomenological models or very light (i.e. s-shell) systems. We present the first ab-initio calculations of p-shell hypernuclei using chiral Hamiltonians including hyperon-nucleon and two- plus three-nucleon interactions, which to date constitute the most consistent starting-point to solving the hypernuclear many-body problem.

The many-body calculations are performed in the framework of the importance-truncated no-core shell model using leading-order (LO) chiral hyperon-nucleon and chiral two- plus three-body nucleon-nucleon interactions at N^{3}LO and N^{2}LO, respectively. To improve convergence with respect to model space size, the interactions are evolved consistently using a similarity renormalization group transformation. We show absolute energies and spectra for selected single-lambda-hypernuclei up to the ${}_\Lambda$Li isotope chain.

∗ Supported by DFG (SFB 634), HIC for FAIR and BMBF (06DA7047I)

HK 20.3 Mo 17:30 HSZ-401

Nuclear Thermodynamics with Chiral Low-Momentum Interactions — •Corbinian Wellenhofer[1], Jeremy Holt[1,2], Norbert Kaiser[1], and Wolfram Weise[1,3] — [1]Physik Department,

Technische Universität München, D-85747 Garching, Germany — [2]Physics Department, University of Washington, Seattle, Washington 98195, USA — [3]ECT*, Villa Tambosi, I-38123 Villazzano (TN), Italy

We discuss the thermodynamical properties of nuclear matter on the basis of chiral low-momentum interactions. The universal low-momentum nucleon-nucleon potential $V_{\text{low-}k}(\Lambda)$ is combined with three-nucleon forces from chiral effective field theory. With these two- and three-body interactions, we have calculated the free energy per particle for both isospin-symmetric nuclear matter and neutron matter by considering contributions up to second order in many-body perturbation theory. In order to examine the model-dependence of the results we have varied the resolution scale Λ, and performed also calculations with a regularized chiral NN potential instead of $V_{\text{low-}k}(\Lambda)$. The critical temperature for the liquid-gas phase transition has been determined to be $T_c \simeq 16\,\text{MeV}$. In the coexistence region of the nuclear liquid and gas phase the physical free energy has been determined by the usual Maxwell construction.

HK 20.4 Mo 17:45 HSZ-401

New modes of nuclear excitations in microscopic and collective model description — •Nadia Tsoneva[1,2] and Horst Lenske[1] — [1]Institut für Theoretische Physik, Universität Gießen — [2]INRNE, BAS, Sofia, Bulgaria

A microscopic approach based on density functional theory and multi-phonon QRPA methods is successfully applied for investigations of pygmy resonances and other excitations of different multipolarities and energies in stable and exotic nuclei. From systematic studies of nuclear response functions a clear indication of close connection between low-energy excited states related to pygmy resonances and nuclear skin oscillations is observed. This is confirmed also in analyses of transition densities and currents. A useful link to collective model approaches is used for distinction of pygmy resonance from other modes of excitations related low-energy multi-phonon vibrations, twist modes or giant resonances observed in response functions and data. Furthermore, nuclear skins are found to affect M1 strength distributions in nuclei, as confirmed by recent experiments. The fine structure of the spin-flip M1 resonance is discussed and compared to experimental data. Supported by BMBF project 06GI9109.

HK 20.5 Mo 18:00 HSZ-401

Untersuchung der O(6) Symmetrie in Pt Isotopen — •Thomas Möller[1], Christopher Bauer[1], Robert Janssens[2], Christopher Lister[2], Elizabeth McCutchan[2], Norbert Pietralla[1], Georgi Rainovski[1,3], Dariusz Seweryniak[2], Christian Stahl[1] und Shaofei Zhu[2] — [1]Institut für Kernphysik, TU Darmstadt — [2]Argonne National Laboratory, Argonne, IL, USA — [3]Faculty of Physics, St. Kliment Ohridski University Sofia, Bulgarien

Die dynamische O(6)-Symmetrie ist eine Lösung des Interacting Boson Modells, deren Realisierung in nur wenigen Kernen vermutet wird, zu denen insbesondere die Pt-Isotope zählen und bisher auch die Xe-Isotope zählten. Die Quantifizierung der erstaunlich großen O(6) Symmetriebrechung in ^{124,126}Xe [1,2] wirft die Frage auf, ob dieses Verhalten auch in den Pt-Isotopen zu beobachten ist. Hierzu wurde am Argonne National Laboratory ein Experiment durchgeführt, bei dem ^{194,196}Pt-Projektile mit dem ATLAS Beschleuniger auf jeweils 850 MeV beschleunigt und beim Durchgang durch ein $^{\text{nat}}$C-Target Coulomb-angeregt wurden. Gammastrahlung wurde mit dem Gammasphere Spektrometer detektiert. Aus beobachteten relativen Coulex Wirkungsquerschnitten können absolute Übergangsstärken berechnet werden. Die Daten werden vorgestellt und die Resultate werden diskutiert. Gefördert durch die DFG unter der Fördernummer Pi 393/2-2.
[1] G. Rainovski *et al.*, Phys. Lett. B **683**, 11 (2010).
[2] L. Coquard *et al.*, Phys. Rev. C **83**, 044318 (2011).

HK 20.6 Mo 18:15 HSZ-401

O(6) Symmetrie im Casten-Dreieck — •Christoph Kremer, Oliver Möller, Norbert Pietralla und Richard Trippel — TU Darmstadt

Das Interacting Boson Model-1 (IBM-1) eignet sich zur Beschreibung kollektiver Anregungen von Kernen mit gerader Protonen und gerader Neutronenzahl [1]. Eine besondere Rolle innerhalb des IBM-1 nehmen die dynamischen Symmetrien $U(5)$, $O(6)$ und $SU(3)$ ein, die im geometrischen Modell vibratorartigen, gamma-weichen und rotorartigen Kernen entsprechen. Am Beispiel von ^{124}Xe wurden erstmals die Fluktuationen der zur $O(6)$ Symmetrie gehörenden Quantenzahl σ genutzt um den Grundzustand von ^{124}Xe auf seine Nähe zur $O(6)$ Symmetrie zu untersuchen [2]. Mit dieser Methode wurde der gesamte Parameterbereich des IBM-1 im erweiterten Konsistent Q-Formalismus (Casten-Dreieck) untersucht. Es wird gezeigt, dass ein Tal niedriger σ-Fluktuationen des Grundzustands außerhalb des dynamischen $O(6)$-Limits existiert. Unter Verwendung von [3] konnten einige Kerne in der Nähe dieses Tales identifiziert werden.

[1] F. Iachello and A. Arima, *The Interacting Boson Model*, (Cambridge 1987)
[2] G. Rainovski *et al.*, Physics Letters **B 683** 11-16 (2010)
[3] E. A McCutchan *et al*, Phys. Rev. **C 69** 064306 (2004)

Gefördert durch die DFG unter der Fördernummer SFB 634.

HK 20.7 Mo 18:30 HSZ-401

Detaillierte Untersuchung des Zerfallsverhaltens der Scherenmode in ^{156}Gd * — •Jacob Beller[1], Tobias Beck[1], Nadia Benouaret[1], Vera Derya[2], Bastian Löher[3,4], Norbert Pietralla[1], Christopher Romig[1], Deniz Savran[3,4], Marcus Scheck[1], Linda Schnorrenberger[1], Werner Tornow[5] und Markus Zweidinger[1] — [1]IKP TU Darmstadt — [2]IKP zu Uni Köln — [3]EMMI, GSI, Darmstadt — [4]FIAS Frankfurt — [5]TUNL, Duke University, USA

Die Scherenmode, eine isovektorielle, niederenergetische K=1 Anregung, wurde bisher im Wesentlichen in (e,e′) und (γ,γ') Experimenten untersucht. Elektronenstreuung ist sensitiv auf die direkte Anregung, während Kernresonanzfluoreszenz (KRF) Experimente mit kontinuierlicher Bremsstrahlung nur auf starke Zerfallskanäle sensitiv sind. Daher wurde bisher angenommen, dass die 1^+ Scherenmodenzustände nur zu der Grundzustandsbande koppeln. In ^{154}Gd konnten in γ-Spektroskopie nach EC bereits erfolgreich Kopplungen der 1^+ Scherenmode zu anderen intrinsischen Anregungen beobachtet werden. In einem KRF-Experiment mit quasi-monoergetischen, linear polarisierten Photonen an der High Intensity $\overrightarrow{\gamma}$-Ray Source (HIγS) der Duke University wurde nun das Nachbarisotop ^{156}Gd untersucht. Die resonant gestreuten γ-Quanten wurden mit je 4 HPGe und LaBr Detektoren in Koinzidenz nachgewiesen. Dies erlaubt eine präzise Bestimmung der Zerfallskanäle der Scherenmode zu intrinsischen Anregungen in ^{156}Gd. Die Messmethode wird vorgestellt und die Ergebnisse präsentiert.
*Gefördert durch die DFG im Rahmen des SFB 634.

HK 20.8 Mo 18:45 HSZ-401

Detailed investigation of octupole vibrational states in ^{168}Yb — •Sorin Pascu, Vera Derya, Janis Endres, Andreas Hennig, Lars Netterdon, Simon G. Pickstone, Mark Spieker, and Andreas Zilges — Institut für Kernphysik, Universität zu Köln

The experimental evidence for the presence of octupole vibrational states in ^{168}Yb is presented. In order to populate the excited states in this nucleus, the ^{166}Er(α,2nγ)^{168}Yb fusion evaporation reaction was used with a beam energy of 24 MeV. Using the coincidence method, the level scheme was corrected and extended up to 3 MeV, both for the positive and negative parity states. In a second step, the lifetimes of five excited states were measured by using the fast timing method with the Bucharest HPGe and $LaBr_3$:Ce detector array using the triple-γ coincidence method. Reduced E1 and E2 transition probabilities were extracted from the measured lifetimes and compared, when possible, with similar observables in neighboring isotopes, showing a smooth behavior with increasing mass. The positive and negative-parity states revealed by this experiment are compared with the Interacting Boson Model and are found to be in good agreement.

Supported by the DFG (ZI 510/4-2). V. D., A. H., S. G. P., and M. S. are members of the Bonn-Cologne Graduate School of Physics and Astronomy

HK 21: Nukleare Astrophysik

Zeit: Montag 16:45–18:45 Raum: HSZ-403

Gruppenbericht HK 21.1 Mo 16:45 HSZ-403

Neutrino Oscillations in Core-collapse Supernovae — •Meng-Ru Wu[1,2], Lutz Huther[1], Tobias Fischer[1,3], Gabriel Martinez-Pinedo[1,3], and Yong-Zhong Qian[2] — [1]TU Darmstadt, Darmstadt — [2]University of Minnesota, Minneapolis, USA — [3]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt

Neutrino oscillations play an important role in determining the spectra of neutrinos emitted from core-collapse supernova and must be considered in the analysis of supernova neutrino detection to understand both the supernova dynamics and the unknown neutrino mass hierarchy. We have studied neutrino oscillations in supernovae using the emission spectra of neutrinos and the dynamically evolving supernova density profile from a state-of-the-art supernova model. We find that in this model, different regions of neutrino oscillations are well separated. Collective neutrino oscillations happen at the innermost part such that the spectra of electron neutrinos and mu/tau neutrinos are partly swapped for the first few seconds in the cooling phase. Then, the high and low MSW resonances that occur after collective oscillations are both adiabatic. Using these results, we find that in this model, neutrino oscillations have little effect on the nucleosynthesis in the neutrino-driven winds. However, the detection of such a signal could possibly allow us to differentiate the neutrino mass hierarchy and to extract the shock revival time.

HK 21.2 Mo 17:15 HSZ-403

Neutral current neutrino reactions in neutrino driven wind nucleosynthesis — •Lutz Huther[1], Tobias Fischer[1], Gabriel Martinez-Pinedo[1,2], and Karlheinz Langanke[1,2,3] — [1]TU Darmstadt, Darmstadt — [2]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt — [3]Frankfurt Institute for Advanced Studies, Frankfurt

Neutrino driven winds in core collapse supernovae are considered as one of the sources for the creation of elements heavier than iron. The detailed nucleosynthetic results are sensitive to various parameters coming from core collapse supernovae simulations, especially the electron neutrino and antineutrino spectra. Depending on the energy difference the ejecta can be proton or neutron rich. Proton rich ejecta constitute the site for the νp-process, while in neutron rich ejecta the r-process can operate. Furthermore neutrinos can interact with the ejecta, exciting them above particle emission thresholds, therefore changing the nucleosynthesis. We have computed the neutrino induced particle evaporation reactions using a two step approach based on the compound picture. In the first step the compound nucleus is formed by neutrino neutral current inelastic excitation of the nucleus. The relevant cross sections are computed within the random phase approximation. In the next step we use a statistical code for the calculation of the different deexcitation channels including emission of p, n and α particles both in the parent and in the successive daughter nuclei. We have explored the impact on the nucleosynthetic outcome. This work is supported by the Deutsche Forschungsgemeinschaft through contract SFB 634.

HK 21.3 Mo 17:30 HSZ-403

Charged-current weak interaction processes in hot and dense matter and its impact on the spectra of neutrinos emitted from proto-neutron star cooling — Gabriel Martinez-Pinedo[1,2], Tobias Fischer[2,1], •Andreas Lohs[1], and Lutz Huther[1] — [1]Institut für Kernphysik, Technische Universität Darmstadt — [2]GSI Helmholtzzentrum für Schwerioneneforschung, Darmstadt

We have performed three-flavor Boltzmann neutrino transport radiation hydrodynamics simulations covering a period of 3 s after the formation of a protoneutron star in a core-collapse supernova explosion. We show that a treatment of charged-current neutrino interactions in hot and dense matter as suggested by Reddy et al. has a strong impact on the luminosities and spectra of the emitted neutrinos. Compared with simulations that neglect mean field effects on the neutrino opacities, we find that the luminosities of all neutrino flavors are reduced while the spectral differences between electron neutrino and antineutrino are increased. Their magnitude depends on the equation of state and in particular on the symmetry energy at sub-nuclear densities. The proton-to-nucleon ratio of the outflow is reduced, increasing slightly their entropy. They are expected to have a substantial impact on the nucleosynthesis in neutrino-driven winds, even though they do not result in conditions that favor an r-process. Contrarily to previous findings, our simulations show that the spectra of electron neutrinos remain substantially different from those of other (anti)neutrino flavors during the entire deleptonization phase of the protoneutron star.

HK 21.4 Mo 17:45 HSZ-403

Axions from cooling compact stars: pair-breaking processes — •Jochen Keller and Armen Sedrakian — Institut für Theoretische Physik, Goethe-Universität, Frankfurt am Main

Once formed in a supernova explosion, a neutron star cools rapidly via neutrino emission during the first $10^4 - 10^5$ years of its life-time. Here we compute the axion emission rate from baryonic components of a star at temperatures below their respective critical temperatures T_c for normal-superfluid phase transition. The axion production is driven by a charge neutral weak process, associated with Cooper pair breaking and recombination. The requirement that the axion cooling does not overshadow the neutrino cooling yields a lower bound on the axion decay constant $f_a > 6 \times 10^9\, T_{c9}^{-1}$ GeV, with $T_{c9} = T_c/10^9$ K. This translates into an upper bound on the axion mass $m_a < 10^{-3}\, T_{c9}$ eV.

HK 21.5 Mo 18:00 HSZ-403

Neutrino interactions with dense nuclear matter based on chiral effective field theory* — •Alexander Bartl[1,2], Christopher J. Pethick[3,4], and Achim Schwenk[2,1] — [1]Institut für Kernphysik, Technische Universität Darmstadt, Germany — [2]ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany — [3]The Niels Bohr International Academy, The Niels Bohr Institute, Copenhagen, Denmark — [4]NORDITA, Royal Institute of Technology and Stockholm University, Stockholm, Sweden

Neutrino pair bremsstrahlung and absorption ($NN \leftrightarrow NN\nu\bar{\nu}$) and inelastic scattering of neutrinos ($NN\nu \leftrightarrow \nu NN$) are of great relevance for the generation of and energy transport by neutrinos in core-collapse supernovae. While the rates of these processes are very important, most simulations are based on the one-pion-exchange approximation for the nucleon-nucleon part of the interaction. In this talk, we will present results on neutrino rates at subnuclear densities that are calculated using the framework of chiral effective field theory for nuclear forces, including first results for mixtures of neutrons and protons. In addition, we consider the impact of chiral two-body currents on the neutrino rates.

*Supported by the Helmholtz Alliance HA216/EMMI and the DFG through SFB 634.

HK 21.6 Mo 18:15 HSZ-403

Systematics of netrinoless double beta decay matrix elements in a major shell — •Tomas Rodriguez — Technische Universität Darmstadt, Darmstadt, Germany

We analyze nuclear matrix elements (NME) of neutrinoless double beta decay calculated for the Cadmium isotopes. Energy density functional methods including beyond mean field effects such as symmetry restoration and shape mixing are used. Strong shell effects are found associated to the underlying nuclear structure of the initial and final nuclei. Furthermore, we show that NME for two-neutrino double beta decay evaluated in the closure approximation, $M^{2\nu}_{\rm cl}$, display a constant proportionality with respect to the Gamow-Teller part of the neutrinoless NME, $M^{0\nu}_{\rm GT}$. This opens the possibility of determining the $M^{0\nu}_{\rm GT}$ matrix elements from $\beta^{\mp}$ Gamow-Teller strength functions. Finally, the interconnected role of deformation, pairing, configuration mixing and shell effects in the NMEs is discussed.

HK 21.7 Mo 18:30 HSZ-403

The Δ Resonance Response Function in Charge-Changing Weak Interactions — •Andreas Fedoseew and Horst Lenske — Institut für Theoretische Physik, Justus-Liebig-Universität Giessen, Heinrich-Buff-Ring 16, D-35392 Giessen

We investigate the response of charge-changing excitations in nuclei in the Δ-resonance region. The N-N, Δ-N and Δ-Δ correlations are treated within the RPA framework. In our approach nuclear density functional theory is used for the self-consistent description of the ground state of nuclear matter and excitations. We include the self-energies in the baryon-propagators and calculate the residual p-h in-

teraction self-consistently by applying Landaus Fermi-Liquid theory. With this approach our fully quantum mechanical calculations of the response functions are free of additional adjustable model parameters. We present our results for inclusive neutrino scattering on nuclei at the valley of stability and with high neutron excess.

HK 22: Instrumentation

Zeit: Montag 16:45–19:00 Raum: HSZ-405

Gruppenbericht HK 22.1 Mo 16:45 HSZ-405

A background veto system for GERDA based on scintillation of liquid argon — •Nuno Barros for the GERDA-Collaboration — Technische Universität Dresden, Dresden, Germany

Gerda is an experiment to search for the neutrinoless double beta decay on ^{76}Ge, where bare germanium detectors are operated in a cryostat with 65 m^3 of liquid argon (LAr). A light instrumentation system installed in the LArGe test facility demonstrated that the detection of argon scintillation light can be used to effectively suppress background events in the germanium, that simultaneously deposit energy in LAr. The results from LArGe demonstrated that this method could significantly contribute to reach the goal in background index of 10^{-3} cts/(keV·kg·yr) for the Phase II of Gerda. Based on these results, several options are being pursued for the light instrumentation of LAr, which have to comply with the stringent radio-purity requirements of the experiment and should provide a significant suppression of the background signals in the region of interest around $Q_{\beta\beta}$ of ^{76}Ge at 2039 keV. This talk gives an account of the different design options under investigation by the Gerda collaboration. Results from the LArGe test facility are presented, demonstrating the feasibility of the method. The designs including photomultipliers (PMT) and silicon photomultipliers (SiPM) are discussed, along with their performance expectations from MC simulations. The progress in the development of these options is also reported, along with the design criteria for the use of light instrumentation in Gerda . This work is funded by the DFG, the BMBF and supported by the HPC@ZIH Dresden.

HK 22.2 Mo 17:15 HSZ-405

Identifying Surface Background Events in the COBRA-Experiment — •Matthew Fritts[1] and Jan Tebrügge[2] for the COBRA-Collaboration — [1]Institut für Kern- und Teilchenphysik (IKTP), Technische Universität Dresden — [2]Lehrstuhl Experimentelle Physik IV, Technische Universität Dortmund

The COBRA-Experiment searches for neutrinoless double beta decay in CdZnTe semiconductor detectors. In the R&D setup at Gran Sasso Underground Laboratory coplanar grid detectors are investigated. Intrinsic to the detector design is the ability to calculate interaction depth, which makes it possible to veto surface events at the anode and cathode side. Furthermore the details of charge induction due to the grid geometry cause distortions in pulse shapes for interactions near the other surfaces. The COBRA collaboration has developed an improved depth reconstruction technique as well as new methods for identifying events near the lateral surfaces using pulse-shape analysis. Alpha radiation at the surface of the detectors is currently the major source of background in the energy region of interest, so using pulse shape analysis offers promising possibilities for background reduction, which is a crucial issue for the COBRA-Experiment.

HK 22.3 Mo 17:30 HSZ-405

Modellierung des CIMBI-Detektors — •Mario Cappellazzo — Institut für Kernphysik der Universität zu Köln, Köln, Deutschland

Das elektrostatische Abbildungssystem des Cologne Ion Monitor for Beam Imaging (CIMBI) wurde in ein Computermodell übersetzt, um daran Untersuchungen zum räumlichen und zeitlichen Auflösungsvermögen durchzuführen. Der CIMBI ist ein "beam tracking detector", welcher als Hilfsdetektor für HISPEC/DESPEC am FAIR entwickelt wird. In einer dünnen Konversionsfolie lösen passierende Ionen Sekundärelektronen aus, welche durch das elektrostatische Abbildungssystem auf einen ortssensitiven Messaufbau, bestehend aus einer Micro Channel Plate und Dual Delay Lines, außerhalb der Ionenflugbahnen abgebildet werden.

Zur Modellierung des Detektors musste die Laplace-Gleichung mit inneren Randbedingungen gelöst werden. Die inneren Randbedingungen ergaben sich, da die Kapazitäten der Komponenten des Abbildungsystems unbekannt waren. Diese wurde nach der Methode der finiten Differenzen diskretisiert und das daraus entstehende lineare Gleichungssystem mit numerischen Methoden gelöst. Es war notwendig, feine Details in der Größenordnung von 0,1mm zu diskretisieren. Durch die Detektorausmaße in der Größenordnung von 0,1m musste ein Gleichungssystem mit rund 1 Milliarde Unbekannten gelöst werden. Dazu wurde das Successive-Over-Relaxation-Verfahren und ein für diesen Zweck modifiziertes Mehrgitterverfahren verwendet.

Mit dem berechneten Potentialverlauf ließen sich Elektronenflugbahnen vorhersagen und Messungen mit verschiedenen Masken simulieren.

HK 22.4 Mo 17:45 HSZ-405

Simulation and reconstruction for the PANDA Barrel DIRC — Klaus Götzen[1], •Maria Patsyuk[1,2], Klaus Peters[1,2], Carsten Schwarz[1], Jochen Schwiening[1], and Marko Zühlsdorf[1,2] for the PANDA-Collaboration — [1]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt — [2]Goethe Universität Frankfurt

The PANDA experiment at the new Facility for Antiproton and Ion Research in Europe (FAIR) at GSI, Darmstadt, will study fundamental questions of hadron physics and QCD. Efficient Particle Identification (PID) for a wide momentum range and the full solid angle is required for reconstructing the various physics channels of the PANDA program. Hadronic PID in the barrel region of the detector will be provided by a DIRC (Detection of Internally Reflected Cherenkov light) counter. The design is based on the successful BABAR DIRC with important improvements, such as focusing optics and fast photon timing.

A detailed detector simulation of the Barrel DIRC, including a number of design options, was performed using Geant. A reconstruction algorithm was developed to quantify the performance in terms of single photon Cherenkov angle resolution and photon yield. Simulation and performance of the design options will be discussed in this contribution.

Work supported by EU6 grant, contract number 515873, DIRACsecondary-Beams, and EU FP7 grant, contract number 227431, HadronPhysics2, and the Helmholtz Graduate School for Hadron and Ion Research HGS-HIRe.

HK 22.5 Mo 18:00 HSZ-405

Triplet Based Online Track Finding in the PANDA-STT — •Marius C. Mertens, James Ritman, and Peter Wintz for the PANDA-Collaboration — Forschungszentrum Jülich GmbH

The PANDA-Experiment at the future FAIR-Facility in Darmstadt will implement a Straw Tube Tracker (STT) as its central tracking subdetector within a 2 T solenoidal magnetic field. The STT is a gas based detector for charged particle tracking which is comprised of 4636 cylindrical drift chambers (straw tubes) of 1 cm diameter and 150 cm length, surrounding a cylindrical volume from 16 cm up to a radius of 42 cm around the silicon based micro vertex detector.

At PANDA a continuous readout mode of the detectors is required due to the broad range of different event topologies and the very high interaction rate of $2 \cdot 10^7$ annihilations per second. As a consequence of this mode of operation the drift start time will not be given by the trigger time but it has to be extracted from either other detector hits or the signature of hit patterns in the STT itself.

One method of track finding without initial knowledge of the drift start time is based on the identification of hit triplets within a certain time window. It is then particularly simple to analytically calculate the circle parameters of the track helix' projection into the xy-plane. We will present the triplet method in detail as well as studies on its applicability under the PANDA operating conditions.

HK 22.6 Mo 18:15 HSZ-405

ALICE TRD GTU Online Tracking Performance in $\sqrt{s} = 7-8$ TeV pp collisions — •Rettig Felix, Kirsch Stefan, and Lindenstruth Volker for the ALICE-Collaboration — Frankfurt Institute for Advanced Studies, University of Frankfurt

The Transition Radiation Detector provides fast trigger contributions for electron and jet signatures to the ALICE experiment at CERN.

More than 65,000 custom multi-processor modules on-detector identify and parametrize short stiff track segments for a total of 1.2 million analog channels. Within 3μs up to several thousand track segments per event are forwarded to the TRD Global Tracking Unit (GTU).

The GTU consists of 109 FPGA-based processing nodes arranged in three levels. 90 nodes receive data at an aggregate bandwidth of up to 2.16 TBit/s. They perform an online 3D track reconstruction and p_T estimation within 1.2μs. Track information is pushed to 18 sector-level nodes, which run trigger algorithms for single electrons and jets. A top-level node provides the TRD trigger contributions to the central ALICE trigger system within 6μs.

In the past years of continuous operation the TRD online tracking performance was studied for pp and Pb-Pb collisions. A p_T resolution of better than 15-20% over the range from 2 to 10 GeV/c was achieved. In 2012 the jet trigger was put into operation, later two single-electron triggers for heavy flavor and quarkonia studies. Based on the data from pp collisions at $\sqrt{s} = 7 - 8$ TeV we present the performance of the online tracking and a technical overview of the triggers.

HK 22.7 Mo 18:30 HSZ-405

FPGA helix tracking algorithm for PANDA — •Yutie Liang, Martin Johannes Galuska, Thomas Gessler, Jifeng Hu, Wolfgang Kühn, Jens Sören Lange, David Münchow, and Björn Spruck for the PANDA-Collaboration — II. Physikalisches Institut, Giessen University, 35392, Germany

The PANDA detector is a general-purpose detector for physics with high luminosity cooled antiproton beams, planed to operate at the FAIR facility in Darmstadt, Germany. The central detector includes a silicon Micro Vertex Detector (MVD) and a Straw Tube Tracker (STT). Without any hardware trigger, large amount of raw data are streaming in the data acquisition system. The data reduction task is performed in the online system by reconstruction algorithms programmed in VHDL (Very High Speed Integrated Circuit Hardware Description Language) on FPGAs (Field Programmable Gate Arrays). One important part in the system is the online track reconstruction. In this presentation, an online tracking finding algorithm for helix track reconstruction in the solenoidal field using conformal transformation and Legendre transformation is shown. The MVD and STT are used in this algorithm.

* This work was supported in part by BMBF (05P12RGFPF) and the LOEWE-Zentrum HICforFAIR.

HK 22.8 Mo 18:45 HSZ-405

GPU Implementations of Online Track Finding Algorithms at PANDA — •Andreas Herten[1], Tobias Stockmanns[1], James Ritman[1], and Mohammad Al-Turany[2] for the PANDA-Collaboration — [1]Institut für Kernphysik, Forschungszentrum Jülich GmbH — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt

The PANDA experiment is a hadron physics experiment that will investigate antiproton annihilation in the charm quark mass region. The experiment is now being constructed as one of the main parts of the FAIR facility.

At an event rate of $2 \cdot 10^7$ /s a data rate of 200 GB/s - 1 TB/s is expected. A reduction of three orders of magnitude is needed in order to save the data for further offline analysis. Since signal and background processes at PANDA have similar signatures, no hardware-level trigger is forseen for the experiment. Instead, a fast online event reconstruction is substituting this element. We investigate the possibility of using graphics processing units (GPUs) for this task.

This talk shows advances in the implementations of fast tracking algorithms for GPUs to be used at PANDA.

HK 23: Instrumentation

Zeit: Montag 16:45–19:15 Raum: WIL-A221

Gruppenbericht HK 23.1 Mo 16:45 WIL-A221

Testmessungen mit einem Prototypen für die Vorwärtsendkappe des PANDA-EMC — •Cathrina Sowa für die PANDA-Kollaboration — Ruhr-Universität Bochum, Inst. f. Experimentalphysik I, 44780 Bochum

Der PANDA-Detektor wird an der zukünftigen Beschleunigeranlage FAIR am Antiproton-Speicherring HESR aufgebaut. Es wird eine maximale Luminosität von $2 \cdot 10^{32}\mathrm{cm}^{-2}\mathrm{s}^{-1}$ durch den Beschuss eines Wasserstofftargets mit Antiprotonen aus dem HESR-Beschleuniger mit Impulsen von 1,5 bis 15 GeV/c erreicht. Einer der zentralen Detektoren ist das, aus einem Barrel und zwei Endkappen, bestehende elektromagnetische Kalorimeter, welches mit Blei-Wolframat-Kristallen bestückt wird. Die strahlnächsten Kristalle der Vorwärtsendkappe werden einer durchschnittlichen Ergeignisrate von $5 \cdot 10^5$/s bei maximaler Luminosität und höchstem Strahlimpuls ausgesetzt sein. Zur Verbesserung der Lichtausbeute werden die Bleiwolframat-Szintillatoren auf eine Temperatur von $-25°$C gekühlt.
Ein Prototyp bestehend aus 216 Kristallen, welche mit VPTTs und LAAPDs ausgelesen werden, wurde an den Beschleunigern MAMI (Mainzer Mikrotron) und SPS (CERN) weiteren Strahltests unterzogen. Am SPS wurde mit Elektronen der höchsten bei PANDA zu erwartenden Teilchenenergien gemessen, während an MAMI mit niederenergetischen, getaggten Photonen gemessen wurde. Die Strahlzeiten dienten der Bestimmung der Linearitaet der Auslesekette, der Auslese- und Rekonstruktionsschwellenwerte sowie der Energieaufloesung.
Gefördert durch das BMBF und die EU.

HK 23.2 Mo 17:15 WIL-A221

Investigation of PANDA EMC modules in a realistic high rate environment — •Marcel Werner, Martin Galuska, Hu Jifeng, Sören Lange, Yutie Liang, Wolfgang Kühn, Björn Spruck, and Matthias Ullrich — II. Physikalisches Institut, Justus-Liebig Universität Gießen

The future physics program of the Panda experiment at FAIR imposes high requirements on the performance on all subdetectors and in particular the electromagnetic calorimeter (EMC).

The installation of a Zero Degree Detector (ZDD) at the Bes III experiment, Beijing, China, using PANDA-type PbWO4 crystals with the purpose of studying the radiative return, offers a unique opportunity for a test under a realistic high rate environment similar to the future Panda operation. As the available space for the ZDD at Bes III is small and therefore the energy resolution of the ZDD is limited, the knowledge of the photon impact at the ZDD is of importance since it determines the event structure in the Bes III detector. Also online event processing using DSP-algorithms, matching Bes III detector and ZDD information, to pick out events of interest is necessary to handle the expected event rates (O(MHz)).

The prototype readout chain comprises a sampling ADC prototype with a fast optical interface and an ATCA-based Compute Node with 5 XILINX Virtex-4 FX60 FPGAs. The status of the system will be presented.

This work was supported in part by BMBF under grant number FAIR-PANDA 05P12RGFPF and HIC4FAIR.

HK 23.3 Mo 17:30 WIL-A221

Measurements and Simulations on Non-Uniformities in the Collection of Scintillation Light in $PbWO_4$-Crystals in PANDA Geometry* — •Daniel Bremer, Tobias Eissner, Valery Dormenev, and Rainer Novotny for the PANDA-Collaboration — II. Phys. Institut, Universität Gießen, Germany

The EM calorimeter of the PANDA target spectrometer is one major component to achieve the expected goals of the physics program. That requires high detection efficiency for photons and leptons combined with excellent resolutions over a large dynamic range. Therefore, a linear response to photons and charged particles, which depends on crystal homogeneity as well as light collection, is mandatory. Nevertheless, due to the tapered geometry of most of the 13 different shapes of $PbWO_4$ crystals, the obtained light yield depends on the longitudinal point of origin of the scintillation light. This contribution will present an experimental program to investigate the position dependent light collection in crystals cooled down to the final operating temperature of -25 °C. The measurement is based on the detection of collimated 511 keV γ-rays from ^{22}Na-Sources. Different approaches are studied to linearize the light collection by various reflector materials and shapes as well as surface modifications. Based on these experimental results

simulations were carried out to evaluate the effect of a light output linearization on the performance of the electromagnetic calorimeter in direct comparison to experimental data obtained over the entire energy range with the PROTO60 prototype matrix. *Work supported by BMBF and GSI

HK 23.4 Mo 17:45 WIL-A221

Stimulated Recovery of Radiation Damage for the PANDA EMC — Till Kuske, •Valera Dormenev, and Rainer Novotny — Justus-Liebig-Universität, Gießen

The future Electromagnetic Calorimeter (EMC) of the PANDA detector at FAIR will be based on a new generation of lead tungstate crystals (PWO-II). It is optimized to measure particle energies from 10 GeV down to 10-20 MeV. The operating temperature of the EMC will be -25°C. Due to the operation in a strong radiation environment one of the most critical parameter of PWO-II is radiation hardness. The radiation damage of PWO-II can be compensated by spontaneous relaxation of the color centers via thermo-activation. The process is strongly suppressed at -25°C, which is limiting the energy resolution of the EMC. The recovery process can be accelerated by illumination of the crystal with light even in the infrared region.The applicability of this process is being studied for implementation primarily into the most forward region of the target spectrometer dealing with the highest rate of radiation damage. The present paper will discuss the conditions for on- and off-line operation for both considered photo sensors such as LAAPDs and VPTT tubes. The effectiveness and wavelength sensitivity will be shown and discussed based on recent experimental data using LEDs as well as LASER diodes as light sources.

This Project has been supported by BMBF

HK 23.5 Mo 18:00 WIL-A221

Current status of the new $LaBr_3$:Ce detector array GALATEA* — •Christopher Walz[1], Ronan Lefol[2], Peter von Neumann-Cosel[1], Philipp Ries[1], Norbert Pietralla[1], Heiko Scheit[1], and Linda Schnorrenberger[1] — [1]Institut für Kernphysik ,TU Darmstadt, Germany — [2]University of Saskatchewan, Canada

In contrast to common scintillation materials like NaI and BaF_2 the recently developed $LaBr_3$:Ce detectors allow measurements with excellent time resolution and high efficiency while retaining a good energy resolution. To perform successful (e,e′γ) and (γ,$\gamma'\gamma$) coincidence experiments at the linear electron accelerator S-DALINAC all three features are of utmost importance. We present the current status of the new $LaBr_3$:Ce detector array GALATEA (GAmma LAnthanum bromide Top Efficiency Array) consisting of 18 large 3"x3" $LaBr_3$:Ce detectors. One focus is on the completely digital DAQ based on flash ADCs and newly developed pulse shape analysis methods for timing and particle identification. The performance of GALATEA is discussed regarding energy resolution, time resolution, linearity and efficiency. The results are compared to GEANT4 simulations.

*Supported by DFG (SFB 634)

HK 23.6 Mo 18:15 WIL-A221

Experimental Determination of the Time and Charge Resolution of a Flash-ADC System for the PANDA STT — •Timm Preuhs, Albrecht Gillitzer, Henner Ohm, and Pawel Kulessa for the PANDA-Collaboration — Forschungszentrum Jülich, Institut für Kernphysik, Deutschland

The PANDA STT detector needs not only a high time resolution for precise spatial reconstruction of the helical trajectories of charged particles but also good deposited energy resolution in order to separate protons, kaons and pions in the momentum region below about 1 GeV/c. Currently a readout system for the PANDA STT based on Flash-ADCs are being investigated as a candidate for the final readout system. This system measures simultaneously pulse-height and time information. While the pulse-height resolution of the system is reasonably well understood, it is not immediately obvious that the timing properties are sufficient. The flash-ADC samples signals with a frequency of 240 MHz so that the spacing between adjacent data points is 4.16 ns. This is too coarse for the required time resolution of the STT. Thus, for timing applications a straight line is fit to the rising slope of a signal and the time of appearance of a signal is then calculated as the intercept of this line with a given signal level. This can provide a better resolution than the period between samples. Long signal integration times needed for full charge collection of signals, however, make the signal slope less steep, thereby reducing the timing resolution. In this presentation the results of the achieved time resolution will be presented for a wide range of signal rise times and amplitudes.

HK 23.7 Mo 18:30 WIL-A221

Gain calibration of n-XYTER 1.0 — a prototype readout ASIC for the Silicon Tracking System of the CBM experiment. — •Iurii Sorokin for the CBM-Collaboration — Goethe University Frankfurt — Kiev Institute for Nuclear Research

n-XYTER is a 128-channel readout ASIC which measures both the integral signal charge and the time of occurance. Due to its self-triggering design, high gain, high rate capability and bipolar front-end, the chip has found a use as a prototype readout for the Silicon Tracking System, Muon and Cherenkov detectors of the CBM experiment. It is also going to be applied in other projects in Darmstadt, Heidelberg and Dubna.

To perform gain calibration of n-XYTER, reference charge pulses of a very small (down to 3000 e^-), yet precisely known amplitude had to be generated. This was achieved by attenuating a voltage step to a sub-millivolt level and passing it through a tiny (1 pF) capacitor. Special care had to be taken to check for possible systematic errors in the measurements of the attenuation factor and of the coupling capacitance. In addition, the system had to be well shielded against RF pickup, the parasitic capacitances had to be minimized and ensured to stay invariable.

Correct estimate of the systematic error was confirmed by performing a measurement with a different signal source — a planar silicon detector, exposed to γ-radiation of ^{241}Am. Finally, the dominating error came from the channel-to-channel gain variation.

Supported by HIC for FAIR, HGS-HIRe and H-QM

HK 23.8 Mo 18:45 WIL-A221

Das Trigger System des Double Chooz-Experiments — •Ilja Bekman, Dario Abu Shibika, Sebastian Lucht, Stefan Roth, Stefan Schoppmann, Achim Stahl, Anselm Stüken und Christopher Wiebusch — RWTH Aachen University, Germany

Das Double-Chooz-Experiment ist ein Reaktorneutrino-Experiment zur Bestimmung des Neutrino-Mischungswinkels θ_{13}. Nahe der Kernreaktoren in Chooz, Frankreich, werden dafür zwei baugleiche mit flüssigem Szintillator gefüllten Detektoren in unterschiedlichen Entfernungen installiert. Diese vermessen den Neutrinofluss, wobei der Neutrino Nachweis über den inversen beta-Zerfall geschieht. Zur Ermöglichung einer hocheffizienten Datennahme und einer Online-Klassifizierung der Ereignisse wird ein Trigger-System mit einem redundanten Konzept verwendet. Für die Triggerentscheidung wird eine Kombination aus der analogen Summe und der Multiplizität der Signale von Photomultipliergruppen ausgewertet. Der Ferndetektor des Experiments nimmt seit fast zwei Jahren erfolgreich Daten, der Nahdetektor soll in diesem Jahr fertiggestellt und in Betrieb genommen werden. In diesem Talk wird der Aufbau und die Funktion des Trigger-Systems vorgestellt, sowie bereits vorgesehene Optimierungen für den Betrieb mit dem Nahdetektor diskutiert.

HK 23.9 Mo 19:00 WIL-A221

Upgrade of the COMPASS calorimetric trigger — •Stefan Huber — Technische Universität München, Garching, Deutschland

In 2009 COMPASS performed a short measurement of neutral Primakoff reactions, characterised by highly energetic photons in one of the two electromagnetic calorimeters. A digital trigger was implemented in the existing readout electronics which calculates the energy released in the central region of the calorimeter. In 2012 a long measurement of these processes has been performed. In order to extend the kinematic range to lower energetic photons the trigger system has been upgraded in a way to be more selective to specific physics channels. The new ADC firmware preserves hit information and provides it to newly developed backplane trigger modules. There hits from all three thousand channels are processed and the trigger decision is made.

HK 24: Beschleunigerphysik V (Strahldiagnose I)

Zeit: Montag 16:45–19:00 Raum: WIL-C205

HK 24.1 Mo 16:45 WIL-C205

The impact of linear space charge on the tomographic reconstruction at PITZ — •Georgios Kourkafas[1], Mikhail Krasilnikov[1], Dmitriy Malyutin[1], Barbara Marchetti[1], Frank Stephan[1], and Galina Asova[2] — [1]DESY, 15738 Zeuthen, Germany — [2]INRNE-BAS, 1784 Sofia, Bulgaria

The Photo Injector Test facility at DESY, Zeuthen site (PITZ) focuses on testing, characterizing and optimizing high brightness electron sources for free electron lasers. Among various diagnostic tools installed at PITZ, the tomography module is used to reconstruct the transverse phase space distribution of the electron beam by capturing its projections while rotating in the phase space. This diagnostic technique can resolve the two transverse planes simultaneously with an improved resolution for pulses of low charge or in the future even for individual bunches within a bunch train.

The low emittance, high charge density and moderate energy of the electron beam at PITZ contribute to significant space-charge forces. The conducted study aims to investigate how the phase space rotations and thus the reconstruction result are affected when considering the linear space-charge effect along the tomography lattice. The beam dynamics simulations were done using the V-Code tool.

HK 24.2 Mo 17:00 WIL-C205

HEDA2 resolution limitation for the longitudinal phase space measurements at PITZ — •Dmitriy Malyutin, Mikhail Krasilnikov, and Frank Stephan — DESY, Zeuthen, Germany

The second High Energy Dispersive Arm (HEDA2) was installed in the PITZ beamline in the year 2011 and the first commissioning was done in the summer 2012. The main goals of this dispersive section are the high resolution momentum measurements up to 40 MeV/c, the longitudinal phase space measurements and the transverse slice emittance measurements. The limits of the momentum and time resolutions of the section are estimated and discussed in the talk. Simulations of the momentum measurement are presented.

HK 24.3 Mo 17:15 WIL-C205

Studies for the determination of the beam energy with Compton backscattered photons — •Cheng Chang, Vitali Judin, Erhard Huttel, Marcel Schuh, Max Streichert, Alexander Papash, Michael J. Nasse, Edmund Hertle, and Anke-Susanne Müller — Karlsruhe Institute of Technology

The method of resonant depolarization which is now used for determination of beam energy (˜2.5GeV) at ANKA becomes cumbersome for lower beam energies. As an alternative method, a compact Compton backscattering setup with a storage cavity of laser and appropriate detection system is proposed. In the presentation, the preliminary design of the setup and simulation results are present.

HK 24.4 Mo 17:30 WIL-C205

Design of planar pick-ups for beam position monitor in the bunch compressor at FLASH and XFEL — •Aleksandar Angelovski[1], Andreas Penirschke[1], Cezary Sydlo[2], Uros Mavric[2], Christopher Gerth[2], and Rolf Jakoby[1] — [1]Institut für Mikrowellentechnik und Photonik, TU Darmstadt, Germany — [2]DESY, Hamburg, Germany

For obtaining ultra short electron bunches at the Free Electron Laser at DESY (FLASH) the beam is compressed in magnetic chicanes. During the compression process the precise knowledge of the energy of the bunches is essential for the longitudinal dynamics control. The measurement of the beam position in the chicane allows for non-destructive measurements of the energy. For that purpose, two stripline pick-ups perpendicular to the beam direction are installed in the chicane at FLASH as a part of the Beam Position Monitor. The recent upgrade in the electronics as well as the increased aperture and length of the beam pipe (for the European XFEL) requires the design of new pick-ups which will fulfill the new demands. Namely, the pick-ups should have maximum signal at 3 GHz with minimum reflections. In this talk, we will present the design of planar transmission line pick-ups for FLASH and XFEL. The planar design of the pick-ups can provide for a proper impedance matching to the subsequent electronics as well as sufficient mechanical stability along the aperture when using alumina substrate. A prototype of the pick-ups was build and installed in a non-hermetic body. The measured S parameters are compared to the simulation.

HK 24.5 Mo 17:45 WIL-C205

Test of a Bunch Shape Monitor for high current LINACs at GSI — •Benjamin Zwicker[1], Peter Forck[1], Oliver Kester[1,2], and Piotr Kowina[1] — [1]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany — [2]Institut für Angewandte Physik, Goethe Universität Frankfurt, Germany

Due to the efficient acceleration foreseen at the Proton-LINAC for FAIR, the longitudinal beam dynamics plays a key role for the optimization of the beam parameters. To achieve the highest current operation foreseen for the FAIR facility, a dedicated instrument for bunch shape measurement is required.

At the heavy ion LINAC at GSI, a novel scheme of non-invasive Bunch Shape Monitor has been tested. Caused by the beam impact on the residual gas, secondary electrons are liberated. These electrons are accelerated by an electrostatic field, transported through a sophisticated electrostatic energy analyzer and an rf-deflector, acting as a time-to-space converter. Finally a MCP detects the electron distribution. This Bunch Shape Monitor is able to obtain longitudinal profiles down to 400 ps with a resolution of 50 ps, corresponding to 2° of the acceleration frequency, and is able to recognize bunch distortion up to 1300 ps. Systematic parameter studies for the device were performed to demonstrate the applicability and to determine the achievable resolution.

HK 24.6 Mo 18:00 WIL-C205

System Design for the FAIR Proton LINAC BPMs — •Peter Forck[1], Mohammed Almalki[1], Gianluigi Clemente[1], Lars Groening[1], Wolfgang Kaufmann[1], Piotr Kowina[1], Claire Simon[2], and Wolfgang Ackermann[3] — [1]GSI — [2]CEA/ Saclay, IRFU — [3]TU Darmstadt, TEMF

The planned Proton LINAC at the FAIR facility will provide a beam current of 70 mA accelerated to 70 MeV by novel CH-type DTLs. Four-fold button Beam Position Monitor (BPM) will be installed at 14 locations along the LINAC. The specification for position measurement is 0.1 mm spatial resolution and for time-of-flight beam velocity determination the accuracy must be 8.5 ps corresponding to 1 degree with respect to the 325 MHz acceleration frequency. Finite element and finite integration technique calculations by CST Particle Studio for non-relativistic velocities were performed to determine the signal characteristic in time- and frequency domain. Most of these BPMs are mounted only about 40 mm upstream of the CH cavities and the BPM signal strength caused by the cavity residual rf-power was estimated. The technical layout of the BPM system is discussed.

HK 24.7 Mo 18:15 WIL-C205

Beam loss studies at the ANKA storage ring — •Edmund Hertle, Nigel Smale, Tobias Götsch, Anke-Susanne Müller, Frans Wegh, and Kai Worms — Karlsruher Institut für Technologie

The real time study and the post mortem analysis of beam loss are powerful tools for the optimization of a storage ring's performance. It allows, for example, a fast identification of failing hardware components or can be used to improve the beam lifetime by a reduction of the losses. This needs a sophisticated beam loss monitor system with appropriate spatial and temporal resolution. This presentation gives an overview of the loss monitor system under study at the ANKA synchrotron radiation facility of the Karlsruhe Institute of Technology.

HK 24.8 Mo 18:30 WIL-C205

Beam Studies with a LNB Detector System — •Joachim Schwarzkopf, Vitali Judin, and Anke-Susanne Müller — Karlsruhe Institut für Technologie

At ANKA, the synchrotron of the KIT (Karlsruhe Institue of Technology), beam studies with a detector system better known for its use in the entertainment industry have been carried out. The system basically consists of a LNB (Low Noise Block), usually part of a satellite TV receiver. One possible application in accelerator physics is the monitoring of the bunch length. This presentation reports on beam experiments with this inexpensive detector.

HK 24.9 Mo 18:45 WIL-C205

Transversal diagnostics of low-charge electron bunches at REGAE — •Shima Bayesteh — Uni Hamburg

A small Linac is operational as an electron source for the ultra-fast relativistic electron diffraction experiment, REGAE (Relativistic Electron Gun for Atomic Exploration), at DESY. Electron bunches, few fs-short, will be used to study structural dynamics of a sample in a time scale comparable to the electron pulse length. In order to confine electrons in a small volume and avoid the space-charge effect, relativistic electrons of 2-5 MeV energy are generated via a photo-injector RF-gun. Furthermore low-charge electron bunches of sub-pico Coulomb are required to keep the beam emittance small. Apart from all these preparations the atomic evolution should be monitored in a shot-to-shot basis. Sophisticated single-shot diagnostics are essential to generate and maintain such electron-bunches. Diagnostics include charge, energy, energy spread and transversal profile measurements. A LYSO scintillator coupled to a detector forms the transversal diagnostics. High-light emission of LYSO crystal in addition to efficient collection of the scintillated light, make the transversal diagnostics very sensitive to the low-charge detection. For this reason the first coupling optics component is located as close as possible to the scintillator. A stand-alone CCD as well as a home-made ICCD can be used as detector. The flexibility of switching between two different detectors provides a wide dynamic range of sensitivity to light. In ICCD mode the detectability of charge goes down to a few electrons per pixel with a significant single-shot S/N ratio. Aside from a breakthrough in low-charge detection in transversal diagnostics, this fulfills the requirements of electron bunch diagnostics at REGAE.

HK 25: Beschleunigerphysik VI (Resonatoren, HF)

Zeit: Montag 16:45–19:00 Raum: WIL-C207

HK 25.1 Mo 16:45 WIL-C207

Amplituden, Phasen- und Temperaturstabilisierung des Hochfrequenzsystems an ELSA — •Dennis Sauerland, André Roth, Manuel Schedler und Wolfgang Hillert — Elektronen-Stretcher-Anlage ELSA, Physikalisches Institut, Universität Bonn

Im Stretcherring der Beschleunigeranlage ELSA werden Elektronen durch eine schnelle Energierampe mit einer Rampgeschwindigkeit von bis zu 6 GeV/s auf 3,2 GeV beschleunigt. Eine geplante Intensitätserhöhung des extrahierten Strahls bei gleichbleibendem Tastverhältnis macht eine Erhöhung des internen Strahlstroms im Stretcherring erforderlich.

Diese Stromerhöhung wird durch die Anregung von Multibunchinstabilitäten limitiert, welche hauptsächlich durch Moden höherer Ordnung der beiden Beschleunigungsresonatoren des Typs PETRA angeregt werden.

Um die Resonanzfrequenzen dieser Moden kontrollieren zu können wurde eine Regelung der Kühlwassertemperatur der Resonatoren durch einen variablen Bypass aufgebaut.

Des weiteren wurde eine erste Einsatzstudie mit dem Prototypen eines LLRF-Systems der Firma DIMTEL durchgeführt, welches in Zukunft für die Amplituden- und Phasenstabilisierung der beschleunigenden Hochfrequenzfelder der Resonatoren zum Einsatz kommen wird.

Erste Erfahrungen mit diesen neuen Systemen werden in diesem Vortrag vorgestellt.

HK 25.2 Mo 17:00 WIL-C207

Higher-Order-Mode Couplers for SPL Cavities — •Kai Papke[1,2], Frank Gerigk[1], and Ursula van Rienen[2] — [1]CERN — [2]University of Rostock

Higher-Order-Modes (HOMs) may affect both beam stability and the refrigerating capacity requirements of superconducting proton linacs like for the CERN SPL. In the process of limiting the effects of these beam induced modes, it is considered to install HOM-Couplers. The full HOM spectrum for medium- and high-beta cavity types is already analyzed in order to define the damping requirements for appropriate couplers. In this work several design approaches are demonstrated and also discussed regarding to the multipacting sensitivity and thermal losses.

HK 25.3 Mo 17:15 WIL-C207

Gepulste HF-Regelung für den p-Linac Teststand bei FAIR — •Patrick Nonn[1], Uwe Bonnes[1], Christoph Burandt[1], Ralf Eichhorn[4], Harald Klingbeil[2,3], Martin Konrad[1] und Norbert Pietralla[1] — [1]Institut für Kernphysik, TU Darmstadt — [2]Institut für die Theorie elektromagnetischer Felder, TU Darmstadt — [3]Gesellschaft für Schwerionenforschung, Darmstadt — [4]Cornell University, Ithaca, NY, USA

Im Rahmen des FAIR-Projekts ist an der GSI in Darmstadt der Aufbau eines dedizierten Protonen-Linacs geplant. Um die neuartigen, gekoppelten CH-Strukturen zu testen, wird ein Teststand aufgebaut. Die HF-Regelung für diesen Teststand wird derzeit am IKP der TU Darmstadt entwickelt.

Sie basiert auf der digitalen Regelung des S-DALINAC, die an die Erfordernisse sowohl des gepulsten Betriebs als auch an die Betriebsfrequenz des p-Linacs von 325 MHz angepasst wurde.

Um die geforderten Regelgüten möglichst schnell zu erreichen, wird die Verwendung einer Vorsteuerung untersucht. Der aktuelle Stand der Entwicklung wird präsentiert.

*Gefördert durch das BMBF, Fördernr.: 05P09RDRB5

HK 25.4 Mo 17:30 WIL-C207

Entwicklung eines rechnerbasierten Resonatorsimulators zum Test von Hochfrequenzregelungen* — •Thore Bahlo[1], Christoph Burandt[1], Ralf Eichhorn[2], Joachim Enders[1], Florian Hug[1], Martin Konrad[1], Patrick Nonn[1] und Norbert Pietralla[1] — [1]Institut für Kernphysik, Technische Universität Darmstadt, Darmstadt, Germany — [2]Cornell University, Ithaca, NY, USA

Um für Tests von Hochfrequenzregelungen nicht auf die Verfügbarkeit von Prototypen angewiesen zu sein, wurde ein Resonator-Simulator entwickelt. Der Simulator basiert auf einem Xilinx-VIRTEX-4 FPGA-Modul und wurde mit Hilfe von MATLAB Simulink und einem speziellen Xilinx-Blockset konfiguriert. Das zugrundeliegende Modell besteht aus einem verlustbehafteten Parallelschwingkreis, der mit gängigen Größen der Hochfrequenztechnik, wie der Resonanzfrequenz, der Treiberfrequenz, der Bandbreite und dem Gütefaktor parametrisiert wurde. Dieser Ansatz ermöglicht die Simulation von normalleitenden Kavitäten mit Gütefaktoren bis zu 10^4 sowie die Simulation von supraleitenden Strukturen mit Güten von bis zu 10^9. Der Simulator kann dabei sowohl im Dauerstrichbetrieb als auch gepulst betrieben werden. Wir präsentieren das mathematische Modell, die digitale Darstellung und Ergebnisse von Vergleichsmessungen mit realen Resonatoren.

* gefördert durch das BMBF, Fördernr.: 05P09RDRB5

HK 25.5 Mo 17:45 WIL-C207

Surface roughness and field emission measurements on diamond turned Cu samples — •Stefan Lagotzky and Günter Müller — University of Wuppertal, D-42097 Wuppertal, Germany

The enhanced field emission (EFE) from particulate contaminations or surface irregularities is one of the main triggers of electrical breakdowns in normal-conducting accelerating structures for CLIC [1]. Deep and quantitative understanding of the EFE of flat and clean Cu surfaces is important to minimize high-gradient (E_{acc}=100 MV/m) breakdowns at the required peak surface fields (E_{pk}/E_{acc}=2.4). Therefore we have systematically measured the surface quality of flat diamond turned Cu samples with an optical profilometer and AFM resulting in a linear roughness of 32-56 nm and geometrical field enhancement factors β_{geo} of at least 5.8. The EFE of the samples was measured with a field emission scanning microscope (FESM) and showed an exponential increase of the emitter number density with the applied surface field, i.e. up to 72 emitters/cm^2 at 190 MV/m. Furthermore the activated emitters showed onset fields down to 92 MV/m and field enhancement factors β_{FN} of up to 90 as determined by local I-V measurements. High resolution SEM images indicated a variety of surface features in the emitting areas. The discrepancy between the values of β_{geo} and β_{FN} will be discussed. First results on the influence of dry ice cleaning (DIC) on the EFE of the Cu samples will also be presented.

[1] K.L. Jensen et al., Phys. Rev. ST Accel. Beams **11**, 081001 (2008)

Funded by BMBF 05H12PX6

HK 25.6 Mo 18:00 WIL-C207

Auslegung und Vermessung eines optimierten TM_{110}-HF-Deflektors zur Strahldiagnose von Picosekunden-Elektronenbunchen" — •Alessandro Ferrarotto[1], Bernard Riemann[1], Thomas Weis[1], Thorsten Kamps[2] und Jeniffa Rudolph[2] — [1]Zentrum für Synchrotronstrahlung, TU-Dortmund — [2]Helmholtz-Zentrum Berlin

Bei Bunchlängen von wenigen Picosekunden oder darunter gestaltet sich die longitudinal aufgelöste transversale Strahldiagnose schwierig. Bei Elektronenenergien im Bereich einiger 100 keV bis hin zu wenigen MeV, wie sie üblicherweise hinter den Elektronenquellen auftreten, ist eine qualitativ hochwertige Messung über optische Verfahren wie Synchrotronstrahlung oder Übergangsstrahlung nur schwer möglich. Man lenkt daher den Strahl durch ein sich zeitlich änderndes hochfrequentes elektromagnetisches Feld in einem TM_{110}-Resonator transversal ab und erzeugt so in einigem Abstand auf einem geeigneten Schirm ein Abbild der longitudinalen Ladungsverteilung. Durch Optimierung der Resonatorgeometrie mit numerischen Methoden lässt sich, bei einer Betriebsfrequenz von 1,3 GHZ, eine transverale Shuntimpedanz von 3,6 MOhm für beide Polarisationen der TM_{110}-Mode erreichen. Die Ergebnisse dieser numerischen Optimierung konnten an verschiedenen Modellresonatoren mit der Störkörpermethode bestätigt werden. Ein solcher optimierter Resonator ist für die longitudinal aufgelöste transversale Strahldiagnose an der supraleitenden HF-Quelle von BERLinPro geplant.

*Gefördert durch das BMBF unter 05K10PEA

HK 25.7 Mo 18:15 WIL-C207

Numerische und messtechnische Charakterisierung von SRF-Mittelzellstrukturen* — •Marc Stürenberg-Jung, Alessandro Ferrarotto, Bernard Riemann und Thomas Weis — Zentrum für Synchrotronstrahlung (DELTA), TU Dortmund

Supraleitende Multizell-HF-Strukturen (SRF) sind unabdingbar für den Betrieb moderner Linearbeschleuniger und künftiger rezirkulierender Beschleunigeranlagen. Die Eigenschaften solcher Strukturen, wie etwa die Lage der Frequenzbänder, die Zwischenzellenkopplung und das Verhältnis von maximaler Oberflächenfeldstärke und Beschleunigungsgradient werden im Wesentlichen durch die Geometrie der Mittelzellen bestimmt. Um eine solche Struktur zu charakterisieren, wurden Aluminiummodelle von Mittelzellen mit einer Fundamentalfrequenz von 1.3 GHz unter periodischen Randbedingungen auf einem HF-Messstand vermessen. Der Beitrag fasst die experimentellen Ergebnisse im Vergleich mit numerischen Ergebnissen zusammen. Die Messungen stehen in direktem Zusammenhang mit der Auslegung des Hauptlinearbeschleunigers für BERLinPro. Dieser wird als Prototyp für einen Energy-Recovery-Linarbeschleuniger (ERL) am Helmholtz-Zentrum Berlin (HZB) aufgebaut.

* gefördert durch das BMBF unter 05K10PEA

HK 25.8 Mo 18:30 WIL-C207

Optimierung und Fehleranalyse eines Solenoiden für einen Photoelektroneninjektor — •Jens Völker — Helmholtz-Zentrum-Berlin

Solenoide spielen eine wichtige Rolle bei der Emittanzkompensation bei Photoelektroneninjektoren. Durch Feldfehler und nicht-lineare Effekte des Solenoidfeldes kann die transversale Emittanz eines Elektronenstrahls nachhaltig beeinflusst werden. In diesem Vortrag sollen Ursprung und Auswirkungen von Feldfehlern wie Dipol- und Quadrupol-Felder im Solenoiden und nicht-lineare Effekte wie Astigmatismus diskutiert werden. Des Weiteren wird gezeigt, wie sich durch numerische Optimierungsrechnungen optimale Solenoiddesigns bestimmen lassen und welche Auswirkungen die Feldfehler in diesen einnehmen.

HK 25.9 Mo 18:45 WIL-C207

Design of permanent magnetic solenoids for REGAE — •Tim Gehrke[1], Klaus Flöttmann[2], Benno Zeitler[1], Stephanie Manz[3], and Florian Grüner[1] — [1]University of Hamburg and Center for Free-Electron Laser Science, Hamburg, Germany — [2]DESY, Hamburg, Germany — [3]MPSD, University of Hamburg, Hamburg, Germany

The Relativistic Electron Gun for Atomic Exploration REGAE is a small linear accelerator at DESY in Hamburg, which produces short, low emittance electron bunches. Two future experiments at REGAE, an external injection experiment for Laser Wakefield Acceleration (LWA) and a time resolving Transmission Electron Microscopy (TEM) setup, require strong focusing magnets inside the target chamber. Permanent magnetic solenoids can provide the needed focusing strength due to their enormous surface current density, while having compact dimensions at the same time. Solenoids are fundamentally non-linear focusing elements whose non-linearity is worst for short, strong magnets as required for REGAE. The induced emittance growth is investigated and minimized for different setups with axially and radially magnetized annular magnets. Since permanent magnetic solenoids cannot be switched off but are not needed in every experiment at REGAE, a mechanical lifting-system and a magnetic shielding has to ensure, that the different experiments do not disturb each other.

HK 26: Eingeladene Hauptvorträge

Zeit: Dienstag 8:30–10:35 Raum: HSZ-02

Hauptvortrag HK 26.1 Di 8:30 HSZ-02

Highlights from ALICE — •Klaus Reygers for the ALICE-Collaboration — Universität Heidelberg, Physikalisches Institut, Im Neuenheimer Feld 226, 69120 Heidelberg

The ALICE experiment at the LHC explores the high temperature and density limit of QCD with Pb+Pb collisions at $\sqrt{s_{NN}} = 2.76$ TeV. Robust tracking over a large transverse momentum range ($0.1 < p_T < 100$ GeV) and excellent particle identification make ALICE a unique tool for characterizing the created QCD matter. A summary of results on Pb+Pb (and p+p) collisions will be presented, including global event properties, anisotropic flow, thermal radiation, jet quenching, and quarkonia. Results on p+Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV, also shown in this talk, shed light on cold nuclear matter effects. Finally, future plans of the ALICE experiment will be summarized.

Hauptvortrag HK 26.2 Di 9:05 HSZ-02

Collective flow in a hot, dense, and strongly interacting medium — •Björn Schenke — Physics Department, Brookhaven National Laboratory, Upton, NY 11973, USA

The large collective flow measured at the Relativistic Heavy-Ion Collider at Brookhaven National Laboratory and the Large Hadron Collider at CERN is one of the most striking observations in heavy-ion experiments. This anisotropy of particle production in the plane transverse to the collision axis is interpreted as the fluid-dynamic response of the created strongly interacting matter to the initial collision geometry, which fluctuates event by event. I review recent developments in the theoretical description of the bulk dynamics of heavy-ion collisions with focus on viscous fluid-dynamics and models for the initial state and its fluctuations. Recent progress using a combined Yang-Mills and viscous fluid-dynamic framework has lead to great successes in describing a wide range of experimental data, leading to the unprecedented opportunity to extract quantitative information on the transport properties of the created quark-gluon plasma, such as its shear viscosity. This demonstrates how heavy-ion collisions can be used to study fundamental properties of quantum-chromo-dynamics.

Hauptvortrag HK 26.3 Di 9:40 HSZ-02

Strongly interacting matter in an external magnetic field — •Pavel Buividovich — Institute for Theoretical Physics, University of Regensburg

The current status of studies of the properties of strongly interacting matter in an external magnetic fields is reviewed. Both experimental and numerical evidences in favor of the Chiral Magnetic Effect and the anisotropic conductivity and superconductivity of hadronic matter and quark-gluon plasma are discussed. I also comment on the possible shift of the confinement-deconfinement phase transition due to the magnetic field.

Preisträgervortrag HK 26.4 Di 10:15 HSZ-02

Exploring QCD phase diagram in heavy ion collisions — •Krzysztof Redlich — University of Wroclaw, Wroclaw, Polen — Laureate of the Smoluchowski-Warburg-Prize

Based on the recent findings of Lattice Gauge Theory and effective models we introduce the phase structure of strongly interacting matter at finite temperature and density. We discuss, how the transition from hadronic phase to a quark gluon plasma can be explored experimentally in heavy ion collisions. The theoretical expectations will be contrasted with recent data obtained in heavy ion collisions at RHIC and LHC energies.

HK 27: Hadronenstruktur und -spektroskopie

Zeit: Dienstag 14:00–16:15 Raum: HSZ-101

Gruppenbericht HK 27.1 Di 14:00 HSZ-101

Electromagnetic form factors of the baryon octet in effective field theory — Torsten Bauer[1], Jan Bernauer[1,2], •Patricia Bickert[1], and Stefan Scherer[1] — [1]Institut für Kernphysik, JGU, Mainz — [2]Laboratory for Nuclear Science, MIT, Cambridge, USA

We present a calculation of the electromagnetic form factors of the nucleon to third chiral order in manifestly Lorentz-invariant effective field theory. The ρ and ω mesons as well as the $\Delta(1232)$ resonance are included as explicit dynamical degrees of freedom. To obtain a self-consistent theory with respect to constraints we consider the proper relations among the couplings of the effective Lagrangian. For the purpose of generating a systematic power counting, the extended on-mass-shell renormalization scheme is applied in combination with the small-scale expansion. The results for the electric and magnetic Sachs form factors are analyzed in terms of experimental data and compared to previous findings in the framework of chiral perturbation theory. Finally, we present the results of a three-flavor calculation of the baryon-octet form factors including vector-meson degrees of freedom.

HK 27.2 Di 14:30 HSZ-101

Studien zur Messung des elektromagnetischen Formfaktors des η' Mesons — •Sascha Wagner, Achim Denig und Marc Unverzagt für die A2-Kollaboration — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz

Elektromagnetische Übergangsformfaktoren liefern einen Einblick in die intrinsische Struktur der Hadronen. Zudem stellen die Formfaktoren von leichten pseudoskalaren Mesonen eine wichtige Größe dar, um die theoretische Unsicherheit der hadronischen Licht-Licht-Streuung in Bezug auf das anomale magnetische Moment des Myons zu reduzieren. In Beschleunigerexperimenten sind diese z. B. mit dem Crystal Ball Aufbau am Mainzer Mikrotron (MAMI) im zeitartigen Bereich über Zerfälle zugänglich.

Innerhalb der A2-Kollaboration am MAMI werden Experimente mit Bremsstrahlungsphotonen durchgeführt. Für die Messungen zum η' Meson kam im Jahr 2012 zum ersten Mal eine neue Photonenmarkierungsanlage (End-point Tagger) in Kombination mit dem Crystal Ball/TAPS-Aufbau zum Einsatz.

In diesem Beitrag wird speziell die Messung des Dalitz-Zerfalls $\eta' \to \gamma^*\gamma \to e^+e^-\gamma$ mit dem Crystal Ball betrachtet. Es werden Simulationsstudien zum η' Dalitz-Zerfall und den wichtigsten Untergrundprozessen, sowie erste Analysen der in 2012 gemessenen Daten vorgestellt.

HK 27.3 Di 14:45 HSZ-101

New experimental approaches to determine the real part of the η'-nucleus potential* — •Mariana Nanova for the CBELSA/TAPS-Collaboration — II. Physikalisches Institut, Justus Liebig Universität Giessen

Transparency ratio measurements provide information on the inelastic cross section and in-medium width of η' and thereby on the imaginary part of the η'-nucleus potential [1]. The real part of the η'-nucleus optical potential can be deduced from the measurement of the η' excitation function and of the η' momentum distribution which are sensitive to the sign and depth of the potential. Data taken in 2009 at CB/TAPS@ELSA on a carbon target have been analysed. The results are compared to model calculations [2] assuming different scenarios for the real part of the potential, related directly to the in-medium mass modification of the meson. The data are consistent with a weakly attractive η'-nucleus potential.

[1] M. Nanova et al., Phys. Lett. B 710 (2012) 600
[2] E. Paryev, arXiv 1209.4050 [nucl-th]

*Funded by DFG(SFB/TR-16)

HK 27.4 Di 15:00 HSZ-101

Measurement of the double polarization observable E in the reaction $\vec{\gamma}\vec{p} \to p\eta'$ — •Farah Noreen Afzal for the CBELSA/TAPS-Collaboration — HISKP, Bonn, Germany

The study of η'-photoproduction off protons allows an investigation of the not well understood high-lying resonances ($m_{N^*} > 1892$ MeV) of the nucleon excitation spectrum. The recent cross section data measured at CLAS and CBELSA/TAPS alone are not sufficient in order to disentangle all the different resonance contributions due to the largely overlapping resonances. Additionally, the measurement of well chosen single and double polarization observables is needed for an unambiguous solution. Several of these polarization observables are measured with the CBELSA/TAPS experiment, utilizing a polarized photon beam and polarized nucleons. The setup provides a nearly full 4π angular coverage and a high detection efficiency for neutral final states. In this talk, the preliminary results of the double polarization observable E in the reaction $\vec{\gamma}\vec{p} \to \eta' p$, using a circularly polarized photon beam in combination with a longitudinally polarized butanol target, will be presented. Supported by the Deutsche Forschungsgemeinschaft (SFB/TR16).

HK 27.5 Di 15:15 HSZ-101

Bestimmung von Polarisationsobservablen in der ω Photoproduktion* — •Holger Eberhardt für die CBELSA/TAPS-Kollaboration — PI Uni Bonn

Ziel des Crystal-Barrel/TAPS-Experimentes am Bonner Elektronen-Beschleuniger ELSA ist die Untersuchung der Nukleon-Resonanzstruktur durch Photoproduktion von Mesonen. Zur Messung der für diesen Zweck notwendigen Polarisationsobservablen werden zur Zeit Doppelpolarisationsexperimente mit polarisiertem Target und polarisierten Photonen durchgeführt. Untersuchungen der ω Photoproduktion in Schwellennähe, sowohl mit unpolarisierten Photonen als auch mit polarisierten Photonen zeigen, neben den dominierenden t-Kanal Beiträgen, signifikante s-Kanal Beiträge in diesem Kanal. Zur Ermittlung der beitragenden Resonanzen kann insbesondere die Strahl-Target-Helizitätsasymmetrie beitragen, da diese Observable als „Spinfilter" im s-Kanal wirkt. Durch eine Partialwellenanalyse gemessener Observablen ist es möglich dominierende Resonanzbeiträge in der untersuchten Reaktion zu extrahieren.

* gefördert durch die Deutsche Forschungsgemeinschaft (SFB/TR-16)

HK 27.6 Di 15:30 HSZ-101

Polarisation Observables F and T in Double π^0 Photoproduction — •Stefanie Garni for the A2-Collaboration — Departement of Physics, University of Basel, CH-4056 Basel, Switzerland

The measurement of single and double polarisation observables gives information about the different resonance contributions to the cross section and hence leads to a better understanding of the nucleon and it's excited states. Double π^0 photoproduction is a very interesting reaction for the investigation of nuclear resonances. Photoproduction of pion pairs allows to study states which decay preferentially via intermediate resonances. The double neutral channel has the additional advantage of only small non-resonant background contributions.

Double π^0-photoproduction off a transversally polarizied H-butanol target has been measured using circularly polarizied bremsstrahlung photons produced by MAMI-C with incident energies up to 1.5 GeV. The double π^0 reaction was identified using a combined setup of the Crystal Ball colorimeter and a TAPS forward wall which results in an almost 4π acceptance. Preliminary results on the single polarization observable T and double polarization observable F will be presented.

HK 27.7 Di 15:45 HSZ-101

Measurements of azimuthal asymmetries in DVCS and associated processes at HERMES — •Erik Etzelmüller, Avetik Airapetian, Irina Brodski, Michael Düren, and Marian Stahl for the HERMES-Collaboration — II.Physikalisches Institut, Justus-Liebig-Universität Gießen, 35392 Gießen, Germany

Azimuthal asymmetries in exclusive electroproduction of real photons by the longitudinally polarized HERA positron beam scattering off an unpolarized hydrogen target ($ep \to ep\gamma$) are measured at HERMES. The asymmetries arise from deeply virtual Compton scattering (DVCS) and its interference with the Bethe-Heitler process. These asymmetries provide the theoretically cleanest access to Generalized Parton Distributions. A recoil detector has been installed in HERMES that allows for the detection of all final state particles in the process $ep \to ep\gamma$. It consisted of a silicon strip detector, a scintillating fibre tracker and a photon detector surrounded by a 1 T superconducting magnet.
In previous publications, associated processes $ep \to e\gamma p\pi^0$ and $ep \to e\gamma n\pi^+$ contributed as background processes about 12% to the DVCS signal. The new ability of HERMES to detect the recoil particles allows to select and measure the associated processes, and it also allows to select clean DVCS processes by reducing the associated background processes to a negligible level. Recent HERMES results on azimuthal asymmetries obtained in DVCS and in the associated processes are presented.

HK 27.8 Di 16:00 HSZ-101

COMPASS results on transverse spin asymmetries in identified two-hadron production in SIDIS — •CHRISTOPHER BRAUN — for the COMPASS collaboration — Uni Erlangen

The parton distribution function h_1 of a transversely polarized quark inside a transversely polarized nucleon, is chiral-odd and therefore not accessible in inclusive deep inelastic scattering. It can only be observed in semi-inclusive deep inelastic scattering (SIDIS) in combination with another chirally odd function like the two-hadron interference fragmentation function (IFF) $H_1^\sphericalangle$. The 160 GeV/c polarized μ^+ beam of CERN's M2 beamline allows COMPASS to investigate the spin structure of the nucleon using polarized solid state targets.

In this contribution an overview of COMPASS results for the azimuthal asymmetries in two-hadron production is given. This includes the results on a polarized deuteron target from the data taken in the years 2002-04, as well as the first data set on a transversely polarized proton target taken in the year 2007 and a data set taken on the same target during 2010 to increase precision. An extraction of h_1 using the two-hadron IFF $H_1^\sphericalangle$ has been carried out for the 2007 data. The COMPASS spectrometer allows an efficient particle identification, which can be used to determine the composition of the h^+h^- pairs in terms of pions and kaons. The results for the possible combinations, optained very recently, will be discussed. In particular the asymmetries for $\pi^+\pi^-$ pairs will be compared to model predictions and the corresponding results from HERMES. – Supported by German BMBF

HK 28: Fundamentale Symmetrien

Zeit: Dienstag 14:00–16:15 Raum: HSZ-103

Gruppenbericht HK 28.1 Di 14:00 HSZ-103

Measurement of Electric Dipole Moments of Charged Particles in Storage Rings — •JÖRG PRETZ for the JEDI-Collaboration — RWTH Aachen University, FZ Jülich

Permanent Electric Dipole Moments (EDMs) of fundamental particles violate both time invariance and parity symmetry. Assuming that the CPT theorem holds this implies also CP violation. The CP violation of the Standard Model is orders of magnitude too small to be observed experimentally in EDMs in the foreseeable future. It is also way too small to explain the asymmetry in abundance of matter and anti-mattter in our Universe. Hence, other CP violating mechanisms outside the realm of the Standard Model are searched for and could result in measurable EDMs.

EDM experiments with charged hadrons are proposed at storage rings where polarized particles are exposed to an electric field. If an EDM exists the spin vector will experience a torque resulting in a change of the original spin direction which can be determined with the help of a polarimeter. Although the principle of the measurement is simple, the smallness of the expected effect makes this a challenging experiment requiring new developments in various experimental areas.

Complementary efforts to measure EDMs of proton, deuteron and light nuclei are pursued at Brookhaven National Laboratory and at Forschungszentrum Jülich with with an ultimate goal to reach a sensitivity of $10^{-29}e$·cm.

Gruppenbericht HK 28.2 Di 14:30 HSZ-103

The hyperfine structure of antihydrogen — •EBERHARD WIDMANN — Stefan-Meyer-Institut, Wien, Österreich

Low-energy antiprotons are an ideal tool to study fundamental symmetries, especially CPT symmetry, by the precision spectroscopy of exotic atoms containing an antiproton. The investigation of the hyperfine structure of such atoms allows first of all the determination of the antiproton magnetic moment, the most precise value of which was obtained recently by the ASACUSA collaboration at the Antiproton Decelerator of CERN, albeit with a precision of order 10^{-3}.

As a next step, ASACUSA is preparing an experiment to measure the ground-state hyperfine structure GS-HFS of antihydrogen, which promises much higher accuracy because the corresponding quantity for hydrogen is measured to relative precision of 10^{-12} in the hydrogen maser. In a first phase a beam of polarized antihydrogen atoms formed by a so-called cusp trap will be used, which will allow the determination of the GS-HFS to better than 10^{-6}. This accuracy will already be enough to observe an influence of the finite size of the antiproton, provided the magnetic moment of the antiproton is measured independently in a Penningtrap, as it is planned by two other groups at the AD. In a second phase the Ramsey method of separated oscillatory fields will be used to increase the precision by one order of magnitude.

HK 28.3 Di 15:00 HSZ-103

A highly sensitive ^{3}He-Magnetometer for the future n2EDM-Experiment at Paul Scherrer Institut, Switzerland — •STEFAN ZIMMER[1], WERNER HEIL[1], HANS-CHRISTIAN KOCH[1,2], ANDREAS KRAFT[1], and NEDM COLLABORATION[3] — [1]Institut für Physik, Universität Mainz — [2]University of Fribourg — [3]PSI

The measurement of the electric dipole moment of the free neutron (nEDM) is directly linked to the question of an accurante determination of the magnetic field conditions inside the nEDM spectrometer. The method is based on monitoring the free spin precession of nuclear polarized ^{3}He by means of optically pumped Cs-magnetometers. The sensitivity to trace tiny magnetic field fluctuations during a typical Ramsey-cycle of 200s reaches the fTesla level. The talk gives an status report on our ^{3}He magnetometer consisting of a compact ^{3}He polarizer- and compressor-unit, a transfer-line for the hyperpolarized gas into the μ-metal shield which houses the actual nEDM spectrometer with its two flat cylindrical magnetometer vessels sandwiching the double chambers for ultracold neutrons storage.

HK 28.4 Di 15:15 HSZ-103

A novel approach to measure the electric dipole moment of ^{129}Xenon — •FLORIAN KUCHLER, PETER FIERLINGER, and DAVID WURM — Excellence Cluster "Universe", Technische Universität München, Boltzmannstr. 2, 85748 Garching

Permanent electric dipole moments (EDM) are promising systems to find new CP violation. The properties of the diamagnetic atom ^{129}Xe make it a particularly interesting candidate for an EDM search, as it enables new experimental strategies. Although the current experimental limit of $d_{Xe} < 4.0 \cdot 10^{-27}$ ecm is many orders of magnitude higher than the Standard Model (SM) prediction, theories beyond the SM usually require larger EDMs.

Our experiment is based on microscopic hyper-polarized liquid xenon droplets, placed in a low-field NMR setup. Employing superconducting pick-up coils and highly sensitive LTc-SQUIDs for detection of the xenon spin precession we aim to increase the sensitivity to an EDM of ^{129}Xe by three orders of magnitude.

Implementation of rotating electric fields enables a conceptually new EDM measurement technique, allowing thorough investigation of systematic effects. Still, a Ramsey-type spin precession experiment with static electric field can be realized at similar sensitivity within the same setup.

The talk will give both an overview of the xenon EDM experiment and an update on the experimental status.

HK 28.5 Di 15:30 HSZ-103

^{3}He-^{129}Xe-Comagnetometer: Search for a Lorentz-violating background field — •FABIAN ALLMENDINGER[1], ULRICH SCHMIDT[1],

Werner Heil[2], Sergei Karpuk[2], Anja Scharth[2], Yuri Sobolev[2], Kathlynne Tullney[2], Martin Burghoff[3], Wolfgang Kilian[3], Silvia Knappe-Grüneberg[3], Allard Schnabel[3], Frank Seifert[3], and Lutz Trahms[3] — [1]Physikalisches Institut, Universität Heidelberg — [2]Institut für Physik, Universität Mainz — [3]PTB Berlin

The minimal Standard Model Extension (SME) of Kostelecký et al. is a low energy effective field theory including operators which break Lorentz symmetry. It predicts an energy shift of nuclear spin states depending on the orientation of the spins relatively to a hypothetical Lorentz-violating background field. Our search for this effect is based on the measurement of free precession of nuclear spin polarized ^{3}He and ^{129}Xe atoms in a homogeneous magnetic guiding field of about 400 nT using LT_C SQUID detectors. As the laboratory frame rotates with the earth, a Lorentz-violating background field would cause a sideral modulation of the precession frequencies. ^{3}He-^{129}Xe-comagnetometry is used to cancel magnetic field drifts. The setup is placed in a strongly magnetically shielded room at the Physikalisch-Technische Bundesanstalt (PTB) in Berlin, allowing long coherence times of several hours for both gases. In this talk we will present the principle of measurement and current results.

HK 28.6 Di 15:45 HSZ-103

Experimental search for the electric dipole moment (EDM) of ^{129}Xe in ^{3}He/^{129}Xe clock-comparison experiments — •Anja Scharth[1], Werner Heil[1], Sergei Karpuk[1], Yury Sobolev[1], Kathlynne Tullney[1], Fabian Allmendinger[2], Ulrich Schmidt[2], Martin Burghoff[3], Wolfgang Kilian[3], Allard Schnabel[3], Frank Seifert[3], Lutz Trahms[3], Olivier Grasdijk[4], Klaus Jungmann[4], and Lorenz Willman[4] — [1]Institut für Physik, Universität Mainz — [2]Physikalisches Institut, Universität Heidelberg — [3]PTB Berlin — [4]University of Groningen

Permanent atomic EDMs would imply a breakdown of both parity and time reversal symmetry and therefore lead to a violation of CP symmetry. Thus searches for the EDM of ^{129}Xe are an unambiguous method to test physics beyond the standard model. Our approach is to use co-located ^{3}He/^{129}Xe spin samples and to measure their coherent spin-precession over extended periods of $\sim$ 1 day, typically. Based on our experience with measurements on Lorentz-invariance [1,2], we intend to reach a measurement sensitivity that will improve the present upper limit $d_{Xe} = 3 \cdot 10^{-27} e \cdot cm$ significantly. Phase I of this experiment will be performed in the magnetically shielded room BMSR-2 of the PTB Berlin using very sensitive SQUID gradiometers as magnetic flux detectors and electric fields of ≈2 kV/cm. The experimental setup and current status of work will be presented.

[1] C.Gemmel et al., Eur. Phys. J D 47, 303 (2010)
[2] C.Gemmel et al., Phys. Rev D 82, 111901(R) (2010)

HK 28.7 Di 16:00 HSZ-103

Test of Time-Reversal Invariance at COSY (TRIC) — Dieter Eversheim[1], •Yury Valdau[2], and Bernd Lorentz[2] — [1]Helmholtz Institut für Strahlen- und Kernphysik, University Bonn, Germany — [2]Institut für Kernphysik, Forschungszentrum Jülich, Germany

At the Cooler Synchrotron COSY a novel (P-even, T-odd) null test of time-reversal invariance to an accuracy of 10^{-6} is planned as an internal target transmission experiment. The parity conserving time-reversal violating observable is the total cross-section asymmetry $A_{y,xz}$. This quantity is measured using a polarized proton beam with an energy of 135 MeV and an internal tensor polarized deuteron target from the PAX atomic beam source. The reaction rate will be determined by the lifetime of the beam. Thus, in this experiment the cooler synchroton ring serves as an ideal forward spectrometer, as a detector, and an accelerator. First steps of the experimental set-up are discussed.

HK 29: Schwerionenkollisionen und QCD Phasen

Zeit: Dienstag 14:00–16:00 Raum: HSZ-201

Gruppenbericht HK 29.1 Di 14:00 HSZ-201

J/ψ production in Pb–Pb collisions at $\sqrt{s_{\rm NN}} = 2.76$ TeV measured with ALICE at the LHC — •Jens Wiechula for the ALICE-Collaboration — Physikalisches Institut, Eberhard Karls Universität Tübingen

Charmonium production has been proposed as an important probe to study the phase of deconfined quarks and gluons (QGP) produced in ultra-relativistic heavy-ion collisions. Due to their large mass, charm quark production can only happen in the initial parton interactions, so that they participate in the whole collision evolution. More than 25 years ago it was predicted that J/ψ production, due to colour screening mechanisms in the QGP phase, should be suppressed in ultra-relativistic heavy-ion collisions in comparison to the yield in pp collisions scaled by the number of binary nucleon-nucleon interactions. This effect has indeed been observed, first at the SPS and later by the RHIC experiments. At LHC energies, however, the large abundance of produced charm quarks allows for studying other J/ψ production mechanisms via (re)combination of c and $\bar{c}$ quarks.

ALICE is the dedicated heavy-ion experiment at the LHC. J/ψ production is measured at mid- and forward rapidity in the di-electron and di-muon decay channel, respectively. In both rapidity intervals the acceptance reaches down to $p_{\rm T} = 0$, being unique among the LHC experiments. Results on the nuclear modification factor ($R_{\rm AA}$) will be presented. A differential analysis as a function of transverse momentum, rapidity and collision centrality has been performed. The results will be discussed and compared to various theoretical calculations.

HK 29.2 Di 14:30 HSZ-201

J/ψ-Hadron Correlations in Proton-Proton Collisions and J/ψ in Proton-Lead Collisions with the Central Barrel of ALICE at the LHC — •Michael Winn for the ALICE-Collaboration — Physikalisches Institut, Universität Heidelberg

The description of J/ψ production in proton-proton (pp) and in proton-nucleus (pA) collisions remains challenging for theory based on perturbative QCD and factorization. Furthermore, the investigation of J/ψ in pp and pA collisions represents an important reference for heavy-ion collisions, where the behaviour of charmonium is seen as a key observable for deconfinement. In this context, in addition to cross section and polarization measurements, azimuthal J/ψ-hadron correlations provide further information constraining the responsible mechanisms at work.

