Fachverband Physik der Hadronen und Kerne (HK)

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Übersicht der Hauptvorträge und Fachsitzungen

(Hörsäle RW 1-3 und P 1-5; Poster P Foyer)

Plenarprogramm

PV I	Mo	12:00–12:45	RW 1	**Dunkle Materie** — •Laura Baudis
PV II	Di	8:45– 9:30	RW 1	**Baryon Spectroscopy using CBELSA/TAPS at ELSA and the CLAS Spectrometer at Jefferson Laboratory** — •Volker Crede
PV III	Di	9:30–10:00	RW 1	**Recent Results from the COMPASS Experiment** — •Frank Nerling
PV IV	Di	10:00–10:30	RW 1	**Finite Volume Methods for Hadron Resonances** — •Michael Döring
PV V	Di	11:00–11:45	RW 1	**Quark-Gluon Plasma at the LHC** — •Silvia Masciocchi
PV VI	Di	11:45–12:15	RW 1	**The QCD Phase Diagram: Results and Perspectives** — •Jan M. Pawlowski
PV VII	Di	12:15–12:45	RW 1	**Entropy Creation in Heavy Ion Collisions** — •Andreas Schäfer
PV VIII	Di	19:30–21:00	RW 1	**Raumfahrt – Eine Kulturaufgabe?** — •Gerhard Thiele
PV IX	Mi	11:20–11:50	RW 1	**Aspekte physikdidaktischer Forschung und Entwicklung** — •Volkhard Nordmeier
PV X	Mi	11:50–12:10	RW 1	**Physik weckt Emotionen** — •Christian Heilshorn
PV XI	Mi	8:45– 9:30	RW 1	**Spectroscopy of Gravity with Ultra-Cold Neutrons** — •Hartmut Abele
PV XII	Mi	9:30–10:00	RW 1	**Newest results on pygmy resonances in atomic nuclei** — •Andreas Zilges
PV XIII	Mi	10:00–10:30	RW 1	**New modes of low-energy excitations** — •Nadia Tsoneva, Horst Lenske
PV XIV	Do	8:45– 9:30	RW 1	**Neutron-rich matter in the laboratory and the cosmos** — •Achim Schwenk
PV XV	Do	9:30–10:00	RW 1	**Präzisionsmassenmessungen an ISOLTRAP für Kernstruktur- und Astrophysik** — •Susanne Kreim
PV XVI	Do	10:00–10:30	RW 1	**Laserspektroskopie an relativistischen 209-Bi82+ und 209-Bi80+ Ionen am Speicherring ESR der GSI** — •Christopher Geppert, Matthias Lochmann, Rodolfo Sanchez, Michael Hammen, Nadja Frömmgen, Elisa Will, Benjamin Botermann, Zoran Andjelkovic, Raphael Jöhren, Jonas Mader, Volker Hannen, Christian Weinheimer, Danyal Winters, Thomas Kühl, Yuri Litvinov, Thomas Stöhlker, Andreas Dax, Michael Bussmann, Weiqiang Wen, Richard Thompson, Wilfried Nörtershäuser
PV XVII	Do	11:00–11:45	RW 1	**The FAIR Accelerator Complex: Challenges and Prospects** — •Oliver Kester, Weinrich Udo, Spiller Peter, Eickhoff Hartmut, Krämer Dieter, Steck Markus, Groening Lars, Kollmus Holger, Knie Klaus, Jacoby Wolfgang, Hagenbuck Frank, Prasuhn Dieter, Maier Rudolf, Winkler Martin
PV XVIII	Do	11:45–12:15	RW 1	**Perspectives of QPACE and iDataCool** — •Tilo Wettig
PV XIX	Do	12:15–12:45	RW 1	**ELENA - an upgrade to the CERN Antiproton Decelerator** — •Walter Oelert
PV XX	Fr	8:45– 9:30	RW 1	**Quarkonium spectroscopy from lattice QCD** — •Georg M. von Hippel
PV XXI	Fr	9:30–10:00	RW 1	**Hybrid Transport Models** — •Hannah Petersen
PV XXII	Fr	10:00–10:30	RW 1	**Strangeness in Hadrons** — •Concettina Sfienti

Am Dienstag, den 20. März 2012, finden von 14:00–16:00 Uhr im Hörsaal RW 1 die Vorträge der Finalisten des GR-HK-T-Dissertationspreises statt.

Die Preisträgervorträge PV IX und PV X sind Teil der Festsitzung am Mittwoch, den 21. März 2012, von 11:00–12:30 Uhr im Hörsaal RW 1.

Fachsitzungen

HK 1.1–1.7	Mo	14:00–16:00	RW 1	**Hadronenstruktur und -spektroskopie**
HK 2.1–2.7	Mo	14:00–16:00	RW 2	**Hadronenstruktur und -spektroskopie**
HK 3.1–3.7	Mo	14:00–16:00	RW 3	**Astroteilchenphysik**
HK 4.1–4.7	Mo	14:00–16:00	P 2	**Instrumentation**
HK 5.1–5.7	Mo	14:00–16:00	P 3	**Instrumentation**
HK 6.1–6.7	Mo	14:00–16:00	P 4	**Struktur und Dynamik von Kernen**
HK 7.1–7.7	Mo	14:00–16:00	P 5	**Schwerionenkollisionen und QCD Phasen**
HK 8.1–8.9	Mo	16:30–19:00	RW 1	**Hadronenstruktur und -spektroskopie**
HK 9.1–9.9	Mo	16:30–19:00	RW 2	**Nukleare Astrophysik**
HK 10.1–10.8	Mo	16:30–19:00	RW 3	**Struktur und Dynamik von Kernen**
HK 11.1–11.9	Mo	16:30–19:00	P 2	**Instrumentation**
HK 12.1–12.9	Mo	16:30–19:00	P 3	**Instrumentation**
HK 13.1–13.9	Mo	16:30–19:00	P 4	**Struktur und Dynamik von Kernen**
HK 14.1–14.9	Mo	16:30–19:00	P 5	**Schwerionenkollisionen und QCD Phasen**
HK 15.1–15.9	Di	16:30–19:00	RW 1	**Hadronenstruktur und -spektroskopie**
HK 16.1–16.9	Di	16:30–19:00	RW 2	**Hadronenstruktur und -spektroskopie**
HK 17.1–17.9	Di	16:30–19:00	RW 3	**Anwendungen kernphysikalischer Methoden**
HK 18.1–18.8	Di	16:30–19:00	P 2	**Instrumentation**
HK 19.1–19.9	Di	16:30–19:00	P 3	**Instrumentation**
HK 20.1–20.9	Di	16:30–19:00	P 4	**Struktur und Dynamik von Kernen**
HK 21.1–21.9	Di	16:30–19:00	P 5	**Schwerionenkollisionen und QCD Phasen**
HK 22.1–22.7	Mi	14:00–16:00	RW 1	**Hadronenstruktur und -spektroskopie**
HK 23.1–23.7	Mi	14:00–16:00	RW 2	**Hadronenstruktur und -spektroskopie**
HK 24.1–24.7	Mi	14:00–16:00	RW 3	**Astroteilchenphysik**
HK 25.1–25.7	Mi	14:00–16:00	P 1	**Fundamentale Symmetrien**
HK 26.1–26.7	Mi	14:00–16:00	P 2	**Instrumentation**
HK 27.1–27.7	Mi	14:00–16:00	P 3	**Instrumentation**
HK 28.1–28.7	Mi	14:00–16:00	P 4	**Struktur und Dynamik von Kernen**
HK 29.1–29.7	Mi	14:00–16:00	P 5	**Schwerionenkollisionen und QCD Phasen**
HK 30.1–30.8	Mi	16:30–18:45	RW 1	**Hadronenstruktur und -spektroskopie**
HK 31.1–31.8	Mi	16:30–19:00	RW 2	**Nukleare Astrophysik**
HK 32.1–32.9	Mi	16:30–19:00	RW 3	**Struktur und Dynamik von Kernen**
HK 33.1–33.8	Mi	16:30–19:00	P 1	**Fundamentale Symmetrien**
HK 34.1–34.8	Mi	16:30–19:00	P 2	**Instrumentation**
HK 35.1–35.9	Mi	16:30–19:00	P 3	**Instrumentation**
HK 36.1–36.7	Mi	16:30–18:45	P 4	**Struktur und Dynamik von Kernen**
HK 37.1–37.9	Mi	16:30–19:00	P 5	**Schwerionenkollisionen und QCD Phasen**
HK 38.1–38.8	Do	16:30–19:00	RW 1	**Hadronenstruktur und -spektroskopie**
HK 39.1–39.9	Do	16:30–19:00	RW 2	**Hadronenstruktur und -spektroskopie**
HK 40.1–40.7	Do	16:30–18:45	RW 3	**Astroteilchenphysik**
HK 41.1–41.8	Do	16:30–19:00	P 2	**Instrumentation**
HK 42.1–42.9	Do	16:30–19:00	P 3	**Instrumentation**
HK 43.1–43.9	Do	16:30–19:00	P 4	**Struktur und Dynamik von Kernen**
HK 44.1–44.9	Do	16:30–19:00	P 5	**Schwerionenkollisionen und QCD Phasen**
HK 45.1–45.10	Do	14:00–16:00	P Foyer	**Poster – Hadronenstruktur und -spektroskopie**
HK 46.1–46.4	Do	14:00–16:00	P Foyer	**Poster – Schwerionenkollisionen und QCD Phasen**
HK 47.1–47.11	Do	14:00–16:00	P Foyer	**Poster – Struktur und Dynamik von Kernen**
HK 48.1–48.10	Do	14:00–16:00	P Foyer	**Poster – Nukleare Astrophysik**
HK 49.1–49.2	Do	14:00–16:00	P Foyer	**Poster – Astroteilchenphysik**
HK 50.1–50.2	Do	14:00–16:00	P Foyer	**Poster – Fundamentale Symmetrien**
HK 51.1–51.3	Do	14:00–16:00	P Foyer	**Poster – Anwendungen physikalischer Methoden**
HK 52.1–52.11	Do	14:00–16:00	P Foyer	**Poster – Beschleuniger**
HK 53.1–53.40	Do	14:00–16:00	P Foyer	**Poster – Instrumentation**

HK 54.1–54.7	Fr	11:00–13:00	RW 1	**Hadronenstruktur und -spektroskopie**
HK 55.1–55.7	Fr	11:00–13:00	RW 2	**Hadronenstruktur und -spektroskopie**
HK 56.1–56.7	Fr	11:00–13:00	RW 3	**Astroteilchenphysik**
HK 57.1–57.7	Fr	11:00–13:00	P 2	**Instrumentation**
HK 58.1–58.7	Fr	11:00–13:00	P 3	**Instrumentation**
HK 59.1–59.7	Fr	11:00–13:00	P 4	**Struktur und Dynamik von Kernen**
HK 60.1–60.8	Fr	11:00–13:00	P 5	**Schwerionenkollisionen und QCD Phasen**
HK 61.1–61.7	Fr	14:00–16:00	RW 1	**Hadronenstruktur und -spektroskopie**
HK 62.1–62.7	Fr	14:00–16:15	RW 2	**Nukleare Astrophysik**
HK 63.1–63.8	Fr	14:00–16:00	RW 3	**Astroteilchenphysik**
HK 64.1–64.8	Fr	14:00–16:15	P 2	**Instrumentation**
HK 65.1–65.5	Fr	14:00–16:00	P 3	**Beschleuniger**
HK 66.1–66.5	Fr	14:00–15:30	P 4	**Struktur und Dynamik von Kernen**
HK 67.1–67.6	Fr	14:00–15:30	P 5	**Schwerionenkollisionen und QCD Phasen**

Mitgliederversammlung Fachverband Physik der Hadronen und Kerne

Donnerstag 18:30–19:30 RW 2

HK 1: Hadronenstruktur und -spektroskopie

Zeit: Montag 14:00–16:00 Raum: RW 1

Gruppenbericht HK 1.1 Mo 14:00 RW 1

Messung von elektromagnetischen Übergangsformfaktoren von pseudoskalaren Mesonen mit dem Crystal Ball am MAMI und mit BES-III am BEPC-II — •Marc Unverzagt, Achim Denig, Alexander Hahn, Benedikt Kloss und Sascha Wagner — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz

Das Studium elektromagnetischer Übergangsformfaktoren der pseudoskalaren Mesonen (P) stellt eine Möglichkeit dar, die intrinsische Struktur von Hadronen zu untersuchen. Ferner sind die Übergangsformfaktoren der leichten Mesonen wichtige Größen bei der Berechnung des Beitrags der hadronischen Licht-Licht-Streuung zum anomalen magnetischen Moment des Myons.

Diese Übergangsformfaktoren lassen sich z.B. mit dem Crystal Ball Aufbau am MAMI (Mainzer Mikrotron) oder mit BES-III am BEPC-II (Beijing Electron Positron Collider) messen. Am MAMI werden Mesonzerfälle $P \to \gamma^*\gamma \to e^+e^-\gamma$ mit zeitartigen Impulsüberträgen ($0 < q^2 < m_P^2$) studiert. Die Mesungen am BEPC-II werden hingegen über $\gamma^*\gamma \to P$ im raumartigen Bereich ($-5GeV^2 < q^2 < 0GeV^2$) durchgeführt.

In diesem Beitrag wird zunächst in die Physik der elektromagnetischen Übergangsformfaktoren eingeführt. Anschließend werden die Experimente am MAMI und am BEPC-II vorgestellt und Messungen und Machbarkeitsstudien zur Bestimmung der elektromagnetischen Übergangsformfaktoren mit dem Crystal Ball und dem BES-III Detektor diskutiert.

HK 1.2 Mo 14:30 RW 1

Measurement of hadronic electromagnetic form factors in BESIII — •Cristina Morales Morales — Helmholtz Institute Mainz, SB1, Johann-Joachim-Becher-Weg 36, 55128 Mainz

The feasibility of a measurement of the electric and magnetic nucleon form factors through radiative return in different e^+e^- colliders has been studied. In particular, the conditions of the BABAR and BESIII experiments have been reproduced and compared. The estimates presented here are based on the integrated luminosity of 10 fb^{-1} which will be collected at $\sqrt{s} = 3.77$ GeV by BESIII in the coming years and the luminosity of 232 fb^{-1} at $\sqrt{s} = 10.6$ GeV published by BABAR. The analysis is based on an extension of the generator PHOKHARA 7.0 including the nucleon-antinucleon final states in the presence of initial state radiation including NLO, and other hadronic channels like $e + e- \to \Lambda\bar{\Lambda}\gamma$ up to Born level. The analysis of the angular distribution of $e + e- \to N\bar{N}\gamma$ allows us to extract the time-like electromagnetic form factors of nucleons and other hadrons and the expected resolution of such measurements in BESIII. In particular the cases of neutrons, protons and lambdas in the final state are presented here, with emphasis in the proton case.

HK 1.3 Mo 14:45 RW 1

New insights on the nucleon form factors — •Ina Lorenz, Hans-Werner Hammer, and Ulf-G. Meissner — Helmholtz-Institut für Strahlen- und Kernphysik und Bethe-Center for Theoretical Physics, Universität Bonn

A dispersion theoretical analysis of the recent electron-proton scattering data from Mainz [1] is presented. The two-pion continuum is considered explicitly. Possible deviations from earlier analyses and their impact on the proton electromagnetic radii are discussed. Our results are confirmed by a continued fraction ansatz. Furthermore, the dependence of the results on the data range is discussed. [2]

[1] J. C. Bernauer et al., Phys. Rev. Lett. 105 (2010) 242001, http://arXiv.org/abs/1007.5076.

[2] I. Lorenz, Master thesis, in preparation.

HK 1.4 Mo 15:00 RW 1

Nucleon form factors in Lattice QCD — •Benjamin Jäger — Institut für Kernphysik und Helmholtz Institut Mainz, Mainz, Germany

The electromagnetic form factors of the nucleon, given by the Pauli- and Dirac form factor, allow to obtain information about the structure of a nucleon. Fundamental quantities, like the charge distribution within the nucleon, can be derived from these form factors.

Lattice QCD delivers an ab initio method to treat the non-perturbative region of QCD. We use non-perturbatively O(a) improved Wilson fermions with two dynamical quarks to compute the relevant matrix elements. We present some preliminary results for the vector form factors, including a preliminary study of systematic uncertainties of the lattice approach like volume and cutoff effects.

HK 1.5 Mo 15:15 RW 1

Feasibility studies of proton electromagnetic form factors with the PANDA detector — •Dmitry Khaneft for the PANDA-Collaboration — KPH, Mainz University, Mainz, Germany — HIM, Mainz, Germany

Perspectives of measuring the proton electromagnetic form factors in the time-like region with the PANDA detector at the FAIR facility are presented. First simulations using the PANDAroot simulation framework for both the signal $\bar{p}p \to e^+e^-$ and main background $\bar{p}p \to \pi^+\pi^-$ channel have been performed. For the simulation of signal events, the hypotheses for the ratio of the electric and magnetic Sachs form factors $|G_E|/|G_M| = 0, 1, 3$ have been considered independently for a number of $\bar{p}p$ center of mass energy values. Based on the simulation results, an efficient set of selection cuts to discriminate signal from background has been developed. Preliminary results on background suppression factors are shown.

HK 1.6 Mo 15:30 RW 1

Resummation of fermionic in-medium ladder diagrams to all orders — •Norbert Kaiser — Physik-Department, Technische Universität München

A system of fermions with a short-range interaction proportional to the scattering length a is studied at finite density. At any order a^n, we evaluate the complete contributions to the energy per particle $\bar{E}(k_f)$ arising from combined (multiple) particle-particle and hole-hole rescatterings in the medium. This novel result is achieved by decomposing the particle-hole propagator into the vacuum propagator plus a medium-insertion. The emerging series in ak_f can be summed to all orders in form of a double-integral over an arctangent function. Taking the unitary limit $a \to \infty$, one obtains the value $\xi = 0.507$ for the universal Bertsch parameter. Extensions of the resummation method by including the s-wave effective range r_s and a (spin-independent) p-wave contact interaction are presented. We perform also an exact (5-loop) calculation of a three-body contact interaction to second order.

Supported in part by BMBF, GSI, and the DFG Cluster of Excellence: Origin and Structure of the Universe.

HK 1.7 Mo 15:45 RW 1

Analytic Structure of Ghosts and Gluons from DSEs in Landau Gauge — •Stefan Strauss[1], Christian Fischer[1], and Christian Kellermann[2] — [1]Institut für theoretische Physik, JLU Gießen, Gießen, Germany — [2]Institut für Kernphysik, TU Darmstadt, Darmstadt, Germany

We report on results for the analytic structure of the Landau gauge ghost and gluon propagators in the complex momentum plane. The hierarchy of Dyson-Schwinger equations is truncated in such a way that the propagators are in good agreement with lattice results at real spacelike Euclidean momenta. In contrast to expectations from Gribov-Zwanziger-like effective theories our results indicate the absence of pole singularities in the complex part of the momentum plane. Additionally, both propagators show branch cut singularities for real timelike momenta and are positivity violating.

HK 2: Hadronenstruktur und -spektroskopie

Zeit: Montag 14:00–16:00 Raum: RW 2

Gruppenbericht HK 2.1 Mo 14:00 RW 2

Near-threshold pion production in diproton reactions with polarized beams and target at ANKE-COSY — •Sergey Dymov for the ANKE-Collaboration — Physikalisches Institut II, Universität Erlangen-Nürnberg, 91058 Erlangen, Germany — Laboratory of Nuclear Problems, Joint Institute for Nuclear Research, 141980 Dubna, Russia

An extensive experimental program for the near-threshold pion production in diproton reactions is undertaken at the ANKE-COSY spectrometer (Jülich). The program is aiming at isolating of the four-nucleon-pion contact interaction term appearing in the χPT expansions of these processes. This will establish links between the pion production and other low energy phenomena within the χPT approach.

The first step in the program was to measure the differential cross-section and the vector analysing power in the $pp \to \{pp\}_s\pi^0$ and $pn \to \{pp\}_s\pi^-$ processes in the full angular range. These data allowed for partial wave analysis applying Watson's theorem. To make the analysis more robust and independent of the uncertainties of the relative normalization, the spin correlation coefficients $A_{x,x}$ and $A_{y,y}$ in the $pn \to \{pp\}_s\pi^-$ process were measured in the following experiment. The first results of the data analysis will be presented and the further development of the program discussed.

This work is supported by the COSY-FFE program.

HK 2.2 Mo 14:30 RW 2

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 — Institut für Kernphysik, Forschungszentrum Jülich, 52425 Jülich, Germany — DLNP, JINR, Joliot-Curie 6, 141980 Dubna, Moscow region, Russia

A kinematically complete double polarization measurement of the $pn \to \{pp\}_s\pi^-$ process near the threshold has been performed recently at the ANKE-COSY spectrometer (Jülich). The experiment aimed to determine the spin correlation coefficients $A_{x,x}$ and $A_{y,y}$ in this process. These results will fascilitate further development of χPT in this 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. The first results of the data analysis will be presented.

Supported by the COSY-FFE program.

HK 2.3 Mo 14:45 RW 2

Effects of a spin-flavour dependent interaction on the baryon mass spectrum — •Michael Ronniger and Bernard Ch. Metsch — University Bonn, Germany

The effective quark interaction in a relativistically covariant constituent quark model based on the Salpeter equation is supplemented by an extra phenomenological flavour dependent force in order to account for some discrepancies mainly in the description of excited negative parity Δ resonances. Simultaneously an improved description of some other features of the light-flavoured baryon mass spectrum and of some electromagnetic form factors is obtained.

HK 2.4 Mo 15:00 RW 2

Excitation of the $\Delta(1232)$ isobar in deuteron charge exchange on hydrogen at 1.6, 1.8 and 2.3 GeV — •David Mchedlishvili for the ANKE-Collaboration — Institut für Kernphysik, Forschungszentrum Jülich, D-52425 Jülich, Germany

Deuteron charge-exchange break-up $\vec{d}p \to \{pp\}n$, where the final $\{pp\}$ diproton system is at very low excitation energy and hence in the $^1S_0$ state, is a powerful tool to probe the spin-flip terms in the proton-neutron charge-exchange reaction. Recent measurements with the ANKE spectrometer at the COSY storage ring at 1.6, 1.8, and 2.3 GeV have extended this study into the pion-production regime in order to investigate the excitation of the $\Delta(1232)$ isobar in the $dp \to \{pp\}\Delta^0$ reaction. Values of the differential cross section and two deuteron tensor analysing powers, A_{xx} and A_{yy}, have been extracted in terms of the diproton production angle or Δ^0 invariant mass. These data can be interpreted in impulse approximation in terms of the spin-longitudinal or spin-transverse contributions to the elementary $\vec{n}p \to \vec{p}\Delta^0$ process. However, the existence of the another contributory mechanism at low mass region will also be demonstrated. The presented results will be compared to those obtained with the SPES-4 spectrometer at Saclay at 2 GeV.

Supported by the COSY-FFE program.

HK 2.5 Mo 15:15 RW 2

Absolute measurement of the differential cross section for pp elastic scattering at ANKE-COSY — •David Chiladze for the ANKE-Collaboration — High Energy Physics Institute, Tbilisi State University, 0186 Tbilisi, Georgia — Institute für Kernphysik, Forschungszentrum Jülich, 52425 Jülich, Germany

Very little is known experimentally on proton-proton elastic scattering in the energy range from 1.6 to 2.8 GeV for centre-of-mass angles between about 10 and 30 degrees. The differential cross section data that do exist seem to fall systematically below the predictions of the SAID data analysis program. Measurements in this kinematical region are possible at the ANKE spectrometer, which is situated inside the COSY-Jülich storage ring. The fast proton that is scattered at small angles is registered in the Forward Detection system and the slow recoil proton emerging at large angles is measured in one of the Silicon Tracking Telescopes.

The ANKE collaboration and the COSY machine crew have jointly developed a very accurate method for determining the absolute luminosity in an experiment at an internal target position. The technique relies on measuring the energy losses due to the electromagnetic interactions of the beam as it passes repeatedly through the target and this can be done by studying the Schottky spectrum. This powerful technique allows one to measure the absolute differential cross section for elastic pp scattering with high precision.

Preliminary results from this experiments will be presented.

Supported by COSY-FFE and SRNSF.

HK 2.6 Mo 15:30 RW 2

Simulation and data analysis with the BGO-OD experiment* — •Thomas Jude for the BGO-OD-Collaboration — Physikalisches Institut, Universität Bonn

The new BGO-OD experiment at the ELSA accelerator facility, Bonn, is approaching the end of the commissioning phase, with data taking expected in 2012. The experiment consists of the highly segmented BGO-Ball with a particle tracking spectrometer at forward angles. The BGO-Ball is ideal for the identification of multi-photon final states with accurate time and energy resolution. The forward spectrometer comprises of a magnetic field with a series of tracking detectors, drift chambers and time of flight walls, allowing precise momentum reconstruction of forward travelling particles.

Analysis and comparison of simulated and measured data will be presented. This includes particle momentum reconstruction with the BGO-Ball, and the tracking of particles and subsequent momenta reconstruction using the forward spectrometer. A new K^+ identification method using the BGO-Ball will also be presented. The K^+ is identified from the time delayed, weak decay within the BGO-Ball crystals. This greatly increases the acceptance region for strangeness and vector meson photoproduction channels.

*Supported by DFG (SFB/TR-16).

HK 2.7 Mo 15:45 RW 2

Einfluss elastischer $p\bar{p}$ Streuprozesse auf die inneren Spurdetektorsysteme bei PANDA* — •Thomas Würschig für die PANDA-Kollaboration — Helmholtz-Institut fuer Strahlen- und Kernphysik, Rheinische Friedrich-Wilhelms-Universität Bonn, Nussallee 14-16, D-53115, Bonn, Germany

Das PANDA-Experiment an FAIR wird unter Verwendung sehr intensiver Antiprotonen-Strahlen und einem festen internen Target hoher räumlicher Dichte einzigartige Untersuchungen zum besseren Verständnis der starken Wechselwirkung und der Struktur von Hadronen ermöglichen. Die inneren Spurdetektorsysteme spielen eine wichtige Rolle im Rahmen des Gesamtdetektorkonzepts bei PANDA. Ein entscheidender Punkt zur Erfüllung der geforderten Detektor-Performance ist die Gewährleistung einer verlustfreie Messung bei einer sehr hohen Wechselwirkungsrate von bis zu $2 \cdot 10^7$/s. Auf Grund des hohen Wirkungsquerschnitts (20% bis 40% bzgl. des totalen $p\bar{p}$

Wirkungsquerschnitts) ist eine genaue Untersuchung des elastischen Streuprozesses notwendig, um den Einfluss der dabei erzeugten langsamen Rückstoßprotonen abschätzen zu können. Im Vortrag werden die Ergebnisse umfangreicher Simulationen mit einem geeigneten Ereignisgenerator präsentiert. Dies beinhaltet auch die Evaluierung der generierten Teilchenverteilungen durch vorhandene experimentelle Daten.

* gefördert durch BMBF

HK 3: Astroteilchenphysik

Zeit: Montag 14:00–16:00 Raum: RW 3

Gruppenbericht HK 3.1 Mo 14:00 RW 3

The Double Chooz Reactor Antineutrino Experiment — •Bernd Reinhold for the Double Chooz-Collaboration — Max-Planck-Institut für Kernphysik

Double Chooz is a reactor neutrino experiment that aims at a precise measurement of the last unknown neutrino mixing angle θ_{13}. This is conducted by investigating a deficit of electron anti-neutrinos from a nuclear power station at Chooz (France). The observation of θ_{13} is moreover important since this value impacts a feasibility of a future measurement of the leptonic CP violation parameter.

The 1 km baseline experiment with reactor neutrinos is advantageous in that this leads to a simple 2 flavor neutrino oscillation formalism, where the clean measurement of θ_{13} is achievable. To fulfill precisely a θ_{13} observation, reduction of possible uncertainties and suppression of backgrounds are required. Double Chooz utilizes various techniques for these aspects including two identical detectors at different baselines with each composed of four-layer liquid structure. The goal of Double Chooz is to measure $\sin^2 2\theta_{13}$ with a sensitivity of 0.03 at 90 % confidence level. The construction of the Double Chooz far detector was successfully completed that is placed at 1 km baseline, and its physics data-taking was started in spring, 2011. In this talk, the experimental concept, results of the first neutrino oscillation analysis, and future prospects of Double Chooz will be presented.

HK 3.2 Mo 14:30 RW 3

Selektion von Neutrinoereignissen beim Double Chooz Experiment — •Ruth Herbertz, Sebastian Lucht, Marcel Rosenthal, Stefan Roth, Stefan Schoppmann, Manuel Schumann, Achim Stahl, Anselm Stüken und Christopher Wiebusch — RWTH Aachen University, Germany

Um den kleinen Neutrinomischungswinkel θ_{13} mit dem Reaktorneutrinoexperiment Double Chooz zu bestimmen, muss der absolute Neutrinofluss mit höchster Präzision bestimmt werden. Hierzu werden die gemessenen Ereignisse im Detektor auf verschiedene Eigenschaften, wie bspw. Energiedeposition und Zeitabstand zum nächsten Ereignis, welche für ein Neutrinoereignis gut bekannt sind, untersucht und gefiltert. Das Ziel ist es, unerwünschte Ereignisse wie Muonendurchgänge und radioaktive Zerfälle zu verwerfen. Die Herausforderung besteht darin, echte Neutrinoereignisse von zufälligen Koinzidenzen aus dem Untergrund zu unterscheiden. Dabei sollen die Schnitte effizient sein, d.h. soviel wie möglich Untergrund eliminieren, aber auch sicher, also so wenig echte Neutrinoereignisse wie möglich verwerfen. In diesem Vortrag werden die Schnitte und ihre Auswirkungen auf die Selektion von Neutrinoereignissen vorgestellt.