The central-barrel detectors of ALICE ($|\eta| < 0.9$) are well suited to detect J/ψ in its dielectron decay channel and the associated charged tracks in the same event with full azimuthal coverage. First results of azimuthal J/ψ-hadron correlations in pp collisions at a center-of-mass energy of 7 TeV will be shown. Finally, the potential of ALICE for J/ψ measurements in proton-lead collisions with the central barrel will be discussed.

HK 29.3 Di 14:45 HSZ-201

Perspectives of ψ' and χ_c measurements in ALICE — •Steffen Weber for the ALICE-Collaboration — TU Darmstadt, Institut für Kernphysik, Darmstadt, Germany

ALICE is a dedicated heavy-ion experiment at the LHC at CERN. The LHC can deliver proton and heavy-ion beams with center-of-mass-energies up to $\sqrt{s} = 14$ TeV for protons and $\sqrt{s_{NN}} = 5.5$ TeV for heavy ions.

At such high energies, $c\bar{c}$-pairs are abundantly produced. They can either form open charm hadrons or quarkonia. The latter are important probes of the hot medium created in heavy-ion collisions. Different models predict either suppression [1] or enhancement [2] of charmonia production in a quark-gluon-phase. Measurements of ψ' and χ_c states would allow to distinguish different production mechanisms.

We present perspectives for ψ' and χ_c measurements in ALICE. We will especially highlight these measurements in connection with the ALICE upgrade plans [3].

[1] T. Matsui and H. Satz, Phys. Lett. B 178, (1986)
[2] P. Braun-Munzinger and J. Stachel, arXiv:0901.2500 [nucl-th], (2009)
[3] L. Musa et al., CERN-LHCC-2012-012, (2012)

HK 29.4 Di 15:00 HSZ-201

Electron Trigger with the ALICE TRD — •Uwe Westerhoff for the ALICE-Collaboration — WWU Münster

Electrons are an important probe to investigate the properties of pp, p-Pb and Pb-Pb collisions.

One source of electrons are the semi-leptonic decays of heavy-flavour hadrons (open charm and beauty). The measurement of these hadrons can be used to test predictions of pertubative QCD. To get a sufficiently large sample of these particles at high transverse momenta, an electron trigger is required.

The J/ψ is an important particle to study proton-proton collisions as well as to investigate the properties of the quark-gluon plasma created in lead-lead collisions. One option to measure this particle is via the decay channel J/$\psi \rightarrow e^+ e^-$. Due to the rather low mass of 3.1 GeV/c^2 of the J/ψ, an electron trigger with a low transverse momentum threshold is required.

The Transition Radiation Detector (TRD) of the ALICE experiment can provide these triggers. We will report on the mode of operation for the electron triggers and their performance in proton-proton collisions at $\sqrt{s} = 8$ TeV.

HK 29.5 Di 15:15 HSZ-201

Can heavy quarkonia be used as thermometers in heavy-ion collisions? — •Nicolas Borghini — Universität Bielefeld

Heavy quarkonia have long been proposed as probes of deconfinement in heavy-ion collisions, and more recently, they were put forward as thermometers of the created matter. I shall examine this claim in the view of our knowledge on the dynamics of the medium, and argue that quarkonia are far from constituting such a tool. Eventually, I shall present some options for describing heavy quark-antiquark pairs in a dynamically evolving environment.

HK 29.6 Di 15:30 HSZ-201

Elliptic Flow of J/ψ at Mid-Rapidity in Pb–Pb Collisions at $\sqrt{s_{NN}}$ = 2.76 TeV with the ALICE experiment — •Julian Book — Institut für Kernphysik, Goethe-Universität Frankfurt am Main

The investigation of the properties of strongly interacting matter under extreme conditions is the aim of the ALICE experiment. Quarkonia, i.e. bound states of heavy (charm or bottom) quarks such as the J/ψ, are expected to be produced in initial hard scattering processes in hadronic collisions. Thus they will provide insights into the earliest and hottest stages of nucleus-nucleus collisions where the formation of a Quark-Gluon Plasma is expected. The recent measurement of the J/ψ production in Pb–Pb collisions performed by ALICE at the LHC clearly showed less suppression with respect to SPS and RHIC results. The study of azimuthal anisotropy of particle production gives information on the collective hydrodynamic expansion of the QGP. Therefore, the measurement of the elliptic flow of J/ψ will help to understand the (re)generation mechanism and the degree of J/ψ thermalisation in Pb–Pb collisions at LHC energies. We present the first look into the elliptic flow measurement of J/ψ decaying into e^+e^- obtained at mid-rapidity ($|y| < 0.9$) in semi-central collisions and discuss its impact together with the results for J/ψ decaying into $\mu^+\mu^-$ measured at forward rapidities ($2.5 < y < 4.0$).

HK 29.7 Di 15:45 HSZ-201

Heavy quarks in a (3+1) dimensional hybrid approach — •Thomas Lang — Frankfurt Institute for Advanced Studies (FIAS), Ruth-Moufang-Straße 1, D-60438 Frankfurt — Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Straße 1, D-60438 Frankfurt

We have implemented a Langevin approach for the transport of heavy quarks in the UrQMD hybrid model. Here two different sets of drag and diffusion coefficients are used, one based on a T-Matrix approach and one based on a resonance model. In case of the resonance model we have investigated the effects of different decoupling temperatures of the heavy quarks from the medium, ranging between 130 MeV and 180 MeV. We present calculations of the nuclear modification factor R_{AA}, as well as of the elliptic flow v_2 in Au+Au collisions at $\sqrt{s_{NN}} = 200$ GeV and Pb+Pb collisions at $\sqrt{s_{NN}} = 2.76$ TeV. In order to compare with data at RHIC and LHC we have implemented a Peterson fragmentation and a quark coalescence approach followed by the semileptonic decay of the D- and B-mesons to electrons. We find that our results strongly depend on the decoupling temperature and the hadronization mechanism. At a decoupling temperature of 130 MeV we reach a good agreement with the measurements at both, RHIC and LHC energies, simultaneously for the elliptic flow v_2 and the nuclear modification factor R_{AA}. We also make a prediction for the medium modification of charm quarks at FAIR energies.

Supported by the Hessian LOEWE initiative through the Helmholtz International Center for FAIR (HIC for FAIR), GSI, and HGS-HIRe.

HK 30: Schwerionenkollisionen und QCD Phasen

Zeit: Dienstag 14:00–16:15 Raum: HSZ-204

Gruppenbericht HK 30.1 Di 14:00 HSZ-204

How Neutron Stars Constrain the Nuclear Equation of State — •Thomas Hell[1,2], Norbert Kaiser[1], and Wolfram Weise[1,2] — [1]Physik-Department, Technische Universität München, D-85747 Garching, Germany — [2]ECT*, Strada delle Tabarelle 286, I-38123 Villazzano (Trento), Italy

Recently, the mass of the pulsar PSR J1614-2230 has been measured with high accuracy to be 1.97 ± 0.04 solar masses. This, in addition to statistical analyses of neutron-star radii, leads to tight constraints for the equation of state of dense baryonic matter inside neutron stars. We combine a realistic phenomenological equation of state at low densities with equations of state around nuclear density derived from chiral effective field theory, on one hand, and from the Polyakov-loop-extended Nambu–Jona-Lasinio model, on the other. In the latter case, we investigate also the particular role of a vector interaction for the chiral phase transition. Our analysis strongly supports a very stiff equation of state of ordinary nuclear matter, without the need of exotic-matter admixtures, in order to reproduce the empirical observations for neutron stars.

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

HK 30.2 Di 14:30 HSZ-204

Shear Viscosity from the Nambu–Jona-Lasinio Model — •Robert Lang, Norbert Kaiser, and Wolfram Weise — Physik Department, Technische Universität München, D-85747 Garching, Germany

The Nambu–Jona-Lasinio (NJL) model provides a good description of strongly-interacting matter where confinement does not play the major role. In the vicinity of the chiral cross over we apply this model to calculate the T and μ dependence of the shear viscosity η. The theoretical foundations are a systematic large-N_c analysis of the NJL model and the Kubo formalism for the calculation of transport coefficients.

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

HK 30.3 Di 14:45 HSZ-204

Self-bound quark matter in the NJL model revisited: from schematic droplets to solitonic lasagne — •Michael Buballa and Stefano Carignano — TU Darmstadt

The existence and the properties of self-bound quark matter in the NJL model at zero temperature are investigated in mean-field approximation, focusing on inhomogeneous structures with one-dimensional spatial modulations. It is found that the most stable homogeneous solutions which have previously been interpreted as schematic quark droplets are unstable against formation of a one-dimensional soliton-antisoliton lattice. The solitons repel each other, so that the minimal energy per quark is realized in the single-soliton limit. The properties of the solitons and their interactions are discussed in detail, and the effect of vector interactions is estimated. The results may be relevant for the dynamics of expanding quark matter.

HK 30.4 Di 15:00 HSZ-204

Inhomogene Phasen stark wechselwirkender Materie mit Vektorwechselwirkung — •Marco Schramm, Daniel Nowakowski, Stefano Carignano und Michael Buballa — Institut für Kernphysik, Technische Universität Darmstadt

Im Rahmen eines Zwei-Flavor-Nambu–Jona-Lasinio-Modells untersuchen wir das Phasendiagramm stark wechselwirkender Materie. Für ein solches Modell wurde gezeigt, dass neben den bekannten homogenen Phasen auch inhomogene Phasen auftreten können, in denen der chirale Ordnungsparameter räumlich variiert. Wir betrachten in diesem Vortrag ein erweitertes Modell mit Vektorwechselwirkung und diskutieren die Auswirkungen auf das Phasendiagramm. Wir beschränken uns hierbei auf eindimensionale Modulationen für das chirale Kondensat. Dabei berücksichtigen wir im Gegensatz zu bisherigen Ansätzen die Rückwirkung der Dichtemodulation auf die Gapgleichung. Für realistische Parameter sind diese inhomogenen Phasen gegenüber homogenen, mit räumlich und zeitlich konstantem Ordnungsparameter und Dichte energetisch favorisiert.

HK 30.5 Di 15:15 HSZ-204

Inhomogene Phasen in der QCD mit Dyson-Schwinger Gleichungen — •Daniel Müller, Michael Buballa und Jochen Wambach — Institut für Kernphysik, TU Darmstadt

Wir verwenden Dyson-Schwinger Gleichungen in Landau Eichung, um den chiralen QCD-Phasenübergang bei hohen Dichten zu beschreiben. Dabei erlauben wir räumlich inhomogene chirale Kondensate. Wir beschränken uns dabei auf eindimensionale Modulationen in Form einer ebenen Welle (chiral density wave). Dabei erhalten wir eine inhomogene Phase, welche den ursprünglichen Phasenübergang erster Ordnung komplett überdeckt.

HK 30.6 Di 15:30 HSZ-204

Temperature dependence of the quark propagator within a Dyson-Schwinger approach — •Marco Viebach, Thomas Hilger, and Burkhard Kämpfer — TU Dresden and Helmholtz-Zentrum Dresden-Rossendorf, D-01328 Dresden, Germany

We present calculations of the quark propagator within the Dyson-Schwinger equations (DSEs) at non-zero temperature for various quark masses. Using a phenomenological gluon propagator and the rainbow approximation to truncate the DSEs the analytical structure is examined for temperature effects. The loci of singularities in the complex momentum plane potentially characterize the phase state with respect to chiral symmetry and confinement.

The chiral condensate and the dual condensate offer measures of the chiral and the deconfinement transition, respectively. They are studied as a function of the temperature and compared with other quantities characterizing the quark propagator.

The results of the DSEs serve as input for the Bethe-Salpeter equation, which provides an access to the meson spectrum and temperature driven medium modifications.

The work is supported by BMBF.

HK 30.7 Di 15:45 HSZ-204

Phasendiagramm der Zwei-Farb-QCD mit Dyson-Schwinger-Gleichungen — •Pascal Buescher, Michael Buballa und Jochen Wambach — Institut für Kernphysik, TU Darmstadt

Wir untersuchen das Phasendiagramm der Zwei-Farb-QCD mithilfe von Dyson-Schwinger-Gleichungen (DSE) und vergleichen unsere Ergebnisse mit denen aus anderen Zugängen. Die DSEs werden hierzu geeignet trunkiert und in Landau-Eichung selbstkonsistent gelöst. Für das Quarkloopdiagramm in der DSE des Gluonpropagators vergleichen wir zwei verschiedene Trunkierungen: die selbstkonsistente Rückkopplung des vollen Quarkpropagators und der Verwendung des Quarkloops in Hard-Dense/Hard-Thermal-Loop-Näherung. Neben der Betrachtung des Phasendiagramms legen wir besonderes Augenmerk auf die Pauli-Gürsey-Symmetrie und die Silver-Blaze-Eigenschaft.

HK 30.8 Di 16:00 HSZ-204

Effective gluon potential and Yang-Mills thermodynamics — •Chihiro Sasaki[1] and Krzysztof Redlich[2] — [1]Frankfurt Institute for Advanced Studies (FIAS), Ruth-Moufang-Straße 1, D-60438 Frankfurt, Germany — [2]Institute of Theoretical Physics, University of Wroclaw,PL-50204 Wrocław,Poland

We show that the Polyakov-loop potential can be derived, using a field theoretical methods, directly from the SU(3) Yang-Mills theory. A class of the Polyakov-loop effective potentials used so far in literature appears as limiting cases of our potential. We deduce the correspondence of U(L) to the strong-coupling expansion, of which the relevant coefficients of the gluon energy distribution are specified solely by characters of the SU(3) group.

At high temperatures the derived gluon potential exhibits the correct asymptotic behavior, whereas at low temperatures, it disfavors gluons as appropriate dynamical degrees of freedom. To quantify the Yang-Mills thermodynamics in a confined phase, we propose a hybrid approach which matches the effective gluon potential to the one of glueballs constrained by the QCD trace anomaly in the context of dilaton fields.

The work of C. S. has been supported in part by the Hessian LOEWE initiative through the Helmholtz International Center for FAIR (HIC for FAIR).

HK 31: Struktur und Dynamik von Kernen

Zeit: Dienstag 14:00–16:15 Raum: HSZ-301

Gruppenbericht HK 31.1 Di 14:00 HSZ-301

Probing the Character of the Pygmy Dipole Resonance — •Vera Derya[1], Janis Endres[1], Muhsin N. Harakeh[2], Deniz Savran[3,4], Mark Spieker[1], Heinrich J. Wörtche[2], and Andreas Zilges[1] — [1]Institut für Kernphysik, Universität zu Köln — [2]Kernfysisch Versneller Instituut, Rijksuniversiteit Groningen, The Netherlands — [3]ExtreMe Matter Institute EMMI and Research Division — [4]Frankfurt Institute for Advanced Studies

In neutron-rich atomic nuclei, a concentration of low-lying $E1$ strength, the electric pygmy dipole resonance (PDR), was observed below and around the neutron-separation threshold. Its character was studied systematically by using different probes and techniques. Complementary to photon scattering experiments, for a set of nuclei the isoscalar probe of α particles at E_α=136 MeV was used in α-γ coincidence experiments at the Big-Bite Spectrometer [1]. The results permit a separation of the PDR from more isovector parts [1,2]. Most recently, a p-γ coincidence experiment at E_p=80 MeV was performed on ^{140}Ce, previously studied by photons and α particles as a probe [2]. An overview of the particle-γ coincidence experiments and the systematics will be presented.

Supported by the DFG (ZI 510/4-2), EURONS, and the Alliance Program of the Helmholtz Association (HA216/EMMI). V.D. and M.S. are members of the Bonn-Cologne Graduate School of Physics and Astronomy.

[1] D. Savran *et al.*, Phys. Rev. Lett. **97** (2006) 172502.
[2] J. Endres *et al.*, Phys. Rev. Lett. **105** (2010) 212503.

HK 31.2 Di 14:30 HSZ-301

Zerfallsverhalten der Pygmy-Dipolresonanz in ^{130}Te — •Johann Isaak[1], Jacob Beller[2], Enrico Fiori[1], Milan Krticka[3], Bastian Löher[1], Norbert Pietralla[2], Christopher Romig[2], Deniz Savran[1], Marcus Scheck[2], Kerstin Sonnabend[4], Anton Tonchev[5], Werner Tornow[5], Henry Weller[5] und Markus Zweidinger[2] — [1]ExtreMe Matter Institute EMMI, GSI, Darmstadt — [2]Institut für Kernphysik, TU Darmstadt — [3]Faculty of Mathematics and Physics, Charles University, Prague, Czech Republic — [4]Institut für Angewandte Physik, Goethe-Universität Frankfurt am Main — [5]Department of Physics, Duke University, USA

In Kernresonanzfluoreszenz-Experimenten am Darmstadt High Intensity Photon Setup (DHIPS) und an der High Intensity $\vec{\gamma}$-Ray Source (HI$\vec{\gamma}$S) an der Duke University wurde die elektrische Dipolstärkeverteilung des Kerns ^{130}Te untersucht. Mit Hilfe von kontinuierlicher Bremsstrahlung am DHIPS war es möglich die absoluten Übergangsstärken von J=1 Zuständen bis zur Neutronenseparationsenergie zu bestimmen. Ergänzend konnte an HI$\vec{\gamma}$S mit quasi-monochromatischen linear polarisierten Photonen sowohl Paritäten als auch der totale Photoabsorptionswirkungsquerschnitt sowie das mittlere Verzweigungsverhältnis in den Grundzustand als Funktion der Anregungsenergie ermittelt werden. Die Ergebnisse werden präsentiert und mit ausführlichen Simulationen im Rahmen des Statistischen Modells mit Hilfe des DICEBOX Codes verglichen.

*Gefördert durch die Helmholtz Alliance EMMI und die DFG (SFB 634 und SO907/1-2).

HK 31.3 Di 14:45 HSZ-301

Photoneninduzierte γ-γ Koinzidenzmessungen mit dem γ^3-Setup an HIγS* am TUNL — •B. Löher[1], T. Aumann[4], J. Beller[4], C. Bernards[5], N. Cooper[5], V. Derya[2], J. Endres[2], A. Hennig[2], E. Fiori[1], J. Kelley[3], N. Pietralla[4], R. Raut[3], C. Romig[4], G. Rusev[3], D. Savran[1], M. Scheck[4], A. Tonchev[3], W. Tornow[3], V. Werner[5] und A. Zilges[2] — [1]ExtreMe Matter Institute EMMI and Research Division, GSI Helmholtzzentrum, Darmstadt, Germany — [2]Institut für Kernphysik, Universität zu Köln, Köln — [3]Department of Physics, Duke University, Durham, USA — [4]Institut für Kernphysik, Technische Universität Darmstadt, Darmstadt — [5]WNSL, Yale University, USA

Die Methode der Kernresonanzfluoreszenz wird zur Untersuchung von Zuständen mit Spin = 1, 2 unterhalb der Teilchenschwellen verwendet. Bisherige Messungen waren meist nicht sensitiv genug, um Übergänge geringer Intensität in angeregte Zustände zu beobachten. Eine Messung von γ-γ Koinzidenzen erhöht deutlich die Sensitivität und ermöglicht die Analyse der entsprechenden Übergangswahrscheinlichkeiten, sowie die direkte Messung der γ-*ray strength function*. Das γ^3-Setup bestehend aus einer Kombination von $LaBr_3$- und hochauflösenden HPGe-Detektoren, mit besonders hoher Effizienz wurde an der High Intensity γ-ray Source installiert. Erste Erkenntnisse über das Zerfallsverhalten der Pygmy-Dipolresonanz von ^{140}Ce werden präsentiert.

* Supported by the Alliance Program of the Helmholtz Association (HA216/EMMI), the DFG (SFB 634 and ZI 510/4-2), and U.S. DOE grant no. DE-FG02-91ER-40609.

HK 31.4 Di 15:00 HSZ-301

Gamma spectroscopy of neutron rich actinide nuclei — •Benedikt Birkenbach, Kerstin Geibel, Andreas Vogt, Herbert Hess, Peter Reiter, Tim Steinbach, and David Schneiders for the AGATA-Collaboration — IKP, Universität zu Köln

Excited states in neutron-rich actinide Th and U nuclei were investigated after multi nucleon transfer reactions employing the AGATA demonstrator and PRISMA setup at LNL (INFN, Italy). A primary ^{136}Xe beam of 1 GeV hitting a ^{238}U target was used to produce the nuclei of interest. Beam-like reaction products of Xe- and Ba isotopes after neutron transfer were selected by the PRISMA spectrometer. The recoil like particles were registered by a MCP detector inside the scattering chamber. Coincident γ-rays from excited states in beam and target like particles were measured with the position sensitive AGATA HPGe detectors. Improved Doppler correction and quality of the γ-spectra is based on the novel γ-ray tracking technique which was successfully exploited. First results on the collective properties of various Th and U isotopes will be discussed.

HK 31.5 Di 15:15 HSZ-301

SONIC - Combining γ and particle spectroscopy in Cologne — •Simon G. Pickstone, Vera Derya, Janis Endres, Andreas Hennig, Jan Mayer, Lars Netterdon, Sorin Pascu, Anne Sauerwein, Philipp Scholz, Mark Spieker, Tina-Mareike Streit, and Andreas Zilges — Institut für Kernphysik, Universität zu Köln

To gain additional information on nuclear structure from particle-induced reactions, the new silicon detector array SONIC consisting of up to eight ΔE-E-telescopes was installed inside the existing HPGe-detector array HORUS in Cologne. Because of the high resolution of the silicon detectors, light ejectiles (p, d, t, and α) can be easily distinguished. The main purpose of this detector array will be the study of inelastic scattering using p, d and α beams delivered by a 10 MV Tandem accelerator. Two test experiments have already been performed. Gating on the excitation of a specific level in ^{140}Ce(p,p'γ) improved the peak-to-background ratio in the γ-ray spectrum and gave access to additional nuclear structure information. In ^{172}Yb(d,$X\gamma$), where X=p, d', or t, clear discrimination of the ejectiles was achieved. The results of these first test experiments will be presented in detail as well as future improvements of the setup and upcoming experiments.

Supported by the DFG (ZI 510/4-2). S.G.P., V.D., A.H., J.M., A.S., P.S., and M.S. are members of the Bonn-Cologne Graduate School of Physics and Astronomy.

HK 31.6 Di 15:30 HSZ-301

Preparations for an optical access to the lowest excited nuclear state in ^{229}Th — •L. v.d.Wense[1,2], P.G. Thirolf[1], D. Kalb[1], and M. Laatiaoui[3] — [1]Ludwig-Maximilians-Universität München — [2]Max-Planck-Institut f. Quantenoptik — [3]GSI Helmholtzzentrum für Schwerionenforschung GmbH

The isomeric lowest excited nuclear level of ^{229}Th has been indirectly measured to be 7.6 ± 0.5 eV (163 ± 11 nm). In order to improve the accuracy as prerequisite of an all-optical control, ^{229m}Th is populated via a 2% decay branch in the α decay of ^{233}U. The Thorium ions are extracted and cooled with the help of a buffer gas stopping cell and an RFQ-cooler. In order to suppress accompanying α decay chain products other than ^{229}Th, a quadrupole mass spectrometer (QMS) has been constructed. First measurements of extraction and transmission efficiency were made, newest results will be presented. Following the QMS, the Thorium isomers will be collected on a $50\mu m$ collection surface. The decay of these isomers can then be detected using deep UV optics, presently under construction based on extensive simulation. The sensitivity is predicted to be large enough to lead to a verification of the isomeric transition even in the presence of a significant nonradiative decay branch.[1]

[1] L.v.d.Wense et al., Towards a direct transition energy measurement of the lowest nuclear excitation in ^{229}Th, arXiv:1211.0710 [nucl-ex]

HK 31.7 Di 15:45 HSZ-301

Angular Distributions of Low-Spin States in ^{240}Pu by Means of the ^{242}Pu(p,t)^{240}Pu Reaction — •Mark Spieker[1], Dorel Bucurescu[2], Janis Endres[1], Thomas Faestermann[3], Ralf Hertenberger[4], Sorin Pascu[1], Hans-Friedrich Wirth[4], Nicolae-Victor Zamfir[2], and Andreas Zilges[1] — [1]Institut für Kernphysik, Universität zu Köln — [2]Horia Hulubei National Institute of Physics and Nuclear Engineering, Bucharest, Romania — [3]Physik Department, Technische Universität München — [4]Fakultät für Physik, Ludwig-Maximilians-Universität München

Since recent experimental and theoretical studies revealed the importance of octupole correlations in the actinide region and especially in ^{240}Pu, a ^{242}Pu(p,t)^{240}Pu experiment has been conducted at the Q3D magnetic spectrograph of the Maier-Leibnitz laboratory in Munich. Excited states in ^{240}Pu were investigated up to an excitation energy of 3 MeV. Angular distributions have been measured at 9 laboratory angles between 5° and 40°. The comparison of the experimental angular distributions with DWBA calculations allowed the assignment of several low-spin states. Most of them were seen for the first time. The experimental data, especially the data on the 21 $J^\pi = 0^+$ states, will be presented and discussed in the framework of the *spdf*-version of the Interacting Boson Model.

Supported by the DFG (ZI-510/4-2). M.S. is member of the Bonn-Cologne Graduate School of Physics and Astronomy.

HK 31.8 Di 16:00 HSZ-301

Investigation of low-energy dipole modes in the heavy deformed nucleus ^{154}Sm via inelastic polarized proton scattering at zero degree * — •Andreas Krugmann[1], Dirk Martin[1], Peter von Neumann-Cosel[1], Norbert Pietralla[1], Iryna Poltoratska[1], Vladimir Ponomarev[1], Atsushi Tamii[2], Chihiro Iwamoto[3], and Kenichi Yoshida[4] for the E350-Collaboration — [1]Institut für Kernphysik, TU Darmstadt — [2]RCNP, Osaka University, Japan — [3]Konan University, Japan — [4]Niigata University, Japan

Polarized proton scattering has been measured on the heavy deformed nucleus ^{154}Sm at extreme forward angles with 300 MeV protons at RCNP, Osaka. The aim is to investigate the impact of ground state deformation on the properties of the pygmy dipole resonance (PDR) and the spin M1 resonance claimed to show a double-hump structure in heavy deformed nuclei. The (p,p') cross sections can be decomposed into $E1$ and $M1$ parts in two independent ways based either on a multipole decomposition of the cross sections or spin transfer observables [1]. The analysis of polarization transfer observables shows dominant non-spinflip cross sections in the excitation energy region 5-9 MeV with a resonance structure interpreted as the PDR, while the spinflip M1 strength shows a broad distribution between 5 and 10 MeV.

[1] A. Tamii, et al., Phys. Rev. Lett. 107, 062502 (2011).

* This work is supported by the DFG through SFB 634 and NE679/3-1.

HK 32: Struktur und Dynamik von Kernen

Zeit: Dienstag 14:00–16:15 Raum: HSZ-401

Gruppenbericht HK 32.1 Di 14:00 HSZ-401

Decay spectroscopy of neutron-rich nuclei around ^{37,38}Al — •Konrad Steiger for the CAITEN-Collaboration — Physik-Department E12, Technische Universität München

An experiment at RIBF (Radioactive Isotope Beam Factory at RIKEN, Japan) investigated N=20 nuclei above ^{29}F and the midshell region around ^{37}Al. These nuclei were produced by relativistic projectile fragmentation of a 345 AMeV ^{48}Ca primary beam from the superconducting ring cyclotron SRC with an average intensity of 70 pnA. The secondary cocktail beam was separated and identified with the BigRIPS fragment separator and the ZeroDegree spectrometer. The identified fragments were implanted in the CAITEN detector (Cylindrical Active Implantation Target for Efficient Nuclear-decay study). The main part of this detector is a highly segmented plastic scintillator with the shape of a hollow cylinder. To reduce background decay events the scintillator was moved axially and vertically similar to a tape-transport system. Implantations and decays were correlated in time and space. For the first time β-delayed γ-rays were measured in the neutron-rich isotopes ^{37,38}Si (with three germanium clover detectors). From β-γ-γ coincidences partial level schemes could be constructed. The results were compared to shell model calculations and a tentative assignment for spins and parities of the experimental level schemes was possible. Significantly more precise half-lives for the implanted nuclei were measured.

Supported by BMBF (06MT9156), DFG (EXC 153, KR2326/2-1), KAKENHI (19340074) and RIKEN President's Fund (2005).

HK 32.2 Di 14:30 HSZ-401

Three-nucleon forces at neutron-rich extremes* — Jason D. Holt[1,2], Javier Menéndez[1,2], Achim Schwenk[2,1], and •Johannes Simonis[1,2] — [1]Institut für Kernphysik, Technische Universität Darmstadt, Germany — [2]ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

In the framework of chiral effective field theory, a systematic expansion for nuclear forces, it is possible to obtain valence shell interactions for nuclear structure calculations. In this approach three-nucleon forces are included naturally, contributing to effective single-particle energies as well as two-body matrix elements. We will apply this to the O and Ca chain. In addition, we investigate contributions from residual three-nucleon forces, which are expected to become more important with valence nucleons, so for the most neutron-rich isotopes. The theoretical findings are compared to recent experiments at CERN, GSI and TRIUMF.

*This work was supported by the DFG through Grant SFB 634, by the BMBF under Contract No. 06DA70471, and by the Helmholtz Alliance HA216/EMMI.

HK 32.3 Di 14:45 HSZ-401

Study of shape transitions in the neutron-rich Os isotopes — •Philipp R. John[1,2], Victor Modamio[3], Jose Javier Valiente-Dobón[3], Daniele Mengoni[1], and Santo Lunardi[1,2] — [1]Dipartimento di Fisica e Astronomia, Universitá degli Studi di Padova, Padua, Italy — [2]INFN Sezione di Padova, Padua, Italy — [3]INFN Laboratori Nazionali di Legnaro, Legnaro (Pd), Italy

The nuclei with A≈190 between Hf and Pt exhibit a great variety of nuclear phenomena, including K-isomeric states, triaxiality and shape transitions across isotopic and isotonic chains. Of particular interest is the transition from axially symmetric deformed, prolate ($\gamma = 0°$) to oblate ($\gamma = 60°$) shapes in the Os isotopic chain. While a study of the neutron-rich ^{194}Os nucleus populated via deep-inelastic reactions suggests a prolate shape for its yrast states, an other study proposed an oblate shape for the ground state of ^{198}Os by comparing the excitation energies of the first and second 2^+ states. For ^{196}Os, the even-even isotope lying between the two, both an oblate and a prolate shape were predicted by microscopic many-body and Total Routhian Surface calculations, respectively. To further elucidate this shape transition and to refine the nuclear models, the key nucleus ^{196}Os was investigated through gamma-spectroscopy using the AGATA demonstrator and the large acceptance heavy ion spectrometer PRISMA at LNL, Italy. A two nucleon transfer from a ^{198}Pt target to a stable ^{82}Se beam was utilized to populate medium-high spin states of ^{196}Os. The current status of the analysis including preliminary results will be presented.

HK 32.4 Di 15:00 HSZ-401

Evolution of Deformation in neutron-rich Cr-Isoptopes — •Thomas Braunroth for the e10021-Collaboration — Institut für Kernphysik, Universität zu Köln

The emerging new region of deformation around the $N = 40$ subshell closure is one of many observable effects in nuclei at extreme isospin conditions. Although level schemes in neutron-rich Cr-isotopes suggest an increase in collectivity, the experimental data are sparse and motivate further experimental efforts to shed more light on the evolution of deformation in this region of the nuclear landscape. For this purpose lifetime measurements on ^{58,60,62}Cr with a dedicated differential plunger device were performed at the NSCL to deduce model-independent B(E2)-values. A ^{82}Se beam at 140 MeV/u was fragmented on a primary ^{9}Be target. The corresponding cocktail beam was filtered in the A1900 fragment separator, which then delivered the high purity ^{59,61,63}Mn-beams at $E \sim 95$ AMeV to the secondary target. Low lying yrast states in the above mentioned Cr-isotopes were then populated in 1p-knockout reactions. The employment of the S800 spectrograph allowed a clear recoil identification, which then lead to clean γ-spectra as measured by the Segmented Germanium Array (SeGA). Preliminary results of this experiment will be shown.

HK 32.5 Di 15:15 HSZ-401

Coulombanregung neutronenreicher Xe-Isotope — •Corinna Henrich, Thorsten Kröll, Sabine Bönig, Stoyanka Ilieva, Markus Scheck und Michael Thürauf für die IS411Xe-Kollaboration — Institut für Kernphysik, TU Darmstadt, Germany

Nach Grodzins Regel hat das Produkt aus Übergangsstärke und Anregungsenergie (B(E2; $0_1^+ \rightarrow 2_1^+$) · E(2_1^+)) von gg-Kernen im Tal der Stabilität einen glatten Verlauf. Untersuchungen an Sn und Te bei N>82 folgen nicht dieser einfachen Systematik. Stattdessen werden B(E2; $0_1^+ \rightarrow 2_1^+$)-Werte gefunden, welche kleiner sind als erwartet. Um die experimentelle Datenlage im Bereich dieser Isotope zu verbessern, wurden im Rahmen der IS411 Kampagne an REX-ISOLDE (CERN, Genf) Coulombanregungen an neutronenreichen Xe-Isotopen durchgeführt. Die emittierten γ-Quanten wurden mit dem MINIBALL-Spektrometer detektiert. Der aktuelle Stand der Analysen zu ^{138,140,142,144}Xe wird vorgestellt.

Dieses Projekt wird unterstützt vom BMBF (06DA9036I, 05P12RDCIA), HIC for FAIR und ENSAR (262010).

HK 32.6 Di 15:30 HSZ-401

Quadrupole collectivity in the Cd isotopic chain investigated with Coulomb excitation — •Sabine Bönig, Thorsten Kröll, and Marcus Scheck for the IS477-Collaboration — Technische Universität Darmstadt

The cadmium isotopic chain with a proton number of Z=48 is one of the most interesting in nuclear structure physics due to the proximity to the proton shell closure at Z=50. Performed Coulomb excitation experiments on $^{122-126}$Cd exhibit high excitation strengths for the $0_{gs}^+ \rightarrow 2_1^+$ transition. Shell model calculations are not able to reproduce the experimentally found values although the shell closure is near. However, Beyond-Mean-Field calculations agree with the experimental results, taking a prolate deformation into account. In this contribution, the latest results on the investigation of the B(E2, $0^+ \rightarrow 2_1^+$) value of ^{128}Cd via Coulomb excitation with MINIBALL at REX-ISOLDE will be presented. We will discuss the experimentally found transition strength considering a non-vanishing quadrupole moment and place it in the overall picture of the behaviour of the B(E2, $0^+ \rightarrow 2_1^+$) values of this isotopic chain. This project is supported by BMBF (No. 06 DA 9036I and No. 05 P12 RDCIA), HIC for FAIR and EU through ENSAR (No. 262010).

HK 32.7 Di 15:45 HSZ-401

Do we understand gamma strength functions? The case of ^{96}Mo * — •Dirk Martin[1], Andreas Krugmann[1], Anna Maria Krumbholz[1], Peter von Neumann-Cosel[1], Norbert Pietralla[1], Iryna Poltoratska[1], Vladimir Ponomarev[1], and Atsushi Tamii[2] for the E376-Collaboration — [1]Institut für Kernphysik, TU Darmstadt — [2]Research Center for Nuclear Physics, Osaka, Japan

The gamma strength function of ^{96}Mo derived from a variety of experimental methods show quite severe disagreement, in particular near the neutron threshold. A new experimental method is discussed, viz. relativistic proton scattering under extreme forward angles at RCNP Osaka, Japan [1], which allows a consistent analysis of data below and above the particle threshold. Here, intermediate-energy proton beams are used in combination with a high energy resolution of the order $\Delta E/E \approx 8 \cdot 10^{-5}$. E1 and M1 strength distributions can be determined by a multipole decomposition of angular distributions utilizing DWBA calculations [2]. The additional measurement of polarization transfer observables provides an independent check of the method. First results from a recent experiment are presented.

[1] A. Tamii et al., Nucl. Inst. Meth. A 605, 326 (2009).
[2] A. Tamii et al., Phys. Rev. Lett. 107, 062502 (2011).

⋆ Supported by DFG through SFB 634 and NE 679/3-1.

HK 32.8 Di 16:00 HSZ-401

Bestimmung von Multipolmischungsverhältnissen von $3_i^- \to 3_1^-$ Übergängen zur Identifikation niederenergetischer isovektorieller Oktupol-Zustände in ^{144}Nd — •Michael Thürauf für die EXILL-144Nd-Kollaboration — Technische Universität Darmstadt

Kürzlich wurden erste Kandidaten für tiefliegende isovektorielle Anregungen, sog. „mixed-symmetry“ Zustände, im Oktupolsektor vorgeschlagen. Die sichere Identifikation liefert einen wesentlichen Beitrag zur Dekomposition der oktupol-oktupol Restwechselwirkung in einen isoskalaren und isovektoriellen Anteil. Dies trägt wesentlich zum Verständnis des Oktupolfreiheitsgrades bei. In ^{144}Nd ist der 3^--Zustand bei 2778 keV ein guter Kandidat für einen solchen oktupol „mixed-symmetry“ Zustand. Diese Klasse an Zuständen wurde im Rahmen des Interacting-Boson-Modell (IBM-2) vorhergesagt. Um die Natur dieses Zustandes zu klären, wurde 2012 im Verlauf der (n,γ)-Kampagne am EX@ILL-Aufbau am ILL, Grenoble, ein Experiment ^{143}Nd$(n,\gamma)^{144}$Nd durchgeführt. Folgend dem Einfang eines Neutrons werden 3^--Zustände durch $M1$-Übergänge vom Einfangszustand aus bevölkert. EX@ILL bietet die Möglichkeit, die Multipolmischungsverhältnisse der Übergänge $3_i^- \to 3_1^-$ zu bestimmen und damit die Natur der 3_i^--Zustände festzulegen. Erste vorläufige Spektren werden hierzu gezeigt. Dieses Experiment ist der erste Schritt einer Kampagne der Arbeitsgruppe zur Untersuchung von Oktupolkorrelationen an FAIR.

Gefördert durch HIC for FAIR.

HK 33: Nukleare Astrophysik

Zeit: Dienstag 14:00–16:15 Raum: HSZ-403

Gruppenbericht HK 33.1 Di 14:00 HSZ-403

Investigation of charged-particle induced reactions for the nucleosynthesis of p nuclei — •Lars Netterdon, Janis Endres, Jan Mayer, Anne Sauerwein, Philipp Scholz, and Andreas Zilges — Institut für Kernphysik, Universität zu Köln

Up to the current understanding, about 35 proton-rich nuclei are bypassed by the s and r process. They are referred to as p nuclei. Since experimental data are very scarce, the majority of the astrophysical reaction rates is calculated using statistical model calculations. Nuclear physics input parameters entering these calculations, such as optical-model potentials, γ strength functions, and nuclear level densities, have to be constrained experimentally. In this talk, an overview of various experimental results will be given. *E.g.* the reactions ^{141}Pr(α,n) [1], ^{168}Yb(α,n), and ^{168}Yb(α,γ) are presented, that were studied using the activation technique. In addition, results of the in-beam measurement on ^{74}Ge(p,γ) [2] are presented. The experimental results are compared to statistical model calculations and their astrophysical impact is discussed. Finally, first results of the reaction ^{89}Y(p,γ) are shown, which was measured with the in-beam technique using the high-efficiency HPGe-detector array HORUS. The beam was delivered by the 10 MV tandem accelerator at the Institute for Nuclear Physics in Cologne.

Supported by the DFG (ZI 510/5-1, INST 216/544-1). J.M., A.S., and P.S. are members of the Bonn-Cologne Graduate School of Physics and Astronomy.

[1] A. Sauerwein *et al.*, Phys. Rev. C **84**, 045808 (2011)
[2] A. Sauerwein *et al.*, Phys. Rev. C **86**, 035802 (2012)

HK 33.2 Di 14:30 HSZ-403

Messung des ^{96}Ru(p,γ) Querschnitts im ESR an der GSI — •Ralf Plag für die E062-Kollaboration — Goethe-Universität, Frankfurt am Main, D-64291, Germany

Die Produktion von mehr als 30 protonenreichen Kernen wird im allgemeinen dem p-Prozess zugeschrieben, einem Reaktionsnetzwerk, das aus fast 2000 Kernen besteht und bei extrem hohen Temperaturen abläuft.

Um die daraus resultierenden Häufigkeiten abzuschätzen, ist die Kenntnis der beteiligten Wirkungsquerschnitte notwendig. Wegen kurzer Halbwertszeiten ist die direkte Messung dieser Querschnitte zumeist schwierig oder gar unmöglich.

Der Experimentierspeicherring ESR an der GSI bietet jedoch die Möglichkeit, (p,γ) und (α,γ)-Querschnitte radioaktiver Isotope mit Hilfe eines Wasserstoff- oder Heliumgastargets zu vermessen. Die Reaktionsprodukte werden dabei von einem Dipolmagneten vom Primärstrahl separiert und von einem Siliziumstreifendetektor nachgewiesen.

Als erstes Experiment dieser Art wurde der (p,γ)-Querschnitt des stabilen Isotops ^{96}Ru bei 9, 10 und 11MeV vermessen.

Gefördert durch HIC for FAIR und die Helmholtznachwuchsgruppe VH-NG-327.

HK 33.3 Di 14:45 HSZ-403

Doppler Shift Attenuation Method: Results of the commissioning experiment ^{32}S(^{3}He,^{4}He)^{31}S* of the new setup at the Maier-Leibnitz-Laboratory — •Clemens Herlitzius and Shawn Bishop — Physik Department E12, Technische Universität München, Garching, Germany

A new setup has been built to measure the lifetimes of excited states in nuclei, using the Doppler shift attenuation method (DSAM).

In the astrophysical context, lifetime measurements are important to determine reaction rates indirectly, if a direct measurement is not feasible. Resonant (p,γ) reaction rates are a valuable input for reaction rate network calculations that study the production of intermediate mass elements in e.g. classical nova events.

The method and the setup will be presented. The analysis and the results of the commissioning experiment ^{32}S(^{3}He,^{4}He)^{31}S* will be shown, where the lifetime of the first excited state in ^{31}S has been determined.

This research was supported by the DFG cluster of excellence 'Origin and Structure of the Universe' (www.universe-cluster.de).

HK 33.4 Di 15:00 HSZ-403

Neutronenproduktionstarget für hohe Protonenströme — Clemens Beinrucker[1], Michael Berger[1], Stefan Fiebiger[1], Micaela Fonseca[5,6], Tanja Heftrich[1], Franz Käppeler[3], Antonin Krasa[2], Claudia Lederer[1], Thomas Metz[1], Ralf Plag[1], Arjan Plompen[2], René Reifarth[1], •Stefan Schmidt[1], Asher Shor[4] und Kerstin Sonnabend[1] — [1]Goethe Univ. Frankfurt a. M. — [2]European Commission, JRC, Institute for Reference Materials and Measurements, Geel, Belgien — [3]Karlsruher Institut für Technologie — [4]Nuclear Physics and Engineering Div., Soreq NRC, Israel — [5]Dep. Física, Faculdade de Ciências e Tecnologia, Univ. Nova de Lisboa, Portugal — [6]Centro de Física Nuclear da Univ. de Lisboa, Portugal

Um seltene Reaktionen zu verstehen, die beim s-Prozess in Roten Riesen ablaufen, werden Neutronenquellen mit hohen Neutronenflüssen immer wichtiger. Die Frankfurter Neutronenquelle am Stern-Gerlach-Zentrum (FRANZ) wird mit einem intensiven Protonenstrahl und mit Hilfe der ^{7}Li(p, n)-Reaktion hohe Neutronenflüsse von bis zu $10^7/(\mathrm{cm}^2\,\mathrm{s})$ im Energiebereich zwischen 1 und 200 keV erreichen.

Beim Auftreffen auf das Target deponiert der Protonenstrahl mehrere Kilowatt Leistung in einer dünnen Schicht. Die entstehende Wärme kann die aufgedampfte Lithium-Schicht beschädigen und muss daher durch ein Kühlsystem abgeführt werden. Dieser Beitrag soll das Kühlkonzept und dessen ersten Test bei niedrigen Leistungen vorstellen und Messungen am Target-Prototyp mit Simulationen vergleichen.

Dieses Projekt wird gefördert durch den GIF Research Grant No. G -1051-103.7/2009 und die Helmholtz Nachwuchsgruppe VH-NG-327.

HK 33.5 Di 15:15 HSZ-403

Simulation des Neutronenspektrums beim Deuteronen-

Photodissoziations-Experiment an ELBE — Anna Ferrari[1], •Roland Hannaske[1,2] und Arnd R. Junghans[1] — [1]Helmholtz-Zentrum Dresden-Rossendorf — [2]Technische Universität Dresden

Die für die primordiale Nukleosynthese wichtige Reaktion $d(\gamma, n)p$ wurde am supraleitenden Elektronen-Linearbeschleuniger ELBE mit Bremsstrahlung bei einer Endpunktenergie von 5,0 MeV untersucht [1]. Neutronen mit einer kinetischen Energie von 20 − 1400 keV wurden mit Hilfe der Flugzeit-Detektoren *RoLAND (Rossendorf Low-Amplitude-Neutron Detector)* nachgewiesen. Wechselwirkungen der emittierten Neutronen mit dem Targetmaterial (23 Schichten aus Aluminium und deuteriertem Polyethylen) und anderen Teilen des Expermientaufbaus (HPGe- und BGO-Detektoren, Bleiabschirmungen, Strahlfänger, Betonwände) haben einen nicht zu vernachlässigenden Einfluss und wurden daher mit FLUKA [2] simuliert. Zusammen mit der experimentell bestimmten Detektoreffektivität erhält man einen Flugzeit-abhängigen Korrekturfaktor für das gemessene Neutronenspektrum. Der Aufbau und die Ergebnisse der Simulation sowie die Bestimmung des Korrekturfaktors und dessen Einfluss auf den ermittelten $d(\gamma, n)p$ Wirkungsquerschnitt werden präsentiert.
[1] R. Hannaske et al., PoS(NIC XI)090 (2010). [2] www.fluka.org
Gefördert durch die DFG (JU 2705/1-1).

HK 33.6 Di 15:30 HSZ-403

Status und Programm für den 5 MV Pelletron-Beschleuniger im Dresdner Felsenkeller — •Daniel Bemmerer[1] und Kai Zuber[2] — [1]Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Dresden — [2]TU Dresden

Die Modellierung astrophysikalischer Szenarien benötigt Eingabeparameter, deren Präzision besser als die Genauigkeit der entsprechenden astronomischen Beobachtungen ist. Da für einige solche Szenarien wie die Urknall-Nukleosynthese, die Sonne, rote Riesensterne und Supernovae in unserer Milchstraße inzwischen eine Vielzahl von Beobachtungen vorliegen, wird es notwendig, die Raten der dort stattfindenden Kernreaktionen im Labor neu und präzise zu vermessen. Ein probates Mittel für leichte Kerne sind beschleunigergestützte Experimente bei den astrophysikalisch relevanten Energien, die wegen der beobachteten sehr geringen Zählraten allerdings nur dann Aussicht auf Erfolg haben, wenn die Experimente in von der Höhenstrahlung geschützte unterirdische Labors verlegt werden. Zur Zeit gibt es nur einen Untertage-Ionenbeschleuniger weltweit, die LUNA 0.4 MV Maschine am Gran Sasso (Italien).

Im Sommer 2012 wurde ein gebrauchtes 5 MV Hochstrom-Pelletron gekauft und nach Dresden transportiert. Es soll 2013 im Dresdner Untertagelabor Felsenkeller installiert werden und wird durch seinen Energiebereich einzigartig sein. Der Felsenkeller ist durch eine 47 m dicke Felsdecke von der Atmosphäre getrennt. In dem Vortrag werden das wissenschaftliche Programm und der Status des Projekts zusammengefasst. – Unterstützt von NAVI.

HK 33.7 Di 15:45 HSZ-403

Big Bang nucleosynthesis and the results of the ^{2}H(α,γ)^{6}Li experiment at LUNA — •Michael Anders for the LUNA-Collaboration — Helmholtz-Zentrum Dresden-Rossendorf — TU Dresden

Observations of the ^{6}Li abundance in very metal-poor stars, if confirmed, show a level of ^{6}Li that is several orders of magnitude larger than the production of this nuclide in standard Big Bang nucleosynthesis. The ^{2}H(α,γ)^{6}Li nuclear reaction is believed to dominate ^{6}Li production in the Big Bang, but there are no directly measured data at relevant energies yet. The reaction has been studied at the LUNA 0.4 MV accelerator, deep underground in the Gran Sasso laboratory in Italy, using an intensive He^+ beam and a windowless deuterium gas target. The conclusions from the final data analysis of the experiment will be presented. – Supported in part by DFG (BE 4100/2-1).

HK 33.8 Di 16:00 HSZ-403

^{14}N(p,γ)^{15}O-Wirkungsquerschnitte für 1-2 MeV Strahlenergie — •Louis Wagner[1,2], Daniel Bemmerer[1], Michael Anders[1,2], Michele Marta[3], Arnd Junghans[1], Zoltán Elekes[1], Tobias Reinhardt[2], Stefan Reinicke[1,2], Konrad Schmidt[1,2], Ronald Schwengner[1], Andreas Wagner[1] und Kai Zuber[2] — [1]Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Dresden — [2]TU Dresden — [3]Helmholtz-Zentrum für Schwerionenforschung (GSI), Darmstadt

Die ^{14}N(p,γ)^{15}O-Reaktion bestimmt als langsamste Kernreaktion die Rate des Bethe-Weizsäcker-Zyklus. Für eine präzise Extrapolation des Wirkungsquerschnitts zu niedrigen Energien ist die genaue Kenntnis der Anregungsfunktion über einen weiten Energiebereich notwendig. Am 3 MV Tandetron des Helmholtz-Zentrums Dresden-Rossendorf wurde der nichtresonante Wirkungsquerschnitt der ^{14}N(p,γ)^{15}O-Reaktion im Bereich von 1-2 MeV Strahlenergie neu untersucht. In dem Vortrag werden vorbereitende Simulationen, erste experimentelle Daten sowie ein Ausblick präsentiert. – Unterstützt durch das „Nuclear Astrophysics Virtual Insitute (VH-VI-417)“ der Helmholtz Gemeinschaft.

HK 34: Instrumentation

Zeit: Dienstag 14:00–16:15 Raum: HSZ-405

Gruppenbericht HK 34.1 Di 14:00 HSZ-405

Optimizing the Data Life Cycle — •Kilian Schwarz[1] and Christopher Jung[2] — [1]GSI, Planckstr. 1, 64291 Darmstadt — [2]KIT, Kaiserstraße 12, 76131 Karlsruhe

Today, data play a central role in most fields of Science. In recent years, the amount of data from experiment, observation, and simulation has increased rapidly and the data complexity has grown. Also, communities and shared storage have become geographically more distributed. Therefore, methods and techniques applied for scientific data need to be revised and partially be replaced, while keeping the community-specific needs in focus. The Helmholtz Portfolio Extension "Large Scale Data Management and Analysis" (LSDMA) focuses on the optimization of the data life cycle in different research areas. In its five Data Life Cycle Labs (DLCLs), data experts closely collaborate with the communities in joint research and development to optimize the respective data life cycle. In addition, the Data Services Integration Team provides data analysis tools and services which are common to several DLCLs. This presentation describes the various activities within LSDMA and focuses on the work done in the DLCL "Structure of Matter". The main topics of this DLCL are the support for the international projects FAIR (Facility for Anti Proton and Ion Research) which will evolve around GSI in Darmstadt and the European XFEL and PETRA III at DESY in Hamburg.

HK 34.2 Di 14:30 HSZ-405

Exploiting Unused Cluster Resources with Virtualization — •Stefan Boettger and Udo Kebschull for the ALICE-Collaboration — IRI, Institut fuer Informatik, Uni Frankfurt

Cluster applications may have timing constraints. One approach to ensuring their satisfaction is over-provisioning, i.e. to provide more hardware resources than needed for processing a certain peak data rate. This concept is used for the HLT-Chain. This application runs in the ALICE HLT cluster and processes events at runtime of the ALICE experiment. Over-provisioning has a drawback: When physical resources are dimensioned for a peak data rate, then these resources are underutilized at times of decreased data rates. From a perspective of efficiency this is not desirable. Therefore a software framework has been developed which allows to run additional third-party applications in order to exploit temporarily unused cluster resources. To avoid relevant negative impact to the time-critical application the third-party applications are encapsuled in Virtual Machines (VMs) and the resource usage of VMs is dynamically adapted at runtime. The adaption is done both globally by e.g. hot-migrating VMs between nodes, but also locally by modifying the local resource share (e.g. CPU) of a VM. Policies allow to tune the trade-off between benefit of third-party applications (increased cluster usage, computed results) and negative impact to the time-critical application. Experiments show that using the framework in parallel to the HLT-Chain leads to additional computed results, increases the cluster CPU usage from 49% to 79% and causes no relevant impact to the HLT-Chain.

HK 34.3 Di 14:45 HSZ-405

Experience Report: System Management at the ALICE HLT Cluster — •Camilo Lara, Falco Vennedey, Jochen Ulrich, Stefan Böttger, Timo Breitner, and Udo Kebschull for the ALICE-Collaboration — Infrastruktur und Rechnersysteme in der Informationsverarbeitung (IRI), Institut für Informatik, Goethe-Universität Frankfurt am Main

The ALICE HLT cluster is responsible for the first analysis and compression of the data from the ALICE experiment at CERN. The processing is performed using hardware accelerators like FPGAs, GPUs and computer nodes with commodity hardware. The mixture of hardware accelerators and several types of nodes causes an increased configuration and system management effort. To handle this effort, we are using a combination of three tools: Chef for the configuration management, Ganglia for the real time monitoring and SysMES for unattended system management, i.e. automatic problem recognition and solution. The tools help to minimize the manpower needed to administrate the cluster by reducing the time needed to recognize and identify problems or even by solving problems automatically. In this talk, we give an insight into our setup and report on the experience we have gained with the heterogeneous, on-line processing cluster during the last four years.

HK 34.4 Di 15:00 HSZ-405

Online software trigger at PANDA/FAIR — •Donghee Kang for the PANDA-Collaboration — Institut für Kernphysik, Universität Mainz, Germany

The PANDA experiment at the FAIR facility will employ a novel trigger-less readout concept. PANDA will have no first level hardware trigger and apply a high level software trigger to do fast event selection based on the physics properties of reconstructed events. A trigger-less data stream implies that an event selection requires track reconstruction and pattern recognition to be performed online, analysing data under real time condition at the event rates up to 40 MHz. A significant event rate reduction is required to reject effectively background events, while retaining the interesting events at the same time. The projected reduction factor is 10^{-3}. Real time event selection in this environment is very challenging and rely on sophistcate algorithms in the software trigger. This presentation will show the implementation and performance tests of the online high level physics trigger algorithms. The impact of parameters such as momentum, mass resolution, and PID probability for the event filtering will be presented.

HK 34.5 Di 15:15 HSZ-405

Entwicklung einer fehlertoleranten Konfigurations- und Scrubbing-Kette für den CBM Read-Out Controller (ROC) — •Andrei-Dumitru Oancea, Sebastian Manz, Heiko Engel, Jano Gebelein und Udo Kebschull für die CBM-Kollaboration — Infrastruktur und Rechnersysteme in der Informationsverarbeitung (IRI), Goethe-Universität Frankfurt, Deutschland

Der CBM Read-Out Controller (ROC) ist in der CBM Kollaboration unter anderem zur Auslese des ToF-Detektors vorgesehen. Dafür muss er unter Strahlungseinwirkung im laufenden Experiment funktionsfähig bleiben und implementiert deswegen die SysCore Architektur. In seiner bisherigen Form des SysCore V2.2 hat das Board als Hauptkomponente einen SRAM basierten FPGA, dessen Konfiguration durch von ionisierenden Teilchen verursachte Single Event Upsets (SEU) beeinträchtigt wird, was die Funktionalität des Chips verändert. Das Board ist außerdem mit einem kleineren Flash basierten FPGA ausgestattet, dessen Konfiguration aufgrund der Flash-Technologie nicht von SEUs betroffen ist. Dieses zweite FPGA hat, neben anderen Schnittstellen, auch eine zum Konfigurationsinterface des ersten FPGAS. Somit kann es SEUs beheben, indem permanent die richtige Konfiguration in den SRAM basierten FPGA geladen wird, ohne den Betrieb zu unterbrechen (engl. configuration scrubbing). Im Zuge einer Diplomarbeit wurde die gesamte Konfigurations- und Scrubbing-Kette entwickelt und in das vorhandene CBM Firmware- und Software- Projekt eingebettet. Die Funktionalität wurde in einem Strahltest am FZ Jülich evaluiert. In diesem Vortrag werden die Ergebnisse dieser Arbeit vorgestellt.

HK 34.6 Di 15:30 HSZ-405

Modular CBM-ROC Firmware - Was bisher geschah und wie es weitergeht. — •Sebastian Manz und Udo Kebschull für die CBM-Kollaboration — Lehrstuhl für Infrastruktur und Rechnersysteme in der Informationsverarbeitung (IRI), Universität Frankfurt, 60325 Frankfurt am Main, Germany

Das SysCore-v2 basierte Read-Out Controller (ROC) Board ist innerhalb der CBM Kollaboration weit verbreitet und wird von vielen Arbeitsgruppen zur Auslese ihrer Detektor Frontend-Elektronik genutzt. Um den unterschiedlichen Ansprüche der jeweiligen Einsatzzwecke mit möglichst geringem Zusatzaufwand gerecht zu werden wurde eine Modularisierung des Firmwaredesigns eingeführt. Dazu wurde die Firmware in zwei Module, ein Frontend- und ein Transport-Modul, unterteilt.

Anfang 2013 findet hardwareseitig ein nahezu vollständiger Generationenwechsel statt. Das SysCore-v2 Board wird durch die nächste Version, dem SysCore-v3, ersetzt. Aber auch die Frontend-Elektronik wird erneuert: sowohl der neue GET4 Chip als auch das neue nXYTER basierte Frontend-Board FEB-E kommen jeweils mit einem neuen Interface. Zusätzlich zu den neuen Hardwarekomponenten wird auch das Kommunikationsprotokoll von CBMNet-v1 auf CBMNet-v2 umgestellt.

Im Zuge der umfangreichen Umstellungen möchten wir auch das Firmwaredesign weiterentwickeln. Dazu ist der Übergang vom bisherigen Zwei-Modul-Konzept zu einem Drei-Modul-Konzept angedacht.

Die bisherige Realisierung sowie Pläne für zukünftige Entwicklungen des Modular CBM-ROC werden hier präsentiert.

HK 34.7 Di 15:45 HSZ-405

Read-Out Receiver Card Upgrade for ALICE DAQ and HLT — •Heiko Engel and Udo Kebschull for the ALICE-Collaboration — Infrastruktur und Rechnersysteme in der Informationsverarbeitung (IRI), Institut für Informatik, Goethe-Universität Frankfurt am Main

In the ALICE read-out chain, both Data Acquisition (DAQ) and High Level Trigger (HLT) use FPGA-based Read-Out Reveicer Cards (RORCs) as interface between the optical Detector Data Link (DDL) and the DAQ and HLT cluster machines. A new version of this card has been developed as a common project of both groups. This card features a fast PCI-Express interface and parallel optical links controlled by a Xilinx Virtex-6 FPGA. This new board provides compatibility with the current read-out architecture while allowing read-out upgrades required for some systems after LS1. First boards are available and are under test. This contribution will present the state of the project.

HK 34.8 Di 16:00 HSZ-405

Kontrollsystem des PANDA-Experiments — •Florian Feldbauer[1,2], Malte Albrecht[3], Tobias Triffterer[3], Mario Fink[3] und Cathrina Sowa[3] für die PANDA-Kollaboration — [1]Helmholtz Institut Mainz — [2]Johannes Gutenberg-Universität Mainz — [3]Ruhr-Universität Bochum

Für das geplante PANDA-Experiment am Antiproton-Speicherring HESR der zukünftigen Beschleunigeranlage FAIR in Darmstadt wird ein Kontrollsystem basierend auf dem Softwarepaket EPICS (Experimental Physics and Industrial Control System) aufgebaut.

EPICS ist eine freie, quelloffene Sammlung von Softwarewerkzeugen, Bibliotheken und Applikationen. Es besitzt eine netzwerkbasierte Server/Client-Architektur und ermöglicht dadurch den Aufbau eines dezentralisierten Kontrollsystems. Das Kontrollsystem des PANDA-Experiment wird auf Embedded-Systemen, wie beispielsweise dem Raspberry Pi Computer, arbeiten. Hierzu werden verschiedene Adapterplatinen für diesen Computer mit den benötigten Schnittstellen entwickelt. Die fuer die PANDA-Slow-Control entwickelte Hard- und Software werden vorgestellt.

Gefördert vom BMBF und der EU.

HK 35: Instrumentation

Zeit: Dienstag 14:00–16:15 Raum: WIL-A221

Gruppenbericht HK 35.1 Di 14:00 WIL-A221

The Silicon Tracking System of the CBM experiment — •Johann M. Heuser — GSI Helmholtzzentrum für Schwerionenforschung GmbH

In the Compressed Baryonic Matter (CBM) experiment at FAIR, the Silicon Tracking System (STS) will perform track reconstruction and momentum determination of the charged particles created in interactions of heavy-ion beams with nuclear targets. The STS consists of 8 tracking layers located at distances between 30 cm and 100 cm downstream of the target inside the 1 T magnetic dipole field. The required momentum resolution of the order of $\Delta p/p = 1\%$ can only be achieved with an ultra-low material budget, imposing particular restrictions on the location of power-dissipating front-end electronics in the fiducial volume. The concept of the STS is based on 300 μm thick double-sided silicon microstrip sensors mounted onto lightweight carbon fiber support ladders. The sensors will be read out through ultra-thin multi-line micro-cables with fast self-triggering electronics at the periphery of the stations where cooling lines and other infrastructure can be placed. The mechanical construction of the STS will allow extracting the detector system and replacing individual ladders e.g. in case of radiation damage.

The status of the STS project is summarized in the presentation. An important milestone was achieved in December 2012 with the submission of the STS Technical Design Report to FAIR.

Supported by EU-FP7 HadronPhysics3, CRISP, MC-PAD, BMBF, LOEWE, HGS-HIRe, H-QM, GSI, ISTC, JINR and ROSATOM.

HK 35.2 Di 14:30 WIL-A221

Upgrade des ALICE Inner Tracking Systems und die Auswirkung auf Messungen schwerer Quarks — •Johannes Stiller für die ALICE-Kollaboration — Physikalisches Institut, Heidelberg

Während der zweiten langen Betriebspause des LHC im Jahr 2018 plant die ALICE Kollaboration die Installation eines neuen, modernisierten Spursystems (Inner Tracking System, ITS) im zentralen Bereich des Experiments. Dieses System wird aus sieben Schichten Siliziumdetektoren bestehen, die ab einer radialen Entfernung von 2.2 cm um den Wechselwirkungspunkt aufgebaut werden. Dabei wird die Materialdicke auf bis zu 0.3 % Strahlungslängen pro Schicht reduziert, und die räumliche Punktauflösung auf bis zu 4 μm verbessert. Des weiteren wird die Ausleserate in Pb–Pb Kollisionen auf bis zu 50 kHz erhöht, so dass neue, einzigartige Messungen von schweren Quarks, z.B. charm und beauty, ermöglicht werden. Mittels detaillierter Monte Carlo Simulationen von pp und Pb–Pb Kollisionen untersuchen wir die Auswirkung des Upgrades auf verschiedenen Messungen schwerer Quarks. Als Maßstab dienen hier die jeweilige Produktion von charmed Mesonen und Baryonen, z.B. über die hadronischen Zerfallskanäle $D^0 \to K^-\pi^+$ und $\Lambda_c^+ \to pK^-\pi^+$, sowie beauty Mesonen und Baryonen mittels versetzter Zerfallsvertices von z.B. $B^+ \to \overline{D}^0\pi^+$ and $\Lambda_b \to \Lambda_c^+\pi^-$.

HK 35.3 Di 14:45 WIL-A221

Development of the Pion Tracker for HADES spectrometer — •Rafal Lalik for the HADES-Collaboration — Excellence Cluster "Universe", TU München, Boltzmannstr.2, 85748 Garching, Germany

We are working on the development of the beam detector for experiments with pion beams at HADES spectrometer in GSI Darmstadt. Pions are created impacting nitrogen or proton beams on a secondary beryllium target and are then delivered through a chicane to the experimental areas. The expected momentum spread of the secondary pion beam is about 8% and the main goal of this beam detector is to deliver information about the pion momentum for each beam particle.

The challenging issue is to achieve an accurate measurement ($\approx$ ‰) of each pion in a high intensity (10^8 part./spill) environment along the pion-bean chicane. This translates into a rate of 10^6 pion/spill with a kinetic energy of 1–2 GeV at the HADES target point.

We are currently testing a tracker system, based on double-sided silicon strips detectors with higher radiation hardness and n-XYTER ASIC readout. For prototyping we have prepared the acquisition system compatible with the CBM data acquisition system, for the future employment with HADES we are currently working on acquisition based on the novel TRB3 board.

In this talk we are showing current status and performance of the system, and recent results obtained in the laboratory and with proton beams.

HK 35.4 Di 15:00 WIL-A221

Kaon Detection at 0° Scattering Angle at MAMI — •Florian Schulz for the A1-Collaboration — Institut für Kernphysik, Johannes Gutenberg-Universität, Mainz

At the Mainz Microtron MAMI experiments in the strangeness sector are being performed by the A1 Collaboration; most recently the decay-pion spectroscopy of electro-produced Λ-hyperons.

A first pioneering experiment aimed to the detection of K^+, with the Kaos spectrometer placed at 0° scattering angle, in coincidence with π^- from weak decays. The momentum of the pion emitted in two-body decays is related to the not precisely known mass of any produced Λ-hypernucleus. By its detection with high-resolution magnetic spectrometers the expected mass resolution is < 30 keV.

In order to advance to an efficient physics run with sufficient statistics, it was nessesary to reduce the electromagnetic background produced at very forward angles by the 1.5 GeV electron beam. Therefore an energy-degrader of up to 12 cm lead was added directly in front of the detector system of Kaos.

The method of kaon identification, upgrades of the detector system, and performance of the recently completed next stage of the experiment, which improved luminosity by one order of magnitude, will be covered in this talk.

HK 35.5 Di 15:15 WIL-A221

Characterization of double sided silicon micro-strip sensors with a pulsed infra-red laser system for the CBM experiment — •Pradeep Ghosh[1] and Juergen Eschke[2] for the CBM-Collaboration — [1]Goethe Universitaet, Frankfurt — [2]GSI Helmholtzzentrum and FAIR GmbH, Darmstadt

The Silicon Tracking System (STS) of the Compressed Baryonic Matter (CBM) experiment at FAIR is composed of 8 tracking stations consisting of 1292 double sided silicon micro-strip sensors.

For the sensor development and for the quality assurance of produced sensors a laser test system has been built up. The aim of the sensor scans with the pulsed infra-red laser system is to determine the charge sharing between strips and to measure the uniformity of the sensor response over the whole active area. The prototype sensors tested with the laser system so far have 256 strips with a pitch of 50 μm on each side. They are read out by the self-triggering n-XYTER prototype read-out electronics.

The laser system measures the sensor response in an automatized procedure at several thousand positions across the sensor with focussed infra-red laser light ($\sigma_{spotsize}$ ≈15 μm, λ=1060 nm). The duration (∼5ns) and power (few mW) of the laser pulses is selected such, that the absorption of the laser light in the 300 μm thick silicon sensors produces a number of about 24k electrons, which is similar to the charge created by minimum ionizing particles in these sensors. Results of laser scans for different sensors will be presented.

Supported by HIC-for-FAIR, HGS-HIRe and H-QM.

HK 35.6 Di 15:30 WIL-A221

Detector module development for the CBM Silicon Tracking System — •Anton Lymanets for the CBM-Collaboration — Physikalisches Institut, Universität Tübingen

The central detector of the CBM experiment at FAIR, the Silicon Tracking System (STS), is being designed to reconstruct hundreds of charged particles produced at rates up to 10 MHz in interactions of ion beams of up to 45 AGeV projectile energies with nuclear targets. The building block of the tracking system is a module suitable for a low-mass detector construction. In a module, the basic functional unit of the STS, radiation tolerant microstrip sensors are read out through low-mass multi-line cables with self-triggering front-end electronics located at the periphery of the system. Light-weight carbon fibre support structures will carry 10 of such modules and build up the STS stations.

In the presentation, the concept of the detector module construction is presented. Quality assurance tests under development for the module components (double-sided silicon microstrip sensors, stacked polyimide microcables, front-end ASICs and boards) and the assembled structures are discussed.

Supported by EU-FP7 HadronPhysics3 and BMBF.

HK 35.7 Di 15:45 WIL-A221

Study of low-mass readout cables for the CBM Silicon Tracking System — •Minni Singla for the CBM-Collaboration — Goethe University, Frankfurt — GSI, Darmstadt

The study of thin multi-line readout cables will be reported. The application is the Silicon Tracking System (STS) of the fixed-target heavy-ion experiment Compressed Baryonic Matter (CBM), under design at the forthcoming accelerator centre FAIR in Germany. These cables will bridge the distance between the microstrip sensors and the signal processing electronics placed at the periphery of the silicon tracking stations. Finite element simulations (using the TCAD package RAPHAEL) have been used to optimize the cables towards minimum possible Equivalent Noise Charge (ENC). Various trace geometries and trace materials have been explored. SPICE modelling has been implemented in Sentaurus Device to study the transmission loss in the cables. The simulations have been validated with measurements. Charge loss in cables of different lengths was determined by injecting charge pulses of known amplitude. An optimized cable design is reported yielding minimum ENC, material budget and transmission loss. Supported by HIC for FAIR, HGS-HIRe and H-QM.

HK 35.8 Di 16:00 WIL-A221

Performance evaluation of a prototype module for the CBM Silicon Tracking System — •Tomas Balog — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany — Comenius University, Bratislava, Slovakia

The building block of the CBM Silicon Tracking System is a detector module, a functional unit of one or several daisy-chained double-sided silicon microstrip sensors, read-out cables and front-end electronics. Ten modules will be located on a detector ladder. Several ladders build up a STS tracking station.

The performance of first prototype modules has been evaluated, resembling the structure of the intended STS module. The prototypes comprise a full-size CBM01 sensor and two 128-channel read-out cables 10, 20 and 30 cm long attached to the read-out pads on either side of the sensor. The cables end in connector boards interfacing to two front-end boards each hosting one n-XYTER chip. The whole setup was mounted into a copper box used as a shield. The hit reconstruction and track finding in the STS requires thresholds to be set at maximum value of 4 ke$^-$.

The presentation discusses the noise determined for all three prototype modules and the signal-to-noise ratio obtained when testing the systems with a ^{241}Am gamma source.

Supported by MC-PAD and HIC for FAIR.

HK 36: Beschleunigerphysik IX (Diverses)

Zeit: Dienstag 14:00–15:45 Raum: WIL-C203

HK 36.1 Di 14:00 WIL-C203

Multi-Leaf Faraday Cup für die Augentumortherapie — •Christoph Kunert, Jürgen Bundesmann, Thassilo Damerow, Andrea Denker und Andreas Weber — Helmhotz-Zentrum Berlin, Hahn-Meitner-Platz 1, 14109 Berlin, Deutschland

Am Helmholtz-Zentrum Berlin (HZB) werden, in Kooperation mit der Charité Berlin, Augentumore mit Protonen bestrahlt. Hierfür wird ein Protonenstrahl mit einer Energie von ca. 68 MeV genutzt, welcher durch das Isochronzyklotron am Lise-Meitner-Campus des HZB als Hauptbeschleuniger bereitgestellt wird.

Eine große Herausforderung bei der Augentumortherapie mit Protonen ist die, im Vergleich zur allgemeinen Hadronentherapie von Tumoren z.B. im Abdomen, höhere geforderte Genauigkeit hinsichtlich der Positionierung des Strahlungsfeldes aufgrund der kleineren Strukturen im Auge. Daher ist es unabdingbar die genaue Reichweite des Protonenstrahls im Gewebe, sowie den Abfall des Bragg-Peaks präzise zu kennen.

Eine Möglichkeit die Reichweite der Protonen direkt zu messen, ist die Verwendung eines Multi-Leaf Faraday Cups, dessen Prinzip und angehende technische Realisierung mit Hinblick auf die konkreten Anforderungen der Augentumortherapie in diesem Vortrag vorgestellt wird.

HK 36.2 Di 14:15 WIL-C203

Induced Pressure in Positron Production Target - An Analytical and Numerical Study — •Olufemi Adeyemi[1], Gudrid Moortgat-Pick[1,2], and Sabine Riemann[3] — [1]II. Institut fuer Theoretische Physik, University of Hamburg, Hamburg, Germany — [2]Deutsches Elektronen-Synchrotron, Hamburg, Germany — [3]Deutsches Elektronen-Synchrotron, Zeuthen, Germany

The target for positron production needs to withstand induced pressure from the energy deposited by the incident beam. In order to determine the survivability of the target impinged by the incident beam, we need to compare the computed induced stress with the ultimate tensile strength of the target material. To do this we used continuum mechanics to study the behaviour of material under intense incident beams. In this report we use both numerical and analytical methods. The results of both approaches have been compared and analyzed.

HK 36.3 Di 14:30 WIL-C203

Halo Collimation of Light and Heavy Ions in the FAIR Synchrotron SIS100 — •Ivan Prokhorov[1], Ivan Strasik[2], and Oliver Boine-Frankenheim[1,2] — [1]TU-Darmstadt, Darmstadt, Germany — [2]GSI, Darmstadt, Germany

The halo collimation system in the FAIR synchrotron SIS100 is needed to prevent an interception of the beam halo particles by the accelerator structure. The two-stage betatron collimation system is considered for operation with protons and fully-stripped ions. An adequate numerical simulation of the collimation system performance taking into account a precise description of the following processes: 1) particle scattering by the primary collimator; 2) inelastic nuclear interaction of the ions with the collimator foil; 3) momentum losses during the interaction with the collimator foil; 4) multi-turn tracking of the particles with the collimation optics included.

The concept of the halo collimation, the current status of research and future plans are presented. Scattering processes and momentum losses were analytically estimated for various ion species and energies; analytical results were compared with the numerical simulations by the ATIMA code. Preliminary results of particle tracking using MAD-X code were obtained.

HK 36.4 Di 14:45 WIL-C203

Entwicklung einer 3-MHz gepulsten, intensiven Neutronen und Gammaquelle für die Anwendung in der Luftfrachtdurchleuchtung — •Benjamin Bromberger[1,2,3], Volker Dangendorf[1], Kai Dunkel[2], Robin Fehrecke[1], Andreas Jankowiak[3], Christian Piel[2] und Kai Tittelmeier[1] — [1]Physikalisch- Technische Bundesanstalt, 38116 Braunschweig — [2]RI Research Instruments GmbH, 51429 Bergisch-Gladbach — [3]Humboldt Universität zu Berlin, 10099 Berlin

Im Rahmen eines deutsch-israelischem Forschungsprojekts soll ein auf Neutronen- und Gammastrahlung basierendes Luftfrachtdurchleuchtungssystem zur Detektion von Sprengstoffen und nuklearem Material entwickelt werden. Die verwendeten Methoden sind Neutronenresonanzradiografie und Gammaradiografie mit 2 diskreten Gammaenergien. Zur Teilchenproduktion soll die Reaktion ^{11}B(d, n+γ)^{12}C bei 5 - 7 MeV Deuteronenenergie verwendet werden. Als Beschleuniger wird ein Radio Frequency Quadrupole (RFQ) als wirtschaftlichste Lösung angesehen. Da die Detektionsmechanismen auf Flugzeitmethoden basieren, ist ein mit 2-3 MHz gepulster Strahl notwendig (Pulsbreite <2 ns, Pulsladung 200 pC). Da RFQs üblicherweise mit Frequenzen von 50 bis 500 MHz betrieben werden, ist die Entwicklung einer 3 MHz Pulsereinheit unabdingbar, welche zwischen Ionenquelle und RFQ eingebaut werden soll. Die Pulsereinheit wurde mithilfe von CST Particle Studio entworfen und simuliert, befindet sich nun im Aufbau und soll an einer Chordis-Ionquelle getestet werden. Abschließende Tests sind am 200 MHz RFQ der NECSA Ltd (Pretoria, Südafrika) vorgesehen.

HK 36.5 Di 15:00 WIL-C203

Entwicklung einer Terminal-Ionenquelle für den 5 MV Pelletron-Beschleuniger im Dresdner Felsenkeller — •Stefan Reinicke[1,2], Chavkat Akhmadaliev[1], Daniel Bemmerer[1] und Kai Zuber[2] — [1]Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Dresden — [2]TU Dresden

Um astrophysikalisch relevante Wirkungsquerschnitte genau und ohne

theoretische Unsicherheiten zu messen, sind Beschleunigerexperimente in geschützten Untertagelabors mit ihrer niedrigen Nullrate oftmals der einzige Weg. Bei Edelgasionen kann zur Erzeugung eines intensiven, hochenergetischen Ionenstrahls aufgrund der geringen Elektronenaffinität kein Tandem-Beschleuniger verwendet werden. Stattdessen werden positive Ionen direkt auf dem Hochspannungsterminal und beim Übergang auf Erdpotential beschleunigt. Der für die Installation im Untertagelabor Felsenkeller vorgesehene 5 MV Pelletron-Tandem wird mit einer zusätzlichen Radiofrequenz-Ionenquelle auf dem Terminal ausgerüstet, um intensive Bestrahlungen mit Edelgasionen zu ermöglichen. In dem Vortrag werden ionenoptische Simulationen zum Einbau der Ionenquelle und erste Ergebnisse an einem Quellenteststand auf Erdpotential vorgestellt. – Unterstützt durch das "Nuclear Astrophysics Virtual Institute (VH-VI-417)" der Helmholtz Gemeinschaft.

HK 36.6 Di 15:15 WIL-C203

Simulation und Design eines Niederenergie-Elektronenscrapers für den S-DALINAC — •Lars Jürgensen[1], Ralf Eichhorn[2], Florian Hug[1], Norbert Pietralla[1] und Carina Ungethüm[1] — [1]Institut für Kernphysik Technische Universität Darmstadt, Darmstadt, Germany — [2]Cornell University, Ithaca, NY, USA

Der supraleitende Darmstädter Elektronenlinearbeschleuniger S-DALINAC ist für eine Elektronenenergie von bis zu 130 MeV ausgelegt. Zur Verbesserung der Energieschärfe und um die Effizienz bei gleichzeitig möglichst kleinen Verlusten im Hauptbeschleuniger zu steigern, wird ein Scraper-System entwickelt. Das System soll an einer Stelle innerhalb des 180°-Bogens zwischen Injektor und Hauptbeschleuniger installiert werden, an welcher der Strahl dispersiv aufgeweitet wird, um mittels des Scrapers eine möglichst feine Einschränkung der Strahlenergie vornehmen zu können. Zur Wahl der Materialien und der geeigneten Geometrie wurden bereits zahlreiche Simulationen mit Geant4 vorgenommen. Um die Ableitung der entstehenden Wärme an den Scraper-Backen sicherzustellen, wurden weitere Simulationen zum Design der Kühlung vorgenommen. Nach Abschluss des Designs und der Fertigung, können erste Vakuumtests stattfinden, sowie die Vorbereitung der Materialien für den Einbau erfolgen.

*Gefördert durch die Deutsche Forschungsgemeinschaft im Rahmen des SFB 634.

HK 36.7 Di 15:30 WIL-C203

A Transverse Electron Target for Heavy Ion Storage Rings — •Sabrina Geyer[1], Dominique Ries[1], Oliver Meusel[1], and Oliver Kester[1,2] — [1]IAP, Frankfurt University, Germany — [2]GSI, Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany

Electron-ion interaction processes are of fundamental interest for several research fields. One aspect is the measurement of the absolute cross sections for example for astrophysical data as well as for plasma applications. In ion beam physics cross sections are fundamental for beam lifetimes in storage rings and beam transport, like from an ECRIS to the subsequent LINAC at the FAIR facility. To investigate this topic, a transverse electron target, dedicated to the FAIR storage rings, is under development. This combination offers high luminosities due to the high revolution frequencies in a storage ring and allows the investigation of time-delayed processes. Using a sheet beam of free electrons in crossed beam geometry promises not only a high energy resolution, but also allows access to the interaction region for spectroscopy under large solid angles. The electron energies ranges between several 10 eV and a few keV, the produced electron densities are in the order of 10^9 electrons/cm^3. First measurements have been performed at a test bench to characterize the beam properties and the target performance. An overview of the project status will be presented including first results compared with numerical simulations.

HK 37: Beschleunigerphysik VIII (PWA II)

Zeit: Dienstag 14:00–16:15 Raum: WIL-C205

HK 37.1 Di 14:00 WIL-C205

Kompakte Combined-Function-Quadrupol-Sextupol-Magnete für die Elektronstrahlführung am JETI-Wakefield-Beschleuniger — •Walter Werner, Veronica Afonso Rodriguez, Tilo Baumbach, Axel Bernhard, Bastian Härer, Peter Peiffer, Robert Rossmanith und Christina Widmann — KIT, Karlsruhe, Deutschland

Laser-Wakefield-Beschleuniger (LWFA) erzeugt kurze Elektronenpakete, mit einer relativ großen Energiebandbreite und Divergenz. Der Transport von Elektronenpaketen mit diesen Eigenschaften erfordert stark fokussierende Magnete mit chromatischer Korrektur. Für die Realisierung einer kompakten Strahlführung am JETI-Wakefield-Beschleuniger in Jena sind Combined-Function (CF) Quadrupol-Sextupol-Magnete vorgesehen.

Die Realisierung der hohen Quadrupol- und Sextupol-Stärken erfordert kleine magnetische Aperturen. Deshalb werden die Magnete im Vakuum aufgebaut, woraus sich besondere Anforderungen an die Kühlung der Spulen ergeben.

In diesem Vortrag werden Ergebnisse der magnetischen Modellierung und Optimierung der CF-Quadrupol-Sextupol-Magnete vorgestellt. Außerdem wird die Kühlung der Spulen im Vakuum diskutiert.

Gefördert durch das BMBF unter Fördernummer 05K10VK2

HK 37.2 Di 14:15 WIL-C205

Design und Optimierung einer Elektronenstrahlführung für den Laser-Wakefield-Beschleuniger in Jena - Teil 1 — •Christina Widmann[1], Veronica Afonso Rodriguez[1], Axel Bernhard[1], Bastian Härer[1], Peter Peiffer[1], Robert Rossmanith[1], Walter Werner[1], Tilo Baumbach[1], Maria Nicolai[2], Thorsten Rinck[2], Alexander Sävert[2], Malte C. Kaluza[2,3], Maria Reuter[3] und Oliver Jäckel[3] — [1]Karlsruher Institut für Technologie (KIT) — [2]Friedrich-Schiller-Universität Jena — [3]Helmholtz-Institut Jena

Der Transport von Elektronen aus einem Laser-Wakefield-Beschleuniger (LWFA) gestaltet sich durch die hohe Energiebandbreite und Divergenz schwierig. Die Divergenz im Bereich von wenigen Milliradiant erfordert Quadrupole mit hohen Gradienten. Wegen der relativen Energiebandbreite im Bereich einiger Prozent müssen die starken Quadrupole chromatisch korrigiert werden.

Am LWFA in Jena wird eine Diagnostik-Beamline aufgebaut, in der eine dispersive Schikane den LWFA mit einem nicht-planaren Undulator verbindet. Dabei wird am Eingang des Undulators die Dispersion in x an dessen x-abhängigen Feldgradienten angepasst, um trotz der hohen Energiebandbreite monochromatische Undulatorstrahlung zu erzeugen. Außerdem müssen die Strahlparameter auf den Undulator abgestimmt werden.

In diesem Vortrag wird die Optimierung der Strahlführung in linearer Näherung diskutiert und eine mögliche Realisierung präsentiert.

Gefördert durch das BMBF (Fördernummer 05K10VK2, 05K10SJ2)

HK 37.3 Di 14:30 WIL-C205

Trojan Horse Underdense Plasma Photocathode Acceleration — •Oliver Karger[1,2], Thomas Königstein[3], Georg Pretzler[3], James B. Rosenzweig[4], and Bernhard Hidding[1,2,4] — [1]Institut für Experimentalphysik, Universität Hamburg — [2]DESY, FLA Arbeitsbereich Beschleunigerphysik, Hamburg — [3]Institut für Laser- und Plasmaphysik, Heinrich-Heine-Universität Düsseldorf — [4]Department of Physics and Astronomy, University of California, Los Angeles

Relativistic electron beams with small emittance and size are needed for advanced applications such as free electron lasers (FEL) and other coherent light sources in the x-ray regime. Present laser plasma acceleration schemes are hardly able to provide electron beams of sufficient quality on a stable level. The concept of underdense plasma photocathode acceleration uses a beam-driven plasma wave in a two component gas mixture consisting a low ionisation threshold medium (LIT) and a high ionisation threshold medium (HIT) and a low-energy laser pulse. Shapeable electron bunches with sub-fs-length and unprecedented normalized emittance down to 10^{-9} m rad can be produced. Based on this method, laboratory-sized-experimental setups may enable performance much better than today's conventional coherent hard x-ray sources. The presentation will discuss the basic concept, shows recent numeroanalytical results and the R&D towards experimental realization.
Reference: PRL 108, 035001 (2012)

HK 37.4 Di 14:45 WIL-C205

Optimization of laser accelerated proton beams for possible applications — •Husam Al-Omari for the LIGHT-Collaboration —

GSI Helmholtzzentrum für Schwerionenforschung GmbH, Planckstraße 1, 64291 Darmstadt

Optimization of transported proton beams through a pulsed solenoid in the laser proton experiment LIGHT at GSI has been studied numerically. TraceWin, SRIM and ATIMA codes were employed for this study with an initial distribution generated by MATLAB program fitted to Phelix measured data. Two individual tools have been used to produce protons beam as a later beam source: an aperture located at the solenoid focal spot as energy selection tool; and a scattering foil at a suitable position in the beam path that smoothens the simulated radial energy imprint on the beam profile. The simulation results show that the proton energy spectrum is filtered by the aperture and the radial energy correlation is smoothened.