HK 3.3 Mo 14:45 RW 3

Schnelle Neutronen als Untergrund im Double Chooz Experiment — •Conradin Langbrandtner für die Double Chooz-Kollaboration — Max-Planck-Institut für Kernphysik,Saupfercheckweg 1,69117 Heidelberg

Schnelle Neutronen (fast neutrons) entstehen durch die Wechselwirkung kosmischer Myonen mit dem Gestein um den Double Chooz Detektor und können in dem Szintillationsdetektor ein korreliertes Untergrundsignal, ähnlich dem der Neutrinoereignisse, erzeugen.

Da Schnelle Neutronen zu den dominierenden Untergrundarten des Double Chooz Experimentes gehören, ist ein sehr gutes Verständnis dieses Untergrundes unerlässlich.

Dieser Vortrag will die Möglichkeiten aufzeigen, mit denen Double Chooz diesen Untergrund unterdrücken und die verbleibende Untergrundrate möglichst genau bestimmen kann.

HK 3.4 Mo 15:00 RW 3

Correlated and Accidential Background induced by Radioimpurities in Double Chooz — •Michael Franke, Franz von Feilitzsch, Marianne Göger-Neff, Martin Hofmann, Lothar Oberauer, Patrick Pfahler, Walter Potzel, Stefan Schönert, and Vincenz Zimmer — Lehrstuhl E15, Technische Universität München

Since April 2011, the reactor $\bar{\nu}_e$ disappearance experiment Double Chooz is successfully taking data with the far detector. To allow a measurement of the neutrino mixing angle ϑ_{13}, the precise determination of the $\bar{\nu}_e$ flux and its spectral shape is important. To achieve the desired precision, several sources of background have to be taken into account and investigated. The talk will focus on the background induced by radioactivity in the detector. The major contribution comes from accidential $\bar{\nu}_e$-like events and (α, n) reactions on ^{13}C as part of the correlated background. The selection cuts applied to the raw data to extract the events of interest will be presented, as well as the BiPo coincidences search. The latter method shows that the radiopurity in Double Chooz is well within the specifications of less than $10^{-13}\ \frac{g}{g}$ of U and Th in all parts of the inner detector. The rate of accidential coincidences is far below the design goal of one event per day, too. However, these events cannot be neglected for an measurement of ϑ_{13} and have to be addressed in further ongoing studies.

This work has been supported by founds of the DFG (Transregio 27: Neutrinos and beyond), the Excellence Cluster Universe and the Maier-Leibnitz-Laboratorium Garching.

HK 3.5 Mo 15:15 RW 3

Erste Ergebnisse zur Messung von θ_{13} mit dem Double Chooz Experiment — •Anselm Stüken für die Double Chooz-Kollaboration — RWTH Aachen University, Germany

Das Reaktorneutrinoexperiment Double Chooz soll den letzten unbekannten Mischungswinkel θ_{13} der Neutrino-Mischungsmatrix bestimmen. Die ersten Ergebnisse zur Bestimmung von θ_{13} wurden im November 2011 vorgestellt. In Kombination mit den Ergebnissen des T2K und MINOS Experiments konnte der Wert für $\theta_{13} = 0$ mit einer Wahrscheinlichkeit von 99.8 % ausgeschlossen werden.

Da Vorgängerexperimente nur eine Obergrenze für θ_{13} liefern konnten, wurde das Double Chooz Experiment als Präzisionsexperiment entworfen. Dies erfordert unter anderem ein Triggersystem, das eine hocheffiziente Triggerentscheidung für Neutrinoereignisse liefert.

Das Triggersystem überwacht kontinuierlich die analogen Signale des Detektors. Es trifft auf Grund von überschrittenen Diskriminatorschwellen und Multiplizitätsbedingungen eine Vorentscheidung über die im Detektor deponierte Energie, die zur Datennahme führt.

In diesem Vortrag soll die Analyse zur Bestimmung von θ_{13} und die ersten Ergebnisse vorgestellt werden. Der Fokus liegt hierbei auf der Bestimmung der Triggereffizienz und dessen Einfluss auf die Analyse.

HK 3.6 Mo 15:30 RW 3

Thermal Leptogenesis – Towards a complete quantum mechanical calculation in a thermal bath — •Janine Hütig, Sebastian Mendizabal, and Owe Philipsen — Institut für Theoretische Physik, Goethe Universität Frankfurt, Deutschland

The observed baryon asymmetry of the universe is well described by the scenario of thermal leptogenesis, where the out-of-equilibrium decay of a heavy majorana neutrino in the plasma of the early universe causes a lepton asymmetry which is later converted to baryons. This picture is consistent with neutrino oscillation experiments and also explains the smallness of the ordinary neutrino mass. Via Kadanoff-Baym equations one can compute the lepton asymmetry completely in a quantum mechanical way. However, the current results have an uncertainty of at least one order of magnitude, since gauge interactions with the thermal bath are not included. In this talk the important contributions are shown and the results are compared with the previous ones.

HK 3.7 Mo 15:45 RW 3

Majorana Demonstrator Project Overview and Status —

•Florian Fraenkle for the Majorana-Collaboration — Department of Physics, University of North Carolina, Chapel Hill, NC, USA — Triangle Universities Nuclear Laboratory, Durham, NC, USA

The Majorana Demonstrator is a mixed array of enriched and natural high-purity germanium p-type point-contact detectors (P-PC HPGe) that will search for the neutrinoless double beta decay ($0\nu\beta\beta$) of the ^{76}Ge isotope. The instrument is composed of two cryostats built from ultra-pure electroformed copper, each containing 20 kg of HPGe detectors. Goals of the Demonstrator are to demonstrate the feasibility of achieving a background rate below one count/tonne/year in the 4 keV region of interest around the 2039 keV Q-value of the ^{76}Ge $0\nu\beta\beta$-decay and to demonstrate technical and engineering scalability toward a tonne-scale instrument. The talk will give an overview of the project and the current status.

HK 4: Instrumentation

Zeit: Montag 14:00–16:00 Raum: P 2

Gruppenbericht HK 4.1 Mo 14:00 P 2

Development of the CBM Silicon Tracking System — •Johann M. Heuser for the CBM-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt

The Silicon Tracking System (STS) is the central detector of the CBM experiment. Its task is the standalone trajectory reconstruction of the high multiplicities of charged particles originating from high-rate beam-target interactions, including momentum determination in a magnetic dipole field. The detector system shall be operational from the start of the CBM physics program at SIS-100, and later at SIS-300. The development of the STS is challenging. The silicon microstrip detectors must be radiation hard and operated at low temperature. Fast self-triggering front-end electronics is needed to send time-stamped detector data to an on-line event processor. High-density electronics boards are required to handle the large number of readout channels. A low-mass construction must be achieved avoiding the front-end electronics, cooling and cabling infrastructure in the aperture. In the presentation I will outline the conceptional layout of the STS, elaborate on the mechanical constraints, describe the expected radiation environment, and summarize the implications for the development of the detector components and their integration into the tracking system. Progress with the STS project will be shown, including the development of silicon microstrip detectors, front-end electronics and mechanical designs, as well as performance studies and in-beam tests of prototypes. Supported by EU-FP7 HadronPhysics3.

HK 4.2 Mo 14:30 P 2

Development of radiation hard silicon microstrip detectors for the CBM experiment — •Minni Singla for the CBM-Collaboration — Goethe University, Frankfurt, Germany

We aim to develop low noise radiation hard Double Sided silicon Strip Detectors (DSSDs) for the CBM Silicon Tracking System (STS). The neutron fluence is expected to reach 1×10^{14} $n_{eq}cm^{-2}$ for some of the STS stations which puts us in the regime of LHC, high energy physics experiments. However our task is much more challenging since we use DSSDs, hence both detectors sides should be operating at such high fluences. In order to investigate the life time of DSSDs, it is imperative to extract charge collection efficiency (CCE) as a function of fluence for which one has to understand strip isolation in particular on the ohmic side. Hence we are exploring various isolation techniques, for example P-stop, P-Spray, Combined P-stop/P-spray (conventional techniques) and also a new isolation technique (Schottky barrier). Four detector designs having these isolation techniques have been fabricated at CiS, Erfurt and are being studied at GSI after neutron irradiation. Some interesting static and dynamic measurements have been done within our group to compare the isolation provided by Schottky barrier and conventional isolation techniques. A simulation model has also been developed which is able to reproduce the experimental observations. We plan to test these DSSDs in beam and to compare these isoltaion techniques in terms of CCE. Supported by EU-FP7 HadronPhysics3, HiC for FAIR and HGS-HIRe for FAIR.

HK 4.3 Mo 14:45 P 2

Radiation damage modelling for developing an operating scenario for the microstrip detectors in the CBM experiment — •Sudeep Chatterji for the CBM-Collaboration — GSI, Darmstadt, Germany

We present the first 3-D TCAD simulated results on Double Sided silicon Strip Detectors(DSSDs) using tools from SYNOPSYS. To determine the radiation hardness of these sensors, we have irradiated some of the prototypes at KRI Cyclotron facility, Russia. Our radiation damage model implemented in TCAD simulations is able to reproduce the irradiated data. Besides the static measurements, we have also extracted interstrip parameters relevant to understand strip isolation and cross-talk issues. Transient simulations have been performed to estimate the charge collection of irradiated sensors and the collected charge has been found to exactly mimic the variation of measured interstrip resistance with bias voltage. The extraced charge collection efficiency has been compared with test beam data. Controlled thermal annealing of irradiated DSSDs have been done to extract the beneficial and reverse annealing time constants and compared with Ziock parameterization. These time constants have been used to develop an operating scenario to understand the evolution of full depletion voltage with periods of annealing expected between the CBM data taking runs. Supported by EU-FP7 HadronPhysics3.

HK 4.4 Mo 15:00 P 2

A Multistrip-MRPC prototype for the CBM Time-of-Flight wall — •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 45 AGeV is a time-of-flight wall placed at 10 m distance from the target covering the polar angular range from 2.5°-25° and full azimuth. The necessary particle identification capabilities require a 80 ps system time resolution at high efficiency and, simultaneously, a rate capability of up to 25 kHz/cm^2. The existing conceptual design foresees a 120 m^2 ToF-wall composed of Multi-gap Resistive Plate Chambers (MRPC) of which the outer-most part can be covered most likely with float glass RPCs in a multi-strip configuration. Based on in-beam tests at GSI/SIS18 at Darmstadt and COSY at Jülich we will present results on the performance reached with a fully differential multi-strip MRPC prototype with normal float glass developed at the Physikalisches Institut at University of Heidelberg.
Supported by EU/FP7 WP2; BMBF 06HD9121I.

HK 4.5 Mo 15:15 P 2

Ceramic Resitive Plate Chambers for High Rate Environments — •Laso Garcia Alejandro, Kämpfer Burkhard, Kaspar Markus, Kotte Roland, Peschke Richard, Stach Daniel, Wendisch Christian, and Wüstenfeld Jörn for the CBM-Collaboration — Helmholtz Zentrum Dresden-Rossendorf

Multi-gap resistive plate chambers will be used to build the Time of Flight wall of the Compressed Baryonic Matter experiment (CBM) at FAIR with a time resolution better than 80 ps. The high fluxes expected at the innermost part of the detector, 20 x 10^3 cm^{-2} s^{-1} have made necessary the development of new materials capable of withstanding such fluxes.

At Helmholtz Zentrum Dresden-Rossendorf, several RPC prototypes of 10x10 cm^2 and 20x20 cm^2 have been built with ceramic plates with bulk resistivities in the range of 10^9-10^{10} Ohm cm [1]. They have been tested at the superconducting electron accelerator facility ELBE with 30 MeV electrons and at COSY, Jülich, with 2.7 Gev/c protons.

We will present characteristics of the ceramic electrodes and the latest results concerning the performance of these prototypes in electron and proton beams up to fluxes of 10^6 cm^{-2} s^{-1}.

[1] L. Naumann et al., NIMA 628(2011) 138-141

HK 4.6 Mo 15:30 P 2

A 200 cm × 50 cm large multigap resistive plate chamber based neutron detector — •Dmitry Yakorev[1], Marko Röder[2], Zoltán Elekes[1], Daniel Bemmerer[1], Thomas Cowan[1,2], Mathias Kempe[1], Manfred Sobiella[1], Daniel Stach[1], An-

dreas Wagner[1], and Kai Zuber[2] — [1]Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Dresden — [2]TU Dresden

A prototype for a multigap resistive plate chamber (MRPC) based detector of 200 cm × 50 cm size for 1 GeV neutrons has been developed, built and tested. The principle of operation is (1) the conversion of the high-energy neutron to a charged particle in an iron converter, and (2) the detection of the charged particle in the MRPC. Experiments using the single-electron mode of operation of the ELBE 40 MeV electron accelerator showed that a time resolution of σ_t<100 ps was reached for minimum-ionizing particles, at nearly full efficiency. Extensive simulations show that it is feasible to construct a time-of-flight detector for GeV neutrons based on such a principle. — Supported by BMBF (06DR9058I) and GSI FuE (DR-GROS and DR-ZUBE).

HK 4.7 Mo 15:45 P 2

Simulation of a new endcap time of flight system for the BESIII experiment — •Matthias Ullrich, Hu Jifeng, Wolfgang Kühn, Sören Lange, Yutie Liang, Björn Spruck, and Marcel Werner for the BES III-Collaboration — 2 Physikalisches Institut, Universität Gießen

The BESIII experiment is located at the BEPC II collider in Beijing, China at the Institute for High Energy Physics, commonly known as IHEP. The symmetric e^+e^- experiment optimized for the investigation of τ and charm physics has allready collected over 220M J/Ψ, 106M $\Psi(2S)$, about $1 fb^{-1}$ $\Psi(3770)$ and 0.5 fb^{-1} $\Psi(4040)$ events. Finishing the next run period in June 2012 the total amount of J/Ψ / $\Psi(2S)$ events is expected to be 1 billion / 0.7 billion, respectively.

The actual endcap time of flight detector has a total time resolution of about 138 ps and is discussed to be replaced by a multigap resistive plate chamber (MRPC) providing a total time resolution of less than 80 ps.

We report about the implementation of such type of detector into the BESIII offline software system (BOSS) as replacement of the actual endcap time of flight detector. A detailed simulation code based on Geant4 as well as a full reconstruction code has been implemented and can easily be utilized for event simulation and reconstruction.