HK 37.5 Di 15:00 WIL-C205

Experimental results on transport and focusing of laser accelerated protons — •Simon Busold[1], Dennis Schumacher[2], Christian Brabetz[3], Oliver Deppert[1], Martin Joost[4], Florian Kroll[4], Husam Al-Omari[3], Abel Blazevic[2], Bernhard Zielbauer[2], Ingo Hofmann[2], Vincent Bagnoud[2], Tom Cowan[4], and Markus Roth[1] for the LIGHT-Collaboration — [1]TU Darmstadt, IKP, Schlossgartenstr. 9, 64289 Darmstadt — [2]GSI Helmholtzzentrum für Schwerionenforschung, Planckstr. 1, 64291 Darmstadt — [3]JWG Universität Frankfurt, IAP, Max von Laue Str. 1, 60438 Frankfurt — [4]Helmholtzzentrum Dresden-Rossendorf, Bautzner Landstr. 400, 01328 Dresden

Irradiation of thin foils with high-intensity laser pulses became a reliable tool during the last decade for producing high-intensity proton bunches in about a pico-second from a sub-millimeter source. However, the energy distribution is of an exponential shape with a currently achievable cut-off energy <100 MeV (TNSA mechanism) and the beam is highly divergent with an energy-dependent envelope-divergence of up to 60 deg. Thus, for most applications it is necessary to be able to capture and control these protons as well as select a specific energy.

In the frame of the LIGHT collaboration, experimental studies were done at the PHELIX laser at GSI Darmstadt using a pulsed high-field solenoid and alternatively a permanent magnet quadrupole triplet in order to match the beam for injection into a RF cavity. The beam was characterized at several distances after the source and the results are compared to particle tracking simulations.

HK 37.6 Di 15:15 WIL-C205

Effects of the proton layer thickness on the TNSA — •Zsolt Lecz[1], Oliver Boine-Frankenheim[1,2], and Vladimir Kornilov[2] for the LIGHT-Collaboration — [1]TEMF, TU Darmstadt — [2]GSI, Darmstadt

This contribution to the LIGHT (Laser Ion Generation, Handling and Transport) project at GSI is devoted to the numerical investigation of the proton acceleration via the TNSA (Target Normal Sheath Acceleration) mechanism. We investigate the acceleration of protons, which are located in a thin hydrogen-rich contamination layer on the rear surface of a thin metal foil interacting with intense and short (several 100 fs) laser pulse. The highly energetic hot electrons, heated by the laser, induce a strong charge separation at the target surface. The spatial profile of the corresponding electric field is studied with a particle-in-cell (PIC) plasma simulation code. Depending on the thickness of the layer the protons can be accelerated in three different ways: quasi-static acceleration for mono-layers, isothermal plasma expansion for thick layers and there is a combined regime for intermediate thicknesses wich is not fully understood. Simulation results exploring this regime will be presented and the effect of the layer thickness on the transverse acceleration (divergence) will be discussed.

HK 37.7 Di 15:30 WIL-C205

Considerations for a Higgs facility based on Laser Wakefield Acceleration — •Steffen Hillenbrand[1,2], Anke-Susanne Müller[2], and Ralph Assmann[3] — [1]CERN, Geneva, Switzerland — [2]KIT, Karlsruhe, Germany — [3]DESY, Hamburg, Germany

Laser Wakefield Accelerators have seen tremendous progress over the last decades. It is hoped that they will allow to significantly reduce the size and cost of a future liner collider. Based on scaling laws, laser-driven plasma accelerators are investigated as drivers for smaller scale facilities capable of producing Z and Higgs bosons.

HK 37.8 Di 15:45 WIL-C205

Merging Conventional and Laser Wakefield Accelerators — •Benno Zeitler[1,2], Matthias Schnepp[1,2], Tim Gehrke[1,2], Julia Grebenyuk[1], Timon Mehrling[1], Jens Osterhoff[1], Klaus Flöttmann[3], and Florian Grüner[1,2] — [1]Universität Hamburg — [2]Center for Free-Electron Laser Science — [3]Deutsches Elektronen-Synchrotron

Laser wakefield accelerators deliver high quality electron beams in terms of emittance and bunch length. However there are also parameters which cannot compete with conventional machines, namely spectral width and shot to shot stability.

One reason for that is that there is no direct access to the injection mechanism. Injecting a well-characterized electron beam produced by a conventional accelerator into a plasma wakefield could help to solve that problem, since such a pump-probe type experiment should allow for a direct reconstruction of the field distribution and a better understanding of the injection process.

REGAE at DESY in Hamburg is a suited accelerator for such a type of experiment. We report on the status of the beamline extension at REGAE and the plans towards the external injection project with the goal to directly measure the wakefield and further improve the stability of laser wakefield accelerators.

HK 37.9 Di 16:00 WIL-C205

Bunching and phase focusing of laser generated proton beams — •Dennis Schumacher[1], Simon Busold[2], Christian Brabetz[3], Ingo Hofmann[1], Markus Roth[2], Bernhard Zielbauer[4], Oliver Boine-Frankenheim[2], Abel Blazevic[1], and Oliver Deppert[1] for the LIGHT-Collaboration — [1]GSI Helmholtzzentrum für Schwerionenforschung — [2]TU Darmstadt — [3]Universität Frankfurt — [4]HI Jena

Laser accelerated proton beams can reach very high intensities and very low emittances. Therefore they are suitable as ion sources for many applications. One is the coupling into common ion accelerator structures to replace pre accelerators that are used so far. The LIGHT (Laser Ion Generation, Handling and Transport) collaboration has been founded to develop ion optics and targets and optimize laser parameter to make this coupling most efficient. In a first step a short pulse beam line for the PHELIX-laser at GSI to the experiment site Z6 has been build in order to laser accelerate protons here. In a second step a pulsed solenoid has been established to collimate the divergent ion beam.

In a third step this collimated beam will be coupled into a bunching unit, which consists of a spiral resonator with three gaps which leads to an overall acceleration voltage of 1 MV. With this cavity it is not only possible to avoid the broadening of the pulse, but also to phase focus it. This talk presents also the progress towards the operation of the spiral resonator as buncher for a laser accelerated ion beam e.g. simulations, tests and performance data and shows the next steps of the beam shaping efforts.

HK 38: Instrumentation

Zeit: Dienstag 14:00–16:15 Raum: WIL-C207

HK 38.1 Di 14:00 WIL-C207

Insitu measurements of Krypton in Xenon gas with a quadrupole mass spectrometer following a cold-trap at a temporarily reduced pumping speed — •Ethan Brown, Stephan Rosendahl, Christian Huhmann, Hans Kettling, Martin Schlak, and Christian Weinheimer — Institut für Kernphysik, Universität Münster

Liquid xenon detectors have risen to be extremely competetive for dark matter and neutrinoless double-beta decay searches. In order to achieve the required sensitivity, backgrounds must be reduced substantially. One important background is the beta-decay of ^{85}Kr, which constitutes a uniform internal background in liquid xenon detectors. Cryogenic distillation can be used to reduce the krypton concentration to acceptable levels, but gas diagnostics become incredibly difficult at these ultra-pure levels.

A new method for measuring the concentration of krypton in xenon

has been developed, expanding on the existing technique of a cold trap and a Residual Gas Analyzer (RGA). By using a liquid nitrogen cold trap, one can take advantage of the difference in vapor pressures of krypton in xenon to freeze most of the xenon gas while allowing the krypton to pass to the measurement chamber. Here, only a few milliliters of xenon is expended in the measurement, while achieving a sensitivity of sub ppb (parts per billion). The key change is the use of a butterfly valve to partially close the opening in front of the turbomolecular pump, thereby reducing the effective pumping speed and enhancing the RGA signal. This work is funded by DFG.

HK 38.2 Di 14:15 WIL-C207

Untersuchung von Spiegelalignment und Gassystem Toleranzen des CBM-RICH* — •Tariq Mahmoud für die CBM-RICH-Kollaboration — II. Physikalisches Institut, Universität Gießen

Das CBM (Compressed Baryonic Matter) Experiment an der geplanten Beschleunigeranlage FAIR wird komprimierte Kernmaterie bei moderaten Temperaturen und höchsten Netto-Baryonendichten in Schwerionenkollisionen von 8-45 AGeV untersuchen. Die erzeugte Materie soll insbesondere auch mit durchdringenden Sonden wie Di-Elektronen charakterisiert werden. Letztere werden in CBM durch einen RICH und mehrere Lagen TRD-Detektoren identifiziert. Der CBM-RICH Detektor soll mit CO_2 als Radiatorgas, sphärischen Glasspiegeln und MAPMTs als Photonendetektor betrieben werden. Zur Verifizierung und Charakterisierung des entwickelten Konzepts wurde ein in allen wesentlichen Dimensionen bereits dem CBM-RICH Detektor entsprechender Prototyp gebaut und am CERN PS getestet.

Wichtige Aspekte, die einen stabilen Betrieb des RICH Detektors garantieren, sind die Reinheit des Radiatorgases und die genaue Spiegeljustierung. Zur Bestimmung von Toleranzen und Spezifikationen für den CBM-RICH wurden während der Teststrahlzeit im November 2012 systematische Messungen von Radiatorgasverunreinigungen und Spiegelversetzungen durchgeführt. Ergebnisse dieser Messungen im Hinblick auf die Güte der Spiegeljustierung, der Position des Cherenkov-Lichtkegels auf der Spiegelebene und des Sauerstoff- und Wasserdampfgehalts des Radiatorgases werden in diesem Beitrag vorgestellt.

*gefördert durch das LOEWE Zentrum, HIC for FAIR und das BMBF.

HK 38.3 Di 14:30 WIL-C207

Compton-Kamera basierend auf einem hochsegmentierten HPGe-Detektor und einem DSSSD — •Rouven Hirsch[1], Lars Lewandowski[1], Tim Steinbach[1], Benedikt Birkenbach[1], Jürgen Eberth[1], Roman Gernhäuser[2], Walter Henning[2], Herbert Hess[1], Ludwig Maier[2], Peter Reiter[1], Michael Schlarb[2] und Max Winkel[2] — [1]IKP, Universität zu Köln, Köln, Deutschland — [2]Physik-Department E12, Technische Universität München, Garching, Deutschland

Im Rahmen des TRAKULA-Projektes wird eine Compton-Kamera, bestehend aus einem 36-fach segmentierten HPGe-Detektor und einem Double-Sided-Silicon-Strip-Detector (DSSSD), entwickelt. Für das γ-Ray-Imaging wird für jede Wechselwirkung innerhalb der in Koinzidenz betriebenen Detektoren sowohl die Energie als auch der Wechselwirkungsort bestimmt. Während die Segmentierung des DSSSD eine Ortsgenauigkeit von einem Millimeter erlaubt, wird innerhalb des großvolumigen HPGe-Detektors mit seiner hervorragenden Energieauflösung eine Ortsbestimmung per Impulsformanalyse durchgeführt. Auf diese Weise wird der Wechselwirkungsort auf wenige Millimeter genau bestimmt. Die Impulsformanalyse wurde für den HPGe-Detektor erstmalig implementiert und das γ-Ray-Imaging durchgeführt. Erste Ergebnisse werden vorgestellt und diskutiert. Gefördert durch BMBF Projekt 02MUK013D und 02NUK013F.

HK 38.4 Di 14:45 WIL-C207

Bau und Test eines DIRC Detektors für das WASA@COSY und das PANDA Experiment — •Adrian Schmidt, Wolfgang Eyrich, Christoph Adolph, Florian Hauenstein und Liwen Li — Physikalisches Institut IV, Universität Erlangen-Nürnberg, Deutschland

Für den Einsatz am WASA@COSY Experiment und als Entwiklungsschritt für das PANDA Experiment wurde ein DIRC (Detector of Internally Cherenkov light) auf Basis von Plexiglas entwickelt und aufgebaut. Simulationen zeigen, dass ein zusätzlicher DIRC im Vorwärtsbereich des WASA Experiments eine signifikante Verbesserung der Teilchenidentifikation und Energieauflösung ermöglicht. Zwei voll ausgestattete Viertel des DIRCs mit verschiedenen Optikkonzepten wurden am COSY Beschleuniger im Protonenstrahl auf ihre Funktion hin untersucht. Die Detektion der Photonen erfolgt mittels Hamamatsu R8900 und H8500C Photomultiplieren sowie durch Photonis PLANACON Microchannelplates. Zur Auslese wird eine an der GSI Darmstadt neu entwickelte Elektronik, bestehend aus Diskriminatorboards und TDCs (TRBv3) auf FPGA Basis verwendet. Die Ergebnisse dieser Messung werden präsentiert und diskutiert.

Gefördert durch BMBF und FZ Jülich

HK 38.5 Di 15:00 WIL-C207

Performance of the PANDA Barrel DIRC Prototype — A. Gerhardt[1], •G. Kalicy[1,2], D. Lehmann[1], M. Patsyuk[1,2], K. Peters[1,2], G. Schepers[1], C. Schwarz[1], J. Schwiening[1], and M. Zühlsdorf[1,2] — [1]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt — [2]Goethe-Universität, Frankfurt

The design of the Barrel DIRC (Detection of Internally Reflected Cherenkov light) detector for the future PANDA experiment at FAIR contains several important improvements compared to the successful BABAR DIRC, such as focusing and fast timing. To test those improvements as well as other design options a prototype was built and successfully tested using a hadronic particle beam at CERN in 2012.

The prototype comprises a radiator bar, focusing lens, mirror, and a solid fused silica prism as a compact expansion volume. An array of micro-channel plate photomultiplier tubes measures the location and arrival time of the Cherenkov photons. During the beam tests many critical parameters were varied, such as beam momentum, incidence angle and position on the bar, and the type of focusing system.

We will discuss the performance of the prototype, including measurements of the photon yield and Cherenkov angle resolution.

Work supported by EU6 grant, contract number 515873, DIRACsecondary-Beams, EU FP7 grant, contract number 227431, HadronPhysics2, and the Helmholtz Graduate School for Hadron and Ion Research HGS-HIRe.

HK 38.6 Di 15:15 WIL-C207

Performance of the PANDA Barrel DIRC Prototype using radiator plates — A. Gerhardt[1], G. Kalicy[1,2], D. Lehmann[1], M. Patsyuk[1,2], K. Peters[1,2], G. Schepers[1], C. Schwarz[1], J. Schwiening[1], and •M. Zühlsdorf[1,2] — [1]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt — [2]Goethe-Universität Frankfurt

The PANDA experiment at the new Facility for Antiproton and Ion Research in Europe (FAIR) at GSI, Darmstadt will study fundamental questions of hadron physics and QCD using high-intensity cooled antiproton beams with momenta between 1.5 and 15 GeV/c. Efficient Particle Identification (PID) for a wide momentum range and the full solid angle is required for reconstructing the various physics channels of the PANDA program. Hadronic PID in the barrel region of the detector will be provided by a DIRC (Detection of Internally Reflected Cherenkov light) counter. The design is based on the successful BABAR DIRC with important improvements, such as focusing optics and fast photon timing.

The use of wider fused silica plates instead of narrow bars, similar to the design of the Belle II iTOP detector, has been proposed to reduce the cost of the radiator production. This contribution describes the geometrical design and reconstruction method as well as results obtained with a prototype plate in a hadronic particle beam at CERN.

Work supported by EU6 grant, CN515873, DIRACsecondary-Beams, EU FP7 grant, CN227431, HadronPhysics2, and the Helmholtz Graduate School for Hadron and Ion Research HGS-HIRe.

HK 38.7 Di 15:30 WIL-C207

Forward End-Cap for CALIFA — •Tudi Le Bleis, Michael Bendel, Roman Gernhaeuser, and Max Winkel — E12, T.U. Muenchen, James-Franck-str. 1, 85748 Garching bei Muenchen

CALIFA is the γ-rays and high energy particles detector for the R^3B setup at FAIR. Due to the different reactions considered at R^3B, CALIFA has to be able to detect and identify a broad range of γ-rays (from a few 100keV to about 20MeV) as well as recoil and knocked-out protons, deuterons, alphas and neutrons.

CALIFA is composed of two pieces: a barrel that surrounds the beam axis and the reaction target ; and an End-Cap that closes the barrel in the forward direction. The barrel composed of about 2000 long CsI crystals read-out by Large-Area APDs read out by a fully digital system.

The End-Cap covers from small polar angles up to the barrel limit. The exact design of the End-Cap is not yet settled as it should solve the difficult task of a good spectrometric response for protons even

above 300MeV without deteriorating the calorimetric resolution of a few MeV γ-rays. During this presentation the current investigation will be explained. In particular, results of experiments with so-called "phoswitch", which is a combination of two different scintillators, will be presented.

HK 38.8 Di 15:45 WIL-C207

The New Photon Tagger Device of the BGO-OD Experiment at ELSA — •Andreas Bella for the BGO-OD-Collaboration — Physikalisches Institut Bonn

The BGO-OD Experiment, currently under construction at ELSA at the University of Bonn, is setup to investigate the photoproduction of mesons off nuclei. Therefore, an electron beam provided by ELSA is used to produce Bremsstrahlung on a thin radiator. To determine the energy of the Bremsstrahlung, the electrons momentum analysed through a dipole magnet which bends them into a hodoscope. It consists of 120 coincidence channels which cover an energy range from 10% to 90% of the incoming electron beam energy E_0. Due to geometrical constraints, the expected energy width of two overlapping scintillators varies from 0.4% to 1.7% of E_0. The optimum positions of the scintillators and the expected energy resolution were determined via Virtual Monte Carlo/Geant4.

*Supported by DFG (SFB/TR-16)

HK 38.9 Di 16:00 WIL-C207

Long Term Stability Study on Underground Operated CZT-CPG Detectors — •Daniel Gehre und Matthew Fritts für die COBRA-Kollaboration — TU Dresden, Institut für Kern- und Teilchenphysik

With the commissioning and continous operation of 32 1cm3 CZT-CPG detectors in the underground laboratory LNGS in Italy, the COBRA experiment gained momentum in 2011/12. A total of 50 kg days during a livetime of roughly one year yielded a huge set of data under ultra low background conditions. Based on regularly performed calibration measurements the longtime stability of the installed detectors has been analyzed. The current status of the experiment, the prospects and latest results will be presented.

HK 39: Schwerionenkollisionen und QCD Phasen

Zeit: Dienstag 16:45–19:00 Raum: HSZ-201

Gruppenbericht HK 39.1 Di 16:45 HSZ-201

Transverse Momentum Spectra of Charged Particles measured in pp, p-Pb and Pb-Pb Collisions with ALICE at the LHC — •Michael Linus Knichel for the ALICE-Collaboration — Research Division and ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung, Planckstraße 1, 64291 Darmstadt, Germany

Particle production in pp collisions at high p_{T} is governed by hard parton-parton scatterings described by pQCD. In heavy-ion collisions the suppression of particle production at high p_{T} is attributed to the energy loss of partons propagating in the hot and dense QCD medium. The study of proton-nucleus collisions, where no QCD medium is created, provides a reference for Pb-Pb and allows the investigation of the so-called cold-nuclear-matter effects. We present results on charged particle production in the central pseudorapidity region for transverse momenta up to 50 GeV/c. Transverse momentum spectra measured in Pb-Pb and p-Pb collisions are compared to that from pp in terms of the nuclear modification factors. Comparison of the p_{T}-spectra and nuclear modification factors with other measurements and model calculations will be discussed.

HK 39.2 Di 17:15 HSZ-201

Pseudorapidity density of charged particles in p–Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 5.02$TeV measured with ALICE at the LHC — •Jonas Anielski for the ALICE-Collaboration — Institut für Kernphysik, WWU Münster, Germany

Particle production in proton–nucleus collisions, in contrast to pp, is expected to be sensitive to cold nuclear effects. Measuring these effects in proton–nucleus collisions can be used to discriminate between initial and final state effects in heavy-ion collisions.

With the data recorded during a short p–Pb pilot run in September 2012 the charged-particle pseudorapidity density was measured over 4 units of pseudorapidity in non-single-diffractive (NSD) p-Pb collisions at a centre-of-mass energy per nucleon pair $\sqrt{s_{\mathrm{NN}}} = 5.02$TeV. The average value at midrapidity is measured to be 16.81 ± 0.71 (*syst.*).

By scaling this result with the number of participating nucleons the pseudorapidity density can be compared to other colliding systems and different energies. The obtained value of 2.14 ± 0.17 (*syst.*) per participating nucleon is 16% lower than in NSD pp collisions interpolated to the same collision energy, and 84% higher than in d–Au collisions at $\sqrt{s_{\mathrm{NN}}} = 0.2$TeV. The measured pseudorapidity density in p–Pb collisions is compared to model predictions, and provides new constraints on the description of particle production in high-energy nuclear collisions.

HK 39.3 Di 17:30 HSZ-201

Glauber-Rechnungen mit Quark- und Diquark-Participants in ultra-relativistischen Kern-Kern-Kollisionen — •Felix Frey, Daniel Lohner und Klaus Reygers — Universität Heidelberg, Physikalisches Institut, Im Neuenheimer Feld 226, 69120 Heidelberg

Multiplizitätsmessungen in hochenergetischen Schwerionenkollisionen werden gemacht, um ein besseres Verständnis des Teilchenproduktionsprozesses zu erlangen. Für das Nucleon-Participant-Modell konnte gezeigt werden, dass es die Teilchenproduktion in Schwerionenkollisionen nicht beschreiben kann. Diese Arbeit zeigt, dass die Multiplizität in Schwerionenkollisionen innerhalb eines Konstituenten-Quark Modells beschrieben werden kann. Es wird gezeigt, dass die zentralitätsabhängige Multiplizität bei mittlerer Rapidität in Au+Au-Kollisionen bei einer Schwerpunktsenergie von 200 GeV proportional zur Anzahl der teilnehmenden Konstituenten-Quarks ist. Bei Au+Au Kollisionen mit gleicher Schwerpunktsenergie ist die gesamte Multiplizität hingegen nicht mit der Anzahl der teilnehmenden Quark-Konstituenten skalierbar. Außerdem zeigen wir, dass sich die gesamte Multiplizität besser mit der Anzahl der teilnehmenden Quark-Konstituenten innerhalb eines Diquark-Modells beschreiben lässt. Im Diquark-Modell skaliert die gesamte Multiplizität konsistent von p+p und d+Au bis zu Au+Au-Kollisionen mit der Anzahl der teilnehmenden Quark-Konstituenten.

HK 39.4 Di 17:45 HSZ-201

Correlations and Fluctuations Arising from Inhomogeneous Initial Conditions — •George Moschelli[1] and Sean Gavin[2] — [1]Frankfurt Institute for Advanced Studies (FIAS), Ruth-Moufang-Str. 1, D-60438 Frankfurt — [2]Department of Physics and Astronomy, Wayne State University, 666 W Hancock,Detroit, MI, 48202, USA

Fluctuation and correlation observables are often measured using multi-particle correlation methods and therefore mutually probe the origins of genuine correlations present in multi-particle distribution functions. We investigate the common influence of correlations arising from the spatially inhomogeneous initial state on multiplicity and momentum fluctuations as well as flow fluctuations. Although these observables reflect different aspects of the initial state, taken together, they can constrain a correlation scale set at the earliest moments of the collision. We calculate both the correlation scale in an initial stage Glasma flux tube picture and the modification to these correlations from later stage hydrodynamic flow and find quantitative agreement with experimental measurements over a range of collision systems and energies.

This work is supported by The Alliance Program of the Helmholtz Association (HA216/EMMI).

HK 39.5 Di 18:00 HSZ-201

Average p_{T} in pp, Pb–Pb and p–Pb collisions with ALICE — •Marco Marquard and Philipp Luettig — Institut für Kernphysik, Goethe Universität Frankfurt am Main, Germany

Since the first collisions in 2009 the ALICE detector at CERN-LHC has measured pp, Pb–Pb and most recently p–Pb collisions at different energies. For all collision systems the transverse momentum spectra of unidentified charged particles have been measured over a wide momentum range with the two innermost detector systems (ITS and TPC)

of the experiment. This allows to determine a characteristic quantity of the spectra, the average p_T ($\langle p_T \rangle$), with small systematic uncertainties. $\langle p_T \rangle$ provides a possibility to compare reference spectra (pp) with the spectra of the initial (p–Pb) and final state (Pb–Pb) reaction systems in a systematic way. In this talk the comparison of $\langle p_T \rangle$ as a function of the event multiplicity for the different collisions systems, measured with ALICE, will be presented.

HK 39.6 Di 18:15 HSZ-201

Event-by-event mean p_T fluctuations measured by the ALICE experiment at the LHC — •Stefan Heckel for the ALICE-Collaboration — Goethe-Universität Frankfurt, Institut für Kernphysik, Max-von-Laue-Str. 1, 60438 Frankfurt am Main

Results on event-by-event fluctuations of the mean transverse momentum of charged particles measured by the ALICE experiment at the LHC are compared to different Monte Carlo approaches. For these studies pp collisions at $\sqrt{s}$ = 0.9, 2.76 and 7 TeV and Pb–Pb collisions at $\sqrt{s_{NN}}$ = 2.76 TeV are used. The analysis is performed within $|\eta| < 0.8$ and $0.15 < p_T < 2$ GeV/c.

The data shows only a small collision energy dependence and indicates a common scaling behaviour with event multiplicity from pp to semi-central Pb–Pb collisions. In central Pb–Pb collisions, the results deviate from this trend, exhibiting a significant reduction of the fluctuation strength.

A systematic comparison of ALICE results in pp to PHOJET and different tunes of the PYTHIA6 and PYTHIA8 event generators is presented. The study indicates a sensitivity of the data to different mechanisms to model high-multiplicity pp events. A comparison of Pb–Pb results to HIJING and AMPT suggests a strong relation between transverse momentum fluctuations and collectivity in central events, and disfavors an independent superposition scenario.

HK 39.7 Di 18:30 HSZ-201

Nichtgleichgewichtsdynamik und Transport außerhalb der Mean-Field-Näherung in effektiven Modellen der QCD — •Alex Meistrenko[1], Christian Wesp[1], Hendrik van Hees[2] und Carsten Greiner[1] — [1]Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Straße 1, D-60438 Frankfurt, Germany — [2]Frankfurt Institute for Advanced Studies (FIAS), Ruth-Moufang-Straße 1, D-60438 Frankfurt, Germany

An modernen Beschleunigeranlagen wird in ultrarelativistischen Schwerionenkollisionen ein Materiezustand erreicht, der kurz nach dem Urknall vorlag und als Quark-Gluon-Plasma bezeichnet wird. Die Untersuchung dieses Mediums von freien Quarks und Gluonen ist von fundamentaler Bedeutung für das Verständnis der starken Wechselwirkung. Innerhalb effektiver Modelle der QCD fokussieren wir unsere Arbeit auf Nichtgleichgewichtseffekte, welche den Ausgangspunkt für kritische Phänomene bilden und sich in langreichweitigen Korrelationen und Fluktuationen äußern können. Ausgehend von der 2PI effektiven Wirkung für die skalare Feldtheorie und dem Linearen Sigma-Modell für den chiralen Phasenübergang wollen wir Kollisionsterme für ein Transportmodell außerhalb der Mean-Field-Näherung ableiten. Die Untersuchung dieses Modells könnte zum besseren Verständnis der Dynamik von Phasenübergängen führen und dazu beitragen mögliche Observablen in Hinblick auf die QCD zu definieren.
Gefördert durch die Exzellenz-Initiative LOEWE des Landes Hessen durch Helmholtz International Center for FAIR (HIC for FAIR), GSI und HGS-HIRe.

HK 39.8 Di 18:45 HSZ-201

Hadronisierung in einem Mikroskopischen Transportmodel — •Felix Reining und Carsten Greiner — Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Straße 1, D-60438 Frankfurt, Germany

Um Daten interpretieren zu können, die bei Beschleunigerexperimenten wie u.A. CMS@LHC, ALICE@LHC oder CBM@FAIR gewonnen werden, ist es erforderlich zu verstehen, welchen Einfluss die Hadronisierung auf die Messgrößen hat. Im vorliegenden Ansatz wird in einem mikroskopischen Transportmodell die Hadronisierung über Zwischenzustände realisiert. Die Partonen in der Simulation verschmelzen dabei mit definierten, nicht divergierenden Wirkungsquerschnitten und unter Erhaltung aller Quantenzahlen zu diesen Zwischenzuständen. Diese wiederum können dynamisch Hadronen abstrahlen oder in zwei Hadronen zerfallen.
Gefördert durch die Exzellenz-Initiative LOEWE des Landes Hessen durch Helmholtz International Center for FAIR (HIC for FAIR) und HGS-HIRe.

HK 40: Schwerionenkollisionen und QCD Phasen

Zeit: Dienstag 16:45–19:00 Raum: HSZ-204

Gruppenbericht HK 40.1 Di 16:45 HSZ-204

Dileptons and photons produced in relativistic heavy ion collisions at SPS, RHIC and LHC — •Olena Linnyk[1], Elena Bratkovskaya[2,3], and Wolfgang Cassing[1] — [1]Justus Liebig Universität Gießen, Gießen, Deutchland — [2]Johann Wolfgang Goethe Universität, Frankfurt am Main, Deutchland — [3]Frankfurt Institute for Advanced Studies, Frankfurt am Main, Deutchland

We address the dilepton and photon production by the (in-medium) mesons, correlated decays of charm and bottom quarks and the quark and gluon interactions in the early stage of relativistic heavy-ion collisions within the parton-hadron-string dynamics (PHSD) off-shell transport approach. The approach treats the full evolution of a relativistic heavy-ion collision from the initial hard scatterings and string formation through the dynamical deconfinement phase transition to the strongly interacting quark-gluon plasma (QGP) as well as hadronization and to the subsequent interactions in the hadronic phase. We study the dilepton yield from the collisions at energies from SPS to RHIC to LHC. By comparing to the data of the NA60, PHENIX and STAR Collaborations, we determine the relative importance of the different dilepton production mechanisms and point out the regions in phase space where partonic channels are dominant. Explicit predictions are presented for dileptons from the Pb+Pb collisions at sqrt(s)=2.76 TeV. Additionally, the photon production under the influence of the strong magnetic fields in the initial stage of the collision is discussed.

HK 40.2 Di 17:15 HSZ-204

Production of Low Mass Dielectrons in Pb-Pb collisions with ALICE — •Christoph Baumann for the ALICE-Collaboration — Goethe-Universität Frankfurt

The measurement of low mass dielectrons allows probing all stages of ultra-relativistic collisions as electrons do not suffer from final state interactions. This enables the search for thermal radiation of the hot and dense medium created in heavy-ion collisions at LHC. We will present the status of the dielectron measurements in Pb-Pb collisions at $\sqrt{s_{NN}}$ = 2.76 TeV with ALICE, focussing on the search for thermal radiation, via the study of a possible dielectron enhancement at low masses. The status and perspectives of dielectron analyses in pp and p-Pb will also be discussed.

HK 40.3 Di 17:30 HSZ-204

ω and ϕ Meson Analysis via the Dielectron Channel in pp at $\sqrt{s}$= 7 TeV with ALICE — •Mahmut Özdemir for the ALICE-Collaboration — Institut für Kernphysik, Goethe Universität, Frankfurt

Low-mass dielectrons are an important experimental tool to probe the properties of the hot and dense medium created in ultrarelativistic heavy-ion collisions. Electrons do not interact strongly, therefore they provide information from all stages of the collision. In particular, dielectron decays of $\omega(782)$ and $\phi(1020)$ mesons carry important information on their in-medium properties, where pp collisions are used as medium-free reference for the possible modifications of the medium. Furthermore, pp collisions are interesting by themselves to investigate particle production at LHC energy. In this contribution we will present the status of a measurement of $\omega(782)$ and $\phi(1020)$ meson production in the e^+e^--decay channel in pp collisions at $\sqrt{s}$ = 7 TeV with ALICE.

HK 40.4 Di 17:45 HSZ-204

Prospects of Low-Mass Dielectron Measurements in ALICE with an upgraded Central Barrel Detector — •Patrick Reichelt for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

The measurement of electron-positron pairs in the low invariant mass region allows to study the vacuum and in-medium properties of light vector mesons. Dielectrons also probe the production of thermal photons in heavy-ion collisions. ALICE is well-suited to perform this measurement due to its excellent tracking and particle identification capabilities at very low momenta. However, Dalitz decays and photon conversions lead to a high combinatorial background. Additionally, coincident semi-leptonic decays of charm and anti-charm hadrons produce a continuum signal, which dominates over a thermal dielectron signal. Both contributions can be reduced by an improved Inner Tracking System, to be installed during LHC's long shutdown 2 (2018). It will further improve the tracking efficiency at low p_{T} and provide excellent detection capabilities for electrons from secondary vertices like conversions and heavy-quark decays. Additionally, an upgrade of the TPC readout will substantially increase the data taking rate. The expected impact on the low-mass dielectron measurement in Pb-Pb collisions at full LHC energy will be presented.

HK 40.5 Di 18:00 HSZ-204

Measurement of direct photons in pp and Pb-Pb collisions with ALICE — •Martin Wilde for the ALICE-Collaboration — WWU Münster

Direct photons are an important probe in diagnosing the highly excited state of nuclear matter created in heavy-ion collisions: They provide access to various stages of the collision including the initial state.

The ALICE detector is equipped with two high resolution electromagnetic calorimeters and a central tracking system that make it well suited to study direct photon production over a brought rang of p_T. In addition to classical calorimeter measurements, the low p_T regime can be targeted via the measurement of photon conversion products by the ALICE TPC with high tracking efficiency.

In this talk the analysis of direct photon production in pp (at $\sqrt{s} = 7\,\mathrm{TeV}$ and $\sqrt{s} = 2.76\,\mathrm{TeV}$) and Pb-Pb (at $\sqrt{s_{NN}} = 2.76\,\mathrm{TeV}$) collisions is presented. The inclusive photon and neutral pion spectrum is measured via photon conversions in the ALICE setup. From the neutral pion yield a decay photon cocktail is deduced. The signal is obtained by calculating the double ratio $(\gamma/\pi^0)/(\gamma_{\mathrm{decay}}/\pi^0)$. Implications on the search for a direct photon excess at low p_T will be discussed.

HK 40.6 Di 18:15 HSZ-204

Measurement of Direct Photon Elliptic Flow in Pb-Pb Collisions at $\sqrt{s} = 2.76$ TeV with ALICE — •Daniel Lohner for the ALICE-Collaboration — Physikalisches Institut, Ruprecht-Karls Universität Heidelberg

A unique tool for the study of the system evolution in nucleus-nucleus collisions is the measurement of photons. Since photons do not interact with the medium they carry undistorted information of the system at their production time. Besides photons from hadron decays also direct photons are emitted at every stage of the system evolution.
Recently, the ALICE collaboration presented a first measurement of the direct-photon spectrum and elliptic flow $v_2^{\gamma,dir}$ in Pb-Pb collisions at $\sqrt{s_{NN}} = 2.76TeV$ at the LHC. The observed direct photon spectrum can be described by NLO (pQCD) predictions at momenta above 4 GeV/c while the spectrum at low p_T shows a clear excess above the NLO pQCD prediction. In order to describe the low p_T direct-photon spectrum, recent hydrodynamical calculations include a substantial portion of thermal photons from the hot plasma phase. As a consequence of the early production time, $v_2^{\gamma,dir}$ is expected to be small compared to hadrons. However, the measurement of the direct photon azimuthal anisotropy provides evidence for a non-zero $v_2^{\gamma,dir}$ for $1 < p_T < 3GeV/c$ with a magnitude similar to the observed charged pion $v_2^{\pi^\pm}$. A large $v_2^{\gamma,dir}$ might lend support for a significant direct-photon emission from late stages of the system evolution where hadron flow has developed.

HK 40.7 Di 18:30 HSZ-204

Thermal Photons at RHIC — •Hendrik van Hees[1], Ralf Rapp[2], and Charles Gale[3] — [1]Frankfurt Institute for Advanced Studies (FIAS), Ruth-Moufang-Straße 1, D-60438 Frankfurt, Germany — [2]Cyclotron Institute, Texas A&M University, College Station, Texas 77843-3366, USA — [3]Department of Physics, McGill University, 3600 University Street, Montreal, Canada H3A 2T8

Recent measurements of direct photons in 200 AGeV Au-Au collisions at RHIC by the PHENIX collaboration find an unexpectedly large anisotropic flow, v_2 of these photons. Here we present a model for thermal-photon emission from the matter created in the heavy-ion collision, taking into account both the partonic (QGP) and hadronic phases of the fireball evolution. For the corresponding thermal-photon rates we use an HTL resummed pQCD matrix element for the emission from the QGP and a hadronic model in the confined phase. Convoluting these rates over the history of the fireball evolution within a simple elliptic blastwave model we find the photon yield to be dominated by radiation from the hadronic phase for $q_T \lesssim$ 2-3 GeV, leading to a direct-photon v_2 comparable with the lower edge of the error bars of the measurement. Also an analysis of the photon-q_T slopes shows consistency of our model with the data due to the blue shift of the hadronic photon spectrum from the radial flow of the thermal source, which compensates the lower temperatures of the hadronic phase.
Supported by the Helmholtz Association through the ExtreMe Matter Institute (EMMI) and BMBF.
[1] H. van Hees, C. Gale, R. Rapp, Phys. Rev. C **84**, 054906 (2011)

HK 40.8 Di 18:45 HSZ-204

Studying Hot and Dense Nuclear Matter at RHIC: High p_T Results from the PHENIX Experiment — •Baldo Sahlmueller — Goethe-Universität Frankfurt — for the PHENIX collaboration

High p_T particles such as π^0 and direct photons were found to be crucial probes to study the hot and dense matter created in ultra-relativistic heavy-ion collisions. The π^0 as the leading particle from jet fragmentation can be used to probe the QGP directly, its modification is connected to the energy loss of partons in the medium. Direct photons on the other hand are produced at various stages of the collision and can leave the medium unaffected, once produced. They give access to the earliest stages of the collision as well as to the thermalized medium that evolves later.

We present recent PHENIX results on direct photon and π^0 production in Au+Au collisions at centre-of-mass energies between 39 and 200 GeV. The results will be discussed in the light of theoretical models and compared to results of similar observables at the LHC.

HK 41: Struktur und Dynamik von Kernen

Zeit: Dienstag 16:45–18:30 Raum: HSZ-301

Gruppenbericht HK 41.1 Di 16:45 HSZ-301

Pygmy Dipole Strength in ^{86}Kr and Systematics of N=50 Isotones — •R. Schwengner[1], R. Massarczyk[1,2], G. Rusev[3], N. Tsoneva[4], D. Bemmerer[1], R. Beyer[1], R. Hannaske[1,2], A.R. Junghans[1], J.H. Kelley[3], E. Kwan[3], H. Lenske[4], M. Marta[1], R. Raut[3], K.D. Schilling[1], A. Tonchev[3], W. Tornow[3], and A. Wagner[1] — [1]Helmholtz-Zentrum Dresden-Rossendorf (HZDR) — [2]TU Dresden — [3]Triangle Universities Nuclear Laboratory (TUNL), Durham NC, USA — [4]Universität Gießen

We present results of the first photon-scattering study of ^{86}Kr. Experiments were carried out with bremsstrahlung at the ELBE accelerator of HZDR and with monoenergetic, polarized γ rays at the HIγS facility of TUNL. A high-pressure gas target was used. We identified about 40 states with $J^\pi = 1^-$ up to the neutron-separation energy for the first time. For the determination of the absorption cross section, strength in the quasicontinuum was taken into account and a correction of the cross section for inelastic transitions was performed on the basis of simulations of statistical γ-ray cascades. The resulting absorption cross section shows enhanced strength considered as a pygmy dipole resonance (PDR) and is compared with predictions of the quasiparticle-phonon model. The behavior of PDR strength within the series of $N = 50$ isotones is discussed. Enhanced photon strength may influence neutron-capture reaction rates relevant for transmutation studies.

This work is supported by the DFG under contract SCHW 883/1-1.

HK 41.2 Di 17:15 HSZ-301

Dipole response in ^{120}Sn — •Anna Maria Krumbholz[1], Peter von Neumann-Cosel[1], Atsushi Tamii[2], Iryna Poltoratska[1], and Vladimir Yu. Ponomarev[1] for the E316-Collaboration — [1]TU Darmstadt — [2]Research Center for Nuclear Physics, Osaka

A consistent and powerful method to measure electric and magnetic dipole modes over a broad excitation energy range including energies below and above the neutron seperation energy is polarized proton scattering at small scattering angles including 0° [1]. A topic of high current interest is the question whether (γ,γ') data provide the correct strength of the pygmy dipole resonance (PDR) since the extraction of B(E1) strength depends on the unobserved branching ratios to excited states. Furthermore, parts of the strength may be missed because of the limits of energy resolution and detection sensitivity. Spectroscopy of the PDR provides important insight into a possible interpretation of the mode as a neutron skin oscillation. Measurements of ^{120}Sn(p,p') reaction have been performed at RCNP with a beam energy of 295 MeV and an energy resolution of about 25 keV. For the separation of electric and magnetic contributions two different independent methods are applied, viz. a multipole decomposition of the angular distributions of the cross sections based on DWBA calculations and a model-independent analysis based on polarization transfer coefficients. Results of the analysis will be presented and compared to a ^{120}Sn(γ, γ') experiment [2].
[1] A. Tamii et al., Phys. Rev. Lett. 107, 062502 (2011).
[2] B. Özel, Ph.D. thesis, Çukurova University, Adana, Turkey (2008).
*Supported by DFG under contracts SFB 634 and NE 679/3-1.

HK 41.3 Di 17:30 HSZ-301

Struktur von ^{98}Pd — •Christoph Fransen, Enrico Ellinger, Andrey Blazhev, Thomas Braunroth, Alfred Dewald, Matthias Hackstein, Jan Jolie und Julia Litzinger — Institut für Kernphysik, Universität zu Köln

Untersuchungen der stabilen $N = 52$ Isotone ^{92}Zr, ^{94}Mo und ^{96}Ru in der Vergangenheit resultierten in genauen Kenntnissen über die Entstehung von Kollektivität in der Nähe der Unterschalenabschlüsse bei $Z = 38$ und $Z = 40$ (siehe z.B. [1]). Für die schwereren instabilen $N = 52$ Isotone in der Nähe des doppelt magischen Kerns ^{100}Sn lagen dagegen nur sehr spärliche Daten vor, speziell waren nur sehr wenige absolute Übergangsstärken bekannt, die ein Verständnis der Entwicklung von Zuständen mit kollektiven Verhalten in der Nähe von ^{100}Sn erlauben würden. Wir haben daher ein Experiment an $^{98}_{52}$Pd mit der Recoil Distance Doppler-Shift Methode mit dem Kölner Plunger am Kölner FN-Tandem Beschleuniger durchgeführt. Es wurden erstmals Lebensdauern der Yrast-Zustände bis zum 10^+_1 und damit absolute $E2$-Übergangsstärken innerhalb der Yrast-Bande bestimmt. Von uns durchgeführte Schalenmodellrechnungen erlauben eine sehr gute Reproduktion sowohl der experimentellen Zustandsenergien wie der $E2$ Stärken und weisen auf dominante Neutronenkonfigurationen der tiefsten Zustände hin, während höhere Yrast-Zustände sowohl Protonen- als auch Neutronenkonfigurationen zeigen. Gefördert durch die DFG, Fördernummer Jo 391/3-2.

HK 41.4 Di 17:45 HSZ-301

B(E2) measurement for neutron deficient ^{104}Sn. — •Giulia Guastalla[1,2], Douglas Di Julio[3], Magdalena Górska[2], Joakim Cederkäll[3], Norbert Pietralla[1], Jürgen Gerl[2], and Hans Jürgen Wollersheim[2] — [1]Institut für Kernphysik, Technische Universität Darmstadt, Darmstadt, Germany — [2]GSI, Darmstadt, Germany — [3]Lund University, Lund, Sweden

The reduced transition probability B(E2: $0^+ \rightarrow 2^+$) = 0.10(4) e^2b^2 has been measured for ^{104}Sn using the relativistic Coulomb excitation technique with the PreSPEC setup at GSI. ^{104}Sn is the closest isotope to ^{100}Sn, the heaviest self-conjugate doubly magic nucleus, for which information on the E2 excitation strength is available now. Our result is therefore important for the conclusion on cross-shell excitations near ^{100}Sn. It agrees with theoretical calculations that themselves are in conflict with data on ^{106,108}Sn[1]. The data and their consequences are discussed. Supported by the BMBF under Nos. 05P09RDFN4, 05P12RDFN8, and by the LOEWE center HIC for FAIR.
[1] A. Jungclaus et al., Phys. Lett. B 695, 110 (2011).

HK 41.5 Di 18:00 HSZ-301

Investigation of the odd mass Tl isotopes in resonant photon scattering experiments * — •Nadia Benouaret, Christopher Romig, Jacob Beller, Markus Zweidinger, Marcus Scheck, and Norbert Pietralla — Institut für Kernphysik, Technische Universität Darmstadt Schlossgartenstraße 9, 64289 Darmstadt, Deutschland

First nuclear resonance fluorescence (NRF) experiments have been performed on the odd mass isotopes ^{203,205}Tl using a bremsstrahlung photon beam at an endpoint energy of 7.5 MeV at the S-DALINAC facility at TU Darmstadt. The measurements were complemented by additional experiments carried out at the High Intensity γ-ray Source HIγS at Duke University, NC, USA, with a linearly polarised quasi-mono-energetic photon beam. New photo-excited states of ^{203,205}Tl isotopes have been identified. The ground state transition widths and the reduced transition probabilities of ^{205}Tl have been extracted from the corresponding measured energy spectra of the scattered photons. The results on 205Tl will be presented.
*Supported by the DFG under grant N0. SFB 634.

HK 41.6 Di 18:15 HSZ-301

Zwei-Phononen-Zustände im Kern ^{96}Zr — •Markus Zweidinger[1], Jacob Beller[1], Nadia Benouaret[1], Sean Finch[2,3], Johann Isaak[4,5], Norbert Pietralla[1], Vladimir Yu. Ponomarev[1], Christopher Romig[1], Deniz Savran[4,5], Marcus Scheck[1], Linda Schnorrenberger[1] und Werner Tornow[1] — [1]Institut für Kernphysik, TU Darmstadt — [2]Triangle Universities Nuclear Laboratory, Durham, NC, USA — [3]Department of Physics, Duke University, Durham, NC, USA — [4]ExtreMe Matter Institute EMMI and Research Division, Darmstadt — [5]Frankfurt Institute for Advanced Studies, Frankfurt am Main

Bei Kernresonanzfluoreszenz-Experimenten am Darmstädter supraleitenden Elektronen-Linearbeschleuniger S-DALINAC wurden im Kern ^{96}Zr die $J = 1$ Spinquantenzahlen und die Übergangsstärken von Dipolanregungen bis zu einer Energie von $E_0 = 5.2$ MeV bestimmt. Die Paritätsquantenzahlen dieser Zustände wurden an der High Intensity γ-ray Source an der Duke University in Durham, North Carolina, USA, gemessen. Dadurch konnten Kandidaten für zwei $\left[2^+_i \otimes 3^-_1\right]_{1^-}$ $(i = 1, 2)$ Zwei-Phononen-Kopplungen negativer Parität und ein Kandidat für eine $\left[2^+_1 \otimes 2^+_{\mathrm{ms}}\right]_{1^+}$ Zwei-Phononen-Kopplung positiver Parität und überwiegend gemischter Proton-Neutron Symmetrie identifiziert werden. Die Ergebnisse werden vorgestellt und in Bezug auf Systematiken der Zwei-Phononen-Zustände diskutiert.
* Gefördert duch die DFG im Rahmen des SFB 634

HK 42: Hadronenstruktur und -spektroskopie

Zeit: Dienstag 16:45–18:45 Raum: HSZ-304

Gruppenbericht HK 42.1 Di 16:45 HSZ-304

Hadronische Wirkungsquerschnittsmessungen via ISR bei BaBar — •Achim Denig, Miriam Fritsch, Konrad Griessinger und Andreas Hafner für die BaBar-Kollaboration — Johannes Gutenberg Universität Mainz, Institut für Kernphysik

Die Messung des hadronischen Wirkunsquerschnittes in der e^+e^- Annihilation ist von entscheidender Bedeutung für eine verbesserte Standardmodellvorhersage des anomalen magnetischen Momentes des Myons a_μ. Mit Hilfe einer Dispersionsrelation ist es möglich, den hadronischen Anteil a_μ^{had} aus den gemessenen exklusiven Wirkungsquerschnitten der hadronischen Reaktionen zu bestimmen.

Der BaBar-Detektor hat von 1999-2008 eine integrierte Luminosität von ca. 500 fb^{-1} am e^+e^--Beschleuniger PEP-II aufgenommen. Die Schwerpunktsenergie beträgt 10.58 GeV. In Initial State Radiation (ISR) Ereignissen wird von einem einkommendem Lepton ein Photon abgestrahlt und dadurch die effektive Schwerpunktsenergie abgesenkt. Mit Hilfe dieser ISR-Methode können bei BaBar hadronische Wirkungsquerschnitte im Energiebereich von der Schwelle bis 5 GeV vermessen werden. Der Reaktionskanal $e^+e^- \rightarrow \pi^+\pi^-$ hat zwar mit ca. 75% des Gesamtbeitrages zum Dispersionsintegral den größten Einfluss auf die Berechnung von a_μ, wurde jedoch mit sehr hoher Präzision vermessen. Dadurch ist der Fehler auf den hadronischen Anteil der Myon-Anomalie momentan dominiert durch Kanäle mit höherer Multiplizität. Diese Messungen werden vorgestellt.

HK 42.2 Di 17:15 HSZ-304

Single-Hadron transverse target spin asymmetries at COMPASS — •Christoph Adolph — for the COMPASS collaboration — Physikalisches Institut IV der Universität Erlangen-Nürnberg

The quark content of the nucleon at twist-two level in the collinear case can be fully described by three independent distribution functions for each quark flavour: the unpolarized distribution function $f_1(x)$, the helicity distribution function $g_1(x)$ and the transverse spin distribution function $h_1(x)$, also called transversity. The measurement of single spin asymmetries in semi-inclusive deep inelastic scattering (SIDIS) on a transversely polarized target are an important part of the COMPASS physics program. By extracting azimuthal asymmetries in hadron production one can access both the Collins fragmentation function and the Sivers distribution function. The COMPASS collaboration has measured these asymmetries in the scattering of a 160 GeV/c polarized μ^+ beam off a transversely polarized ^{6}LiD (deuteron) target in the years 2002–2004 and off a transversely polarized NH_3 (proton) target in 2007 and 2010. In this contribution we especially present results from the 2010 data for the Collins and Sivers asymmetries for identified pions and kaons.

HK 42.3 Di 17:30 HSZ-304

Exclusive ρ^0 muoprodugen on transversely polarised protons and deuterons — •Katharina Schmidt, Steffen Bauer, Horst Fischer, Florian Herrmann, Kay Königsmann, Michael Kunz, Tobias Kunz, Pasquale Malm, Christopher Regali, Robert Schäfer, Stefan Sirtl, Tobias Szameitat, and Johannes ter Wolbeek — for the COMPASS collaboration, Physikalisches Institut, Albert- Ludwigs-Universität Freiburg

The theoretical framework of Generalized Parton Distributions (GPDs) provides a dynamical and geometrical picture of the nucleon. Additional to the longitudinal momentum information of partons they contain information on the transverse localisation of the constituents. The exclusive production of ρ^0 mesons off a transversely polarised target allow for instance to constrain the GPD E which is connected, according to Ji's sum rule, with the total angular momentum of quarks and gluons. At the COMPASS experiment at CERN measurements were performed scattering a 160 GeV/c longitudinal poalized muon beam off a transversely polarised ^{6}LiD (2003-2004) and NH_3 (2007, 2010) target. The final state particles are detected with the two-stage spectrometer with high resolution tracking and calorimetry.
This talk gives an introduction to the analysis of exclusively produced ρ^0 mesons. Results for the azimuthal asymmetry are presented. Supported by BMBF, DFG and EU FP7 (Grant Agreement 283286)

HK 42.4 Di 17:45 HSZ-304

Measurement of the Proton Scalar Polarizabilities at MAMI — •Vahe Sokhoyan for the A2-Collaboration — George Washington University, Washington, USA — Institut für Kernphysik, Universität Mainz, Germany

The scalar polarizabilities, α_{E1} and β_{M1}, are fundamental properties of the nucleon. They play a crucial role not only in our understanding of the nucleon, but also in other areas such as atomic physics, where they provide e.g. corrections to the Lamb Shift. Recent analyses suggest significant model dependence in the extraction of α_{E1} and β_{M1}. To date, these observables were extracted in parallel from unpolarized cross-sections of Compton scattering on the proton. At the MAMI accelerator facility in Mainz, the nucleon polarizabilities will be measured using a linearly polarized photon beam for the first time in a photon energy range from 110 to 150 MeV. The beam will impinge on a liquid Hydrogen target and the reaction products will be detected in the Crystal Ball and TAPS 4π spectrometer setup. This measurement will allow for the first independent extraction of the observables α_{E1} and β_{M1} using real Compton scattering on the proton below pion threshold. In the talk the current status of the α_{E1} and β_{M1} measurement will be presented. In addition the current status of the investigation of dilepton photoproduction off the proton, which will be measured in parallel due to the necessarily open trigger conditions, will be discussed.

HK 42.5 Di 18:00 HSZ-304

Symmetric Møller/Bhabha luminosity monitor for the OLYMPUS experiment — •Roberto Perez Benito for the OLYMPUS-Collaboration — Johannes Gutenberg Universität Mainz

Recent determinations of the proton electric to magnetic form factor ratio indicate an unexpected discrepancy between the ratio obtained using polarisation transfer measurements and the ratio from the Rosenbluth separation technique in unpolarised cross section measurements. This discrepancy has been explained theoretically as the effect of two-photon exchange.

The *OLYMPUS* experiment at DESY proposed to measure the ratio of positron-proton and electron-proton elastic scattering cross sections. The experiment utilised beams of electrons and positrons in the DORIS ring at 2.0 GeV incident on an unpolarized internal hydrogen gas target and the BLAST detector from the MIT-Bates Linear Accelerator Center with modest upgrades.

In order to reduce the systematic error from the determination of luminosity, redundant measurements of the relative luminosity were necessary. The symmetric Møller/Bhabha luminosity monitor built at the University of Mainz consisted of two symmetric arrays of lead fluoride (PbF_2) crystals. Results on the performance of the symmetric Møller/Bhabha luminosity monitor will be presented in this contribution.

HK 42.6 Di 18:15 HSZ-304

OLYMPUS Luminosity Monitoring — •Ozgur Ates for the OLYMPUS-Collaboration — Hampton University, Hampton, Virginia, USA

The OLYMPUS experiment at DESY has been measuring the ratio of positron-proton and electron-proton elastic scattering cross sections to quantify the effect of two-photon exchange, which is widely considered to be responsible for the discrepancy between measurements of the proton electric to magnetic form factor ratio with the Rosenbluth and polarization transfer methods. In order to control the systematic uncertainties to the percent level, the luminosities are monitored redundantly with high precision by measuring the rates for symmetric Moller and Bhabha scattering, and by measuring the ep-elastic count rates at forward angles and low momentum transfer with tracking telescopes based on GEM (Gas Electron Multiplier) and MWPC (Multi Wire Proportional Chamber) technology. During two data taking periods, performances of GEM and MWPC luminosity monitors will be presented.

HK 42.7 Di 18:30 HSZ-304

Energy Calibration for the Forward Detector at WASA-at-COSY* — •Kay Demmich, Florian Bergmann, Paul Goslawski, Nils Hüsken, Florian Schepers, Alexander Täschner, and Alfons Khoukaz — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster

One focus of the WASA-at-COSY physics program is the investigation of meson productions and rare meson decays. The experimental setup itself allows for meson production in scattering reactions with any combination of protons and deuterons. The forward scattered ejectiles can be detected in the forward detector and the four-momenta can be reconstructed e.g. for missing mass studies. Generally the energy calibration of the forward detector is performed by comparing measured with simulated or calculated energy loss distributions in different detector layers as function of the ejectile energy. For investigations on the η' production in the p+d $\rightarrow$ ^{3}He+η' reaction the accuracy of this calibration is crucial since the reaction cross section is very small compared to background reactions. A new powerful tool to calibrate the forward detector is presented. It enables the variation of the calibration parameters within a graphical user interface and a following optimization by an adjusted method based on least square fitting. Although primarily developed for the η' production, this program has been applied successfully to an η production data set, as well, and can be adapted for ^{3}He and ^{4}He production reactions. In this talk the calibration method and first results of the implementation will be presented.

*Supported by COSY-FFE grants

HK 43: Astroteilchenphysik

Zeit: Dienstag 16:45–18:45 Raum: HSZ-401

Gruppenbericht HK 43.1 Di 16:45 HSZ-401

Precision measurements of neutron decay observables with PERC — •Bastian Märkisch for the PERC-Collaboration — Physikalisches Institut, Universität Heidelberg

Neutron beta decay is the simplest semi-leptonic weak process, and precision measurements of angular correlations coefficients provide unique information about the weak interaction and contribute significantly to precision tests of the Standard Model of particle physics.

We present the new facility PERC (Proton Electron Radiation Channel), a novel source of neutron decay products, which is currently under construction at the Forschungs-Neutronenquelle Heinz Maier-Leibnitz. PERC will provide the maximum available phase space density of neutron decay products by using the inside of an 8 m long neutron guide as active decay volume. Electrons and protons are extracted from this volume, and separated from the neutron beam by a strong magnetic field. A magnetic barrier field of up to 6 T serves to precisely define the phase space of the emerging decay particles. Spectra and angular distributions will be distortion-free on the level of 10^{-4}, an improvement of more than an order of magnitude compared to existing instruments.

We give an overview on the concept of the PERC instrument, observables accessible, and the current status.

Gruppenbericht HK 43.2 Di 17:15 HSZ-401

GERDA status report — •Mark Heisel for the GERDA-Collaboration — Max-Planck-Institut für Kernphysik, Heidelberg

The GERmanium Detector Array, Gerda, is an experiment designed to search for the neutrinoless double beta decay of ^{76}Ge. An array of bare high-purity germanium detectors made from isotopically modified material (^{76}Ge enriched to 86%) is operated in a cryostat with 65 m^3 of liquid argon. The experiment aims at exploring neutrinoless double beta decay half-lives up to $1.4 \cdot 10^{26}$ yr. This will be achieved by collecting an exposure of about 100 kg·yr in two phases. The first phase is taking data since November 2011 with a background index of about $2{\cdot}10^{-2}$ cts/(keV·kg·yr) in the region of interest at the Q–value of the decay (2039 keV). The second phase will commence in 2013 with the deployment of additional 20 kg of enriched thick-window broad energy germanium detectors (BEGe) together with an instrumentation to detect the liquid argon scintillation light. The design goal of phase II is to reduce the background further by a factor 10 w.r. to the current background index. This talk summarises the GERDA activities and results obtained to date. In particular latest numbers on the background index and the half life of the two-neutrino double beta decay are reported. The region of interest is concealed due to a blind analysis until summer 2013.

HK 43.3 Di 17:45 HSZ-401

Large-scale nuclear structure calculation of spin-dependent WIMP scattering off nuclei with chiral currents* — •Philipp Klos[1], Javier Menéndez[1,2], and Achim Schwenk[1,2] — [1]Institut für Kernphysik, Technische Universität Darmstadt — [2]ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung GmbH

Chiral effective field theory (EFT) provides a systematic expansion for the coupling of WIMPs to nucleons at the momentum transfers relevant to direct cold dark matter detection. We derive the currents for spin-dependent WIMP scattering off nuclei at the one-body level and include the leading long-range two-body currents, which are predicted in chiral EFT, as well as the formalism necessary to describe WIMP-nucleus scattering at the most general level including both elastic and inelastic interactions. As an application, we calculate the structure factor for elastic, spin-dependent WIMP scattering off the experimentally relevant isotopes ^{129,131}Xe, ^{127}I, ^{73}Ge, ^{19}F, ^{23}Na ,^{27}Al and ^{29}Si nuclei, using nuclear interactions that have been developed to study nuclear structure. We provide theoretical error bands due to the nuclear uncertainties of WIMP currents in nuclei.

*This work was supported in part by the DFG through grant SFB 634, the Helmholtz Alliance HA216/EMMI, and a BMBF ARCHES Award.

HK 43.4 Di 18:00 HSZ-401

Tritiumnachweis per β-induzierter Röntgenspektroskopie (BIXS) — •Marco Röllig für die KATRIN-Kollaboration — Institut für experimentelle Kernphysik, KIT, Karlsruhe, Deutschland

Das KArlsruher TRItium Neutrino-Experiment (KATRIN) untersucht spektroskopisch das Elektronenspektrum des Tritium β-Zerfalls $^3\mathrm{H} \rightarrow {}^3\mathrm{He} + \mathrm{e}^- + \bar{\nu}_\mathrm{e}$ nahe dem kinematischen Endpunkt von 18,6 keV. Mit einer fensterlosen, molekularen, gasförmigen Tritiumquelle hoher Luminosität und einem hochauflösenden elektrostatischen Filter mit bisher unerreichter Energieauflösung $\Delta E = 1\,\mathrm{eV}$, wird KATRIN eine modellunabhängige Bestimmung der Neutrinomasse mit einer erwarteten Sensitivität von 0,2 eV (90% CL) ermöglichen. Für eine derart präzise Massenbestimmung ist insbesondere die Stabilität der Quelle bezüglich ihrer β-Aktivität ein Schlüsselparameter. Die Stabilität der Quellaktivität von 0,1% soll mit Hilfe eines BIXS-Systems überwacht werden. In diesem Vortrag werden der Aufbau eines BIXS-Systems im Tritiumlabor Karlsruhe sowie aktuelle Ergebnisse vorgestellt. Darüber hinaus werden Ergebnisse von Monte-Carlo-Simulationen präsentiert, die zeigen das eine KATRIN Quellüberwachung mit einer Stabilität von 0,1% in ≤ 250 s mit Hilfe eines BIXS-Systems möglich ist.

HK 43.5 Di 18:15 HSZ-401

Status des KATRIN Fokalebenendetektors am KIT — •Johannes Schwarz für die KATRIN-Kollaboration — Karlsruher Institut für Technologie, Institut für Experimentelle Kernphysik

Das Ziel des **KA**rlsruher **TRI**tium **N**eutrino Experiments ist die direkte und modellunabhängige Bestimmung der Ruhemasse des Elektron-Antineutrinos aus dem Energiespektrum des Tritium β-Zerfalls nahe der kinematischen Endpunktsenergie von 18,6 keV mit einer bisher unerreichten Sensitivität von 200 meV/c^2 (90% C.L.). Hierzu werden die in einer fensterlosen molekularen Tritium-Quelle emittierten β-Elektronen über eine differentielle und kryogene Transportstrecke zu einem System aus zwei elektrostatischen Spektrometern mit magnetisch adiabatischer Kollimation (MAC-E-Filter) geführt und von einem großflächig segmentierten Siliziumdetektor mit einem Durchmesser von 90 mm und 148 gleichgroßen Pixeln nahezu untergrundfrei nachgewiesen.

Das System des Fokalebenendetektors wurde an der University of Washington entwickelt, inzwischen am KIT aufgebaut und ausgiebig auf einen stabilen Langzeitbetrieb für das KATRIN Experiment getestet und optimiert. In diesem Beitrag werden sowohl das Konzept des Systems vorgestellt als auch Resultate der Inbetriebnahme und die sich daraus ergebenden Verbesserungen zur weiteren Untergrundreduzierung für den finalen Aufbau am KATRIN Experiment erläutert.

Gefördert vom BMBF unter Kennzeichen 05A11VK3 und von der Helmholtz-Gemeinschaft.

HK 43.6 Di 18:30 HSZ-401

Untersuchung zum Design der Datenaquisition des LENA-Experiments — •Michael Kiel, Marta Meloni, Michael Soiron, Achim Stahl und Christopher Wiebusch — RWTH Aachen, III. Physikalisches Institut B

LENA steht für Low Energy Neutrino Astronomy und ist ein neuer Neutrinodetektor, der sich gegenwärtig in der Planungsphase befindet. Zur Messung der Neutrinos werden 50kt Flüssigszintillator verwendet, mit dem eine niedrige Energieschwelle und hohe Energieauflösung erreicht werden kann. Mit LENA ist es möglich, Neutrinos aus unterschiedlichen Quellen zu messen. Die Spanne reicht von astrophysikalischen Neutrinos aus Supernovae und der Sonne über geoterrestrische und atmosphärische Neutrinos bis hin zu einem künstlichen Neutrinostrahl. Diese physikalischen Ziele setzen hohe Anforderungen an das Datennahmesystem, wie zum Beispiel eine gute Zeitauflösung, hoher Dynamikbereich und Totzeitfreiheit. In diesem Vortag werden diese Forderungen und erste Studien vorgestellt.

HK 44: Hadronenstruktur und -spektroskopie

Zeit: Dienstag 16:45–19:00 Raum: HSZ-403

Gruppenbericht HK 44.1 Di 16:45 HSZ-403

A chiral model with (axial-)vector mesons and glueballs: meson and baryon phenomenology — •Francesco Giacosa[1], Susanna Gallas[1], Denis Parganlija[1,2], Stanislaus Janowski[1], Achim Heinz[1], Walaa I. Eshraim[1], Khaled Teilab[1], Peter Kovacs[3], Gyuri Wolf[3], and Dirk H. Rischke[1,4] — [1]Inst. for Theor. Physics, Johann Wolfgang Goethe University, Max-von-Laue-Str. 1, D-60438 Frankfurt am Main, Germany — [2]Inst. for Theor. Physics, Vienna University of Technology, Wiedner Hauptstr. 8-10, A-1040 Vienna, Austria — [3]Inst. for Particle and Nuclear Physics, Wigner Research Center for Physics, Hungarian Academy of Sciences, H-1525 Budapest, Hungary — [4]Frankfurt Institute for Advanced Studies, Ruth-Moufang-Str. 1 D-60438 Frankfurt am Main, Germany

We present an effective model for low-energy hadron phenomenology, called extended linear sigma model (eLSM), which is based on chiral symmetry and dilatation invariance. The d.o.f. in the mesonic sector are the (pseudo)scalar and (axial-)vector quark-antiquark fields, as well as the scalar and the pseudoscalar glueballs. A good description of the existing PDG data on masses and decay widths is achieved and predictions for future experiments are shown. In the baryonic sector the nucleon doublet (the nucleon and and its chiral partner) are introduced through the mirror assignment: in this way a contribution to the nucleon mass, which does not originate from the chiral condensate, is possible and turns out to be sizable. Decays and scattering processes involving nucleons are presented. In the end, an outlook for future studies in both the mesonic and baryonic sectors is discussed.

HK 44.2 Di 17:15 HSZ-403

Phenomenology of the Scalar-Isoscalar Resonances $f_0(1370)$, $f_0(1500)$ and $f_0(1710)$ — •Stanislaus Janowski[1], Denis Parganlija[2], Francesco Giacosa[1], and Dirk H. Rischke[1,3] — [1]Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Straße 1, D-60438 Frankfurt — [2]Institute for Theoretical Physics, Vienna University of Technology, Wiedner Hauptstr. 8-10, A-1040 Vienna, Austria — [3]Frankfurt Institute for Advanced Studies (FIAS), Ruth-Moufang-Straße 1, D-60438 Frankfurt

In the framework of the $U(3)_R \times U(3)_L$ chirally symmetric extended Linear Sigma Model (eLSM) with three flavors we investigate the phenomenology of the three scalar-isoscalar resonances $f_0(1370)$, $f_0(1500)$, and $f_0(1710)$. The degrees of freedom of the eLSM are (pseudo)scalars and axial(vectors) as well as a scalar glueball. In order to understand which of the scalar-isoscalar states is predominantly a nonstrange, $\bar{n}n = (\bar{u}u + \bar{d}d)/\sqrt{2}$, and a strange, $\bar{s}s$, quark-antiquark state as well as predominantly a scalar glueball state we study their mixing behavior. This is the continuation of the work arXiv:1103.3238 and aims towards a full determination of the structure of the scalar-isoscalar mesons above 1 GeV.
Supported by the Helmholtz Research School for Quark Matter Studies (H-QM) and HGS-HIRe and GSI.

HK 44.3 Di 17:30 HSZ-403

A $U(4)_r \times U(4)_l$ linear sigma model with (axial-)vector mesons — •Walaa Eshraim[1], Francesco Giacosa[1], and Dirk H. Rischke[1,2] — [1]Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Straße 1, D-60438 Frankfurt — [2]Frankfurt Institute for Advanced Studies (FIAS), Ruth-Moufang-Straße 1, D-60438 Frankfurt

We present a linear sigma model with $U(4)_r \times U(4)_l$ global chiral symmetry, which in addition to scalar and pseudoscalar mesons also includes vector and axial-vector mesons. Apart from three new parameters pertaining to the charm degree of freedom, the parameters of the model are fixed from the $N_f = 3$ flavor sector. Our results for the charmed meson masses and weak decay constants are in surprisingly good agreement with experimental data, with the marked exception of the scalar degrees of freedom, providing an indication that these states may not adhere to the standard quark-antiquark picture of a meson.
Supported by DAAD and HGS-HIRe.

HK 44.4 Di 17:45 HSZ-403

The $K\Sigma$ production in pion- and photo-induced reactions up to 2.0 GeV — •Xu Cao, Vitaly Shklyar, and Horst Lenske — Institut für Theoretische Physik, Universität Gießen

A coupled-channel model based on effective Lagrangians is applied to the combined analysis of the $(\pi,\gamma)N \to K\Sigma$ reactions up to the center of mass energy 2 GeV. The couplings constants and resonance parameters of the $K\Sigma$ state are extracted in the calculation. The main resonance contributions to the process come from the $S_{11}(1650)$, $D_{13}(1520)$, $D_{15}(1675)$, $P_{13}(1900)$, $P_{31}(1750)$, $D_{33}(1700)$ and $D_{35}(1930)$ states. The coherent sum of resonances and background contributions is essential to describe the recent photoproduction data obtained by the CLAS, CBELSA, LEPS, and GRAAL groups.

HK 44.5 Di 18:00 HSZ-403

Hadron form factors and large-Nc phenomenology — •Pere Masjuan — Institut für Kernphysik, Johannes Gutenberg Universtität Mainz

We suggest using the half-width rule to make an estimate of the 1/Nc errors in hadronic models containing resonances. We show simple consequences of these idees for the analysis of meson Regge trajectories and for the pion, nucleon and generalized hadronic form factors.

HK 44.6 Di 18:15 HSZ-403

Photon-fusion reactions from the chiral Lagrangian with dynamical light vector mesons — •Igor Danilkin[1], Matthias Lutz[1], Stefan Leupold[2], and Carla Terschlüsen[2] — [1]GSI, Planckstrßae 1, 64291 Darmstadt, Germany — [2]Uppsala Universitet, Box 516, 75120 Uppsala, Sweden

We study the reactions $\gamma\gamma \to \pi^0\pi^0$, $\pi^+\pi^-$, $K^0\bar{K}^0$, K^+K^-, $\eta\,\eta$ and $\pi^0\eta$ based on a chiral Lagrangian with dynamical light vector mesons as formulated within the hadrogenesis conjecture. At present our chiral Lagrangian contains 5 unknown parameters that are relevant for the photon fusion reactions. They parameterize the strength of interaction terms involving two vector meson fields. These parameters are fitted to photon fusion data $\gamma\gamma \to \pi^0\pi^0$, $\pi^+\pi^-$, $\pi^0\eta$ and to the decay $\eta \to \pi^0\gamma\gamma$. In order to derive gauge invariant reaction amplitudes in the resonance region constraints from micro-causality and exact coupled-channel unitarity are used. Our results are in good agreement with the existing experimental data from threshold up to about 0.9 GeV for the two-pion final states. The a_0 meson in the $\pi^0\eta$ channel is dynamically generated and an accurate reproduction of the $\gamma\gamma \to \pi^0\eta$ data is achieved up to 1.2 GeV. Based on our parameter sets we predict the $\gamma\gamma \to K^0\bar{K}^0$, K^+K^-, $\eta\,\eta$ cross sections [1].

[1] I. V. Danilkin, M. F. M. Lutz, S. Leupold and C. Terschlusen, arXiv:1211.1503 [hep-ph].

HK 44.7 Di 18:30 HSZ-403

Sum rules for light-by-light scattering — •Vladyslav Pauk[1,2], Vladimir Paskalutsa[1], and Marc Vanderhaeghen[1] — [1]Johannes Gutenberg University, Mainz — [2]National Taras Shevchenko University of Kyiv

Title: Light-by-light scattering sum rules and meson transition form factors

In the seminar a set of exact sum rules for the light-by-light fusion process will be discussed. These sum rules involve energy weighted integrals of light-by-light fusion cross sections, which can be measured at e+ e- colliders and allow one to constrain the energy behavior of these response functions. The implication of the sum rules within a perturbative quantum field theory framework will be shown. Specifically, electrodynamics of spin-0, spin-1/2, and spin-1 fields will be considered at tree level and beyond. The sum rules will then by applied to the production of mesons by a virtual photon and a real photon. It will be demonstrated that these sum rules imply non-trivial new relations between the two-photon decay widths of mesons and the gamma* gamma transition form factors for (pseudo-) scalar, axial-vector and tensor mesons. The phenomenological implications of these results for mesons both in the light quark sector and in the charm quark sector will be discussed. The seminar will also give an outlook on the application of these new results to constrain the hadronic uncertainties due to the light-by-light contribution to the muon's anomalous magnetic moment.

HK 44.8 Di 18:45 HSZ-403

Updated determinations of the pion-nucleon sigma term and the strangeness content of the nucleon with covariant baryon

chiral perturbation theory — •Jose Manuel Alarcon[1], Jorge Martin Camalich[2], and Jose Antonio Oller[3] — [1]Institut für Kernphysik, Johannes Gutenberg Universität, Mainz D-55099, Germany — [2]Department of Physics and Astronomy, University of Sussex, BN1 9QH, Brighton, UK — [3]Departamento de Fśica. Universidad de Murcia. E-30071, Murcia, Spain

In this talk I want to present the community our recent determinations of $\sigma_{\pi N}$ and σ_s employing covariant baryon chiral perturbation theory and updated experimental information. We show how these determinations overcome the difficulties that the old values of $\sigma_{\pi N} = 45$ MeV and $y \approx 0.23$ have when trying to explain the modern experiments regarding the nuclear structure and LQCD determinations. From our results, a new scenario emerges where $\sigma_{\pi N}$ and σ_s are in good agreement with updated phenomenology and recent LQCD calculations.

HK 45: Instrumentation

Zeit: Dienstag 16:45–19:00 Raum: HSZ-405

Preisträgervortrag HK 45.1 Di 16:45 HSZ-405

A new Design of a highly Segmented Neutron Detector — •Magdalena Rohrbeck — Universität Koblenz-Landau, Institut für Integrierte Naturwissenschaften - Physik, 56070 Koblenz, Germany — Laureate of the Georg-Simon-Ohm-Prize

Since neutrons carry no electric charge and therefore do not interact with matter by means of the Coulomb force, the detection of neutrons is particularly challenging. Progress in the development of neutron detectors is of great importance for neutron physics due to the poor data situation compared to experiments with protons. Disadvantages of previously used neutron detectors are their low detection efficiency and counting rate capability. The neutron detection efficiency of about 1 %/cm for typical plastic scintillators necessitates a high detector volume and the counting rate capability of applied photomultipliers of about 1 MHz limits the number of detectable events. Both the detector volume and the number of applied photomultipliers are mainly restricted by the available budget. A new design of a scintillation-based neutron detector is presented. Replacement of conventional photomultiplier tubes by low-prized silicon photon counters and usage of standardized components allow the development of a detector with a high volume and a high segmentation. Due to the planned volume of $(0.96\ \mathrm{m})^3$ a detection efficiency close to 100 % can be achieved, at the same time the counting rate load on each photon counter can be kept low because of the high segmentation with single modules with a squared diameter of 2 cm. The neutron detector will be integrated into the experimental setup of the A1 collaboration at MAMI, Mainz, and will e.g. enable precise determination of the neutron's form factors.

Gruppenbericht HK 45.2 Di 17:00 HSZ-405

The R3B experiment at FAIR: Current Status and Outlook — •Heiko Scheit for the R3B-Collaboration — TU Darmstadt

I will report on the current status of the NuSTAR experiment Reactions with Relativistic Radioactive Beams (R^3B) at the FAIR facility.

HK 45.3 Di 17:30 HSZ-405

NeuLAND prototype test experiment: simulations and first results — •Dmytro Kresan[1], Thomas Aumann[2], Konstanze Boretzky[1], Michael Heil[1], and Haik Simon[1] for the R3B-Collaboration — [1]GSI Helmholtzzentrum für Schweerionenforschung mbH — [2]Technische Universität Darmstadt

The New Large Area Neutron Detector (NeuLAND) in R3B experiment at future FAIR facility has a concept of fully active scintillator and will be used for high precision multi-neutron recognition and measurement. The test experiment with a detector prototype is required in order to study the efficiency and time resolution of scintillator bars, read out photomultipliers and electronics components. We present the simulation study as well as first results of the data analysis of the deuteron test experiment at GSI (S406). Such aspects as neutron detection efficiency, time resolution and comparison of energy deposit in the simulation and experimental data will be addressed. Supported by HIC for FAIR, GSI, and the BMBF project 06DA7047I.

HK 45.4 Di 17:45 HSZ-405

NeuLand Submodules Exposed to Fast Neutrons — •Igor Gasparic[1,2], Thomas Aumann[1,3], Konstanze Boretzky[3], Michael Heil[3], Simon Jährling[1], and Haik Simon[3] for the R3B-Collaboration — [1]Technische Universität, Darmstadt, Germany — [2]Rudjer Boskovic Institute, Zagreb, Croatia — [3]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

Within the R^3B collaboration (Reactions with Relativistic Radioactive Beams), a new neutron detector NeuLAND (New Large Area Neutron Detector) is being developed. The technical design was finalized in November 2011, a fully active scintillator concept was chosen. It will be a box-shaped $2.5\times2.5\times3$ m^3 detector consisting of 3000 scintillator bars arranged in 60 planes with mutually orthogonal orientation. An array of 150 NeuLAND bars was exposed to fast "mono-energetic" neutrons stemming from quasi-free deuteron breakup reactions on a CH_2 target (250 to 1500 AMeV). The experiment carried out at GSI in Nov. 2012 aims for determination of both time resolution and efficiency of NeuLAND submodules. Preliminary results of the analysis will be presented.

Supported by HIC for FAIR, GSI, and the BMBF project 06DA7047I.

HK 45.5 Di 18:00 HSZ-405

Current status of the neutron lifetime experiment PENeLOPE — •Wolfgang Schreyer for the PENeLOPE-Collaboration — TU München

The neutron lifetime is an important parameter in the Standard Model of particle physics and in Big Bang cosmology. Recent measurements disagreed about its value and lead to several corrections with increased error budgets by the Particle Data Group.

The experiment PENeLOPE, currently under construction at the Physik-Department of Technische Universität München, aims to resolve this dilemma by determining the neutron lifetime with a precision of 0.1 s. It will trap ultra-cold neutrons in a magneto-gravitational trap using a large superconducting magnet and will measure their lifetime by both neutron counting and online proton detection.

This presentation will give an overview over the recent progress and the next steps of the project.

The project is supported by the Maier-Leibnitz-Laboratorium (Garching), the Deutsche Forschungsgemeinschaft and the Excellence Cluster "Origin and Structure of the Universe".

HK 45.6 Di 18:15 HSZ-405

Protonendetektion im Neutronenlebensdauerexperiment PENeLOPE — •Christian Tietze für die PENeLOPE-Kollaboration — Technische Universität München

Obwohl die Lebensdauer τ_n des freien Neutrons eine wichtige Rolle im Standardmodell der Teilchenphysik spielt ist sie bisher nur unzureichend genau bekannt und oft diskutiert. So wurde der offizielle Mittelwert der Particle Data Group in den letzten zwei Jahren um insgesamt 5,1 (neue) Standardabweichungen auf $880,1 \pm 1,1$s gesenkt.

Das Präzisionsexperiment PENeLOPE wird derzeit an der TU München entwickelt um zur Klärung dieses Sachverhaltes beizutragen. Hierbei ist neben der verlustfreien magnetischen Speicherung von ultrakalten Neutronen im Multipolfeld supraleitender Spulen und anschließender Messung der überlebenden Neutronen die simultane Detektion der Zerfallsprotonen während der Speicherphase entscheidend. Die Kombination beider Messvarianten resultiert zusammen mit den guten Möglichkeiten zur Handhabung der systematischen Fehler in einer bisher bei der Neutronenlebensdauer nicht erreichten Präzision von 0,1s.

Dieser Beitrag soll auf die Herausforderungen der Protonendetektion eingehen und insbesondere das entwickelte Konzept mit der Verwendung von Lawinenphotodioden (APDs) zur direkten Protonendetektion vorstellen. Dabei werden die bei einem Prototypen mit angepasster Frontend-Elektronik gewonnenen Ergebnisse präsentiert.

Das Projekt wird gefördert vom Exzellenzcluster „Origin and Structure of the Universe“, der Deutschen Forschungsgemeinschaft sowie dem Maier-Leibnitz-Laboratorium, Garching.

HK 45.7 Di 18:30 HSZ-405

A Scintillator Based Proton Detector with Silicon Photomultiplier Readout for the Neutron Lifetime Experiment PENeLOPE — •Wolfgang Gebauer for the PENeLOPE-Collaboration

— Technische Universität München, Physik Department, E18

The lifetime of the free neutron, a major characteristic in the Standard Model of particle physics, is still not sufficiently well known: the previous measurements showed large discrepancies. Due to this fact, the new neutron lifetime experiment PENeLOPE is developed at Physik-Department of Technische Universität München.

Therefore ultra-cold neutrons are stored in a superconducting magneto-gravitational trap. Beside the detection of the neutrons, the low-energy protons emerging from the neutron beta decay will be accelerated and used for the determination of the neutron lifetime.

As the proton detector is located in the cryostat above the storage volume, it has to work at cryogenic temperatures and in high magnetic fields of about 1 T. A possible solution would be a scintillation detector using pure CsI crystals which have a high light yield at low temperatures. Due to the low energy of the irradiating protons the light emission is still low, thus silicon photomultipliers (SiPM) are a good option for the light detection system.

This contribution shows the characterization of SiPM and the development of CsI readout with SiPM at cryogenic temperatures.

This work is supported by the Excellence Cluster "Origin and Structure of the Universe", the Deutsche Forschungsgemeinschaft and the Maier-Leibnitz-Laboratorium, Garching.

HK 45.8 Di 18:45 HSZ-405

Direct detection of low energy protons using large-area avalanche photodiodes (LAAPDs) — •Thomas Pöschl for the PENeLOPE-Collaboration — Technische Universität München, Physik Department, E18

In the last couple of years the average of the measured neutron lifetime has decreased steadily. Discrepancies by more than 6σ from the world average value demand new precise measurements of this quantity. One promising experiment is PENeLOPE, which is developed at the Physics Department of Technische Universität München. This magnetic-bottle experiment is not only based on counting the surviving neutrons, but also on detecting the protons from the neutron decay in order to obtain better precision. Although the protons are accelerated by an electric field of about 30 keV, the detection is challenging because of their little penetration depth of only a few hundred nanometers in most materials.

In our work we investigate the response of a large-area avalanche photodiode (LAAPD) to protons, H_2^+ and H_3^+ ions with kinetic energies up to 30 keV. We already achieved to detect protons down to 10 keV with a good resolution of 2.8 keV (FWHM) at room temperature. For this measurements we used the linear accelerator $PAFF$ which has been built as a test facility for detector characterization.

This work is supported by the Excellence Cluster "Origin and Structure of the Universe", Deutsche Forschungsgemeinschaft and the Maier-Leibnitz-Laboratorium Garching.

HK 46: Instrumentation

Zeit: Dienstag 16:45–19:15 Raum: WIL-A221

HK 46.1 Di 16:45 WIL-A221

CBM Time-of-Flight wall layout - design considerations — •Ingo Deppner and Norbert Herrmann for the CBM-Collaboration — Physikalisches Institut, Universität Heidelberg

The Compressed Baryonic Matter spectrometer (CBM) is expected to be operational in the year 2018 at the Facility for Anti-proton and Ion Research (FAIR) in Darmstadt, Germany. The key element providing hadron identification at incident energies between 2 and 10 AGeV is a Time-of-Flight (ToF) wall covering the polar angular range from 2.5°-25° and full azimuth [1]. The necessary particle identification capabilities require a 80 ps system time resolution at high efficiency and, due to 10 MHz interaction rate, a rate capability of up to 30 kHz/cm^2. We will discuss the existing conceptual design which foresees a 120 m^2 ToF-wall composed of Multi-gap Resistive Plate Chambers (MRPC) constructed in a multi-strip configuration. The wall is designed in a modular way such that it can be located at a distance of 6 m downstream of the target for SIS 100 and with additional components at 10 m for SIS 300. The performance will be discussed on the basis of two fully differential MRPC full size prototypes developed at our institute.

Supported by EU/FP7 WP2; BMBF 06HD9121I.

[1] I. Deppner et al., The CBM time-of-flight wall, Nucl. Instr. and Meth. A, 661, Sup. 1 (2012), p. 121 doi.org/10.1016/j.nima.2010.09.165

HK 46.2 Di 17:00 WIL-A221

Ceramic Resistive Plate Chambers for High Rate Environments — •Alejandro Laso Garcia, Marcus Kaspar, Burkhard Kämpfer, Roland Kotte, Lothar Naumann, Daniel Stach, Christian Wendisch, and Jörn Wüstenfeld for the CBM-Collaboration — Helmholtz-Zentrum Dresden-Rossendorf, Dresden, Sachsen

The future Compressed Baryonic Matter Experiment to be built at FAIR is foreseen to use Resistive Plate Chambers as Time of Flight detectors. However, for the most central part of the ToF Wall high particle fluxes are expected, the simulations predict fluxes in the order of 2x10^4 particles/cm^2 s and even higher the closer the wall approaches the beampipe. This high fluxes show the need to develop new materials.

At Helmholtz-Zentrum Dresden Rossendorf, new semiconductor ceramic composites have been developed, several prototypes of RPCs with ceramic electrodes up to 20x20 cm^2 have been developed and tested.

In this talk, the performance of this detectors in electron (ELBE) and proton (COSY) beams will be presented, as well as, the performance of this detectors under irradiation in Ni+Pb collisions at 1.9 AGeV (SIS18, GSI). This performance can be quantified as an efficiency close to 100% and a time resolution better than 100 ps.

HK 46.3 Di 17:15 WIL-A221

Load test of RPC prototypes — •Christian Simon and Norbert Herrmann for the CBM-Collaboration — Physikalisches Institut and Department of Physics and Astronomy, Ruprecht-Karls-Universität Heidelberg, D-69120 Heidelberg, Germany

The Time-of-Flight (ToF) wall of the Compressed Baryonic Matter experiment (CBM), conceptualized on the basis of high-resolution timing Multi-gap Resistive Plate Chambers (MRPC), is intended to account for concise hadron identification at an unprecedented event rate of 10 MHz. To explore the performance and limitations of the current design, high-rate tests with GSI/SIS-18 heavy ion beams irradiating the full surface of a 30×30 cm^2, fully differential multi-strip MRPC demonstrator have been performed in the fall of 2012.
A calibration scheme adjusted to the layout of the prototype has been developed and will be described. Preliminary results concerning efficiency and timing resolution will be presented as function of the incident particle flux.

Supported by EU/FP7 WP2; BMBF 06HD9121I.

HK 46.4 Di 17:30 WIL-A221

Significantly increased lifetime of recent microchannel-plate photomultipliers — •Alexander Britting, Wolfgang Eyrich, Albert Lehmann, and Fred Uhlig — Physikalisches Institut, Universität Erlangen-Nürnberg

Microchannel plate photo multipliers (MCP-PMT) are the favored sensors for the DIRC detectors (Detection of Internally Reflected Cherenkov Light) of the PANDA experiment. The main reasons for this are their usability in high magnetic fields of up to $2T$, a time resolution of better than $\sigma = 50ps$ and a rate capability high enough to withstand a detected photon rate of about 200 $kHz\,cm^{-2}$ at the MCP-PMTs surface, which is anticipated at the average luminosity of $2 \cdot 10^{32}\ cm^{-2}s^{-1}$ in PANDA. Moreover, for the reconstruction of the Cherenkov angle using the planned optics for the barrel DIRC a spatial resolution of about 5 mm at the focal plane is needed .

Until recently the major drawback of MCP-PMTs was their limited lifetime which was by far not sufficient to stand the integrated anode charge, which is $\approx 5C/cm^2$ for the Barrel-DIRC and even more for the Disc-DIRC. However, the latest MCP prototype devices show a hugh step forward in this respect. The results of these lifetime measurements will be presented. The achieved values are meanwhile close to the PANDA requirements for the Barrel-DIRC.

- supported by BMBF and GSI -

HK 46.5 Di 17:45 WIL-A221

Charakterisierung verschiedener Multi-Anoden Photodetektoren im CBM-RICH Strahltest 2012* — •Sascha Reinecke für die CBM-RICH-Kollaboration — Bergische Universität Wuppertal

In Darmstadt an der GSI wird derzeit die Facility for Antiproton and Ion Research (FAIR) gebaut. Eines der dort geplanten Projekte ist das Schwerionenexperiment Compressed Baryonic Matter (CBM). Ziel ist die Vermessung des QCD-Phasendiagramms bei hohen Netto-Baryonendichten und moderaten Temperaturen sowie die Charakterisierung des Phasenübergangs hadronischer Materie zum Quark-Gluon Plasma. Eine wesentliche Komponente des CBM-Detektors ist ein Ring-abbildender Cherenkov-Detektor (RICH), in welchem das Cherenkov-Licht schneller Teilchen ($v > c_n = c/n$) über sphärische Spiegel ringförmig auf den Photodetektor abgebildet wird.

Im Rahmen einer im Oktober 2012 durchgeführten Teststrahlzeit am CERN-PS Beschleuniger konnten wichtige Informationen unter anderem für den Aufbau des Photodetektors des RICH gewonnen werden. Ein Ziel der Strahlzeit war die Charakterisierung von neuen Hamamatsu Multi-Anoden Photomultipliern (MAPMT) des Typs R11265 sowie von Micro-Channel-Plates (MCP) des Typs XP85012 der Firma Planacon sowie der jeweilige Vergleich mit den Hamamatsu H8500 MAPMTs. Wichtige Eigenschaften, die dabei von Interesse sind, sind z.B. die Anzahl an detektierten Photonen pro Cherenkov-Ring oder auch die Ringbreite. Wir berichten über erste Resultate der Analyse der bei dieser Strahlzeit gewonnenen Daten.

*gefördert durch BMBF 05P12PXFCE, und GSI

HK 46.6 Di 18:00 WIL-A221

Tests of Silicon Photomultipliers for NeuLAND — •Tobias Reinhardt[1], Daniel Bemmerer[2], Thomas Cowan[1,2], Zoltán Elekes[2], Klaus Heidel[2], Mathias Kempe[2], Marko Röder[1], Daniel Stach[2], and Andreas Wagner[2] — [1]Institut für Kern- und Teilchenphysik, Technische Universität Dresden — [2]Helmholtz-Zentrum Dresden-Rossendorf (HZDR)

For upcoming large-scale neutron time-of-flight detectors like NeuLAND at FAIR the use of photomultiplier tubes is still state-of-the-art for the detection of the scintillation light. However, recent developments in the field of Silicon Photomultiplier indicate that they may also be suitable for this type of application. $3 \times 3\,\mathrm{mm}^2$ prototypes from various manufacturers were tested with small scale scintillators and a Sr-90 source. Using inhouse developed preamplifier boards, first time resolution measurements with a 270 cm long NeuLAND BC-408 scintillation bar were carried out at the electron accelerator ELBE.
— Supported by NupNET NEDENSAA (05 P09 CRFN5).

HK 46.7 Di 18:15 WIL-A221

Characterization Measurements of the new APD-Based Readout of the CB Calorimeter at MAMI and ELSA — •Christian Honisch for the CBELSA/TAPS-Collaboration — HISKP, Nussallee 14-16, 53175 Bonn, Germany

One goal of the CBELSA/TAPS-Experiment is the measurement of double polarization observables in meson photoproduction, with the Crystal Barral calorimeter (CB) as the central detector component. In the current setup the trigger efficiency for purely neutral reactions (e.g. $\gamma n \rightarrow n\pi^0$) is limited, because the CB is only integrated in the second level of the trigger. To improve the trigger efficiency for purely neutral channels, the existing PIN photo diode readout has to be replaced. The new avalanche photo diode (APD) readout will improve the signal to noise ratio and provide a timing signal fast enough, to include the CB in the first level trigger. The utilization of APDs allows the future operation of the CB calorimeter in a 2 T magnetic field.
A 3x3 matrix of CB crystals equipped with the new APD readout has been tested in the tagged photon beams at ELSA and MAMI. The results of these test measurements including energy resolution, time resolution, and active gain stabilization of the new APD readout electronics will be presented in this talk.
Supported by the Deutsche Forschungsgemeischaft (SFB/TR16) and Schweizerischer Nationalfonds.

HK 46.8 Di 18:30 WIL-A221

Wavelength Shifting Reflector Foils for Liquid Ar Scintillation Light — •Manuel Walter for the GERDA-Collaboration — Physik Institut, Universität Zürich, Schweiz

Liquid argon is used as a scintillator in several present and upcoming experiments. In Gerda it is used as a coolant, shielding and will be instrumented to become an active veto in Phase II. Its scintillation light has a wavelength of 128 nm, that gets absorbed by quartz. In order to measure the light using photo multiplier tubes (PMT) for cryogenic temperatures which have a quartz window, it is converted to longer wavelength by coated reflector foils. The conversion efficiency and stability of several such coatings was optimized using VM2000 and Tetratex separately as reflector foils. The efficiency has been measured in a liquid Ar set up build especially for this purpose. It employs a 3" low radioactivity PMT of type R11065-10 from Hamamatsu, the favorite photo sensor candidate to be used in Gerda.

HK 46.9 Di 18:45 WIL-A221

Wellenlängenkonvertierende Schichten auf Multianoden-Photomultipliern für den Einsatz im CBM Ring Imaging Cherenkov Detektor* — •Jan Kopfer für die CBM-RICH-Kollaboration — Bergische Universität Wuppertal

Der Ring Imaging Cherenkov Detektor (RICH) des Compressed Baryonic Matter Experiments (CBM) an der zukünftigen Beschleunigeranlage FAIR wird einen gasförmigen CO_2 Radiator verwenden. Wegen des $1/\lambda^2$ Verhaltens des Cherenkov-Spektrums und der guten Transmissionseigenschaften von CO_2 im ultravioletten Spektralbereich ist ein für kurzwellige Photonen sensitiver Photodetektor von Vorteil. Für den RICH Detektor wird der Einsatz von Multinanoden-Photomultiplieren (MAPMTs) in Betracht gezogen. Durch die Absorptionskante der Eintrittsfenster liegt die Quanteneffizienz der MAPMTs im Wellenlängenbereich von 200 nm bei etwa 10 %. Mit Hilfe von nasschemisch hergestellten Schichten aus organischen Molekülen, die UV-Photonen absorbieren und im sichtbaren Bereich über Fluoreszenz emittieren, kann die Detektoreffizienz gesteigert werden.

Wir stellen Untersuchungen zur Schichtdickenabhängigkeit vor, gehen auf den Unterschied zwischen tauchgezogenen und aufgedampften Schichten ein und zeigen Ergebnisse zur Photonenausbeute in einem RICH Prototypen während eines Strahltests am CERN PS.

* gefördert durch GSI-Projekt WKAMPE1012 und BMBF Verbundforschung 06WU9195I

HK 46.10 Di 19:00 WIL-A221

The precision high voltage system of the KATRIN-experiment — •Oliver Rest for the KATRIN-Collaboration — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster

The KATRIN- (KArlsruhe TRItium Neutrino-) experiment will measure the endpoint region of the tritium β decay spectrum to determine the mass of the $\overline{\nu}_e$. To achieve sub-eV sensitivity the energy of the decay electrons will be analyzed using a MAC-E type spectrometer. The retarding potential of the MAC-E-filter up to $-30\,\mathrm{kV}$ has to be monitored with a precision of 3 ppm.
To fine-tune the shape of the electric field inside the main spectrometer 46 different voltages can be applied to the wire electrode system inside the main spectrometer. All these channels are controlled by the KATRIN high voltage slow control system. The potential will be measured directly via two high precision voltage dividers, which were developed in cooperation with the PTB (Physikalisch-Technische Bundesanstalt) Braunschweig.

This talk will give an overview of the HV system and show first results of functionality tests performed at KIT (Karlsruher Institut für Technologie).

This project is supported by BMBF under contract number 05A11PM2.

HK 47: Beschleunigerphysik VII (Strahldynamik/Simulation)

Zeit: Dienstag 16:45–19:00 Raum: WIL-C203

HK 47.1 Di 16:45 WIL-C203

Understanding transverse tune spectrum for high intensity ions beams at GSI SIS-18 — •Rahul Singh[1,2], Peter Forck[1], Piotr Kowina[1], Oliver Boine-Frankenheim[1,2], Wolfgang Kaufmann[1], Kevin Lang[1], Rainer Haseitl[1], and Thomas Weiland[2] — [1]GSI, Darmstadt, Germany — [2]TEMF, TU Darmstadt, Germany

Several experiments involving transverse tune spectra measurements were performed at GSI SIS-18 with various beam intensities to understand the effect of intensity on tune spectra. Besides the machine tune, the spectra provides information about the intensity dependent coherent and the incoherent space charge tune shift. The space charge tune shift is measured from a fit of the observed shifted positions of the measured head tail modes to the predictions of an analytic model. Additionally, each mode is temporally identified by using a novel excitation mechanism and fast sampling ADCs. The longitudinal structure of each head tail mode gives a direct measurement of chromaticity.

HK 47.2 Di 17:00 WIL-C203

Bunch-by-Bunch Analysis of the LHC Heavy-Ion Luminosity and Potential Future Upgrades — •Michaela Schaumann — CERN, Geneva, Switzerland — RWTH Aachen, Aachen, Germany

The lead-ion bunches in the LHC are strongly influenced by intra-beam scattering, especially on the injection plateau of the LHC and even more of the SPS. In combination with the different times the bunches spend at each injection plateau, this results in a spread of the luminosity produced in each bunch crossing. The particle losses during collisions are dominated by nuclear electromagnetic processes, leading to a non-exponential intensity decay during the fill and short luminosity lifetime. The beam and luminosity evolution of the 2011 run was analysed bunch-by-bunch and compared with simulations. Based on this analysis, estimates of the potential luminosity performance at 6.5 Z TeV, after the present shutdown, and options to increase the luminosity are discussed.

HK 47.3 Di 17:15 WIL-C203

Emittance simulation for a different electron bunch charges with upgraded PITZ setup — •Grygorii Vashchenko — DESY, Platanenallee 6, 15738 Zeuthen

The photo injector test facility at DESY, Zeuthen site (PITZ) was invented with an aim to develop, characterize and optimize the electron sources for linac driven free electron lasers like FLASH and European XFEL. As a prerequisite for a successful experimental emittance optimization, emittance dependencies on the majority of linac parameters have to be studied in simulations. Despite that the nominal electron bunch charge for the operation of FLASH and XFEL is 1nC, there is an interest of the community to operate with other bunch charges. Emittance dependencies on such machine parameters like laser spot size on the photo cathode, laser pulse length, gun launching phase, focusing solenoid current and first accelerating structure gradient are simulated for different electron bunch charges. Based on the simulations data the systematic errors caused by detuning of the different machine parameters from their optimum values are estimated.

HK 47.4 Di 17:30 WIL-C203

Study on the 90m β^* optics for the ALFA experiment at the LHC — •Andy Langner[1,2] and Rogelio Tomás García[1] — [1]CERN, Geneva, Switzerland — [2]University of Hamburg, Germany

The ALFA experiment, which is located at the ATLAS interaction region, measures elastic scattering at very small angles in order to determine the absolute luminosity at the interaction point (IP). For that purpose, Roman Pot detectors are positioned very close to the LHC beam. The Luminosity determination requires very accurate knowledge of the accelerator optics in between the IP and the Roman Pots. Phase advances and beta functions can be measured by exciting beam oscillations and recording the turn-by-turn data with beam position monitors. Monte-Carlo simulations will be presented, which have been used to combine these optics measurements with constraints from different techniques, in order to find uncertainties in the model parameters.

HK 47.5 Di 17:45 WIL-C203

Dipol-Magnetdesign und Status der dritten Rezirkulation für den S-DALINAC* — •Michaela Kleinmann[1], Ralf Eichhorn[2], Sylvain Franke[3], Florian Hug[1], Norbert Pietralla[1] und Thomas Weiland[3] — [1]Institut für Kernphysik, Technische Universität Darmstadt, Darmstadt, Germany — [2]Cornell University, Ithaca, NY, USA — [3]Institut für Theorie Elektromagnetischer Felder , Technische Universität Darmstadt, Darmstadt, Germany

Der supraleitende Darmstädter Elektronenlinearbeschleuniger S-DALINAC wurde bis 1991 als 2-fach rezirkulierender Linac aufgebaut und wird seither erfolgreich betrieben. Allerdings konnte er seine Design-Endenergie von 130 MeV im cw-Betrieb bisher nicht erreichen, weil die Güten der supraleitenden Beschleunigungsresonatoren hinter den Erwartungen zurückblieben.

Die maximal erreichbare Strahlenergie kann jedoch durch den Bau einer dritten Rezirkulation erhöht werden. Ein technisches Design, entsprechende Strahldynamiksimulationen und der Entwurf neuer Magnete bilden die Grundlagen für dieses Projekt, das in 2014 mit dem Einbau in den S-DALINAC und anschließendem Betrieb umgesetzt werden soll.

Der Vortrag beschäftigt sich mit dem aktuellen Stand des Projekts und wird dabei näher auf das Design der benötigten, neuen Dipolmagneten eingehen. Vor allem der neue Separationsdipol spielt dabei eine wichtige Rolle.

* Gefördert durch die DFG im Rahmen des SFB 634

HK 47.6 Di 18:00 WIL-C203

Erhöhung der Energieschärfe des S-DALINAC durch nicht-isochrones Rezirkulieren* — •Florian Hug[1], Christoph Burandt[1], Ralf Eichhorn[2], Michaela Kleinmann[1], Martin Konrad[1], Thorsten Kürzeder[1] und Norbert Pietralla[1] — [1]Institut für Kernphysik, TU-Darmstadt, Schlossgartenstr. 9, 64289 Darmstadt — [2]Cornell Laboratory for Accelerator-Based Sciences and Education, Cornell University (CLASSE)

Der supraleitende Elektronenbeschleuniger S-DALINAC liefert Elektronenstrahlen mit einer Maximalenergie von 130 MeV und einem maximalen Strom von 20 μA im cw Betrieb für Experimente der Kernphysik und nuklearen Astrophysik.

Zur Erhöhung der Energieschärfe des rezirkulierten Elektronenstrahls soll in Zukunft ein nicht-isochrones Rezirkulationsschema verwendet werden, bei dem die Rezirkulationen mit einer definierten longitudinalen Dispersion betrieben werden, während die Beschleunigung nicht mehr im Maximum sondern auf der Flanke des Beschleunigungsfeldes erfolgt.

Wir stellen Simulationsrechnungen vor, die zur Charakterisierung des optimalen longitudinalen Arbeitspunkts durchgeführt wurden und vergleichen diese mit systematischen Messungen am Elektronenstrahl des S-DALINAC.

*Gefördert durch die DFG unter SFB 634

HK 47.7 Di 18:15 WIL-C203

Lifetime Studies at Metrology Light Source and ANKA — •Tobias Goetsch[1,2], Jörg Feikes[1], Markus Ries[1], Godehard Wüstefeld[1], and Anke-Susanne Müller[2] — [1]HZB, Berlin — [2]KIT, Karlsruhe

The Metrology Lightsource (MLS)*, situated in Berlin / Germany is an electron storage ring operating from 100 MeV to 629 MeV and is serving as the national primary radiation source standard from the near infrared to the vacuum ultraviolet spectral region. In its standard user mode, the lifetime is dominated by the Touschek effect. Measurements and analysis of the Touschek lifetime as a function of beam current, beam energy, filling pattern, RF-Voltage and emittance coupling will be presented and compared to measurements done at the ANKA electron storage ring (Karlsruhe / Germany) which operates at 0.5 to 2.5 GeV**.

* R. Klein et al., Phys. Rev. ST-AB 11, 110701 (2008)

** A.-S. Müller et al., Energy Calibration Of The ANKA Storage Ring,In Proceedings of EPAC 2004

HK 47.8 Di 18:30 WIL-C203

Die neue Strahlführung für Detektortests an ELSA — •Nikolas Heurich, Philipp Hänisch, Frank Frommberger und Wolfgang Hillert — Elektronen-Stretcher-Anlage ELSA, Physikalisches Institut, Universität Bonn

Gegenwärtig wird am Elektronenbeschleuniger ELSA eine neue externe Strahlführung aufgebaut, deren Aufgabe es ist, einen primären Elektronenstrahl für Detektortests zur Verfügung zu stellen. Damit steht die Beschleunigeranlage nicht nur für die momentan durchgeführten Doppelpolarisationsexperimente zur Baryonenspektroskopie zur Verfügung, sondern leistet auch ihre Dienste für das „Forschungs- und Technologiezentrum Detektorphysik“ zur Entwicklung von Detektoren für die Teilchen- und Astroteilchenphysik, welches unweit des Beschleunigers in Bonn errichtet wird.

Die Anforderungen an die neue Strahlführung ist, die Strahlparameter wie Strahlstrom und -breite über einen großen Bereich variieren zu können. Durch die an ELSA genutze Resonanzextraktion ist es möglich, die mit einer maximalen Energie von 3,5 GeV umlaufenden Elektronen langsam zu extrahieren und dem Testplatz einen quasikontinuierlichen externen Strahlstrom von 1 fA bis zu 100 pA anzubieten. Eine weitere Verringerung des Stroms lässt sich mit der Fertigstellung des Einzelpulsbetriebs an ELSA realisieren. Die Strahlbreite kann in beiden transversalen Richtungen kontinuierlich von 1 mm bis zu 8 mm verändert werden.

Der Vortrag gibt einen Überblick über die mit *MAD-X* und *elegant* durchgeführten Simulationen und den Aufbau der Strahlführung.

HK 47.9 Di 18:45 WIL-C203

Comparison of different approaches to determine the bursting threshold at ANKA — •Patrik Schönfeldt, Nicole Hiller, Vitali Judin, and Anke-Susanne Müller — Karlsruhe Institue of Technology

The synchrotron light source ANKA at the Karlsruhe Institute of Technology provides a dedicated low-α-optics. In this mode bursting of Coherent Synchrotron Radiation (CSR) is observed for bunch charges above a threshold that depends on beam parameters. This threshold can be determined by several approaches, e.g. bunch lengthening or changes in the THz radiation spectra. This talk compares different methods and their implementation at the ANKA storage ring outlining their advantages, disadvantages and limitations, including reliability and possibility of real time analysis.

HK 48: Beschleunigerphysik X (Injektoren)

Zeit: Dienstag 16:45–18:45 Raum: WIL-C205

HK 48.1 Di 16:45 WIL-C205

Ultrakurzzeitexperimente an der Quelle polarisierter Elektronen am Darmstädter S-DALINAC — •Markus Wagner, Joachim Enders, Martin Espig, Yuliya Fritzsche und Janina Lindemann — Institut für Kernphysik, TU Darmstadt, Deutschland

Der Darmstädter supraleitende Elektronen-Linearbeschleuniger S-DALINAC ist im Jahr 2010 um eine neue Quelle polarisierter Elektronen erweitert worden. Die polarisierten Elektronen werden durch Beschuss einer Strained-superlattice-GaAs-Photokathode mit zirkular polarisiertem Laserlicht erzeugt. Durch die Nutzung eines Titan-Saphir-Lasers mit Laserpulslängen von einigen 100 fs werden ultrakurzen Elektronenbunche am Ort der Photokathode erzeugt. 2012 ist die Quelle auf ihre Polarisations- und Pulslängeneigenschaften überprüft worden. Wir berichten über die Messung der Elektronenbunchlänge und über die Variation der Elektronenpolarisation über die zeitliche Entwicklung des Elektronenbunchs. Geplante Weiterentwicklungen werden vorgestellt.

Gefördert durch die DFG im Rahmen des SFB 634 und durch das Land Hessen im Rahmen des LOEWE-Zentrums HIC for FAIR.

HK 48.2 Di 17:00 WIL-C205

Multipactor discharge simulation for the RF Photo Gun at PITZ. — •Igor Isaev and Mikhail Krasilnikov — DESY, Platanenallee 6, 15738 Zeuthen, Germany

Multipactor discharge is the phenomenon of undesirable resonant secondary electron emission. The multipactor discharge may lead to operational problems of the RF systems such as vacuum breakdown, power losses, overheating and damage of RF components. The multipactor discharge simulations for the PITZ RF Photo Gun were performed by CST Studio. The Photo Injector Test facility at DESY, location Zeuthen (PITZ) was built to develop, test and optimize high quality beam source for Free Electron Lasers (FELs). The PITZ gun is a 1.6 cell L-band normal conducting RF cavity with a Cs2Te photocathode. Maximum accelerating field at the cathode is about 60 MV/m. The gun is surrounded by the pair of solenoids for beam focusing to counteract the space charge effect. The research of the multipactor discharge process in the PITZ Gun was performed.

HK 48.3 Di 17:15 WIL-C205

Emittance measurements on an SRF electron gun prototype — •Martin Schmeisser — Helmholtz-Zentrum Berlin

The SRF photoinjector is the concept of choice to achieve high average current, low emittance electron beams for the planned energy recovery linac test facility BERLinPro at Helmholtz-Zentrum Berlin. Emittance measurements and transverse phase space characterization of a beam delivered from a lead photocathode were performed at a dedicated cavity test stand using both slit based and solenoid scan techniques.

HK 48.4 Di 17:30 WIL-C205

Untersuchung der photoinduzierten Feldemission von Elektronen aus flachen n-Si-Kristallen — •Stephan Mingels, Benjamin Bornmann, Dirk Lützenkirchen-Hecht und Günter Müller — Bergische Universität Wuppertal

Moderne Freier-Elektronen-Laser wie XFEL oder FLASH stellen besondere Ansprüche an die Brillanz der Elektronenquelle. Derzeit werden Cs_2Te-Photokathoden eingesetzt, deren Billanz durch die thermische Emittanz begrenzt ist. Die *photoinduzierte Feldemission* (PFE) kombiniert die kurze Pulsdauer eines Lasers mit der geringen Emittanz feldemittierter Elektronen aus Metall- oder Halbleiterkathoden für robuste, hochbrillante Elektronenquellen. Deshalb wurde an der BUW ein UHV-PFE-Messsystem mit Gitterelektrode (Feldstärken bis zu 400 MV/m), durchstimmbarem Laser (0,5-5,9 eV) und Elektronenspektrometer (<38 meV Auflösung) zur Untersuchung flacher Kathoden aufgebaut [1]. Messungen zur PFE an flachen Au- und Ag-Kristallen unterschiedlicher Vorzugsorientierung zeigten resonante Elektronenemission sowie Hinweise auf PFE. So konnte an Ag(111) bei einer Photonenenerige von 4,68 eV, welche unterhalb der Austrittsarbeit von 4,74 eV liegt, eine exponentielle Feldabhängigkeit der Quanteneffizienz (QE) beobachtet werden. Jedoch wurden insgesamt nur geringe QE-Werte aufgrund der Relaxation der Elektronen im Metall gemessen. Daher sollen in Zukunft Messungen an Halbleiterkirstallen durchgeführt werden. Es sollen erste PFE-Ergebnisse an flachem n-Si gezeigt werden. [1] B. Bornmann et al., Rev. Sci. Instrum. 83, 013302 (2012)

HK 48.5 Di 17:45 WIL-C205

Emittance Compensation for an SRF Photo Injector — •H. Vennekate[1,6], A. Arnold[1], T. Kamps[2], P. Kneisel[7], P. Lu[1,6], P. Mucek[1], J. Teichert[1], J. Völker[2,5], V. Volkov[4], I. Will[3], and R. Xiang[1] — [1]HZDR — [2]HZB — [3]MBI — [4]BINP — [5]Humboldt Universität Berlin — [6]TU Dresden — [7]JLab

The development of a superconducting photo injector is an ongoing challenge at the HZDR in Dresden. Several milestones like the first operation of a half cell niobium cavity in 2002 and the worldwide first beam transfer from a $3\frac{1}{2}$-cell SRF gun into an actual accelerator structure have already been accomplished. Nevertheless, as superconducting electron sources are of great interest for future ERL or cw operated FEL projects, studies to improve their output parameters and stability continue to get them on the same level as their normal conducting counterparts. The talk is going to discuss several of the current approaches to reduce the transversal emittance of the next $3\frac{1}{2}$-cell cavity at the HZDR including the installation of a superconducting solenoid within the gun's cryostat.

HK 48.6 Di 18:00 WIL-C205

Das neue Injektionssystem für den Linac II am DESY — •Clemens Liebig, Markus Hüning und Michael Schmitz — DESY, Hamburg

Für den Linac II am DESY befindet sich ein neues Injektionssystem im Aufbau. Neben der Sicherung eines zuverlässigen Betriebs sollen damit die Strahlverluste bei hohen Energien vermieden werden. Es wurden Simulationen des Injektionsystems und des Linacs durchgeführt, um

den geplanten Aufbau zu untersuchen und hinsichtlich des Betriebs im Linac zu optimieren. Als Elektronenquelle dient eine 6A/100kV Triodengun. Die neue Hybridbuncherstruktur besteht aus einer Wanderwellenstruktur im $2\pi/3$ Mode an die eine Einfangzelle angekoppelt ist, die im π Mode betrieben wird. Eine der beiden gefertigten Buncherstrukturen vervollständigt nach dem Tuning den Teststand für das komplette Injektionssystem, der nach dem Konditionieren der Buncherstruktur für Tests unter Nutzung der umfangreichen Diagnostik zur Verfügung steht. Im Shutdown ab Sommer 2013 wird das neue System parallel zur bestehenden Injektion in Betrieb genommen.

HK 48.7 Di 18:15 WIL-C205

Optimization of the longitudinal phase space distribution of a 20 pC e-bunch at the RF-gun exit for quasi single spike operation at the European XFEL — Barbara Marchetti[1], Mikhail Krasilnikov[1], Frank Stephan[1], and •Igor Zagorodnov[2] — [1]DESY, Zeuthen, Germany — [2]DESY, Hamburg, Germany

The production of ultra-short (fs or sub-fs long), high power, radiation pulses in the X-ray spectral region, represents a challenge for many existent SASE FELs. In order to realize single spike lasing the length of the electron bunch after compression must be extremely small (less than a micrometer) thus it is necessary to tune the linac and magnetic compressors at the maximum compression point. In this setup, the final length of the e-bunch strongly depends on the non-linearity in its longitudinal phase space. The use of a third harmonic RF cavity placed right after the injector is foreseen at the European XFEL in order to correct the longitudinal phase space non-linearity up to the third order. In this paper we compare the compression of different longitudinal phase space distributions of a 20 pC e-bunch at the gun exit in terms of final e-bunch length, peak current, energy spread and RF-tolerance.

HK 48.8 Di 18:30 WIL-C205

Commissioning and Characterisation of the Photo-Injector Laser for Single-Spike Operation at FLASH — •Tim Plath[1], Juliane Rönsch-Schulenburg[1], and Bernd Steffen[2] — [1]Universität Hamburg, Deutschland — [2]Deutsches Elektronen Synchrotron, Hamburg, Deutschland

An important feature of FELs is the short duration of the light pulse, especially the generation of ultra-short FEL pulses. While there are several ways to achieve this, like seeding, the most robust one is to generate electron bunches with a length of only one optical mode. At FLASH, this length is about 1*m (3fs), which requires a charge of only about 20pC. The reduction of the charge also allows the shortening of the electron bunch duration directly at the photo cathode, which allows for stable operation with these short pulses. This requires a shorter photo-injector laser pulse and therefore a different photo-injector laser.

This talk presents the setup and commissioning of a new photo-injector laser system as well as first studies on laser beam characteristics, like beam position and distribution, spectra, temporal distribution and the stability of those properties. This partially requires the development of new diagnostics.

HK 49: Instrumentation

Zeit: Dienstag 16:45–19:00 Raum: WIL-C207

HK 49.1 Di 16:45 WIL-C207

Shaping of Cluster-Jet Beams for Storage Ring Experiments — •Ann-Katrin Hergemöller, Silke Grieser, Esperanza Köhler, Alexander Täschner, Hans-Werner Ortjohann, Daniel Bonaventura, and Alfons Khoukaz — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, 48149 Münster, Deutschland

With a cluster-jet target high and constant densities at the interaction point can be achieved and adjusted continuously during operation. At the University of Münster the prototype of the cluster-jet target for the PANDA experiment was built up in PANDA geometry and set successfully into operation. Due to observed structures within the cluster beam, a tilting system was installed, allowing for an adjustment of the nozzle system relative to the experimental setup. With this installation target densities of more than 2×10^{15} atoms/cm^2 were achieved at 2.1 m behind the nozzle. By the use of special shaped skimmers it is possible to determine the size and shape of the cluster beam at the later scattering chamber. Beside the absolutely target density also a low residual gas background at the interaction region is of high interest. Thus the identification of an optimized skimmer geometry will be of high relevance for the experimental conditions at PANDA. From measured cluster beam profiles it is possible to calculate both the expected areal density at the interaction point as well as the gas background. The results of target beam properties with a shaped cluster beam by slit collimators will be presented and discussed. Supported by EU (FP7), BMBF, and GSI F+E.

HK 49.2 Di 17:00 WIL-C207

Cluster Beam Visualization with MCPs — •Esperanza Köhler, Silke Grieser, Ann-Katrin Hergemöller, Alexander Täschner, Hans-Werner Ortjohann, Daniel Bonaventura, and Alfons Khoukaz — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, 48149 Münster, Deutschland

A cluster-jet target will be the first installed internal target for the PANDA experiment at HESR/FAIR. For performance studies a cluster-jet target prototype in complete PANDA geometry was already built up and set successfully into operation at the University of Münster. At present this target prototype is routinely operated with hydrogen and the use of other materials such as deuterium is also possible. The observation of distinct density structures within the jet beam behind the nozzle and the use of a new tilting system lead to areal target densities of more than 2×10^{15} atoms/cm^2 at a distance of 2.1 m. The thickness is reproducible, constant in time, and variable over several orders of magnitude. Depending on the experimental program the target beam size and shape is variable. This can be visualized by a new monitoring system based on a Micro Channel Plate (MCP), which allows for a direct observation of an ionized cluster beam. Therefore, the cluster beam is ionized by an electron beam and the signals in the MCP are observed by a phosphor screen in combination with a CCD camera. In this talk the performance of the cluster-jet target and MCP images of the cluster beam will be presented and discussed. Supported by EU (FP7), BMBF, and GSI F+E.

HK 49.3 Di 17:15 WIL-C207

Optimization of Atomic Beam Sources for Polarization Experiments — •Martin Gaisser, Alexander Nass, and Hans Ströher — IKP, Forschungszentrum Jülich

For experiments with spin-polarized protons and neutrons a dense target is required. In current atomic beam sources an atomic hydrogen or deuterium beam is expanded through a cold nozzle and a system of sextupole magnets and RF-transition units selects a certain hyperfine state. The achievable flux seems to be limited to about 10^{17} particles per second with a high nuclear polarization. A lot of experimental and theoretical effort has been undertaken to understand all effects and to increase the flux. However, improvements have remained marginal. Now, a Monte Carlo simulation based on the DSMC part of the open source C++ library OpenFOAM is set up in order to get a better understanding of the flow and to optimize the various elements. It is intended to include important effects like deflection from magnetic fields, recombination on the walls and spin exchange collisions in the simulation and make quantitative predictions of changes in the experimental setup. The goal is to get a tool that helps to further increase the output of an atomic beam source. So far, a new binary collision model, magnetic fields, RF-transition units and a tool to measure the collision age are included. The next step will be to couple the whole simulation with an optimization algorithm implementing **A**daptive **S**imulated **A**nnealing (ASA) in order to automatically optimize the atomic beam source.

HK 49.4 Di 17:30 WIL-C207

Production of short lived radioactive molecular ion beams at ISOLDE/CERN — •Christoph Seiffert[1,2], Thierry Stora[1], Thorsten Kroell[2], Alexander Gottberg[1], and Matthias Kronberger[1] — [1]CERN — [2]TU Darmstadt

The ISOLDE facility at CERN offers a wide range of radioactive isotopes all over the nuclear chart with half lives down to milliseconds for various types of experiments in nuclear structure. Nevertheless some

isotopes are not yet extractable in a decent amount. The reasons for this are diverse. For the case of Carbon and Boron isotopes one reason is, that the boiling point of these elements is above the maximum achievable operation temperature of the target units. Forming with these elements more volatile molecules, e.g. oxides or fluorides, enables their *extraction* at accessible temperatures. Even when the molecules are produced, the extraction is not necessarily possible. For instance chemical reactivity might cause an irreversible interaction and losses of the molecules with the target container material. When a chemically inert material is used high adsorption enthalpies of the molecules on the surface can induce sticking times for a multiple of the half live of the isotope and thus leads to decay losses. The presentation shows the progress of the investigations and on-line results.

HK 49.5 Di 17:45 WIL-C207

Measurement of Nuclear Polarization in H_2 and D_2 Molecules after Recombination of polarized H or D Atoms — •Robert Gorski — Institut für Kernphysik, FZ Jülich, Germany

The increased interest in spin-dependent observables requires the production of polarized internal gas targets (PIT) and ion beams like at ANKE/COSY. The ABS beam intensity seems to saturate and limits, therefore, the target-gas density. By cooling down the storage cell, the polarized atoms become slower and this results in an increase of the target-gas density. But temperatures below $\sim$ 100 Kelvin are not possible due to large polarization losses. One option to cross the limit is the use of polarized molecular hydrogen or deuterium which results from the recombination of polarized atoms before, because the polarization of the gas molecules should not depend much on the temperature. It is known that polarized hydrogen atoms, recombining on a copper surface, maintain up to one half of their nuclear polarization in sufficiently strong magnetic fields. It is the aim of the present project to study the nuclear polarization of recombined hydrogen and deuterium molecules by variation of the boundary conditions like temperature, magnetic field and surface material. It might be possible to increase the figure of merit of double polarized experiments by increasing the target density without too large polarization losses. This experience may help to produce gas of polarized molecular deuterium for future nuclear fusion experiments with polarized fuel.

HK 49.6 Di 18:00 WIL-C207

Detector for polarized internal target experiments — •Christian Weidemann for the PAX-Collaboration — Institut für Kernphysik, FZ-Jülich — University of Ferrara, Italy

The PAX collaboration is aiming to reveal the mystery of the proton spin and its interpretation in terms of its internal constituents. A multitude of findings, e.g. the transversity, which are accessible via $\vec{p}$(bar)$\vec{p}$ scattering experiments, led the Polarized Antiproton eXperiments (PAX) collaboration to propose such investigations at the High Energy Storage Ring (HESR) of the Facility for Antiproton and Ion Research (FAIR).
Already the production of intense polarized antiproton beams is still an unsolved problem. A dedicated experimental program with protons at the COSY storage ring in Jülich confirmed the validity of the spin-filtering method to polarize a stored beam. Subsequently, spin filtering has to be realized with antiprotons. The $\vec{p}$(bar) beam polarization will be measured by elastic $\vec{p}$(bar)$\vec{p}$ scattering. For this purpose a ϕ-symmetric detection system based on 24 silicon microstrip detectors of different thickness, that allows the measurement of all spin observables, is under development. The operation close to the target region within the accelerator vacuum, demands for UHV capability and a dedicated cooling system. Its versatility is essential for additional experiments, such as the study of three nucleon continuum in proton deuteron breakup reactions or time reversal invariance tests at COSY. The talk outlines the status of the detector development.

HK 49.7 Di 18:15 WIL-C207

New fiber detector with nXyter readout for tracking of radioactive beams — •Philipp Schrock for the R3B-Collaboration — Institut für Kernphysik, TU Darmstadt

The R^3B setup (Reactions with Relativistic Radioactive Beams) at FAIR will allow kinematically complete measurements in order to study various astrophysical and nuclear structure questions. The mass number A of the beamlike particles will be determined from the deflection in a magnetic field. To achieve an adequate mass resolution a new fiber detector for tracking of heavy fragments has been designed and tested.

The detector is built of 1024 scintillating optical fibers with a width of 250 μm each. All individual fibers are read out separately. The needed 1024 electronic channels are realized by using position sensitive photomultiplier tubes and nXyter (neutron-X-Y-time-energy readout) chips. The nXyter is a self-triggered ASIC with 128 independent channels which buffer charge and time information for each hit in each fiber. It is included in the triggered R^3B-LAND setup with the help of "Gemex" front-end boards. Each board has implemented two nXyter and an FPGA which controls the nXyter and which sorts their data to packages with respect to external triggers.

The detector was in use with different modifications of Gemex boards during several experiments, partially in vacuum. Besides the detector itself a first analysis of its data will be presented.

This work is supported by HIC for FAIR, GSI, NAVI and the BMBF project 06DA7047I.

HK 49.8 Di 18:30 WIL-C207

Messungen der elektronischen Spin-Gitter-Relaxationszeiten mit Hilfe der NEDOR-Methode — •Jonas Herick, Alexander Berlin, Christian Hess, Werner Meyer, Gerhard Reicherz und Hendrik Vondracek — Institut für Experimentalphysik I - AG, Ruhr-Universität Bochu,

Ein Parameter, der entscheidenden Einfluss auf den Prozess der Dynamischen Nukleonen Polaristion (DNP) hat, ist die elektronische Spin-Gitter-Relaxationszeit T_{1e} der eingebrachten paramagnetischen Zentren. Einen Zugang zu diesem Parameter bietet die sogenannte NEDOR-Methode (**N**uclear-**E**lectron **Do**uble **R**esonance), mit deren Hilfe der Einfluss verschiedener Größen auf diese Zeit untersucht wurde.

HK 49.9 Di 18:45 WIL-C207

UF_6 as a Detector Gas for Fission Studies* — •Christian Eckardt[1], Joachim Enders[1], Martin Freudenberger[1], Alf Göök[2], Peter von Neumann-Cosel[1], Andreas Oberstedt[3,4], and Stephan Oberstedt[2] — [1]Institut für Kernphysik, Technische Universität Darmstadt — [2]Institute for Reference Materials and Measurements,JRC, European Commission, 2440 Geel, Belgium — [3]Akademin för naturvetenskap och teknik, Örebro Universitet, 70182 Örebro, Sweden — [4]Fundamental Fysik, Chalmers Tekniska Högskola, 41296 Göteborg, Sweden

A Frisch-grid ionization chamber has been built to test a mixture of argon with gaseous UF_6 and to study its properties as a counting gas. We present first results using increasing mass fractions of $^{238}UF_6$ mixed into argon. The drift velocity of the electrons increases with the content of $^{238}UF_6$, while a good signal quality and energy resolution of the ionization chamber is preserved.

Using uranium hexafluoride in the detector gas may give access to experiments where extremely high luminosity is required in combination with good angular and energy and/or mass resolution. Examples comprise the investigation of spontaneous fission of ^{238}U, the study of parity non-conservation in the fission process, or precision measurements of fission fragments with good resolution using tagged photons in the entrance channel.

* Work supported by DFG through SFB 634, by the state of Hesse through the LOEWE center HIC for FAIR, and through the GSI-TU-Darmstadt cooperation.

HK 50: Poster - Fundamentale Symmetrien

Zeit: Mittwoch 16:45–16:45 Raum: HSZ 1.OG

HK 50.1 Mi 16:45 HSZ 1.OG

aSPECT: Improvement of the high voltage electrodes — •Michael Klopf[1], Jacqueline Erhart[1], Gertrud Konrad[1], and Torsten Soldner[2] for the aSPECT-Collaboration — [1]Atominstitut, TU Wien, Austria — [2]Institut Laue-Langevin, Grenoble, France

The purpose of the retardation spectrometer aSPECT is to determine the anti-neutrino electron angular correlation coefficient a with high precision, by measuring the integral proton spectrum in free neutron decay. The precise measurement of the correlation coefficient a serves as a test of the validity of the Standard Model.
The analysis of the decay protons is based on a precise energy measurement, by means of an electrostatic filter. Hereby the independence of the background from the filter potential is a basic prerequisite for the determination of a. However, in previous measurements with aSPECT some dependencies have been found. The background, first mainly caused by strong discharge phenomena, has already been significantly reduced by the re-design of several electrodes. In order to reach our design accuracy in a, we have to further suppress this dependency. We therefore improved the shape of our high voltage electrodes to further reduce the electric field and thereby the probability for field emission. The theoretical background of such discharge phenomena as well as the optimization of the high voltage electrodes will be presented.

HK 50.2 Mi 16:45 HSZ 1.OG

$\mathbf{R}\times\mathbf{B}$ drift momentum spectrometer for PERC — •Xiangzun Wang, Gertrud Konrad, and Hartmut Abele — Atominstitut, TU Wien, Austria

We propose a new type of momentum spectrometer, which uses the $\mathbf{R}\times\mathbf{B}$ drift effect to disperse the charged particles in a uniformly curved magnetic field, and measures the particles with large phase space acceptance and high resolution. This kind of $\mathbf{R}\times\mathbf{B}$ spectrometer is designed for the momentum analyses of the decay electrons and protons in the PERC (Proton and Electron Radiation Channel) beam station, which provides a strong magnetic field to guide the charged particles in the instrument. Instead of eliminating the guiding field, the $\mathbf{R}\times\mathbf{B}$ spectrometer evolves the field gradually to the analysing field, and the charged particles can be adiabatically transported during the dispersion and detection. The drifts of the particles have similar properties as their dispersion in the normal magnetic spectrometer. Besides, the $\mathbf{R}\times\mathbf{B}$ spectrometer is especially ideal for the measurements of particles with low momenta and large incident angles. We present a design of the $\mathbf{R}\times\mathbf{B}$ spectrometer, which can be used in PERC. For the particles with solid angle smaller than 88 msr, the maximum aberration is below 10^{-4}. The resolution of the momentum spectra can reach 14.4 keV/c, if the particle position measurements have a resolution of 1 mm.

HK 51: Poster - Beschleunigerphysik

Zeit: Mittwoch 16:45–16:45 Raum: HSZ 1.OG

HK 51.1 Mi 16:45 HSZ 1.OG

Teststand zur Optimierung und Reinigung von Photokathoden auf GaAs-Basis — •Martin Espig, Joachim Enders, Yuliya Fritzsche, Neeraj Kurichiyanil und Markus Wagner — Institut für Kernphysik, Technische Universität Darmstadt

Eine Quelle spinpolarisierter Elektronen wurde vor Kurzem am supraleitenden Darmstädter Elektronen-Linearbeschleuniger S-DALINAC in Betrieb genommen. Die Kathoden für die polarisierte Quelle sollen an einem separaten Teststand mit atomarem Wasserstoff gereinigt und die Präparationsprozeduren optimiert werden, um über lange Betriebszeiten hohe Quantenausbeuten gewährleisten zu können.
Gefördert durch die DFG im Rahmen des SFB 634 und durch das Land Hessen im LOEWE-Zentrum HIC for FAIR.

HK 51.2 Mi 16:45 HSZ 1.OG

Gepulste magnetische Quadrupollinsen — •Carmen Tenholt[1], Peter Spiller[2], Isfried Petzenhauser[2], Udo Blell[2] und Oliver Kester[1,2] — [1]IAP, Frankfurt University, Germany — [2]GSI, Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany

Zur finalen Fokussierung eines Ionenstrahls oder zum Transfer von Ionen zwischen Synchrotronen werden eisenfreie, hochstromgepulste Quadrupollinsen entwickelt. Es wird mindestens eine Dublette zur Fokussierung benötigt, die über ihr erzeugtes Magnetfeld den Ionenstrahl in beide Achsenrichtungen staucht. Um den gewünschten Magnetfeldgradienten zu erreichen, wird ein Strom von ca. 400 kA benötigt. Um diesen hohen Strom erzielen zu können, wird gepulst gearbeitet. Der Puls, welcher einige 10 microsec andauern soll, entsteht durch das Entladen einer Kondensatorbank über eine Funkenstrecke. Diese führt den Strom dann zu vier in Reihe geschaltete Leiter weiter. Die Leiter der Linse sollen aus vielen einzelnen Litzen aufgebaut sein, die verdrillt und gegeneinander isoliert verlaufen. So wird dem Skin-Effekt Rechnung getragen. Die Leiter haben eine spezielle Form, die unter Berücksichtigung der Dicke und deren Abstand zum Strahl einer cos (2teta)Verteilung entspricht. Angedacht wird noch eine Abschirmung um die Linse herum, die laminiert konstruiert werden soll, um die Entstehung von Wirbelströmen zu vermeiden.

HK 51.3 Mi 16:45 HSZ 1.OG

TELBE - the super-radiant THz facility at ELBE — •Bertram Green[1], Sergei Kovalev[1], Jens Hauser[1], Michael Kuntzsch[1], Alaa Al-Shemmary[2], Harald Schneider[1], Stephan Winnerl[1], Wolfgang Seidel[1], Sergei Zvyagin[1], Simon Wall[5], Ilie Radu[2], Lukas M Eng[3], Ulf Lehnert[1], Manfred Helm[1], Nikola Stojanovic[2], Joachim Heberle[4], Andrea Cavalleri[2], Peter Michel[1], and Michael Gensch[1] — [1]Helmholtz-Zentrum Dresden Rossendorf — [2]Deutsches Elektronen-Synchrotron — [3]Technische Universitaet Dresden — [4]FU Berlin — [5]FHI Berlin

It has been shown recently that relativistic electron bunches can be utilized for the generation of super-radiant coherent THz radiation by one single pass through an undulator, bending magnet, or CDR/CTR screens. However, the high THz fields have all been achieved at large accelerators that allow for high electron beam energies. A crucially important research topic for the next years at the HZDR is therefore to investigate whether an equally fine control over highly charged electron bunch form can be routinely achieved in a low electron beam energy accelerator like ELBE. If successful this development would allow the generation of high field THz fields by linear accelerators at considerably reduced cost. Given stable operation can be provided, TELBE, could also become a world-wide unique research facility for high field THz science. The current status and an outlook on future developments are presented.

HK 51.4 Mi 16:45 HSZ 1.OG

Few Femtosecond level electron bunch diagnostic at quasi-cw electron accelerators — •Bertram Green[1], Michael Kuntzsch[1], Sergei Kovalev[1], Al-Shemmary Alaa[2], Jens Hauser[1], Stefan Findeisen[1], Christian Schneider[1], Caglar Kaya[1], Nikola Stojanovic[2], Peter Michel[1], and Michael Gensch[1] — [1]Helmholtz-Zentrum Dresden Rossendorf — [2]Deutsches Elektronen-Synchrotron

At the SRF based prototype cw accelerator ELBE a new electron beamline, providing for femtosecond electron bunches with nC bunch charges and repetition rates in the 1-200 KHz regime and with pC bunch charge and repetition rates of 13 MHz, is currently being constructed. The 40 MeV electrons will be used in photon-electron interaction experiments with TW and PW class lasers and the generation of broad and narrow bandwidth coherent THz pulses. Discussed here are ideas for novel online diagnostics of the electron bunch properties (e.g. arrival time and bunch form) based on the time and frequency domain analysis of the emitted coherent THz radiation, but also based on direct measurements by e.g. electro-optic sampling. The suitability of ELBE as a testbed for diagnostic of future cw X-ray photon sources (e.g. energy recovery linacs) will be discussed.

HK 51.5 Mi 16:45 HSZ 1.OG

Berechnung von Eigenmoden für die GSI SIS18 Ferritkavität

— •Klaus Klopfer, Wolfgang Ackermann und Thomas Weiland — Theorie Elektromagnetischer Felder, TU Darmstadt, Darmstadt, Deutschland

Das GSI Helmholtzzentrum für Schwerionenforschung in Darmstadt betreibt das Schwerionensynchrotron SIS18, um die Energie stabiler Kerne verschiedener Ordnungszahl nach einer Vorbeschleunigung weiter zu erhöhen. Hierzu sind im Ring zwei ferritgeladene Kavitäten installiert. Während der Phase der Beschleunigung ist es erforderlich, die Resonanzfrequenz dieser Resonatoren an die Umlauffrequenz der Teilchen anzupassen, da die Geschwindigkeit der schweren Ionen während der Energiezufuhr kontinuierlich ansteigt. Zu diesem Zweck sind innerhalb der Kavität spezielle vormagnetisierte Ferritringe angebracht, die eine breitbandige Frequenzabstimmung ermöglicht. Durch Wahl eines geeigneten Vormagnetisierungsstromes können die differentielle Permeabilität des Ferritmaterials und damit letztlich die Eigenfrequenz des Systems angepasst werden. Neben den geometrischen Abmessungen des Resonators bestimmen vor allem die magnetischen Eigenschaften der Ferrite die Resonanzfrequenz. Im vorliegenden Beitrag wird die numerische Bestimmung der niedrigsten Eigenmoden der GSI SIS18 Ferritkavität vorgestellt, wofür ein neuer Eigenwertlöser auf Basis der Methode der Finiten Integration entwickelt wurde.

HK 51.6 Mi 16:45 HSZ 1.OG

Numerische Berechnung elektromagnetischer Felder in Beschleunigungsresonatoren unter präziser Berücksichtigung der Kopplerstrukturen — •Cong Liu, Wolfgang Ackermann, Wolfgang F.O. Müller und Thomas Weiland — Institut für Theorie Elektromagnetischer Felder , Technische Universität Darmstadt , Darmstadt, Deutschland

Die Beschleunigung mit supraleitenden Hochfrequenz (HF)-Kavitäten erfordert geeignete Koppler, um die Energie von der HF-Quelle zum Teilchenstrahl zu transportieren. Gleichzeitig müssen Koppler zur Extraktion der Moden höherer Ordnung (HOM) für die Dämpfung der parasitären Felder eingesetzt werden. Aufgrund des damit einhergehenden Energietransports ist die numerische Eigenmodenanalyse bezogen auf reellwertige Größen für die Beschreibung der verlustbehafteten Beschleunigungsstrukturen nicht mehr geeignet. Am Institut für Theorie Elektromagnetischer Felder (TEMF) steht mittlerweile ein paralleler, robuster Eigenwertlöser zur Berechnung der Eigenmoden in verlustbehafteten Beschleunigungsstrukturen zur Verfügung. Der Eigenwertlöser beruht auf komplexwertiger Finite-Elemente-Analyse und verwendet Basisfunktionen bis zur zweiten Ordnung auf quadratischen Tetraeder-Elementen, um eine präzise Simulation für die ellipsenförmigen Kavitäten zu ermöglichen. Der Eigenwertlöser wurde auf die TESLA 1,3 GHz-Beschleunigungskavität angewandt, um die Resonanzfrequenz, den Gütefaktor und die entsprechende Verteilung elektromagnetischer Felder für alle Eigenmoden bis zum fünften Dipol-Passband (3,12 GHz) zu bestimmen.

HK 51.7 Mi 16:45 HSZ 1.OG

Chopping High Intensity Proton Beams — •Christoph Wiesner, Hannes Dinter, Martin Droba, Oliver Meusel, Ilja Müller, Daniel Noll, Onur Payir, Ulrich Ratzinger, and Philipp Schneider — IAP, Goethe-Universität Frankfurt, Max-von-Laue-Str. 1, 60438 Frankfurt am Main

A novel E×B chopper system for high intensity proton beams is being developed to deliver 100 ns beam pulses in the low energy transport line of the accelerator driven neutron source FRANZ [1]. It combines a static magnetic deflection field with a pulsed electric compensation field in a Wien filter-type E×B configuration. Behind the deflection unit a massless septum system is used for beam separation. The setup minimizes the risk of voltage breakdowns and provides secure beam dumping outside the transport line.

The electric deflection field is driven by a HV pulse generator providing ±6 kV at a repetition rate of 250 kHz. Accurate layout of the deflection plates is required to tackle the issues of field quality, cooling and spark prevention.

Careful matching of electric and magnetic deflection forces is required to prevent aberrations and emittance growth. [2] Numerical studies for the field design and their effects on beam transport are presented and an overview of the hardware development is given.

[1] U. Ratzinger et al., Proc. of IPAC2011, San Sebastián, Spain, WEPS040

[2] C. Wiesner et al., Proc. of IPAC2012, New Orleans, LA., USA, THPPP074

HK 51.8 Mi 16:45 HSZ 1.OG

Transverse Phase Space Measurement of SRF-gun in HZDR using Single Slit Method — •Pengnan Lu[1,2], Jochen Teichert[1], Hannes Vennekate[1,2], Petr Murcek[1], Rong Xiang[1], and André Arnold[1] — [1]Helmholtz Zentrum Dresden Rossendorf, Dresden, Germany — [2]Dresden University of Technology, Dresden, Germany

A three-and-a-half-cell SRF-gun has been developed and commissioned in HZDR since 2004. The emittance of this gun was measured before by both solinoid/quadrupol scanning method and multiple slits method. Recently we did new measurements via single slit method to obtain the beam phase space with a higher space resolution and without the overlapping problem.

At first the hardware system composed of slit boards, a YAG screen and a camera will be described. Then the interface and structure of a labview program for data acquisition and processing will be shown. In data processing we will discuss the image correction, sensitivity of several parameters to the final result and how the background was eliminated. Finally we will give the estimation of the measurement error and the analysis of phase space measurement of both electron current and dark current. For electron current, the normalized rms emittance has a good agreement with that measured by solenoid scanning. For dark current, the phase space shows clearly two components, which echoes the assumption that both the cathode and the cavity contribute part of the dark current with different phases.

HK 51.9 Mi 16:45 HSZ 1.OG

Eigenvalue study of a chaotic resonator — •Todorka Banova[1,2], Wolfgang Ackermann[1], and Thomas Weiland[1] — [1]Technische Universität Darmstadt, Institut für Theorie Elektromagnetischer Felder (TEMF), Schlossgartenstraße 8, D-64289 Darmstadt, Germany — [2]Technische Universität Darmstadt, Graduate School of Computational Engineering, Dolivostraße 15, D-64293 Darmstadt, Germany

The field of quantum chaos comprises the study of the manifestations of classical chaos in the properties of the corresponding quantum systems. Within this work, we compute the eigenfrequencies that are needed for the level spacing analysis of a microwave resonator with chaotic characteristics. The major challenges posed by our work are: first, the ability of the approaches to tackle the large scale eigenvalue problem and second, the capability to extract many, i.e. order of thousands, eigenfrequencies for the considered cavity. The first proposed approach for an accurate eigenfrequency extraction takes into consideration the evaluated electric field computations in time domain of a superconducting cavity and by means of signal-processing techniques extracts the eigenfrequencies. The second approach is based on the finite element method with curvilinear elements, which transforms the continuous eigenvalue problem to a discrete generalized eigenvalue problem. Afterwards, the Lanczos algorithm is used for the solution of the generalized eigenvalue problem. In the poster, a summary of the applied algorithms, as well as, critical implementation details together with the simulation results will be provided.

HK 51.10 Mi 16:45 HSZ 1.OG

Simulations of beam transport at FRANZ — •Ole Hinrichs, Oliver Meusel, Kerstin Sonnabend, Rene Reifarth, Daniel Noll, Malte Schwarz, Manuel Heilmann, and Stefan Schmidt — Goethe-Universität Frankfurt

The Frankfurt Neutron Source at the Stern-Gerlach-Zentrum (FRANZ) currently under construction is operated by a proton beam of up to 20 mA current with energies between 1.8 and 2.2 MeV. This facility aims to explore proton- and neutron-induced reactions of astrophysical interest. The high proton flux is well suited for studying p-nuclei. Their nucleosynthesis might yield hints on the physics of type Ia supernovae. Furthermore, FRANZ will offer the opportunity to measure radiative neutron capture reactions for the unstable branch point nuclei of the s-process.

This poster will present the current status of the beam line towards the neutron production target and the setup to measure proton-induced reactions. It will focus on simulations to optimise beam transport and phase space distribution with respect to a variable beam spot size to provide optimal experimental conditions.

This project is supported by the DFG (SO907/1-2), the Helmholtz International Center for FAIR, the Helmholtznachwuchsgruppe VH-NG-327.

HK 51.11 Mi 16:45 HSZ 1.OG

Quantifizierung von durch Messfehler bedingten Unsicherheiten in Magnetfeldern — Andreas Bartel[1], Herbert

De Gersem[2], Timo Hülsmann[1], •Ulrich Römer[3], Sebastian Schöps[3,4] und Thomas Weiland[3] — [1]Bergische Universität Wuppertal, Chair of Applied Mathematics, Wuppertal, Germany — [2]KU Leuven, Wave Propagation and Signal Processing Group, Kortrijk, Belgium — [3]Technische Universität Darmstadt, Institut für Theorie Elektromagnetischer Felder, Darmstadt, Germany — [4]Technische Universität Darmstadt, Graduate School of Computational Engineering, Darmstadt, Germany

Eine Herausforderung im Designprozess für Beschleunigermagnete ist das stark nichtlineare Verhalten ferromagnetischer Materialien. Da die nichtlineare BH-Kennlinie durch Messungen bestimmt wird enthalten Simulationsergebnisse, wie die Berechnung von Multipolkoeffizienten, zwangsläufig Unsicherheiten. Zu deren Quantifizierung wurden in letzter Zeit verschiedene neue Verfahren vorgeschlagen, darunter das stochastische Kollokationsverfahren mit polynomialen Chaos. Ein zentraler Vorteil dieses Verfahrens ist der nicht-intrusive Charakter, das heißt bestehende Simulationsverfahren können direkt weiterverwendet werden. Diese Arbeit beschreibt die Anwendung einer stochastischen Kollokationsmethode zur Quantifizierung von Unsicherheiten in den Multipolkoeffizienten eines Beschleunigermagneten. Die Materialkennlinie wird durch das Brauermodell mit entsprechenden Messunsicherheiten modelliert. Als Anwendung werden Ergebnisse für einen Dipolmagneten gezeigt.

HK 51.12 Mi 16:45 HSZ 1.OG

Die gekoppelte RFQ-IH Kombination der Neutronenquelle FRANZ — •Manuel Heilmann, Dominik Mäder, Oliver Meusel, Ulrich Ratzinger, Alwin Schempp und Malte Schwarz — Goethe Universität, Frankfurt

Die Frankfurter Neutronenquelle am Stern-Gerlach Zentrum (FRANZ-Projekt) liefert Neutronen hoher Intensität mit einer Energie zwischen 1 und 300 keV. Die Neutronen werden mit 2 MeV Protonen über eine 7Li(p,n)7Be Reaktion erzeugt. Die Linearbeschleuniger-Sektion enthält einen 4-Rod-RFQ gekoppelt an eine 8 Spalt IH-Kavität mit einer Gesamtlänge von 2,3 m. Die RFQ-IH-Kombination ermöglicht dabei einen Energiehub von 120 keV auf 2,03 MeV bei 175 MHz und einer Verlustleistung um 200 kW. Die gekoppelte Struktur wird von einem HF-Sender betrieben, um Anschaffungs- bzw. Betriebskosten zu sparen. Die Leistung wird induktiv in den RFQ eingekoppelt und die IH-Struktur wird über eine induktive interne Kopplung mit angeregt. Die RFQ-IH Kombination ist mit numerischen Simulationen und an einem HF-Model untersucht worden. Die longitudinale Spannungsverteilung entlang der Elektroden, die Frequenz und das Spannungsverhältnis zwischen beiden Kavitäten müssen für den Betrieb zueinander passen. Die RFQ Elektroden sind für einen Strahlstrom von 50 mA ausgelegt. Die Kavitäten werden wegen der kritischen Zeitstruktur im Dauerstrich (cw) betrieben, denn der Strahl ist mit 100 ns (250 kHz) gepulst.

HK 51.13 Mi 16:45 HSZ 1.OG

Beam Dynamics in a Rebunching CH Cavity with High Space Charge — •Malte Schwarz, Manuel Heilmann, Oliver Meusel, Daniel Noll, Holger Podlech, Ulrich Ratzinger, and Anja Seibel — Institute for Applied Physics, Goethe-University, Frankfurt/Main, Germany

The Frankfurt Neutron Source at the Stern-Gerlach-Zentrum (FRANZ) will provide ultra short neutron pulses at high intensities and repetition rates. The facility is under construction with expected first beam in 2013. It will allow research on nucleosynthesis of elements in stars by the s-process as well as on neutron capture cross sections for activation experiments providing knowledge gain on transmutation of radioactive waste and fusion reactor materials. The 5-gap CH rebuncher is installed behind a coupled RFQ/IH-DTL combination and completes the LINAC section. It will be used for varying the output energy between 1.8 and 2.2 MeV as well as for focusing the proton beam bunch longitudinally to compensate the huge space charge forces at high currents up to 200 mA.

Therefore beam dynamics and beam transport performance research on this CH cavity is under progress. It includes benchmarking of different beam dynamic codes like LORASR, TraceWin and a new particle-in-cell tracking code for non-relativistic beams currently under development at IAP as well as validation of the results by measurements. Furthermore, this CH rebuncher serves as prototype for CH cavity operation at MYRRHA (Mol, Belgium), an Accelerator Driven System (ADS) for transmutation of high level nuclear waste.

HK 51.14 Mi 16:45 HSZ 1.OG

Neue Methode zur Reduzierung des Anteils der Strahlposition im quadrupolaren Signal — •Joel Alain Tsemo Kamga, Wolfgang F. O. Müller und Thomas Weiland — Theorie Elektromagnetischer Felder, Schloßgartenstrasse 8, 64289 Darmstadt

Quadrupolare Pickups sind in der Beschleunigerphysik von besonderer Bedeutung, weil sie die Messung bestimmter Parameter, wie der transversalen Ausdehnung des Strahls, ermöglichen. Dennoch ist das quadrupolare Signal aus einem üblichen elektrostatischen Pickup mit vier Elektroden nicht nur proportional zur r.ms. der Strahldimension ($\sigma_x^2-\sigma_y^2$), sondern hängt auch von der Strahlposition (x^2-y^2) ab. Insofern kann aus einem solchen Pickup die zu messende Strahldimension nicht direkt bestimmt werden, sondern erst nachdem der Anteil der Strahlposition von dem quadrupolaren Signal abgezogen wurde. Eine angemessene Genauigkeit erreicht man jedoch nur, wenn die Strahlposition klein gegenüber der transversalen Abmessung des Strahls ist. Das Ziel dieser Arbeit besteht darin, eine neue Methode zur Bestimmung des quadrupolaren Signals mit möglichst geringer Abhängigkeit von der Strahlposition.

HK 51.15 Mi 16:45 HSZ 1.OG

Beam Dynamics in Magnetic Quadrupol Triplets — •Christine Claessens, Manuel Heilmann, Oliver Meusel, Holger Podlech, Ulrich Ratzinger, and Christoph Wiesner — IAP, University of Frankfurt, Germany

The Frankfurt Neutron source at the Stern-Gerlach-Zentrum (FRANZ) will produce high intensity neutron pulses in the energy range of 1 to 500 keV at a very short repetition rate. The neutrons are gained from 7Li(p,n)7Be reactions induced by 2 MeV protons and will be used to examine the nucleosynthesis during the s-process as it occurs in stars, cross sections of neutron capture reactions as well as the behaviour of non-neutral plasmas. In the linear accelerator section, consisting of a 4-rod-radio-frequency-quadrupol and a H-type drift tube linac, the proton pulses are accelerated to 2.03 MeV. Inside the drift tube cavity a magnetic quadrupole triplet will be integrated, in order to compensate transversally defocussing effects and therefore avoid losses. Behind the linear accelerator section the proton beam ist rebunched in a 5-cell CH-rebuncher which is framed by two more quadrupole triplets. To investigate the beam dynamics inside the magnetic quadrupole triplets, various magnetostatic and particle tracking codes like CST Studio and LORASR were used to simulate the beam transport properties of the magnets and compare the individual magnetic field distributions with the ones measured at the magnet laboratory at GSI. In doing so, important aspects to be considered are the longitudinal and transversal fringe fields and the saturation effects which all possibly cause emittance growth and geometrical aberrations.

HK 51.16 Mi 16:45 HSZ 1.OG

Development of a reusable beam profile analyzer for laser accelerated proton beams — •Simon Frydrych, Simon Busold, Oliver Deppert, and Markus Roth — Institut für Kernphysik, TU Darmstadt, Schlossgartenstraße 9, 64289 Darmstadt

At the GSI Helmholtzzentrum für Schwerionenforschung GmbH, proton beams are generated with the PHELIX laser system through target normal sheath acceleration (TNSA). Within 1 ps, 10^{13} protons are produced with an exponential energy spectrum up to 50 MeV. For characterisation, the spatial beam profile is currently detected by a stack of radiochromatic films (RCF). These are blued depending on the beam intensity. One disadvantage of RCFs is its one-time usability. Therefore, they shall be replaced by a scintillator array. To ensure the longest possible shelf life of this new detector, the scintillator material used must be very robust against radiation damage. Also a point of current research is the maximal amount of particles, which can be detected separately.

HK 51.17 Mi 16:45 HSZ 1.OG

Design and calibration of ultra-short, broadband (200nm - 12 μm), single-shot spectrometer for ultrashort electron bunch durations diagnostics — •Omid Zarini, Alexander Debus, Michael Bussmann, Jurjen Couperous, Arie Irman, Wolfgang Seidel, and Ulrich Schramm — Helmholtz-Zentrum Dresden-Rossendorf, Dresden, Germany

The properties of electron bunch based on the Laser-Wakefield accelerators (LWFA) vary from shot to shot due to changes in the environment, such as gas jet profile or laser pointing. In order to understand the properties of these ultra-short electron bunches like bunch duration and bunch substructure in the range of 0.7 to 40 fs we are building a

broadband-spectrometer for measuring coherent and incoherent transition radiation (TR).

Our TR-spectrometer is able to measure the TR-spectrum from a thin Al-foil in a single shot experiment from UV (200 nm) to mid-IR (12 μm) by means of a CCD detector for the UV to VIS range and two array detectors for the NIR and MIR range. In this poster we present our design and calibration results of the detectors.

HK 51.18 Mi 16:45 HSZ 1.OG

Niederenergetischer Strahltransport intensiver Ionenstrahlen für FRANZ — •Philipp Schneider, Hannes Dinter, Martin Droba, Oliver Meusel, Daniel Noll, Onur Payir, Ulrich Ratzinger und Christoph Wiesner — IAP, Goethe-Universität Frankfurt, Max-von-Laue-Str. 1, D-60438 Frankfurt am Main

Der Transport niederenergetischer Ionenstrahlen stellt insbesondere bei hohen Strahlintensitäten eine Herausforderung dar. In der Low Energy Beam Transport Section (LEBT) der Frankfurter Neutronenquelle FRANZ werden zur Fokussierung entlang der Transportstrecke vier Solenoide eingesetzt.

Die ersten beiden Solenoide fokussieren den Strahl in ein Choppersystem, das notwendig ist, um die für die Messung von Neutroneneinfangquerschnitten notwendigen Zeitstrukturen dem Ionenstrahl aufzuprägen. Zwei weitere Solenoide passen den Strahl der Akzeptanz der anschließenden Beschleunigerstruktur an.

Wegen des von der Akzeptanz geforderten kleinen Radius werden die dort wirkenden Raumladungskräfte sehr hoch. Die daraus resultierende Aufweitung des Strahls muss mit hoher Genauigkeit berechnet werden, da die zu erwartenden Verlustleistungen eines falsch fokussierten Strahls in der anschließenden Beschleunigungsstruktur zu einer Leistungsdeposition von bis zu $200 kW/cm^2$ führen können.

Es werden Simulationen für den Strahltransport und zur Betrachtung der Strahldynamik vorgestellt.

HK 51.19 Mi 16:45 HSZ 1.OG

Relativistic LTE fluid plasma simulation — •Leon Buikstra[1,2], Michael Bussmann[1], Fred van Goor[2], Arie Irman[1], Ulrich Schramm[1], and Thomas Cowan[1] — [1]Helmholtz-Zentrum Dresden-Rossendorf, Dresden, Germany — [2]Universiteit Twente, Enschede, The Netherlands

To allow simulation of nanosecond scale plasma processes, we are developing a 3D fully relativistic fluid code with LTE (local thermal equilibrium) closure. This code is intended to be able to take output from PIC simulations as its initial state, to allow self-consistent simulation of processes acting over multiple time and density scales. In this code, both electrons and ions are treated as inertial fluids. Local fluid pressure is tied to the energy density using the Maxwell-Jüttner distribution, allowing investigation of the effect of local temperatures on, for example, the expanding sheath in TNSA (target normal sheath acceleration) experiments.

HK 51.20 Mi 16:45 HSZ 1.OG

Entwicklung des Krylov-Schur Eeigenwertlösers für supraleitende Beschleunigungsstrukturen — •Vladimir Kudrin, Wolfgang Ackermann, Wolfgang F.O. Müller und Thomas Weiland — Theorie Elektromagnetischer Felder, TU Darmstadt, Darmstadt, Deutschland

In vielen Linearbeschleunigern werden zum effizienten Beschleunigen der geladenen Teilchenstrahlen erfolgreich geeignete Hochfrequenzresonatoren eingesetzt. Der Übertrag der Energie von den Quellen zu den einzelnen Teilchen erfolgt mit Hilfe der Kavitäten über ein gezielt von außen angeregtes elektromagnetisches Feld. Als unerwünschter Nebeneffekt tritt dabei der Teilchenstrahl selbst als die Quelle für breitbandige elektromagnetische Felder auf. Die angeregten parasitäre Moden erschweren ihrerseits den Betrieb des Beschleunigers oder können ihn gar gefährden. Die Anregung der Moden höherer Ordnung (engl. higher order modes, HOM), hängt dabei sowohl von der Geometrie der verwendeten Resonatoren als auch von der Verteilung des Teilchenstrahls ab und kann praktisch nicht vermieden werden. Für die in der Praxis relevanten Fälle kann die Berechnung dieser Moden nur numerisch durchgeführt werden. Zur Lösung kann man beispielsweise auf komplexwertige Eigenwertformulierungen zurückgreifen, wofür im Rahmen der vorgestellten Arbeit ein geeignetes Simulationswerkzeug basierend auf Krylov-Schur Verfahren entwickelt wurde.

HK 51.21 Mi 16:45 HSZ 1.OG

TADPOLE for longitudinal electron-bunch diagnostics based on electro-optic upconversion — •Jan-Patrick Schwinkendorf, Steffen Wunderlich, Bernhard Schmidt, and Jens Osterhoff — Deutsches Elektronen-Synchrotron DESY, Notkestrasse 85, 22607 Hamburg, Germany

Electron-bunch diagnostics are desired to utilize unambiguous, nondestructive, single-shot techniques. Various methods fulfill the latter two demands, but feature significant ambiguities and constraints in the reconstruction of a time-domain electron-bunch profile, as for example uncertainties due to the phase retrieval of coherent radiation using the Kramers-Kronig relation. We present a novel method of upconverting the THz-field spectrum of fs electron bunches at the free-electron laser FLASH into the near-infrared in an electro-optic crystal. This technique allows the single-shot detection of its longitudinal form factor in both, amplitude and phase. The spectral phase and amplitude information is measured and thus the temporal profile reconstructed using temporal analysis by dispersing a pair of light E-fields, also known as TADPOLE. This is a combination of frequency resolved optical gating (FROG) and spectral interferometry, which enables the temporal measurement of low-power laser pulses. In this experiment, a narrowbandwidth laser pulse detecting the longitudinal electric field of an electron bunch is interfered with a broadband and FROG-characterized reference pulse. The longitudinal beam profile may therefore be unambiguously inferred from the generated interferogram and the detected spectral-phase-information of the reference pulse.

HK 51.22 Mi 16:45 HSZ 1.OG

Beam Dynamics Simulation of the S-DALINAC Injector Section — •Sylvain Franke, Wolfgang Ackermann, and Thomas Weiland — Institut für Theorie Elektromagnetischer Felder , Technische Universität Darmstadt, Darmstadt, Germany

In order to extend the experimental possibilities at the superconducting electron linear accelerator S-DALINAC a new polarized gun has recently been installed in addition to the well-established thermionic electron source. Beside the two electron sources the injector section consists of several short quadrupole triplets, an alpha magnet, a Wien filter and a chopper/prebuncher system. The setup of these components differs depending on whether bunched polarized electrons with kinetic energy in the 100 keV range are supplied by the polarized source or whether a continuous unpolarized 250 keV electron beam is extracted from the thermionic gun. The electrons pass through the injector at a relatively low energy and therefore are very sensitive to the beam forming elements in this section. Thus, a proper knowledge of the particle distribution at the exit of the injector section is essential for the quality of any simulation of the subsequent accelerator parts. In this contribution first numerical beam dynamics simulation results of the S-DALINAC injector setup will be discussed.

HK 51.23 Mi 16:45 HSZ 1.OG

PIConGPU - How to built one of the fastest GPU particle-in-cell codes in the world — •Heiko Burau[1], Alexander Debus[1], Anton Helm[1], Axel Hübl[1], Thomas Kluge[1], Rene Widera[1], Michael Bussmann[1], Ulrich Schramm[1], Thomas Cowan[1], Guido Juckeland[2,3], Felix Schmitt[4], and Wolfgang Nagel[2,3] — [1]HZDR, Dresden — [2]TU Dresden — [3]ZIH Dresden — [4]NVIDIA

We present the algorithmic building blocks of PIConGPU, one of the fastest implementations of the particle-in-cell algortihm on GPU clusters. PIConGPU is a highly-scalable, 3D3V electromagnetic PIC code that is used in laser plasma and astrophysical plasma simulations.

HK 51.24 Mi 16:45 HSZ 1.OG

PIConGPU - Physics Validation for Laser Plasma and Astrophysics Plasma Simulations — Axel Hübl[1], Heiko Burau[1], Anton Helm[1], Rene Widera[1], Alexander Debus[1], Thomas Kluge[1], Jurjen Couperous[1], Arie Irman[1], Michael Bussmann[1], Ulrich Schramm[1], Thomas Cowan[1], Felix Schmitt[2], Guido Juckeland[3,4], and •Wolfgang Nagel[3,4] — [1]HZDR, Dresden — [2]NVIDIA — [3]TU Dresden — [4]ZIH, Dresden

PIConGPU is a highly-scalable implementation of a 3D3V electromagnetic particle-in-cell code. It allows for fast simulations of laser plasma interaction and astrophysical plasmas. We present several physics validation results and show applications in laser wakefield acceleration of electrons instabilities in plasmas.

HK 51.25 Mi 16:45 HSZ 1.OG

Pulsed power magnet technology for laser particle acceleration and laser plasma physics - a survey of developments at Helmholtz-Zentrum Dresden-Rossendorf — •Florian

Kroll[1,2], Trevor Burris-Mog[1], Thomas Herrmannsdörfer[1], Martin Joost[1,2], Stephan Kraft[1], Umar Masood[1], Hans-Peter Schlenvoigt[1], Manfred Sobiella[1], Bernd Wustmann[1], Sergei Zherlitsyn[1], Thomas Cowan[1], and Ulrich Schramm[1] — [1]Helmholtz-Zentrum Dresden-Rossendorf — [2]TU Dresden

Since the mid-1950s, pulsed high-field magnets have become a common, versatile research tool with application mostly in solid state physics and material research. Recently developed pulsed power magnet technology, specifically designed to meet the demands of laser acceleration and laser plasma experiments, open up new research opportunities:

We present a pulsed air core solenoid (up to 20 T) for effective collection and focusing of laser accelerated particles. It could function as a crucial part of a compact, laser-based ion source (pursued by the LIGHT collaboration) or of beam guidance systems. Furthermore, the poster shows a split pair coil, utterly compact and with optical access in between the coil pairs and on axis, to study laser-driven plasma expansion under high magnetic fields (~ 30 T). To power such devices, portable capacitor-based pulse generators have been developed at Helmholtz-Zentrum Dresden-Rossendorf. We present first results of the functional testing of our third-generation pulse generator. Looking forward, we outline a concept for a medical gantry based on pulsed high field beam optics.

HK 51.26 Mi 16:45 HSZ 1.OG

Generation and Transport of laser accelerated ion beams — •Peter Schmidt[1,2], Oliver Boine-Frankenheim[1,2], Vladimir Kornilov[2], and Peter Spädtke[2] for the LIGHT-Collaboration — [1]Technische Universität Darmstadt, Darmstadt, Germany — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

Currently the LIGHT- Project (Laser Ion Generation, Handling and Transport) is performed at the GSI Helmholtzzentrum für Schwerionenforschung GmbH Darmstadt. Within this project, intense proton beams are generated by laser acceleration, using the TNSA mechanism. After the laser acceleration the protons are transported through the beam pipe by a pulsed power solenoid. To study the transport a VORPAL 3D simulation is compared with CST simulation. A criterion as a function of beam parameters was worked out, to rate the importance of space charge. Furthermore, an exemplary comparison of the solenoid with a magnetic quadrupole-triplet was carried out. In the further course of the LIGHT-Project, it is planned to generate ion beams with higher kinetic energies, using ultra-thin targets. The acceleration processes that can appear are: RPA (Radiation Pressure Acceleration) and BOA (Break-Out Afterburner). Therefore the transport of an ion distribution will be studied, as it emerges from a RPA acceleration.

HK 51.27 Mi 16:45 HSZ 1.OG

Higher Order Modes in Superconducting Radio Frequency Resonators for Energy Recovery Linacs — •Tomasz Galek and Ursula van Rienen — Universität Rostock, Institut Allgemeine Elektrotechnik, Albert-Einstein-Str. 2, 18051 Rostock, Germany

The main scope of this work is the automation of the extraction procedure of the external quality factors of Higher Order Modes (HOMs) in Superconducting Radio Frequency (SRF) cavities. The HOMs are generated by charged particle beams traveling through a SRF cavity at the speed of light. The HOMs decay very slowly, depending on localization inside the structure and cell-to-cell coupling, and may influence succeeding charged particle bunches. Thus it is important, at the SRF cavity design optimization stage, to calculate the external quality factors (Qext) of HOMs. Traveling Poles Elimination (TPE) scheme was used to automatically extract Qext from the transmission spectra and careful eigenmode analysis of the SC cavity was performed to confirm TPE results. The eigenmode analysis also delivers important information about band structure, cell-to-cell coupling of HOMs and allows rapid identification of modes that could interact with the charged particle bunches.

HK 51.28 Mi 16:45 HSZ 1.OG

First coupled CH Power Cavity for the FAIR Proton Injector — •Robert Brodhage[1], Ulrich Ratzinger[1], Wolfgang Vinzenz[2], and Gianluigi Clemente[2] — [1]IAP, Uni Frankfurt — [2]GSI, Darmstadt

For the research program with cooled antiprotons at FAIR a dedicated 70 MeV, 70 mA proton injector is required. The main acceleration of this room temperature linac will be provided by six CH cavities operated at 325 MHz. Each cavity will be powered by a 2.5 MW Klystron. For the second acceleration unit from 11.5 MeV to 24.2 MeV a 1:2 scaled model has been built. Low level RF measurements have been performed to determine the main parameters and to prove the concept of coupled CH cavities. In Summer 2012, the assembly and tuning of the first power prototype was finished. Until then, the cavity was tested with a preliminary aluminum drift tube structure, which was used for precise frequency and field tuning. Before Spring 2013 the final drift tube structure will be welded inside the main tanks and the preparation for copper plating will take place. This paper will report on the main tuning and commissioning steps towards that novel type of DTL and it will show the latest results measured on a fully operational CH proton cavity.

HK 51.29 Mi 16:45 HSZ 1.OG

Design Study of a High Frequency Proton Ladder RFQ — •Robert Brodhage and Ulrich Ratzinger — IAP, Uni Frankfurt

For the research program with cooled antiprotons at FAIR a dedicated 70 MeV, 70 mA proton injector is required. In the low energy section, between the Ion Source and the main linac an RFQ has to be designed. Accelerating protons from 95 keV to 3.0 MeV the RFQ will oscillate at 325 MHz. This particular high frequency for an RFQ creates difficulties which are challenging in developing this cavity. In order to define a satisfactory geometrical configuration for this resonator, both from the RF and the mechanical point of view, different designs have been examined and compared. Very promising results have been reached with an ladder type RFQ, especially concerning the dipole component of the accelerating fields, which is almost not noticeable. This paper will show 3D simulations of the general layout and a whole cavity demonstrating the power of a ladder type RFQ. It will outline a possible layout for the RFQ within the new FAIR proton injector.

HK 51.30 Mi 16:45 HSZ 1.OG

Hollow Beam creation with diffractive phase masks at PHELIX — •Christian Brabetz[1], Simon Busold[2], Oliver Deppert[2], Oliver Kester[1,2], Dennis Schumacher[3], Florian Wagner[2], Bernhard Zielbauer[3], and Vincent Bagnoud[3] for the LIGHT-Collaboration — [1]Goethe-Universität Frankfurt, Senckenberganlage 31, 60325 Frankfurt am Main, Germany — [2]Technische Universität Darmstadt, Karolinenplatz 5, 64289 Darmstadt, Germany — [3]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Planckstraße 1, 64291 Darmstadt , Germany

In the framework of the Laser Ion Generation Handling and Transport (LIGHT) research project at GSI, the reduction of the divergence of the laser accelerated ions is a central issue. One solution resides on engineering the electron sheath using in TNSA for reducing the initial divergence of the ion beam. In our first attempt, we were successful in creating and propagating a *donut* laser mode at the PHELIX laser. We have then conducted a experimental campaign at PHELIX

One sees a qualitative effect of the focal spot beam shape on the ion beam divergence as expected.

The energy cut-off in the proton spectrum was nearly higher when a donut focus was applied, although this resulted in contradiction with the intensity scaling law of TNSA.

HK 52: Poster - Instrumentation I

Zeit: Mittwoch 16:45–16:45 Raum: HSZ 2.OG

HK 52.1 Mi 16:45 HSZ 2.OG

Development and Test of the Readout System for the CBM-MVD Prototype* — •Borislav Milanović, Bertram Neuman, Michael Wiebusch, Samir Amar-Youcef, Ingo Fröhlich, and Joachim Stroth for the CRESST-Collaboration — Institut fur Kernphysik, Goethe-Universität Frankfurt - for the CBM-MVD Collaboration

The CBM Experiment at FAIR aims towards better understanding of

the QCD phase-diagram and in-medium properties of matter under high densities. In order to enhance the detection of rare probes via their secondary decay vertices and to support the primary tracking system, the CBM Micro Vertex Detector (MVD) is foreseen.

Recently, the MVD Prototype has been developed at the IKF in Frankfurt. The module contains one quarter of the first MVD station featuring four prototype-sensors MIMOSA-26 AHR thinned down to 50 μm. The prototype has been tested at the CERN SPS accelerator with high energetic pions in November 2012.

This contribution discusses the stability and scalability of the DAQ, slow-control and monitoring routines during the beamtime, as well as sensor behavior under high load of up to 700 000 particles per second. The readout system partially uses hardware from the HADES detector which will also run at FAIR. Readout rates of 98 MB/s at the limit of gigabit ethernet have been achieved showing no sign of data loss or corruption.

*supported by BMBF grants 06FY9099I and 06FY7113I

HK 52.2 Mi 16:45 HSZ 2.OG

Differentielle, winkelkontinuierliche Doppler Shift Attenuation Method: Eine Lebensdauer-Messmethode für relativistische, radioaktive Ionenstrahlen — •Marc Lettmann, Christian Stahl und Norbert Pietralla — Institut für Kermphysik, Technische Universität Darmstadt

Mit der Doppler-Shift Attenution Method (DSAM) werden Lebensdauern angeregter Kernzustände von ca. 10fs-10ps durch Analyse der Doppler-verbreiterten Linienform emittierter Gammastrahlung während des Abbremsvorgangs ihrer Emitter in Materie bestimmt. Dazu werden berechnete Linienformen an experimentelle Spektren gefittet, mit der Lebensdauer als Fitparameter. Um die DSAM für Experimente mit relativistischen, radioaktiven Ionenstrahlen zu verwenden, müssen besondere Anforderungen berücksichtigt werden. Diese umfassen u.a. breite Strahlprofile sowie die Notwendigkeit, den Strahl nicht im Target zu stoppen, um die Akkumulation von Aktivität im Target zu vermeiden und die Identifikation der Ionen hinter dem Target zu ermöglichen. Breite Strahlprofile und eventuelle Abregung der Ionen hinter dem Target machen geometrische Korrekturen der von den Gamma-Detektoren abgedeckten Raumwinkel nötig. Die Effektivität der Methode kann durch Doppler-Korrektur der Gamma-Energie mithilfe der messbaren Geschwindigkeits- und Ortsvektoren der aus dem Target austretenden Ionen gesteigert werden. Außerdem ergibt sich durch die mögliche Abregung außerhalb des Targets ein neuer Sensitivitätsbereich der DSAM für längere Lebensdauern. Gefördert durch das BMBF unter 05P12RDFN8.