HK 5: Instrumentation

Zeit: Montag 14:00–16:00 Raum: P 3

Gruppenbericht HK 5.1 Mo 14:00 P 3

Testmessungen mit einem Prototypen der Vorwärtsendkappe des elektromagnetischen Kalorimeters des PANDA-Experiments — •Malte Albrecht für die PANDA-Kollaboration — Ruhr-Universität Bochum

An der im Bau befindlichen Beschleunigeranlage FAIR wird am Antiproton-Speicherring HESR das PANDA-Experiment aufgebaut. Die Antiprotonen aus dem HESR-Beschleuniger werden mit Impulsen zwischen 1,5 und 15 GeV/c auf ein ruhendes Wasserstofftarget geschossen, wobei eine maximale Luminosität von $2 \cdot 10^{32} \mathrm{cm}^{-2} \mathrm{s}^{-1}$ erreicht wird. Das elektromagnetische Kalorimeter für das PANDA-Experiment wird mit Bleiwolframat-Kristallen bestückt, welche auf −25°C heruntergekühlt werden, um die Lichtausbeute zu erhöhen. Mit dem Kalorimeter werden später Photonenenergien bis 15 GeV gemessen. Die durchschnittliche Ereignisrate bei der maximalen Luminosität wird für die strahlnächsten Kristalle des Kalorimeters bei $5 \cdot 10^5\,\mathrm{s}^{-1}$ liegen.

Ein aus 216 Kristallen bestehender Prototyp der Vorwärtsendkappe wurde aufgebaut und getestet. Ergebnisse der Teststrahlzeiten am SPS-Beschleuniger am CERN sowie am ELSA-Beschleuniger in Bonn werden vorgestellt. Während am CERN bei den für PANDA höchsten Energien (bis 15 GeV) gemessen wurde, zielten die Messungen am ELSA-Beschleuniger vor allem auf hohe Ereignisraten von bis zu 2 MHz ab.

Gefördert durch das BMBF und die EU.

HK 5.2 Mo 14:30 P 3

Response of the Prototype for the PANDA Barrel EMC to 15 GeV Positrons* — •Markus Moritz, Daniel Bremer, Tobias Eissner, Peter Drexler, and Rainer Novotny for the PANDA-Collaboration — 2. Physikalisches Institut, Universität Giessen

The electromagnetic calorimeter of the PANDA target spectrometer is one of the central detector components to achieve the proposed physical goals, in particular due to the expected performance and efficiency for photons and electrons over a extremely wide energy range. Beside a good energy resolution of the device based on lead tungstate, it is necessary as well to achieve a sufficient position and time information. Therefore, detailed tests of prototypes are necessary. The talk will present the results of a test performed at CERN SPS with the prototype PROTO60, which represents a subsection of the barrel detector and consists of a 6 × 10 matrix of tapered crystals. A 15 GeV positron beam was used impinging at different positions. The report describes the analysis procedure, including the calibration with cosmic muons and muon beam, algorithms for position reconstruction and applied corrections. It finally summarizes the achieved results with respect to energy, position and time resolution.

*Work supported by BMBF, GSI and HIC for FAIR

HK 5.3 Mo 14:45 P 3

Tests von Photodetektoren für das PANDA-EMC — •Tobias Triffterer für die PANDA-Kollaboration — Ruhr-Universität Bochum

Für die Vorwärts-Endkappe des elektromagnetischen Kalorimeters des PANDA-Detektors am zukünftigen Antiprotonen-Speicherring HESR an FAIR werden Einzelkristallraten von bis zu $2 \cdot 10^6\,\mathrm{s}^{-1}$ erwartet, welche die in einem Magnetfeld von bis zu 1,2 T betriebenen Photodetektoren verarbeiten können müssen. Daher wurden vier Typen von Photodetektoren (Vakuum-Phototrioden, Vakuum-Phototetroden von zwei verschiedenen Herstellern sowie Avalanche-Photodioden) auf ihre Eignung untersucht. Dabei wurde die gesamte Auslesekette vom Photodetektor über den Vorverstärker und Shaper bis zum ADC getestet.

Die Ergebnisse von Ratentests mit einem Lichtpulser im Labor sowie von Strahltests mit getaggten Photonen am ELSA-Beschleuniger in Bonn mit Raten von $100 \cdot 10^3\ \mathrm{s}^{-1}$ bis $1{,}8 \cdot 10^6\ \mathrm{s}^{-1}$ sowie die Ergebnisse von Labortests in einem Magnetfeld von 1,7 T werden präsentiert. Basierend auf den Messergebnissen konnte die Ausleseelektronik optimiert werden.

Gefördert durch das BMBF und die EU.

HK 5.4 Mo 15:00 P 3

Aspects and Implementation of Stimulated Recovery for the PANDA EMC * — •Till Kuske, Valera Dormenev, Rainer Novotny, and Rene Schubert for the PANDA-Collaboration — 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 new results of the stimulated recovery under light illumination with different intensity in parallel (online mode) and after (offline mode) γ-irradiation at different temperatures is presented. The possible implementation of the stimulated recovery in both modes for the PANDA EMC is discussed. A recovery model based on the results will be presented.

*The work is supported by BMBF.

HK 5.5 Mo 15:15 P 3

Investigation of PANDA EMC modules in a realistic high rate environment — •Marcel Werner, Wolfgang Kühn, Sören Lange, and Björn Spruck for the PANDA-Collaboration — II. Physikalisches Institut, JLU Gießen

The PANDA experiment is expected to start its physics program within the next decade with the goal to study hadron physics in the charm region. The experiment imposes high requirements on the performance of the single detector parts of PANDA, tests of the detector subsystems are indispensable.

The installation of a Zero Degree Detector (ZDD) at the Bes III experiment, Beijing, China, using PANDA-type PWO crystals with the purpose of studying the radiative return, offers a unique opportunity to study the PANDA EMC DAQ chain in detail in a realistic high rate environment. As the available space for the ZDD at Bes III is very 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 information and ZDD information, to pick out events of interest is necessary to handle the expected event rates (O(MHz)). The Compute Node developed for PANDA by the Institute of High Energy Physics (IHEP) at Beijing and the university of Giessen is suitable to handle these tasks.

This work was supported in part by BMBF under grant number 06GI 9107I PANDA and HIC For FAIR.

HK 5.6 Mo 15:30 P 3

Characterisation of a 3x3 Prototype of the Forward Shashlyk EMC of the PANDA detector with photons up to 770 MeV — Stefan Diehl[1], Daniel Bremer[1], Peter Drexler[1], Pavel Semenov[2], •Rainer Novotny[1], Tobias Eissner[1], and Valery Dormenev[1] for the PANDA-Collaboration — [1]2nd Physics Institute, University Giessen, Germany — [2]IHEP Protvino, Russia

The PANDA detector at the future FAIR facility will be used for hadron physics experiments with cooled antiprotons. The detection of high-energetic photons up to 15GeV energy is one of the main tasks, since most of the envisaged physics channels are accompanied by primary or secondary photons. Therefore, a nearly 4 π coverage is mandatory Complementary to the Target-EMC, comprised of $PbWO_4$ scintillation crystals, the most forward region is covered by a sampling calorimeter of Shashlyk-type. The individual modules consists of several layers of led and plastic scintillator tiles, which are sandwiched together and read out via wavelength shifting (WLS) fibers which are guided through the holes in the lead and scintillator layers, respectively, and read out by photomultipliers at the rear end. The talk will present the results of a response test of a 3x3 prototype matrix developed and build at BTCP, Protvino. The measurement was performed with tagged photons in the energy range between 100 and 770MeV, respectively, at the Mainz Mictrotron (MAMI). The talk will focus primarily on the energy resolution depending on the point of impact of the photon beam. The results are compared to Monte-Carlo simulations and complementary studies at several GeV energy.

HK 5.7 Mo 15:45 P 3

Performances of the HADES electromagnetic calorimeter* — •Kirill Lapidus for the HADES-Collaboration — TU München, Boltzmannstr. 2, 85748 Garching, Germany

The **H**igh **A**cceptance **Di**-**E**lectron **S**pectrometer is a multipurpose detector located at the GSI Helmholtzzentrum. An electromagnetic calorimeter for the HADES experiment is currently under construction. The calorimeter allows to reconstruct photons and improves the purity of the electron/positron identification at high momenta ($p > 0.5$ GeV/c).

Realistic simulations of the calorimeter performance, based on results of experimental tests, will be presented. First, it will be shown that the proposed calorimeter gives access to a variety of interesting physics channels, including production of rare strange resonances, in pion-proton and proton-proton reactions. Afterwards, π^0, η reconstruction and the electron-pion separation in heavy-ion reactions at 2–8 AGeV will be discussed.

*Supported by BMBF and Excellence Cluster "Universe".

HK 6: Struktur und Dynamik von Kernen

Zeit: Montag 14:00–16:00 Raum: P 4

Gruppenbericht HK 6.1 Mo 14:00 P 4

Simultaneous Lifetime and Magnetic Moment Measurements — •Desiree Radeck[1,2], Volker Werner[2], Gabriela Ilie[2], Nathan Cooper[2], Vassia Anagnostatou[2], Tan Ahn[2], Christian Bernards[1,2], Linus Bettermann[1,2], Robert Casperson[2], Raphael Chevrier[2], Andreas Heinz[2], Matthew Hinton[2], Jan Jolie[1], Dave McCarthy[2], and Elizabeth Williams[2] — [1]IKP, Universität zu Köln — [2]WNSL, Yale University, USA

Lifetime measurements of excited states are essential for understanding nuclear structure. Another important observable are magnetic moments that provide information on the microscopic structure of excited states. We present a technique that allows the simultaneous measurement of lifetimes and g factors. By using projectile Coulomb excitation in combination with a plunger setup, lifetimes in the ps region can be determined by employing the well-established RDDS method. The time-dependent deorientation of nuclei in their excited state is measured directly for the deorientation correction in the lifetime analysis. This determination also allows to calibrate parameters of the hyperfine interaction. Under the same experimental conditions, g factors of excited states in an isotopic chain can be measured relative to each other in parallel to the determination of their lifetimes using this g-Plunger technique. The method was succesfully tested at WNSL with stable Ru and Pd isotopes. The technique is introduced, results on the isotopes ^{96,98,104}Ru are presented, and challenges and applications of the method are discussed. Supported by U.S. DOE, Grant DE-FG02-91ER-40609. D.R. thanks the DAAD for financial support.

HK 6.2 Mo 14:30 P 4

Dipolanregungen und Paritäten in ^{48}Ca — •Vera Derya[1], Janis Endres[1], Muhsin N. Harakeh[2], Deniz Savran[3,4], Heinrich J. Wörtche[2] und Andreas Zilges[1] — [1]Institut für Kernphysik, Universität zu Köln — [2]Kernfysisch Versneller Instituut, Rijksuniversiteit Groningen, Niederlande — [3]ExtreMe Matter Institute EMMI and Research Division, GSI — [4]Frankfurt Institute for Advanced Studies

Dipolanregungen im doppelt-magischen Kern ^{48}Ca wurden bis zur Neutronenseparationsenergie in Kernresonanzfluoreszenzexperimenten untersucht [1]. Um die Natur der Anregungen zu klären, ist die Verwendung komplementärer Sonden erforderlich. Daher wurde ein $(\alpha, \alpha'\gamma)$-Koinzidenzexperiment am Big-Bite Spektrometer des Kernfysisch Versneller Instituuts in Groningen (Niederlande) durchgeführt. In vorherigen Messungen konnte gezeigt werden, dass die Kombination der genannten experimentellen Methoden Einblick in die Struktur von $E1$-Anregungen, in diesem Fall der Pygmydipolresonanz, gibt [2,3].

Durch erste Ergebnisse motiviert, wurden in einem $(\vec{\gamma}, \gamma')$-Experiment an der HI$\vec{\gamma}$S facility der Duke University in Durham (USA), ergänzend die Paritäten von $(J = 1)$-Zuständen bestimmt.

Gefördert durch die DFG (ZI 510/4-1), EURONS und die Helmholtz Alliance EMMI. V.D. ist Mitglied der Bonn-Cologne Graduate School of Physics and Astronomy.

[1] T. Hartmann *et al.*, Phys. Rev. Lett. **93** (2004) 192501.
[2] D. Savran *et al.*, Phys. Rev. Lett. **97** (2006) 172502.
[3] J. Endres *et al.*, Phys. Rev. Lett. **105** (2010) 212503.

HK 6.3 Mo 14:45 P 4

Untersuchung der Dipolstärkeverteilung in ^{94}Zr bis 8.7 MeV* — •Markus Zweidinger[1], Jacob Beller[1], Matthias Fritzsche[1], Johann Isaak[1], Norbert Pietralla[1], Vladimir Yu. Ponomarev[1], Christopher Romig[1], Deniz Savran[2,3], Marcus Scheck[1] und Kerstin Sonnabend[4] — [1]Institut für Kernphysik, TU Darmstadt — [2]ExtreMe Matter Institute EMMI, Darmstadt — [3]Frankfurt Institute for Advanced Studies — [4]Institut für angewandte Physik, Goethe-Universität Frankfurt

Am Darmstädter supraleitenden Elektronen-Linearbeschleuniger S-DALINAC wurden Kernresonanzfluoreszenz-Experimente am Kern ^{94}Zr durchgeführt. Die Anregung der Targetkerne erfolgte mit Hilfe eines energie-kontinuierlichen Bremsstrahlungsspektrums mit Bremsstrahlungs-Endpunktsenergien von $E_0 = 5.4$, 6.7 und 8.3 MeV. Die resultierende Dipolantwort wurde mit großvolumigen HPGe-Detektoren spektroskopiert. Für eine Vielzahl der angeregten Zuständen konnte erstmaligst die Spinquantenzahl und die Übergangsstärke in den Grundzustand bestimmt werden. Die Ergebnisse werden in Bezug auf die Dipol-Stärkeverteilung diskutiert und mit Daten für das Isotop ^{96}Zr verglichen.

* Gefördert durch die DFG im Rahmen des SFB 634

HK 6.4 Mo 15:00 P 4

Dipolstärkeverteilung im nicht-magischen Isotop ^{130}Te* —

•Johann Isaak[1], J. Beller[1], N. Pietralla[1], C. Romig[1], D. Savran[2,3], M. Scheck[1], K. Sonnabend[4], A.P. Tonchev[5], W. Tornow[5], H.R. Weller[5] und M. 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 — [4]Institut für Angewandte Physik, Goethe-Universität Frankfurt am Main — [5]Duke University, Durham, 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 Dipolantwort des nicht-magischen Nuklids ^{130}Te untersucht. Hierzu wurden am DHIPS mit Hilfe eines kontinuierlichen Bremsstrahlungsspektrums mit Endpunktsenergien von E_0=6.2 und 8.5 MeV Zustände der Spinquantenzahl J=1 angeregt und deren Übergangsstärke in den Grundzustand bis zur Neutronenseparationsschwelle bei 8.4 MeV bestimmt. Ergänzend konnte an HI$\vec{\gamma}$S durch nahezu vollständig linear polarisierte Photonen im Eingangskanal dem Großteil der J=1 Zustände ihre Paritätsquantenzahl zugeordnet werden. Die Ergebnisse werden präsentiert und die Verteilung der Dipolstärke diskutiert.
*Gefördert durch die DFG im Rahmen des SFB 634.

HK 6.5 Mo 15:15 P 4

Investigation of low-energy dipole modes in the heavy deformed nucleus ^{154}Sm via inelastic polarized proton scattering at zero degree * — •Andreas Krugmann[1], Belash Bozorgian[1], Anna Maria Krumbholz[1], Dirk Martin[1], Peter von Neumann-Cosel[1], Norbert Pietralla[1], Iryna Poltoratska[1], Johannes Simonis[1], and Atsushi Tamii[2] — [1]Institut für Kernphysik, TU Darmstadt — [2]RCNP, Osaka University, Japan

A polarized proton scattering experiment has been performed on the heavy deformed nucleus ^{154}Sm at extreme forward angles with 300 MeV protons at RCNP, Osaka[1]. Our scientific goal is to investigate the impact of ground state deformation on the properties of the pygmy dipole resonance and the spin M1 resonance showing 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 as has been demonstrated for the case of ^{208}Pb [2]. We present first results of the angular distributions including zero degree and a preliminary analysis of polarization transfer observables.

[1] Experiment Proposal E350, RCNP, Osaka.
[2] 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 6.6 Mo 15:30 P 4

Dioplstärkeverteilung 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]Department of Physics,Graduate School of Science,Osaka University, Japan

Die inelastische Streuung polarisierter Protonen unter extremen Vorwärtswinkeln stellt ein leistungsfähiges Verfahren dar, um elektrische Dipol($E1$)- und magnetische Spin($M1$)-Anregungen mit hoher Energieauflösung insbesondere in doppelt magischen Kernen zu untersuchen. Das Experiment erlaubt die simultane Messung eines Energiebereichs von etwa 5 - 26 MeV. Deshalb kann die $E1$-Stärke vollständig bestimmt werden und damit die $E1$-Polarisierbarkeit. Daraus lässt sich die Dicke der Neutronenhaut des Kerns ermitteln, wie kürzlich am ^{208}Pb demonstriert [1]. Diese Untersuchungen sollen auf ^{48}Ca ausgedehnt werden. Dazu stehen Daten aus einem (p, p')-Experiment zur Verfügung [2]. Auf die Winkelversteilungen der Wirkungsquerschnitte wird eine Multipolentfaltung angewendet, um $E1$-, $E2$- und $M1$-Übergänge zu trennen und deren Stärken zu bestimmen. Die hierfür nötigen Übergangsamplituden liefern QRPA-Rechnungen. Erste Ergebnisse werden vorgestellt.

[1] A. Tamii, et al., Phys. Rev. Lett 107 (2011) 062502.
[2] H. Matsubara, PhD thesis, Osaka University, Japan (2009).

HK 6.7 Mo 15:45 P 4

Preparing a dedicated set up for level lifetime measurements using the Recoil Doppler Shift technique with fast radioactive beams — •M. Hackstein[1], C. Fransen[1], A. Dewald[1], A. Algora[6], F. Ameil[2], P. Boutachkov[2], N. Braun[1], T. Braunroth[1], A. Corsi[5], M. Doncel[6], A. Gadea[6], J. Gerl[2], J. Grebosz[2], G. Guastalla[2], T. Habermann[2], J. Jolie[1], N. Kurz[2], J. Litzinger[1], C. Louchar[5], E. Merchan[2], K. Moschner[1], C. Nociforo[2], A. Obertelli[5], M. Reese[4], P. Reiter[1], P. Petkov[3], M. Pfeiffer[1], S. Pietri[2], B. Quitana[2], W. Rother[1], J. Taprogge[1], A. Wendt[1], H. Wollersheim[2], and K.O. Zell[1] — [1]IKP, U. zu Köln, Germany — [2]KP II, GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany — [3]INRNE, Sofia, Bulgaria — [4]IKP, TU Darmstadt, Germany — [5]CEA Saclay, France — [6]Instituto de Fisica Corpuscular (IFIC), Valencia, Spain

In this paper we report on the development of a new plunger device especially designed to meet the constraints found at the fragment recoil separator (FRS) at GSI (Darmstadt) in combination with PRESPEC. The aim is to measure level lifetimes in the pico-second range using the recoil distance Doppler shift (RDDS) method of states in exotic nuclei excited via Coulomb excitation or knock-out reactions with radioactive beams at relativistic energies. We will also report on the first results obtained from a first commissioning run performed recently with a stable ^{54}Cr beam.

HK 7: Schwerionenkollisionen und QCD Phasen

Zeit: Montag 14:00–16:00 Raum: P 5

Gruppenbericht HK 7.1 Mo 14:00 P 5

Dilepton production at SIS energies with the GiBUU transport model — •Janus Weil and Ulrich Mosel — Institut für Theoretische Physik, Universität Giessen, Germany

We investigate dilepton production at SIS energies with the GiBUU transport code in a resonance model approach. In a first step, we fix the model input via dilepton spectra from elementary NN collisions (measured recently by the HADES collaboration) as well as other elementary data, paying special attention to meson production via baryon resonances (which is most important for the ρ). Subsequently, we investigate additional effects of the nuclear medium in pA and AA reactions, from collisional broadening and meson absorption to a possible in-medium mass-shift of the vector mesons. Work supported by HGS-HIRe and BMBF.

HK 7.2 Mo 14:30 P 5

The role of the ρ meson in the HADES dilepton mass spectra — •Claudia Behnke[1], Tetyana Galatyuk[1,2], and Joachim Stroth[1,3] — [1]Goethe-Universität, Frankfurt — [2]ExtreMe Matter Institute EMMI, Darmstadt — [3]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt

Photons and lepton pairs emerging from decays of virtual photons are the most promising probes for studying dense hadronic matter. In the energy domain of 1 - 2 GeV per nucleon, HADES has measured electron pairs in C+C, Ar+KCl, p+p, d+p and p+Nb collisions. For the first time, the electron pairs from quasi free n+p sub-reactions were reconstructed by detecting the proton spectator from the deuteron breakup. An experimentally constrained N+N reference spectrum was established. Moreover, for the first time at this energy the inclusive production cross sections of light vector mesons were extracted. These results allow for putting tight constraints on vector meson production in heavy-ion collisions at beam energies of few GeV per nucleon. In this contribution, we compare the HADES data to predictions from UrQMD microscopic transport model calculations and introduce an approach which allows to separate in a transparent way the generation of the event background from the emission pattern of physics observables under consideration.
This work has been supported by BMBF (06 FY 9100 I), HIC for FAIR, EMMI and GSI.

HK 7.3 Mo 14:45 P 5

Dielectron production in pp collisions at 7 TeV with ALICE — •Markus Konrad Köhler für die ALICE-Kollaboration — Research

Division and ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung, Planckstr.1

Low-mass dielectrons are a unique probe for the hot and dense medium which can be created in ultrarelativistic heavy-ion collisions. Since leptons do not interact strongly, they carry the information from all collision stages to the detector with negligible final-state interaction. Potential modifications of the medium, like phase transitions, could have measurable impact on the characteristics of dielectrons, where pp collisions can be used as reference for a medium-free environment.
In the ALICE experiment at the LHC, electrons can be identified at mid-rapidity in the central barrel due to their specific energy loss (ITS and TPC), transition radiation (TRD), and time-of-flight (TOF).
In this contribution the status of the low-mass dielectron analysis is presented for pp collisions at $\sqrt{s}$ =7 TeV.

HK 7.4 Mo 15:00 P 5

Production of Low Mass Dielectrons in Pb-Pb collisions at ALICE — •Christoph Baumann — Goethe-Universität Frankfurt

The measurement of low mass dielectrons allows to probe all stages of ultra-relativistic collision because electrons do not undergo strong interactions. Thus the search for thermal signatures of a hot and dense medium created in heavy-ion collisions at LHC becomes possible. We will present the status of such measurements in Pb-Pb collisions with ALICE at $\sqrt{s_{\rm NN}} = 2.76$ TeV and discuss possible thermal signatures, especially the search for an enhanced production of virtual photons.

HK 7.5 Mo 15:15 P 5

Magnetic field studies for the measurement of dielectrons with ALICE — •Ole Hinrichs for the ALICE-Collaboration — Institut für Kernphysik, Universität Frankfurt, Germany

The study of dielectrons is an important tool for obtaining information from all phases of ultra-relativistic collisions as they do not undergo strong interactions. The major obstacles in the measurement of dielectrons are the relatively small signal and large combinatorial background, such that one needs a large acceptance and a good particle identification at low transverse momentum. The latter two aspects can be improved by lowering the magnetic field in the central barrel of the ALICE detector from the nominal value of B=0.5T.
We present detailed studies with two different types of simulation to understand and quantify the effect of a reduced magnetic field. First, the full chain of simulation was used: pp collisions were generated with the event generator PYTHIA6 and propagated in a detailed simulation of the ALICE setup with GEANT3. Finally, the particles were reconstructed with the ALICE tracking software within AliRoot. As this procedure requires a huge amount of CPU-time a large number of events were produced with fast simulations. These are based on a parametrization of particle spectra and detector responses. The results of these simulations will be presented and confronted with available data.

HK 7.6 Mo 15:30 P 5

Measurement of the Nuclear Modification Factor of Electrons from Semileptonic Heavy Flavor Decays in PbPb Collisions with ALICE at the LHC — •Martin Völkl for the ALICE-Collaboration — Physikalisches Institut Heidelberg, Heidelberg, Germany

Heavy quarks are important probes of the QCD medium produced via heavy ion collisions as the medium-induced parton energy loss depends on the mass and its color-charge. Charm and beauty quarks are for the most part created early in the collision and thus traverse much of the hadronic matter. In 2010 and 2011, pp collisions at $\sqrt{s} = 7$ TeV and PbPb collisions at $\sqrt{s_{NN}} = 2.76$ TeV have been recorded by ALICE at the LHC. By subtracting the measured spectra of electrons from other sources, the spectrum of electrons from heavy flavor decays may be obtained. To gain an insight into the contribution from charm and beauty quarks individually, a cut on the impact parameter of the electrons can be used to preferentially select electrons from the decays of hadrons containing beauty quarks due to their high mass and large proper decay length ($c\tau \approx 500\mu$m). We present the preliminary results of the nuclear modification factor for electrons from heavy flavor decays and the current status of the analysis of the beauty contribution to it.

HK 7.7 Mo 15:45 P 5

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

The measurement of the production cross-section of B mesons in pp collisions in ALICE is important in two respects. First it allows to test perturbative quantum chromodynamics calculations. Secondly it provides an essential reference for 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 depends significantly on the quark mass, beauty as the heaviest observable flavour is of particular interest for the exploration of QGP properties.

A promising method for obtaining the B meson yield is the analysis of electrons from its semileptonic decay channels, whose methods and results will be presented in this talk. First, the electron identification using ALICE's Time Projection Chamber (TPC) and Time Of Flight (TOF) detector will be outlined. Then it will be explained how we make use of the B mesons' larger decay length ($\sim$ 500 μm) in comparison to D mesons and other background sources by selecting electrons with a large impact parameter. The method for estimation of the remaining background electrons in the selected sample will be presented, which is based on calculations using ALICE measured p_t spectra of π^0 and D mesons. As a result, the B meson spectrum measured in pp collisions at $\sqrt{s} = 7$ TeV in 2010 will be shown.

HK 8: Hadronenstruktur und -spektroskopie

Zeit: Montag 16:30–19:00 Raum: RW 1

Gruppenbericht HK 8.1 Mo 16:30 RW 1

Hadron Spectroscopy with COMPASS — •Boris Grube for the COMPASS-Collaboration — 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 primary goal is the search for new hadronic states, in particular exotic mesons and glueballs using hadron beams.

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. In addition 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.

A significant spin-exotic $J^{PC} = 1^{-+}$ resonance consistent with the controversial $\pi_1(1600)$ was seen already in the 2004 pilot-run data in $\pi^-\pi^+\pi^-$ final states diffractively produced by a 190 GeV/c π^- beam. During 2008 and 2009 COMPASS took a data sample about 100 times larger using negative and positive hadron beams on H_2, Ni, and Pb targets. We will give an overview of the first results from this data set that cover a variety of channels. In particular the talk will focus on the search for spin-exotic mesons in diffractively produced 3π, $\eta'\pi$, and possibly 5π final states and the analysis of central-production reactions in order to study glueballs in the scalar sector.

HK 8.2 Mo 17:00 RW 1

Resonanzen der Systeme $\pi^-\eta$ und $\pi^-\eta'$ in der Reaktion $\pi^- p \to \pi^-\eta^{(\prime)} p_{\rm slow}$ bei COMPASS — •Tobias Schlüter, Wolfgang Dünnweber und Martin Faessler für die COMPASS-Kollaboration — Ludwig-Maximilians-Universität, München

Wir beschreiben Partialwellenanalysen der Systeme $\pi\eta$ und $\pi\eta'$, erzeugt in Wechselwirkungen eines π^--Strahls (190 GeV) mit einem Wasserstofftarget. Die Daten wurden von COMPASS 2008 aufgezeichnet, wobei auf ein langsames Rückstoßproton ($|t| \gtrsim 0,1\,\mathrm{GeV}^2$) getriggert wurde. Wir vergleichen Analysen der $\pi\eta$- und $\pi\eta'$-Daten. Signifikante Beiträge können dem in der D-Welle beobachteten $a_2(1320)$ und dem in der G-Welle beobachteten $a_4(2040)$ zugeordnet werden. Wir untersuchen den Einfluss nichtresonanter Produktionsmechanismen. Schließlich behandeln wir die Möglichkeit einer resonanten Interpretation der P-Welle, deren neutraler Isospinpartner die einem

Quark-Antiquark-System nicht zugänglichen („exotischen“) Quantenzahlen $J^{PC} = 1^{-+}$ besäße.