HK 52.3 Mi 16:45 HSZ 2.OG

A New Avalanche Photo Diode Readout for the Crystal Barrel Calorimeter — •Martin Urban for the CBELSA/TAPS-Collaboration — Helmholtz-Institut für Strahlen- und Kernphysik, Nussallee 14-16, 53115 Bonn

The CBELSA/TAPS experiment at ELSA measures double polarisation observables in meson photoproduction off protons and neutrons. To be able to measure purely neutral reactions on a polarized neutron target with high efficiency, the main calorimeter has to be integrated into the first level trigger. This requires to exchange the existing PIN photo diode by a new avalanche photo diode (APD) readout.

The new electronics, including a whole new timing readout branch, will provide a fast trigger signal down to 10 MeV energy deposit per crystal. A 3x3 CsI crystal matrix, assembled with the complete new APD readout electronics, has been tested at the tagged photon beam facilities at ELSA and MAMI. This poster presents the results of these test measurements including energy resolution, time resolution and the active gain stabilization of the new APD readout electronics.

Supported by the Deutsche Forschungsgemeischaft (SFB/TR16) and Schweizerischer Nationalfonds.

HK 52.4 Mi 16:45 HSZ 2.OG

Commissioning of the FrontEnd Electronics for the BGO-OD Tagger Detector — •Francesco Messi for the BGO-OD-Collaboration — Physikalisches Institut, Bonn, Germany

The BGO-OD experiment, presently under construction at the electron accelerator ELSA at Bonn university, is intended for the systematic investigation of the photo-production of mesons off the nucleon. The experiment will use bremsstrahlung photons from an e^- beam incident upon a thin metal radiator. The photon energy will be measured via the deflection of the electrons in the magnetic field of a photon tagger.

The electrons are detected in a 120 channel hodoscope with an expected rate up to 10MHz per single channel and 50MHz for the total detector. A coincidence between two neighboring channels is required to suppress background. Additional to the measurement of the photon energy, time information from the detection of the deflected electrons will be used for coincidence measurements in the BGO-OD experiment.

To match these requirements, a new tagger electronics was developed and installed. The final detector and the full electronics are under commissioning. Results will be presented in this poster.

HK 52.5 Mi 16:45 HSZ 2.OG

Datenaufnahmekonzept und eine neue Generation Driftkammern für das QCLAM-Spektrometer am S-DALINAC — •Andreas Köhler, Simela Aslanidou, Jonny Birkhan, Uwe Bonnes, Thilo Egenolf, Joachim Enders, Christoph Kremer, Andreas Krugmann, Peter von Neumann-Cosel und Norbert Pietralla — Institut für Kernphysik, Technische Universität Darmstadt, Germany

Im Elektronenstreuexperiment ELISe der FAIR sollen mit Driftkammern betriebene Magnetspektrometer zum Einsatz kommen. Diese sollen mit eigens entwickelten Elektronikmodulen auf FPGA-Basis und Multi-Hit TDCs ausgelesen werden. Das QCLAM-Magnetspektrometer für Elektronenstreu- und Koinzidenzexperimente am supraleitenden Darmstädter Linearbeschleuniger S-DALINAC wurde mit solchen Driftkammern ausgestattet. Erste Ergebnisse der Performancetests mit den neuen Driftkammern werden präsentiert. Die entwickelten Systeme sollen auf die Anforderungen für Drahtkammerauslese bei GSI/FAIR übertragbar sein.

Gefördert durch die DFG (SFB 634), durch das LOEWE-Zentrum HIC for FAIR des Landes Hessen, durch das BMBF (06DA9040I) und den TU-Darmstadt-GSI-Kooperationsvertrag.

HK 52.6 Mi 16:45 HSZ 2.OG

Kalibration und Inbetriebnahme eines Faserdetektors für das Kaos-Spektrometer — •Adrian Weber für die A1-Kollaboration — Institut für Kernphysik, Johannes Gutenberg-Universität, Mainz

Der Faserdetektor des Kaos-Spektrometers am Mainzer Mikrotron, MAMI, besteht aus zwei Faserebenen, die je ca. 1,94 m lang sind, mit jeweils 2304 Kanälen, die von 144 PMTs ausgelesen werden.

Zur Optimierung der Ortsauflösung des Detektors wurden die PMTs kalibriert. Dabei wurde die Verstärkung jedes Kanals gemessen, wie auch die Abhängigkeit der Verstärkung jedes PMTs von der angelegten Hochspannung. Die Hochspannungen der PMTs werden so angepasst, dass alle PMTs die gleiche Verstärkung aufweisen. Außerdem werden die Schwellenwerte der Doppelschwellendiskriminatoren (DTD), so gesetzt, dass das gesamte Detektorsystem möglichst homogen arbeitet. Aus den gewonnenen Daten der Kalibration kann zudem eine Korrektur der Faserposition durchgeführt werden. Die differentielle Nichtlinearität beträgt ca. 0,03 mm pro Ebene.

Zur Verbesserung der Bestimmung der Durchtrittszeit von Teilchen durch den Detektor wurden die DTDs hinsichtlich ihrer Zeitschwankung untersucht. Diese betrug bei idealen Schnitten ca. 300 ps für die fallende Flanke des Ausgangssignals und ca. 3 ns für die steigende. Für die Bestimmung der Durchtrittszeit durch den Detektor wird nur die fallende Flanke des Ausgangssignals benutzt.

Die Vorbereitungen für den erstmaligen Betrieb des gesamten Faserdetektors im Kaos-Spektrometer an MAMI laufen.

HK 52.7 Mi 16:45 HSZ 2.OG

Characterization of a $LaBr_3$ crystal with multi-anode PMT readout* — •Saad Aldawood[1,2], Christian Lang[1], Dieter Habs[1,3], Ludwig Maier[4], Katia Parodi[1], and Peter G. Thirolf[1] — [1]LMU München — [2]King Saud University, Riyadh, Saudi Arabia — [3]MPI f. Quantenoptik, Garching — [4]TU München

A Compton camera is presently under construction in Garching, aiming to allow for monitoring the ion-beam range and activity distribution from ion-beam irradiations of bio-medical samples via position-resolved prompt γ-ray detection. The Compton camera consists of a stack of six double-sided Si-strip detectors (50 x 50 mm^2, 0.5 mm thick, pitch 390 μm) acting as scatterers, while the absorber is formed by a $LaBr_3$ scintillator crystal (50 x 50 x 30 mm^3), read out by a multi-anode PMT. Results from characterization measurements will be presented, covering energy, time, and spatial resolution. In order to characterize the position resolution, a strong and collimated ^{137}Cs source (662 keV) was used to scan the 8 x 8 PMT pixel structure of the crystal.

* Supported by the DFG Cluster of Excellence, MAP (Munich-centre for Advanced Photonics), King Saud University(Saudi Arabia).

HK 52.8 Mi 16:45 HSZ 2.OG

Measurement of the e^- beam polarization and photon flux at the BGO-OD Experiment* — •Thomas Zimmermann for the BGO-OD-Collaboration — Physikalisches Institut, Universität Bonn

The BGO-OD experiment, presently under construction at the electron accelerator ELSA at Bonn university, is intended for the systematic investigation of the photo-production of mesons off the nucleon.

Polarized photon beams are routinely used. To determine the degree of circular polarization, the polarization of the e^- beam will be measured in-situ by a Møller polarimeter. The photon flux will be monitored simultaneously with data taking, using a flux monitor consisting of two parts: a total- and a partial-absorption detector.

*Supported by the DFG (SFB/TR-16)

HK 52.9 Mi 16:45 HSZ 2.OG

The B-FrED board — •Francesco Messi for the BGO-OD-Collaboration — Physikalisches Institut Uni-Bonn, Bonn, Germany

The B-FrED is a 16 channel *double-threshold discriminator and shaper* board designed as Front-End Electronics for the new Tagger detector of the BGO-OD experiment. It is a 6U-VME form factor card based on commercial components.
The analog input stage has a Slew Rate of $4580V/\mu s$. The Output stage provides a LVDS signals with a fan-out of two and an expected time jitter of $\sim 10ps$ with respect to the input signal.
The threshold settings are managed by a micro-controller which is remotely accessible through Ethernet.

HK 52.10 Mi 16:45 HSZ 2.OG

Ein Kühlsystem für den PANDA-Luminositätsdetektor — •Heinrich Leithoff[1,2], Florian Feldbauer[1,2], Miriam Fritsch[1,2], Prometeusz Jasinski[1,2], Anastasia Karavdina[2], Mathias Michel[1,2], Stefan Pflüger[1,2] und Tobias Weber[1,2] — [1]Helmholtz Institut Mainz — [2]Johannes Gutenberg Universität Mainz

Der Luminositätsdetektor für das PANDA-Experiment (Teil der neuen FAIR-Beschleunigeranlage, Darmstadt) wird die Luminosität anhand der Winkelverteilung der elastisch gestreuten Antiprotonen bei sehr kleinen Winkeln extrahieren. Für die Messung der Antiprotonen-Spuren werden vier Ebenen von HV-MAPS (High Voltage Monolithic Activ Pixel Sensoren) verwendet. Für die angestrebte Genauigkeit der Luminositätsmessung muss die Vielfachstreuung minimiert werden; deshalb befindet sich das gesamte Detektorsystem im Vakuum. Dies impliziert, dass die HV-MAPS aktiv gekühlt werden müssen, da die von den Halbleiterdetektoren erzeugte Wärme nicht über Konvektion abgeführt werden kann. Um die Materialbelegung gering zu halten, werden die Sensoren auf 200 μm dünnen Diamantscheiben aufgebracht, die an einem Aluminiumträger befestigt sind. Dieser soll durch ein eingeschmolzenes Edelstahlrohr gekühlt werden, damit ein möglichst guter thermischer Übergang zwischen der Kühlflüssigkeit und der Auflage der Diamantscheiben gewährleistet wird.

Präsentiert wird ein Überblick über den Status des Kühlsystems und seine erwartete Leistungsfähigkeit sowie die mechanische Stabilität der tragenden Struktur.

HK 52.11 Mi 16:45 HSZ 2.OG

HV-MAP (High Voltage Monolithic Active Pixel) Sensoren für den PANDA-Luminositätsdetektor* — •Tobias Weber, Florian Feldbauer, Miriam Fritsch, Prometeusz Jasinski, Anastasia Karavdina, Heinrich Leidhoff und Mathias Michel für die PANDA-Kollaboration — Institut für Kernphysik, Universität Mainz und Helmholtz-Institut Mainz

Das PANDA-Experiment, das am Antiprotonenstrahl der geplanten Beschleunigeranlage FAIR in Darmstadt aufgebaut wird, ist für Fragen der Hadronspektroskopie optimiert. Diese Fragen werden zum einen mit Messungen bei hoher Luminosität und zum anderen mit Messungen hoher Präzision des einlaufenden Antipotronenstrahls angegangen. In beiden Fällen wird für die Bestimmung der absoluten Messgrößen und für die Methode der Energie-Scans die präzise Messung der Luminosität benötigt.
Das Konzept des Luminositätsdetektors sieht vor, die Luminosität durch Messung der Verteilung der elastisch gestreuten Antiprotonen in unmittelbarer Strahlnähe (3-8 mrad) zu bestimmen. Hierzu kommen 4 Lagen sehr dünner Siliziumpixelsensoren (HV-MAPS) zum Einsatz, die in Kollaboration mit der Mu3e-Gruppe Heidelberg entwickelt werden.
Das Konzept der Luminositätsmessung bei PANDA und Studien zu HV-MAP Sensoren und Auslese-Elektronik werden vorgestellt.

*gefördert durch BMBF, DFG und HGF

HK 52.12 Mi 16:45 HSZ 2.OG

A high resolution germanium detector array for hypernuclear studies at $\overline{\text{P}}$ANDA — Sebastian Bleser[1], Jürgen Gerl[2], Felicce Iazzi[3], Ivan Kojouharov[2], Josef Pochodzalla[4], Kai Rittgen[4], Cihan Sahin[4], Alicia Sanchez Lorente[1], and •Marcell Steinen[1] for the PANDA-Collaboration — [1]Helmholtz-Institut Mainz — [2]GSI Darmstadt — [3]Politecnico and INFN, Torino — [4]Institute for nuclear physics, JGU Mainz

The $\overline{\text{P}}$ANDA experiment, planned at the FAIR facility in Darmstadt, aims at the high resolution γ-spectroscopy of double Λ hypernuclei. For this purpose a devoted detector setup is required, consisting of a primary nuclear target, an active secondary target and a germanium detector array for the γ-spectroscopy. Due to the limited space within the $\overline{\text{P}}$ANDA detector a compact design is required. In particular the conventional LN_2 cooling system must be replaced by an electromechanical device and a new arrangement of the crystals is needed.

This poster shows the ongoing development of the germanium detectors. Test measurements of a single crystal prototype with an improved cooling concept are shown. Thermal simulations for a triple crystal detector are presented. Aditionally studies of the optimization of the detector arrangement inside the $\overline{\text{P}}$ANDA barrel spectrometer are shown. Finally the status on digital pulse shape analysis is presented which will be necessary to deal with high counting rates and to recover the high original energy resolution in case of neutron damage.

HK 52.13 Mi 16:45 HSZ 2.OG

Study for the online data processing with the MVD prototype* — •Qiyan Li, Samir Amar-Youcef, Michael Deveaux, Christian Muentz, and Joachim Stroth for the CBM-MVD-Collaboration — Goethe-Universität,Frankfurt

The CBM experiment at FAIR will explore the structure and properties of nuclear matter under extreme conditions namely highest net baryon densities. As the one subdetector of the CBM experiment, the Micro-Vertex-Detector (MVD) will provide precise vertexing to identify the short-lived open charm particles.

Because of the expected high hit densities, the DAQ system of the MVD will have a heavy burden with data transmission and storage. To reduce it two essential aspects are considered, on-chip zero suppression and online cluster finding and classification. The latter will be implemented on FPGAs, which are arranged directly after the front-end electronics.

As a first approach into that direction the MVD prototype was tested at CERN SPS with high energy pion beams. The setup was chosen, that the device under test was referenced with 4 alike additional stations. All stations were equipped with thinned MIMOSA-26 AHR CMOS sensors. This contribution discusses the dedicated cluster finding algorithm and the investigation of cluster shapes at various experimental conditions.

*supported by HIC for FAIR,the GSI Helmholtzzentrum fär Schwerionenforschung, BMBF grants 06FY9100I and 06FY7114I, IPHC,Strasbourg.

HK 52.14 Mi 16:45 HSZ 2.OG

Mechanical integration of the Prototype of the CBM Micro Vertex Detector* — •Tobias Tischler, Michal Koziel, Christian Müntz, and Joachim Stroth for the CBM-MVD-Collaboration — Goethe Universität, Frankfurt

For the reconstruction of Open Charm Hadrons with the CBM experiment a Micro Vertex Detector (MVD) with an excellent resolution of the secondary decay vertex (< 70 μm along the beam axis) is required. To achieve this vertex resolution a material budget of a few 0.1% X_0 is mandatory for the individual detector stations positioned downstream in close vicinity to the target. To further reduce the multiple scattering the MVD operates in vacuum.

The need of prototyping and characterizing the CBM-MVD motivated the construction of an ultra-low mass, high precision detector setup comprising several prototype stations. Each station contains 2 (single-sided station) or 4 (double-sided station) 50 μm thick thinned CMOS sensors (MIMOSA-26 AHR). The sensors are glued to CVD diamond carriers which provide at the same time a mechanical support and efficient heat evacuation.
This contribution presents the in-beam performance of the prototype stations, with emphasis on the doubled-sided, ultra-thin (0.3% x/X_0) micro-tracking station which was tested at CERN SPS in November 2012.

*supported by HIC for FAIR, the GSI Helmholtzzentrum für Schwerionenforschung, BMBF grants 06FY9100I and 06FY7114I, IPHC, Strasbourg

HK 52.15 Mi 16:45 HSZ 2.OG

Pulse shape analysis using CsI(Tl) Crystals* — •Joel Silva[1,2], Enrico Fiori[1,2], Johann Isaak[1,2], Bastian Loher[1,2], Deniz Savran[1,2], Matjaz Vencelj[3], and Roland Wirth[1,2] — [1]ExtreMe Matter Institute EMMI and Research Division, GSI Helmholtzzentrum, Darmstadt, Germany — [2]Frankfurt Institute for Advanced Studies FIAS, Frankfurt, Germany — [3]Jozef Stefan Institute, Ljubljana, Slovenia

The decay time of CsI(Tl) scintillating material consists of more than a single exponential component. The ratio between the intensity of these components varies as a function of the ionizing power of the absorbed particles, such as gamma-rays or protons, and the temperature. This property can therefore be used for particle discrimination and for temperature monitoring, using pulse shape analysis.

An unsupervised method that uses fuzzy clustering algorithms for particle identification based on pulse shape analysis is presented. The method is applied to discriminate between photon- and proton-induced signals in CsI(Tl) scintillator detectors.

The first results of a method that uses pulse shape analysis for correcting the temperature-dependent gain effect of the detector are also presented. The method aims at conserving a good energy resolution in a temperature varying environment without the need to measure the temperature of the detector externally.

* Supported by the Alliance Program of the Helmholtz Association (HA216/EMMI)

HK 52.16 Mi 16:45 HSZ 2.OG

Untergrundunterdrückung im KATRIN-Experiment mit Hilfe magnetischer Pulse — •Jan David Behrens für die KATRIN-Kollaboration — Westfälische Wilhelms-Universität, Münster

Durch das **KA**rlsruhe **TRI**tium **N**eutrino-Experiment soll die Masse des Elektron-Antineutrinos mit einer Sensitivität von 200 meV/c^2 (90% C.L.) vermessen werden. Die Vermessung der Form des Tritium-β-Spektrums im Endpunktbereich ermöglicht eine modellunabhängige Bestimmung dieses wichtigen Parameters.

Die Energieanalyse der Zerfallselektronen erfolgt beim KATRIN-Experiment in einem elektrostatischen Spektrometer, das nach dem Prinzip des MAC-E-Filters arbeitet. Im Spektrometer können in Penningfallen gespeicherte Elektronen und Ionen zu einem erhöhten Untergrund führen.

Eine Möglichkeit zum Entfernen von gespeicherten Elektronen ist die Erzeugung eines magnetischen Pulses, der die Speicherbedingungen aufhebt. Dazu muss das Magnetfeld der Luftspulen am Hauptspektrometer über eine Brückenschaltung (*H-Bridge*) invertiert werden. Das Poster stellt die Methode des magnetischen Pulses sowie eine erste technische Umsetzung der Brückenschaltung vor.

Dieses Projekt wird unter dem Kennzeichen 05A11PM2 durch das BMBF gefördert.

HK 52.17 Mi 16:45 HSZ 2.OG

The Cluster-Jet Target for PANDA — •Ann-Katrin Hergemöller, Esperanza Köhler, Silke Grieser, Alexander Töschner, Hans-Werner Ortjohann, Daniel Bonaventura, and Alfons Khoukaz — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, 48149 Münster, Deutschland

A cluster-jet target will be the first one of two planned internal targets for the PANDA experiment at FAIR. At the University of Münster the target prototype was built up in complete PANDA geometry and successfully set into operation. Areal target densities of more than 2×10^{15} atoms/cm^2 at a distance of 2.1 m behind the nozzle were achieved by the installation of a new tilting system. This device allows for an adjustment of the nozzle relative to the experimental setup. The thickness is reproducible, constant in time, and variable over several orders of magnitude by the adjustment of the stagnation pressure and temperature before the nozzle. Depending on the experimental program the target beam size and shape should be variable and should guarantee a low residual gas background. That can be realized with the application of special shaped skimmers for the target beam preparation. The cluster beam shape can be visualized by a new monitoring system based on a Micro Channel Plate. This enables a direct observation of an ionized cluster beam at a phosphor screen in combination with a CCD camera. In this presentation an overview of the cluster-jet target, various special features, and images of the cluster beam will be presented and discussed. Supported by EU (FP7), BMBF, and GSI F+E.

HK 52.18 Mi 16:45 HSZ 2.OG

Field Programmable Gate Array Based Data Digitisation with Commercial Elements — Cahit Ugur[1], Wolfgang Koenig[1], •Jan Michel[2], Grzegorz Korcyl[3], Marek Palka[3], and Michael Traxler[1] — [1]GSI Helmholtz Centre for Heavy Ion Research, Germany — [2]Goethe-University Frankfurt, Germany — [3]Jagiellonian University, Poland

One of the most important aspects of particle identification experiments is the digitisation of time, amplitude and charge data from detectors. These conversions are done mostly with Application Specific ICs (ASICs). However, the recent developments in Field Programmable Gate Array (FPGA) technology allow us to use commercial electronic components for the required Front-End Electronics (FEE) and do the digitisation in the FPGA. It is possible to do Time-of-Flight (ToF), Time-over-Threshold (ToT), amplitude and charge measurements with converters implemented in FPGA. We call this principle COME & KISS: Use COMplex COMmercial Elements & Keep It Small and Simple.

HK 52.19 Mi 16:45 HSZ 2.OG

Detection systems for forward emitted XUV photons from relativistic ion beams at the ESR — Ch. Geppert[2,3], V. Hannen[1], R. Jöhren[1], Th. Kühl[2,3,4], W. Nörtershäuser[2,3], H.-W. Ortjohann[1], R. Sánchez[3], Th. Stöhlker[3,4,5], •J. Vollbrecht[1], Ch. Weinheimer[1], and D. Winters[3] — [1]Institut für Kernphysik, Uni Münster — [2]Institut für Kernchemie, Uni Mainz — [3]GSI, Darmstadt — [4]Helmholtz Institut Jena — [5]Uni Jena

Laser spectroscopy experiments with stored relativistic heavy ions can test atomic structure calculations by exploiting the large Doppler "boost" of the transitions. However, this "boost" also strongly shifts the fluorescence from the ions, and directs it into a narrow forward cone (searchlight). This renders the need for a moveable detection system, which collects the light around the ion beam in vacuo. We would now like to study effects of electron-electron correlations in Be-like krypton ($^{84}Kr^{32+}$) via a laser spectroscopic measurement of the $^3P_1 - ^3P_0$ transition. Based on the successful design for a previous ESR experiment, a new detection system for forward emitted XUV photons will be constructed. The Krypton ions are stored at high velocities ($\beta \approx 0.69$) in the ESR, therefore the wavelength for de-excitation to the ground state is Doppler shifted from $\lambda_0 \approx 17$ nm to $\lambda \approx 9$ nm. When these photons hit a metal collector they will produce secondary electrons at low energies ($\approx$ 3 eV). The electrons will be electrostatically guided onto a MCP detector. The underlying principles as well as the current design of the XUV detection system will be presented on this poster. This work is supported by BMBF under contract number 06MS7191.

HK 52.20 Mi 16:45 HSZ 2.OG

The TIGER Trigger Processor for the CAMERA Detector at COMPASS-II — Tobias Baumann, Maximilian Büchele, Horst Fischer, Matthias Gorzellik, Tobias Grussenmeyer, Florian Herrmann, Philipp Jörg, Paul Kremser, Tobias Kunz, Christoph Michalski, •Sebastian Schopferer, and Tobias Szameitat — Physikalisches Institut der Universität Freiburg

In today's nuclear and high-energy physics experiments the background-induced occupancy of the detector channels can be quite high; therefore it is important to have sophisticated trigger subsystems which process the data in real-time to generate trigger objects for the global trigger decision. In this work we present a FPGA based low-latency trigger processor for the COMPASS-II experiment.

TIGER is a high-performance trigger processor that was developed to fit perfectly in the GANDALF framework and extend its versatility. It is designed as a VXS module and is allocated to the central VXS switch slot, which has a direct link from every payload slot. The synchronous transfer protocol was optimized for low latencies and offers a bandwidth of up to 8 Gbit/s per link. The centerpiece of the board is a Xilinx Virtex-6 SX315T FPGA, offering vast programmable logic, embedded memory and DSP resources. It is accompanied by DDR3 memory, a COM Express CPU and a MXM GPU. Besides the VXS backplane ports, the board features two SFP+ transceivers, 32 LVDS inputs and 32 LVDS outputs to interface with the global trigger system and a Gigabit Ethernet port for configuration and monitoring.

Supported by BMBF and EU FP7 (Grant Agreement 283286).

HK 52.21 Mi 16:45 HSZ 2.OG

Development of a cooling system and vacuum chamber for the pion tracker for HADES — •Joana Wirth for the HADES-Collaboration — Excellence Cluster "Universe", TU München, Boltzmannstr. 2, 85748 Garching, Germany

One of the future experiments planned at SIS18 with the HADES spectrometer in GSI Darmstadt envisages the employment of pion beam colliding on LH2 or nuclear target. Due to the fact that secondary pion beam has high momentum spread, since the precise knowledge of pion momentum is mandatory to carry out the planned exclusive measurements, we have to measure the momentum for each individual pion.

For this purpose our group is developing a pion beam tracking system, which consists of two silicon detectors. Both detectors are located in the beamline and therefore have to cope the high-intensity secondary beam. Cooling of a silicon detector strongly improves its radiation hardness and performance. It reduces the leakage current and thus the noise, which is important for the detection of MIPs like pions.

We have designed and built a complete prototype system of vacuum chamber and detector cooling. With use of the Finite Element Method we simulated the mechanical and thermal properties of the prototype.

The proposed poster will show the current status and performance of the cooling system for a test-detector, focusing on the reduction of the leakage current and the noise.

HK 52.22 Mi 16:45 HSZ 2.OG

Data-driven calibration procedure for the HADES electromagnetic calorimeter — •Dimitar Mihaylov for the HADES-Collaboration — Excellence Cluster "Universe", Boltzmannstr. 2, 85748, Garching, Germany

The High Acceptance Di-Electron Spectrometer (HADES) is dedicated to study the dense nuclear matter. Currently the HADES detector system is not capable to detect photons. In order to improve the situation an electromagnetic calorimeter (EMC) has been proposed. It will enable the identification of the neutral pseudoscalar mesons (π^0, η) via their decay into two photons. The reconstruction of those particles is achieved by analyzing the invariant mass spectrum (IMS) of the detected photons.

The existing photon reconstruction procedure delivers systematical errors to the momenta of the photons which lead to inaccuracies in the IMS. A calibration procedure capable of improving the IMS of the photons was developed and will be presented. This procedure has been implemented in a standalone C++ program. The calibration procedure is based on an algorithm that allows to correct the momenta of the individual photons by using the π^0 mass as a reference. The accuracy of procedure has been tested on simulated data.

HK 52.23 Mi 16:45 HSZ 2.OG

Development of a time projection chamber for Crystal Ball at MAMI — •Oliver Steffen, Martin Wolfes, and Wolfgang Gradl for the A2-Collaboration — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz, D-55099 Mainz

The Crystal Ball Collaboration uses energy tagged bremstrahlung photons produced from the MAMI electron beam to study photo-induced reactions on nucleons and nuclei. The Crystal Ball/TAPS 4π calorimeter setup is optimized for the detection of neutral final states. Charged particles are identified and measured by the inner detector system including a two layer MWPC. The increased rate of charged particles in current and future experiments exceeds the rate capability of these MWPCs.

We are developing a small Time Projection Chamber with triple GEM readout meeting the stringent space requirements of the Crystal Ball experiment. This new tracking detector will feature higher rate capabilities and allows better track reconstruction. A small GEM-TPC prototype has successfully been tested in the MAMI electron beam, showing good first results on rate capability and track reconstruction. Additional simulation studies on track resolution, detector geometry and acceptance are done to optimize the design.

This poster will give an overview of the current status of the project and present the latest results.

HK 52.24 Mi 16:45 HSZ 2.OG

CALIFA at R^{3}B: LED-based gain monitoring system and gamma-ray energy reconstruction algorithm — •Han-Bum Rhee, Lucas Lutz, Timo Bloch, Alexander Ignatov, Stoyanka Ilieva, Thorsten Kröll, and Mirko von Schmid — Technische Universität Darmstadt, Darmstadt, Germany

CALIFA is a calorimeter and spectrometer that aims to detect gamma-rays and light charged particles. It is a part of the R^{3}B experiment at the future FAIR facility. CALIFA is a highly segmented detector surrounding the target to allow measurement of the emission angle and energy of reaction products. The CALIFA barrel consists of CsI(Tl) scintillating crystals, which are individually read out with Avalanche Photodiodes. Therefore, a gain monitoring system is needed. In this work we propose to use light signals from a pulsed LED, distributed to the detector elements via optical fibres, to monitor gain variations. Another part of the work concerns the detection of gamma-rays and the reconstruction of its initial energy. Gamma-ray typically deposits its energy in several crystals and gets Lorenz-boosted while being emitted by a relativistic ion. An algorithm to reconstruct the multiplicity and the initial energy of gamma-rays using R^{3}BRoot simulation package is investigated.

This work is supported by BMBF (06DA9040I, 05P12RDFN8) and HIC for FAIR.

HK 52.25 Mi 16:45 HSZ 2.OG

Fully-automated field mapping of a dipole magnet of a multi-passage spectrometer (MPS) [*] — •Robert Meissner, Peter Thirolf, and Christine Weber — Fakultät für Physik, LMU - München

MLLTRAP is a Penning-trap mass-spectrometer facility, which is currently being commissioned at the Maier-Leibnitz Laboratory in Garching. Here, atomic mass values are determined by measuring cyclotron frequencies of stored ions in a strong magnetic field. In the future, highly-charged ions should be utilized for an improvement in the achievable mass accuracy. For this purpose, singly-charged ions will have to be injected into a charge-breeding device, such as an EBIT, and transferred back towards the Penning traps, while being q/A selected. To fulfill these tasks a multi-passage-spectrometer (MPS) is being built. It consists of a fast-ramping, round-pole dipole magnet with an electrostatic mirror system. A basic requirement for building the MPS is a detailed knowledge on the magnetic field produced by the magnet. It is necessary to simulate the trajectories of the ions and gain knowledge on the design and geometry of the electrostatic mirror system and the vacuum chamber. For this purpose, a robot was designed, which - powered by three step motors - measures the magnetic field fully automated. The robot moves a Hall probe within three dimensions with a resolution of 1 mm and an uncertainty of 0.5 mm. In this presentation, the development of the robot, its control and data acquisition via LabView and the results will be presented.

[*] Supported by DFG under HA 1101/14-1.

HK 52.26 Mi 16:45 HSZ 2.OG

Design of the Magnetic Shielding for PERC — •Philip Haiden[1], Jacqueline Erhart[1], Harald Fillunger[1], Miklos Horvath[1], Gertrud Konrad[1], Martin Moser[1], Xiangzun Wang[1], Carmen Ziener[2], and Hartmut Abele[1] for the PERC-Collaboration — [1]Atominstitut, TU Wien, Austria — [2]Universität Heidelberg, Germany

The new facility PERC is a novel source of neutron decay products, currently under development by an international collaboration. Its main component is a more than 11 m long superconducting magnet system (up to 6 T). In order not to disturb other experiments in the vicinity of PERC, we have designed a magnetic shielding. The finite element method (COMSOL Multiphysics) has been used to determine the most suited geometry for the shielding. The following considerations were taken into account: the magnetic stray field is suppressed to the cardiac pacemaker level (0.5 mT at less than 3.0 m), the internal magnetic field and its homogeneity (up to 10^{-4}) are not disturbed, the additional forces onto the coils are not destructive, and the shielding deals with the limited space conditions. For experimental reasons, the magnet geometry is non-axisymmetric and therefore has to be simulated in 3D. To reduce the computing time and simultaneously increase the numerical accuracy, we simulated only one half of the geometry, taking advantage of the symmetry both of magnet and shielding. However, to study the influence of the shielding on the particle trajectories we had to simulate the full geometry. The magnetic and the mechanical design of the magnetic shielding for PERC will be presented.

HK 52.27 Mi 16:45 HSZ 2.OG

Untersuchung der Rückstreuung von Elektronen zur Verbesserung der Energieauflösung bei PERC — •Martin Moser, Jacqueline Erhart, Philip Haiden, Gertrud Konrad, Claus Kovacs und Hartmut Abele für die PERC-Kollaboration — Ato-

minstitut, TU Wien, Austria

Das freie Neutron zerfällt auf Grund der schwachen Wechselwirkung. Über die Winkelkorrelationen der Zerfallsteilchen ist es möglich, die Gültigkeit des Standardmodells der Teilchenphysik zu überprüfen. Das neue Instrument PERC ermöglicht es, die Korrelationskoeffizienten zwischen dem Neutronenspin und den Impulsen der Zerfallsprodukte in noch nie dagewesener Präzision zu messen. Das zum Einsatz kommende Elektronenspektrometer basiert dabei auf dem Detektionsprinzip von PERKEO III. In Wien wird einer der Detektoren von PERKEO III charakterisiert und dessen für die Elektronenspektroskopie relevanten Systematiken untersucht. Die Energiedetektion erfolgt dabei über einen Szintillator mit Photomultiplierauslese. Auf Grund ihrer kurzen Auslesezeit und hohen Zeitauflösung ist es möglich, bei besonders hohen Zählraten zu arbeiten, was gerade für PERC von großer Bedeutung ist. Zusätzlich wird auch die Stabilität des Messsystems erhöht und charakterisiert. Ergänzend werden auch MC Berechnungen durchgeführt, die sowohl das Rückstreuverhalten als auch die Elektronenabsorption und -transmission am Szintillationsmaterial untersuchen, und zwar mit CASINO und PENELOPE. So können wir Energieverluste, die bei der Detektion von Elektronen mit dem Szintillator auftreten, beschreiben und die gemessenen Energiespektren korrigieren.

HK 52.28 Mi 16:45 HSZ 2.OG

Development of a Flexible Trigger System for FAIR — •Manuel Penschuck[1], Jan Michel[1], Joachim Stroth[1], and Michael Traxler[2] — [1]Goethe-Universität, Frankfurt — [2]GSI Gesellschaft für Schwerionenforschung, Darmstadt

In the scope of experimental set-ups for the upcoming FAIR experiments, a general purpose trigger and read-out board (TRB3) has been developed which is already in use in several detector set-ups. For on- and off-board communication between the DAQ's subsystems, TrbNet, a specialized high-speed, low-latency network protocol developed for the DAQ system of the HADES detector, is used. Communication with any computer infrastructure is provided by Gigabit Ethernet.

The TRB3 can be operated as a stand-alone board for small detectors, in combination with other TrbNet-enabled frontends, or as a subsystem of an existing DAQ infrastructure. In order to support these different scenarios, a flexible and modular central trigger system was developed. Trigger criteria can range from basic trigger strobes, internal pulser signals to complex data streams from other, foreign trigger systems. Additional features include detection of coincidence from several input signals with adjustable time delays and windows. A precise time information of all input signals with 20 ps precision is foreseen in the design.

In this contribution the design of the new trigger system and its web-based control and monitoring tools will be presented.

Supported by BMBF (06FY9100I and 06FY7114), HIC for FAIR, EMMI, GSI and HGS-Hire.

HK 52.29 Mi 16:45 HSZ 2.OG

Characterization of APDs for single photon counting — Wladimir Buglak[1], Volker Hannen[1], Raphael Jöhren[1], •Martin Surholt[1], Jonas Vollbrecht[1], Wilfried Nörtershäuser[2,3], Rodolfo Sánchez[3], and Christian Weinheimer[1] — [1]Institut für Kernphysik, Universität Münster — [2]Institut für Kernchemie, Universität Mainz — [3]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt

For the SPECTRAP experiment at GSI, Germany, a detector system with single-photon counting capability operating in the wavelength region from 300 nm up to 1100 nm has been developed at the University of Münster. The detector system utilises a silicon avalanche photo diode (APD) cooled to liquid nitrogen temperatures and operated near the breakdown voltage to obtain high gain values. While the current setup uses a 2×2 mm^2 APD (type RMD S0223), it would be advantageous to have a larger active area for easier adjustment of the experiment optics. On the other hand a larger active area is accompanied by increased thermal noise which might harm the photon counting performance of the device. The characterization of a 8×8 mm^2 APD (RMD S0814) is the subject of this poster.
Furthermore a signal analysis software was developed to supress noise signals, e.g. caused by microphonic effects. The software processes signal waveforms recorded by a Flash ADC and should allow for a lower trigger threshold and thus higher detection efficiency.

Supported by BMBF under contract number 06MS7191.

HK 52.30 Mi 16:45 HSZ 2.OG

Pattern Recognition for the PANDA Forward Tracking System* — •Martin J. Galuska, Jifeng Hu, Wolfgang Kühn, J. Sören Lange, Yutie Liang, David Münchow, and Björn Spruck for the PANDA-Collaboration — II. Physik. Inst., JLU Gießen

The PANDA experiment is planned to start operation in 2017 as part of the future FAIR facility. PANDA is particularly suited to perform resonance scans of exclusively produced charmonium(-like) states. As it is a fixed target experiment a large fraction of final state particles will be boosted toward forward angles. The key challenges for forward tracking arise from the beam momentum dependent magnetic fields: PANDA is comprised of a barrel part with a solenoid field of $B_z = 2$ T and a forward detector with a dipole field of $B \cdot L = 2$ Tm. The interference of the aforementioned magnetic fields leads to complex particle tracks making accurate matching of hits challenging. A Hough Transform alorithm for pattern recognition in the Forward Tracking System based upon a parabola track model was developed. The performance of a proof-of-concept implementation was studied with detailed PandaRoot simulations. Results for momentum resolution, efficiency and ghost rate will be discussed.

* This work was supported in part by BMBF (05P12RGFPF), HGS-HIRe for FAIR and the LOEWE-Zentrum HICforFAIR.

HK 52.31 Mi 16:45 HSZ 2.OG

Verbessertes Design der Schutzdioden für supraleitende Magnete im KATRIN-Experimen — •Alexander Jansen für die KATRIN-Kollaboration — KIT, IKP, Postfach 3640, 76021 Karlsruhe

Die absolute Neutrinomasse ist sowohl für die Astroteilchenphysik, als auch für die Kosmologie von großer Bedeutung. Ziel des KATRIN-Experiments ist die modellunabhängige Messung der Neutrinomasse mit einer Sensitivität von $0.2eV/c^2(90\%C.L.)$ über die Kinematik des Tritium-β-Zerfalls. Hierzu werden die Zerfallselektronen aus der fensterlosen, gasförmigen Tritiumquelle (WGTS) über eine differentielle Pumpstrecke (DPS) und eine kryogene Pumpstrecke (CPS) zum Spektrometerbereich (MAC-E-Filter) geführt, wo ihre Energie mit hoher Präzision gemessen wird.

Die Aufgabe der Transportstrecke (DPS und CPS) ist es, das gesamte Tritiumgas abzupumpen, bevor es das Spektrometer erreichen kann. Gleichzeitig werden die Zerfallselektronen adiabatisch zum Spektrometer geleitet. Der Elektronentransport erfolgt dabei mit Hilfe magnetischer Felder, die durch supraleitende Magnete erzeugt werden. Der sichere Betrieb der Anlage erfordert besondere Maßnahmen zum Schutz der Magnete im Quenchfall. Dabei muss die im Magnetfeld gespeicherte Energie sicher abgeführt werden. Hierzu wurde ein neues Design für die Schutzdioden mit verbesserter Wärmeankopplung konzipiert. Das Poster gibt einen Überblick über den Quell- und Transportbereich und stellt erste Testdaten der neuen Schutzdioden vor.

Dieses Projekt wird vom BMBF unter dem Kennzeichen 05A11VK3 und von der Helmholtz-Gemeinschaft gefördert.

HK 52.32 Mi 16:45 HSZ 2.OG

General readout scheme for the HADES Electromagnetic Calorimeter: status and perspectives — •Behruz Kardan[1], Adrian Rost[2], and Ondřej Svoboda[3] for the HADES-Collaboration — [1]Goethe-Universiät, Frankfurt am Main — [2]TU Darmstadt, Darmstadt — [3]Nuclear Physics Institute of ASCR, Rez, Czech Republic

The HADES spectrometer is located at the SIS18 accelerator at the GSI Helmholtz Center for Heavy Ion Research in Darmstadt. An electromagnetic calorimeter for the HADES experiment is currently under design.

The calorimeter allows to measure neutral meson (π^0 and η) production, which is essential for interpretation of dilepton data, but up to now unknown in heavy-ion reactions in the energy range of the planned FAIR experiments at SIS100.

In order to investigate the optimal functionality of the calorimeter module properties a series of dedicated test experiments of the prototype frontend-electronics in combination with different PMT types have been performed. In this contribution we present details of the detector layout, the module properties, the readout system and its performance studies.

Supported by BMBF (06FY9100I and 06FY7114), HIC for FAIR, EMMI, GSI and HGS-HIRe.

HK 52.33 Mi 16:45 HSZ 2.OG

Investigations of the MCP Detector of a Time-Of-Flight Detector for IMS at the FRS-ESR — •Christine Hornung[1], Marcel Diwisch[1], Hans Geissel[1,2], Natalia Kuzminchuk-Feuerstein[1], Wolfgang Plass[1,2], and Christoph

Scheidenberger[1,2] — [1]Justus- Liebig-Universität Gießen — [2]GSI, Darmstadt

The Isochronous Mass Spectrometry at the FRS-ESR facility at GSI can be used to perform high-precision mass measurements of exotic nuclei. The mass values are obtained from measuring the revolution time of the ions in the storage ring with a time-of-flight detector. The ions pass a thin carbon foil in the detector and release secondary electrons. These electrons are guided by electric and magnetic fields to two MCP detectors. Their number is amplified by micro channel plates and the resulting current is detected by an anode. In order to achieve an accurate time signal, the timing performance of the MCP detector is very important.

The timing performance and the signal shape of the detector setup has been improved by including a new anode design. At the same time, the detector performance dependence on the magnetic field and the electron velocity inside of the MCP-detector was tested. The new detector design and the test results will be presented.

HK 52.34 Mi 16:45 HSZ 2.OG

A Laser Ablation Ion Source for the FRS Ion Catcher — •Ann-Kathrin Rink[1], Timo Dickel[1,2], Jens Ebert[1], Hans Geissel[1,2], Wolfgang Plass[1,2], Martin Petrick[1], Sivaji Purushothamen[2], Pascal Reiter[1], and Christoph Scheidenberger[1,2] — [1]Justus-Liebig Universität Giessen — [2]GSI Darmstadt

The FRS Ion Catcher was developed to serve as test bench for the low energy branch of the Super FRS to slow down exotic nuclei and prepare them for further measurements/ experiments. It consists of a cryogenic stopping cell to thermalise the ions, a diagnostic unit for stopping cell characterisation and various radiofrequency quadrupole structures to guide the ions to the Multiple-Reflection Time-of-Flight Mass Spectrometer for mass measurements, α spectroscopy and isobar separation. To characterise the extraction times of the stopping cell, which is one of the main performance parameters of such a cell, a laser ablation ion source has been develped and tested. This ion source provides a sharply defined starting point of the ions for the extraction time measurement. In the future this source will provide reference ions to calibrate the mass spectrometer for accurate mass measurements.

HK 53: Poster - Instrumentation II

Zeit: Mittwoch 16:45–16:45 Raum: HSZ 3.OG

HK 53.1 Mi 16:45 HSZ 3.OG

Geometrie und Auslese eines aktiven polarisierten Targets für das Crystal-Ball-Experiment — •Maik Biroth für die A2-Kollaboration — Institut für Kernphysik, Johannes Gutenberg-Universität, Mainz

Das Crystal-Ball-Experiment am Elektronen-Beschleuniger Mainzer Mikrotron zur Streuung reeller Photonen wurde 2009 um ein polarisiertes Frozen-Spin-Target ergänzt, welches mit Hilfe eines ^{3}He-^{4}He-Mischerkryostaten bei Temperaturen von 25 mK betrieben wird.
Zum Nachweis niederenergetischer Protonen im Kryostaten soll ein aktives Target als Stapel aus polarisierbaren Szintillatorplättchen realisiert werden. Die Kühlung wird durch das in den Zwischenräumen zirkulierende flüssige Helium gewährleistet. Die Lichtpulse sollen in einem Hohlzylinder aus Wellenlängen verschiebendem Material aus dem Kältereservoir geführt werden.
Veranschaulicht wird eine Studie zur Photonenausbeute in Abhängigkeit von der Targetgeometrie durch Monte-Carlo-Simulation und die resultierenden Anforderungen an die Konstruktion eines neuen Einschubs für den Kryostaten.
Als potentielle Auslesesensoren wurden spezielle Typen von SiPMs und APDs bei der Temperatur flüssigen Heliums getestet und Problem optimierte Vorverstärker entwickelt. Die Temperaturabhängigkeit und Signalqualität wurden quantifiziert.

HK 53.2 Mi 16:45 HSZ 3.OG

Weiterentwicklung des experimentellen Aufbaus für Experimente der Form (e,e'p) und (e,e'pp) an ^{3}He am S-DALINAC — •Simela Aslanidou, Jonny Birkhan, Thorsten Kröll, Peter v. Neumann-Cosel und Gabriel Schaumann — Institut für Kernphysik, Technische Universität Darmstadt

Am Supraleitenden Darmstädter Elektronenbeschleuniger sind Aufbruchexperimente der Art (e,e'p) und (e,e'pp) am Kern ^{3}He geplant. Das Experiment soll am hochauflösenden QCLAM-Spektometer bei niedrigen Impulsüberträgen realisiert werden, da es in diesem Bereich kaum Daten gibt. Dies erlaubt einen wichtigen Test von theoretischen Vorhersagen im Rahmen von Potenzialmodellen[1] und der effektiven Feldtheorie[2]. Verwendet wird ein im Rahmen einer Diplomarbeit entwickeltes gekühltes Gastarget[3]. Für die koinzidente Datenaufnahme steht ein Detektorarray aus Siliziumzählern zur Verfügung, mit welchem die Abdeckung eines möglichst hohen Raumwinkels und die vollständige Bestimmung der Reaktionskinematik ermöglicht werden soll. Weiterhin wird ein neu entwickeltes Konzept für die Positionierung des Gastargets vorgestellt, da kommerzielle Lösungen aufgrund der Besonderheiten des Aufbaus nicht möglich sind.

Der experimentelle Aufbau und die physikalischen Fragestellungen sowie erste Ergebnisse am Teststand werden vorgestellt.

Gefördert durch die DFG im Rahmen des SFB634

[1] J. Golak et al., Phys. Rep. 415 (2005) 89
[2] E. Epelbaum, et al., Rev. Mod. Phys. 81 (2009) 1773
[3] O. Schmitt, Diplomarbeit, TU Darmstadt (2005)

HK 53.3 Mi 16:45 HSZ 3.OG

Calibration of a High-Resolution Straw-Tube-Tracker for the COSY-TOF Experiment — •Sedigheh Jowzaee for the COSY-TOF-Collaboration — Jagiellonian University, Krakow, Poland

The Straw-Tube-Tracker (STT) is an essential detector in the COSY-TOF experiment which provides accurate position information of charged particle tracks to study strangeness physics. The STT consists of about 2700 straw tubes in 26 layers, installed in a vacuum tank about 30 *cm* behind the target. It is operated with 1.2 *bar* overpressure to provide mechanical stability despite the low material budget of 1% X/X_0 radiation length. The STT has been successfully used in the measurement of hyperon production reactions in which a spatial resolution of 150 μm and an efficiency of 98% has been achieved.
The STT performance could be improved further by optimizing the calibration. This will increase the reconstruction efficiency and resolution in order to identify delayed vertices at even shorter distances from the primary vertex. The new calibration has to include subtle effects e.g. signal propagation in wire and systematic effects of the DAQ. Hence, *pp* elastic scattering events were measured in Fall 2012 at 2.95 GeV/c beam momentum are analyzed for the improved calibration of the STT. The results of the improved calibration will be presented.

Supported by FZ-Jülich

HK 53.4 Mi 16:45 HSZ 3.OG

Entwicklungen für den PANDA MVD-Streifen-Detektor* — Tommaso Quagli, •Robert Schnell und Hans-Georg Zaunick — II. Physikalisches Institut, Justus-Liebig-Universität Gießen, Heinrich-Buff-Ring 16, 35392 Gießen

Das PANDA-Experiment am zukünftigen Beschleunigerzentrum FAIR in Darmstadt wird Reaktionen von Antiprotonen mit stationären Targets (Wasserstoff und schwere Kerne) untersuchen. Das Messprogramm von PANDA auf Gebieten wie Charmonium-Spektroskopie und der Suche nach exotischen hadronischen Zuständen soll Zugang zu fundamentalen Aspekten der starken Wechselwirkung ermöglichen. Der Mikro-Vertex-Detektor (MVD) als zentraler Tracking-Detektor soll hoch aufgelöste Spurvermessung und das Erkennen sekundärer Vertizes ermöglichen. Besondere Anforderungen an den MVD stellen die hohe Wechselwirkungsrate von bis zu $2{\cdot}10^7$ Ereignissen pro Sekunde, das triggerlose Auslesekonzept und die Anforderungen einer geringen Materialbelegung. Prototyp-Sensoren in finaler Geometrie wurden vollständig charakterisiert durch Probestation-Messungen, Betrahlungstests und Prototyp-Detektormodule, eingesetzt in Teststrahlmessungen. Dünne Flex-PCB-Technologie mit Feinleiterstruktur, erlaubt die Integration des nötigen Pitchadapter zwischen Front-end und Sensor in das Hybrid-Design.

*Unterstützt vom BMBF, HICforFAIR, HGSHire und JCHP, Jülich.

HK 53.5 Mi 16:45 HSZ 3.OG

Optimization of the target system for the hypernuclear experiment at $\bar{\mathrm{P}}$ANDA — •Sebastian Bleser[1], Felice Iazzi[2], Josef Pochodzalla[3], Kai Rittgen[3], Cihan Sahin[3], Alicia Sanchez Lorente[1], and Marcell Steinen[1] for the PANDA-Collaboration — [1]Helmholtz-Institut Mainz — [2]Politecnico di Torino and INFN, Sez. di Torino, Italy — [3]Institut für Kernphysik, Johannes Gutenberg-Universität, Mainz

Gamma spectroscopy of double Λ hypernuclei will be one of the main topics addressed by the $\bar{\mathrm{P}}$ANDA experiment at the planned FAIR-Facility at Darmstadt, Germany. For this project a dedicated hypernuclear detector setup will be installed. In addition to the general purpose of the $\bar{\mathrm{P}}$ANDA detector it consists of a primary nuclear target for the production of $\Xi^- + \bar{\Xi}$ pairs, a secondary active target for the formation of hypernuclei and the identification of associated decay products as well as a germanium detector array to perform γ spectroscopy.

In order to stop the Ξ^- particles and track pions from the decay of the produced hypernuclei, the secondary target is composed as a compact structure of silicon microstrip detectors and absorber material.

Results of the current hardware development will be presented on the poster including stability tests for the primary target chamber, the readout of silicon microstrip detectors with ultra-thin flexible cables to fan out the readout electronics and design studies of support structures for the whole detector setup. On the simulation side a compromise between the stopping of Ξ^- hyperons and the reconstruction accuracy of weak decay pions will be discussed.

HK 53.6 Mi 16:45 HSZ 3.OG

Aufbau eines Mess- und Regelsystem für die Temperatur eines PbWO4-Detektors — •Felix Welzel — HIM, Mainz, Deutschland

Bleiwolframat (PbWO4) wird zunehmend als anorganisches Szintillationsmaterial für Teilchendetektoren eingesetzt. Seine Lichtausbeute und die damit verbundene Energieauflösung kann signifikant verbessert werden, wenn das Material bei tiefen Temperaturen gehalten wird.

Um die Stabilität der Energiemessung eines aus PbWO4-Kristallen bestehenden Detektors zu gewährleisten, muss für eine Echtzeitmessung und -regelung der Kristallentemperatur gesorgt werden.

Dieser Beitrag befasst sich mit dem Aufbau eines Temperaturmess- und -regelsystems für ein PbWO4 Testkalorimeter, das am Helmholtz-Institut Mainz entwickelt wird. Dabei befinden sich die PbWO4-Kristalle in einer Isolationsbox, die mittels eines Wasser-Ethanol-Kühlers auf einer Temperatur von -25°C gehalten wird.

Der Temperaturverlauf entlang der Kristalle soll mit Pt100-Temperaturfühlern gemessen und durch eine Labview-Anwendung erfasst werden. Dieselbe Anwendung steuert den Kühler. Dadurch kann ein Regelkreis erstellt werden.

HK 53.7 Mi 16:45 HSZ 3.OG

A 98-channel FPGA-based time-to-digital converter (TDC) — •John Bieling for the BGO-OD-Collaboration — Physikalische Institut der Universität Bonn

A new 98-channel FPGA-based time-to-digital converter (TDC) has been developed for the BGO-OD experiment located at the ELSA accelerator facility in Bonn. Its main feature is the ability to handle an input rate of 200MHz on all channels in parallel for up to 1.25μs. It uses a Spartan6 from Xilinx and has as resolution (bin-size) of 100ps (240ps using a Spartan3).

To achieve this, the TDC serializes the recorded hits only after the trigger event and uses a second memory page to continuously record hits. Furthermore, it uses the carry-chain-sampling method to reach its sampling resolution.

The poster illustrates the ideas and technical methods invoked.

HK 53.8 Mi 16:45 HSZ 3.OG

Strahltests zur Positionsauflösung des PANDA-EMC — •Christian Hammann für die PANDA-Kollaboration — HISKP, Universität Bonn, Deutschland

Eine wichtige Detektorkomponente des PANDA Experiments an FAIR ist das elektromagnetische Kalorimeter (EMC). Das EMC des Targetspektrometers wird aus ca. 15500 Bleiwolframat-Kristallen bestehen, die bei −25°C betrieben werden. Die Kristalle sollen mit jeweils zwei APDs, oder im Bereich hoher Raten mit einer VPT oder VPTT, ausgelesen werden.

Der Proto192 ist ein Prototyp für den in Vorwärtsrichtung gelegenen Teil des Kalorimeters. Dieser Prototyp wurde sowohl mit APDs als auch mit VPT und VPTT ausgestattet, um alle für die Verwendung in PANDA in möglichen Photodetektoren untersuchen zu können.

Mit dem Proto192 wurden am SPS-Beschleuniger am CERN Strahltests mit Elektronen in einem Energiebereich von 5 bis 15 GeV durchgeführt. Dabei stand auch eine Trackingstation mit zwei Siliziumstreifendetektoren und einem Detektor aus szintilierenden Fasern zur Verfügung. Mit diesen Detektoren konnte die Spur der Elektronen genau vermessen werden und so die Ortsauflösung des Proto192 bestimmt werden. Einige Ergebnisse dieser Testmessung werden vorgestellt.

Gefördert durch das BMBF.

HK 53.9 Mi 16:45 HSZ 3.OG

Foil stretching device for the CBM-TRD — •Kathrin Reuss and Michael Seidl for the CBM-Collaboration — Institut für Kernphysik Frankfurt

The Compressed Baryionic Matter experiment uses a Transition Radiator Detector for the electron-pion separation. This detector employs a Multiwire Proportional Chamber with a thin mylar-foil coated with aluminium as entrance window. Because of the large area of the foil it is very sensitive to pressure variations. Since the gain stability depends on the gas volume it is important to keep it constant. Thus a good control of the foil tension is mandatory. This is achieved by using a plexiglass frame and heating coils to stretch the foil and reduce the pressure sensitivity. Furthermore we present simulations and measurements of the expansion of the entrance window due to pressure fluctuations.

HK 53.10 Mi 16:45 HSZ 3.OG

Investigation of the work function fluctuations of electrodes for high precision low energy experiments — •Marcus Beck[1], Werner Heil[1], Ernst-Wilhelm Otten[1], Alexander Wunderle[1], Martin Babutzka[2], Kerstin Schönung[2], Klaus Schlösser[2], Matt Bahr[3], and Benjamin Monreal[3] — [1]Institut für Physik, Johannes Gutenberg Universität Mainz — [2]Institut für Experimentelle Kernphysik KIT, Karlsruhe — [3]Department of Physics, University of California, Santa Barbara, USA

High precision experiments at low energies are used in several areas of fundamental physics. Examples are, a.o., high precision beta decay experiments and experiments using Penning traps for mass measurements or for g-factor measurements. The knowledge of the potentials and potential differences inside these experiments is crucial to achieve the desired sensitivities. However, the potentials are modified by the work function of the electrodes, which can show fluctuations of of several hundred meV, both spatially and temporally. For the low energy precision experiments *a*SPECT and KATRIN we have commissioned and studied a scanning Kelvin probe system to investigate the work function fluctuations of gold surfaces on different substrates. Since the Kelvin probe is a relative method, also photoelectron spectroscopy was performed additionally to obtain information on the absolute work functions. The temporal stability of the work functions of the surfaces was also tested, as well as the influence of standard cleaning procedures for ultra-high vacuum applications and bake-out. This poster will present the results of these measurements.

HK 53.11 Mi 16:45 HSZ 3.OG

Ein Slow-Control Konzept für das CALIFA-Kalorimeter — •Michael Bendel, Roman Gernhäuser, Walter Henning, Tudi Le Bleis und Max Winkel für die R3B-Kollaboration — Technische Universität München, Physik-Dept. E12, 85748 Garching

Im R^3B-Experiment, das an der neuen Experimentiereinrichtung FAIR (Darmstadt) aufgebaut wird, soll die gesamte Targetregion von dem grossvolumigen Kalorimeter CALIFA eingeschlossen werden. CALIFA ist ein sehr vielseitiges Instrument, das eine Schlüsselrolle in der Realisation von kinematisch vollständigen Messungen spielt. Das Kalorimeter besteht aus ca. 5000 CsI-Kristallen, die mit Silizium-Avalanche-Photodioden ausgelesen werden sollen. Zusätzlich werden ein LED-Pulser sowie ein elektronischer Pulser installiert, um eine kontinuierliche Kalibration jedes einzelnen Kanals zu ermöglichen. Die große Anzahl an Kanälen stellt hohe Anforderungen an die Slow Control, um effizient eine Vielzahl an Parametern justieren zu können. Wir stellen ein erstes Konzept vor, um diese Systeme zu vereinheitlichen.

HK 53.12 Mi 16:45 HSZ 3.OG

Echtzeit Analyse für das Califa Kalorimeter — •Max Winkel, Michael Bendel, Roman Gernhäuser und Tudi LeBleis für die R3B-Kollaboration — Technische Universität München, Garching, Deutschland

Die Planung des CALIFA-Barrel, einem elektromagnetischem Kalorimeter und Spektrometer für R^{3}B am FAIR, schreitet stetig voran. Ein entscheidender Meilenstein ist die Entwicklung des CALIFA-Demonstrators, der Anfang 2014 in Betrieb gehen soll. In diesem Poster werden die Besonderheiten der Elektronik, Auslese und Signalverarbeitung vorgestellt, sowie deren vielversprechende Resultate aus ersten Tests.

Das CALIFA-Barrel besteht aus rund 2.000 CsI(Tl) Szintillatoren, welche über Avalanche Photo Dioden ausgelesen werden. Besondere Merkmale und Herausforderungen für Detektordesign und Auslese sind der hohe dynamische Energiebereich (ca. 100 keV – 300 MeV), sowie die Möglichkeit zur Teilchenidentifizierung aus dem Szintillationssignal. Dazu wurden hochspezialisierte Algorithmen entwickelt und in Field Programmable Gate Arrays (FPGA) implementiert. Die Firmware erlaubt die Signalverarbeitung in Echtzeit ohne Konversions-Totzeit.

Diese Arbeit wurde unterstützt durch BMBF(05P12WONUE) und DFG (EXC153).

HK 54: Poster - Hadronenstruktur und -spektroskopie

Zeit: Mittwoch 16:45–16:45 Raum: HSZ 3.OG

HK 54.1 Mi 16:45 HSZ 3.OG

Ein allgemeines Partialwellen-Analyse-Framework für PANDA — Florian Feldbauer[1,2], Miriam Fritsch[1,2], Klaus Götzen[1,4], Prometeusz Jasinski[1,2], Anastasia Karavdina[2], Bertram Kopf[3], •Mathias Michel[1,2], Klaus Peters[1,4] und Matthias Steinke[3] für die PANDA-Kollaboration — [1]HI Mainz — [2]Universität Mainz — [3]Universität Bochum — [4]GSI Darmstadt

Ein Großteil des Physikprogramms des PANDA-Experiments an FAIR (Darmstadt) beschäftigt sich mit der Suche nach neuen konventionellen sowie exotischen hadronischen Zuständen wie z.B. Hybriden oder Gluebällen. Zur Identifizierung möglicher Kandidaten und zur eindeutigen Einordnung bereits bekannter Zustände wird bei PANDA in einem Großteil der Analysen eine Partialwellenanalyse (PWA) benötigt. Zu diesem Zweck wird ein neues, flexibles und effizientes PWA-Framework entwickelt. Es wird modular gestaltet, was es erlaubt, problemlos weitere Modelle und Formalismen hinzuzufügen, wie auch gleichzeitig mehrere Datensätze (auch verschiedener Experimente) anzupassen. Außerdem werden verschiedene Minimierungs- und Bewertungsroutinen zur Verfügung gestellt. Ziel ist es, die Software mit Daten laufender Experimente wie z.B. BaBar oder BESIII zu verwenden und zu testen. Bei der Erstellungen der Anforderungen an das Programm-Paket wurden Erfahrungen anderer PWA-Programme berücksichtigt, um mögliche Einschränkungen zu vermeiden. Das Poster wird den Status der Implementierung des Software-Frameworks für die PANDA-PWA sowie erste einfache Tests vorstellen.

HK 54.2 Mi 16:45 HSZ 3.OG

Search for ppK^- - Status of the FOPI p-p Experiment* — •Robert Muenzer — Excellence Cluster Universe - TU München

The investigation of the kaon-nucleon interaction has been intensified in the last year due to new results on $\Lambda(1405)$ (1) and indications on the existence of the ppK^- bound state (2).
In a dedicated experiment at the FOPI Sepctrometer at GSI in Darmstadt the possible production of this state in proton proton collision is investigated. During this experiment an additional detector was used to select during data taking events containing Lambda Hyperons (3). This contribution will show the status of the ongoing analysis, expecially the reconstuction of the p$K^+\Lambda$ final state, with the help of a kinemtical refit tool, which allows an improvement of the signal quality.
(1) L. Fabbietti, J. Siebenson / arXiv:1208.0205
(2) T. Yamazaki, M. Maggiora, P. Kienle / PRL 104 / 132502 (2010)
(3) M. Berger, L. Fabbietti, R. Muenzer / in press

HK 54.3 Mi 16:45 HSZ 3.OG

Starke Wechselwirkung in Pionischen Atomen — •Jan Muehlhans, Stefanie Lourenco und Horst Lenske — Institut für Theoretische Physik, Universität Gießen

Aus der Klein-Gordon Gleichung für ein Pion im Coulombpotential eines ^{208}Pb Kerns werden numerisch die Radialwellenfunktionen und Bindungsenergien berechnet. Die endliche Ausdehnung der Kernladungsverteilung wird in verschiedenen Näherungen berücksichtigt. Die starke Wechselwirkung wird in Form eines komplexen optischen Potentials eingeführt. Dieses beinhaltet Beiträge für s- und p-Wellen-Streuung. Die Klein-Gordon Gleichung wird um den Realteil des optischen Potentials erweitert, während der Beitrag des Imaginärteils störungstheoretisch abgeschätzt wird. Die störungstheoretische Behandlung des Imaginärteils liefert verläßliche Korrekturen zur Bindungsenergie aber unterschätzt die Zerfallsbreiten. Der Vergleich der Radialwellenfunktionen für reines Coulomb und Coulomb mit optischem Potential zeigt den abstoßenden Charakter der starken Wechselwirkung. Die Ergebnisse werden mit anderen Rechnungen verglichen.

HK 54.4 Mi 16:45 HSZ 3.OG

Feasibility studies for the measurement of the time-like form factors of the proton in $\bar{p}p \to \mu^+\mu^-$ at the PANDA experiment. — •Iris Zimmermann — HIM Mainz

The process of annihilation of proton and antiproton into a pair of charged leptons can be used to investigate the inner structure of the proton. Simulations using the software package PANDARoot can provide information about the feasibility of using such processes. A challenge will be the suppression of the large hadronic background, mainly coming from $\pi^+\pi^-$, because of the similar masses of muon and pion. First simulation studies have been done to investigate the behaviour of the signal and background process inside the PANDA detector.

HK 54.5 Mi 16:45 HSZ 3.OG

Upper limit of the Hypertriton production in the Ar+KCl collision system at 1.76 AGeV with HADES — •Timo Scheib for the HADES-Collaboration — Goethe-Universität, Frankfurt am Main

In September 2005 data of the collision system Ar+KCl at a kinetic beam energy of 1.76 GeV per nucleon was measured with HADES. In this context several strange particles, which are suitable probes of the high density phase in heavy ion collisions, have been successfully reconstructed. Among them is the hypertriton, the lightest of the so called hypernuclei, which decays into a helium nucleus and a negative pion with a branching ratio of about 35%.
In this contribution we present the results of this investigation. Since the hypertriton is not observed in the given system, we calculate an upper limit for the production of this particle.
Supported by BMBF (06FY9100I and 06FY7114), HIC for FAIR, EMMI, GSI and HGS-Hire.

HK 54.6 Mi 16:45 HSZ 3.OG

Light meson production in nucleon-nucleon reactions — •Khaled Teilab[1], Susanna Gallas[1], Francesco Giacosa[1], and Dirk H. Rischke[1,2] — [1]Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Straße 1, D-60438 Frankfurt — [2]Frankfurt Institute for Advanced Studies (FIAS), Ruth-Moufang-Straße 1, D-60438 Frankfurt

We study the production of mesons in nucleon-nucleon reactions at center-of-mass energies of a few GeV using an $N_f = 2$ linear sigma model, extended by including the $N_f = 2$ multiplets of (pseudo-) scalar and (axial-) vector mesons and a doublet of the nucleon together with its chiral partner (the $N^*(1535)$ or $N^*(1650)$ resonance). Results of the calculations are compared to experimental data.

HK 54.7 Mi 16:45 HSZ 3.OG

Feasibility studies of proton time-like electromagnetic form factors with the PANDA detector — •Dmitry Khaneft for the PANDA-Collaboration — Helmholtz-Institut Mainz, Mainz, Deutschland

Perspectives of measuring proton electromagnetic form factors in the time-like region at FAIR with the $\bar{\text{P}}$ANDA detector are presented. The official software framework of the $\bar{\text{P}}$ANDA collaboration ($\bar{\text{P}}$ANDAroot) has been used for performing Monte Carlo simulations of the signal process $\bar{p}p \to e^+e^-$ as well as of the most important background process $\bar{p}p \to \pi^+\pi^-$, in order to study signal detection efficiency and background suppression. The three hypotheses $G_E/G_M = 0, 1, 3$ have

been considered for the generation of signal events. A set of cuts were implemented into the analysis procedure for separating the signal from the background. Preliminary results for the estimation of the statistical error are shown.

HK 54.8 Mi 16:45 HSZ 3.OG

P2 - The weak charge of the proton — •Dominik Becker — Institut für Kernphysik, Mainz

Since early 2012, a new high precision measurement of the proton weak charge is being prepared in Mainz. It is our goal to determine the electroweak mixing angle $\sin^2(\theta_W)$ to a relative precision of 0.15 %, which can be achieved by measuring the proton weak charge to a relative uncertainty of 1.9 % through the parity-violating asymmetry in elastic electron-proton-scattering at low momentum transfer. We will present studies of the achievable precision in the determination of $\sin^2(\theta_W)$ within P2. Furthermore, we are going to show results of GEANT4 simulations, which are being done to explore the future experimental setup.

HK 54.9 Mi 16:45 HSZ 3.OG

Paritätsverletzende Elektronstreuung an MAMI und MESA — •Sebastian Baunack — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz

In den vergangenen Jahren wurde von der A4-Kollaboration am Elektronenbeschleuniger MAMI ein Experiment zur paritätsverletzenden Elektronstreuung betrieben. Ziel der Messungen war primär die Bestimmung der Strangequarkbeiträge zu den Vektorformfaktoren des Nukleons.

Ab diesem Jahr wird ein neues Paritätsexperiment vorbereitet, welches an der neuen Beschleunigereinheit MESA unter anderem Tests des Standardmodells durchführen wird.

Die im Rahmen des A4-Experiments gewonnenen Erkenntnisse und Erfahrungen werden skizziert und es werden Planungen und Anforderungen für das neue Paritätsexperiment an MESA vorgestellt.

HK 54.10 Mi 16:45 HSZ 3.OG

Feasibility Study of a Transversely Polarized Target in PANDA — •Bertalan Feher — Helmholtz-Institut Mainz

PANDA (Antiproton Annihilation at Darmstadt) is a key project at the Facility for Antiproton and Ion Research (FAIR), i. e. an accelerator facility currently under construction at GSI Darmstadt. PANDA is a state of the art detector for antiproton-proton fixed target experiments. A transversely polarized target in PANDA allows the determination of the electromagnetic time-like form factors with unprecedented accuracy and the first extraction of the imaginary part from the latter. The measurement of this will open a new window for investigating the nucleon structure. Since the PANDA spectrometer is based on a longitudinal solenoid field, the target region needs to be shielded in order to have a transverse polarization. A high-temperature type-2 superconducting shield will be used for this purpose. Simulations using a finite element method were performed to calculate the resulting field map.

HK 54.11 Mi 16:45 HSZ 3.OG

Study of the $\Lambda(1116)$ interaction with the cold nuclear environment — •Oliver Arnold for the HADES-Collaboration — Excellence Cluster "Universe", Boltzmannstr. 2, 85748, Garching, Germany

The question of the existence of $\Lambda(1116)$-hyperons in the interior of a neutron star is not clarified at the moment. The attractive potential of Λ-hyperons eventually leads to the appearance of this particle in the neutron star core and this might substantially soften the nuclear equation of state. This hypothesis should be critically examined in the view of a recent precise measurement of a two-solar-mass neutron star, which disfavours a soft equation of state. Therefore, the strength of the potential is an important parameter in theoretical models of nuclear equations of state.

In order to get information about the Λ interaction strength with nuclear matter at ground state density, we confront the HADES results on Λ production in proton-niobium collisions at a beam kinetic energy of 3.5 GeV with the predictions of different transport models. In particular, we discuss the influence of different parameters of the model (such as production and scattering cross-sections) with help of the GIBUU code.

HK 54.12 Mi 16:45 HSZ 3.OG

Luminosity Determination at ANKE with Different Reference Reactions — •Christopher Fritzsch, Paul Goslawski, Malte Mielke, Michael Papenbrock, Daniel Schröer, Alexander Täschner, and Alfons Khoukaz — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, D-48149 Münster, Germany

A high precision measurement on the mass of the eta meson was the main objective of the COSY proposal Nr. 187. In detail the meson production reaction $dp \to {}^3\mathrm{He}\,X$ has been studied with X being the eta meson identified by the missing mass technique. However, parallel to the already very successfully performed eta mass determination [1], the obtained data also allow for studies on total and differential cross sections for the reaction $dp \to {}^3\mathrm{He}\,\eta$ close to threshold as well as for a study of the ABC-effect in the channel $dp \to {}^3\mathrm{He}\,\pi^+\pi^-$. For this purpose a careful data normalization and luminosity determination is required. While *dp*-elastic scattering is commonly used as reference reaction for the luminosity determination at ANKE, an independent normalization channel is of high interest as cross reference. Therefore, the ${}^3\mathrm{He}\,\pi^0$ final state is analyzed in parallel and the results are compared to the *dp*-elastic scattering data. The method and recent results will be presented.

Supported by COSY FFE.

[1] P. Goslawski et al., Phys. Rev. D85 (2012) 112011

HK 54.13 Mi 16:45 HSZ 3.OG

PANDA EMC backward end-cap mechanics — Luigi Capozza, Jorge Ceballos, Dexu Lin, Frank Maas, •David Rodriguez, Roserio Valente, and Felix Welzel for the PANDA-Collaboration — Helmholtz-Institut Mainz

The PANDA experiment at the FAIR facility will be a multipurpose hermetic spectrometer covering the full solid angle range. A key role for several physics cases will be played by the electromagnetic calorimeter. This includes ca. 15000 PbWO4 scintillating crystals arranged in a central barrel, a forward and a backward end-cap.

The backward end-cap of the PANDA electromagnetic calorimeter is composed by 540 straight crystals covering the scattering angles between 147* and 161*. They are housed in the so-called alveoli which are carbon fibre boxes, providing both strength and low material budget.

The crystals are to work at -25*C in order to improve the light yield. To achieve this temperature a cooling system and thermal insulation are needed. The cooling system removes the heat coming from the electronics and through walls, cables and mechanical supports. Vacuum insulated panels are installed as a thermal shielding.

Avalanche Photodiodes (APD) have been chosen as photon detectors, since they are still functional under strong magnetic fields. ASIC chips will be used to amplify the APD signal, this preamplifier features low noise and low heat generation.

Due to the weight of this detector, it will be supported from the outside of the PANDA target spectrometer in a counter lever arm position.

HK 54.14 Mi 16:45 HSZ 3.OG

Measurement of Polarization Observables T, P, and H in Pseudoscalar Meson Photoproduction with the CBELSA/TAPS Experiment — •Jan Hartmann for the CBELSA/TAPS-Collaboration — HISKP, Universität Bonn

In order to extract the contributing resonances in photoproduction experiments, partial wave analyses need to be performed. Here, a complete experiment is required to unambiguously determine the contributing amplitudes. This involves the measurement of carefully chosen single and double polarization observables.

The Crystal Barrel/TAPS experiment with a longitudinally or transversely polarized target and an energy tagged, linearly or circularly polarized photon beam allows the measurement of a large set of polarization observables. Due to its good energy resolution, high detection efficiency for photons, and the nearly complete solid angle coverage it is ideally suited for the measurement of photoproduction of neutral mesons decaying into photons.

Preliminary results for the target asymmetry T, recoil polarization P and the double polarization observable H will be presented for π^0 and η photoproduction off the proton.

Supported by DFG within CRC16

HK 54.15 Mi 16:45 HSZ 3.OG

Carbon-12 target for P2 — •Kathrin Gerz — Institut für Kernphysik Mainz

The P2-Experiment at the Mesa accelerator - due to be operational in 2017 - in Mainz aims to determine the electro-weak mixing angle with a relative precision of 0.15% by measuring the parity-violating asymmetry in elastic scattering of electrons from nuclei at low Q^2.

The current approach is based on a 60cm long liquid hydrogen target. Studies are under way to investigate alternative target materials. This poster will show first results of simulations for an experimental setup with a graphite target as well as potential advantages and experimental challenges as compared to cryogenic hydrogen.

HK 54.16 Mi 16:45 HSZ 3.OG

Background estimations for the A4 experiment — •Luigi Capozza — Helmholtz-Institut Mainz, Mainz, Germany

The A4 experiment at the MAMI accelerator facility at Mainz studies the nucleon structure by measuring single spin asymmetries in elastic electron-proton and quasi-elastic electron-deuteron scattering. Elastic and inelastic events are separated by measuring the energy of the scattered particles in an homogeneous PbF_2 electromagnetic calorimeter. Besides inelastic events, gammas from the π^0 decay constitute another source of background which is particularly important in backward angle measurements. An electron tagger made of plastic scintillating slabs is used at backward angles for suppressing most of this background. In order to correct for the remaining background contributions, MC simulations of the relevant scattering processes and of the detector response are used. Backward results on a hydrogen target have already been published for the beam energy of 315 MeV. There are analyses ongoing on data at other beam energies and both on hydrogen and deuterium targets. Upgrades of the MC for treating these cases will be presented.

HK 55: Poster - Schwerionenkollisionen und QCD Phasen

Zeit: Mittwoch 16:45–16:45 Raum: HSZ 3.OG

HK 55.1 Mi 16:45 HSZ 3.OG

Production of p, d and t in Ar+KCl-Collisions at 1.76 AGeV — •Heidi Schuldes for the HADES-Collaboration — Goethe-Universität, Frankfurt am Main

This contribution present the final results on the production and emission of protons and light fragments in the reaction Ar+KCl at 1.76 AGeV measured with HADES. Yields and spectral shapes are confronted with the results gained from the analysis of charged pions and strange particles measured in the same run and their interpretation within the statistical model. We will demonstrate that the assumption of a purely thermalized source for protons and light fragments does not apply and will discuss the role of radial flow in this medium sized mass system.
Supported by BMBF (06 FY 9100 I and 06 FY 7114), HIC for FAIR, EMMI, GSI, HGS-Hire and HQM.

HK 55.2 Mi 16:45 HSZ 3.OG

Leptonenidentifikation in Au+Au bei 1,23 GeV/u — •Patrick Sellheim für die HADES-Kollaboration — IKF, Goethe-Universität Frankfurt

Das HADES (High Acceptance Di-Electron Spectrometer) Experiment am Helmholtzzentrum für Schwerionenforschung (GSI) in Darmstadt untersucht die Dileptonen und Strangenessproduktion in elementaren Nukleon-Nukleon sowie Schwerionenkollisionen.
Nach der Aufrüstung einzelner Detektorkomponenten konnte die lange geplante Au+Au Strahlzeit im Mai 2012 durchgeführt werden. Die Messung bei 1,23 GeV/u stellt das bisher schwerste gemessene Kollisionssystem unter HADES dar und stellt daher neue Herausforderungen an die Dileptonenrekonstrukion, auf die wir in diesem Beitrag eingehen werden.
Neben Informationen wie der Teilchengeschwindigkeit legen wir den Fokus besonders auf den Ring Imaging Cherenkov Detektor, welcher zur Leptonenidentifikation verwendet wird und präsentieren wichtige Schritte zur Verwendung der Detektorinformationen hinsichtlich einer erfolgreichen Leptonenidentifikation.
Gefördert durch BMBF (06FY9100I und 06FY7114), HIC for FAIR, EMMI, GSI and HGS-Hire.

HK 55.3 Mi 16:45 HSZ 3.OG

How I found high momentum leptons in HADES — •Szymon Harabasz[1,2], Tetyana Galatyuk[1], and Piotr Salabura[2] — [1]Technische Universität Darmstadt, Darmstadt, Germany — [2]Jagiellonian University, Cracow, Poland

The High Acceptance Di-Electron Spectrometer experiment, installed at GSI, Darmstadt, has measured rare penetrating probes and strange particles production in elementary nucleon-nucleon as well as in heavy-ion collisions. In recent years, an upgrade of the data acquisition system was carried out and a major improvement of the spectrometer in terms of granularity and particle identification capability has been made by replacing the TOFino detector with the new Resistive Plate Chamber (RPC) time-of-flight wall. Thanks to this, the heaviest system, Au+Au at a beam kinetic energy of 1.23 GeV/u has been measured by HADES in April - May 2012.

In such collisions, extracting a pure sample of very rare di-electrons radiated from a dense fireball plays a crucial role. Therefore, a careful electron identification is necessary. This can be achieved by exploring not only information from the Ring Imaging Cherenkov detector but also from the time-of-flight measurement in combination with an evidence of an electromagnetic shower formation.

In this contribution we present results on efficiency and purity of electron identification obtained from the combined information provided by the RPC and the electromagnetic shower detector.
Supported by BMBF (06FY9100I and 06FY7114), HIC for FAIR, EMMI, GSI and HGS-HIRe.

HK 55.4 Mi 16:45 HSZ 3.OG

Systematics of pi0 and eta Dalitz decays in the Gold on Gold beam time of HADES — •Claudia Behnke for the HADES-Collaboration — IKF, Goethe Universität Frankfurt

Lepton pairs emerging from decays of virtual photons are the most promising probes of dense hadronic matter. HADES measured systematically electron pair production in light, medium and heavy mass systems as well as in p and d induced reactions. The understanding of the corresponding experimental results calls for supporting studies from transport calculation. This contribution focuses on systematic studies of pi0 and eta Dalitz decays, relevant for the interpretation of the dynamics of the fireball created in the hot and dense stage. We will compare a clean sample of simulated mesons created with the PLUTO event generator to UrQMD cocktail simulations as well as real measured lepton pair distributions. Supported by BMBF (06FY9100I and 06FY7114), HIC for FAIR, EMMI, GSI, HGS-Hire and H-QM.

HK 55.5 Mi 16:45 HSZ 3.OG

New keys for interpreting A/A collisions realized at relativistic energies — •Christian Ythier and Genevieve Mouze — Université de Nice,06108 Nice cedex 2, France

Nucleus /Nucleus collisions at high energies should create a new state of nuclear matter of 0.17 yoctosecond, as any reaction leading to the complete fusion of projectile and target [1,2]. But at relativistic energies new phenomena should show themselves: The survival of the transverse momentum even in head-on lead/ lead collisions might be the signature of the motion in time of any charge. This new point of view leads to an interpretation of the color as being a three-dimensional time coordinate and even to a new interpretation of inertia [3]. [1] G. Mouze et al., http://arxiv.org/abs/1204.2647 [nucl-exp] 12 April 2012. [2] G. Mouze and C. Ythier, http://arxiv.org/abs/1211.3530 [nucl-exp] 15 nov 2012. [3] C. Ythier and G. Mouze, http://arxiv.org/abs/1212.3091 [physics.gen-ph] 19 Dec.2012.

HK 55.6 Mi 16:45 HSZ 3.OG

A new state of nuclear matter observed in transfer reactions — Genevieve Mouze and •Christian Ythier — Université de Nice, 06108 Nice cedex 2,France

The cross section curves for the formation, at the barrier, of trans-target isotopes of a heavy element by bombardment of a heavy target with various heavy ions, and those for the formation of isotopes of a superheavy element by complete fusion projectile and target, both are similar to the distribution of the neutron number N of a fission

fragment around its most probable value [1,2]. This situation suggests that nucleons are transferred according to one and the same law in the fission reaction and in the transfer reactions: This law results from the creation of a new state of nuclear matter, having a lifetime of only 0.17 yoctosecond, and causing uncertainties in the neutron number N of the product amounting to 2.54 atomic mass unit, as measured by J. Terrell in his study of the prompt *neutron emission. [1] G. Mouze et al. http://arxiv.org/abs/1204.2647 [nucl-exp] 12 April 2012. [2] G. Mouze and C. Ythier, http://arxiv.org/abs/ 1211.3530 [nucl-exp] 15 nov.2012.

HK 56: Poster - Struktur und Dynamik von Kernen

Zeit: Mittwoch 16:45–16:45 Raum: HSZ 4.OG

HK 56.1 Mi 16:45 HSZ 4.OG

Neue Formen der Darstellung des Elektrons und Protons mit Plancks Definition des Griechischen Atombegriffs — •Erhard Schulz — Wiesenstraße 32, 01987 Schwarzheide

Wenn E als unbeschränkt teilbare Größe angesehen wird, ist die Verteilung auf unendlich viele Arten möglich. Wir betrachten aber - und dies ist der wesentliche Punkt der ganzen Betrachtung - E als zusammengesetzt aus einer ganz bestimmten Anzahl endlich gleicher Teile .. [Zitat aus Annalen der Physik1901, p. 553 bis 563 von Planck]. Diese endlich gleiche Teile (Quanten) sind identisch mit den Griechischen Atomen. Diese Quanten bewegen sich mit konstanten Geschwindigkeiten und beschreiben unteilbare physikalische Zustände. Diese elementare Energie existiert in zwei Formen als reines Photon (Impulsform) und reines Roton (Spinform). Wechselwirkungen bestehen aus der Absorption oder Emission von Quanten. Diese Wechselwirkungen werden experimentell als Kräfte, Zeit, Gravitation, elektromagnetische Felder und andere physikalische Größen wahrgenommen. Das Elektron und das Proton wird mit diesen elementaren Energieformen beschrieben. Siehe: http://gisela43ch.wordpress.com.

HK 56.2 Mi 16:45 HSZ 4.OG

Study of the γ-decay behavior of $(2^+ \otimes 3^-)_{1^-}$ candidates with the γ^3 setup at HIγS — •Anne Sauerwein[1], Vera Derya[1], Janis Endres[1], Andreas Hennig[1], Bastian Löher[2,3], Deniz Savran[2,3], Werner Tornow[4], and Andreas Zilges[1] — [1]Institut für Kernphysik, Universität zu Köln — [2]ExtreMe Matter Institute EMMI and Research Division, GSI — [3]Frankfurt Institute for Advanced Studies — [4]Department of Physics, Duke University, USA

Vibrational excitations in atomic nuclei can be described within the scope of the harmonic phonon-model. The coupling of a quadrupole phonon with an octupole phonon leads to a quintuplet of negative-parity states, including the two-phonon $J^\pi = 1^-$ state. A direct test of the two-phonon character is the study of the γ decay into constituent one-phonon excitations, and the comparison of their reduced transition strengths to model predictions. The high-efficiency γ^3 setup at the High Intensity γ-ray Source facility was used, in order to investigate the γ-decay behavior of $(2^+ \otimes 3^-)_{1^-}$ candidates in ^{40}Ca and ^{140}Ce. A detector-array consisting of four High-Purity Germanium detectors, four 3" LaBr detectors and three 1.5" LaBr detectors was used for γ-ray detection. The data acquisition is capable of storing γ-γ coincidence events as well as singles events, allowing for the determination of γ-decay branching ratios.

Supported by the DFG (ZI 510/4-2) and the Alliance Program of the Helmholtz Association (HA216/EMMI). A.S., V.D., and A.H. are members of the Bonn-Cologne Graduate School of Physics and Astronomy.

HK 56.3 Mi 16:45 HSZ 4.OG

Precision mass measurements with the mass spectrometer ISOLTRAP — •Dinko Atanasov for the ISOLTRAP-Collaboration — Max-Planck-Institut für Kernphysik, Heidelberg, Germany, — IMPRS-PTFS, Heidelberg, Germany.

The precision of nuclear masses has been greatly improved after introducing Penning traps as a tool for direct mass measurements. With the mass spectrometer ISOLTRAP relative mass uncertainties of $1{\cdot}10^{-8}$ or better are routinely reached. The present setup consists of a combination of four traps: a radio frequency Paul trap (used to cool and bunch the beam), a multi-reflection time-of-flight mass separator or MR-TOF MS for short (used to purify the beam), a preparation Penning trap (for further preparation and purification), and a precision Penning trap (for the mass measurement). Presently, the ISOLTRAP setup offers several techniques to determine the masses of singly charged ions. For example, the time-of-flight method employed at the MR-TOF or the time-of-flight ion cyclotron resonance (TOF-ICR) technique using the precision Penning trap. Measurements with the MR-TOF MS still offer a relative uncertainty on the order of 10^{-7}.

The ISOLTRAP experiment itself is located at the isotope separator on-line facility (ISOLDE) at CERN, where a broad mass range of stable and short-lived exotic species can be investigated. Recent mass measurements on neutron-rich Zn and Cs isotopes will be presented. Furthermore, their impact on nuclear structure and astrophysics will be discussed.

HK 56.4 Mi 16:45 HSZ 4.OG

Neutron-capture experiment on ^{78}Se with EXOGAM at ILL Grenoble — •Robert John[1], Ralph Massarczyk[1], Ronald Schwengner[1], Aurelien Blanc[2], Michael Jentschel[2], Ulli Köster[2], Paolo Mutti[2], Waldemar Urban[2], Tamas Belgya[3], and Stanislav Valenta[4] — [1]Helmholtz Zentrum Dresden Rossendorf — [2]ILL Grenoble — [3]IKI Budapest — [4]Charles University Prague

We present first results of a neutron-capture study of ^{78}Se. The experiment was carried out with cold neutrons at the reactor of the Institut Laue-Langevin (ILL) at Grenoble. Gamma rays following the ^{77}Se(n,γ) reaction were measured with eight EXOGAM clover detectors, one clover detector taken from the Lohengrin setup and six GASP detectors. This setup enabled the measurement of two- and three-fold γ-ray coincidences as well as of angular correlations of the γ rays with high efficiency. The aim of the analysis is to gain detailed information about the deexcitation patterns of the capture state and lower-lying excited states. These may be used as a test for statistical simulations of γ-ray cascades and their inputs, such as γ-ray strength functions and level densities. This work was supported by the BMBF Joint Research Project TRAKULA.

HK 56.5 Mi 16:45 HSZ 4.OG

Precision mass measurements of exotic calcium isotopes using ISOLTRAP's multi-reflection time-of-flight mass spectrometer — •Frank Wienholtz for the IS532-Collaboration — Ernst-Moritz-Arndt-Universität, Institut für Physik, 17487 Greifswald, Germany

State-of-the-art precision measurements on radioactive ions have been performed with the Penning-trap mass spectrometer ISOLTRAP at CERN. Minute production rates often accompanied by huge isobaric background and millisecond half-lives pose enormous challenges on the experimental setup and often require new experimental techniques. The ISOLTRAP setup has recently been enhanced with an electrostatic mirror ion trap acting as a multi-reflection time-of-flight mass separator (MR-ToF MS) for beam purification. It can likewise be used as a spectrometer in combination with a suitable detector increasing the mass-measurement capability of ISOLTRAP considerably. The measurements on the calcium isotopic chain will be presented together with the nuclear structure they reveal. The measurements up to ^{54}Ca are compared with predictions from models that utilize three-body nuclear forces.

HK 56.6 Mi 16:45 HSZ 4.OG

Aktuelle Ergebnisse zur photoinduzierten Spaltung am S-DALINAC — •Martin Freudenberger[1], Alf Göök[1,2], Christian Eckardt[1], Joachim Enders[1], Peter von Neumann-Cosel[1], Andreas Oberstedt[3,4] und Stephan Oberstedt[2] — [1]Institut für Kernphysik, TU Darmstadt — [2]European Commission, DG Joint Research Centre (IRMM), Geel, Belgien — [3]Akademin för Naturvetenskap och Teknik, Örebro Universitet, Schweden — [4]CEA-DAM Ile de France, Bruyères-le-Châtel, Frankreich

Die Massen- und Winkelverteilung sowie die totale kinetische Energie (TKE) der Spaltfragmente in der Spaltung leichter Aktinide wurde am Darmstädter supraleitenden Elektronenbeschleuniger S-DALINAC mit Hilfe von Bremsstrahlungsphotonen bei Energien knappp oberhalb der Spaltbarriere untersucht. Die Spaltmodengewichte von ^{234,238}U und

^{232}Th, im Rahmen des Multi-Modal Random Neck-Rupture Modells [1] und eine Korrelation zwischen Winkel- und Massenverteilung sowie TKE der Spaltfragmente werden vorgestellt [2].

Diese Arbeit wurde in Teilen unterstützt durch den SFB 634 der DFG, dem Kooperationsvertrag zwischen der TU Darmstadt und der GSI sowie dem LOEWE Zentrum HIC for FAIR des Landes Hessen.

[1] U. Brosa, S. Grossman, A. Müller, Phys. Rep. 197 (1990) 167.
[2] A. Göök, Dissertation, D17, TU Darmstadt (2012).

HK 56.7 Mi 16:45 HSZ 4.OG

High-resolution proton scattering off ^{70}Zn under extreme forward angles* — •Andreas Ebert[1], Dirk Martin[1], Peter von Neumann-Cosel[1], Norbert Pietralla[1], and Atsushi Tamii[2] for the E377-Collaboration — [1]Institut für Kernphysik, TU Darmstadt — [2]Research Center for Nuclear Physics, Osaka, Japan

A high-resolution scattering experiment was performed with a 295 MeV proton beam at the Research Center of Nuclear Physics in Osaka, Japan. The nucleus ^{70}Zn has been measured under scattering angles of 0°, 3° and 4.5°. From the angular distributions it is possible to distinguish spin-M1 and E1 response [1]. The spin-M1 response is assumed to be affected by the shell evolution due to the tensor force towards the exotic neutron-rich doubly magic nuclei ^{78}Ni [2]. The experiments will also provide important information on the evolution of the pygmy dipole resonance with neutron excess by comparison with unstable neutron-rich isotones ^{68}Ni discovered recently at GSI [3].

During the analysis procedure, ion optical correction methods, drift time to distance conversion, high-resolution corrections and an energy calibration are applied. After the background subtraction, double differential cross sections can be extracted. And the cross sections will decomposed into M1-response and E1-response.

[1] A. Tamii et. al. Phys. Rev. Lett. 107,062502 (2011).
[2] T. Otsuka Phys. Rev. Lett. 104 (2010) 012501.
[3] O. Wieland et. al. Phys. Rev. Lett. 102 (2009) 092502.
*Supported by DFG through SFB 634 and NE 679/3-1.

HK 57: Poster - Nukleare Astrophysik

Zeit: Mittwoch 16:45–16:45 Raum: HSZ 4.OG

HK 57.1 Mi 16:45 HSZ 4.OG

Geant4 simulation for proton induced reactions at ESR — •Bo Mei[1,2], Ganna Rastrepina[1,2], Rene Reifarth[1,2], Michael Heil[2], and Ralf Plag[1,2] — [1]University of Frankfurt, Frankfurt am Main, Germany — [2]GSI, Darmstadt, Germany

It is essential to measure the cross sections of the (p, γ) reactions in Gamow window of the p-process in order to understand the nucleosynthesis of 35 stable proton-rich nuclides between ^{74}Se and ^{196}Hg [1]. The investigation of proton capture rates of radioactive nuclides in traditional kinematics is limited to nuclides of long half-lives. Therefore, a proof-of-principle experiment in inverse kinematics has been successfully performed at the Experimental Storage Ring (ESR) of GSI Helmholtzzentrum für Schwerionenforschung GmbH. The circulating ions were interacting with a hydrogen gas jet target at ESR. A preliminary result of the ^{96}Ru(p,γ)^{97}Rh cross section at 10 AMeV is already published [2]. In order to improve the accuracy of the background determination, extensive Geant4 simulations of the experimental setup have been performed to determine the transmission of all proton-induced reaction products. The results agree well with the experimental data. The simulation tool has also been applied for a proposed, improved experiment aiming at cross section measurements down to $E_{CM} \approx 5$ AMeV. The project was supported by Helmholtz International Center for FAIR and Helmholtz Young Investigator Group VH-NG-327.

[1] M. Arnould and S. Goriely, Phys. Rep. 384 (2003) 1.
[2] Q. Zhong et al., Journal of Physics 202 (2010) 012011.

HK 57.2 Mi 16:45 HSZ 4.OG

In-beam Experiments for Nuclear Astrophysics at HORUS — •Jan Mayer, Janis Endres, Lars Netterdon, Anne Sauerwein, Philipp Scholz, and Andreas Zilges — Institut für Kernphysik, Universität zu Köln

The p process involves a large network consisting of about 20000 reactions on approximately 2000 nuclei. As only few experimental data are available, network calculations are based almost completely on reaction rates predicted by theoretical models. Accurate predictions depend on nuclear physics input, e.g., optical-model potentials. In-beam experiments aim at reactions resulting in stable as well as unstable nuclei which are mostly not accessible in activation measurements and, therefore, provide an important method to improve theoretical models. Additional information, e.g. partial cross sections, can also be obtained.

Located at the 10 MV tandem accelerator of the University of Cologne, the high-efficiency HORUS γ-ray spectrometer provides excellent opportunities to improve the experimental situation on charged particle induced reactions relevant for the p process. The experimental setup features a reaction chamber equipped with multiple current readouts, a cooling trap, and a detector for Rutherford-Backscattering Spectrometry. First experiments on ^{89}Y have successfully been performed and preliminary results are presented.

Supported by the DFG (Zi 510/5-1). J.M., A.S., and P.S. are members of the Bonn-Cologne Graduate School of Physics and Astronomy.

HK 57.3 Mi 16:45 HSZ 4.OG

Activation measurements of α-induced reactions relevant for p-process nucleosynthesis — •Philipp Scholz, Janis Endres, Jan Mayer, Lars Netterdon, Anne Sauerwein, and Andreas Zilges — Institut für Kernphysik, Universität zu Köln

The production of p nuclei, those proton-rich nuclei that are not produced by neutron-capture reactions, is mainly attributed to sequences of photodisintegration reactions - the so called γ process.

Most of the predicted reaction rates for reaction network calculations for the γ process are derived from Hauser-Feshbach calculations which strongly depend on γ-strength functions, nuclear-level densities and adopted nuclear models for optical-model potentials. Experimental data for α-induced reactions at low energies are rare. Hence, the construction of a global optical potential and therefore reliable predictions of reaction rates are difficult.

For the improvement of the experimental situation the reactions ^{141}Pr(α,n)^{144}Pm, ^{168}Yb(α,n)^{171}Hf, and ^{168}Yb(α,γ)^{172}Hf were studied with the activation technique [1]. Additionally, an activation experiment for the reaction ^{187}Re(α,n) was recently performed. The counting setup at the Institut für Kernphysik in Cologne as well as experimental results are presented.

Supported under the DFG contracts (ZI 510/5-1, INST 216/544-1). P.S, J.M. and A.S. are member of the Bonn-Cologne Graduate School of Physics and Astronomy.

[1] A. Sauerwein *et al.*, Phys. Rev. C **84**, 045808 (2011)

HK 57.4 Mi 16:45 HSZ 4.OG

Zustandsgleichungen von Neutronensternen — •Katja Kleeberg, Theodoros Gaitanos und Horst Lenske — Institut für Theoretische Physik, Universität Gießen

Um Aufschluss über das Verhalten von Kernmaterie über große Dichtebereiche zu bekommen und umgekehrt durch vorhandene Kenntnisse auf Eigenschaften eines Neutronensterns rückschließen zu können, löst man die Tolman-Oppenheimer-Volkoff Gleichung für eine geeignete Zustandsgleichung. Entsprechende Zustandsgleichungen gewinnen wir aus dem Skyrme-Energiedichtefunktional, welches die Wechselwirkungen in neutronenreicher Kernmaterie zweckmäßig beschreibt. Die relativen Häufigkeiten von Nukleonen und Leptonen bestimmen die Gleichungen des β-Gleichgewichts. Es werden mehrere Parametersätze gegenüber gestellt. Ein auf den ersten Blick unerwartetes Ergebnis ist, dass einige Parametersätze eine zunächst suspekt erscheinende Schalenstruktur von Protonen und Neutronen im Neutronenstern vermuten lassen. Ergebnisse für die Masse-Radius Zustandsgleichung von Neutronensternen werden vorgestellt.

HK 57.5 Mi 16:45 HSZ 4.OG

Experimentelle Studie optischer Potentiale mit Relevanz für den astrophysikalischen γ Prozess* — •Jan Glorius für die anpn-Kollaboration — Institut für Angewandte Physik, Goethe Universität Frankfurt am Main, Deutschland

Der astrophysikalische γ Prozess umfasst ein komplexes Reaktionsnetzwerk. Zur Modellierung sind tausende von Reaktionraten unter stella-

ren Bedingungen im Rahmen des Statistischen Modells zu berechnen. Dieses Model stützt sich auf einen Satz von Parametern, der von experimentellen Daten abgeleitet wird. Optische Potentiale sind ein wichtiger Bestandteil dieses Parametersatzes. Die ungenügende Beschreibung der Potentiale in den derzeigen Modellen gilt als hauptverantwortlich für die großen Unsicherheiten von Vorhersagen für Reaktionen mit Protonen und α-Teilchen. Um diese Beschreibung der Wechselwirkung zwischen Kernen und geladenen Teilchen zu verbessern, wurden die Reaktionen ^{166}Er(α,n), ^{165}Ho(α,n), ^{175}Lu(p,n) sowie ^{169}Tm(p,n) mit der Aktivierungsmethode am FN Tandem der University of Notre Dame gemessen. Bei diesen Messungen liegt eine exklusive Sensitivität auf das optische α-Teilchen- bzw. Protonenpotential vor. Die Daten können folglich als Test für die Vorhersagen des Statistischen Modells sowie als Grundlage zur Verbesserung globaler optischer Potentiale dienen. Den experimentellen Ergebnissen werden Vorhersagen auf Basis aktueller optischer Potentiale gegenübergestellt.

*gefördert durch DFG (SFB 634, SO 907/2-1), DAAD (50141757), JINA (NSF, USA), HIC for FAIR und HGS-HIRe

HK 57.6 Mi 16:45 HSZ 4.OG

Bestimmung der Lichtausbeute von NeuLAND-Szintillatoren — •Jerson Andres Bonilla Guzman, Claudia Lederer, Moritz Pohl und Rene Reifarth für die R3B-Kollaboration — Goethe Universität Frankfurt

Bei der Untersuchung exotischer neutronenreicher Nuklide spielt die Detektion schneller Neutronen eine wichtige Rolle. Mit steigender Neutron-Proton Asymmetrie sinkt die Neutronenseparationsenergie und die Emission von Neutronen wird der dominierende Zerfallsprozess. Am R^{3}B Aufbau (Reactions with Relativistic Radioactive Beams) werden zukünftig Reaktionen mit relativistischen exotischen Teilchenstrahlen mit Energien von bis zu 1 $\sim$ AGeV untersucht. Der R^{3}B Aufbau wird am künftigen FAIR Beschleunigerzentrum am GSI Helmholtz-Zentrum betrieben werden. Der NeuLAND (New Large Area Neutron Detector) ist ein wichtiger Bestandteil des R^{3}B Aufbaus und in der Lage, Neutronen mit Energien zwischen 0,1 und 1 GeV nachzuweisen. NeuLAND wird eine hohe Effizienz und eine dreifach bessere Energieauflösung als sein Vorgänger LAND aufweisen. NeuLAND wird aus 3000 Submodulen (Plastikszintillatoren) mit den Dimensionen 5 x 5 x 270 cm^3 bestehen. Sie werden in 30 Doppelebenen mit jeweils 100 Szintillatoren so angeordnet, so dass eine Detektionsfläche von 270 x 270 cm^2 und eine Tiefe von 3 m erreicht werden. Jeder einzelne Szintillator muss eine Qualitätskontrolle durchlaufen. In diesem Beitrag werden Möglichkeiten zur schnellen und sicheren Untersuchung der Szintillatorstäbe vorgestellt, die sich später zur massenhaften Anwendung eignen. Dieses Projekt wird von BMBF (06FY71051) unterstützt.

HK 57.7 Mi 16:45 HSZ 4.OG

Entwicklung eines Prototypen zur Neutronenproduktion via ^{7}Li(p,n) — •Stefan Fiebiger[1], Clemens Beinrucker[1], Michael Berger[1], Micaela Fonseca[4], Tanja Heftrich[1], Franz Käppeler[3], Antonin Krása[2], Claudia Lederer[1], Ralf Plag[1], Arjan Plompen[2], René Reifarth[1], Stefan Schmidt[1] und Kerstin Sonnabend[1] — [1]Goethe Univ. Frankfurt a. M. — [2]European Commission, JRC, Institute for Reference Materials and Measurements, Geel, Belgien — [3]Karlsruher Institut für Technologie — [4]Centro de Física Nuclear da Universidade de Lisboa, Portugal

Für den FRANZ-Beschleuniger an der Goethe Universität in Frankfurt a. M. wurde ein Prototyp zur Neutronenproduktion entwickelt. Beim Beschuss mit Protonen mit einer Energie von etwa 2 MeV und einem gepulsten Strom von 2 mA werden Neutronen mit Hilfe der ^{7}Li(p,n) Reaktion produziert. Wegen den hohen thermischen Anforderungen lag der Schwerpunkt der Entwicklung auf der Planung und Auslegung der Kühlung. Die Kühlung erfolgt, indem die Rückseite der mit Lithium bedampften Kupferscheibe direkt überströmt wird. Simulationen mit GEANT 3 zeigen, dass die Wasserkühlschicht auf schnelle Neutronen um 100 keV besonders moderierend wirkt. Erste Tests des Prototypen am IRMM (Institute for Reference Materials and Measurements) zeigen eine gute Übereinstimmung mit den simulierten Ergebnissen. Die Simulationen zeigen weiterhin, dass schweres Wasser (D_2O) einen geringeren Einfluss auf das Neutronenspektrum hat.

Dieses Projekt wurde unterstützt durch EFNUDAT und die Helmholtznachwuchsgruppe VH-NG-327.

HK 57.8 Mi 16:45 HSZ 4.OG

Mass separation with ISOLTRAP's MR-ToF — •R. Wolf for the ISOLTRAP-Collaboration — Ernst-Moritz-Arndt-Universität, Institut für Physik, 17487 Greifswald

A contaminant-free beam is a crucial condition for mass measurements of short-lived nuclides on an uncertainty level of $\delta m/m = 10^{-8}$, as performed with ISOLTRAP at CERN-ISOLDE. The radioactive beam delivered by an ISOL facility contains a mixture of isobars, where far from stability the ions of interest often amount to only a minute fraction, drowned by contamination. ISOLTRAP has been upgraded with a multi-reflection time-of-flight (MR-ToF) mass analyzer and a Bradbury Nielsen gate, primarily intended as an auxiliary device to provide a faster purification of isobaric mixtures. Mass-resolving power of 10^5 and a contamination suppression of 10^4 have been reached in only a few tens of milliseconds, which decreases the purification period by over an order of magnitude compared to mass-selective buffer-gas centering in a dedicated Penning trap. On the one hand, the system can be used as the only mass separator and selector for very short-lived nuclides, where the buffer-gas filled Penning trap acts only for cooling and bunching. On the other hand, for intermediate half-lives and very high contamination to ion of interest ratios, several Penning-trap capture cycles can be performed to filter the few or even the only one ion of interest, for the actual mass measurement. This improves the ion-of-interest throughput by more than a factor of 10. The application of this method, e.g for the mass measurement of ^{82}Zn and its astrophysical impact on the neutron-star crust, will be presented.

HK 57.9 Mi 16:45 HSZ 4.OG

Neutron capture on the s-process branch point nucleus ^{63}Ni — •M. Weigand[1], T.A. Bredeweg[2], A. Couture[2], M. Jandel[2], F. Käppeler[4], G. Korschinek[3], C. Lederer[1], J.M. O'Donnell[2], R. Reifarth[1], J.L. Ullmann[2], and A. Wallner[5] — [1]Goethe Universität, Frankfurt, Germany — [2]LANL, Los Alamos, USA — [3]TUM, Garching, Germany — [4]KIT, Karlsruhe, Germany — [5]Australian National University, Australia

One of the important questions in nuclear astrophysics is how the observed abundances of elements came to be. Nearly all of it are either formed by the s- or the r-process in almost equal shares. The precise s-process path depends on stellar parameters like temperature and neutron density. In addition, unstable isotopes act as branching points, creating different possible ways for the nucleosynthesis, neutron capture and β^--decay compete, depending on the conditions in the star. This affects the isotopic abundances of the heavier elements. Therefore it is important to know the neutron capture cross section (NCS) for these isotopes. ^{63}Ni is one of these branching points in the weak component of the s-process. In order to determine the NCS in the astrophysical energy region, an experiment has been performed using the calorimetric 4π-BaF_2 array DANCE at the Los Alamos National Lab (LANL). The results of the ^{63}Ni(n,γ) experiment will be presented. Various ^{63}Ni resonances have been identified based on the energy deposition in the γ-detector. This work is supported by the Helmholtz Nachwuchsgruppe VH-NG-327 and the Nuclear Astrophysics Virtual Institute NAVI.

HK 57.10 Mi 16:45 HSZ 4.OG

Bestimmung der Zeitauflösung eines FADC-basierten Datenaufnahmesystems — •Richard Kraemer, Ole Hinrichs, Claudia Lederer, Ralf Plag, Rene Reifarth, Stefan Schmidt und Kerstin Sonnabend — Goethe Universität Frankfurt

An der im Aufbau befindlichen Frankfurter Neutronenquelle am Stern-Gerlach-Zentrum (FRANZ) wird es möglich sein, neutronen- und protoneninduzierte Reaktionen mit astrophysikalischer Motivation zu messen. Der Nachweis der Reaktionen kann in beiden Fällen mit 4π-Detektoren aus BaF_2 erfolgen. Man will diese Untersuchungen auch an radioaktiven Isotopen durchzuführen, da sie wertvolle Einblicke in das Innere von Sternen in deren Spätphasen liefern.

Um die Anzahl der Probenatome für solche Messungen zu maximieren, ist es notwendig, Datennahmesysteme zu entwickeln, die trotz hoher Zählraten aus dem Zerfall der Probenatome, zuverlässig die seltenen, zu untersuchenden Reaktionen detektieren. Insbesondere ist hier die Diskriminierung von fast gleichzeitig auftretenden Untergrundereignissen gewünschter Ereignissen von entscheidender Bedeutung.

Moderne Aufbauten machen sich dabei Flash-ADC zunutze. In diesem Beitrag werden erste Untersuchungen vorgestellt, bei denen die Zeitauflösung eines FADC-basierten Datennahmesystems mit einem herkömmlichen ADC-System verglichen wird. Dieses System wird in naher Zukunft mit einem schon vorhandenen BaF_2-Kalorimeter an der Goethe-Universität Frankfurt zum Einsatz kommen. Dieses Projekt wird von PIANO (Helmholtznachwuchsgruppe VH-NG-327) unterstützt.

HK 57.11 Mi 16:45 HSZ 4.OG

Production rate of ^{41}Ca in Interplanetary Dust Particles and the possibility to measure by means of Accelerator Mass Spectrometry (AMS) — •Jose Manuel Gómez-Guzmán, Thomas Faestermann, Leticia Fimiani, Karin Hain, Stephan Jahn, Gunther Korschinek, and Peter Ludwig — Physik Department E12/E15, TU München. D-85748 Garching, Germany.

Interplanetary Dust Particles (IDP) are small grains in orbit around the Sun. The most important source of IDP is the Asteroid Belt located at approximately 3 AU between Mars and Jupiter. During their flight to the Earth they are irradiated by SCR and GCR (solar and galactic cosmic rays) and some radionuclides are formed, including ^{41}Ca and ^{53}Mn.

^{41}Ca ($T_{1/2} = 1.03 \times 10^5 y$) can be used as a unique tracer to determine the accretion rate of IDP on Earth because there are no significant terrestrial sources for this radionuclide. In this work, a model describing the irradiation history of these IDP and the expected ^{41}Ca production rate due to this irradiation are shown. Once known, the ^{41}Ca accretion rate on Earth can be calculated. This is the first time that ^{41}Ca will be used as tracer of extraterrestrial matter, due to the very low expected $^{41}Ca/^{40}Ca$ ratios, in the order of 10^{-15}. The AMS facility of the MLL, with sensitivity down to 10^{-16} for this radionuclide, is presently the only one with the capacity to measure these low ratios.

HK 57.12 Mi 16:45 HSZ 4.OG

Nukleosynthese in Sternen mittler und niedriger Masse bei subsolarer Metallizität* — •Christian Ritter[1,2], Falk Herwig[2], Rene Reifarth[1] und die NuGrid Kollaboration[3] — [1]University of Victoria, Kanada — [2]Goethe-Universität Frankfurt — [3]www.nugridstars.org

Sterne mit sehr viel geringerer Metallizität als die Sonne bieten besondere Möglichkeiten die Entwicklung der Elemententstehung im Detail zu untersuchen und sich ein Bild von der galaktischen chemischen Entwicklung zu machen. Sternsimulationen erlauben dabei die beobachteteten Parameter, z.B. Häufigkeitsverteilungen, mit individuellen Nukleosyntheseprozessen in Verbindung zu bringen. Dabei spielen in AGB Sternen die Wechselwirkungen zwischen Nukleosynthese und Mischprozessen eine wichtige Rolle. Die simulierten Sternhäufigkeiten für alle Elemente (einschließlich ihrer Isotope) als Funktion der stellaren Anfangsmasse und Metallizität können mit Beobachtungen vieler neuentdeckter metallarmer Sterne verglichen werden, insbesondere der sogenannten CEMP (Carbon-Enhanced Metal-Poor, [C/Fe]>1) Sterne. Die neuesten NuGrid Modellrechnungen schließen Neutroneneinfangprozesse (s-Prozess) in AGB Sternen geringer Metallizität ein und werden in diesem Beitrag vorgestellt. Die Abhängigkeit der Modelvorhersagen von Unsicherheiten der nuklearen Reaktionsraten, wie z.B. der Neutronen produzierende ^{22}Ne(α,n)^{25}Mg Rate, sowie einiger repräsentativen Neutroneinfangraten wird diskutiert. *Gefördert vom DAAD (PROMOS).

HK 58: Poster - Astroteilchenphysik

Zeit: Mittwoch 16:45–16:45 Raum: HSZ 4.OG

HK 58.1 Mi 16:45 HSZ 4.OG

Distillation Column for XENON1T Dark Matter Project — •Michael Murra[1], Ethan Brown[1], Stephan Rosendahl[1], Ion Cristescu[2], Christian Huhmann[1], Alex Fieguth[1], and Christian Weinheimer[1] — [1]Institut für Kernphysik, Universität Münster — [2]Karlsruhe Institute of Technology

The XENON1T experiment is the next generation experiment for the direct detection of dark matter in the form of Weakly Interacting Massive Particles (WIMPS). While current limits set by XENON100 and other experiments constrain the WIMP-nucleon cross section to $\sigma < 2.0 \times 10^{-45}$ cm^2, XENON1T will achieve an increased sensitivity by two orders of magnitude by utilizing about 2.6 tons of liquid xenon. A key requirement to reach this sensitivity is the reduction of radioactive backgrounds. One dominant radioactive contamination at this level is ^{85}Kr, which has a beta-decay with an endpoint energy of 687keV. To reach the final sensitivity, the xenon has to be purified to a concentration of < 0.5 ppt (parts per trillion) natural krypton in xenon. Because of different boiling points of Kr and Xe a cryogenic distillation column is used to achieve the required purity. For XENON1T, a rectification column, which operates with partial reflux, is being constructed and characterized to purify ≈ 3 tons of xenon. The key features of this column will be presented, along with a status of the construction.

Different aspects of this project have been funded by DFG-Großgeräte, BMBF and Helmholtz-Alliance for Astroparticle Physics (HAP).

HK 58.2 Mi 16:45 HSZ 4.OG

^{83m}Kr tracer method to determine the separation factor of a cryogenic distillation column for the XENON1T experiment — •Alexander Fieguth, Ethan Brown, Volker Hannen, Stephan Rosendahl, and Christian Weinheimer for the XENON collaboration — Institut für Kernphysik, Universität Münster

A promising approach to look for dark matter in form of Weakly Interacting Massive Particles (WIMPs) is the use of liquid noble detectors to detect the signals produced when a WIMP scatters off of a target nucleus. The XENON project, using a xenon target for such a detector, has achieved the best sensitivity to the WIMP-nucleon cross section with the XENON100 experiment, placing the most stringent limits to date of$\sigma < 2.0 \times 10^{-45}$ cm^2. The next stage XENON1T aims to achieve an increased sensitivity by using more liquid Xenon and enhanced background suppression. One important background is ^{85}Kr. To reach the necessary level, natural krypton has to be removed to a level $<$0.5 ppt. Here the technique of cryogenic distillation is used, and a column is under construction to achieve a separation factor of 10^5. To characterize the column, and to quantify the separation factor, a doping method has been developed using ^{83m}Kr, which is no contamination to the system due to its short half-life of 1.83h. ^{83m}Kr detectors have been build, which measure the scintillation light produced in xenon with a PMT at different points in the column which allows characterization and determination of the separation factor. The project is funded by DFG and Helmholtz Allianz for Astroparticle Physics HAP.

HK 58.3 Mi 16:45 HSZ 4.OG

Das COBRA-Experiment — •Jan Timm für die COBRA-Kollaboration — Institut für Experimentalphysik, Hamburg

In den letzten Jahren wurde eine neuartige Eigenschaft der Neutrinos, die Neutrinooszillation, entdeckt. Ein Neutrino, das sein eigenes Antiteilchen wäre, könnte helfen weitere Fragen bezüglich der Neutrinomassen oder der Baryogenese zu beanworten. Der neutrinolose Doppel-Beta Zerfall bietet zur Zeit die einzige Möglichkeit, diesen hypothetischen Majorana-Teilchenkarakter der Neutrinos zu verifizieren. Das COBRA-Experiment sucht diesen Zerfall mit Hilfe von Raumtemperatur-Halbleiterdetektoren aus Cadmium, Zink und Tellur mit insgesamt 9 Doppel-Beta zerfallenden Isotopen. Cd-116 hat einen, im Vergleich zum natürlichen radioaktivem Gamma-Untergrund, relativ hohen Q-Wert von etwa 2,8 MeV und somit eine gute Ausgangslage diesen seltenen hypothetischen Zerfall zu untersuchen. Das Poster stellt die Detektor- und Abschirmungskonzepte des COBRA-Experiments vor.

HK 59: Poster - Anwendungen physikalischer Methoden

Zeit: Mittwoch 16:45–16:45 Raum: HSZ 4.OG

HK 59.1 Mi 16:45 HSZ 4.OG

Detection of long-lived Plutonium Isotopes in Environmental Samples by Accelerator Mass Spectrometry (AMS) — •Karin Hain[1], Thomas Faestermann[1], Leticia Fimiani[1], José Manuel Gomez Guzmán[1], Gunther Korschinek[1], Peter Ludwig[1], and Taeko Shinonaga[2] — [1]Technische Universität München — [2]Helmholtz Zentrum München

The Plutonium isotopes ^{239}Pu ($T_{1/2}$=2.4·10^{4}a), ^{240}Pu ($T_{1/2}$=6.5·10^{3}a) and ^{242}Pu ($T_{1/2}$=3.7·10^{5}a) are anthropogenic radionuclides emitted into the environment by nuclear activities. Pu is accumulated in the human body and hence, poses a considerable hazard to human health. Due to the long half-lives, these isotopes are present in the biosphere on large time scales and a build-up can be expected. Therefore it is important to study the contamination pathway of Pu into the drinking water.

At the Maier-Leibnitz-Laboratory in Munich a method to detect long-lived Pu isotopes by Accelerator Mass Spectrometry (AMS) is being developed. AMS requires only few milligrams of sample material, which is a substantial advantage over decay counting techniques. Consequently, more samples from different locations can be taken which is essential when searching for locally increased Pu concentrations as in the Pacific Ocean after the Fukushima accident in March 2011. Samples from different locations in the Pacific Ocean and from the snow-hydrosphere are planned to be investigated by AMS.

The principle detection method using AMS and an overview of the status of the project will be presented.

HK 60: Eingeladene Hauptvorträge

Zeit: Donnerstag 8:30–10:30 Raum: HSZ-02

Hauptvortrag HK 60.1 Do 8:30 HSZ-02

Investigating the charge of the proton — •Michael Kohl for the OLYMPUS-Collaboration — Hampton University and Jefferson Lab, Virginia, USA

It has been known from the beginnings of electron scattering that the electric charge of the proton is not pointlike. The elastic form factors characterize the distributions of charge and magnetization in momentum space and are important input for calculations of strong interaction phenomena and nuclear structure. With improvements in experimental techniques and higher precision, data have shown inconsistencies when analyzed in the single-photon exchange approximation, generating a large uncertainty particularly for the proton charge form factor at high momentum transfer. Previously neglected higher-order radiative corrections have been favored for an explanation. To quantify the role of two-photon exchange is the main purpose of the OLYMPUS experiment at DESY. In the static limit, the elastic charge form factor is related to the root-mean-square charge radius, which can also be determined from atomic hydrogen spectroscopy. Recent measurements of the proton charge radius from elastic electron scattering and from the Lamb shift in muonic hydrogen have generated the so-called proton radius puzzle. I will give an overview on the current data landscape and discuss present and future efforts to resolve the pending puzzles of the proton form factors and the proton charge radius.

Hauptvortrag HK 60.2 Do 9:10 HSZ-02

Hadronenphysik mit COMPASS — •Jan Friedrich — Physik-Department Technische Universität München

Der Vortrag zieht Bilanz aus einem Jahrzehnt Hadronenphysik mit COMPASS. Die wichtigsten Erkenntnisse aus der tiefunelastischen Myonstreuung, sowie zu Hadronresonanzen in diffraktiven und durch Photonaustausch induzierten Hadron-Kern-Streureaktionen werden vorgestellt, und der Einfluss auf das Verständnis der starken Wechselwirkung diskutiert. Im Ausblick wird auch das Physikprogramm von COMPASS-II umrissen.

Hauptvortrag HK 60.3 Do 9:50 HSZ-02

The Mesa accelerator — •Kurt Aulenbacher, Marco Dehn, Robert Heine, and Hans-Jochen Kreidel — Institut für Kernphysik der Universität Mainz

The Mainz Energy Recovering Superconducting Accelerator (Mesa) will be used to explore scattering reactions on windowless targets, i.e. under extremely low background conditions. In our case, the energy recovery linac principle allows for stationary conditions in single pass operation at low beam energies in the 100 MeV range. Mesa allows for sufficient luminosity due to its 1MegaWatt of beam power. Due to energy recovery, only 50 kW occur as real load on the RF-system. The machine will also be used as a conventional c.w. accelerator for a precision measurement of the electro weak mixing angle.

HK 61: Hadronenstruktur und -spektroskopie

Zeit: Donnerstag 14:00–16:15 Raum: HSZ-105

Gruppenbericht HK 61.1 Do 14:00 HSZ-105

Baryon spectroscopy at BESIII — •Yutie Liang, Jifeng Hu, Wolfgang Kühn, Jens Sören Lange, Björn Spruck, Matthias Ullrich, Marcel Werner, and Hua Ye — II. Physikalisches Institut, Giessen University, 35392, Germany

Although three-quark models of baryons are quite successful in interpreting low-lying excited baryon resonances, our present knowledge on baryon spectroscopy is still in its infancy. Many very fundamental issues in baryon spectroscopy are still not well understood. On the experimental side, our present knowledge of baryon spectroscopy has come almost entirely from the traditional πN and γN experiments, in which many broad resonances with various possible quantum numbers overlap each other and make it difficult to disentangle. An alternative method to investigate baryon states employs decays of charmonium states such as J/ψ and $\psi(3686)$, in which the natural isospin filter makes the analysis less complicate. In July 2008 the BESIII experiment in Beijing recorded the first hadronic e^+e^- collision at the BEPCII storage ring. Since then, the BESIII detector has taken over 100 million $\Psi(2S)$ and over 1 billion J/ψ events, as well as a data sample corresponding to an integrated luminosity of 2.9 fb^{-1} at the $\psi(3770)$ resonance. This is so far the largest amount of electron collider data on charmonia and provide the opportunity for high precise measurements. In this talk, a selection of recent results relevant to baryon spectroscopy are shown.

HK 61.2 Do 14:30 HSZ-105

Measurement of the $e^+e^- \to \pi^+\pi^-$ Cross Section Using Initial State Radiation at BES-III — •Benedikt Kloss — Institut für Kernphysik Mainz

The magnetic moment of the muon is one of the most precisely measured quantities in modern particle physics. The theoretical prediction and the experimental measurement differ by more than 3 standard deviations. The hadronic cross section of $e^+e^- \to \pi^+\pi^-$ is an important impact for the theoretical prediction of the hadronic contribution to the magnetic moment of the muon.
The experimental measurement of this cross section was performed by the KLOE and the BABAR experiment with high precision. These experiments dominate the world average but they differ below 1 GeV by more than 2 standard deviations. Another comparable experiment is therefore needed.

This measurement can be done at the BES-III experiment in Beijing, China. Using the technique of initial state radiation we are planning to measure this hadronic cross section below 3.0 GeV with a comparable precision to BABAR and KLOE. This talk will give an overview of the current status of this analysis.

HK 61.3 Do 14:45 HSZ-105

Measurement of the hadronic cross section e+e- to pi+pi-pi0pi0 at BES-III — •Martin Ripka — Kernphysik Uni Mainz

Experimental and theoretical values of the muon anomalous magnetic moment presently show a deviation of more than 3 standard deviations. While the electromagnetic and the weak contributions to its theoretical value are well under control, the QCD contributions have to be obtained from data. Experimental measurements of hadronic cross sections can indeed be used to determine the QCD loop contributions using the optical theorem. This talk is about the contribution of the 2pi2pi0 ISR channel using ISR data from the BESIII experiment in Beijing/China. Preliminary results of the simulated cross section will be shown.

HK 61.4 Do 15:00 HSZ-105

Measurement of $e^+e^- \to \pi^+\pi^-\pi^0$ cross section via initial state radiation — Achim Denig[1], •Yaqian Wang[1], Changzheng Yuan[2], and Xueyao Zhang[3] — [1]Institute of Nuclear Physics, Mainz, Germany — [2]Institute of High Energy Physics, Beijing, China — [3]Shandong University, Jinan, China

Based on the 2.9 pb^{-1} data with $\sqrt{s} = 3.773$ GeV collected by the BESIII detector in Beijing, cross section of $e^+e^- \to \pi^+\pi^-\pi^0$ is measured with the ISR method. Depending on the angular distribution of the ISR photon, both the tagged and untagged method are performed to select the signal events.

HK 61.5 Do 15:15 HSZ-105

Study of the transition form factors in the $\gamma\gamma^*$ interaction processes e^+e^-h ($h = \pi^0/\eta$) at BES III — •Elisabetta Prencipe and Achim Denig — Institute for Nuclear Physics, Johannes Gutenberg-Universität Mainz

The experiment BES III, located at BEPC2 in Beijing (China) is a symmetric e^+e^- collider well suited for spectroscopy studies. It offers also a unique opportunity to perform precision measurements of the transition form factors as function of the transfer momentum Q^2 at low energy. This is important to our better understanding of the Standard Model prediction of the muon anomaly a_μ, in particular of the light-by-light hadronic contribution, as the study of the form factor at medium and low Q^2 range represents a test of the Standard Model at low energy frontiers. The study of the channels $e^+e^-\pi^0/\eta$ via $\gamma\gamma^*$ interactions (in the space-like Q^2 region), where both π^0 and η in this analysis decay to 2-photons, plays an important role in this context. First results with the BES III dataset collected at the energy in the center of mass of $\psi''(3770)$ will be shown here, corresponding to an integrated luminosity of 2.9 fb^{-1}, in the range of $Q^2 \in [0.3;10.0]$ GeV^2. This analysis allows to test with high precision the distribution of the function $F(Q^2)\cdot Q^2$ in the range of $Q^2 \in [0.3;1.5]$ GeV^2; to improve the previous measurements performed by CLEO in the range of $Q^2 \in [1.5;3.0]$ GeV^2; to cross check the BaBar and Belle data in the range of $Q^2 \in [4.0;10.0]$ GeV^2.

HK 61.6 Do 15:30 HSZ-105

Messung der polarisierten Strukturfunktion $\sigma_{LT'}$ in der Kaon-Elektroproduktion an MAMI — •Patrick Achenbach für die A1-Kollaboration — Institut für Kernphysik, Johannes Gutenberg-Universität, Mainz

Am Mainzer Mikrotron MAMI werden durch elektromagnetische Anregung neue Einblicke in die Niederenergiestruktur des Protons gewonnen. Die Elektroproduktion von Kaonen am angeregten Proton weist bei Energien von 1–2 GeV eine Vielzahl überlappender hadronischer Resonanzen auf.

Erste Messungen der polarisierten Strukturfunktion $\sigma_{LT'}$ für die Reaktion $p(\vec{e}, e'K^+)\Lambda$ bei kleinem Viererimpulsübertrag werden gezeigt, die mit spin-polarisiertem Elektronenstrahl an der Spektrometeranlage durchgeführt worden sind.

$\sigma_{LT'}$ ist ein imaginärer Teil der longitudinal-transversalen Beiträge im Wirkungsquerschnitt. Modelle, die auf effektiven Lagrangedichten basieren, zeigen Abhängigkeiten von Interferenzen zwischen Nukleon-Resonanzen im s-Kanal sowie Interferenzen zwischen resonanten und nicht-resonanten Prozessen.

Die an MAMI gemessene Strukturfunktion hat das gegenteilige Vorzeichen der mit CLAS am Jefferson Lab gemessenen Werte bei höherem Viererimpulsübertrag.

HK 61.7 Do 15:45 HSZ-105

Beam asymmetry Σ in π^0 photoproduction off protons bound in carbon nuclei — •Inke Jürgensen for the CBELSA/TAPS-Collaboration — HISKP University of Bonn

In order to study the dynamics of the inner components of the nucleon, its excitation spectrum is investigated through meson-photoproduction. Due to the strong overlap of the nucleon's excited states, it is insufficient to determine the cross section only. To identify all resonance contributions unambiguously, single and double polarization observables have to be measured. At the Crystal Barrel experiment at ELSA in Bonn, this is achieved utilizing linearly or circularly polarized photons and longitudinally or transversely polarized nucleons. Polarized protons are realized in a butanol target, which consists of hydrogen, oxygen and carbon. A pure carbon target was used to perform a background measurement. The results for the beam asymmetry Σ in π^0 photoproduction, obtained with a carbon target and a linearly polarized photon beam, will be presented. Furthermore, the influence of carbon background on the measured polarization observables will be discussed. Supported by the Deutsche Forschungsgemeinschaft (SFB/TR 16)

HK 61.8 Do 16:00 HSZ-105

Spin alignment and OZI violation in exclusive ω and ϕ production with pp collisions at COMPASS — •Johannes Bernhard — for the COMPASS collaboration

Institut für Kernphysik, Johannes-Gutenberg-Universität, 55099 Mainz

The COMPASS collaboration investigates the exclusive production of ω and ϕ mesons with a 190 GeV proton beam on a liquid hydrogen target with the aim to explore the interplay of several production mechanisms. For this, cross section ratios and their dependence on x_F of the leading proton p_{fast} and the mass of the $p_{fast}V$ system are determined. We find a significant violation of the OZI rule which can be partly explained by the role of intermediate baryon resonances contributing to ω production. Additionally, the spin alignment of the vector mesons is measured within a set of reference frames which are sensitive to different production types. Again, dependencies of the alignment on x_F and the $p_{fast}V$ mass are found which differ significantly for ω and ϕ.

This work is supported by the BMBF.

HK 62: Schwerionenkollisionen und QCD Phasen

Zeit: Donnerstag 14:00–16:15 Raum: HSZ-201

Gruppenbericht HK 62.1 Do 14:00 HSZ-201

(Anti-)matter and hyper-matter production at the LHC with ALICE — •Nicole Martin for the ALICE-Collaboration — Research Division and ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany — TU Darmstadt, Institut für Kernphysik, Darmstadt, Germany

ALICE is the experiment at the CERN LHC dedicated to the investigation of nucleus–nucleus collisions at the highest energies ever reached in the laboratory. The excellent particle identification capabilities and the ultralow momentum reach of ALICE allow for the reconstruction of a significant number of rare states or even exotic ones. In this talk we present results from a sample of Pb–Pb collisions at a center of mass energy of $\sqrt{s_{\rm NN}} = 2.76$ TeV per nucleon–nucleon pair. Light nuclei up to ^{3}He and ^{4}He as well as the corresponding anti-nuclei have been identified based on their specific energy loss in the Time Projection Chamber and velocity information from the Time-Of-Flight detector. (Anti-)hyper-tritons have been reconstructed via their mesonic decay channel ($^3_\Lambda$H $\to$ ^{3}He+π) exploiting their secondary vertex de-

cay topology. The (^{3}He, π) invariant mass spectrum are presented. In addition, searches for even lighter exotic hyper-matter states, i.e. Λ-Λ (also known as H-Dibaryon) and Λ-n bound states, are discussed. The results are compared with model expectations.

HK 62.2 Do 14:30 HSZ-201

The KFParticle Package for the Fast Particle Reconstruction in ALICE and CBM — •Maksym Zyzak[1,2,3], Ivan Kisel[1,2,3], Igor Kulakov[1,2,3], and Iourii Vassiliev[1,3] for the CBM-Collaboration — [1]Goethe-Universitaet Frankfurt, Frankfurt am Main, Germany — [2]Frankfurt Institute for Advanced Studies, Frankfurt am Main, Germany — [3]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

Modern heavy-ion experiments operate with very high data rates and track multiplicities collecting petabytes of data, therefore the speed of the reconstruction algorithms is crucial both for the online and offline data analysis. The KFParticle package for short-lived particles reconstruction has been developed and is actively used both in the CBM and ALICE experiments. The package is based on the Kalman filter mathematics and has rich functionality. It is geometry independent and can be used in other experiments too.

Almost all modern servers are equipped with many or multi-core processors, which contain SIMD modules. The KFParticle has been SIMDized, which gives the additional speedup factor of 3-5. KFParticle allows to reconstruct about 50 decay channels achieving speed of 1.5 ms per Au+Au mbias collisions at 25 AGeV on a single core. The package has been parallelized between cores and shows strong linear scalability on servers with up to 80 logical cores.

Supported by FIAS, HICforFAIR and HGS-HIRe for FAIR. Das Projekt wird vom Hessischen Ministerium für Wissenschaft und Kunst gefördert.

HK 62.3 Do 14:45 HSZ-201

Strange particle production in Pb–Pb collisions at $\sqrt{s_{NN}}$ = 2.76 TeV with ALICE at the LHC — •Maria Nicassio for the ALICE-Collaboration — Research Division and ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

The ALICE Collaboration at the LHC has measured mid-rapidity transverse momentum spectra of the Λ, Ξ and Ω baryons and their anti-particles, as well as of the K^0_S meson. Results in Pb–Pb interactions at $\sqrt{s_{NN}}$ = 2.76 TeV will be presented as a function of centrality and compared to pp and lower energy nucleus–nucleus measurements. In particular, the strangeness enhancements and the baryon to meson ratio will be discussed.

HK 62.4 Do 15:00 HSZ-201

Elliptic Flow Measurement of Heavy Flavour Decay Electrons in Pb-Pb Collisions at $\sqrt{s}$ 2.76TeV with ALICE — •Theodor Rascanu for the ALICE-Collaboration — Institut fuer Kernphysik Frankfurt, Deutschanld

In heavy-ion collisions, charm and beauty quarks are produced in the initial hard scattering processes. They then propagate and interact strongly with the created medium, the Quark Gluon Plasma (QGP), and thus allow to probe its properties. One way to measure heavy-quarks is via electrons from the semileptonic decays of open charm and beauty hadrons. At low transverse momentum, the level of thermalization of heavy quarks can be studied via the azimuthal anisotropy of the heavy flavour electron emission in the transverse plane, the elliptic flow, v_{2}. At high pt, v_{2} provides insight on the path length dependence of parton energy-loss. In this talk we present v_{2} measurements of electrons from heavy flavour decays at mid rapidity with ALICE in semi-central (20-40%) Pb-Pb collisions at $\sqrt{s_{NN}}$ = 2.76 TeV. The electrons are identified using the Time Of Flight detector and Time Projection Chamber at low momenta, as well as the Electromagnetic Calorimeter at higher momenta. The latter provides in addition the possibility to trigger on electrons in the collision. We report on the electron identification and explain how the non-heavy flavour electron background is subtracted. Finally the results are compared to different theoretical models.

HK 62.5 Do 15:15 HSZ-201

Dynamical freeze-out in hydrodynamics — •Hannu Holopainen and Pasi Huovinen — Frankfurt Institute for Advanced Studies, Ruth-Moufang-Straße 1, D-60438 Frankfurt, Germany

In hydrodynamical modeling of the ultrarelativistic heavy-ion collisions the freeze-out is typically performed at a constant temperature. In this work we introduce a dynamical freeze-out criterion, which compares the hydrodynamical expansion rate with the pion scattering rate. We present hadron spectra and elliptic flow calculated using (3+1)-dimensional ideal hydrodynamics, and show the differences between constant temperature and dynamical freeze-out criteria. First we discuss the systematics of the dynamical freeze-out, and for simplicity these calculations have been performed using smooth initial states. Finally dynamical freeze-out condition is applied to event-by-event calculations to evaluate v_2. We find that the differences caused by different freeze-out criteria are small in all studied cases.

This work was supported by the ExtreMe Matter Institute (EMMI) and by BMBF.

HK 62.6 Do 15:30 HSZ-201

Resolving substructures in the emission geometry using azimuthalsensitive HBT — •Gunnar Graef — Frankfurt Institute for Advanced Studies (FIAS), Ruth-Moufang-Str. 1, D-60438 Frankfurt — Institute für Theoretische Physik, Goethe-Universität, Frankfurt am Main

We use the non-equilibrium transport approach Ultra-relativistic Quantum Molecular Dynamics (UrQMD) to compute the dynamics of heavy ion collisions up to LHC energies. From this model we obtain directly the full phasespace distribution of all particles at the kinetic freeze out. By performing a Hanbury-Brown Twiss analysis differential in azimuth angle we are able to extract a distortion and a tilt of the source away from the beam axis. In the freeze out distribution we do not only observe a tilt but also a substructure that originates from particles emitted at different collision times. We show that it is in principle possible to resolve the substructure with experimental methods.
G. G. thanks the Helmholtz Research School for Quark Matter Studies (H-QM) and the Helmholtz Center for FAIR (HIC for FAIR) for support and the LOEWE-CSC for providing computational resources.

HK 62.7 Do 15:45 HSZ-201

Simulations of heavy ion collisions in a pQCD-based partonic transport model and a closer look on the Gunion-Bertsch approximation — •Oliver Fochler[1], Jan Uphoff[1], Zhe Xu[2], and Carsten Greiner[1] — [1]Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Straße 1, D-60438 Frankfurt, Germany — [2]Department of Physics, Tsinghua University, Beijing, China

The perturbative QCD-based partonic transport model BAMPS (Boltzmann Approach to Multi-Parton Scatterings) incorporates binary interactions of gluons and quarks based on leading order pQCD cross sections as well as 2<->3 processes that obey detailed balance and are based on the Gunion-Bertsch approximation of the radiative matrix element. The validity of the Gunion-Bertsch approximation and its application to Boltzmann transport is discussed and compared to the exact leading order matrix element by Berends et al. Based on this analysis, improvements to the commonly used version of the Gunion-Bertsch approximation are discussed that are necessary when computing transport rates. First results on the implications on fully dynamic simulations of heavy ion collisions at RHIC and at LHC energies within our transport model BAMPS will be discussed.
Supported by BMBF.

HK 62.8 Do 16:00 HSZ-201

Molecular dynamics description of an expanding q/qbar plasmawith the NJL model and applications to heavy ion collisions. — •Rudy Marty and Elena Bratkovskaya — Frankfurt Institute for Advanced Studies (FIAS), Ruth-Moufang-Straße 1, D-60438 Frankfurt, Germany

We present a relativistic molecular dynamics approach based on the Nambu-Jona-Lasinio Lagrangian. We derive the relativistic time evolution equations for an expanding plasma, discuss the hadronization cross section and how they act in such a scenario. We present in detail how one can transform the time evolution equation to a simulation program and apply this program to study the expansion of a plasma created in experiments at RHIC and LHC. We present first results on the centrality dependence of v2 and of the transverse momentum spectra of pions and kaons and discuss in detail the hadronisation mechanism.
Supported by the Hessian LOEWE initiative through the Helmholtz International Center for FAIR (HIC for FAIR) and the LOEWE-CSC for computational resources.

HK 63: Schwerionenkollisionen und QCD Phasen

Zeit: Donnerstag 14:00–16:15 Raum: HSZ-204

Gruppenbericht HK 63.1 Do 14:00 HSZ-204

Das Compressed Baryonic Matter Experiment - Status und Ausblick* — •Christian Pauly für die CBM-Kollaboration — Bergische Universität Wuppertal

Die Erforschung des QCD-Phasendiagramms im Bereich hoher baryonischer Dichten und moderater Temperaturen ist das Kernziel des Compressed Baryonic Matter Experiments (CBM), welches eine der vier wissenschaftlichen Säulen der neuen Facility for Antiproton and Ion Research (FAIR) darstellt. In Kern-Kern-Kollisionen am geplanten SIS100 Synchrotron bei Energien von bis zu 14 GeV/Nukleon (später am SIS300 bis 45 GeV/Nukleon) sollen Materiezustände höchster Dichte (bis zu 10-fache Kerndichte) untersucht werden. Das Experiment ist auf die Erzielung höchster Ereignisraten (bis zu 10 MHz) ausgelegt und erlaubt somit die Erforschung sehr seltener Prozesse. Ein Beispiel sind leptonische Zerfälle von Vektormesonen oder Charm. Diese Proben wechselwirken nicht stark mit dem dichten, hadronischen Medium und erlauben daher einen Einblick in die frühe, hochdichte Phase des Kollisionsprozesses. Inzwischen ist die Planung und Entwicklung des CBM-Detektorsystems weit fortgeschritten und für verschiedene Komponenten des Experiments wurden bereits Technical Design Reports fertiggestellt. Im Rahmen diverser Teststrahlzeiten am CERN, COSY und an der GSI konnte die Leistungsfähigkeit von Prototyp-Detektoren inklusive (ungetriggerter) Auslese-Elektronik getestet und weiterentwickelt werden. Der Vortrag gibt einen Überblick über das CBM-Projekt sowie den Entwicklungsstand der verschiedenen Subdetektorsysteme.
*Gefördert durch BMBF, EU-FP7-HP3 und HIC-for-FAIR

HK 63.2 Do 14:30 HSZ-204

Detector Independent Cellular Automaton Algorithm for Track Reconstruction — Ivan Kisel[1,2,3], •Igor Kulakov[1,2,3], and Maksym Zyzak[1,2,3] for the CBM-Collaboration — [1]Goethe-Universitat Frankfurt am Main — [2]Frankfurt Institute for Advanced Studies — [3]GSI Helmholtzzentrum fur Schwerionenforschung GmbH

Track reconstruction is one of the most challenging problems of data analysis in modern high energy physics (HEP) experiments, which have to process per second of the order of 10^7 events with high track multiplicity and density, registered by detectors of different types and, in many cases, located in non-homogeneous magnetic field. Creation of reconstruction package common for all experiments is considered to be important in order to consolidate efforts.

The cellular automaton (CA) track reconstruction approach has been used successfully in many HEP experiments. It is very simple, efficient, local and parallel. Meanwhile it is intrinsically independent of detector geometry and good candidate for common track reconstruction.

The CA implementation for the CBM experiment has been generalized and applied to the ALICE ITS and STAR HFT detectors. Tests with simulated collisions have been performed. The track reconstruction efficiencies are at the level of 95% for majority of the signal tracks for all detectors.

Supported by EU-FP7 HadronPhysics3, HIC for FAIR, HGS-HIRe for FAIR and Hessischen Ministerium fuer Wissenschaft und Kunst gefoerdert.

HK 63.3 Do 14:45 HSZ-204

The Cellular Automaton track finder at high track multiplicities — •Valentina Akishina[1,3,4], Ivan Kisel[1,2,3], Igor Kulakov[1,2,3], and Maksym Zyzak[1,3,4] — [1]Goethe-Universität Frankfurt am Main, Frankfurt am Main, Germany — [2]Frankfurt Institute for Advanced Studies, Frankfurt am Main, Germany — [3]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany — [4]JINR Joint Institute for Nuclear Research, Dubna, Russia

The CBM experiment at FAIR is being designed to study heavy-ion collisions at extremely high interaction rates. The event selection has to be done online, therefore fast and efficient reconstruction algorithms are required. The Cellular Automaton (CA) track finder is fast and robust and thereby is used both for the online and offline track reconstruction in CBM. Since the CBM beam will have no bunch structure, but continuous, the reconstruction of time slices rather than events is needed. Measurements in this case will be 4D (x, y, z, t). In order to study the worst case scenario with no time measurment taken into account a number of minimum bias events (up to 100) was grouped into one, which was treated by the track finder as one event. The study has showed that CA track finder is stable with respect to track multiplicity: the efficiency of the algorithm decreases only by 4% for 100 minimum bias events in one group. The speed of the algorithm behaves as a second order polynomial with the number of track. Supported by FIAS, HICforFAIR and HGS-HIRe for FAIR. Das Projekt wird vom Hessischen Ministerium für Wissenschaft und Kunst gefördert.

HK 63.4 Do 15:00 HSZ-204

Lattice QCD based equation of state at finite baryon density — •Pasi Huovinen — Frankfurt Institute for Advanced Studies (FIAS), Ruth-Moufang-Straße 1, D-60438 Frankfurt, Germany

We employ the lattice QCD data on Taylor expansion coefficients to extend the parametrization of the equation of state to finite baryon density. When we take into account lattice spacing and quark mass dependence of the hadron masses, the Taylor coefficients at low temperature are equal to those of hadron resonance gas. Thus we require that the equation of state is smoothly connected to the hadron resonance gas equation of state at low temperatures. We also show how the hydrodynamical evolution is affected by this equation of state in the energy range relevant for SPS and the RHIC energy scan.
This work is funded by BMBF.

HK 63.5 Do 15:15 HSZ-204

Dense Matter and Renormalization Group — •Matthias Drews[1,2], Bertram Klein[1], and Wolfram Weise[1,2] — [1]Technische Universität München — [2]ECT* Trento, Italien

As a contribution to the ongoing discussion on the question of a critical endpoint of a chiral phase transition, a nucleon-meson model was studied recently [1]. There was no evidence of a critical phase transition in the region of chemical freeze-out for larger chemical potential. We try to extend and solidify the calculations that were done at the mean field level by including mesonic fluctuations with help of the functional renormalization group equations.

[1] S. Floerchinger and C. Wetterich, Nucl.Phys.A 890-891 (2012)

Supported in part by BMBF and by the DFG cluster "Origin and Structure of the Universe"

HK 63.6 Do 15:30 HSZ-204

Domain formation and density fluctuations as a signal for the QCD first order phase transition — •Christoph Herold[1,2] and Marcus Bleicher[1,2] — [1]Institut für Theoretische Physik, Goethe-Universität, Max-von-Laue-Str. 1, D-60438 Frankfurt — [2]Frankfurt Institute for Advanced Studies (FIAS), Ruth-Moufang-Str. 1, D-60438 Frankfurt

We develop a nonequilibrium Polyakov-chiral fluid dynamics model in order to understand dynamical symmetry breaking and to give realistic estimates for experimental observables connected to the QCD phase transition. The expansion of the hot fireball after a heavy ion collision is simulated by a fluid-dynamically propagated quark medium. On this background the order parameters for the chiral and deconfinement transition are explicitly propagated by Langevin equations. Large nonequilibrium fluctuations at the first order transition influence the trajectories in the phase diagram. Here the transition proceeds through the formation of domains where high- and low-temperature phases coexist until finally all chirally symmetric and deconfined domains have decayed. These inhomogeneous structures produce large pressure gradients leading to the formation of high density clusters, an effect that is not observed if the system evolves through the crossover or the critical end point. These clusters might constitute excellent experimental probes for a first order phase transition, e. g. non-monotonic hadron multiplicity fluctuations.
Supported by the Hessian LOEWE initiative through the Helmholtz International Center for FAIR (HIC for FAIR), GSI, and HGS-HIRe.

HK 63.7 Do 15:45 HSZ-204

The thermal transition from twisted mass lattice QCD — •Christopher Pinke and Owe Philipsen — Goethe Universität Frankfurt am Main

The phase diagram of QCD is subject to ongoing investigations, and lattice QCD provides a tool to study it from first principles. We re-

port on our results for the thermal transition of QCD in the chiral limit with two flavours of twisted-mass fermions by means of universal scaling behaviour and analysis of screening masses.

HK 63.8 Do 16:00 HSZ-204

Finite-volume effects in O(N)-models — •Paul Springer and Bertram Klein — Physik Department, Technische Universität München, 85747 Garching

The investigation of QCD phases is currently a much discussed topic in particle physics. In the context of this discussion the knowledge about the nature of chiral phase transition is significant. A powerful tool for this purpose are lattice simulations. They are, however, still carried out at quark masses far from the chiral limit and in small volumes, which could strongly influence the critical behavior.

Since continuous phase transitions are controlled by the long range fluctuations only the dimensionality and symmetries dictate the universal behavior near the critical point. Therefore, more simple systems from the same universality class can be used to analyze QCD at chiral phase transition.

We investigate 3-dimensional O(2)- and O(4)-models in finite volumes using non-perturbative Renormalization Group methods. We provide scaling functions in infinite and finite volume that are universal for O(2)- and O(4)-universality classes in d=3 dimensions and applicable to the chiral phase transition. We also investigate the effects of the finite volume on the critical behavior and determine the finite-size scaling region for both models in order to provide a tool, which assists in analysis of lattice QCD data.

HK 64: Struktur und Dynamik von Kernen

Zeit: Donnerstag 14:00–16:00 Raum: HSZ-301

Gruppenbericht HK 64.1 Do 14:00 HSZ-301

High-precision mass measurements of the heaviest elements with SHIPTRAP — •Christian Droese for the SHIPTRAP-Collaboration — Universität Greifswald

High-precision mass measurements in the region of the heaviest elements have been performed at the Penning-trap mass spectrometer SHIPTRAP. In recent experiments the masses of the isotopes $^{252-255}$No and ^{255,256}Lr have been measured directly for the first time with an uncertainty as low as 15 keV. In combination with the results of decay-spectroscopy experiments the mass values of superheavy elements up to ^{270}Ds can be pinned down. These mass values give access to the binding energies and provide valuable information on the nuclear structure of superheavy elements as well as input for theoretical models. The recent results allow a mapping of shell effects across the neutron number N=152. Direct mass measurements of superheavy elements (Z>103) are now within reach, as an increase of the overall efficiency of the SHIPTRAP setup will allow studying isotopes produced at a yet smaller production rate the those studied to date. A cryogenic stopping cell provides a gain in the stopping and extraction efficiency by a factor of three or more. The status of the commissioning and the results of the first efficiency determinations will be presented.

HK 64.2 Do 14:30 HSZ-301

Recent high-precision nuclear mass measurements at TRIGA-TRAP — •M. Eibach[1,2], T. Beyer[2,3], K. Blaum[2,3], M. Block[4], Ch. E. Düllmann[1,4,5], K. Eberhardt[1,5], Sz. Nagy[3,4], W. Nörtershäuser[1,4], D. Renisch[1], and C. Smorra[2,3] — [1]Institut für Kernchemie, Johannes Gutenberg-Universität, Mainz — [2]Fakultät für Physik und Astronomie, Ruprecht-Karls-Universität, Heidelberg — [3]Max-Planck-Institut für Kernphysik, Heidelberg — [4]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt — [5]Helmholtz-Institut Mainz, Mainz

Calculations on the astrophysical r-process, tests of nuclear mass models and predictions of neutrinoless double-beta decays require high-precision nuclear mass or Q value data. Penning-trap mass spectrometers such as TRIGA-TRAP, a branch of the TRIGA-SPEC experiment, are well-suited to provide such data with the requested precision. The nuclides of interest are either produced by thermal neutron-induced fission of e.g. ^{235}U at the research reactor TRIGA Mainz or ionized off-line by a non-resonant laser ablation ion source. In this contribution the present status of TRIGA-TRAP is outlined. Recent mass measurements of stable and long-lived nuclides as well as Q value measurements of their transitions will be presented.

HK 64.3 Do 14:45 HSZ-301

Nuclear structure studies of neutron-rich heavy nuclei by mass measurements of francium and radium isotopes — •Marco Rosenbusch for the ISOLTRAP-Collaboration — Ernst-Moritz-Arndt-Universität, Institut für Physik, 17487 Greifswald

The mass is a unique property of an atomic nucleus reflecting its binding energy and thus the sum of all interactions at work. Precise measurements of nuclear masses especially of short-lived exotic nuclides provide important input for nuclear structure, nuclear astrophysics, tests of the Standard Model, and weak interaction studies. The Penning-trap mass spectrometer ISOLTRAP at the on-line isotope separator ISOLDE/CERN has been set up for precision mass measurements and continuously improved for accessing more exotic nuclides. The mass uncertainty is typically $\delta m/m = 10^{-8}$ and the accessible half-life has been reduced to about 50 ms. In this contribution, the results of a measurement campaign of neutron-rich francium and radium isotopes will be presented, i.e. the masses of the isotopic chain of $^{224-233}$Fr and ^{233,234}Ra, one of the most neutron-rich ensemble obtainable at ISOL facilities. The mass ^{234}Ra denotes the heaviest mass ever measured with ISOLTRAP. Experimental data in the neutron-rich, heavy mass region is of great interest for studies of structural evolution far from stability, especially because the knowledge from nuclear mass models is scarce. The impact of the new data on the physics in this mass region as well as recent technical developments of ISOLTRAP will be discussed.

HK 64.4 Do 15:00 HSZ-301

Nuclear Excitation by a Strong Zeptosecond Laser Pulse: Theoretical Expectations — Adriana Pálffy and •Hans A. Weidenmüller — Max-Planck-Institut für Kernphysik, Heidelberg

At the Nuclear Physics Pillar of the Extreme Light Infrastructure, efforts are under way to generate a multi-MeV zeptosecond laser beam [1]. Which reactions may occur when such a laser pulse hits a medium–weight or heavy target nucleus? The laser pulse consists of $N \lesssim 10^4$ coherent photons and the nuclear response is characterized by the excitation rate $N\Gamma_{\rm dip}$ with the dipole width $\Gamma_{\rm dip} \approx 5$ keV, and by the spreading width $\Gamma^{\downarrow} \approx 5$ MeV. While the perturbative regime was addressed in Ref. [2], here we focus on the quasi-adiabatic regime $N\Gamma_{\rm dip} \approx \Gamma^{\downarrow}$ where the compound nucleus is excited to several 100 MeV above yrast.

We have developed a new approach [3] to nuclear level densities at high excitation energy and extended it beyond the constant-spacing model for the single-particle energies. This allows us to give a semi-quantitative description of the quasi-adiabatic process. The target nucleus is excited up to several hundred MeV energies close to the maximum of the level density. Photon-induced nucleon emission and neutron evaporation populate a range of daughter nuclei above the valley of stability. We expect that experimental data will shed light on the energy dependence of the level density at high excitation energies, and on the structure of proton-rich nuclei.

[1] G. Mourou and T. Tajima, Science 331 (2011) 41.
[2] H. A. Weidenmüller, Phys. Rev. Lett. 106 (2011) 122502.
[3] A. Pálffy and H. A. Weidenmüller, Phys. Lett. B (2012) in press.

HK 64.5 Do 15:15 HSZ-301

Photofission of ^{238}U induced by a brilliant, quasi-monochromatic, Compton-backscattered γ beam* — •Lorant Csige[1,2], D.M. Filipescu[3], T. Glodariou[3], J. Gulyas[4], M. Guenther[5], D. Habs[5], H.J. Karwowski[6], A. Krasznahorkay[4], G.C. Rich[6], L. Stroe[3], O. Tesileanu[3], and P.G. Thirolf[1] — [1]LMU München, Garching, Germany — [2]Excellence Cluster Universe, Garching, Germany — [3]IFIN-HH, Bucharest, Romania — [4]ATOMKI, Debrecen, Hungary — [5]MPI for Quantum Optics, Garching, Germany — [6]TUNL, Durham, USA

The photofission cross-section of ^{238}U was measured at sub-barrier energies as a function of the γ energy using, for the first time, a monochromatic, high-brilliance, Compton-backscattered γ beam. This

prototype experiment was performed at the HIGS γ-beam facility, using the ^{238}U(γ,f) reaction at a beam energy varied between E=4.7-6.0 MeV and with an energy resolution of dE=150-200 keV. Clear indications of predicted resonance structures have been observed at excitation energies of E=5.1 and 5.6 MeV. With the significantly higher intensity of the beam, when comparing to a tagged-photon facility, the cross-section could be measured at deep sub-barrier energies. The triple-humped fission barrier parameters of ^{238}U have been determined by fitting EMPIRE3.1 nuclear reaction code calculations to the experimental photofission cross-section. Our present results on the fission barrier of ^{238}U support a deep third minimum (E_{III}=3.6 MeV) and a low inner barrier (E_A=4.3 MeV).

*supported by the DFG Cluster of Excellence Universe.

HK 64.6 Do 15:30 HSZ-301

Collinear Laser Spectroscopy of Potassium Isotopes Beyond the $N = 28$ Shell Closure — •Kim Kreim for the COLLAPS-Collaboration — Max-Planck-Institut für Kernphysik, Heidelberg, Deutschland

The hyperfine structures and isotope shifts of Potassium from $N = 19$ to $N = 32$ ($^{38,39,42,44,46,47-51}$K) have been measured successfully. From these spins, magnetic moments and changes in root mean square charge radii $\delta\langle r^2\rangle$ have been extracted. The model independent spin determinations obtained in this work clarify the level schemes of neutron rich Potassium isotopes. For the first time the range and extend of the $\pi d_{3/2}$ to $\pi s_{1/2}$ ground state inversion has been established. The extracted $\delta\langle r^2\rangle$, in conjunction with those of Ca, Cr, Mn and Fe provide a first insight into the regional Z dependence of the evolution of nuclear size beyond $N = 28$.

HK 64.7 Do 15:45 HSZ-301

Bestimmung der Spins, Momente und Ladungsradien von $^{100-130}$Cd mittels kollinearer Laserspektroskopie — •Nadja Frömmgen für die COLLAPS-Kollaboration — Institut für Kernchemie, Johannes Gutenberg-Universität Mainz, Deutschland

Die Hyperfeinstruktur und die Isotopieverschiebung der Cadmiumisotope (Z=48) mit Neutronenzahl N=52 bis N=82 wurden mittels kollinearer Laserspektroskopie an der COLLAPS-Apparatur an ISOLDE untersucht. Hierbei konnten sowohl die Grundzustände als auch die langlebigen $11/2^-$ Isomere der Isotope spektroskopiert werden. Dabei wurden erstmals langlebige I=$11/2^-$ Zustände der Isotope ^{127,129}Cd beobachtet. Ziel dieser Untersuchungen knapp unterhalb des Z=50 Schalenabschlusses ist ein besseres Verständnis der Kernstruktur in der Nähe der doppelt magischen Kerne ^{100}Sn$_{50}$ und ^{132}Sn$_{82}$.

Die elektromagnetischen Momente und die Ladungsradien der Grundzustände und der Isomere wurden aus den laserspektroskopischen Daten extrahiert. Diese Ergebnisse werden diskutiert.

HK 65: Hadronenstruktur und -spektroskopie

Zeit: Donnerstag 14:00–16:00 Raum: HSZ-304

Gruppenbericht HK 65.1 Do 14:00 HSZ-304

Hadron Electromagnetic Form Factors in the Timelike Region — •Cristina Morales, Frank E. Maas, Paul Larin, Dexu Lin, Manuel Zambrana, Roberto Perez, Luigi Capozza, Mari Carmen Mora, Dmitry Khaneft, Iris Zimmermann, Bertalan Feher, David Rodriguez, Jorge Ceballos, Roserio Valente, Oliver Noll, and Felix Welzel — Helmholtz-Institut Mainz, SB1, Johann-Joachim-Becher-Weg 36, 55128 Mainz

The electromagnetic form factors of hadrons in the timelike region are re-viewed. We present the current status of the field and we emphasize the relevant role of initial state radiation processes studied in high luminosity storage rings, such as the B-factory PEP-II and the tau-charm factory BEPCII, i.e. from BaBar and BES-III experiments, respectively. We also present expectations from BES-III R-scan measurements around the hadron production threshold and above.

HK 65.2 Do 14:30 HSZ-304

Four pion hadronic cross sections at BABAR — •Konrad Griessinger for the BaBar-Collaboration — Institut für Kernphysik, Mainz

One of the most significant deviations from the Standard Model (SM) in laboratory experiments can be observed when comparing the SM prediction and the direct measurement of $g - 2$ of the muon. In order to increase the current significance (3.6σ) to the level where evidence of this effect may be claimed or rejected, we need to improve upon the experimental input for the theoretical prediction. For this purpose the most pressing issue is the precision measurement of the four pion cross sections $\sigma(e^+e^- \to \pi^+\pi^-\pi^+\pi^-)$ and $\sigma(e^+e^- \to \pi^+\pi^-\pi^0\pi^0)$. The fully charged mode has recently been published by BABAR with unprecedented precision, and the semi-neutral mode is in preparation.

HK 65.3 Do 14:45 HSZ-304

Search for ω-mesic states* — •Stefan Friedrich for the CBELSA/TAPS-Collaboration — II. Physikalisches Institut, Gießen

Experiments searching for the existence of ω-mesic states, using the tagged photon beam at the ELSA accelerator in Bonn, are presented. The combined setup of the Crystal Barrel and MiniTAPS detector systems, which form a 4π electromagnetic calorimeter, was used for detecting the possible ω-mesic states via the $\omega \to \pi^\circ + \gamma$ decay mode. The recoiling proton of the $\gamma + p \to \omega + p$ reaction was identified with an aerogel Cherenkov detector and the forward angle spectrometer MiniTAPS. Two experiments on a carbon target have been performed as well as a reference measurement on LH_2. A comparison of the experimental results with theoretical predictions indicates a weakly attractive or even repulsive ω-nucleus potential.

*Funded by DFG (SFB/TR16)

HK 65.4 Do 15:00 HSZ-304

Partialwellenanalyse der Reaktion $\overline{p}p \to \omega\pi^0$ — •Julian Pychy, Helmut Koch, Bertram Kopf und Ulrich Wiedner — Ruhr-Universität Bochum

Um wichtige Erkenntnisse für das zukünftige $\overline{\text{P}}$anda-Experiment zu gewinnen, wurde mit Daten des Crystal Barrel (LEAR)-Experimentes eine Partialwellenanalyse (PWA) der Reaktion $\overline{p}p \to \omega\pi^0$ durchgeführt. Die beiden dominanten Zerfälle des ω-Mesons in $\pi^0\gamma$ und $\pi^+\pi^-\pi^0$ wurden separat für verschiedene $\overline{p}$-Impulse zwischen 600 MeV/c und 1940 MeV/c untersucht. Durch ein elaboriertes Verfahren zur Unterdrückung des Untergrundes konnte eine exzellente Datenqualität erzielt werden. Mit der PWA wurden der maximal beitragende Bahndrehimpuls des $\overline{p}p$-Systems und insbesondere die Elemente der Spin-Dichtematrix des ω bestimmt, welche wichtige Informationen über die Ausrichtung (Alignment) und den Produktionsprozess dieses Mesons enthalten. Ergänzend wurden die Elemente der Spin-Dichtematrix mittels der herkömmlichen Methode über die Zerfallswinkelverteilungen ermittelt. Die jeweiligen Resultate stehen in sehr gutem Einklang miteinander und zeigen ein signifikantes, vom Produktionswinkel abhängiges Alignment des ω.

Gefördert durch das BMBF.

HK 65.5 Do 15:15 HSZ-304

Search for antiproton-^{15}N Bound State in PANDA — •Dexu Lin[1,2], Alexei Larionov[3,4], Yue Ma[5], Igor Mishustin[3,4], and Frank Maas[1,2,6] — [1]Helmholtz Institut Mainz, 55128 Mainz, Germany — [2]Johannes Gutenberg Universität Mainz, Institut für Kernphysik, 55099 Mainz, Germany — [3]Frankfurt Institute for Advanced Studies (FIAS), D-60438 Frankfurt am Main, Germany — [4]National Research Center "Kurchatov Institute", 123182 Moscow, Russia — [5]RIKEN, Saitama 351-0198, Japan — [6]GSI Helmholtzzentrum fuer Schwerionenforschung, GmbH, 64291 Darmstadt, Germany

In order to study the antiproton-nucleus potential (antimatter-mater potential), and prepare a possible experiment for the PANDA spectrometer at FAIR facility, we carried out a calculation with the Gießen-Boltzman-Uehling-Uhlenbeck(GiBUU) model.

The calculation was performed for an antiproton beam energy 1.5 GeV and an ^{16}O target. The interesting events, which provide information about the antiproton-^{15}N potential, are required to have one knocked-out proton in forward direction and two or more pions from the antiproton annihilation at rest. Preliminary results of these studies will be presented

HK 65.6 Do 15:30 HSZ-304

The $\bar{p}p \to l^+l^-$ ($l = e, \mu$ or τ) and $\bar{p}p \to \pi^+\pi^-$ cross section — •Manuel Zambrana — Institut fuer Kernphysik, Johannes Gutenberg Universitaet Mainz, Germany

We describe the differential cross section for the processes $\bar{p}p \to l^+l^-$, with $l = e, \mu$ or τ, and $\bar{p}p \to \pi^+\pi^-$, when both the proton target and the antiproton beam are unpolarized. For lepton production, the cross section is a leading order calculation with a massive lepton in the final state. For pion production, the parametrization of the cross section in the low energy regime is based on a Legendre polynomial fit to data from the (antiproton beam) CERN 28 GeV proton synchroton, whereas in the high energy regime the recent predictions by J. van de Wiele and S. Ong based on a Regge Theory approach were used. A public C++ code to perform integration of both the lepton and pion cross section in a user-defined kinematic region is also described. This code is a useful tool for simulation studies with PANDA at FAIR.

HK 65.7 Do 15:45 HSZ-304

Central Diffraction in Proton-Proton Collisions at $\sqrt{s} = 7$ TeV with the ALICE Experiment — •Felix Reidt — Physikalisches Institut, Universität Heidelberg

The ALICE Experiment consists of a central barrel covering the pseudorapidity range $-0.9 < \eta < 0.9$ accompanied by additional detectors in the region $-3.7 < \eta < -0.9$ and $0.9 < \eta < 5.1$. Using this detector configuration, central diffractive events can be identified by their topology. This topology, characterized by rapidity gaps, is defined by hadronic activity in the central barrel and missing activity in the additional detectors. This talk will summarize first results from the analysis of double-gap events.

HK 66: Astroteilchenphysik

Zeit: Donnerstag 14:00–16:00 Raum: HSZ-401

Gruppenbericht HK 66.1 Do 14:00 HSZ-401

The neutrino experiment SNO+: Overview and status — •Belina von Krosigk, Valentina Lozza, Nuno Barros, Arnd Sörensen, Felix Krüger, Laura Neumann, Axel Boeltzig, Johannes Petzold, and Kai Zuber — TU Dresden, Deutschland

SNO+ (Sudbury Neutrino Observatory) is an upcoming low energie neutrino experiment. It makes use of the former SNO detector, located at the currently deepest underground laboratory SNOLAB in a mine near Sudbury, Canada. This location provides ca. 6000 m.w.e. overburden for cosmic ray shielding. The core of the detector, a 12 m diameter acrylic vessel, will be filled with about 780 t of liquid scintillator, increasing the light yield compared to the SNO Cherenkov detector by a factor of about 50 and lowering the threshold below 1 MeV. Together with the use of ultra–pure materials SNO+ becomes thus sensitive to low energy neutrinos. The main goal of SNO+ is the search for neutrinoless double beta decay of 150Nd after loading the scintillator with 0.1% to 0.3% natural Nd (referring to about 44 kg to 132 kg 150Nd). In this phase searches for 8B solar-neutrinos, geo-neutrinos originating from radioactivity in the earth, atmospheric neutrinos, the potential observation of supernovae neutrinos and the study of reactor neutrino oscillations are also possible. In a later phase, for the detection of pep and CNO solar neutrinos, the Nd will be removed from the liquid scintillator.

HK 66.2 Do 14:30 HSZ-401

Proton activation of a natural neodymium target for the SNO+ experiment — •Johannes Petzoldt[1], Valentina Lozza[1], Ondrej Lebeda[2], Jan Stursa[2], and Kai Zuber[1] — [1]Technical University of Dresden, 01069 Dresden, Germany — [2]Nuclear Physics Institute of the ASCR, 25068 Husinec-Rez, Czech Republic

In experiments searching for rare events, like the neutrinoless double beta decay, background knowledge and reduction is essential. For SNO+, the follow up of the Sudbury Neutrino Observatory experiment, the investigated transition is ^{150}Nd $\rightarrow$ ^{150}Sm with an estimated half-life for the 0ν-channel of $T_{1/2} \approx 10^{25}$ years. SNO+ is a liquid scintillator based detector with a total mass of 780 tons. In order to study the mentioned transition, the detector will be loaded with 0.3 % natural neodymium. Even with the desired amount of 131 kg of ^{150}Nd in SNO+, only few decays are expected. Their observation and the measured half-life would not only give an answer on the effective neutrino mass, but also to other important questions in modern neutrino physics.

Long-living radioisotopes, induced by cosmogenic activation on natural Nd, contribute to the background in SNO+ and are investigated at TU Dresden. Proton activation measurements for determining the excitation functions for different isotopes in the energy range of 10 to 30 MeV were done in 2010/2011 while in 2012 the lower and higher energies were investigated. The procedure and the latest results are presented.

This work was funded by the German Research Foundation DFG.

HK 66.3 Do 14:45 HSZ-401

Sensitivity of KATRIN-like experiments for keV Neutrinos — •Susanne Mertens — Lawrence Berkeley National Laboratory, Berkeley, USA — Helmholtz Alliance for Astroparticle Physics, Karlsruhe, Germany

The KATRIN experiment is designed to probe the absolute neutrino mass scale with a sensitivity of 200 meV at 90% confidence level in a direct and model independent way. This is achieved through a measurement of the spectral shape of tritium beta decay close to the endpoint, where the influence of a non-zero neutrino mass is maximal.

KATRIN makes use of a gaseous molecular tritium source of extremely high activity and stability. These unique source properties allow KATRIN to extent its physics reach from its main goal of measuring the neutrino mass in the sub-eV range to look for contributions of possible neutrinos in the multi-keV range constituting a possible candidate for Warm Dark Matter. A heavy sterile neutrino would manifest itself as a tiny kink and subsequent spectral distortion deep in the beta spectrum, further away from the endpoint.

In this talk a sensitivity study of a KATRIN-like experiment to detect keV neutrinos will be presented. Different statistical analysis techniques, the effect of systematic uncertainties and possible technical realizations will be discussed.

We acknowledge the support by BMBF and HAP.

HK 66.4 Do 15:00 HSZ-401

Ein Jahr Messungen am KATRIN Monitorspektrometer — •Moritz Erhard für die KATRIN-Kollaboration — Karlsruher Institut für Technologie, Institut für Experimentelle Kernphysik

Das Ziel des KArlsruhe TRItium Neutrino Experiments KATRIN ist die Bestimmung der Ruhemasse des Elektron-Antineutrinos, mit der bisher unerreichten Sensitivität von 200 meV/c^2. Für das Experiment wird ein Spektrometer nach dem MAC-E-Filter Prinzip aufgebaut, um damit das Energiespektrum des Tritium-Betazerfalls am Endpunkt zu vermessen. Um diese Sensitivität über die gesamte Messzeit gewährleisten zu können, ist eine langzeitstabile Spannungsüberwachung und Kalibration erforderlich mit einer Unsicherheit von 60 meV bei 18,6 kV. Hierzu werden am Monitorspektrometer, ebenfalls ein MAC-E-Filter der von der Hochspannungsquelle des Hauptspektrometers versorgt wird, monoenergetische Konversionselektronen einer festen, ionenimplantierten Rb/Kr Quelle gemessen. Dieser Vortrag gibt einen Überblick auf über ein Jahr Messungen am Monitorspektrometer und die gewonnen Erkenntnisse zur Charakterisierung Rb/Kr Quelle und ihre Eignung als nuklearer Standard. Gefördert durch das BMBF unter der Kennzeichnung 05A11VK3 und der Helmholtz-Gemeinschaft.

HK 66.5 Do 15:15 HSZ-401

Testmessungen mit nicht-axialsymmetrischem Magnetfeld am Katrin-Monitorspektrometer — •Benjamin Leiber für die KATRIN-Kollaboration — Karlsruher Institut für Technologie (KIT), Institut für Experimentelle Kernphysik

Das **KA**rlsruher **TRI**tium **N**eutrino Experiment wird die Masse des Elektron-Antineutrinos mit einer Sensitivität von 0.2 eV/c^2 (90% C.L.) über die Messung des Tritium β-Spektrums in der Nähe des Endpunktes bestimmen. Um die Energie der Zerfallselektronen zu analysieren, werden diese in einem elektrostatischen Spektrometer nach dem MAC-E Filter-Prinzip entlang von Magnetfeldlinien geführt. Durch die adiabatische Änderung des Feldes um einen Faktor von 20.000 wird die transversale Energie der Zerfallselektronen in longitudinale umgewandelt, welche dann mit dem elektrischen Retar-

dierungspotential analysiert wird. Simulationen haben ergeben, dass durch eine Nicht-Axialsymmetrie des Magnetfeldes, wie sie z.B. durch Verformungen des Luftspulensystems, welches das Hauptspektrometer umschließt und den magnetischen Materialien in der Spektrometerhalle, verursacht wird, eine erhöhte Untergrundrate hervorgerufen wird. Um diesen Effekt zu bewerten wurden Testmessungen am Katrin-Monitorspektrometer durchgeführt, bei denen gezielt ein nicht-axialsymmetrisches Magnetfeld eingeführt wurde. Dieses Projekt wird durch die BMBF-Verbundforschung mit dem Förderkennzeichen 05A08VK2 gefördert.

HK 66.6 Do 15:30 HSZ-401

Application of the A/E pulse shape discrimination method to first Ge-76 enriched BEGe detectors operated in GERDA — •Andrea Lazzaro, Matteo Agostini, Dusan Budjas, and Stefan Schoenert for the GERDA-Collaboration — Physik-Department E15, Technische Universität München, Germany

In 2013 the Gerda experiment will be upgraded to its second phase with more than double of the current ^{76}Ge mass. The additional diodes are custom made Broad Energy Germanium (BEGe) detectors. This design has been chosen to enhance the pulse shape discrimination (PSD) capability, with respect to the Phase I coaxial detectors. The goal of Phase II is to improve by one order of magnitude the current background index; the PSD will bring a major contribution to this result.

Since summer 2012 the first set of five enriched BEGe detectors are operated in Gerda Phase I. This offers us the possibility to test the PSD performances and the signal analysis in an environment as close as possible to the Gerda Phase II configuration. In this talk I will present the A/E analysis, the calibration of the cut parameters and the results in terms of background reduction for the data taken with these enriched BEGe.

This work was supported in part by BMBF (05A11W01).