HK 8.3 Mo 17:15 RW 1

Spin-exotic search in the $\rho\pi$ decay channel: First results on $\pi^-\pi^0\pi^0$ in comparison to $\pi^-\pi^+\pi^-$ final states (diffractively produced on proton) — •Frank Nerling for the COMPASS-Collaboration — Universität Freiburg, Physikalisches Institut

The COMPASS experiment at the CERN SPS features good charged particle tracking and coverage by electromagnetic calorimetry, and our data provide excellent opportunity for simultaneous observation of new states in two different decay modes within the same experiment. The existence of the spin-exotic $\pi_1(1600)$ resonance in the $\rho\pi$ decay channel is studied for the first time in COMPASS in both decay modes of the diffractively produced $(3\pi)^-$ system: $\pi^- p \to \pi^-\pi^+\pi^- p$ and $\pi^- p \to \pi^-\pi^0\pi^0 p$. A preliminary partial-wave analysis performed on the 2008 proton target data allows for a first conclusive comparison of both $(3\pi)^-$ decay modes not only for main waves but also for small ones. We find the neutral versus charged mode results in excellent agreement with expectations from isospin symmetry. Both, the intensities and the relative phases to well-known resonances, are consistent for the neutral and the charged decay modes of the $(3\pi)^-$ system. The status on the search for the spin-exotic $\pi_1(1600)$ resonance produced on a proton target is discussed.

HK 8.4 Mo 17:30 RW 1

Search for Resonances in the Diffractively Produced 5 Pion System at COMPASS — •Sebastian Neubert for the COMPASS-Collaboration — Technische Universität München

COMPASS is a multi-purpose fixed-target experiment at the CERN SPS, which investigates the structure and spectroscopy of hadrons. Diffractive dissociation of pions on nuclear and liquid hydrogen targets provides clean access to light meson resonances. Owing to the large acceptance and high resolution, COMPASS can measure exclusive multi-particle final states containing both neutral and charged particles with unprecedented accuracy. Events with 5 charged pions in the final state populate the mass region around and beyond $2\,\mathrm{GeV/c^2}$, where many interesting candidates for mesonic resonances have been discussed in the past, but still need further experimental investigation. In this talk, we will report on the progress of the development of a partial wave analysis for this complex final state and discuss first results.

HK 8.5 Mo 17:45 RW 1

Analysis of diffractive dissociation of exclusive $K^-\pi^+\pi^-$ events in the high energetic hadron beam of the COMPASS-experiment — •Prometeusz Jasinski[1] and for the COMPASS Collaboration[2] — [1]Institut für Kernphysik, Universität Mainz, Johann-Joachim-Becherweg 45, 55099 Mainz — [2]CERN

The COMPASS experiment at CERN took data with a 190 GeV/c hadron beam hitting a liquid hydrogen target in the years 2008 and 2009. The main purpose is the study of the light meson spectrum in the context of non-pertubative QCD.

The negative hadron beam contains mainly pions but also a small fraction of about 2.5% of kaons, giving access to production mechanisms of isospin 1/2 resonances. One of the channels of interest is diffractively produced resonances decaying into the K^- π^+ π^- final state. I will discuss the data selection and quality studies for this channel. The invariant mass spectra show already the well known resonances as the $K_1(1270)$ $K_1(1400)$ and the $K_2(1770)$. To disentangle all contributing resonances, techniques of mass-indendent partial wave analysis are applied. Most important results are discussed.

Supported by BMBF under the contract 06MZ224

HK 8.6 Mo 18:00 RW 1

Meson Production in Antiproton-Nucleus Interactions — •Stefanie Lourenco[1], Jan Haas[1], Horst Lenske[1], Thorsten Steinert[1], and Slawomir Wycech[2] — [1]Institut für Theoretische Physik, Universität Gießen — [2]National Center for Nuclear Studies, Hoza 69, 00-681, Warsaw, Poland

With the upcoming FAIR@GSI facility a variety of new antimatter-experiments become accessible. An interesting case is to study properties of exotic nuclei by using antiprotons for spectroscopy. The main part of the interaction is the strong annihilation, which leads to various possible particles produced in the exit channel. For the initial state $\bar{p}$A interaction we use an optical potential in t-ρ approximation, where the NN t-matrix taken from Juelich or Paris approach is folded with microscopical densities obtained from self-consistent Hartree-Fock Bogoliubov (HFB) calculations. Presently we focus on two meson production, namely pions. The final state interaction between the produced pions and the residual nucleus is taken into account by an optical potential of Kisslinger-type with additional higher resonances extensions. Results for elastic scattering, antiprotonic atoms and particle production on Ni isotopes are presented.

Supported in part by DFG, contract Le439/8 – 1

HK 8.7 Mo 18:15 RW 1

proposal for a revisit of antiproton nucleus collision experiment with PANDA — •Yue Ma and Frank Maas — Helmholtz Institute Mainz

By the 1980s, a series of experiments have been performed around the world(CERN, KEK and BNL) to study the antiproton nucleus interaction. However, considerable ambiguities still exist regarding to the real part of antiproton nucleus potential. For example, elastic antiproton nucleus scattering shows a small attractive potential of 30 MeV while recent antiprotonic analysis favors a value of 110 MeV. Recently, a theoretical investigation based on GiBUU transportation model has been carried out, which demonstrates the possibility of the existence of an attractive potential about 150 MeV. Based on this result, the same group suggests the existence of a cold compressed phase of normal nucleus due to the attraction from a embedded antiproton. This talk will outline the motivation of a revisit of antiproton nucleus collision experiment with modern detector, PANDA, at FAIR facility. Extractions of interested physical variables will be illustrated and improvements compared with previous experiments will be emphasized.

HK 8.8 Mo 18:30 RW 1

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-time extraction of the imaginary part from the latter. The measurement of this will open a new window for investigating the nucleon structure.

A transversely polarized target in PANDA implies that the longitudinal magnetic flux density applied by the PANDA-solenoid has to be shielded. A numerical simulation of the shielding with a Bi-2212 superconducting tube was performed.

HK 8.9 Mo 18:45 RW 1

Simulations for the measurement of $\bar{p}p \to e^+e^-\pi^0$ with PANDA in the TDA approach — •Maria Carmen Mora Espi for the PANDA-Collaboration — Helmholtz Institut Mainz, Mainz, Germany

Transition Distribution Amplitudes (TDA) describe the transition between a baryon and a meson state. They are useful to calculate the cross section of hard exclusive processes. The cross section of $\bar{p}p \to e^+e^-\pi^0$ has been calculated for small values of the momentum transfer t and high total center of mass energy W^2 using the TDA approach. Simulations of $\bar{p}p \to e^+e^-\pi^0$ have been done to study the feasibility of measurement of this cross section with PANDA. The main background channel $\bar{p}p \to \pi^+\pi^-\pi^0$ has been taken into account.

HK 9: Nukleare Astrophysik

Zeit: Montag 16:30–19:00 Raum: RW 2

Gruppenbericht HK 9.1 Mo 16:30 RW 2

Protonen- und α-induzierte Reaktionen für den astrophysikalischen p-Prozess — •Anne Sauerwein, Janis Endres, Lars Netterdon, Friederike Schlüter und Andreas Zilges — Institut für Kernphysik, Universität zu Köln

Das Reaktionsnetzwerk des p-Prozesses umfasst mehr als 20000 Reaktionen an 2000 Kernen. Oberhalb von Kalzium werden die meisten Reaktionsraten im Rahmen des Statistischen Modells berechnet. Die Genauigkeit dieser Rechnungen hängt von den verwendeten Kernmodellen für die optischen Potentiale, γ-Stärkefunktionen und Kernzustandsdichten ab.

Ein Ziel von experimentellen Untersuchungen zum p-Prozess ist daher die Verbesserung der Beschreibung von optischen Potentialen. Aus diesem Grund wurden u. a. die beiden Reaktionen ^{141}Pr(α,n) und ^{74}Ge(p,γ) studiert. Es wurden zwei unterschiedliche experimentelle Methoden verwendet: Die Reaktion ^{141}Pr(α,n) wurde am Zyklotron der Physikalisch-Technischen Bundesanstalt in Braunschweig mit der Aktivierungsmethode untersucht [1], während das ^{74}Ge(p,γ)-Experiment in-beam am Tandem Beschleuniger des DEMOKRITOS-Instituts in Athen durchgeführt wurde. In diesem Beitrag werden neben den experimentellen Methoden die astrophysikalischen S Faktoren präsentiert und mit Statistischen Modell-Rechnungen verglichen.

Gefördert durch die DFG (ZI 510/5-1 und INST 216/544-1) und das BMBF (O6 KY 9136). A.S. ist Mitglied der Bonn-Cologne Graduate School of Physics and Astronomy.

[1] Anne Sauerwein *et al.*, Phys. Rev. C **84** (2011) 045808.

HK 9.2 Mo 17:00 RW 2

(α,n) und (p,n) Reaktionen zur Optimierung Optischer Potentiale relevant für der p Prozess* — •Jan Glorius für die an-pn-Kollaboration — Institut für Angewandte Physik, Goethe Universität Frankfurt am Main, Deutschland

Der astrophysikalische p Prozess umfasst ein komplexes Reaktionsnetzwerk. Zur Modellierung sind tausende von Reaktionraten unter stellaren Bedingungen theoretisch zu berechnen. Diese Theorie stützt sich auf einen Satz von Parametern, der von experimentellen Daten abgeleitet wird. Optische Potentiale sind wichtiger Bestandteil dieses Parametersatzes. Die ungenügende Beschreibung der Potentiale in den derzeigen Modellen gilt als hauptverantwortlich für die ungenügende Vorhersagekraft der Theorie für Reaktionen mit Protonen und α-Teilchen.

Um diese Beschreibung der Wechselwirkung zwischen Kern 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 weiterer Test für die Vorhersagen des Statistischen Modells sowie als Grundlage zur Verbesserung globaler optischer Potentiale dienen. Die einzelnen Messungen und vorläufige Ergebnisse werden vorgestellt.

*gefördert durch DFG (SFB 634), DAAD (50141757), JINA (NSF,USA), HIC for FAIR und die Helmholtz Nachwuchsgruppe VH-NG-327

HK 9.3 Mo 17:15 RW 2

Untersuchung der ^{40}Ca(α,γ)^{44}Ti-Reaktion bei $E_\alpha \sim 3.5$ MeV — •Konrad Schmidt[1,2], Chavkat Akhmadaliev[1], Michael Anders[1], Daniel Bemmerer[1], Konstanze Boretzky[3], Antonio Caciolli[4], Zoltán Elekes[1], Zsolt Fülöp[5], Stefan Gohl[1], György Gyürky[5], Roland Hannaske[1], Arnd Junghans[1], Michele Marta[1,3], Ronald Schwengner[1], Tamas Szücs[5], Andreas Wagner[1], Dmitry Yakorev[1] und Kai Zuber[2] — [1]Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Dresden — [2]TU Dresden — [3]GSI, Darmstadt — [4]INFN Padua, Italien — [5]ATOMKI, Debrecen, Ungarn

Das radioaktive Nuklid ^{44}Ti wird Modellrechnungen zufolge in Kernkollaps-Supernovae erzeugt. Die γ-Strahlung aus seinem Zerfall kann als Werkzeug zum Test von Supernova-Modellen genutzt werden, weil sie zumindest für einen Supernova-Überrest durch satellitengestützte Gamma-Teleskope nachweisbar ist. Zur Interpretation dieser Messungen ist eine genaue Kenntnis der Kernreaktionsraten für die Erzeugung und Zerstörung von ^{44}Ti erforderlich. Die ^{40}Ca(α,γ)^{44}Ti-Reaktion dominiert die Erzeugung von ^{44}Ti. Ihre Rate wird je nach Temperatur von mehreren Resonanzen dominiert. Die Stärken der Resonanzen bei 3.5-3.7 MeV α-Energie werden am Dresdner 3 MV Tandetron sowohl mittels in-beam γ-Spektrometrie als auch durch eine Aktivierungsmessung im Felsenkeller-Niederniveaumesslabor bestimmt.

– Gefördert von der EU (FP7-SPIRIT 227012) und der DFG (BE 4100/2-1).

HK 9.4 Mo 17:30 RW 2

Measurements of proton-induced reactions on ruthenium-96 in the ESR at GSI — •Ganna Rastrepina for the E062-Collaboration — Goethe-Universität, Frankfurt am Main, D-64291, Germany

The Experimental Storage Ring at GSI provides the possibility to investigate radioactive isotopes, which are relevant for the astrophysical nucleosynthesis p-process. Measurements of proton-induced and alpha-induced reactions in inverse kinematics allow to determine the cross-sections for these reactions. The reaction products are identified by their mass-over-charge ratio. A pioneering experiment has been performed at the Experimental Storage Ring (ESR) at GSI using a stable ^{96}Ru beam at 9-11 AMeV and a hydrogen target. The different background components accompanying the ^{96}Ru(p,γ)^{97}Rh reaction were simulated with Geant4 code. Such background reactions are ^{96}Ru(p,α)^{93}Tc, ^{96}Ru(p,n)^{96}Rh and ^{96}Ru^{44+}(p,p)^{96}Ru^{43+}. In these simulations, the experimental setup was described in detail from the target to the detector position. A comparison of simulated predictions with the experimental results shows a good agreement and allows the extraction of the cross section. The reaction cross-section was calculated relative to the cross section of the electron capture for the ^{96}Ru^{44+}(p,p)^{96}Ru^{43+} reaction. This project was supported by the Helmholtz International Center for FAIR and the Helmholtz Young Investigator Group VH-NG-327.

HK 9.5 Mo 17:45 RW 2

^{94}Mo(γ,n)^{93}Mo measured by Coulomb Dissociation — •Kathrin Göbel for the s295-Collaboration — Goethe-Universität Frankfurt a. M.

Most of the p-nuclei between ^{74}Se and ^{196}Hg are produced in explosive conditions by sequences of photo dissociations and β-decays. The region of A $\approx$ 100 marks the end of the rp-process. In order to study the production of p-nuclei in this region, the experimental validation of the involved reaction rates predicted by statistical model calculations has to be performed.

Most nuclei involved in photo dissociation reactions in stellar nucleosynthesis networks are unstable and cannot be prepared as a target for experiments using real photons. Therefore, the (γ,n) reaction has to be studied in inverse kinematics using a beam of the radioactive nuclei in the Coulomb field of a high-Z target nucleus.

The ^{94}Mo(γ,n)^{93}Mo cross section has been measured using Coulomb Dissociation at the SIS/FRS/LAND setup at GSI in Darmstadt in 2005. First results will be presented.

This project was supported by the Helmholtz International Center for FAIR and the Helmholtz Young Investigator Group VH-NG-327.