HK 66.7 Do 15:45 HSZ-401

Investigation and development of the suppression methods of the ^{42}K background in LArGe. — •Alexey Lubashevskiy for the GERDA-Collaboration — Max-Planck-Institut für Kernphysik, Saupfercheckweg 1, D-69117 Heidelberg, Germany

GERDA is an ultra-low background experiment aimed for the neutrinoless double beta decay search. The search is performed using HPGe detectors operated in liquid argon (LAr). One of the most dangerous backgrounds in GERDA is the background from ^{42}K which is a daughter isotope of cosmogenically produced ^{42}Ar. ^{42}K ions are collected towards to the detector by the electric field of the detector. Estimation of the background contribution and development of the suppression methods were performed in the low background test facility LArGe. For this purpose encapsulated HPGe and bare BEGe detectors were operated in 1m^3 of LAr in the LArGe setup. It is equipped with scintillation veto, so particles which deposit part of their energy in LAr can be detected by 9 PMTs. In order to better understand background and to increase statistics the LAr of LArGe was spiked with specially produced ^{42}Ar. All these investigations allowed us to estimate background contribution from ^{42}K and demonstrate the possibility to suppress it in future measurements in GERDA Phase II.

HK 67: Nukleare Astrophysik

Zeit: Donnerstag 14:00–16:00 Raum: HSZ-403

Gruppenbericht HK 67.1 Do 14:00 HSZ-403

New prompt fission γ-ray spectral data and its impact on present evaluated nuclear data files — •Stephan Oberstedt[1], Robert Billnert[1,2], Andreas Oberstedt[2,3], Tamas Belgya[4], and Trino Martinez[5] — [1]European Commission, JRC IRMM, B-2400 Geel — [2]Fundamental Fysik, CTH, S-41296 Göteborg, Sweden — [3]CEA/DAM Île-de-France, F-91297 Arpajon Cedex — [4]KFKI, H-1121 Budapest 114 — [5]CIEMAT, E-28040 Madrid

The Generation-IV International Forum (GIF) point out that fast reactors, and modeling their new and innovative cores based on existing data for the most common reactor isotopes ^{235}U and ^{239}Pu leads to an intolerable underestimation of the γ-heating, new measurements are required. Therefore, these two isotopes have been included in OECD/NEA's high priority nuclear data request list for prompt fission γ-ray data; in particular γ-multiplicity and mean energy are requested. Precise knowledge of the prompt γ-ray spectrum is one key to the fundamental understanding of the share of excitation energy between the two fission fragments and the (γ,n) reaction yield in the surrounding matter. With a new detection system, based on lanthanide-halide scintillation detectors, a first validation experiment was performed on the spontaneous fission of ^{252}Cf.

We will present first results and discuss their impact on evaluated data tables not only for this nuclide, but also for ^{238}U and ^{241}Pu, which is always present in a reactor. Furthermore, we will show preliminary results from our investigation of prompt γ-ray emission from the reaction ^{235}U(n$_{th}$, f), measured at the KFKI in Budapest.

HK 67.2 Do 14:30 HSZ-403

Opportunities for a better understanding of the synthesis of the heavy elements at the National Ignition Facility, Lawrence Livermore National Lab — •Kathrin Göbel[1], Tanja Heftrich[1], Alisa Lier[1], René Reifarth[1], Kerstin Sonnabend[1], Joseph A. Caggiano[2], Uwe Greife[3], and Dieter Schneider[2] — [1]Experimentelle Astrophysik, Goethe-Universität Frankfurt a. M. — [2]Lawrence Livermore National Laboratory, CA, USA — [3]Colorado School of Mines, CO, USA

The elements beyond iron are produced by neutron captures in the s and the r processes, by proton captures or via photodisintegration reactions.

The National Ignition Facility (NIF) at the Lawrence Livermore National Laboratory, CA, USA, offers unique, unprecedented opportunities to investigate some of the important reactions in a completely complementary approach. The high densities and temperatures in the plasma allow the investigation under almost stellar conditions. The experimental challenge is, however, the extreme short time during which such conditions are available.

Some ideas and options for experiments with astrophysical motivation at NIF will be discussed. Currently sensitivity studies for upcoming experiments are carried out. First results will be presented.

This project was supported by the Helmholtz International Center for FAIR, the Helmholtz Young Investigator Group VH-NG-327, DFG (SO907/1-2) and HGS-HIRe.

HK 67.3 Do 14:45 HSZ-403

Verwendung eines Low-Energy Photon Spectrometers (LEPS) in (γ,n)-Aktivierungsexperimenten — •Taniya Thomas[1], Philipp Erbacher[1], Deniz Savran[2], Jan Glorius[1], Kerstin Sonnabend[1] und Rene Reifarth[1] — [1]Goethe Universität Frankfurt — [2]ExtreMe Matter Institute EMMI, GSI, Darmstadt

Zwei Low-Energy Photon Spectrometer (Germanium-Halbleiter-Detektoren) wurden für die Auszählung von Materialien verwendet, die bei Experimenten an der High Intensity Gamma-Ray Source der Duke University, North Carolina, USA, und am 10 MV Tandem-Beschleuniger der University of Notre Dame, Indiana, USA, aktiviert wurden. Für die Auswertung der Daten ist eine gute Kenntnis der Detektoren erforderlich und somit deren Kalibration notwendig.

Es wurden sowohl die Energieauflösung als auch die Effizienzen beider Detektoren bestimmt, sowie eine Energiekalibration vorgenommen. Die Untersuchungen wurden an γ-Spektren von Eichquellen unter zwei verschiedenen Einstellungen des Spektroskopie-Verstärkers durchgeführt. Dabei wurde der Abstand der Quellen zum Detektor variiert, um die Abhängigkeit der Effizienz vom Raumwinkel sowie den Einfluss von Summeneffekten zu untersuchen. Abschließend wurden die experimentellen Ergebnisse mit Monte-Carlo-Simulationen verglichen. Die so erhaltenen Effizienzen werden in der Auswertung der Aktivierungsexperimente verwendet. Der vorläufige Stand zur Bestimmung der Wirkungsquerschnitte der Reaktionen ^{170,176}Yb(γ,n) und ^{169}Tm(γ,n) wird vorgestellt. Dieses Projekt wird gefördert durch die DFG (SFB 634, SO907/1-2), PIANO, HIC for FAIR, HGS-HIRe und EMMI.

HK 67.4 Do 15:00 HSZ-403

(n,γ)-Wirkungsquerschnitte von ^{69,71}Ga und ^{63,65}Cu bei 25 und 90 keV — •Clemens Beinrucker[1], Michael Berger[1],

Stefan Fiebiger[1], Micaela Fonseca[4], Tanja Heftrich[1], Franz Käppeler[3], Antonin Krasa[2], Claudia Lederer[1], Ralf Plag[1], Arjan Plompen[2], Rene Reifarth[1], Stefan Schmidt[1] und Kerstin Sonnabend[1] — [1]Goethe Universität, Frankfurt — [2]Institute for Reference Materials and Measurements, Geel — [3]Karlsruhe Institute of Technology, Karlsruhe — [4]Centro de Fisica Nuclear da Universidade de Lisboa, Portugal

Im s-Prozess werden etwa die Hälfte der Isotope der solaren Häufigkeitsverteilung mit $A > 56$ durch Neutroneneinfänge und β-Zerfälle produziert. Zum besseren Verständnis des s-Prozesses sind die (n,γ)-Querschnitte bei stellaren Energien von Bedeutung.

Neutroneneinfangquerschnitte können u.a. in einem Aktivierungsexperiment bestimmt werden. Zuerst wird eine Probe durch Neutronenbestrahlung β-instabil und später werden die Photonen aus dem radioaktiven Zerfall durch hochreine Germanium-Detektoren nachgewiesen. Der Neutronenfluss wird dabei relativ zu ^{197}Au(n,γ) gemessen.

Der Vortrag stellt erste Ergebnisse eines solchen Experiment mit Proben aus natürlichem Gallium und Kupfer vor. Dabei wurden Protonen von einem Van-de-Graaff-Generator beschleunigt, um mittels der ^{7}Li(p,n)-Reaktion ein der Boltzmannverteilung bei $kT = 25\ keV$ ähnliches Spektrum und eine breite Verteilung um 90 keV zu erhalten.

Dieses Projekt wurde durch EFNUDAT, ERINDA und das EuroGENESIS Projekt MASCHE unterstützt.

HK 67.5 Do 15:15 HSZ-403

Measurement of the ^{20}N(γ,n)^{19}N reaction rate for r-process nucleosynthesis — •Marko Röder[1,2], Daniel Bemmerer[2], Thomas Cowan[1,2], Zoltán Elekes[2], Tobias Reinhardt[1,2], Andreas Wagner[2], and Kai Zuber[1] for the R3B-Collaboration — [1]Institut für Kern- und Teilchenphysik, Technische Universität Dresden — [2]Helmholtz-Zentrum Dresden-Rossendorf (HZDR)

In the astrophysical r-process (rapid neutron capture process), that is important for the nucleosynthesis of heavy elements, many neutron-rich nuclei are involved. The reactions on these exotic nuclei can only be studied with radioactive ion beams since target material cannot be fabricated from them. One example of these reactions is the ^{19}N(n,γ)^{20}N reaction that is important in a neutrino-driven wind scenario. Using ^{20}N as a beam, this reaction was studied at GSI in inverse kinematics via Coulomb-dissociation exploiting the virtual gamma field of a heavy target in the so called s393-experiment. The experiment was performed at the LAND/R3B setup (Large Area Neutron Detector, Reactions with Relativistic Radioactive Beams) in a kinematically complete measurement, i.e., detecting all particles leaving the nuclear reaction. The neutrons flying at relativistic velocity were observed by the LAND-detector, the calibration of which plays a crucial role for the above specific reaction. I will give an overview of the R3B-setup, the calibration of the LAND-detector and a status of the analysis of the ^{20}N(γ,n)^{19}N reaction.

— Supported by GSI F&E (DR-ZUBE) and NupNET NEDENSAA (05 P09 CRFN5).

HK 67.6 Do 15:30 HSZ-403

Untersuchung der ^{40}Ca(α,γ)^{44}Ti-Reaktion mittels Aktivierungsmessung im Felsenkeller Dresden — •Konrad Schmidt[1,2], Chavkat Akhmadaliev[1], Michael Anders[1], Daniel Bemmerer[1], Konstanze Boretzky[3], Antonio Caciolli[4], Mirco Dietz[1,2], Zoltán Elekes[1], Zsolt Fülöp[5], György Gyürky[5], Roland Hannaske[1], Arnd Junghans[1], Michele Marta[1,3], Marie-Luise Menzel[1,2], Ronald Schwengner[1], Tamás Szücs[5], Andreas Wagner[1], Louis Wagner[1,2], Dmitry Yakorev[1] und Kai Zuber[2] — [1]Helmholtz-Zentrum Dresden-Rossendorf (HZDR) — [2]TU Dresden — [3]GSI, Darmstadt — [4]INFN Padua, Italien — [5]ATOMKI, Debrecen, Ungarn

Modelle einer Kernkollaps-Supernova sagen vorher, dass ^{44}Ti ($t_{1/2} = 58,9$ a) produziert wird. Dementsprechend werden mehrere ^{44}Ti-γ-Strahlungsquellen in unserer Galaxie erwartet. Jedoch konnte ^{44}Ti bisher nur in den Supernovaüberresten Cassiopeia A und SN 1987A nachgewiesen werden.

^{40}Ca(α,γ)^{44}Ti ist die wichtigste Reaktion, die ^{44}Ti erzeugt. Ihre Reaktionsrate wird durch mehrere Resonanzen dominiert.

Am 3 MV Tandetron des Helmholtz-Zentrums Dresden-Rossendorf werden die Verzweigungsverhältnisse mittels in-beam γ-Spektrometrie untersucht und anschließend die Resonanzstärken durch eine Aktivierungsmessung im Niederniveaumesslabor Felsenkeller bestimmt. – Unterstützt von der DFG (BE 4100/2-1).

HK 67.7 Do 15:45 HSZ-403

The thermal neutron capture cross section of ^{60}Fe — •Zuzana Slavkovská[1], Tanja Heftrich[1], Franz Käppeler[2], Claudia Lederer[1], Jörg Neuhausen[3], René Reifarth[1], Stefan Schmidt[1], Dorothea Schumann[3], Kerstin Sonnabend[1], and Anton Wallner[4] — [1]Goethe Universität Frankfurt — [2]Karlsruher Institut für Technologie — [3]Paul Scherrer Institut — [4]Australian National University

^{60}Fe is an interesting long-lived radioactive nucleus. With an half-live of 2.6 Myr, its decay can be observed in the center of our galaxy witnessing ongoing nucleosynthesis. In order to understand the production and destruction of ^{60}Fe in stars, it is important to determine the neutron capture cross section experimentally.

An ^{60}Fe sample, produced in the framework of the ERAWAST program at the Paul Scherrer Institute in Switzerland, was irradiated at the research reactor TRIGA at the Johannes Gutenberg University in Mainz, Germany.

The irradiation of the sample took place in May 2012. The counting of the reaction product, ^{61}Fe, was undertaken using a HPGe detector. The thermal as well as the epithermal neutron flux during the irradiation were determined by simultaneous activation of zirconium foils. The activity of those foils was measured using the same γ-counting setup, which significantly reduced the systematic uncertainties.

This project was supported by the Helmholtz Young Investigator Project VH-NG-327 and the EuroGENESIS project MASCHE.

HK 68: Instrumentation

Zeit: Donnerstag 14:00–16:15 Raum: HSZ-405

HK 68.1 Do 14:00 HSZ-405

Offline Signal Tail-Correction for the ALICE TPC — •Mesut Arslandok for the ALICE-Collaboration — Institut für Kernphysik (IKF), Goethe Universität, Max-von-Laue-Str. 1 60438 Frankfurt am Main

The ALICE Time Projection Chamber (TPC) is the main tracking and particle identification (PID) detector of ALICE at the CERN-LHC. It was designed for multiplicities of up to 20,000 primary and secondary charged particles emerging from a single central Pb-Pb collision. The PID in the TPC is calculated from the specific energy loss measurement (dE/dx), which is derived from the pulse height distribution of charged particle tracks measured along 159 read-out planes. The signals from the Multi Wire Proportional Chambers (MWPC) show a characteristic long undershoot after the signal, which is due to the long ion drift times in the MWPC amplification region. Such an "ion tail" may lead to a loss of signal amplitude for the following signals on the same readout pad. Eventually, this results in a deterioration of the dE/dx resolution, in particular in the high multiplicity environment of Pb-Pb collisions. In this study, an offline correction method is presented which is expected to improve the dE/dx resolution and thus the PID quality of TPC. The method will be applied to the Pb-Pb collision data set taken in 2010 and 2011. Details of the correction procedure and first results will be presented.

HK 68.2 Do 14:15 HSZ-405

Extraction of Photomultiplier-Pulse Features — •Philipp Joerg, Tobias Baumann, Maximilian Büchele, Horst Fischer, Matthias Gorzellik, Tobias Grussenmeyer, Florian Herrmann, Paul Kremser, Tobias Kunz, Christoph Michalski, Sebastian Schopferer, and Tobias Szameitat — Physikalisches Institut der Universität Freiburg

Experiments in subatomic physics have to handle data rates at several MHz per readout channel to reach statistical significance for the measured quantities. Frequently such experiments have to deal with fast signals which may cover large dynamic ranges. For applications

which require amplitude as well as time measurements with highest accuracy transient recorders with very high resolution and deep on-board memory are the first choice. We have built a 16-channel 12-or14 bit single unit VME64x/VXS sampling ADC module which may sample at rates up to 1GS/s. Fast algorithms have been developed and successfully implemented for the readout of the recoil-proton detector at the COMPASS-II Experiment at CERN. We report on the implementation of the feature extraction algorithms and the performance achieved during a pilot with the COMPASS-II Experiment.

Supported by BMBF and EU FP7 (Grant Agreement283286).

HK 68.3 Do 14:30 HSZ-405

PSA via Singular Value Decomposition — •Tobias Habermann[1], Joachim Maruhn[1], and Jürgen Gerl[2] — [1]Goethe Universität Frankfurt — [2]GSI, Darmstadt

Gamma ray tracking is a substantial feature of upcoming gamma ray detector arrays (e.g. AGATA, GRETA). The precision and efficiency of tracking algorithms heavily depends on the knowledge of the exact interaction position inside the detector volume. To determine the position inside a segment of the detector pulse shape analysis (PSA) is applied. Due to a complicated electric field in parts of the detector there is no simple method to determine the position for a given pulse. Instead a database of pulse shapes with corresponding positions is created either by scanning the detector or from electric field simulations. The problem of finding the exact position for a given pulse is reduced to finding the best fit to this signal from the database. Finding the best fit from the database can be substantially accelerated by applying a transformation to the signals in the database and to the recorded pulse shape of the event before comparing them. An optimal linear transformation is obtained by calculating a Singular Value Decomposition of all the signals in the database.

HK 68.4 Do 14:45 HSZ-405

Offline software for the luminosity detector at PANDA — •Anastasia Karavdina[1], Achim Denig[1,2], Florian Feldbauer[1,2], Miriam Fritsch[1,2], Prometeusz Jasinski[1,2], Heinrich Leithoff[1,2], Mathias Michel[1,2], Stefan Pflueger[1,2], and Tobias Weber[1,2] for the PANDA-Collaboration — [1]Institut für Kernphysik, Johannes Gutenberg-Universität Mainz — [2]Helmholtz-Institut Mainz

The precise determination of the luminosity is crucial for the PANDA experiment which will be built at the new antiproton accelerator HESR (FAIR, Darmstadt, Germany). For this measurement elastic antiproton-proton scattering can be used. In the range of very small momentum transfer this process can be calculated exactly from QED. Therefore we are going to perform measurements at very small momentum transfer (and thus very small scattering angle). The current design for the detector has four planes (10/20 cm in between). It is located outside the magnetic field, 11 m behind the interaction point. Our reconstruction software includes standard parts as hit reconstruction, track finding and track fitting and specific procedures for luminosity extraction and background treatment. Beside these algorithms we developed a software alignment procedure based on reconstructed tracks by using the Millipede algorithm.

In this talk an overview of the basic concept and Monte Carlo based performance studies will be presented.

HK 68.5 Do 15:00 HSZ-405

Time Based Detector Simulation for the PANDA Experiment — •Tobias Stockmanns[1] and Mohammad Al-Turany[2] for the PANDA-Collaboration — [1]Forschungszentrum Jülich GmbH, IKP-1, 52425 Jülich — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Planckstraße 1, 64291 Darmstadt

PANDA is one of the main experiments of the future Facility for Antiproton and Ion Research (FAIR) at Darmstadt. Its purpose is the examination of the strong force in the energy regime of charmonium.

To be able to handle different physics questions PANDA abstains from the use of a first level hardware trigger. The complete detector data is read out to the control room where a software based event selection is done with the full PANDA data set.

This readout concept sets huge requirements on the readout system of PANDA as well as the used data selection algorithms. To be able to develop and test those it is necessary to do a chronologically ordered data simulation which differs strongly from the usual event based Monte-Carlo simulation of detectors.

The existing simulation software *pandaRoot* was extended to give both possibilities: event and time based simulation. The concept and simulation results will be shown in the presentation.

HK 68.6 Do 15:15 HSZ-405

Time-based simulation of the PANDA EMC — •Jifeng Hu, Martin Johannes Galuska, Wolfgang Kühn, Jens Sören Lange, Yutie Liang, and Björn Spruck for the PANDA-Collaboration — II.Physikalisches Institut, JUSTUS-LIEBIG University Giessen, 35392, Germany

The PANDA detector is a general-purpose detector for antiproton physics that will be operating at FAIR. The detector will be running at interaction rates of up to 30 MHz, leading to significant pile-up of events. As an important component of the detector, the electromagnetic calorimeter (EMC) will be exposed to this high rate environment. To understand the implications such as potential loss of efficiency or resolution, a framework for time-based simulation has been implemented within the PandaRoot software package. In this presentation, the concept of this simulation will be explained and the photon detection efficiency as a function of energy, polar angle, and event rate will be discussed.

This work was supported in part by the LOEWE Center HICforFAIR and BMBF under contract number 05P12RGFPF.

HK 68.7 Do 15:30 HSZ-405

FLUKA Rechnungen für das CBM Experiment an FAIR* — •ANNA SENGER für die CBM-Kollaboration — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Deutschland

Die Mission des Compressed Baryonic Matter (CBM) Experiments an FAIR ist die Erforschung der Eigenschaften von Kernmaterie bei extrem hohen Dichten, wie sie im Innern von Neutronensternen auftreten. Die an FAIR zur Verfügung stehenden Schwerionenstrahlen sind besonders dafür geeignet, solche Bedingungen im Labor zu erzeugen. Neue Erkenntnisse erwartet man von der Untersuchung von Teilchen die in der dichten Phase des Stoßes entstehen: seltsame und charmante Hadronen, sowie Mesonen die in Leptonenpaare zerfallen. Diese Messungen erfordern Reaktionsraten von bis zu 107 Au+Au Stößen pro sec. Die damit verbundenen Dosisbelastungen der Detektoren, die Aktivierung von Materialien und die benötigten Abschirmungen wurden durch realistische Simulationen unter Verwendung des FLUKA-Programmpakets untersucht. Diese Rechnungen gingen ein in die Auslegung der Detektoren und bildeten die Grundlage für die Auslegung der Experimentierhalle. Einige Ergebnisse werden vorgestellt.

*gefördet durch EU-FP7 HadronPhysics3

HK 68.8 Do 15:45 HSZ-405

Particle Identification with a large GEM-TPC — •Felix Valentin Böhmer for the GEM-TPC-Collaboration — Technische Universität München

A Time Projection Chamber (TPC) with its low material budget constitutes an almost ideal device for 3-dimensional tracking of charged particles.

The employment of Gas Electron Multiplier (GEM) foils for gas amplification promises to remedy the former limitation of TPCs to low-rate experiments: The intrinsic ion backflow suppression features of GEMs make traditional gating structures dispensable and thus open the possibility of a continuous operation of TPCs even in high-rate environments.

A large prototype (75 cm length, 15 cm radius) of such a GEM-TPC with $\sim$ 10000 readout channels has been built and successfully used in a physics campaign (π-beam on different targets) at the FOPI experiment at GSI, Darmstadt. From the recorded data, charged particle tracks entering the GEM-TPC are reconstructed using a fully 3-dimensional clustering algorithm and then matched with the surrounding FOPI tracking detectors.

In this talk we present a first analysis of the specific energy loss (dE/dx) of Pions, Kaons and Protons as a function of the particle momentum. Energy loss resolutions as well as separation power for particle identification are discussed.

This work has been supported by the BMBF and the DFG Cluster of Excellence "Universe" (Exc153)

HK 68.9 Do 16:00 HSZ-405

Particle Identification with a Disc DIRC Detector — •Julian Rieke, Michael Düren, Avetik Hayrapetyan, Klaus Föhl, Oliver Merle, Benno Kröck, and Daniel Mühlheim — Justus Liebig Universität, Gießen, Germany

The PANDA experiment at the future FAIR facility needs excellent

particle identification to do precision studies of antiproton-proton reactions in the 1.5-15 GeV/c momentum range. To fulfill this need, two Cherenkov detectors will be installed in the PANDA Target Spectrometer, both based on the DIRC concept that uses internally reflected Cherenkov light to perform particle identification, with a focus on the separation of pions and kaons. While the Barrel-DIRC covers central angles, the Disc-DIRC is designed to cap the forward region of theta angles between 5 and 22 degrees. It will be the first time that a Disc-DIRC is used for PID in a real physics experiment beyond prototyping.

A prototyping Disc-DIRC apparatus has been developed at the JLU Giessen featuring a quarter segment of the total disc. It was equipped with 30 multi-anode-phototubes with a total of 480 photo sensor pixels. The performance of the DIRC was tested using 3 GeV electrons provided by DESY Hamburg and a mixed hadron beam provided by CERN. A first analysis of the recorded data will be shown as well as results from a Monte Carlo simulation.

HK 69: Instrumentation

Zeit: Donnerstag 14:00–16:15 Raum: WIL-A221

Gruppenbericht HK 69.1 Do 14:00 WIL-A221

Der PANDA-Luminositätsdetektor — Florian Feldbauer[1,2], Miriam Fritsch[1,2], •Prometeusz Jasinski[1,2], Anastasia Karavdina[2], Heinrich Leithoff[1,2], Mathias Michel[1,2], Stefan Pflüger[1,2] und Tobias Weber[1,2] — [1]Helmholtzinstitut-Mainz — [2]Universität-Mainz

Mit PANDA wird am Antiprotonenring des Beschleunigerkomplexes FAIR in Darmstadt ein Experiment zur Verfügung stehen, das für Fragen der Hadronphysik optimiert ist. Mit dieser Anlage wird es möglich sein, neue Zustände zu entdecken und die Linienform dieser wie auch bereits bekannter Zustände sehr präzise zu vermessen. Die dafür verwendeten Energie-Scan-Messung benötigt die exakte Kenntnis der Luminosität zur Normierung.

Die Luminosität wird bei PANDA anhand der Winkelverteilung der elastischen Antiproton-Proton-Streuung gemessen. Dazu wird der Luminositätsdetektor 11 m hinter dem Wechselwirkungspunkt nahe der Strahlachse (3.5-8mrad) im Vakuum platziert, um die Unsicherheit in der Bestimmung der Luminosität durch Kleinwinkelstreuung und Modellannahmen zu minimieren. Angestrebt ist eine Messgenauigkeit von 3 %. Die Teilchenspuren werden mit 4 Detektorebenen rekonstruiert. Diese sind mit HV-MAPS bestückt, die auf wärmeleitenden CVD-Diamantscheiben aufgebracht werden.

Das Konzept des Luminositätsdetektors wird vorgestellt und dabei technische Aspekte wie Vakuumsystem, Kühlung und Elektronik diskutiert.

HK 69.2 Do 14:30 WIL-A221

Bestimmung der Luminosität mit dem PANDA Luminositätsdetektor — •Stefan Pflüger[1,2], Florian Feldbauer[1,2], Miriam Fritsch[1,2], Prometeusz Jasinski[1,2], Anastasia Karavdina[1], Heinrich Leithoff[1,2], Mathias Michel[1,2] und Tobias Weber[1,2] für die PANDA-Kollaboration — [1]Universität Mainz — [2]HI Mainz

Das PANDA Experiment, das am neuen Beschleunigerkomplex FAIR der GSI in Darmstadt entsteht, ist für Hadronspektroskopie optimiert. Im Vordergrund steht die Suche nach neuen Zuständen und die präzise Vermessung bereits entdeckter Zustände, z.B. dem X(3872). Die erforderliche Präzision für diese Messungen kann nur mit Hilfe der Energie-Scan-Methode erreicht werden. Voraussetzung für die Normierung der Messpunkte untereinander, ist die genaue Messung der Luminosität.

Bei PANDA wird die Luminosität mittels elastischer Antiproton-Proton-Streuung im Winkelbereich von 3-8 mrad gemessen. Dies hat den Vorteil, dass der Coulomb-Anteil der elastischen Streuung dominiert, der exakt berechnet werden kann. Der Luminositätsdetektor liegt ausserhalb des Magnetfeldes hinter dem PANDA-Spektrometer und besteht aus 4 Ebenen mit Silizium-Pixel-Detektoren (HV-MAPS, High Voltage Monolithic Active Pixel Sensor). Im Anschluss an die Spurrekonstruktion der elastisch gestreuten Antiprotonen wird die integrierte Luminosität extrahiert. Systematische Unsicherheiten bei der geometrischen Akzeptanz, Detektorauflösung und Lage und Form des Antiprotonenstrahls haben Einfluss auf die Genauigkeit der Luminositätsmessung und werden in diesem Beitrag vorgestellt.

HK 69.3 Do 14:45 WIL-A221

Development of a Compton Camera for online monitoring and dosimetry of laser-accelerated proton beams* — •Peter G. Thirolf[1], Christian Lang[1], Saad Aldawood[1], Dietrich Habs[1,2], Ludwig Maier[3], and Katia Parodi[1] — [1]LMU München — [2]MPI f. Quantenoptik, Garching — [3]TU München

A Compton camera is presently under construction in Garching, designed for monitoring and dosimetry of laser-accelerated protons for bio-medical applications via position-resolved prompt γ-ray detection. When ion beams suitable for hadron therapy (protons, carbon ions) interact with tissue (or tissue-equivalent plastic or water phantoms), nuclear reactions induce prompt γ rays that can be utilized, e.g., to verify the ion beam range (i.e. monitor the Bragg peak position) by exploiting the Compton scattering kinematics of these photons. Our Compton camera (formed by a combination of scatter and absorber detector) consists of a stack of six double-sided Si-strip detectors (50x50 mm^2, 0.5 mm thick, 128 strips/side, pitch 390 μm) acting as scatterers, while the absorber is formed by a $LaBr_3$ scintillator crystal (50x50x30 mm^3), read out by a (8x8) pixelated multi-anode PMT. Simulation results for design specifications and expected values of resolution and efficiency will be presented, as well as the status of the prototype presently under construction.

* supported by the DFG Cluster of Excellence MAP (Munich-centre for Advanced Photonics)

HK 69.4 Do 15:00 WIL-A221

Scintillating screens for intense heavy ion beams — •Eiko Gütlich[1], Peter Forck[2], Wolfgang Ensinger[3], and Oliver Kester[1,2] — [1]Goethe-Universität Frankfurt, Institut für Angewandte Physik — [2]GSI Helmholtzzentrum für Schwerionenforschung — [3]Technische Universität Darmstadt, Materialwissenschaften

Beam diagnostics is a fundamental part of every particle accelerator. In contrast to other methods, scintillating screens are a very cost efficient and simple method to determine the transversal beam properties. They are used for the qualitative beam alignment as well as for optimization of the beam intensity distribution in nearly all accelerators. To perform quantitative measurements with scintillating screens the imaging properties, aging and dynamical behaviour have to be known. Thus, extensive investigations have been carried at the GSI linear accelerator UNILAC. Due to the energy deposition of heavy ions with kinetic energy of 11.4 MeV/u, the resulting dose rates for the materials are up to 10^{12} Gy/h. The high dose rates and heat loads limit the potential screen materials to radiation hard materials like ceramic Al_2O_3 or ZrO_2. The measurements show that the imaging quality can depend on the materials itself, its temperature, the accumulated fluence $[ions/cm^2]$, the flux $[ions/(cm^2 * s)]$, the ion energy as well as the observed emission wavelength. For Al_2O_3 a model has been developed to explain the observed saturation effects. To validate the model, experiments with a known ion beam distribution and flux have been carried out. For Carbon and Titanium ions with kinetic energy of 11.4 MeV/u the flux and the pulse length have been varied.

HK 69.5 Do 15:15 WIL-A221

A multiple-reflection time-of-flight isobar separator for TITAN at TRIUMF — •Christian Jesch[1], Timo Dickel[1,2], Wolfgang Plass[1,2], Jens Ebert[1], Hans Geissel[1,2], Johannes Lang[1], Moritz Pascal Reiter[1], Christoph Scheidenberger[1,2], and Mikhail I. Yavor[3] — [1]Justus-Liebig-Universität Gießen — [2]GSI, Darmstadt — [3]Inst. for Analytical Instrum., Russian Academy of Sci., St. Petersburg

The production of radioactive ion beams via the ISOL method has the advantage of a high yield of the desired radioisotope. The often even higher production and ionization yields of contaminants requires efficient separation methods. The commonly used magnetic separators with mass resolving power of a few 10^3 allow the separation of contaminants with a mass difference $\geq$ 1 amu but no preparation of an isobarically clean beam.

TRIUMF's Ion Trap for Atomic and Nuclear science, TITAN, is a facility for mass measurements, laser spectroscopy and nuclear branching ratio measurements in Vancouver, Canada.

In order to extend TITAN's capabilities, a specialized multiple-

reflection time-of-flight mass spectrometer has been developed in order to provide an efficient, fast (≈ ms), high mass resolving power (≈ 10^5) and high capacity (> 10^6/s) isobar separation of the radioactive nuclei. The separator concept, its design and preliminary results will be presented.

HK 69.6 Do 15:30 WIL-A221

Status of the Intrap project at MLLTRAP — •Peter Müller, Jasmin Moazzami-Fallah, Jurek Szerypo, Peter G. Thirolf, and Christine Weber — Fakultät für Physik, LMU München, 85748 Garching

The precision of decay-spectroscopy experiments is limited due to scattering effects in the source material. However, well-localized ions in a Penning trap can be considered as an ideal, carrier-free source. In order to investigate alpha- and conversion-electron decays, a novel type of "Detector-Trap" is presently under construction at the Garching double Penning-trap facility MLLTRAP for the future MATS facility at FAIR. Here, the trap's ring electrode is replaced by a cubic detector array, also providing the trapping potential. It consists of four position-sensitive silicon strip detectors, which allow for a measurement of energy spectra and enable a determination of the decay axis of stored alpha-emitters. Moreover, low-energetic electrons from conversion decays are efficiently guided along the magnetic field lines and detected in the fringe field region of the trap's superconducting magnet. For this purpose, alpha- and electron detectors are presently developed, and extensively characterized under the future ambient conditions given in the MATS experimental setups. This presentation reports on the physics goals of future experiments and gives an overview on the present status of the developments.

[*] Supported by BMBF (06ML9148, 05P12WMFNE), DFG (HA 1101/14-1), and MLL.

HK 69.7 Do 15:45 WIL-A221

Feasibility studies for the EXL project at the ESR storage ring — •J.C. Zamora for the EXL E105-Collaboration — Institut für Kernphysik, TU Darmstadt

The objective of the EXL project is the investigation of nuclear structure of EXotic nuclei in Light-ion induced reactions, by using the storage ring NESR (at FAIR). In this project a universal detector system will provide high resolution and large solid angle coverage for kinematically complete measurements.
In a recent experiment at the present ESR storage ring, the collaboration has performed feasibility studies and first experiments by using a dedicated detector setup including UHV capable DSSD's and PIN diodes for the detection of target like recoil ions, and beam like reaction products, respectively. With this setup the interaction of ^{56,58}Ni beams with internal hydrogen and helium gas-jet targets was investigated. Some preliminary results from this experiment will be presented, together with GEANT4 simulations employed to understand the different reaction channels observed. This work is supported by BMBF (06DA9040I and 05P12RDFN8) and HIC for FAIR.

HK 69.8 Do 16:00 WIL-A221

design of internal superconducting polarizing solenoid for frozen spin target — •James Linturi for the A2-Collaboration — Institute fuer kernphysik,mainz, germany

scattering experiments with polarized targets and beams are necessary to check the present models and to achieve a better knowledge of the nucleon structure. The development of the frozen spin target technique has opened the possibility to use a polarized target with high density of polarized nucleons in combination with a particle detector with nearly 4π solid angle. Thus, high luminosity experiments, even with low intensity beams, can be performed. The frozen spin target at MAMI uses a thin, superconducting holding coil inside the refrigerator to keep the polarization with a relaxation time in the order of 1000 hours. After a measurement period of approximately one week the detector or the target has to be changed and the target material has to be re-polarized in a strong superconducting magnet. This leads to a loss in beamtime and overall efficiency.

To allow a continuous operation of the target, the theory and design of a 10 layer notched internal superconducting solenoid of length 13.6cm and radius 2.4cm is described. Calculations of the magnetic field inside the solenoid are summarized. The simulated results show that it is possible to attain a magnetic field of 2.5T with homogeneity of 10-4 at the target region.

HK 70: Beschleunigerphysik XI (Strahlinstabilitäten II)

Zeit: Donnerstag 14:00–16:00 Raum: WIL-C203

HK 70.1 Do 14:00 WIL-C203

Das neue System zur schnellen Korrektur der Gleichgewichtsbahn an ELSA — •Jens-Peter Thiry, Andreas Dieckmann, Andreas Balling, Frank Frommberger und Wolfgang Hillert — Elektronen-Stretcher-Anlage ELSA, Physikalisches Institut, Universität Bonn

An der Beschleunigeranlage ELSA werden polarisierte Elektronen auf zur Zeit bis zu 2,4 GeV beschleunigt. Der Beschleunigungsvorgang findet dabei mittels einer schnellen Energierampe mit Rampgeschwindigkeiten von bis zu 6 GeV/s statt. Eine präzise vertikale Zentrierung der Gleichgewichtsbahn in den Quadrupolmagneten während der gesamten Energierampe ist dabei eine wichtige Voraussetzung um den Polarisationsgrad der Elektronen zu konservieren. Die mittlere vertikale Abweichung der Gleichgewichtsbahn von der Sollbahn soll dabei während der Beschleunigung auf unter 50 μm korrigiert werden können.

Zukünftig ist geplant polarisierte Elektronen auf eine Energie von bis zu 3,2 GeV zu beschleunigen. Dazu wird gegenwärtig das vertikale Korrektorsystem aufgerüstet: In einem ersten Schritt wurden neue Netzgeräte für die Korrekturmagnete entwickelt und zunächst mit dem alten Korrektorsystem erfolgreich getestet. In einem zweiten Schritt ist nun zunächst die erste Hälfte der Korrekturmagnete durch neu entwickelte Magnete ersetzt worden.

In diesem Vortrag wird die verwendete Hardware des Korrektursystems vorgestellt und von ersten Erfahrungen im Betrieb berichtet.

Gruppenbericht HK 70.2 Do 14:15 WIL-C203

Hochstrombetrieb an ELSA* — •Manuel Schedler, Wolfgang Hillert, André Roth, Dennis Sauerland und Frank Frommberger — Elektronen-Stretcher-Anlage ELSA, Physikalisches Institut, Universität Bon

Im Zuge der Erhöhung des extrahierten Strahlstromes an den Experimentierplätzen der Elektronen-Stretcher-Anlage ELSA muss auch der interne Strom des ELSA-Rings auf bis zu 200 mA erhöht werden.

Die limitierenden Effekte hoher Strahlströme im Stretcherring sind Ioneninstabilitäten und schmalbandige HOM-Impedanzen der zur Beschleunigung verwendeten fünfzelligen PETRA-Resonatoren. Diese äußern sich durch Anregung von Multibunchinstabilitäten, die durch ein aktives Bunch-by-Bunch Feedback-System kompensiert werden können. Die Auswirkungen der Strahlneutralisation durch Ioneneffekte und die damit verbundene Verschiebung der transversalen Arbeitspunkte treten insbesondere bei der Injektionsenergie von 1.2 GeV auf und müssen korrigiert werden.

In diesem Vortrag werden Messungen der HOM-Spektren der PETRA-Resonatoren, deren Auswirkungen auf den Elektronenstrahl und mögliche Gegenmaßnahmen vorstellt, sowie Messungen zu Vielteilcheneffekten und deren Auswirkung auf den maximal möglichen Strahlstrom und die Füllstruktur.

*Gefördert durch die DFG im Rahmen des Sonderforschungsbereiches/Transregio 16.

HK 70.3 Do 14:45 WIL-C203

Status of Digital Bunch-by-Bunch Feedback Systems at DELTA and their Application as Diagnostics Tools.* — •Markus Höner, Holger Huck, Shaukat Khan, Robert Molo, Andreas Schick, Peter Ungelenk, and Maryam Zeinalzadeh — Center for Synchrotron Radiation (DELTA), TU Dortmund University, 44227 Dortmund, Germany

Digital bunch-by-bunch feedback systems allow to detect and counteract longitudinal as well as transverse multi-bunch instabilities. Beam current-dependent grow-damp measurements have been performed in order to characterize these instabilities at the DELTA storage ring. The longitudinal feedback system is used permanently during the op-

eration of the new short-pulse facility in order to damp longitudinal bunch oscillations. Besides that, all three feedback systems are in use as excellent diagnostics tools, e.g. to investigate the injection process or to take data during sudden beam loss for post-processing. * Work supported by the BMBF.

HK 70.4 Do 15:00 WIL-C203

Messung der Strahlkoppelimpedanz von SIS100 Komponenten — •Lewin Eidam[1], Uwe Niedermayer[2] und Oliver Boine-Frankenheim[1,2] — [1]GSI, Darmstadt, Deutschland — [2]TEMF, Darmstadt, Deutschland

Für die Optimierung des FAIR Schwerionensynchrotons SIS100 für höchste Strahlströme ist eine genaue Kenntnis der Koppelimpedanz erforderlich. Speziell die Koppelimpedanzen der Ferrit-Kickermagnete und der Graphit-Kollimatoren können transversale Instabilitäten verursachen, weshalb die Impedanz bei der Auslegung der Komponenten zu berücksichtigen ist. Dafür ist zuerst eine genaue Vermessung der Koppelimpedanz erforderlich.

Auf Grund der vergleichbaren Feldverteilung eines ultrarelativistischen Strahls und einer TEM Welle, kann die Koppelimpedanz durch die Leitungstheorie beschrieben werden. Der Strahl wird für die longitudinale durch einen Leiter und für die transversale Koppelimpedanz durch zwei Leiter mit entgegengesetzter Polarität ersetzt und mit einem Netzwerkanalysator vermessen. Um die Sensivität bei niedrigen Frequenzen zu erhöhen, kann der Doppelleiter zu einer Spule erweitert und ein LCR-Meter verwendet werden. Es werden eine Beschreibung der Messaufbauten und erste Ergebnisse diskutiert.

HK 70.5 Do 15:15 WIL-C203

Messung von Elektronenwolken mit Mikrowellen — •Oliver Haas und Oliver Boine-Frankenheim — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Planckstraße 1, 64291 Darmstadt

In modernen Beschleunigern hat sich der so genannte Elektronenwolken-Effekt (engl. electron cloud effect) als eines der wichtigsten Phänomene für Intensitätslimitierungen herauskristallisiert. In einem Strahlrohr sind immer einige freie Elektronen vorhanden, welche durch das elektrische Feld des Primärstrahl beschleunigt werden und an den Wänden des Strahlrohr Sekundärelektronenemission induzieren. Dies kann zu einer dichten Elektronenwolke führen, welche sich negativ auf die Strahlqualität – bis hin zu Strahlverlusten – auswirken kann.

Für die Evaluation von Gegenmaßnahmen ist es wichtig direkte Messmethoden zur Bestimmung der Elektronendichte im Beschleuniger zu haben. Die Mikrowellen Transmission misst im Gegensatz zu lokalen Detektoren, wie z. B. Gegenfeld-Spektrometern, die integrierte Elektronendichte über einen längeren Abschnitt eines Beschleunigers.

In der vorliegenden Arbeit wurden u.a. in PIC Simulationen die verschiedenen Einflüsse von Temperatur, räumlicher Verteilung der Elektronenwolke, äußeren Magnetfeldern und Polarisation der Mikrowelle auf die Messmethode separat betrachtet. Für einfache Modelle der Elektronenwolke wurde eine sehr gute Übereinstimmung zwischen analytischen Berechnungen und Simulationen gefunden. Realistische Verteilungen der Elektronenwolke können jedoch die Messung mit Mikrowellen massiv beeinflussen.

HK 70.6 Do 15:30 WIL-C203

Ein schmalbandiges Feedback für ELSA — •Christine Reinsch, Wolfgang Hillert, Frank Frommberger und Manuel Schedler — Physikalisches Institut, Universität Bonn

An der Elektronen-Stretcher-Anlage ELSA der Universität Bonn werden Doppelpolarisationsexperimente zur Baryonenspektroskopie durchgeführt. Dazu ist eine Erhöhung des extrahierten Strahlstroms erforderlich, was bedingt, dass auch der interne Strom im ELSA-Ring auf bis zu 200 mA erhöht werden muss. Der Elektronenstrahl induziert Ströme auf der Vakuumkammer und den Beschleunigungsresonatoren, wodurch Störfelder entstehen, die die nachfolgenden Elektronenpakete zu longitudinalen Schwingungen anregen. Dabei können sich verschiedene Schwingungsmoden ausbilden, die durch eine definierte Phasenbeziehung zwischen benachbarten Elektronenpaketen charakterisiert sind. Die auftretenden Strahlinstabilitäten können mit einen bereits bestehenden breitbandigem Bunch-by-Bunch Feedback-System gedämpft werden. Für eine höhere Mode bei 1,459 GHz ist dies nicht ausreichend. Mit Hilfe eines schmalbandigen Resonators soll diese Schwingung unterdrückt werden. Die Anforderungen an den Resonator, dessen Simulation und die geplante Einbindung in die Beschleunigeranlage werden vorgestellt.

HK 70.7 Do 15:45 WIL-C203

Einfluß einer Breitbandkavität auf einen Ionenstrahl hoher Intensität — •Monika Mehler[1,2] und Peter Hülsmann[1,2] — [1]GSI Helmholtzzentrum für Schwerionenforschung mbH — [2]IAP Institut für Angewandte Physik, Goethe Universität Frankfurt

Für die neue FAIR (Facility for Antiproton and Ion Research) Anlage am GSI Helmholtzzentrum für Schwerionenforschung mbH wird die Leistungsfähigkeit des Synchrotrons SIS-18 verbessert, damit dieser als Injektor für den zu bauenden SIS-100 dienen kann. Dazu wird eine Breitbandkavität aus Magnetic Alloy (MA) Ringkernen gebaut, die den Doppelharmonischenbetrieb ermöglichen soll. Die Breitbandkavität wird hierfür auf der zweiten Umlaufharmonischen h=2 betrieben. Das Material MA wird verwendet, um eine möglichst kurze Einbaulänge zu gewährleisten. Eine weitere schmalbandige Ferritkavität wird auf der vierten Umlaufharmonischen h=4 betrieben. Sie dient der Formgebung des phasenstabilen Bereichs innerhalb der Separatrix (bucket). Der gemessene Frequenzgang der Breitbandkavität soll hier gezeigt und dessen Einfluß auf den Schwerionenstrahl mit hoher Intensität soll hier untersucht werden.

HK 71: Beschleunigerphysik XII (Kurze Pulse)

Zeit: Donnerstag 14:00–16:15 Raum: WIL-C205

HK 71.1 Do 14:00 WIL-C205

Novel Drift compensation for a femtosecond laser system at a quasi-cw electron accelerator — •Bertram Green, Michael Kuntzsch, Sergei Kovalev, and Michael Gensch — Helmholtz-Zentrum Dresden-Rossendorf

A method for electron beam/THz to femtosecond (fs) - laser synchronization drift correction at the quasi-cw linear electron accelerator ELBE is presented, which is utilizing THz radiation generated by a CDR/CTR screen and an undulator respectively. Measurements of these pulses will allow for compensation of slow drifts in the arrival time on millisecond timescales between the THz and the fs-laser pulses. The method requires two electro-optic detection setups which allow for the sampling of a single THz pulse, at two different working points. Given a consistent pulse shape these two data points can provide information on the sign of the arrival time drift relative to the laser. This information can be used both for providing feedback on fs laser arrival time in a potential THz time domain experiment as well as the electron bunch arrival time in the accelerator.

HK 71.2 Do 14:15 WIL-C205

Optical Synchronization and Electron Bunch Diagnostic at the quasi-cw accelerator ELBE — •Michael Kuntzsch[1,2], Ulf Lehnert[1], Fabian Röser[1], Marie Kristin Czwalinna[3], Sebastian Schulz[3], Holger Schlarb[3], and Silke Vilcins[3] — [1]Helmholtz-Zentrum Dresden-Rossendorf, Dresden, Germany — [2]Technische Universität Dresden, Dresden, Germany — [3]Deutsches Elektronen-Synchrotron, Hamburg, Germany

The continuous wave electron accelerator ELBE is upgraded to generate short and highly charged electron bunches (~200fs duration, up to 1 nC) with an energy of up to 40 MeV. In the last years a prototype of an optical synchronization system using a mode locked fiber laser has been build up which is now in commissioning phase. The stabilized pulse train can be used for new methods of electron bunch diagnostics like bunch arrival time measurement with the resolution down to a few femtoseconds. At ELBE a bunch arrival time monitor (BAM) has been designed and tested at the accelerator. The contribution will show the concept of the femtosecond synchronization system, the design of the BAM and first measurement results.

HK 71.3 Do 14:30 WIL-C205

Detection of ultrashort VUV radiation pulses using photoelectron spectroscopy at DELTA — •Maryam Zeinalzadeh[1], Stefan Cramm[2], Sven Döring[3], Markus Höner[1], Holger

Huck[1], Shaukat Khan[1], Robert Molo[1], Lukasz Plucinski[1], Andreas Schick[1], and Peter Ungelenk[1] — [1]Zentrum für Synchrotronstrahlung (DELTA), TU Dortmund — [2]Forschungszentrum Jülich — [3]Universität Duisburg-Essen

At the 1.5-GeV electron storage ring DELTA operated by the TU-Dortmund University, coherent VUV radiation is generated in a short-pulse facility based on the Coherent Harmonic Generation (CHG) scheme. In this scheme, a femtosecond laser pulse is used to induce a periodic modulation of the electron energy in an undulator. The energy modulation is converted to a density modulation in a dispersive section. The resulting electron microbunches radiate coherently at higher harmonics of the laser wavelength in a second undulator. The VUV beamline operated by the Forschungszentrum Jülich will be employed for pump-probe experiments. It comprises a plane-grating monochromator and a photoelectron spectrometer optimized for angle-resolved photoemission spectroscopy. While a dedicated setup was initially used during commissioning of the short-pulse facility, the CHG-generated pulses can now be characterized directly in the VUV beamline.

HK 71.4 Do 14:45 WIL-C205

Sub-Femtosecond X-Ray Pulse from Electron Bunches with Very Low Charge at LCLS — •Violetta Wacker[1], Juliane Rönsch-Schulenburg[1], Yuantao Ding[2], Zhirong Huang[2], and Feng Zhou[2] — [1]University Of Hamburg, Hamburg, Germany — [2]SLAC, CA 94025, USA

The Linac Coherent Light Source (LCLS) is an x-ray free-electron laser (FEL) at SLAC National Accelerator Laboratory, supporting a wide range of scientific research with an x-ray pulse length varying from a few to several hundred femtoseconds. There is also a large interest in even shorter x-ray pulses consisting of a single spike only, which will allow the investigation of matter at the atomic length (Å) and time scale (fs). For the hard x-ray operation at 13.6 GeV of LCLS, we investigate the FEL performance using 1 pC and 3 pC electron bunches, based on start-to-end simulations. With an optimization of the machine set up, simulations show that single spike, sub-fs, hard x-ray pulses are achievable at such a low charge. Additionally single spike pulse studies for the soft x-ray operation at 4.3 GeV of LCLS using a 5 pC electron bunch are in progress.

HK 71.5 Do 15:00 WIL-C205

Status and latest improvements of the short-pulse facility at the DELTA storage ring* — •Andreas Schick, Markus Höner, Holger Huck, Shaukat Khan, Robert Molo, Peter Ungelenk, and Maryam Zeinalzadeh — Center for Synchrotron Radiation (DELTA), TU Dortmund University, 44227 Dortmund, Germany

The new short-pulse facility at the synchrotron light source DELTA utilizes the interaction of the electrons with an ultrashort laser pulse in an undulator (Coherent Harmonic Generation principle). Subsequent microbunching leads to coherent radiation of sub-ps pulses in the VUV regime, which will be used for time-resolved photoelectron-spectroscopy experiments. In addition, coherent, ultrashort THz pulses are generated. Improvements regarding the stability, availability and reliability are presented. Furthermore, the progress towards the emission of shorter wavelengths and towards pump-probe experiments at an existing user beamline are shown.

* Work supported by DFG, BMBF and by the Federal State NRW.

HK 71.6 Do 15:15 WIL-C205

FLASH II - a Multi Beamline FEL facility. — •Sven Ackermann — DESY, Hamburg — Universität Hamburg

The Free-Electron Laser (FLASH) in Hamburg generates coherent XUV radiation used in various research projects. In order to provide more beam time for the growing community of photon users, DESY in collaboration with HZB started the FLASH II project in 2010. FLASH II is an extension of the existing FLASH facility consisting of a new undulator section in a separate tunnel and a new experimental hall. The two Free-Electron Lasers share the same super conducting linac. Due to the fixed gap undulators used in the present FLASH setup the radiation wavelength can be changed only by changing the electron energy. FLASH II, in contrast, will benefit from variable gap undulators which will allow to have largely independent radiation wavelength. For the generation of different electron bunch trains two different injector lasers will use the same photocathode RF gun. The linac will then accelerate the different bunch trains. This means that for the independent operation the gradients and phases of the superconducting acceleration modules have to be changed within the RF pulse. A first demonstration has been performed in 2012. In addition to the SASE operating mode, a HHG direct seeding option between 10 nm and 40 nm with a final repitition rate up to 100 kHz is foreseen. Other seeding schemes like HGHG, EEHG and Hybrid schemes are currently under investigation.

HK 71.7 Do 15:30 WIL-C205

Dynamics of ion heating and ionization in high power ultra-short laser pulses interacting with solid density plasmas — •Lingen Huang[1,2], Thomas Kluge[1], Christian Gutt[3], Michael Bussmann[1], and Thomas E. Cowan[1] — [1]Helmholtz-Zentrum Dresden-Rossendorf , Dresden 01328 , Germany — [2]Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, Shanghai 201800, China — [3]Deutsches Elektronen-Synchrotron, Hamburg 22603, Germany

Plasma heating and ionization are important processes during the interaction of high power ultra-short laser pulses with solid density targets. In order to understand the relevant physics, particle-in-cell simulations including collisions and ionization were run to study ion heating dynamics in buried layer targets illuminated by high-intensity, ultra-short laser pulses. Our results show that bulk ions can be heated to above 1keV temperature. When studying the ionization dynamics strong filaments have been observed which depend on preplasma on the target front side, laser pulse duration and intensity. In order to study the evolution of ionization and ion bulk heating in experiment, ultra-bright X-ray free electron lasers - such as the European XFEL - are a very promising and strong tool to resolve the spatial and temporal scales of these processes inside the solid target.

HK 71.8 Do 15:45 WIL-C205

Does electron dynamics in Travelling-wave Thomson-scattering allow for an optical FEL? — •Klaus Steiniger, Alexander Debus, Michael Bussmann, and Roland Sauerbrey — Helmholtz-Zentrum Dresden-Rossendorf, Dresden, Germany

In the Travelling-wave Thomson-scattering (TWTS) scheme ultrashort and narrow-band light pulses in the X-Ray region of the spectrum are created by scattering high intensity laser pulses from relativistic electron bunches. TWTS uses lasers with a pulse front tilt in a side-scattering geometry to scale the interaction length into the centimeter to meter range. This is crucial for allowing the scattered radiation to act back on the electrons which eventually can lead to coherent amplification of the radiation as in a free electron laser (FEL). We study the electron dynamics in the laser field including back reaction effects and discuss the applicability of TWTS as a SASE-FEL.

HK 71.9 Do 16:00 WIL-C205

Status of the short bunch operation project at FLASH — Eugen Hass[1], Alexander Kuhl[1], •Marie Rehders[1,2], Juliane Rönsch-Schulenburg[1,2], Jörg Rossbach[1], Holger Schlarb[3], and Siegfried Schreiber[3] — [1]University of Hamburg — [2]CFEL, Hamburg — [3]DESY, Hamburg

The FEL FLASH (Free-Electron Laser in Hamburg) operates between 4.12 and 45nm. Typically photon pulses between 50 and 200fs are generated. Many users at FLASH work on pump-probe experiments, where time resolution is determined by the pulse duration. Therefore they have expressed a keen interest in being provided with shorter XUV pulses. The shortest possible SASE pulse is a single longitudinal optical mode of the FEL radiation. The most direct way to realize this at FLASH would be to reduce the electron bunch length to only a few μm at the entrance of the undulator section. In the ideal case a bunch charge of only 20pC is suited for the generation of such short bunches. Thus a shorter initial bunch length at the photo-cathode can be chosen, which in turn reduces the bunch compression required to reach single mode conditions. A new photo-injector laser with adjustable pulse duration is used to optimize the initial electron bunch length. Beam dynamic studies are being performed to optimize the injection and compression of small charge electron bunches, starting with the pulse parameters of the injector laser. Improvements of important diagnostics are under way to adapt for charges and bunch lengths that are very small compared to standard FLASH operation. An overview and current status of the project is given in this contribution.

HK 72: Beschleunigerphysik XIII (Synchrotronstrahlung/THz)

Zeit: Donnerstag 14:00–16:15 Raum: WIL-C207

HK 72.1 Do 14:00 WIL-C207

Current Activities at the DELTA THz Beamline* — •Peter Ungelenk, Markus Höner, Holger Huck, Shaukat Khan, Robert Molo, Andreas Schick, and Maryam Zeinalzadeh — Center for Synchrotron Radiation (DELTA), TU Dortmund University, 44227 Dortmund, Germany

In addition to an InSb Bolometer, which detects laser-induced coherent THz pulses at the synchrotron light source DELTA since June 2011, a Fourier transform infrared spectrometer is currently being commissioned. Furthermore, a fast hot-electron bolometer has been used in cooperation with the Karlsruhe Institute of Technology to study the evolution of the laser-induced electron density modulation over several revolutions in the storage ring.

* Work supported by DFG, BMBF, and by the Federal State NRW.

HK 72.2 Do 14:15 WIL-C207

Single Particle Tracking for Simultaneous Long and Short Electron Bunches in the BESSY II Storage Ring — •Martin Ruprecht[1], Axel Neumann[1], Markus Ries[1], Godehard Wuestefeld[1], and Thomas Weis[2] — [1]Helmholtz-Zentrum Berlin, Germany — [2]Technische Universität Dortmund, Germany

A scheme where 1.5 ps and 15 ps long bunches (rms) can be stored simultaneously in the BESSY II storage ring has recently been proposed (BESSY^{VSR}[1]). Based on that scheme, this talk presents simulations of single particle beam dynamics influenced by superconducting cavities used for the strong longitudinal beam focusing. The effect of perturbations to the ideal system of cavities, such as jitter and offsets in amplitude, frequency and phase is investigated and results are discussed. The primary goal is to reveal preliminary design specifications on the operating parameters of the sc-cavities and the LLRF system in the BESSY II storage ring.

[1] G. Wüstefeld, A. Jankowiak, J. Knobloch, M. Ries, Simultaneous Long and Short Electron Bunches in the BESSY II Storage Ring, Proceedings of IPAC2011, San Sebastián, Spain

HK 72.3 Do 14:30 WIL-C207

Beamline for THz beam diagnostics at the ANKA storage ring — •Jan Christoph Heip, Vitali Judin, Michael J. Nasse, Marcel Schuh, Yves-Laurent Mathis, and Anke-Susanne Müller — KIT, Karlsruhe

A new dedicated beamline for THz radiation at ANKA, the electron storage ring at the Karlsruhe Institute of Technology, will allow measurements of the electron bunch characteristics. Since the wavelength of THz radiation is in the mm range, the wave nature of the radiation has to be taken into account when planning the beamline.This presentation discusses possible designs for this beamline.

HK 72.4 Do 14:45 WIL-C207

HF-Bunchkompressionsstudien für FLUTE — •Marcel Schuh für die FLUTE-Kollaboration — KIT, Karlsruhe, Deutschland

FLUTE ist eine geplante 40 bis 50 MeV Beschleunigertestanlage, bestehend aus einem Elektronenlinearbeschleuniger und einer Magnetschikane zur Bunchkompression. In der Anlage soll die Bunchkompression und Erzeugungsmechanismen von koheränter Synchrotron-, Übergangs- und Kantenstrahlung im THz-Bereich für einen großen Ladungsbereich von Pikocoulomb bis zu mehreren Nanocoulomb untersucht werden. In diesem Beitrag wird der Einfluss einer Buncher-Kavität zwischen Elektronenkanone und Linearbeschleuniger untersucht, um Bunchlängen von Femtosekunden im pC Bereich zu erzeugen. Die Kavität wird um etwa 90 Grad phasenverschoben betrieben und in der anschliessenden Driftstrecke setzt ballistische Bunchkompression ein. Durch Wahl der geeigneten Amplitude, Phase im Buncher und der Driftstreckenlänge kann der Bunch vorkomprimiert und die Bunchlänge im Linac weiter reduziert werden.

HK 72.5 Do 15:00 WIL-C207

Studies of bunch length and charge for the planned THz source, FLUTE — •Somprasong Naknaimueang for the FLUTE-Collaboration — Karlsruhe Institute of Technology, Karlsruhe, Germany

FLUTE is a THz source consisting of a 7 MeV photon gun, a 40 to 50 MeV linac, and a bunch compressor. The gun can produce up to 3 nC electron bunches which are several picoseconds long. At high charges, the transverse and longitudinal beam sizes are limited by space charge effects. In addition, coherent synchrotron radiation effects in the compressor limit the minimum obtainable bunch length in this case. The relationship between bunch charge and obtainable bunch length for a FLUTE-type accelerator is discussed.

HK 72.6 Do 15:15 WIL-C207

A Transmittive Photon Flux Detector for Laser-Plasma-Driven Soft X-Ray Undulator Radiation — •Niels Delbos, Christian Werle, Benno Zeitler, Andreas Richard Maier, and Florian Grüner — University of Hamburg, Center for Free-Electron Laser Science

In recent experiments early 2012 our group demonstrated the energy tunability of a laser-plasma driven undulator source, emitting ultrashort soft x-ray (SXR) pulses of only a few femtoseconds with energies up to the water window.

Based on these results, the next step is to use the generated SXR pulses in pump-probe experiments. The photon flux of the undulator, however, is subject to fluctuations, as the electron beam parameters vary from shot to shot. Hence a diagnostic, measuring the photon flux on-line with high transmission, efficiency and sensitivity is needed to bedeveloped for future experiments.

Since SXR radiation shows a characteristically high degree of absorption in matter,the development of a detector that meets the particularly high requirements posed a considerable challenge. This talk discusses the development and calibration of a detector, which is easy to use and shows high and adjustable transmission for a broad photon energy range, based on the photoionization of noble gases.

HK 72.7 Do 15:30 WIL-C207

Design of a transmission grating hard X-ray spectrometer for laser-driven undulator sources — •Christian Werle[1], Nathaniel Kajumba[2], Anfdreas Maier[1], Benno Zeitler[1], Niels Delbos[1], and Florian Grüner[1] — [1]University of Hamburg / CFEL, Hamburg, Germany — [2]Ludwig Maximilian University, Munich, Germany

State-of-the-art laser-driven undulator sources are already becoming very versatile and powerful light sources, especially due to their wavelength tunability and ultra-short pulses. However, being still in development, they suffer from instabilities, which can make the spectral characterization of their radiation rather challenging, especially in the few-nm range. The hard X-ray transmission grating spectrometer, presented in this talk, was specifically optimized to tackle these difficulties. Its simple base design and its fully motorized optical components grant a high degree of flexibility during operation, fitting nicely to the nature of this radiation source. During calibration the device has been proven to measure wavelengths from 18 nm to 5 nm, but was in general also designed to address the sub-nm range. Following these test runs, the spectrometer was installed during a undulator campaign and was successfully used to measure laser-driven undulator radiation from 100 eV up to 300 eV, being the highest energy photons ever demonstrated with such a source.

HK 72.8 Do 15:45 WIL-C207

EEHG at FLASH and DELTA* — •Robert Molo[1], Markus Höner[1], Holger Huck[1], Kirsten Hacker[1], Shaukat Khan[1], Andreas Schick[1], Peter Ungelenk[1], Maryam Zeinalzadeh[1], Peter Van der Meulen[2], Peter Salen[2], Gergana Angelova Hamberg[3], and Volker Ziemann[3] — [1]Center for Synchrotron Radiation (DELTA), TU Dortmund University, Germany — [2]Stockholm University, Sweden — [3]Uppsala University, Sweden

The echo-enabled harmonic generation (EEHG) scheme utilizes two modulators with two magnetic chicanes in order to generate an electron density modulation with high harmonic content. In contrast to free-electron lasers (FEL) based on self-amplified spontaneous emission (SASE), the radiation of an EEHG FEL has better longitudinal coherence and is naturally synchronized with an external laser, which is advantageous for pump-probe applications. At the free-electron laser in Hamburg (FLASH), an EEHG experiment is currently under preparation. The short-pulse facility at DELTA (a 1.5-GeV synchrotron light source operated by the TU Dortmund University) based on coherent

harmonic generation (CHG) will be upgraded using the EEHG technique in order to reach shorter wavelengths.

*Supported by DFG, BMBF, and the Federal State NRW.

HK 72.9 Do 16:00 WIL-C207

sFLASH: Seeding at 38nm — •Christoph Lechner for the sFLASH-Collaboration — University of Hamburg, Hamburg, Germany

Many free-electron lasers (FEL) producing light in the UV and extreme ultraviolet (XUV) wavelength ranges start up from noise, operating in the self-amplified spontaneous emission (SASE) mode and therefore have poor longitudinal coherence. It has recently been demonstrated that using so-called 'seeding' techniques, it is possible to generate almost fully coherent photon pulses.

The sFLASH experiment at DESY has been built to study seeding using a source based on a high-harmonic generation (HHG) process. In contrast to SASE, the seeded FEL is operated as an amplifier of the HHG seed. Critical for successful seeding is the precise 6D overlap between the electron bunch and the HHG radiation in the undulator. As a result, one expects greatly improved longitudinal coherence and higher shot-to-shot stability of the pulse spectra and energy. In addition, the output of the seeded FEL is intrinsically synchronized to the HHG drive laser, thus enabling pump-probe experiments with a resolution in the order of 10 fs. In this contribution, the sFLASH layout as well as recent experimental results are presented.

HK 73: Hadronenstruktur und -spektroskopie

Zeit: Donnerstag 16:45–19:15 Raum: HSZ-105

Gruppenbericht HK 73.1 Do 16:45 HSZ-105

Pion photo- and electroproduction in effective field theory — •Marius Hilt[1], Stefan Scherer[1], Lothar Tiator[1], and Jambul Gegelia[2] — [1]Institut für Kernphysik, Universität Mainz — [2]Institut für Theoretische Physik II, Ruhr-Universität Bochum

We present a calculation of pion photo- and electroproduction on the nucleon in manifestly Lorentz-invariant baryon chiral perturbation theory up to and including chiral order q^4. With the results we analyze the new $\pi^0 p$ photoproduction data in the threshold region obtained at the Mainz Microtron. In the calculation of observables and the fit of the low-energy constants, we take S, P, and D waves into account. We compare the results for the multipoles with the corresponding single-energy analysis. Furthermore, we also fit the (q^4) heavy baryon chiral perturbation theory calculation and compare both results. In a second approach we include vector mesons as explicit degrees of freedom in one-loop contributions up to order q^3 in order to improve the description for the electroproduction process. We compare this approach and the q^4 calculation with existing data of pion electroproduction in the threshold region. We provide predictions for several polarization observables for future experiments.

HK 73.2 Do 17:15 HSZ-105

Propagator poles and an emergent stable state below threshold: general discussion and the $E(38)$ state — •Thomas Wolkanowski and Francesco Giacosa — Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Straße 1, D-60438 Frankfurt, Germany

Employing a simple quantum field-theoretical model which describes the decay of a scalar state into two (pseudo)scalar ones, we investigate the poles of the scalar propagator. Besides the expected resonance pole in the lower half-plane of the second Riemann sheet, we find – for a sufficiently large coupling constant – an additional pole on the first sheet below threshold, corresponding to a dynamically generated stable state. We then perform a numerical study for a hadronic system involving a scalar seed state that couples to pions. It is clarified under which conditions a stable state below the two-pion threshold can emerge. In particular, in reference to the recent claim of a novel scalar boson with mass 38 MeV (termed $E(38)$), we explore the case of a stable state with such a mass. Our findings suggest that the resonance $f_0(500)$ and the stable state $E(38)$ could be interpreted as two different manifestations of one and the same 'object'.

HK 73.3 Do 17:30 HSZ-105

Quasifree Photoproduction of Eta-Pion Pairs off the Deuteron — •Alexander Kaeser for the A2-Collaboration — Departement of Physics, University of Basel, CH-4056 Basel, Switzerland, for the Crystal Ball/TAPS collaboration

The photoproduction of $\eta\pi^0$ and $\eta\pi^\pm$ pairs off the deuteron was investigated at the Mainz Microtron accelerator facility MAMI for photon energies up to 1.5 GeV. The detector setup consisted of the combined Cystal Ball and TAPS electromagnetic calorimeters. Invariant mass distributions for the neutral and charged channels as well as angular distributions for Φ and $cos(\Theta)$ were extracted from the data. In addition, total cross-sections for both channels have been extracted. The results will be discussed in the context of the contributions of different resonances to the respective reactions.

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

HK 73.4 Do 17:45 HSZ-105

Discussion on a complete experiment for single pseudoscalar meson photoproduction — •Yannick Wunderlich for the CBELSA/TAPS-Collaboration — HISKP University of Bonn

Photoproduction of single pseudoscalar mesons poses a commonly used tool for the study of the nucleon excitation spectrum. In this reaction, the measurement of 16 different polarization observables is possible. The observables comprise a rich volume of accessible experimental information, usable for the disentanglement of the strongly overlapping resonances of the nucleon.

Since the beginning of the 1970s, the problem of the so called complete experiment started to emerge in the literature. It deals with the question which minimum subsets of all 16 polarization observables are sufficient in order to maximally constrain the underlying amplitudes. This optimization problem is important in the context of currently ongoing polarization measurements at facilities like MAMI, JLAB and ELSA. In the 1990s, it was shown that 8 carefully chosen observables suffice to yield a complete experiment. However, in the low energy region of certain photoproduction channels and in connection to a maximally model independent truncated partial wave analysis, there exists the realistic chance for achieving completeness with even less than 8 observables.

This talk will state and discuss the origin of the above mentioned results. Supported by the Deutsche Forschungsgemeinschaft (SFB/TR∼16).

HK 73.5 Do 18:00 HSZ-105

NLO corrections to NN scattering amplitude in modified Weinberg approach — Evgeny Epelbaum[1] and •Jambul Gegelia[1,2] — [1]Institut für Theoretische Physik II, Fakultät für Physik und Astronomie,
Ruhr-Universität Bochum 44780 Bochum, Germany — [2]Tbilisi State University, 0186 Tbilisi, Georgia

We consider the next-to-leading order corrections to the NN scattering amplitude in modified Weinberg approach. We present the corrections to the partial wave phase shifts. To probe the convergence, for the $^1S_0$ partial wave by applying the subtractive renormalization we compare the results of perturbative and non-perturbative treatment of the next-to-leading order contact interaction correction to the effective potential.

HK 73.6 Do 18:15 HSZ-105

τ Spectral Functions within a Linear Sigma Model with-Electroweak Interactions — •Anja Habersetzer[1], Francesco Giacosa[1], and Dirk H. Rischke[1,2] — [1]Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Straße 1, D-60438 Frankfurt — [2]Frankfurt Institute for Advanced Studies (FIAS), Ruth-Moufang-Straße 1, D-60438 Frankfurt

We present the (axial-) vector spectral function for the τ lepton within a Linear Sigma Model with global chiral $U(2)_L \times U(2)_R$ symmetry. The τ decays weakly with intermediate ρ and a_1 meson states. The electroweak interaction was introduced via a $SU(2)_L \times U(1)_Y$ gauge transformation of the hadronic fields and an additional gauge invariant term. The spontaneously broken chiral symmetry leads to a mass difference between the chiral partners ρ and a_1 and is also exhibited

in the vector and axial-vector coupling constants. We show the results for the τ spectral function in the vector and axial-vector channel and compare them to the spectral functions as measured by the ALEPH collaboration.
Supported by the Helmholtz Research School for Quark Matter Studies (H-QM) and HGS-HIRe and GSI.

HK 73.7 Do 18:30 HSZ-105

Meson Production in Coherent Antiproton-Nucleus Reactions — •Stefanie Lourenco[1], Horst Lenske[1] und Slawomir Wycech[2] — [1]Institut für Theoretische Physik, Universität Gießen — [2]National Centre for Nuclear Studies, Hoza 69, 00-681, Warsaw, Poland

Meson and hadron production by antinucleon-nucleus annihilation reactions is well suited to explore a broad spectrum of final particle configurations and physics phenomena. We are investigating coherent meson production in antiproton-nucleus reactions, intended as exploratory studies for the PANDA experiment and, if realized at a later stage of FAIR, also for the nuclear structure-oriented use of high energy antiprotons aimed for by the AIC proposal. Coherent reactions have the distinct advantage of a full quantum mechanical treatment of all parts of the production process. As a concrete and typical example we treat explicitly the case of two pion production. Two different reaction mechanisms are presented including initial and final state interactions. The underlying fundamental antinucleon-nucleon $\overline{N}N$ and pion-nucleon πN interactions enter into the optical potentials, which are folded with Hartree-Fock-Bogoliubov nuclear densities. Existing approaches to pion nucleus interactions have been extended to higher energies beyond the Δ-resonance. Cross sections are shown for the elementary processes and future experiments at FAIR.
Supported in part by DFG, contract Le439/8 − 1 and Le439/7 − 1

HK 73.8 Do 18:45 HSZ-105

Two-pion production in the first resonance energy region — •Vitaly Shklyar, Horst Lenske und Ulrich Mosel — Institut für Theoretische Physik, Universität Gießen

The $\pi N \to \pi N$, $2\pi N$ reactions are analyzed within a coupled-channel unitary Lagrangian model. The contributions to $2\pi N$ are described in terms of the isobar production mechanism with σN and $\pi\Delta$ in the intermediate state. The self-energies of the σ-meson and the $\Delta(1232)$-isobar are taken into account to reproduce a correct energy behavior of resonance decays in the isobar channel. The analysis of the Crystal Ball data on $2\pi^0$ production is presented and discussed.

HK 73.9 Do 19:00 HSZ-105

Photoproduction of Pion-Pairs off Nucleons — •Markus Oberle for the A2-Collaboration — Departement of Physics, University of Basel, CH-4056 Basel, Switzerland

Photoproduction of meson pairs is an important tool for the investigation of nucleon resonances. At higher excitation energies many nucleon resonances have only small decay branching ratios to the nucleon ground state. They decay preferentially to intermediate excited states. This is similar to nuclear physics, only a very rudimentary picture of nuclear structure would arise when only ground-state transitions were considered. The experimental study of such decays requires the measurement of final states with at least meson pairs. The analysis of such reactions requires the measurement of differential cross sections and polarization observables.

The present experiment measured photoproduction of pion pairs ($\pi^0\pi^0$, $\pi^0\pi^\pm$ final states) off free protons and off quasi-free protons and neutrons bound in the deuteron at the MAMI accelerator in Mainz with the Crystal Ball/TAPS detector. Results for beam-helicity asymmetries and differential cross sections will be discussed and compared to the results from reaction models.

HK 74: Schwerionenkollisionen und QCD Phasen

Zeit: Donnerstag 16:45–19:00 Raum: HSZ-201

Gruppenbericht HK 74.1 Do 16:45 HSZ-201

Thermalization through Hagedorn-States — •Maxim Beitel, Kai Gallmeister, and Carsten Greiner — Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Straße 1, D-60438 Frankfurt, Germany

We examine the evolution of a heavy ion collision starting from non-equilibrium to an equilibrium state by looking at the corresponding thermalization times. Therefore we use the hadronic transport model "UrQMD" as microscopic model for high-energetic heavy ion collisions. Unfortunately these times are too long at present because detailed balance is not realized for all collisions which may occur. In order to get rid of this drawback we deploy Hagedorn-States proposed by the "Statistical Bootstrap Model". We study the question, whether creation of these states in binary collisions and their decay into two particles only will lower the thermalization times in UrQMD.
Supported by the Hessian LOEWE initiative through the Helmholtz International Center for FAIR (HIC for FAIR), GSI and HGS-HIRe.

HK 74.2 Do 17:15 HSZ-201

Thermalization of weakly coupled non-abelian plasmas — •Soeren Schlichting — Universität Heidelberg

The question how thermalization is achieved in relativistic heavy-ion collision provides one of the biggest theoretical challenges in our current understanding of the experiments performed at RHIC and the LHC. In this talk I will address the problem of thermalization of weakly coupled non-abelian plasmas from a more general point, by considering a class of systems which share important features with the one created in relativistic heavy-ion collisions. In the first part of this talk, I will discuss the occurrence of Kolmogorov wave turbulence in non-abelian gauge theories which drives the thermalization process in non-expanding plasmas [1,2]. In the second part of this talk I will present preliminary results on the properties of longitudinally expanding plasmas, which are phenomenologically relevant for relativistic heavy-ion collisions. In both cases numerical and analytical considerations will be presented.

[1] J. Berges, S. Schlichting, D. Sexty, Phys.Rev. **D** 86, 074006
[2] S.Schlichting, Phys. Rev. **D** 86, 065008

HK 74.3 Do 17:30 HSZ-201

Hydrodynamics on graphic cards — •Jochen Gerhard[1,2], Volker Lindenstruth[1,2], and Marcus Bleicher[1,3] — [1]Frankfurt Institute for Advanced Studies (FIAS), Ruth-Moufang-Str. 1, D-60438 Frankfurt — [2]Institut für Informatik, Goethe-Universität Frankfurt, Robert-Meyer-Straße 11-15, D-60054 Frankfurt — [3]Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Straße 1, D-60438 Frankfurt

In the field of high-energetic nucleus-nucleus collisions at RHIC and LHC ideal and dissipative relativistic hydrodynamics is used to calculate the evolution of hot and dense QCD matter. A large body of current numerical tools employs relativistic hydrodynamics in various facets. The acceleration of relativistic hydrodynamics using graphic cards (GPUs) is therefore of highest relevance to this fields. The results reported here are based on the Sharp And Smooth Transport Algorithm SHASTA, which is employed in many hydrodynamical models and hybrid simulation packages, e.g. the Ultrarelativistic Quantum Molecular Dynamics model (UrQMD). We have redesigned the SHASTA using the OpenCL computing framework to work on accelerators like graphic processing units (GPUs) as well as on multi-core processors. With the redesign of the algorithm the hydrodynamic calculations have been accelerated by a factor 160 allowing for event-by-event calculations and better statistics in hybrid calculations.
Supported by the Hessian LOEWE initiative through the Helmholtz International Center for FAIR (HIC for FAIR).

HK 74.4 Do 17:45 HSZ-201

Der chirale Phasenübergang - dynamische Transport-Simulation eineslinearen Sigma Models — •Christian Wesp und Carsten Greiner — Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Straße 1, D-60438 Frankfurt, Germany

Ziel dieser Studie ist die Suche nach Signaturen des chiralen Phasenübergangs. Um den Einfluss des Überganges oder eines kritischen Punktes auf Fluktuationen in z.B. der Baryonenzahl zu untersuchen,

behandeln wir das lineare Sigma Model in einer dynamischen 3+1D numerischen Simulation. Die chiralen Felder werden als klassische Felder genähert, während die Quarks durch Quasiteilchen in einer Vlasov-Gleichung beschrieben werden. Zusätzliche Systemdynamik wird mit einer Quark-Quark und Quark-Feld Interaktion erziehlt. Als modellhafte Nichtgleichgewichtsbehandlung einer Scherionenkollision wird die Expansion eines Feuerballs simuliert.
Gefördert durch die Exzellenz-Initiative LOEWE des Landes Hessen durch Helmholtz International Center for FAIR (HIC for FAIR), GSI und HGS-HIRe.

HK 74.5 Do 18:00 HSZ-201

Off-equilibrium photon production during the chiral phase transition — •Frank Michler[1], Hendrik van Hees[1,2], Dennis Dean Dietrich[1], Stefan Leupold[3], and Carsten Greiner[1] — [1]Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Straße 1, D-60438 Frankfurt, Germany — [2]Frankfurt Institute for Advanced Studies (FIAS), Ruth-Moufang-Straße 1, D-60438 Frankfurt, Germany — [3]Institutionen för fysik och astronomi, Uppsala Universitet, Box 516, 75120 Uppsala, Sweden

We investigate the photon emission arising from the chiral mass shift during the chiral phase transition in the early stage of ultrarelativistic heavy-ion collisions. As this mass shift leads the spontaneous creation of quark-antiquark pairs and thus contributes to the formation of the quark-gluon plasma, our investigations are relevant in the context of finite lifetime effects on the photon emission from the latter. Earlier investigations on this topic were accompanied by a divergent vacuum contribution and a non-integrability of the remaining contributions in the ultraviolet domain. In contrast to these investigations, we do not consider the photon numbers at finite times but for free asymptotic states obtained by an adiabatic switching of the electromagnetic interaction according to the Gell-Mann and Low theorem. This approach eliminates possible unphysical vacuum contributions and leads to photon spectra integrable in the UV domain. It is emphasized that the consideration of free asymptotic states is indeed crucial to obtain such physically reasonable results.
Supported by Land Hessen and HGS-HIRe.

HK 74.6 Do 18:15 HSZ-201

Direct Photons at FAIR — •Bjørn Baeuchle[1], Marcus Bleicher[1,2], and Andreas Grimm[1,2] — [1]Frankfurt Institute for Advanced Studies (FIAS), Ruth-Moufang-Str. 1, D-60438 Frankfurt — [2]Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Straße 1, D-60438 Frankfurt

Photons, as all electromagnetic probes, can give direct access to the hot and dense phase of a heavy-ion reaction. We show calculations of direct photon emission at SiS100- and SiS-300 energies with the UrQMD-hybrid model. UrQMD is a full microscopic+macroscopic transport/fluiddynamics hybrid model with hadron- and string-driven equilibration phase, a full (3+1)-dimensional fluiddynamic hot and dense phase and a hadronic after-burner. Unequilibrated matter at high rapidity is preserved during the fluid phase. A strong emphasis is set on the impact of viscosity and Equation of State at zero and non-zero baryon density to the spectra and flow patterns of thermal and non-thermal photons in A+A-collisions at the colliding systems relevant for FAIR.
Supported by the Hessian LOEWE initiative through the Helmholtz International Center for FAIR (HIC for FAIR) and BMBF.

HK 74.7 Do 18:30 HSZ-201

Real and virtual photon emission of strongly interacting matter — •Falk Wunderlich and Burkhard Kämpfer — Helmholtz-Zentrum Dresden-Rossendorf, D-01328 Dresden, Germany

We present calculations of the photon emissivity of strongly interacting matter. Within the HTL approximation the resulting spectral function is analyzed to find suitable cuts on the real and virtual photon spectrum in order to obtain a clear signal from the deconfined phase. Emphasis is put on imprints of Van Hove singularities. The analysis is extended to effective theories which describe the chiral or deconfinement phase transition. Here, we search for signals of soft modes nearby a critical point.The work was funded by BMBF.

HK 74.8 Do 18:45 HSZ-201

Holographic reconstruction of the dilaton potential in a gravity dual of the pure gluon plasma — •Roman Yaresko[1,2] and Burkhard Kampfer[1,2] — [1]Helmholtz-Zentrum Dresden-Rossendorf, POB 51 01 19, 01314 Dresden, Germany — [2]TU Dresden, Institut für Theoretische Physik, 01062 Dresden, Germany

Employing new precision data of the $SU(3)$ Yang-Mills theory (gluon plasma) the potential of the gravity dual with a dilaton field is reconstructed in a wide temperature range above the deconfinement temperature T_c. The compact form of the potential employed recently by Gubser is shown to reproduce the lattice data with suitable parameter adjustments. The ratio of bulk-to-shear viscosity exhibits within such a setting a pronounced increase when approaching T_c^+.

HK 75: Anwendungen kernphysikalischer Methoden

Zeit: Donnerstag 16:45–19:00 Raum: HSZ-204

Gruppenbericht HK 75.1 Do 16:45 HSZ-204

The TRAKULA joint research project — •Roland Beyer for the TRAKULA-Collaboration — Helmholtz-Zentrum Dresden-Rossendorf, Dresden, Germany

TRAKULA is a BMBF joint research project in the framework "Energie 2020+" that aims for precise measurements of nuclear data relevant for nuclear transmutation technologies. The collaboration consists of the University of Cologne, the Technical University Dresden, the Johannes-Gutenberg University Mainz, the Technical University Munich, the Physikalisch-Technische Bundesanstalt Braunschweig, and the Helmholtz-Zentrum Dresden-Rossendorf. The topics covered are the production and experimental use of fast neutrons to study nuclear reactions, the spectroscopy with photon beams in the MeV range, the development of a high resolution Compton camera, the measurement of low radioactivities including accelerator mass spectroscopy, and the production of homogeneous thin actinide targets for neutron-induced fission measurements. Graduate seminars have been organized to maintain competencies in the field of nuclear safety and radiation research. All topics are connected to each other by their application to nuclear transmutation and nuclear waste management. The progress of the various topics will be explained and results will be presented. Experiments at the neutron-time-of-flight facility nELBE and measurements of fast neutron induced reactions will be discussed in detail. TRAKULA is supported by the German Federal Ministry of Education and Research (Contract 02NUK13A).

Gruppenbericht HK 75.2 Do 17:15 HSZ-204

Positron Annihilation Spectroscopy at a Superconducting Electron Accelerator — •Andreas Wagner[1], Wolfgang Anwand[1], Maik Butterling[1], Thomas E. Cowan[1,2], Fine Fiedler[1], Fabian Fritz[1,2], Marco Jungmann[3], Mathias Kempe[1,2], and Reinhard Krause-Rehberg[3] — [1]Inst. für Strahlenphysik, Helmholtz-Zentrum Dresden-Rossendorf, D-01328 Dresden — [2]Inst. für Kern- und Teilchenphysik, Technische Univ. Dresden, D-01069 Dresden — [3]Inst. für Physik, Martin-Luther Univ., D-06099 Halle

High-power superconducting linear electron accelerators allow producing a variety of secondary beams. At the Helmholtz-Zentrum Dresden-Rossendorf a 40 MeV superconducting electron accelerator is operated at beam currents up to 1.6 mA in continous-wave mode delivering neutrons from photo-production off lead, tunable coherent laser light from free-electron lasers, intense Bremsstrahlung for nuclear (astro-) physics, and positrons from pair production. New developments now enable for the first time positron annihilation lifetime experiments in bulk materials, fluids, gases and organic tissue. A 3-D tomographic annihilation lifetime imaging systems has been developped for new classes of experiments for quantitative and qualitative crystal-defect characterizations, chemsitry of positronium in insulators and porous materials. Some recent applications will be presented.

HK 75.3 Do 17:45 HSZ-204

PGAA experiments close to detection limits — •Petra Kudejova[1], Anne Houben[2], Ivo Tomandl[3], Ladislav Viererbl[4], and Zsolt Revay[1] — [1]Technische Universität München,

Forschungsneutronenquelle Heinz Maier-Leibnitz (FRM II), Garching, Germany — [2]Max-Planck-Institut fuer Plasmaphysik, Garching, Germany — [3]Nuclear Physics Institute, Academy of Science CR, Czech Republic — [4]Research Centre Rez Ltd., Nuclear Research Institute Rez plc, Czech Republic

The ultimate detection limits (DL) of the Prompt Gamma Activation Analysis (PGAA) method depend strongly on the amount and matrix of the measured sample as well as on the background signal contribution to the signal coming from the sample itself.