HK 9.6 Mo 18:00 RW 2

Untersuchung der Reaktion ^{168}Yb(α,n)^{171}Hf für den astrophysikalischen p-Prozess — •Lars Netterdon[1], Michael Elvers[1], Janis Endres[1], Ulrich Giesen[2], Andreas Hennig[1], Anne Sauerwein[1], Friederike Schlüter[1] und Andreas Zilges[1] — [1]Institut für Kernphysik, Universität zu Köln — [2]Physikalisch-Technische Bundesanstalt (PTB), Bundesallee 100, 38116 Braunschweig

Experimentell bestimmte kernphysikalische Eingangsparameter dienen als wichtige Grundlage für die theoretischen Vorhersagen des Statistischen Modells, auf dem die Modellierung des p-Prozesses, einem Prozess für die Nukleosynthese von $\approx$ 35 protonenreichen Kernen im Massenbereich $74 < A < 196$, basiert. Dazu wurde der Wirkungsquerschnitt der Reaktion ^{168}Yb(α,n)^{171}Hf bei sechs verschiedenen α-Energien kurz oberhalb des Gamowfensters gemessen. Die Aktivierungen fanden an der PTB in Braunschweig statt, während die Spektroskopie der aktivierten Targets am Auszählaufbau am Institut für

Kernphysik in Köln vorgenommen wurde, der aus zwei HPGe-Clover Detektoren besteht. In diesem Beitrag werden die Ergebnisse dieser Messung präsentiert. Des Weiteren wird das hocheffiziente γ-Detektor-Array HORUS vorgestellt, das hervorragende Möglichkeiten bietet, um für den p-Prozess relevante Reaktionen mit der *in-beam*-Methode zu vermessen.

Gefördert durch die DFG (ZI 510/5-1, INST 216/544-1). A.H. und A.S. sind Mitglieder der Bonn-Cologne Graduate School of Physics and Astronomy.

HK 9.7 Mo 18:15 RW 2

Lifetime mearusement of the first excited state in ^{31}S with the Doppler Shift Attenuation Method (DSAM) — •Clemens Herlitzius, Shawn Bishop, and Alberto Vesentini — Physik Department E12, TU München, Germany

Measuring lifetimes of excited states of nuclei is important to constrain or estimate resonant (p,γ) capture reaction rates that cannot be determined in a direct measurement, yet are relevant for the production of intermediate mass elements in classical nova events. A new facility has been built and commissioned at the Maier-Leibnitz-Laboratorium (LMU/TUM) that allows to measure lifetimes of states in excited nuclei using the Doppler Shift Attenuation Method. This talk will describe the experimental technique and show data of the beamtime, where the first state in ^{31}S has been populated via $^{32}S(^3He,^4He)$ in inverse kinematics. The analysis is in process and the status will be presented.

HK 9.8 Mo 18:30 RW 2

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

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 included 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 differential cross section with respect to the excitation energy by using the invariant-mass method. First 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 9.9 Mo 18:45 RW 2

Half-life measurements for neutral and highly-charged α-emitters — •Fabio Farinon for the E073-Collaboration — GSI, Darmstadt, Germany — Justus-Liebig Universität, Giessen, Germany

The influence of the bound electron cloud on the α-decay constant λ has been discussed theoretically since the late 50s. Tiny changes in Q-values and α-decay half-lives of fully stripped ions are expected and can provide information on the electron screening energy, thereby deducing reliable reaction rates in stellar environments. Recently, the measurements of α-decay half-lives are feasible also for highly-charged radioactive nuclides. Using a ^{238}U beam at relativistic energies at the present FRS-ESR facility at GSI it is possible to produce, efficiently separate and store highly charged α-emitters. ^{213}Fr^{86+} have been investigated by using the Schottky Mass Spectrometry technique. In order to establish a solid reference data set, lifetime measurements of the corresponding neutral atoms have been performed directly at the FRS by implanting the separated ions into an active silicon stopper. These results will be reported.

HK 10: Struktur und Dynamik von Kernen

Zeit: Montag 16:30–19:00 Raum: RW 3

Gruppenbericht HK 10.1 Mo 16:30 RW 3

Chiral Fermi liquid description of nuclear matter — •Jeremy Holt, Norbert Kaiser, and Wolfram Weise — Technische Universität München

We employ Landau's theory of normal Fermi liquids to study the bulk properties of nuclear matter with high-precision two- and three-nucleon interactions derived within the framework of chiral effective field theory. The $L = 0, 1$ Landau parameters, characterizing the isotropic and p-wave interaction between two quasiparticles on the Fermi surface, are computed to second order in many-body perturbation theory (MBPT) with chiral and low-momentum two-nucleon forces. Already at this order a number of observables are well described in the theory, including the nuclear isospin asymmetry energy, the quasiparticle effective mass and the spin-isospin response. An adequate description of the nuclear compression modulus (encoded in the Landau parameter F_0) requires the inclusion of the leading-order (N^{2}LO) chiral three-nucleon force, which we include to first order in MBPT. The remaining $L = 0$ Landau parameters receive only small corrections from the chiral three-nucleon force, and the $L = 1$ parameters are all reduced, resulting in an effective interaction of apparent short range. We then employ renormalization group techniques to study the scale dependence of the quasiparticle interaction, which allows for an estimation of theoretical uncertainties.

Work supported in part by BMBF, GSI and by the DFG cluster of excellence: Origin and Structure of the Universe.

Gruppenbericht HK 10.2 Mo 17:00 RW 3

Ab-Initio Theory of Medium-Mass Nuclei with Normal-Ordered Chiral NN+3N Interactions — •Sven Binder, Joachim Langhammer, Angelo Calci, Klaus Vobig, and Robert Roth — Institut für Kernphysik, Technische Universität Darmstadt

We study the use of truncated normal-ordered three-nucleon interactions in ab initio nuclear structure calculations starting from chiral two- plus three-nucleon Hamiltonians evolved consistently with the similarity renormalization group (SRG). We present three key steps: (i) a rigorous benchmark of the normal-ordering approximation in the importance-truncated no-core shell model (IT-NCSM) for ^{4}He, ^{16}O, and ^{40}Ca; (ii) a direct comparison of the IT-NCSM results with coupled-cluster calculations at the singles and doubles level (CCSD) for ^{16}O; and (iii) first applications of SRG-evolved chiral NN+3N Hamiltonians in CCSD for the medium-mass nuclei ^{16,24}O and ^{40,48}Ca. We show that the normal-ordered two-body approximation works very well beyond the lightest isotopes and opens a path for ab initio studies of medium-mass and heavy nuclei with chiral two- plus three-nucleon interactions. For low-lying excited states and collective excitations we present first applications of the EOM-CCSD method, which is superior to RPA-type approaches.

Supported by DFG (SFB 634), HIC for FAIR, and BMBF (06DA9040I).

HK 10.3 Mo 17:30 RW 3

Resummations and chiral dynamics of nuclear matter — •Sebastian Schultess, Nobert Kaiser, and Wolfram Weise — Physik-Department, Technische Universität München, 85748 Garching, Germany

The equation of state of isospin-symmetric nuclear matter and pure neutron matter is calculated to three-loop order with in-medium chiral perturbation theory, taking into account also two-pion exchange with Δ-isobar excitations. The large empirical S-wave NN-scattering lengths, $a_s = 19\,\mathrm{fm}$ and $a_t = -5.4\,\mathrm{fm}$, require a non-perturbative treatment via a resummation of ladder diagrams to all orders. Our resummation method includes (combined) particle-particle and hole-hole rescatterings in the medium. The remaining short range part of the interaction is described by adjustable (p^2-dependent) NN-contact terms.

In this framework the saturation properties of symmetric nuclear matter can be well reproduced and the nuclear matter compressibility takes on an improved value in comparison to earlier calculations without resummations. The neutron matter equation of state is particularly improved by the resummations. At low densities the energy per particle follows one half of the kinetic energy, which is a feature of the unitary fermi gas. The results of sophisticated neutron matter calculations can be reproduced up to high neutron densities $\rho_n = 0.4\,\mathrm{fm}^3$.

Work supported in part by BMBF, GSI and the DFG Cluster of

Excellence "Origin and Structure of the Universe".

HK 10.4 Mo 17:45 RW 3

Topological phases for bound states moving in a finite volume — •Shahin Bour Bour[1], Dean Lee[2], Hans-Werner Hammer[1], Ulf-G. Meissner[1], and Sebastian König[1] — [1]Helmholtz-Institut für Strahlen- und Kernphysik und Bethe-Center for Theoretical Physics, Universität Bonn — [2]Department of Physics, North Carolina State University, Raleigh, NC 27695, USA

We show that bound states moving in a finite periodic volume have an energy correction which is topological in origin and universal in character. The topological volume corrections contain information about the number and mass of the constituents of the bound states. These results have broad applications to lattice calculations involving nucleons, nuclei, hadronic molecules, and cold atoms. We illustrate and verify the analytical results with several numerical lattice calculations.

[1] Phys. Rev. D 84, 091503(R) (2011), arXiv:1107.1272v2

HK 10.5 Mo 18:00 RW 3

Consistent SRG transformed chiral two- plus three-body interactions — •Angelo Calci, Joachim Langhammer, Sven Binder, and Robert Roth — Institut für Kernphysik, Technische Universität Darmstadt

Chiral effective field theory provides two- (NN) and three-body (3N) interactions from QCD in a consistent manner. We employ these interactions in ab initio nuclear structure calculations within the importance-truncated no-core shell model (IT-NSCM) using an additional Similarity Renormalization Group (SRG) transformation to improve convergence. Formally, the SRG induces irreducible many-body contributions, which nowadays can be included up to the three-body level. Using a flow-parameter analysis we show that the conventional SRG evolution induces sizeable many-body contributions for nuclei in the mid-p-shell and beyond. We demonstrate that the induced many-body contributions originate from the two-pion exchange terms of the initial 3N interaction. Finally, the suppression of the induced many-body contributions either by an alternative formulation of the SRG or by a modification of the initial chiral interactions is discussed. This opens an opportunity to universal applications of chiral 3N interactions in nuclear structure.

Supported by DFG (SFB 634), HIC for FAIR, and BMBF (06DA9040I).

HK 10.6 Mo 18:15 RW 3

Relativistic Quasi-Particle Interaction in Nuclear Matter — •Andreas Fedoseew, Julian Georg, and Horst Lenske — Institut für Theoretische Physik, Justus-Liebig-Universität Giessen, Heinrich-Buff-Ring 16, D-35392 Giessen

We present a generalized Dirac Fermi-Liquid Theory for nuclear matter. The concept of quasi-particle residual interaction is extended to a fully covariant and thermodynamically consistent field theory. In our calculation we use the ab initio Lagrangian of the Giessen Density Dependent Relativistic Hadron (DDRH) field theory for the NN interaction. With this approach higher order corrections to the common quasi-particle interaction are included. We discuss self-consistent relativistic RPA calculations for response functions of asymmetric nuclear matter and finite nuclei. Applications to quasielastic (e, e') scattering and charge-changing current reactions will be presented.

Supported by HIC for FAIR and GSI.

HK 10.7 Mo 18:30 RW 3

Neutral pion photoproduction on the trinucleon in ChPT — •Mark Lenkewitz[1], Evgeny Epelbaum[2], Hans-Werner Hammer[1], and Ulf-G. Meissner[1] — [1]Helmholtz-Institut für Strahlen- und Kernphysik und Bethe-Center for Theoretical Physics, Universität Bonn — [2]Institut für Theoretische Physik II, Ruhr-Universität Bochum

Threshold pion photoproduction on the trinucleon is investigated in the framework of baryon ChPT at next-to-leading one-loop order in the chiral expansion. To this order in small momenta, the production operator is a sum of one- and two-nucleon terms. We calculate the expectation value of the production operator using chiral wave functions in a manifestly three-dimensional approach without partial wave expansion. The resulting integrals are evaluated using Monte Carlo integration.We obtain results for the threshold production multipoles on 3He and 3H and comment on the sensitivity to the fundamental neutron amplitude.

[1] M. Lenkewitz, E. Epelbaum, H.-W. Hammer, Ulf-G. Meißner, Phys. Lett. B 700 (2011) 365. http://arxiv.org/abs/1103.3400

HK 10.8 Mo 18:45 RW 3

Constraining the in-medium hyperon-nucleon interactionin heavy-ion collisions — •Theodoros Gaitanos, Anika Obermann, and Horst Lenske — Institut für Theoretische Physik, Universität Giessen, Germany

The knowledge of the strangeness sector of strong interactions is important for our understanding of hadron dynamics. It is still a widely debated topic how the hyperon-nucleon interaction is modified inside a dense hadronic environment. From our recent in-medium T-matrix calculations for hyperon-nucleon scattering with strangeness exchange, e.g., $\Sigma^+ n \to \Sigma^0 p, \Lambda p$, we determine the in-medium modifications of cross sections at finite baryon density. The results are used in intermediate energy heavy-ion collisions, which offer an unique opportunity to investigate this issue in the laboratory. Indeed, precise data on $K^{0,+}$ and $\Lambda + \Sigma^0$ production exist and can help us to study the in-medium modifications of the hyperon-nucleon interaction with strangeness exchange. We apply a relativistic Boltzmann-like transport approach, which incorporates a perturbative propagation of particles with finite strangeness (positive and neutral kaons with $S = 1$ and hyperons with $S = -1$) under the influence of chiral potentials for the kaons and hyperons self-energies. Our calculations shows that strangeness production in heavy-ion collisions is a sensitive tool for investigations of in-medium YN- and YY-interactions. We compare transport theoretical results on strangeness yields and their rapidity distributions with data and discuss in particular the high density properties of YN-interactions, entering e.g. also into neutron star calculations.

HK 11: Instrumentation

Zeit: Montag 16:30–19:00 Raum: P 2

Gruppenbericht HK 11.1 Mo 16:30 P 2

Development of a High-Rate 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 ideal device for 3-dimensional tracking of charged particles. In the past, an important limitation of TPCs has been the necessity to introduce a gating grid in order to prevent the migration of ions created in the gas amplification stage into the active volume. Unfortunately, such gating techniques limit the possible trigger rates to $\mathcal{O}(100\,\mathrm{Hz})$.

To make the advantages of a TPC (low material budget, good $\mathrm{d}E/\mathrm{d}x$ performance, robust pattern recognition even in very high track densities) available to modern particle physics experiments with interaction rates exceeding this limit by many orders of magnitude, it has to be operated in a continuous, ungated mode. The development of such a device is the goal of this project. The suppression of ion back-drift is achieved by utilizing a stack of Gas Electron Multiplier (GEM) foils as gas amplification stage.

A large prototype of the GEM-TPC (728 mm length, 154 mm radius) with $\sim$ 10000 readout channels has been built and successfully used in a physics campaign (π beam on different nuclear targets) at the FOPI experiment at GSI, Darmstadt. The data acquisition is realized with the AFTER ASIC, which has been originally developed for the T2K experiment. Details of the detector design, electronics setup as well as simulation and reconstruction algorithms will be presented, complemented with first results from data analysis.