We have performed few experiments close to the detection limits for given elements at the high-flux-PGAA facility at FRM II in Garching. One of the most important elements which can be determined by the PGAA technique is Hydrogen. Hydrogen impurities in Silicon as well as Hydrogen implantation in Beryllium crystals were measured and analysed. Concerning Silicon, which appears frequently in the nature and so in the PGAA samples, we could determine 3 ppm Hydrogen in the crystals. Another experiment testing the limits of the PGAA facility at FRM II was performed in a frame of a Transmutation detectors (TMD) proposal. In this presentation, the experiments and the results will be discussed and possible ways how to improve the detection limits will be proposed.

HK 75.4 Do 18:00 HSZ-204

Hints of supernova debris deposition on the lunar surface: ^{60}Fe and ^{53}Mn measurements by means of accelerator mass spectrometry — •Leticia Fimiani[1], Thomas Faestermann[1], José Manuel Gómez Guzmán[1], Karin Hain[1], Gregory Herzog[2], Gunther Korschinek[1], Bret Ligon[2], Peter Ludwig[1], Jisun Park[2], and Georg Rugel[3] — [1]Physik Department, Technische Universität München, Garching, Germany — [2]Department of Chemistry and Chemical Biology, Rutgers University, Piscataway, NJ, USA — [3]Forschungszentrum Dresden Rossendorf, Dresden, Germany

The enhanced concentration of ^{60}Fe in a deep ocean ferro-manganese crust about (2.1±0.4) Myr old (Fitoussi *et al.*, PRL 101, 121101 (2008)), suggests that one or more supernova (SN) explosions occurred in the vicinity of the Solar System. That observation was only possible with the ultra sensitive Accelerator Mass Spectrometry (AMS) technique at the Maier-Leibnitz-Laboratorium in Munich, where we are able to measure concentrations of ^{60}Fe/Fe down to a level of 10^{-16}. Because of its lacking atmosphere and negligible sedimentation rate, the Lunar surface is an excellent quantitative reservoir for SN debris. We searched for live ^{60}Fe and ^{53}Mn in samples from 3 Apollo missions. ^{53}Mn is, similar as ^{26}Al and ^{60}Fe, a tool to trace nucleosynthesis activities. It is formed primarily during the explosive silicon-burning of the inner shells of SNe via ^{53}Fe which β-decays to ^{53}Mn with an 8.51 min half-life. Samples where we found an enhanced ^{60}Fe concentration showed also an enhancement of ^{53}Mn. If confirmed, this could be the first detection of live ^{53}Mn originating from nucleosynthesis.

HK 75.5 Do 18:15 HSZ-204

Search for supernova produced ^{60}Fe in Earth's microfossil record — •Peter Ludwig[1], Shawn Bishop[1], Ramon Egli[2], Valentyna Chernenko[1], Thomas Faestermann[1], Leticia Fimiani[1], Jose Gomez[1], Karin Hain[1], and Gunther Korschinek[1] — [1]Physik Department, Technische Universität München, Garching — [2]Central Institute for Meteorology and Geodynamics, Vienna

The detection of supernova debris on Earth can be achieved by use of accelerator mass spectrometry (AMS) to search for radionuclides like ^{60}Fe. This long-lived isotope ($T_{1/2} = 2.6$ Myr) is produced in massive stars and is expected to be present in the debris of type II supernovae. The discovery of ^{60}Fe in a ferromanganese crust from the Pacific ocean (Knie et al., 2004) was interpreted as the input of a supernova explosion about 2.2 Myr ago. Currently, several projects are aiming for the confirmation of the signature of ^{60}Fe in terrestrial and lunar samples. In this talk, the search for this ^{60}Fe signature in Earth's microfossil record will be presented. The sample material for this study is marine sediment from the eastern equatorial Pacific. A specific kind of secondary (formed in situ) magnetite mineral contained in the sample material are magnetofossils, which are the remains of magnetotactic bacteria, which are the target for extraction. The chemical extraction technique used to produce AMS samples has been characterized using newly developed magnetic analysis methods and has been shown to be extremely selective towards secondary magnetite. The AMS samples produced in this way are uniquely suited for the search for supernova ^{60}Fe. Preliminary AMS results will be presented.

HK 75.6 Do 18:30 HSZ-204

Funktionsnachweis eines Messsystems zur Bestimmung der Tritiumkonzentration in Wasser mittels Verstärkerfolie und Photodioden — •Manuel Klein — Karlsruher Insitut für Technologie, Institut für experimentelle Kernphysik

Das KArlsruher TRItium Neutrino-Experiment KATRIN untersucht spektroskopisch das Elektronenspektrum des Tritium β-Zerfalls $^3\mathrm{H} \rightarrow {}^3\mathrm{He} + \mathrm{e}^- + \nu_\mathrm{e}$ nahe dem kinematischen Endpunkt von 18.6 keV. Mit einer fensterlosen molekularen gasförmigen Tritiumquelle hoher Luminosität und einem hochauflösenden elektrostatischen Filter von bisher unerreichter Energieauflösung $\Delta E = 1$ eV wird KATRIN eine modellunabhängige Bestimmung der Neutrinomasse mit einer erwarteten Sensitivität von 0.2 eV (90 % CL) ermöglichen. Wichtig für eine derart präzise Massenbestimmung ist die Stabilität der Quelle bezüglich ihrer β-Aktivität, um die Nachweisgrenze für den Wert der Neutrinomasse zu erreichen. Das dazu notwendige aktive Pumpen geschieht mit wassergekühlten Turbomolekularpumpen, durch deren Metallwände Tritium in den Kühlwasserkreislauf permetieren kann. Um dort die Tritiumkonzentration zu überwachen, wird ein kostengünstiges Messsystem benötigt. Das Experiment TrAMPeL (Tritium Activity Monitoring with Photodiodes in Liquids) soll den Funktionsnachweis für ein Messverfahren erbringen, das mithilfe gängiger Verstärkerfolien aus der Medizintechnik und Photodioden die Bremsstrahlung von β-Zerfallselektronen in Wasser registriert. Dieser Vortrag präsentiert Konzeptionierung und Konstruktion einer solchen Messzelle, sowie die Ergebnisse der mit ihr angefertigten Messreihe.

HK 75.7 Do 18:45 HSZ-204

Tritium Measurement in Water using Bremsstrahlung X-Rays and a Silicon Drift Detector — •Simon Niemes — Karlsruhe Institut of Technology, Institute for Technical Physics - Tritium Laboratory, Karlsruhe, Germany

Applications like future fusion plants or scientific experiments like KATRIN need a closed tritium infrastructure to cycle and handle tritium safely. At some process stages tritiated water (HTO) is generated, making measuring the tritium content in HTO vital for process control, accountancy and safety.

There are several methods used to measure HTO, primarily Liquid Scintillation Counting (LSC). A new technique promising fast, inline and wasteless measurement compared to LSC is the Beta Induced X-ray Spectroscopy (BIXS). The principle of BIXS is detecting the bremsstrahlung spectrum from the decelerated decay electrons in water and calibrate it to known concentrations.

A novel approach utilizing a Silicon Drift Detector (SDD) to measure the emitted X-ray spectrum has several advantages over other detector types like scintillation counters. A SDD is a semiconductor detector with very low noise and good energy resolution, suitable for detecting the low intensity, low energy signal from BIXS.

In this talk an overview of the experimental setup and detector will be given and first results will be presented.

HK 76: Struktur und Dynamik von Kernen

Zeit: Donnerstag 16:45–19:00 Raum: HSZ-301

Gruppenbericht HK 76.1 Do 16:45 HSZ-301

Short-range correlations studied with unitarily transformed interactions and operators — •Thomas Neff, Hans Feldmeier, and Dennis Weber — GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany

Short-range correlations in light nuclei are investigated using the Argonne V18 and the chiral N3LO interactions. Unitary transformations in the similarity renormalization group (SRG) approach are used to obtain effective interactions which allow to obtain converged wave functions within the no-core shell model. For a consistent description the SRG transformation has to be applied also to observables. This is especially important for observables that are sensitive to short-range or

high-momentum physics. A prime example are two-body densities that reflect the short-range correlations inside the nucleus.

We find for each interaction a universal behaviour of the two-body density at small nucleon distances and for high relative momenta. The momentum distributions above the Fermi momentum are dominated by tensor forces. At intermediate momenta the two-body densities are sensitive to three-body correlations that vary with the SRG flow parameter. This dependence is minimized for nucleon pairs with vanishing center-of-mass momentum.

[1] H. Feldmeier, W. Horiuchi, T. Neff, and Y. Suzuki, Phys. Rev. C 84, 054003 (2011)
[2] T. Neff, H. Feldmeier, D. Weber, *in preparation*

HK 76.2 Do 17:15 HSZ-301

Chiral Interactions with Similarity Renormalization Group at the Three-Body Level and Beyond — •Angelo Calci, Joachim Langhammer, Sven Binder, and Robert Roth — Institut für Kernphysik, Technische Universität Darmstadt, D-64289 Darmstadt, Germany

Chiral effective field theory provides a systematic scheme to obtain two- (NN), three-body (3N) and higher-body interactions based on the fundamental symmetries of QCD. In the past years several chiral interactions were developed using different regulator functions, cutoffs and chiral expansion orders. Due to the recent extension of the Similarity Renormalization Group (SRG) beyond the two-body level, we are able to probe these interactions in ab initio nuclear structure calculations for nuclei in the p- and lower sd-shell. By applying the importance-truncated no-core shell model (IT-NSCM) to specific nuclei in the p-shell, we provide an uncertainty quantification for various NN+3N interaction e.g. by varying the cutoffs of the chiral order. In this context we demonstrate the importance of the three- and four-body contributions induced during the SRG transformation and give a perspective for the handling of SRG transformed chiral interactions including four-body contributions.

Supported by DFG (SFB 634), HIC for FAIR, and BMBF (06DA7047I).

HK 76.3 Do 17:30 HSZ-301

Operator representation for effective realistic interactions — •Dennis Weber, Hans Feldmeier, and Thomas Neff — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

We present a method to derive an operator representation from the partial wave matrix elements of effective realistic nucleon-nucleon potentials. This method allows to employ modern effective interactions, which are mostly given in matrix element representation, also in nuclear many-body methods requiring explicitly the operator representation, for example "Fermionic Molecular Dynamics" (FMD). We present results for the operator representation of effective interactions obtained from the Argonne V18 potential with the "Unitary Correlation Operator Method" (UCOM) and the "Similarity Renormalization Group" (SRG). Moreover, the operator representation allows a better insight in the nonlocal structure of the potential: While the UCOM transformed potential only shows a quadratic momentum dependence, the momentum dependence of SRG transformed potentials is beyond such a simple polynomial form.

HK 76.4 Do 17:45 HSZ-301

Asymmetric nuclear matter based on chiral effective field theory interactions — •Christian Drischler[1,2], Vittorio Somà[1,2], and Achim Schwenk[2,1] — [1]Institut für Kernphysik, Technische Universität Darmstadt, Germany — [2]ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

We investigate the properties of asymmetric nuclear matter with small proton fractions (high asymmetries). Our calculations are based on two- and three-nucleon forces from chiral effective field theory. We compare our microscopic results, including theoretical uncertainties, to a quasi-parabolic approximation developed to interpolate between pure neutron and symmetric nuclear matter. Our investigations are important for neutron-rich matter in astrophysics and as constraints for energy density functionals.

*Supported by DFG through SFB 634 and Helmholtz Alliance HA216/EMMI

HK 76.5 Do 18:00 HSZ-301

Spectroscopy of Open-Shell Nuclei with Normal-Ordered 3N Interactions — •Eskendr Gebrerufael, Robert Roth, Joachim Langhammer, and Angelo Calci — Institut für Kernphysik, Technische Universität Darmstadt

The inclusion of three-nucleon (3N) interactions, that are important to understand the structure of nuclei, is still a challenging task in *ab-initio* nuclear-structure calculations, because of the tremendous computational cost.

We have shown that normal ordering with respect to a single-reference state provides a helpful tool to derive an approximate lower-particle-rank form of any 3N interaction. This approximation, however, is limited to closed-shell nuclei. We now extend the normal-ordering approximation to open-shell systems using a multi-determinantal reference state, i.e. a linear combination of single Slater determinants.

For the first time, we present spectra for p-shell nuclei, e.g. ^{6}Li and ^{10}B, calculated in importance-truncated no-core shell model using chiral 3N interactions in normal-order approximation with respect to a multi-determinantal reference state. We compare them to calculations using full 3N interactions, and go beyond model-space sizes that can be handled with full 3N interactions.

Supported by DFG (SFB 634), HIC for FAIR, and BMBF 06DA7047I

HK 76.6 Do 18:15 HSZ-301

Random-phase approximation with chiral two- plus three-body interactions — •Richard Trippel and Robert Roth — Institut für Kernphysik, Technische Universität Darmstadt

The random-phase approximation (RPA) is a standard tool for the description of collective excitations in nuclei. We derive the equations for the RPA for full three-body (3B) interactions within the framework of the quasi-boson approximation. The RPA is then applied to a number of doubly magic nuclei (^{16}O, ^{40}Ca, ^{48}Ca, ^{56}Ni and ^{90}Zr).

For the calculations we use two- plus three-body interactions derived from chiral effective field theory with different momentum cutoffs, which are the same as in few-body calculations. These bare interactions are then transformed by means of the similarity renormalization group (SRG) to improve convergence. We perform the calculations for pure two-body (2B) potentials as well as SRG-induced and initial 3B forces. We investigate the convergence properties of the Hartree-Fock and RPA results with respect to the basis size. From the solution of the RPA problem we compute the isoscalar monopole, the isovector and isoscalar dipole as well as the isocalar quadrupole transition strengths. We compare the different potentials with each other and with experimental values and examine the impact of 3B interactions.

Supported by DFG (SFB 634), HIC for FAIR and BMBF (06DA7047I).

HK 76.7 Do 18:30 HSZ-301

Importance-Truncated Large-Scale Shell Model — •Christina Stumpf and Robert Roth — Institut für Kernphysik, Technische Universität Darmstadt

The (valence-space) shell model is a successful tool for the spectroscopic description of medium-mass and heavy nuclei. Shell-model calculations require the computation and diagonalization of huge Hamilton matrices for large-scale model spaces. We apply an importance-truncation scheme with an importance measure derived from perturbation theory to the shell model in order to reduce the model spaces to those basis states that are relevant for the description of a few target eigenstates. In this way, we extend the applicability to valence spaces and nuclei beyond the reach of the conventional shell model.

We benchmark ground-state and excitation energies as well as transition strengths of ^{56}Ni obtained in the importance-truncated pf-shell model space and compare them to results obtained in standard shell-model calculations. Furthermore, we present results for ^{64}Ge in a full $pfg_{9/2}$ valence space, which is not accessible in the conventional shell model.

Supported by DFG (SFB 634), HIC for FAIR, and BMBF (06DA7047I).

HK 76.8 Do 18:45 HSZ-301

Non-yrast split parity-doublet spectra in odd-mass nuclei — •Michael Strecker[1], Nikolay Minkov[2] und Horst Lenske[1] — [1]Institut für Theoretische Physik, Universität Gießen — [2]Institute of Nuclear Research and Nuclear Energy, Sofia, Bulgaria

We extend the coherent quadrupole and octupole model to describe non-yrast split parity-doublet bands in odd-A nuclei. It is shown that the model describes both the yrast and non-yrast quasi-parity doublet

spectra and the related B(E1) and B(E2) transition rates in various odd-A nuclei from the rare-earth to the actinide region. As in case of even-even nuclei we make use of an analytically derived formula for the energies. The model parameters are adjusted in order to obtain the best description of the experiment. The observed Coriolis decoupling effects are taken into account phenomenologically. Results are compared to recent spectroscopic data.

Supported by DFG contract Le439/10-1 and HIC for FAIR.

HK 77: Hadronenstruktur und -spektroskopie

Zeit: Donnerstag 16:45–19:00 Raum: HSZ-304

Gruppenbericht HK 77.1 Do 16:45 HSZ-304

Hadron Spectroscopy with COMPASS — •Boris Grube — Physik-Department E18, Technische Universität München

COMPASS is a multi-purpose fixed-target experiment at the CERN Super Proton Synchrotron aimed at studying the structure and spectrum of hadrons. One main goal is the search for new hadronic states, in particular hybrid mesons and glueballs. Its large acceptance, high resolution, and high-rate capability make the COMPASS experiment an excellent device to study the spectrum of light-quark mesons in diffractive and central production up to masses of about 2.5 GeV/c^2. COMPASS is able to measure final states with charged as well as neutral particles, so that resonances can be studied in different reactions and decay channels. During 2008 and 2009, COMPASS took a large data sample using 190 GeV negative and positive hadron beams on various targets. The presented overview of the first results from this data set focuses in particular on the search for spin-exotic mesons in diffractively produced multi-particle final states and the analysis of central-production reactions in order to study glueballs in the scalar sector.

This work was supported by the BMBF, the DFG Cluster of Excellence "Origin and Structure of the Universe" (Exc 153), and the Maier-Leibnitz-Laboratorium der Universität und der Technischen Universität München.

HK 77.2 Do 17:15 HSZ-304

Baryon Spectroscopy at COMPASS — •Tobias Weisrock — Institut für Kernphysik, Universität Mainz

The COMPASS 2009 data taking with a 190 GeV/c proton beam impinging on a liquid hydrogen target offers the possibility to study baryon resonances in multiple channels. Complementary to existing data obtained from electro- and photoproduction these hadron-induced reactions can help to complement the known spectrum of baryons.

Only exclusive events will be used for analyses, therefore the recoiling target proton has to be measured using a recoil proton detector. First studies of $p_f\pi^+\pi^-p_{\mathrm{rec}}$, $p_fK^+K^-p_{\mathrm{rec}}$ and $p_f\pi^0\pi^0p_{\mathrm{rec}}$ final states will be presented and an outlook on further analyses given.

Supported by BMBF under the contract 05P12UMCC1 and GRK Symmetry Breaking (DFG/GRK 1581).

HK 77.3 Do 17:30 HSZ-304

Towards spectroscopy of final states with neutral particles at COMPASS — •Sebastian Uhl — Technische Universität München, Physik Department E18, 85748 Garching

COMPASS aims to study the structure and the spectrum of hadrons. The fixed-target spectrometer is located at CERN's Super Proton Synchrotron. Equipped with precise tracking detectors and two electromagnetic calorimeters, it features a wide angular acceptance, and high resolution for charged and neutral particles. In 2008 and 2009 several billion events of a π^- beam impinging on a liquid hydrogen target have been recorded. These data can be used to study the light-quark meson spectrum in diffractive production.

The reconstruction of photons has recently been improved, allowing a new insight into final states containing neutral particles. Events with a single charged particle and four photons in the final state are studied for the occurrence of either two π^0 or two η mesons. The prospects of a partial-wave analysis of these data will be discussed. In case the final state is $\pi^-\pi^0\pi^0$, a comparison to the $\pi^-\pi^+\pi^-$ final state should allow an important consistency check, and provide a handle on systematic effects.

This work was supported by the BMBF, the DFG Cluster of Excellence "Origin and Structure of the Universe" (Exc 153), and the Maier-Leibnitz-Laboratorium der Universität und der Technischen Universität München.

HK 77.4 Do 17:45 HSZ-304

Messung der Pion-Polarisierbarkeit bei COMPASS — •Stefan Huber für die COMPASS Kollaboration — Technische Universität München, Garching, Deutschland

Die Pion-Polarisierbarkeit ist eine Grösse, deren Wert durch die Chirale Störungsrechnung vorhergesagt wird. Bisherige experimentelle Untersuchungen stehen sowohl in Widerspruch mit diesem Wert als auch untereinander. Ende 2009 wurde dazu am COMPASS Experiment eine Messung über die sogenannte Primakoff Reaktion an Nickel ($\pi^- + Z \rightarrow \pi^- + \gamma + Z$) durchgeführt. Die dabei erhaltene Statistik, sowie die möglichkeit systematische Effekte anhand des analogen Prozesses mit Muonen zu studieren, erlaubt es den bisher genauesten experimentellen Wert zu bestimmen.

In diesem Vortrag wird die experimentelle Methode vorgestellt sowie das daraus resultierende Ergebnisse präsentiert. Diese Arbeit wird unterstützt vom BMBF and dem Maier-Leibnitz-Labor sowie dem Exzellenzcluster 'Origin and Structure of the Universe' unterstützt.

HK 77.5 Do 18:00 HSZ-304

4π-continuous mode polarized solid state target — •Stefan Runkel, Hartmut Dutz, Stefan Goertz, Marcel Bornstein, and Scott Reeve — Physikalisches Institut Universität Bonn

For high quality measurements of polarization variables at CB-ELSA the Polarized Target Group in Bonn focusses much of its efforts on the improvement of the instrumentation and hardware. Currently one of the main tasks is the competition of a 4π-continuous mode target which could be used to maintain higher mean polarization values at lower temperatures. The new cryostat uses specially designed pre-cooling elements as well a unique superconducting inverse notched coil for polarization. Due to this development the need for the cumbersome alternation of polarization and data-taking is removed and makes an external polarizing magnet unnecessary. In addition the data-taking period in cold operation is increased. It is designed to provide a transversal and a longitudinal polarization if necessary.

HK 77.6 Do 18:15 HSZ-304

Hadron Identification with Time-of-Flight Method at COMPASS — •Nicolas du Fresne von Hohenesche — Institut für Kernphysik, Mainz, Deutschland

An import study of the COMPASS experiment is the extraction of fragmentation functions from pion and kaon multiplicities. Semi-inclusive deep inelastic scattering (SIDIS) is measured with a 160 GeV muon beam on a fixed target. The charged hadrons are identified with the RICH, a Ring Imaging CHerenkov detector. Depending on the refractive index of the filling gas, kaons, pions and proton can be identified only in a limited momentum range between 10 and 50 GeV.
In 2010, an additional trigger hodoscope was installed in front of the RICH, here not only to detect scattered muons but also low momentum hadrons due to the good time resolution of the scintillator slabs. With an offline method, the time-of-flight is calculated thus allows the identification of the low momentum tracks.
Supported by BMBF

HK 77.7 Do 18:30 HSZ-304

Measurement of radiative widths at COMPASS — •Stefanie Grabmüller — Technische Universität München, Physik-Department E18, 85748 Garching

COMPASS is a multi-purpose fixed-target experiment at CERN SPS, that investigates the structure and spectroscopy of hadrons. Dissociation of pions on nuclear or hydrogen targets provides clean access to the light meson spectrum. During a short run with π^- beam on lead in the year 2004, about 4 million exclusive $\pi^-\pi^-\pi^+$ events have been collected. For the 3 million events with low momentum transfer $t' < 0.01\,\mathrm{GeV}^2/c^2$, coherent scattering off the nucleus as a whole can be assumed, with contributions from Reggeon (Pomeron) and quasi-real photon exchange. For the lowest $t' < 0.001\,\mathrm{GeV}^2/c^2$, the electromag-

netic interaction part becomes apparent.

The partial-wave analysis of these data leads to the observation of resonances as the $a_2(1320)$ dominantly produced by quasi-real photon exchange. The extraction of their radiative widths will be presented.

This work is supported by BMBF, Maier-Leibnitz-Labor München and the DFG Cluster of Excellence Exc153.

HK 77.8 Do 18:45 HSZ-304

A Geant4 based MC simulation for the COMPASS-II experiment at CERN — •Tobias Szameitat, Steffen Bauer, Horst Fischer, Florian Herrmann, Kay Königsmann, Michael Kunz, Tobias Kunz, Pasquale Malm, Christopher Regali, Robert Schäfer, Katharina Schmidt, Stefan Sirtl, and Johannes ter Wolbeek — for the COMPASS collaboration, Physikalisches Institut, Albert-Ludwigs-Universität Freiburg

A dynamical and geometrical picture of the nucleon is provided by the theoretical framework of Generalized Parton Distributions (GPDs). Experimentally the GPDs can be accessed in exclusive measurements such as Hard Exclusive Meson Production and Deeply Virtual Compton Scattering. Upgrades of the COMPASS-II setup performed through 2012 allow for measurements of such exclusive reactions. The COMPASS-II experiment at CERN is a fixed-target experiment for the investigation of the spin structure of the nucleon and for hadron spectroscopy. The experiment is built as a multi-purpose two stage spectrometer. For a detailed understanding of the spectrometer acceptance a new Geant4 based simulation tool has been developed. We report on the implementation of the different detectors in Geant4 and key-performance figures. Supported by BMBF, DFG and EU FP7 (Grant Agreement 283286).

HK 78: Fundamentale Symmetrien

Zeit: Donnerstag 16:45–19:00 Raum: HSZ-401

Gruppenbericht HK 78.1 Do 16:45 HSZ-401

A test of Lorentz invariance in β decay — Auke Sytema, Elwin Dijck, Stefan Müller, Gerco Onderwater, Coen Pijpker, •Hans Wilschut, Jacob Noordmans, and Rob Timmermans — Kernfysisch Versneller Instituut, Rijksuniversiteit Groningen, Nehterlands

In theories aiming to unify the Standard Model with gravity, Lorentz invariance may be broken. Although Lorentz symmetry appears to hold well, few experiments have been performed that consider its violation in the weak interaction. We have started a theoretical and experimental research program to this effect. In particular we consider a Lorentz-violating correction of the W-boson propagator, which manifests itself in a directional dependence of the β-decay rate and may be independent of boosts. We will discuss in the context of this extension of the Standard Model which observables are sensitive. Specifically, we consider allowed Fermi and Gamow-Teller transitions and explore the spin degrees of freedom in the latter.

Experimentally we exploit the Gamow-Teller transition of polarized ^{20}Na. The transition rate (i.e. lifetime) would depend on the spin orientation of ^{20}Na. The accuracy of the experiment relies on the fact that one measures an asymmetry when reversing the spin. The asymmetry should also follow the earth's rotation, depending on the polarization direction. The method of the measurement will be presented, together with the first results.

Gruppenbericht HK 78.2 Do 17:15 HSZ-401

Status of the WITCH experiment — •Martin Breitenfeldt for the WITCH-Collaboration — IKS, Leuven, Belgien

In the field of fundamental interactions two main branches of experimental techniques are pursued: The precision and the high-energy experiments. Both branches are complementary, in the first one probes the effect new particles have on certain observables. In the case of the WITCH experiment the weak interaction in nuclear beta decay is probed by observing the recoil energy distribution of the daughter nuclei. Measuring this distribution to very high precision could reveal the presence of exotic (non standard -model) components in the weak interaction. For this exotic component the mediator could a charged Higgs boson, which might be discovered on the high-energy frontier. In the WITCH setup Penning trap technology is combined with a MAC-E type retardation spectrometer to allow for the measurement of the recoil energy. After several upgrades in the last years the WITCH experiment finished its commissioning phase. By acquiring several sets of data last year not only could first physics information be extracted, but it was also possible to further characterize the WITCH system and solve the last issues. With the run in November 2012 we were aiming for a first complete data set for ^{35}Ar. In this talk preliminary results will be discussed together with the procedure to determine systematic uncertainties with the help of simulations.

HK 78.3 Do 17:45 HSZ-401

Analyse der Test-Strahlzeit des WITCH-Experiments mit ^{35}Ar-Ionen vom Herbst 2011. — •Peter Friedag für die WITCH-Kollaboration — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster

Das WITCH-Experiment untersucht den Betazerfall von in einer Penning-Falle gespeicherten Ionen mit Hilfe eine Retardierungsspektrometers. Mittels Variation der angelegten Retardierungsspannung wird ein Rückstoßenergiespektrum gemessen. Aus diesem läßt sich die Beta-Neutrino-Winkelkorellation a bestimmen, über welche Rückschlüsse auf die Natur der zugrunde liegenden Wechselwirkungen möglich sind. Ziel des Experiments ist es, die Beta-Neutrino-Winkelkorellation mit einer Genauigkeit von $a < 0.5\%$ zu messen.

Eine Test-Strahlzeit mit dem Isotop ^{35}Ar im Herbst 2011 lieferte 6 Stunden Daten, welche genutzt wurden, um den Messzyklus zu optimieren, Systematiken zu charakterisieren und experimentelle Defizite aufzuzeigen. Des Weiteren wurde ein Vorgehen entwickelt um a aus den Daten zu bestimmen. Die Ergebnisse dieser Analyse bildeten eine wichtige Grundlage für die Vorbereitung einer längeren Messung mit dem gleichen Isotop welche im Herbst 2012 durchgeführt wurde. In diesem Vortrag wird das Analyse-Verfahren beschrieben und die Ergebnisse diskutiert.

Dieses Projekt wird vom BMBF unter der Nummer 06MS9151I unterstützt.

HK 78.4 Do 18:00 HSZ-401

The planned neutron lifetime experiment at the TRIGA reactor in Mainz — •Marcus Beck[1], Werner Heil[1], Jan Karch[1], Youri Sobolev[1,2], Tobias Reich[2], and Norbert Trautmann[2] — [1]Institut für Physik, Johannes Gutenberg Universität Mainz — [2]Institut für Kernchemie, Johannes Gutenberg Univesität Mainz

The lifetime of the neutron is of high interest for modern physics. It is an important particle property, plays a significant role in big bang nucleosynthesis and is used to determine the first element of the CKM-matrix. However, the results for the neutron lifetimes of the most precise experiments up to date differ significantly. In order to resolve these differences new experiments to measure the neutron lifetime are being set-up using magnetic storage to reduce the systematic uncertainties compared to material wall storage used in previous experiments. We will set up a neutron lifetime experiment, aSPECT-τ_n, at the new ultra-cold neutron source of the TRIGA reactor in Mainz. It will use existing parts of the aSPECT experiment and can thus proceed quickly. Especially, the UHV-system, the solenoids for the longitudinal storage, and the online decay proton detection are already available. Start-up funding is provided by the PRISMA cluster of excellence. In this talk we will present the principle of the experiment and first design studies.

HK 78.5 Do 18:15 HSZ-401

aSPECT, prepared for a new physics run — •Alexander Wunderle and Marcus Beck for the aSPECT-Collaboration — Institut für Physik, Johannes Gutenberg-Universität Mainz

The aSPECT retardation spectrometer measures the electron antineutrino angular correlation coefficient a in free neutron β-decay with high precision. This measurement can be used to determine the ratio of $\frac{g_A}{g_V}$ of the weak coupling constants, as well as to search for physics beyond the Standard Model. Currently a is known with a precision of $\frac{\Delta a}{a} \approx 4\%$ (PDG), whereas aSPECT aims for a precision of $\frac{\Delta a}{a} \approx 0.3\%$.

Since the last physics run of aSPECT at the Institut Laue-Langevin (ILL) in 2011 several significant improvements have been implemented. Namely the surfaces of our electrodes have been smoothed and there-

fore their field emission could be reduced. This and the renewal of several electrodes reduced runaway discharges in the spectrometer considerably. In the same step the uncertainty of the transmission-function due to workfunction fluctuations of the main electrode could be lowered considerably.

Since 2012 aSPECT has been operated at a separate test zone at the ILL, where we could investigate and determine the background level in our spectrometer in detail (see talk of Romain Maisonobe).

With all the improvements presented in this talk, we will determine a in 2013 with a yet unknown precision.

HK 78.6 Do 18:30 HSZ-401

Background studies for the spectrometer aSPECT — •Romain Maisonobe for the aSPECT-Collaboration — Institut Laue-Langevin, Grenoble, France

The retardation spectrometer aSPECT was built to determine the electron-antineutrino angular correlation coefficient a in neutron beta-decay with unprecedented accuracy $\Delta a/a \approx 0.3\%$, by measuring the proton recoil spectrum. The a coefficient can be used to derive the ratio $\lambda = g_A/g_V$ of the weak coupling constants g_A and g_V and to test the unitarity of the CKM matrix, or to derive limits for physics beyond the Standard Model. The attempted precision requires a good understanding of the background.

In 2012, the spectrometer was installed offline (without neutron beam) in order to perform high-voltage tests, to optimize operation parameters of the spectrometer (see talk of Alexander Wunderle), and to study the background behavior for different electrode voltage settings and vacuum conditions. A beta source (activated gold foil) was used to simulate rest-gas ionization by electrons from neutron decay. We present these background studies and the conclusions for the measurement of a.

A new beamtime with aSPECT is scheduled for spring 2013.

HK 78.7 Do 18:45 HSZ-401

A test of Lorentz-invariance in the β decay of ^{20}Na — •Auke Sytema, Elwin Dijck, Stefan Müller, Gerco Onderwater, Coen Pijpker, and Hans Wilschut — Kernfysisch Versneller Instituut, Rijksuniversiteit Groningen, Netherlands

In Quantum-Gravity theories Lorentz symmetry may be broken. Although Lorentz invariance has been tested precisely in QED no symmetry breaking has been observed. However, such precise tests have not been done for the weak interaction. Anisotropy of the weak interaction can be tested in various ways. The present experiment aims to observe the lifetime of ^{20}Na as function of the direction of its polarization. The characteristic β asymmetry is used to measure the polarization while the $2^+ \rightarrow 0^+$ γ transition in the ^{20}Ne daughter nucleus is used to measure the decay rate. ^{20}Na is produced by shooting a beam of ^{20}Ne on a hydrogen target. The ^{20}Na is magnetically separated from the beam and stopped in a gas cell where it is polarized by laser light. The short halflife of ^{20}Na (0.448 s) allows it to decay before it diffuses outside the optically active region. By reversing the spin direction an asymmetry can be built which is sensitive to Lorentz-invariance violation but that is insensitive to most systematic errors associated with lifetime measurements. Details of the experimental procedure will be discussed and first results presented.

HK 79: Nukleare Astrophysik

Zeit: Donnerstag 16:45–18:45 Raum: HSZ-403

Gruppenbericht HK 79.1 Do 16:45 HSZ-403

Equation of state constraints based on chiral effective field theory interactions* — •Ingo Tews[1,2], Thomas Krüger[1,2], Kai Hebeler[3], and Achim Schwenk[2,1] — [1]Institut für Kernphysik, Technische Universität Darmstadt — [2]ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung GmbH — [3]Department of Physics, The Ohio State University, Columbus, USA

Neutron matter presents a unique system for chiral effective field theory (EFT), because all many-body forces among neutrons are predicted to next-to-next-to-next-to-leading order (N^3LO). We present the first complete N^3LO calculation of the neutron matter energy. This includes the subleading three-nucleon (3N) forces for the first time and all leading four-nucleon (4N) forces. Our results provide constraints for the equation of state of neutron-rich matter in astrophysics and for the properties of neutron stars, with controlled theoretical uncertainties.

*This work was supported by the ERC Grant No. 307986 STRONGINT, by the DFG through Grant SFB 634, and by the Helmholtz Alliance HA216/EMMI.

Gruppenbericht HK 79.2 Do 17:15 HSZ-403

Equation of state of stellar matter in an effective relativistic density functional approach — •Stefan Typel[1], Maria Voskresenskaya[1], Gerd Röpke[2], Thomas Klähn[3], David Blaschke[3], and Hermann H. Wolter[4] — [1]GSI Darmstadt — [2]Universität Rostock — [3]Uniwersytet Wrocławski — [4]LMU München

The simulation of astrophysical processes such as supernovae explosions and compact star formation requires realistic models for the equation of state of stellar matter in a wide range of density, temperature and isospin asymmetry. The properties of dense matter, in particular the chemical composition and phase transitions, are strongly affected by correlations. They can be considered partly by using quasi-particle concepts. Explicit correlations are treated in the model by introducing additional degrees of freedom with medium-dependent properties. In this contribution, the formation and dissolution of clusters, i.e. many-nucleon correlations, and the crystallization of matter due to long-range Coulomb correlations will be described in an effective way using a relativistic density functional approach taking into account various experimental constraints.

HK 79.3 Do 17:45 HSZ-403

correlations in nuclear matter at low densities in an extended relativistic mean-field model — •Maria Voskresenskaya and Stefan Typel — GSI, Darmstadt

The knowledge of the equation of state of strongly interacting matter is required for the description of the variety of nuclear matter phases in a wide range of densities, temperatures and proton fractions. In this work we extend the generalized relativistic mean-field (gRMF) model with density dependent couplings by including two-body scattering correlations and pairing effects self-consistently in the model. We show that these two-body correlations modify the composition and thermodynamic properties of matter. Scattering states are represented by quasiparticles with density and temperature dependent properties. The correct low-density behavior of nuclear matter at finite temperatures is considered within a virial expansion. The comparison of the virial equation of state with the gRMF approach by means of a series expansion of the grand canonical potential in powers of the nucleon fugacities is performed. Consistency relations are derived which connect quasiparticle parameters with the meson-nucleon couplings in the vacuum and the phase shifts or effective-range parameters of nucleon-nucleon scattering. Pairing effects are considered with the Yamaguchi separable potential for $^1S_0$ nn channel. Corresponding pairing gaps are computed for various temperatures. The overall effect of the pairing correlations on thermodynamic properties is estimated.

HK 79.4 Do 18:00 HSZ-403

Chiral condensate in neutron matter* — •Thomas Krüger[1,2], Ingo Tews[1,2], Bengt Friman[3], Kai Hebeler[4], and Achim Schwenk[2,1] — [1]Institut für Kernphysik, Technische Universität Darmstadt — [2]ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt — [3]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt — [4]Department of Physics, The Ohio State University, Columbus, USA

The chiral condensate is the order parameter of spontaneous chiral symmetry breaking. We present results for the chiral condensate at nuclear and subnuclear densities in neutron matter based on chiral effective field theory (EFT). The calculations are based on a complete neutron matter calculation at next-to-next-to-next-to-leading order (N^3LO) with estimates of the theoretical uncertainties. Our results provide constraints for astrophysics, and limit the possibility of a phase transition to quark matter at nuclear densities ($n \lesssim 0.2\,\mathrm{fm}^{-3}$).

*This work was supported by the DFG through Grant SFB 634,

by the ERC Grant No. 307986 STRONGINT, and by the Helmholtz Alliance HA216/EMMI.

HK 79.5 Do 18:15 HSZ-403

Low- and high-density nuclear equation of state and the hyperon puzzle — •Giuseppe Colucci and Armen Sedrakian — Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Straße 1, D-60438 Frankfurt, Germany

The measurements of the unusually high mass of the millisecond pulsar PSR J1614-2230 ($1.97 \pm 0.04 M_\odot$) imposes a strong constraint on the nuclear Equation of State (EoS), in particular for what concerns the finite density behaviour of nuclear and neutron matter. In my talk I will first discuss a model for the low-density part of the EoS, based on chiral one-pion exchange. I consider a self-consistent approach at finite temperature and density and show that even in a fully-relativistic theory the one-pion exchange contribution is dominated by a contact interaction. Then, a relativistic mean-field approach will be used to discuss the high-density part of the EoS, including the presence of hyperons. In the latter, a density dependent parametrization is used and a parameter study on the hyperon-scalar meson coupling is performed.

Supported by the Hessian LOEWE initiative through the Helmholtz International Center for FAIR (HIC for FAIR).

HK 79.6 Do 18:30 HSZ-403

Phase diagram of dilute nuclear matter: Unconventional pairing and the BCS-BEC crossover — •Martin Stein and Armen Sedrakian — Institut für Theoretische Physik, Goethe-UniversitätFrankfurt, Max-von-Laue-Straße 1, D-60438 Frankfurt, Germany

We report on a comprehensive study of the phase structure of cold, dilute nuclear matter featuring a ${}^3S_1$-${}^3D_1$ condensate at non-zero isospin asymmetry, within wide ranges of temperatures and densities. We find a rich phase diagram comprising three superfluid phases, namely a LOFF phase, the ordinary BCS phase, and a heterogeneous, phase-separated BCS phase, with associated crossovers from the latter two phases to a homogeneous or phase-separated Bose-Einstein condensate of deuterons. The phase diagram contains two tri-critical points (one a Lifshitz point), which may degenerate into a single tetra-critical point for some degree of isospin asymmetry.

HK 80: Instrumentation

Zeit: Donnerstag 16:45–19:00 Raum: HSZ-405

Gruppenbericht HK 80.1 Do 16:45 HSZ-405

Status and future of the ALICE TPC, a high-resolution detector for the highest particle multiplicities — •Christian Lippmann for the ALICE TPC-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany

The Time Projection Chamber (TPC) of the ALICE experiment is a large 3-dimensional tracking and particle identification device for ultra-high multiplicity collision events. It has been operated successfully at the Large Hadron Collider (LHC) at CERN, recording collisions of protons (since November 2009) and lead nuclei (one month each in 2010 and 2011). In the beginning of 2013, just before the first long LHC shutdown (LS1) starts, ALICE will record p-Pb collisions that are expected to occur at interaction rates up to 200 kHz. During LS1 the necessary consolidation and upgrade activities in order to ensure reliable operation at nominal LHC energies ($\sqrt{s} = 14$ TeV pp and $\sqrt{s_{NN}} = 5.5$ TeV Pb-Pb collisions) will be carried out.

A new phase of the data taking will finally commence after the second long LHC shutdown (LS2) in 2018, where the ALICE upgrade plans foresee to operate the experiment in Pb-Pb at an interaction rate of 50 kHz. For this purpose, the MWPC-based TPC readout chambers will be replaced by Gas Electron Multipliers (GEMs), allowing a continuous readout of the TPC. These upgrade plans have recently been endorsed by the CERN LHC Committee.

In this presentation the performance and operational experience with the current TPC will be discussed and an overview of the upgrade plans and the ongoing R&D activities will be given.

HK 80.2 Do 17:15 HSZ-405

First results from the ALICE GEM TPC prototype test — •Piotr Gasik for the ALICE TPC-Collaboration — TU München, Boltzmannstr. 2, 85748 Garching, Germany

A large Time Projection Chamber (TPC) is the main device for tracking and charged particle identification in the ALICE experiment at the CERN LHC. After the second long shutdown in 2018, the LHC will deliver Pb beams colliding at an interaction rate of about 50 kHz, which is about a factor of 100 above the present readout rate of the TPC. In order to make full use of this luminosity, a major upgrade of the TPC is required. It is foreseen to replace the existing MWPC-based readout with Gas Electron Multiplier (GEM) foils. A GEM TPC can exploit the intrinsic suppression of back-drifting ions from the amplification stage to reduce the problem of drift-field distortions in an ungated operation. The latter is essential for a continuous readout required for all central detectors of ALICE after the upgrade.

A prototype of an ALICE Inner Read-Out Chamber (IROC) was equipped with three large-size GEM foils as amplification stage to demonstrate the feasibility of this solution. The GEM IROC was installed within a test field cage with a drift length of 115 mm and commissioned with radioactive sources. The dE/dx resolution of the prototype was evaluated in a test beam campaign using protons, pions and electrons (1 to 6 GeV/c) at the CERN PS. Preliminary results from these measurements will be discussed in this contribution.

This work is supported by BMBF and DFG Cluster of Excellence "Universe" (Exc 153).

HK 80.3 Do 17:30 HSZ-405

Energy Calibration of a GEM-TPC with Kr83m — •Roman Schmitz for the GEM-TPC-Collaboration — Helmholtz-Institut für Strahlen- und Kernphysik, Universität Bonn

A Time Projection Chamber (TPC) with Gas Electron Multiplier (GEM) readout has been developed with an inner/outer radius of 5/15 cm and a total drift length of 73 cm. It has been used as an inner tracking upgrade for the FOPI experiment at GSI and is planned as a future upgrade to the CBELSA/TAPS experiment. A radioactive ^{83m}Kr source has been produced and integrated into the setup in order to perform an accurate channel-wise relative gain calibration and monitor gain stability to achieve optimal dE/dx resolution. Its gaseous form makes it perfectly suitable for this purpose allowing a full coverage of the readout plane and providing a wide energy range of conversion peaks. Also its half-life of 1.83 h allows for normal detector operation after a short flushing period of several hours. Calibration method and measured energy resolution for different gas mixtures which have been compared to simulation results are presented in this talk. Also first results on gain stability and pressure/temperature-dependence will be showed.

This work is supported by DFG SFB/TR 16.

HK 80.4 Do 17:45 HSZ-405

Alterungseffekte in GEM-Detektoren — •Christian Dreisbach, Alexander Austregesilo, Jacopo Durandi, Florian Haas, Matthias Huber, Bernhard Ketzer, Igor Konorov, Stephan Paul, Katia Rodewald, Michael Tasior und Sebastian Uhl — TU München, Physik-Department E18, Garching bei München

Im COMPASS Experiment am CERN kommen „Gas Electron Multiplier (GEM)"-Spurdetektoren in einer höchst strahlungsreichen Umgebung zum Einsatz. Insbesondere die PixelGEM-Detektoren sind dem direkten Myonen- oder Hadronenstrahl ausgesetzt. Einige dieser Detektoren zeigten nach vierjahrigem Betrieb verminderte Signalstärken und damit verminderte Detektoreffizienzen. Dieses sogenannte „Aging" wird häufig durch Verunreinigungen im aktiven Gasvolumen eines Detektors hervorgerufen, welche im Betrieb zu Ablagerungen auf Auslese- oder Verstärkungselementen führen können.

Eine Untersuchung von GEM-Folien aus einem betroffenen Detektor mittels eines optischen Mikroskops, eines Rasterelektronenmikroskops (REM/SEM) und der Elementanalyse durch eine energiedispersive Röntgenspektroskopie (EDRS/EDX) ergab Silizium- und Schwefelablagerungen in den Bereichen hoher Strahlungsintensitäten. Die Ergebnisse dieser Untersuchung sowie mögliche Quellen der Ablagerungen werden präsentiert. Zudem wird ein Versuchsaufbau für Langzeitmessungen zur Reproduktion solcher Alterungseffekte in GEM-Detektoren

gezeigt.

Gefördert durch BMBF, DFG Cluster of Excellence „Origin and Structure of the Universe“ (Exc 153), und MLL der LMU und TUM.

HK 80.5 Do 18:00 HSZ-405

Construction and simulations of full-size CBM-TRD prototypes — •Ernst Hellbär for the CBM-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

The Compressed Baryonic Matter (CBM) experiment at the future FAIR facility in Darmstadt will explore the QCD phase diagram in the region of high baryon densities. One of the key observables will be charmed particles and vector mesons decaying into leptons or lepton pairs. To provide an efficient electron-pion separation and tracking capability multiple layers of Transition Radiation Detectors (TRD) will be used. The concept of a thin and fast Multiwire Proportional Chamber (MWPC) without drift region is considered with the aim of handling the high event rates in the experiment of up to 10 MHz. A thin foil-based entrance window leads to low transition radiation (TR) absorption probabilities. The development and construction of the first full-size TRD prototypes with this foil-based entrance window will be presented. Simulations of the mechanical stability of the entrance window and the influence on the gas gain of the detector will be shown and resulting design options will be discussed.

HK 80.6 Do 18:15 HSZ-405

In-beam performance studies of the first full-size CBM-TRD prototypes developed in Frankfurt. — •Pascal Dillenseger for the CBM-Collaboration — Institut für Kernphysik, Goethe Universität, Frankfurt

The Compressed Baryonic Matter (CBM) experiment at FAIR will explore the QCD phase-diagram by studying fixed-target heavy-ion collisions from 10 to 45 *A*GeV. The CBM Transition-Radiation Detector (TRD) has to deliver a good tracking and particle identification performance in the high particle-density environment of the experiment. We plan to match the experimental requirements in terms of position resolution and electron identification, employing a thin MultiWire Proportional Chamber (MWPC). This type of readout-concept combined with different radiators was tested using full-size prototypes at the CERN-PS in October 2012. The results of the detector and radiator studies will be presented.

HK 80.7 Do 18:30 HSZ-405

Performance of CBM TRD Prototypes from Münster — •Cyrano Bergmann for the CBM-Collaboration — Institut für Kernphysik WWU, Münster, Deutschland

CBM is a fixed target heavy-ion experiment at the future FAIR accelerator facility. The CBM Transition Radiation Detector (TRD) is one of the key detectors to provide electron identification and charged particle tracking. Based on the ALICE TRD design, two CBM TRD prototype modules of $59\times59\,\mathrm{cm}^2$ were built in Münster and tested during October 2012 in beam at the CERN Proton Synchroton (PS) with electrons and pions of momenta up to $10\,\mathrm{GeV}/c$. Readout was performed with the time sampling Self-triggered Pulse Amplification and Digitization asIC (SPADIC), an especially designed front-end electronics component for the CBM TRD. The objectives of the beam test included measurements of: electron identification performance for different regular and irregular radiators, position resolution and dependence on particle momentum. First results of these measurements will be presented. The layout of the final TRD will be driven by these beam test results. Depending on the achieved electron identification performance, the TRD could be constructed in 6-10 layers, consisting in total of several 100 individual detector modules covering an area of up to $600\,\mathrm{m}^2$.

Work supported by BMBF and the HadronPhysics3 project financed by EU-FP7.

HK 80.8 Do 18:45 HSZ-405

Simulationen zur Gasverstärkung im ALICE-TRD und einem Driftmonitor GOOFIE — •Stephan Dyba für die ALICE-Kollaboration — Wilhelm-Klemm-Str. 9, 48149 Münster, Institut für Kernphysik

Der ALICE Transition Radiation Detector (TRD) dient zur Identifikation von Elektronen und unterstützt die Rekonstruktion von Teilchenspuren. Zur Überwachung der Driftgeschwindigkeit und der Gasverstärkung des TRD ist ein Messystem, der Gas Proportional Counter For Drifting Electrons (GOOFIE), entwickelt worden. Dieser befindet sich zusammen mit dem TRD in der gleichen Gasversorgung. Dadurch ist sichergestellt, dass das Driftgas in beiden System vergleichbar ist. Driftgeschwindigkeit und Gasverstärkung hängen empfindlich von Umgebungsparametern ab, z.B. Temperatur, Druck und Gaszusammensetzung. Die Gaszusammensetzung variiert aufgrund von Kammerausgasungen und Austausch mit der Umgebungsluft. Temperatur und Druckänderungen sind mit den Wetterbedingungen vernüpft. Anhand von Simulationen der Gasverstärkung mit den Programmen MAGBOLTZ und GARFIELD werdem die Auswirkungen der oben genannten Parameter in Modellgeometrien einer TRD-Read-Out-Kammer und des GOOFIE studiert. Aus der Analyse der GOOFIE-Daten soll eine aktive online Kalibrierung der Drift- und Anodenspannung des TRD ermöglicht werden.

HK 81: Instrumentation

Zeit: Donnerstag 16:45–19:00 Raum: WIL-A221

Gruppenbericht HK 81.1 Do 16:45 WIL-A221

On-Line Commissioning of the Cryogenic Stopping Cell for the (Super-)FRS at the FRS Ion Catcher — •Moritz Pascal Reiter for the FRS Ion Catcher-Collaboration — II. Physikalisches Institut, Justus-Liebig-Universität Giessen, Giessen, Germany

At the FRS projectile and fission fragments are produced at relativistic energies, separated in-flight, range-bunched, slowed-down and thermalized in the FRS Ion Catcher, a cryogenic stopping cell (CSC), from which they are extracted with kinetic energies of a few eV. A multiple-reflection time-of-flight mass spectrometer (MR-TOF-MS) is used as a diagnostic tool for the extracted ions, to remove isobaric contaminants and to perform direct mass measurements of the projectile and fission fragments. The achieved clean beam may be delivered to further experiments, for example mass-selected decay spectroscopy. The FRS Ion Catcher serves as a test facility for the Low-Energy-Branch of the Super-FRS at FAIR, where the CSC and the MR-TOF-MS will be key devices for experiments with very neutron rich fission fragments.
In October 2011 and July/August 2012, the CSC and the MR-TOF-MS were commissioned on-line at the FRS Ion Catcher at GSI. For the first time, a stopping cell for exotic nuclei was operated on-line at cryogenic temperatures. Using a gas density almost two times higher than ever reached before for a stopping cell with RF ion repelling structures, various projectile fragments were thermalized and extracted with high efficiencies and short extraction times. For the first time, direct mass measurements of short-lived nuclei were performed with an MR-TOF-MS, among them the nuclide 213Rn with a half-life of only 20 ms.

HK 81.2 Do 17:15 WIL-A221

The Neutron Distribution System of the new Ultra-Cold Neutron Source at the FRM II — •Stephan Wlokka[1], Andreas Frei[1], Peter Fierlinger[2], Stephan Paul[2], and Peter Geltenbort[3] — [1]Forschungsneutronenquelle Heinz Maier-Leibnitz (FRM II), Technische Universität München, Lichtenbergstraße 1, D-85747 Garching — [2]Physik Department, Technische Universität München, James-Franck-Straße 1, D-85748 Garching — [3]Institut Laue-Langevin, BP 156, 6, rue Jules Horowitz, 38042 Grenoble Cedex 9, France

Ultra-cold neutrons (UCN) are neutrons which are totally reflected from a given material surface. Typical energies of UCN are below 300 neV and velocities below 8 m/s. Thus they can be stored in material or magnetic bottles for several hundreds of seconds. As such, UCN are excellent laboratories to study fundamental parameters, e.g. the free neutron lifetime or the electric dipole moment of the neutron.

The new UCN source foreseen at the FRM II will deliver high UCN densities to four experimental areas. Hence a mechanism to distribute as many UCN as possible to these areas is needed. We have developed a high efficiency UCN switch for this purpose.

This talk reports about a series of measurements conducted with this switch. There have been three types of measurements, testing the

transmission, storage and surface properties of the switch.

This work was funded by the DFG Excellenz-Cluster EXC153 "Origin and Structure of the Universe" and the Maier-Leibnitz-Laboratorium (MLL) of the TU and LMU Munich.

HK 81.3 Do 17:30 WIL-A221

A powerful source for ultracold neutrons at TRIGA Mainz: latest results — Markus Beck[1], Klaus Eberhardt[2], Gabriele Hampel[2], Werner Heil[1], •Jan Peter Karch[1], Robin Kieser[1], Christian Plonka-Spehr[2], Tobias Reich[2], Iouri Sobolev[1], and Norbert Trautmann[2] — [1]Institut für Physik, Universität Mainz — [2]Institut für Kernchemie, Universität Mainz

Ultracold neutrons (UCN) are a powerful tool for addressing many fascinating questions in particle physics, nuclear physics, and astronomy. UCNs offer unique opportunities for investigating the properties of the free neutron, such as its lifetime, with exceptionally high precision. In order to tackle the obvious count rate limitations, super-thermal UCN sources are now under construction at different places worldwide.

Within PRISMA cluster of excellence the existing UCN source at TRIGA Mainz will be upgraded in its performance to reach very high UCN number densities. The talk gives an overview on the present optimization work at the pulsable UCN source at beamport D, measures to improve the UCN yield and future plans to establish a user facility at TRIGA Mainz.

HK 81.4 Do 17:45 WIL-A221

On-line coupling of the TRIGA-SPEC facility at the research reactor TRIGA Mainz — •Dennis Renisch for the TRIGA-SPEC-Collaboration — Institut für Kernchemie, Johannes Gutenberg-Universität, Mainz, Germany

To determine ground-state properties of exotic nuclides, the TRIGA-SPEC experiment at the TRIGA Mainz research reactor was recently installed. It includes the Penning-trap mass spectrometer TRIGA-TRAP and the collinear laser spectroscopy setup TRIGA-LASER. Nuclides of interest are produced via neutron-induced fission of suitable actinoide isotopes, thermalized in a gas-filled volume and transported with a gas-jet system to an on-line ion source. Ionization of the fission products occurs inside a hot cavity of the ion source, which is heated by electron bombardment to temperatures of about 2000°C. The ion beam is extracted by a high potential difference and mass separated by a 90° dipole magnet. Afterwards, the ion beam is injected into an RF-cooler/buncher and finally decelerated by a pulsed drift tube so that the ions can be captured in a Penning trap. The efficiencies of the different parts of the beamline were tested recently and the latest results about the performance will be presented.

HK 81.5 Do 18:00 WIL-A221

CoTEx 2.0 - Coil tests for the neutron lifetime experiment PENeLOPE — •Dominic Gaisbauer for the PENeLOPE-Collaboration — Technische Universität München, München, Deutschland

PENeLOPE is an experiment with ultra cold neutrons (UCN) for determining their lifetime in a magneto-gravitational trap with special designed superconducting coils developed at the Technische Universität München. It is designed to have a precision of up to 'pm 0.1s.Due to their unique characteristics all coils for the trap have to be trained and tested in a preliminary experiment called CoTEx 2.0 before they can be inserted into PENeLOPE. The talk will highlight the results of the first prototype coil tests and the three coils delivered in January 2013. A short overview of CoTEx in general and the slow control and quench detection of CoTEx will also be presented.

This project is supported by the Deutsche Forschungsgemeinschaft, the Maier-Leibnitz-Laboratorium Garching and the Cluster of Excellence "Origin and Structure of the Universe".

HK 81.6 Do 18:15 WIL-A221

High Precision Neutron Polarisation with Supermirrors — •Christine Klauser[1,2], Thierry Bigault[1], Peter Böni[3], Pilar Guimerá Millán[1], Martin Schneider[4], and Torsten Soldner[1] — [1]Institut Laue-Langevin, Grenoble, France — [2]Atominstitut, Technische Universität Wien, Austria — [3]Physikdepartment E21, Technische Universität München, Germany — [4]SwissNeutronics AG, Brühlstrasse 28, CH-5313 Klingnau, Switzerland

Absolute measurements of correlation coefficients in neutron beta decay are presently limited to a relative accuracy in the order of 10^{-3} by systematics and statistics. Next-generation instruments aim for 10^{-4} accuracy, implying a 10^{-4} accuracy for the polarization of a large cold neutron beam. State-of-the-art polarizing super mirrors in the X-SM geometry deliver about 99.7% polarization only. This limitation of the performance is caused by depolarization by the supermirrors themselves. We present a systematic study of depolarizing effects in polarizing supermirrors. The highly sensitive Opaque Test Bench based on 3He spin filters is used as diagnostic tool. We have studied depolarization in both reflection and transmission for different supermirrors, varying in material and supermirror factor m, and investigated the relationship to magnetizing field, incidence angle and wavelength. The results of this study have been used to push the polarisation of the X-SM geometry to 99.970(3), combining a FeSi mirror and a CoTi bender.

HK 81.7 Do 18:30 WIL-A221

An angular selective electron gun for the KATRIN experiment — •Michael Zacher, Hans-Werner Ortjohann, Nicholas Steinbrink, Lorenz Josten, Volker Hannen, Christian Weinheimer, and Daniel Winzen for the KATRIN-Collaboration — Westfälische Wilhelms-Universität, Münster

The **KA**rlsruhe **TRI**tium **N**eutrino experiment aims for a measurement of the electron anti-neutrino mass with a sensitivity of 200 meV/c^2 (95% C.L.) by analysing the endpoint region of the tritium β-decay. The main spectrometer (MAC-E filter type, 23m length) is one of the central parts of the experiment, featuring an energy resolution of Δ E<1 eV. For commissioning of the spectrometer a well defined electron source is needed that allows to determine the transmission characteristics and compare the electromagnetic properties to simulations. For this purpose an angular selective electron gun was developed.

A pulsed UV-Laser produces electrons via the photo-electric effect, which are then accelerated electro-statically in a magnetic field. It features a small energy spread, a sharp selectable emission angle and covers the whole magnetic flux tube of KATRIN. By that, the characteristics of the spectrometer can be investigated with high precision. The time structure of the electron pulses allows time of flight measurements, offering enhanced sensitivity. The talk will give an overview about the e-gun design and its properties.

This project is funded by the BMBF under contract number 05A11PM2.

HK 81.8 Do 18:45 WIL-A221

Novel laser ellipsometry method for the KATRIN condensed ^{83m}Kr source — •Miroslav Zbořil for the KATRIN-Collaboration — Institut für Kernphysik, Uni Münster

One of the systematic effects in the neutrino mass experiment KATRIN are the fluctuations of the electric retarding potential which is experienced by the tritium β electrons on their path through the spectrometer. For the purpose of long-term monitoring of the energy scale stability several calibration electron sources will be utilised at KATRIN. One of them is the condensed ^{83m}Kr source based on a frozen ^{83m}Kr film on a HOPG backing at about 20 K. The isomeric state decays via a cascade of highly converted transitions, yielding conversion electron lines with energies ranging from 7.5 keV to 32.1 keV, useful for the energy calibration. The cleanliness of the HOPG backing is crucial as any adsorption of residual gas would shift the kinetic energy of the conversion electrons. The backing is cleaned via laser ablation and resistive heating. The cleanliness is checked via a novel method of laser ellipsometry where the polarisation analysis takes place directly in ultrahigh vacuum. The polarisation analysis is realised by an analyser and light detector at 90 K embedded in the cold baffle. This method allows to determine film thicknesses with a resolution of better than an atomic monolayer. As a byproduct it can be also used to determine the indices of refraction of condensed krypton and of the HOPG backing.

The main features of the calibration source will be reviewed and the results of test measurements will be presented. The project is supported by BMBF under contract number 05A11PM2.

HK 82: Beschleunigerphysik XIV (Strahldiagnose II)

Zeit: Donnerstag 16:45–19:00 Raum: WIL-C203

HK 82.1 Do 16:45 WIL-C203

Spectral methods for measuring ultrashort electron bunch durations from Laser-wakefield accelerators — •Alexander Debus, Omid Zarini, Michael Bussmann, Jurjen Couperous, Arie Irman, Wolfgang Seidel, and Ulrich Schramm — Helmholtz-Zentrum Dresden-Rossendorf, Dresden, Germany

Laser-wakefield accelerators (LWFA) feature electron bunch durations ranging from several fs to tens of fs. Knowledge and control of the electron bunch duration is vital to the design of future table-top, X-ray light-sources for laser-synchronized pump-probe experiments, ranging from betatron radiation, Thomson scattering to FELs. Due to the nonlinear nature of the laser-wakefield electron injection and small changes in initial experimental conditions the electron bunch properties are often subject to large shot-to-shot variations, which requires diagnostics working not only at ultrashort time-scales but also at single-shot.

We aim for measurements of the LWFA electron bunch duration and bunch substructure at single-shot by analysing the coherent and incoherent transition radiation spectrum. Our ultra-broadband spectrometer ranges from the UV (200 nm) to the mid-IR (12 μm), which allows to resolve time-scales from 0.7 to 40 fs. The prims and grating-based spectrometer divides and maps the spectrum onto three detector systems (UV/VIS;NIR;MIR) of staggered, increasing resolution towards lower wavelengths. Here we present the experimental approach, scope and current status of our spectrometer project.

HK 82.2 Do 17:00 WIL-C203

Electro-optical bunch shape measurements - possible temporal resolution limits — •Andrii Borysenko, Nicole Hiller, Benjamin Kehrer, Michael J. Nasse, Edmund Hertle, Marcel Schuch, Sebastian Marsching, and Anke-Susanne Müller — Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany

Coherent synchrotron radiation arises when the longitudinal electron bunch length is smaller than the wavelength. In storage rings, substructures on the electron bunches (micro-bunching) can lead to strong "bursting" of coherent radiation and investigation of such effects requires a measurement of the electron bunch length with sufficient temporal resolution. In linear accelerators, the bunch lengths themselves can be extremely short. This report considers the main electro-optical techniques for bunch length measurements and discusses systematic limitations of the method. Special emphasis is put on possible ways to increase the temporal resolution.

HK 82.3 Do 17:15 WIL-C203

Transverse emittance measurement at REGAE via a solenoid scan — •Max Hachmann[1], Frank Mayet[1], Klaus Flöttmann[2], and Florian Grüner[1] — [1]Institut für Experimentalphysik, Universität Hamburg — [2]DESY, Hamburg

The linear accelerator REGAE at DESY produces short and low charged electron bunches, on the one hand to resolve the excitation transitions of atoms temporally by pump probe electron diffraction experiments and on the other hand to investigate principal mechanisms of laser plasma acceleration. For both cases a high quality electron beam is required which can be identified with a small beam emittance. The current method to measure the transverse beam emittance at REGAE and results will be presented.

HK 82.4 Do 17:30 WIL-C203

Digital Beam Position and Phase Monitor for P-LINAC for FAIR — •Mohammed almalki — Planckstrasse 1, 64291 Darmstadt,

For the planned P-LINAC for the FAIR facility, Beam Position Monitors (BPM) will be installed at 14 locations along the LINAC. The digital signal processing to derive the transverse beam position and the beam phase will be implemented by "Libera Single Pass H". The specification for position measurement is 0.1 mm spatial resolution and phase accuracy is 1 degree with respect to 325 MHz acceleration frequency. The results from the Libera digital signal processing were compared with the time-domain approach and the FFT analytic calculations. The first test was performed at the GSI UNILAC with a Ne4+ beam at 1.4 MeV / u with a beam current of ~ 80 *A. A single BPM was used to act as a "Bunch arrival monitor" to characterize the dependence of beam arrival time on bunch shape. The signals were sampled at 117.440 MHz with a 16-bit ADC to produce I and Q data streams. The first experimental results will be reported.

HK 82.5 Do 17:45 WIL-C203

Electro-optical bunch length measurements at the ANKA storage ring - First lessons learned — •Nicole Hiller, Andrii Borysenko, Edmund Hertle, Erhard Huttel, Vitali Judin, Sebastian Marsching, Anke-Susanne Müller, Michael J. Nasse, and Marcel Schuh — Karlsruher Institut für Technologie, Kaiserstraße 12, 76131 Karlsruhe

A set up for near-field electro optical bunch length measurements has recently been installed into the UHV system of the ANKA storage ring. For electro-optical bunch length measurements during ANKA's low alpha operation a laser pulse is used to probe the field induced birefringence in an electro-optical crystal (GaP in our case). The setup allows for both, electro-optical sampling (EOS, multi-shot) and spectral decoding (EOSD, single- and multi-shot) measurements. This talk presents first results and discusses challenges that needed to be overcome in order for this method to work at storage rings.

HK 82.6 Do 18:00 WIL-C203

Inbetriebnahme eines neuen hochempfindlichen Bunch-Ankunftszeitmonitors am FLASH — •Alexander Kuhl[1], Juliane Rönsch-Schulenburg[1], Jörg Rossbach[1], Michael Bousonville[2], Marie Kristin Czwalinna[2], Holger Schlarb[2], Cezary Sydlo[2], Sascha Schnepp[3] und Thomas Weiland[4] — [1]Universität Hamburg, Hamburg, Deutschland — [2]DESY, Hamburg, Deutschland — [3]Laboratory for Electromagnetic Fields and Microwave Electronics, ETH Zurich, Schweiz — [4]TEMF, Technische Universität Darmstadt, Darmstadt, Deutschland

Der Freie-Elektronen-Laser FLASH in Hamburg verfügt derzeit über vier Bunch-Ankunftszeitmonitore (BAMs) welche eine Zeitauflösung von weniger als 10 fs bei Bunchladungen von mehr als 500 pC ermöglichen. Für den FEL-Betrieb bei FLASH mit sogenannten "Single-Spike-Pulsen" werden niedrigere Bunchladungen von 20 pC benötigt. Die aktuellen BAMs sind mit einer Bandbreite von 10 GHz limitiert und erreichen daher für solch eine kleine Ladungen nicht mehr die geforderte Zeitauflösung von 10 fs. Um diese neuen Anforderungen erfüllen zu können, wurde ein neuer breitbandiger Ankunftszeitmonitor mit einem Frequenzbereich bis 40 GHz entwickelt und an einer fünften Position bei FLASH installiert. In dem Vortrag werden der Aufbau sowie die Inbetriebnahme des Systems als auch die ersten Messungen mit diesem BAM und deren Analyse vorgestellt.

HK 82.7 Do 18:15 WIL-C203

Bunch arrival time monitors; Concepts towards improving the sensitivity for low charge operation for FLASH II and XFEL — •Andreas Penirschke[1], Aleksandar Angelovski[1], Cesary Sydlo[2], Michael Bousonville[2], Alexander Kuhl[3], Marie Kristin Czwalinna[2], Holger Schlarb[2], Thomas Weiland[4], and Rolf Jakoby[1] — [1]TU Darmstadt, Institut für Mikrowellentechnik und Photonik, Merckstr. 25, 64283 Darmstadt — [2]Deutsches Elektronen-Synchrotron DESY, Notkestr. 85, 22607 Hamburg — [3]University of Hamburg, Physics Department, Accelerator physics group — [4]TU Darmstadt, Institut Theorie Elektromagnetischer Felder, Schlossgartenstr. 8, 64289 Darmstadt

High gain Free-Electron Lasers can generate ultra short X-ray pulses in the femtosecond range. For a stable operation of the FEL, the precise knowledge of the bunch arrival time is crucial. A novel high bandwidth Bunch Arrival time Monitor was recently installed at FLASH to allow a low charge operation mode with a sub-10fs resolution for bunch charges of 20pC or more. The BAM is equipped with cone shaped pickups for the precise measurement of both, the high and low bunch charge operation mode. For the extension of FLASH facility to FLASH II new pickups for the high bandwidth BAMs need to be developed. The new BAM needs to maximize the voltage level of the beam induced signal for low charge operation mode in order to provide sufficient signal strength for the subsequent electronics. In this talk, we will present concepts to improve the signal strength at the electro-optic modulators for low charge operation at FLASH II and XFEL.

HK 82.8 Do 18:30 WIL-C203

Overview of the Beam Instrumentation of the European Spal-

lation Source — •Christian Böhme — European Spallation Source, Lund, Schweden

With the transition to high-power accelerators the need for new methods in beam instrumentation has risen. An overview of the planned beam instrumentation of the European Spallation Source will be given. As main focus the planned beam profile measurements will be presented, as these have to be measured in different environments: From low ultra-high vacuum regions in between cryogenic cavities to atmospheric pressure helium in a highly radiated area close to the beam target.

HK 82.9 Do 18:45 WIL-C203

High resolution synchrotron light analysis at ELSA — •Michael Switka, Sven Zander, and Wolfgang Hillert — Electron stretcher facility ELSA, Physics Institute of Bonn University

The pulse stretcher ring ELSA provides polarized electrons with energies up to 3.5 GeV for external hadron experiments. In order to suffice the need of stored beam intensities towards 200 mA, advanced beam instability studies need to be carried out. An external diagnostic beamline for synchrotron light analysis has been set up and provides the space for multiple diagnostic tools including a streak camera with time resolution of < 1 ps. Beam profile measurements are expected to identify instabilities and reveal their thresholds. The effect of adequate countermeasures is subject to analysis. The current status of the beamline development will be presented.

HK 83: Beschleunigerphysik XV (Kontrolle, Strahlkühlung)

Zeit: Donnerstag 16:45–18:45 Raum: WIL-C205

HK 83.1 Do 16:45 WIL-C205

Turbogeneratoren für die Energieversorgung der HV-Solenoide am HESR-Elektronenkühler — •Andre Hofmann[1], Kurt Aulenbacher[2], Max-Wilhelm Bruker[1], Jürgern Dietrich[1], Simon Friedrich[1] und Tobias Weilbach[1] — [1]Helmholtz-Institut Mainz — [2]Johannes Gutenberg-Universität Mainz

Für eine erfolgreiche Durchführung der Experimente am High Energy Storage Ring (HESR) bzw. dem Electron Nuclear Collider (ENC) ist eine magnetisierte Elektronenkühlung bei relativistischen Energien notwendig. Das Helmholtz-Institut Mainz (HIM) ist in Kooperation mit dem Budker Institut Novosibirsk (BINP) an der Entwicklung der hierzu notwendigen Technologien beteiligt. Eine Herausforderung stellt dabei die Stromversorgung der auf verschiedenen HV-Potenialen liegenden Komponenten, z.B. der HV-Solenoide, dar. Ein zur Zeit verfolgtes Konzept ist der Einsatz von Turbogeneratoren, welche die oben genannten Komponenten mit Strom versorgen sollen. Die Präsentation gibt einen Überblick über das "Turbinenprojekt". Nach einer Einführung in die Problemstellung folgt eine Übersicht über den gegenwärtigen Status sowie einen Ausblick über das weitere Vorgehen.

Gruppenbericht HK 83.2 Do 17:00 WIL-C205

Status des HESR-Elektronenkühler-Teststands — •Max-Wilhelm Bruker[1], Tobias Weilbach[1], Simon Friederich[1], André Hofmann[1], Jürgen Dietrich[1] und Kurt Aulenbacher[1,2] — [1]Helmholtz-Institut Mainz — [2]Institut für Kernphysik, Johannes-Gutenberg-Universität Mainz

Es ist geplant, am zukünftigen Hochenergiespeicherring HESR bei FAIR einen Elektronenkühler mit einem Strahlstrom von 3 A und einer Strahlenergie von 8 MeV zu installieren. Am Helmholtz-Institut Mainz (HIM) wurde ein Teststand errichtet, um kritische Komponenten des Kühlersystems zu erproben. Eines der Hauptziele dieses Teststands ist die experimentelle Überprüfung der Parameter der Elektronenquelle, die vom TSL (Uppsala) vorgeschlagen wurde, insbesondere in Bezug auf die Handhabung des Vakuums, die elektromagnetischen Felder und die resultierenden Strahleigenschaften. Desweiteren soll eine Energierückgewinnungseffizienz von $1 - 10^{-5}$ erreicht werden. Um diese Größe zu messen, wird ein Wienfilter eingesetzt werden, der auch in der Lage sein wird, Kollektorverluste zu minimieren. Der aktuelle Status dieses Projekts wird vorgestellt.

HK 83.3 Do 17:30 WIL-C205

Broadband Lasercooling of Relativistic Ion Beams at ESR — •Michael Bussmann[1], Michael Seltmann[1], Matthias Siebold[1], Ulrich Schramm[1], Weiqiang Wen[2], Danyal Winters[3], Tobias Beck[4], Benjamin Rein[4], Thomas Walther[4], Sascha Tichelmann[4], Gerhard Birkl[4], Rodolfo Sanchez-Alarcon[3,5], Johannes Ullmann[3,5], Matthias Lochmann[3,5], Wilfried Nörtershäuser[3,5], Colin Clark[3], Christophor Kozhuharov[3], Markus Steck[3], Christina Dimopoulou[3], Fritz Nolden[3], Dacheng Zhang[2], Xinwen Ma[2], and Thomas Stöhlker[3] — [1]HZDR — [2]IMPCAS Lanzhou — [3]GSI — [4]TU Darmstadt — [5]Uni Mainz

We present new results on laser cooling of relativistic C3+ ion beams at the Experimental Storage Ring at GSI. For the first time we could show laser cooling of bunched relativistic ion beams using fast scanning of the frequency of the cooling laser over a range larger than the momentum acceptance of the bucket. Unlike previously employed cooling schemes where the bucket frequency was scanned relatively to a fixed laser frequency, scanning of the laser frequency can be readily applied to future high energy storage rings such as HESR or SIS 100 at FAIR.

HK 83.4 Do 17:45 WIL-C205

Das Kontrollsystem der Beschleunigeranlage ELSA — •Dennis Proft, Frank Frommberger und Wolfgang Hillert — Elektronen-Stretcher-Anlage ELSA, Physikalisches Institut, Universität Bonn

Um den Anforderungen des Nachbeschleunigungsmodus der Beschleunigeranlage ELSA gerecht zu werden wurde in den neunziger Jahren ein neues Kontrollsystem zur Steuerung und Überwachung der Anlage sowie der Strahlparameter entwickelt. Es bildet die oberste Ebene eines verteilten Rechnerkontrollnetzes bestehend aus HP Workstations, VME-Prozessoren und Feldbusprozessoren sowie Linux-PCs.

Alle beschleunigerphysikalisch relevanten Größen, beispielsweise Arbeitspunkte oder die Extraktionsenergie, lassen sich direkt über eine fenster-basierte grafische Benutzeroberfläche einstellen und werden vom Kontrollsystem in Sollwertvorgaben für die Hardware umgerechnet. Strahlparameter, wie z.B. die transversale Emittanz, stehen auf dem gleichen Wege in Echtzeit zur Verfügung. Dies ermöglicht eine vollkommen intuitive Bedienung der Anlage ohne Detailkenntnisse der Realisierung auf Hardwareebene.

In diesem Vortrag wird das Kontrollsystem vorgestellt sowie auf Details und Vorteile des kürzlich erfolgten Umstiegs von HP Workstations auf einen PC mit Linux als Betriebssystem eingegangen.

HK 83.5 Do 18:00 WIL-C205

Status des EPICS-basierten Kontrollsystems am S-DALINAC* — •Christoph Burandt[1], Ralf Eichhorn[2], Florian Hug[1], Martin Konrad[1], Uwe Bonnes[1], Joachim Enders[1] und Thomas Schösser[1] — [1]Institut für Kernphysik, Technische Universität Darmstadt, Darmstadt, Germany — [2]Cornell University, Ithaca, NY, USA

Am supraleitenden Darmstädter Elektronenbeschleuniger S-DALINAC wurde vor zwei Jahren eine neue Hochfrequenzregelung in Betrieb genommen. Um den Anforderungen der weitgehend digitalen Hardware gerecht zu werden, wurde gleichzeitig ein neues EPICS-basiertes Kontrollsystem eingeführt.

Inzwischen wurde die Migration weiterer Komponenten auf das neue Kontrollsystem vorangetrieben. Dabei wurden auch übergeordnete Dienste, wie etwa eine umfassende Archivierung von Prozessvariablen, eingerichtet.

Es wird über die bereits abgeschlossenen Arbeiten sowie aktuelle Entwicklungen berichtet. Dabei werden sowohl Aspekte der Hardware als auch der Software beschrieben.

*Gefördert durch die DFG im Rahmen des SFB 634

HK 83.6 Do 18:15 WIL-C205

Weiterentwicklung der Benutzerschnittstellen für das EPICS-basierte Kontrollsystem am S-DALINAC* — •Thomas Schösser, Uwe Bonnes, Christoph Burandt, Florian Hug, Martin Konrad und Norbert Pietralla — Institut für Kernphysik, Technische Universität Darmstadt, Darmstadt, Germany

Im Zuge der Umstellung des Kontroll- und Steuersystems des supra-

leitenden Darmstädter Elektronen-Linearbeschleunigers S-DALINAC auf ein EPICS-basiertes Kontrollsystem sind auch die Benutzerschnittstellen angepasst worden. Während die Erstellung von gewöhnlichen graphischen Bedienfenstern mit der Software „Control System Studio“ erfolgt, sollen zukünftig die von den Operateuren bevorzugten Drehknöpfe ebenfalls für das EPICS-System zur Verfügung stehen. Redundante Systeme und eine schnelle Ersetzbarkeit defekter Teile erweitern die Aufgabenstellung an dieses Projekt.

Wir berichten über den aktuellen Stand der Arbeiten und präsentieren Ziele und weitere Verbesserungsmöglichkeiten.

*Gefördert durch die DFG im Rahmen des SFB 634

HK 83.7 Do 18:30 WIL-C205

Design Concept for the FLUTE Control System — •Sebastian Marsching, Erhard Huttel, Anke-Susanne Müller, Somprasong Naknaimueang, Michael J. Nasse, Robert Rossmanith, Marco Schreck, Marcel Schuh, and Markus Schwarz — Karlsruhe Institute of Technology, Karlsruhe, Germany

FLUTE is a linac-based THz-source being constructed at the Karlsruhe Institute of Technology (KIT). One of the goals of the FLUTE project is the generation of femtosecond electron-bunches. In order to study the various effects influencing the final bunch length, data-acquisition and storage systems that allow correlation of parameters on a per-pulse basis are required.

We are planning to use an EPICS-based control system that employs special techniques for pulse-synchronous data-acquisition. In this talk we will present the current design concept for this system.

HK 84: Eingeladene Hauptvorträge

Zeit: Freitag 8:30–10:30 Raum: HSZ-02

Hauptvortrag HK 84.1 Fr 8:30 HSZ-02

Erste Gammaspektroskopie-Experimente mit PRESPEC bei GSI — •Jürgen Gerl für die AGATA-Kollaboration — GSI, Darmstadt

Mit dem PRESPEC-AGATA Experiment werden Streuexperimente zur Untersuchung der Struktur exotischer Atomkerne am SIS/FRS Komplex der GSI, Darmstadt durchgeführt. Für eine erste Experimentserie wurde das AGATA Spektrometer, eine Anordnung von zur Zeit 19 hochauflösenden, Ge Gamma-Trackingdetektoren an der GSI aufgebaut. Zur Identifikation der Reaktionsprodukte kam das Schwerionenkalorimeter LYCCA-1 zum Einsatz. Der Aufbau stellt die erste vollständige Implementierung des HISPEC Experiments für FAIR/NUSTAR dar. Nach der erfolgreichen Inbetriebnahme des Experimentaufbaus wurden im Herbst 2012 eine Reihe von relativistischen Coulombanregungs- und Sekundärfragmentationsexperimenten durchgeführt. Dabei ging es um die Bestimmung von B(E2)-Werten an neutronenreichen, instabilen Pb, Hg und Pt Isotopen, die Feinstruktur der Pygmy-Resonanz in 64Fe, Coulombanregung von Yrast-Trap Zuständen in 52Fe und Lebensdauern angeregter Zustände neutronenreicher Zr und Mo Kerne. Erste Ergebnisse bestätigen, dass das Experiment eine weltweit einzigartige Sensitivität besitzt, die gegenüber dem erfolgreichen Vorgänger Experiment RISING um wenigstens eine Größenordnung höher ist und somit einmalige Zugänge zur Struktur exotische Atomkerne ermöglicht.

Hauptvortrag HK 84.2 Fr 9:10 HSZ-02

The Subnuclear Structure of Matter - Baryon Spectroscopy at ELSA — •Ulrike Thoma — Helmholtz-Institut für Strahlen- und Kernphysik, Universität Bonn, D-53115 Bonn

One of the open challenges in subnuclear physics is to understand the non-perturbative regime of Quantum Chromodynamics, including the world of the nucleon and its excitations. The investigation of the formation and decay of baryon resonances made of the light quarks up, down and strange is the main theme of the CRC 16 “Subnuclear Structure of Matter”. While the underlying gauge theory, Quantum Chromodynamics(QCD), is well established, the non-perturbative phenomenon of structure formation - the fundamental fields (the quarks and gluons) only appear within bound states (mesons and baryons) and their excitations - is not yet understood. Progress can only be made through a strong interplay of experiment and theory. A focus of this talk will be on the baryon spectroscopy results obtained at the electron accelerator ELSA, including in particular the recent double polarization experiments.

Hauptvortrag HK 84.3 Fr 9:50 HSZ-02

Hypernuclear Spectroscopy at MAMI — •Anselm Esser for the A1-Collaboration — Institut f. Kernphysik, Mainz, Germany

Excited hypernuclei created in (e,e’K) reactions are likely to fragment creating a set of different light hyperfragments. A large fraction of which can be stopped inside the target and deexcites electromagnetically before it’s decay. Mesonic two-body weak decays of these hyperfragments at rest result in mono-energetic pions. By measuring the momenta of these pions using high-resolution magnetic spectrometers one gains direct access to the ground-state masses of most produced hyperfragments.

In 2011 and 2012 at the Mainz Microtron electron accelerator, a dedicated kaon spectrometer located at 0° was used to detect kaons emitted in forward direction in coincidence to pions detected by two high-resolution spectrometers at backward angles. A second technique, the missing mass method, offers the unique possibility to extract detailed structure information on the ground and excited hypernuclear states. For this purpose the kaon spectrometer was equipped with a highly segmented fibre detector for the detection of scattered electrons and will serve as a double arm spectrometer in 2013. The target used for the decay-pion spectroscopy was ^{9}Be, while for the missing mass spectroscopy natural ^{6,7}Li and ^{4}He are considered. The combination of both spectroscopic methods will allow for the first time precision studies of charge symmetry breaking (CSB) in the hypernuclear systems $^{4}_{\Lambda}$H and $^{4}_{\Lambda}$He as well as $^{7}_{\Lambda}$He and $^{7}_{\Lambda}$Li.

Supported by DFG (SFB 1044) and EU HadronPhysics2 (SPHERE)

HK 85: Eingeladene Hauptvorträge

Zeit: Freitag 11:00–13:00 Raum: HSZ-02

Hauptvortrag HK 85.1 Fr 11:00 HSZ-02

Matrix Elements for Fundamental Symmetries — •Javier Menendez — Technische Universität Darmstadt — ExtreMe Matter Institute

Symmetries are crucial for our understanding of Nature and can be tested at low energies with massive detectors. These processes depend on matrix elements that involve both nuclear states, described with state-of-the-art nuclear structure calculations; and hadronic currents, obtained at nuclear energies within chiral effective field theory. Two processes will be reviewed: neutrinoless double-beta (0nbb) decay, and the scattering of weakly interacting massive particles (WIMPs) off nuclei. 0nbb decay violates lepton number conservation and its observation would establish the Majorana nature of neutrinos. WIMPs are predicted in supersymmetric extensions of the Standard Model and are among the most promising candidates for Dark Matter.

This work was supported by the DFG through Grant SFB 634 and by the Helmholtz Alliance HA216/EMMI.

Hauptvortrag HK 85.2 Fr 11:40 HSZ-02

Nuclear reactions for astrophysics studied at LUNA and in the Dresden Felsenkeller — •Daniel Bemmerer for the LUNA-Collaboration — Helmholtz-Zentrum Dresden-Rossendorf

Nuclear reactions power our Sun, and they create the chemical elements that are necessary for human life. In order to correctly understand what happens in stars, one needs astronomical observations, but also nuclear physics data. For a number of astrophysical scenarios such

as the Big Bang and our Sun, precise astronomical data are now available. This calls for new nuclear reaction data of similar precision.

The nuclear reactions that are important for hydrogen burning in the Sun and for Big Bang nucleosynthesis have to be studied by low-energy experiments with intensive beams of stable ions. Due to the low cross sections involved, the experiments are usually performed in a low-background environment, such as an underground laboratory. The results obtained in the last decade at the pioneering LUNA 0.4 MV accelerator deep underground in the Gran Sasso laboratory, Italy, will be summarized, as well as related studies at surface-based ion accelerators.

New, higher-energy underground accelerators are necessary to extend the energy range of the solar fusion data, and to address stellar helium and carbon burning. Relevant projects are underway both at LUNA and at the Dresden Felsenkeller.

Hauptvortrag HK 85.3 Fr 12:20 HSZ-02

Nukleare Astrophysik an FRANZ — •Kerstin Sonnabend — Goethe-Universität Frankfurt

An der Goethe-Universität Frankfurt entsteht zur Zeit die FRAnkfurter Neutronenquelle am Stern-Gerlach-Zentrum (FRANZ), deren hochintensiver Protonenstrahl und die damit produzierten Neutronen im keV-Energiebereich zukünftig für zahlreiche astrophysikalisch motivierte Experimente genutzt werden. Dabei werden neutronen- und protoneninduzierte Reaktionsraten, die für die Synthese der schweren Elemente im s- und p-Prozess verantwortlich sind, mit verschiedenen experimentellen Ansätzen untersucht. Aktuelle technische Entwicklungen und Highlights des geplanten experimentellen Programms werden vorgestellt.

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