HK 11.2 Mo 17:00 P 2

Energy Calibration of a GEM-TPC Prototype — •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 diameter of 105/300 mm and a total drift length of 725 mm. A triple GEM stack is used for gas charge amplification to reach sufficiently high gain. In addition the GEM stack provides an intrinsic strong secondary ion backflow suppression without the necessity for an ion gate, which opens the possibility to operate such a detector in a continuous mode even at high interaction rates. The anode of the prototype GEM-TPC consists of 10254 hexagonal pads with an outer radius of 1.5 mm which are read out by 42 front end cards based on the T2K/AFTER chip. The TPC is used to improve the inner tracking and vertexing of the FOPI experiment at GSI and serves as a full-scale prototype for the CBELSA/TAPS experiment. In order to perform an accurate channel-wise relative gain calibration and a total gain estimation, a ^{83m}Kr source is used. Its gaseous form makes it perfectly suitable for this purpose and several conversion electron peaks between 9.4 keV and 41.55 keV enable gain calibration over a wide energy range. The short half-life of 1.83 h allows for normal detector operation after a short flushing period of about one hour. Details on source production, integration and first calibration results compared to calibration results obtained with cosmic rays are presented.

This work is supported by DFG SFB/TR 16.

HK 11.3 Mo 17:15 P 2

Gain Calibration of the ALICE TRD using the Decay of 83mKr as an Electron Source — •Johannes Stiller für die ALICE-Kollaboration — Physikalisches Institut, Heidelberg, Deutschland

For an early calibration of the ALICE Transition Radiation Detector (TRD) on the level of individual readout pads, a dedicated calibration run with a Krypton source was carried out. We recorded 2.28 billion decays of metastable 83mKr in the 646k readout-pads of the 10 TRD super modules presently installed in the ALICE experiment at CERN. In our analysis the gain uniformity within each chamber as well as the energy resolution of all installed chambers were obtained. These results are crucial for good online particle identification and triggering. In an iterative analysis step, the gain calibration results in a gain uniformity of better than 2 %. A comparison between our results and corresponding findings from earlier measurements during chamber construction was performed and good agreement was found. The gain factors are now available for download to the front-end electronics and online calibration and analysis.

HK 11.4 Mo 17:30 P 2

Fast Simulation Studies for a Crystal Ball TPC — •Martin Wolfes, Oliver Steffen, Wolfgang Gradl, and Martin Hattemer for the A2-Collaboration — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz, D-55099 Mainz

The A2-Collaboration at MAMI studies photon induced reactions with the Crystal Ball/TAPS detector, which covers almost the whole solid angle of 4π. The photon beam is produced via energy tagged bremsstrahlung. The inner detector system includes a two-layer MWPC for the detection of charged particle tracks.

The increased rate of charged particles for future η and η' production experiments exceeds the rate capabilities of these MWPCs. A possible solution is to replace the existing tracking detectors with a small Time Projection Chamber (TPC). This type of detector has higher rate capability and provides the means for real track reconstruction.

To study detector and track resolution we have developed a parameter-driven fast simulation, in which different chamber geometries and readout pad configurations can be implemented very easily. The simulation includes ionisation statistics, transversal and longitudinal diffusion within the electric field, gas amplification of an arbitrary number of GEM foils and signal response from the electronics. The fast simulation can also be used to test the reconstruction software. We present recent results obtained with this simulation.

HK 11.5 Mo 17:45 P 2

Particle identification using clustering algorithms — •Roland Wirth[1,2], Enrico Fiori[1,2], Bastian Löher[1,2], and Deniz Savran[1,2] — [1]ExtreMe Matter Institute EMMI and Research Division, GSI Helmholtzzentrum, Darmstadt, Germany — [2]Frankfurt Institute for Advanced Studies FIAS, Frankfurt

Particle identification (PID) is an important task for many experimental techniques. A well-known approach for PID in many detection systems is based on pulse shape analysis (PSA), i.e. identification based on the difference in the pulse shape produced by different particle species. In most methods specific features of the detector signals are analyzed employing profound knowledge of the involved pulse shapes and the need of precise adjustments for individual detectors. A new approach to achieve PID based on PSA uses clustering algorithms without making any assumptions on the shape of detector pulses and is thus applicable to many detector types. The method is also self-tuning, i.e. no adjustment to a specific detector is necessary. In this talk a method is presented that uses the fuzzy c-means clustering algorithm and has already been applied to liquid scintillators for γ-n discrimination [1]. The same method can be used without modifications to perform γ-p discrimination for CsI(Tl) scintillator signals and in particular produces identical results for different individual detectors.

* Supported by the Alliance Program of the Helmholtz Association (HA216/EMMI)

[1] D. Savran *et al.*, Nucl. Inst. and Meth. A, **624** (2010) 675

HK 11.6 Mo 18:00 P 2

ALICE TRD GTU Online Tracking and Trigger Performance in recent p-p and Pb-Pb Collisions — •Felix Rettig, Stefan Kirsch, and Volker Lindenstruth for the ALICE-Collaboration — Frankfurt Institute for Advanced Studies, Johann Wolfgang Goethe-Universtät, Frankfurt

The Transition Radiation Detector of the ALICE experiment at the LHC is designed to provide fast trigger contributions based on an online reconstruction of charged tracks with high transverse momentum.

Within about 4 microseconds after a collision, a total of 1.2 million analog channels is scanned for short track segments by more than 65,000 custom multi-chip modules in the front-end electronics. The parametrizations of these segments are transferred to the Global Tracking Unit (GTU) at up to 2.2 TBit/s.

The GTU is a massively parallel low-latency computing system consisting of 109 dedicated high-performance FPGA-based nodes. 90 nodes in the input layer perform a full 3D reconstruction and momentum calculation for high-momentum tracks. 18 middle layer nodes and one top-layer node then infer various Level-1 trigger contributions about 6 microseconds after the collision.

Presented here is a performance analysis of the online tracking in p-p as well as Pb-Pb collisions over the past two years of LHC operation. Selected trigger algorithms based on the online tracking are outlined.

HK 11.7 Mo 18:15 P 2

Online Electron Identification for Triggering with the ALICE Transition Radiation Detector — •Benjamin Hess for the ALICE-Collaboration — Physikalisches Institut, Universität Heidelberg

The ALICE Transition Radiation Detector (TRD) is a fast tracker with good e/π-separation for high momenta already at the trigger level. It can be used to enhance rare probes such as high-p_t jets and electrons. For the latter, a strategy for Particle Identification (PID) based on look-up tables containing the electron likelihoods for different deposited charges has been studied. The deposited charge of electrons is higher than that of pions due to a higher specific energy loss and a much more probable emission of transition radiation.

Monte Carlo simulations have been used to systematically investigate the PID performance. The best achievable pion suppression was found to be around 40 for an electron efficiency of 90%.

The PID performance depends on several parameters, like gas gain and drift velocity. The simulations showed that the gas gain changes critically limit the stability of the PID performance and that a stable drift velocity is also important.

The results of these studies allow to assess the tolerances of gas gain and drift velocity that are required for a reliable PID performance.

HK 11.8 Mo 18:30 P 2

Performance of CBM TRD Prototypes from Münster — •Cyrano Bergmann — Institut für Kernphysik, WWU Münster

CBM is a fixed target heavy-ion experiment at the future FAIR 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, four CBM TRD prototype modules were built in Münster and tested during October 2011 in beam at the CERN Proton Synchroton with electrons and pions of momenta up to 10 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 radiators, position resolution and dependence on particle momentum. First results of these measure-

ments 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 m^2.

Work supported by BMBF and the HadronPhysics2 project financed by EU-FP7.

HK 11.9 Mo 18:45 P 2

Results on the CBM TRD prototype performance from the test beam time at CERN-PS — •Andreas Arend for the CBM-Collaboration — Institut für Kernphysik, Goethe University Frankfurt, Germany

The development of a Transition Radiation Detector (TRD) for the Compressed Baryonic Matter (CBM) Experiment at the future FAIR facility is aimed to provide good electron-pion-separation and tracking capabilities in an environment of unprecedented high particle fluxes.

In this talk, an approach to employ thin and fast Multi-Wire Proportional Chambers (MWPC) without drift region to fulfill the given requirements will be presented. Several prototypes with different wire geometries and a variety of radiator types, such as regular foil stack radiators, a foam based radiator and a fiber radiator have been developed and constructed. Measurements with different MWPC and radiator combinations have been performed during the test beam campaign at the CERN-PS in October 2011. Results for the CBM-TRD prototypes will be presented. The electron-pion-separation capabilities for different radiator types will be discussed as well as its dependency on the geometry of the MWPC.

HK 12: Instrumentation

Zeit: Montag 16:30–19:00 Raum: P 3

Gruppenbericht HK 12.1 Mo 16:30 P 3

The New Trigger and Data Acquisition System of HADES - First In-beam Experience* — •Jan Michel for the HADES-Collaboration — Goethe-University, 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. Since 2002 several experiments with light and medium sized collision systems at incident energies between 1 and 3.5 AGeV were conducted. Recently, the spectrometer was upgraded to reach highest event rates even in the heaviest mass systems.

In this context, the data acquisition was completely replaced to be able to record data at event rates of 20 kHz for heavy ion collisions and up to 100 kHz for light systems. The new electronics is based on universal FPGA-equipped platforms to reach high data bandwidth combined with very low latencies. Additional flexibility is achieved by adding a unified configuration and monitoring interface to all front-ends. All data-transport is based on optical fibers to reduce the electromagnetic noise environment in the detector. In August 2011, a first test-experiment with Au+Au at 1.25 AGeV was conducted successfully. In this contribution, the HADES Upgrade is presented, the DAQ network is described and first in-beam experiences are shown.

*This work is supported by BMBF (06FY9100I), EU FP6, GSI, EMMI and HIC for FAIR.

HK 12.2 Mo 17:00 P 3

Datenerfassung für das BGO-OD Experiment an ELSA * — •Daniel Hammann für die BGO-OD-Kollaboration — Physikalisches Institut, Universität Bonn

2011 hat das BGO-OD Experiment an ELSA seinen Betrieb aufgenommen. Zur Untersuchung der Photoproduktion von Mesonen sollen dabei insbesondere gemischt geladene/neutrale Endzustände beobachtet werden. Hierzu besteht der Aufbau aus einem BGO-Kalorimeter, welches den größten Teil des Raumwinkels abdeckt und einem Dipol-Spektrometer in Vorwärtsrichtung. Zur Spurmessung kommen großflächige Driftkammern und szintillierende Fasern zum Einsatz. Eine Szintillatorwand hinter dem Spektrometer dient zur Bestimmung der Flugzeit und damit zur Identifikation der Teilchen.

Sowohl das allgemeine Konzept, als auch Daten zur Leistungsfähigkeit der Datenerfassung während der ersten Teststrahlzeiten werden vorgestellt.

* gefördert durch die DFG im Rahmen des SFB / TR 16

HK 12.3 Mo 17:15 P 3

Digitale Signalverarbeitung für das CALIFA-Barrel Kalorimeter — •Max Winkel, Michael Bendel, Michael Böhmer, Roman Gernhäuser, Florian Kurz und Tudi Le Bleis für die R3B-Kollaboration — Technische Universität München, Garching, Deutschland

Das CALIFA-Barrel ist ein elektromagnetisches Kalorimeter, das das Target des R^3B-Detektorsystems an der neuen Forschungseinrichtung FAIR umgeben wird. Es besteht aus 1.952 CsI(Tl) Kristallen, welche über Avalanche Photo Dioden (APD) ausgelesen werden.

Besondere Merkmale von CALIFA sind der hohe dynamische Energiebereich (ca. 100 keV – 300 MeV), sowie die Möglichkeit zur Teilchenidentifikation aus dem Szintillationssignal. Zu diesem Zweck wurde eine digitale, *Field Programmable Gate Array* (FPGA) basierte Signalverbeitung entwickelt. Die detektornahe Signalverarbeitung in Echtzeit ermöglicht hohe Ereignissraten, sowie eine schnelle High-Level Trigger Entscheidung ($t < 1\mu s$) für nachfolgende Detektoren.

Neben dem Konzept der Signalverarbeitung werden in diesem Vortrag ein neuer Algorithmus zur Teilchenidentifizierung, ein Prototyp für einen detektorweiten, digitalen Multiplizitäts- und Energiesummen-Trigger, sowie die Ergebnisse eines Testexperiments an einem 24 MeV Protonenstrahl vorgestellt.

Diese Arbeit wurde unterstützt durch BMBF(06MT9156) und DFG (EXC153).

HK 12.4 Mo 17:30 P 3

SRAM FPGA Finite State Machines in Particle Physics Experiments: Beamtest Results — •Jano Gebelein[1] and Udo Kebschull[2] for the CBM-Collaboration — [1]Infrastruktur und Rechnersysteme in der Informationsverarbeitung, Goethe-Universität Frankfurt am Main, Senckenberganlage 31, 60325 Frankfurt am Main, Deutschland — [2]Hochschulrechenzentrum, Goethe-Universität Frankfurt am Main, Senckenberganlage 31, 60325 Frankfurt am Main, Deutschland

Continuous research and development in the field of particle accelerator detector electronics focusing on Static Random Access Memory (SRAM) Field Programmable Gate Arrays (FPGA) confirmed that the use of fault tolerance techniques is inevitably required for safe operation in radiation susceptible environments. Therefore, several formerly presented research results dealt with the well-known partial configuration scrubbing, especially blind scrubbing, supported by a minority of such devices. Current approaches address techniques on Register-Transfer-Level, especially Hamming based Finite State Machine (FSM) design, in combination with Triple Modular Redundancy (TMR). Due to the fact that commercially available tools which apply global TMR fault tolerance to existing hardware designs are quite expensive and are working on netlists only, manual Hamming FSM designs with TMR have been created and tested in GeV proton particle beam at the COSY accelerator in Juelich, Germany.

HK 12.5 Mo 17:45 P 3

Development of a Deadtime Measurement System for the COMPASS experiment using FPGA technology — •Oliver Freyermuth — Physikalisches Institut, Universität Bonn on behalf of the COMPASS collaboration

The muon beam of the COMPASS experiment at CERN has a large halo component which causes unwanted triggered events. A veto system is used to suppress these. In this presentation, an FPGA based system using the method of delayed coincidences will be presented to measure the losses in muon flux due to random coincidences. In comparison to the existing setup, the new system will have the ability to measure with several independent delays in parallel and thus allow us to study possible modulations of the beam.

HK 12.6 Mo 18:00 P 3

CBM First-Level Event Selector Concept — •Dirk Hutter, Jan de Cuveland, and Volker Lindenstruth for the CBM-

Collaboration — Frankfurt Institute for Advanced Studies, Goethe University, Frankfurt, Germany

The CBM experiment at the future FAIR facility is designed to study QCD predictions at high baryon densities. The CBM First-Level Event Selector (FLES) is the central event selection system of the experiment. Designed as a high-performance computing cluster its task is an online analysis of the physics data at a total data rate of 1 TByte/s. As CBM is based on free-running, self-triggered detectors delivering timestamped data streams, there is no inherent event separation. Thus, classical approaches for global event building and event selection are not applicable. Instead of classical event building, the FLES has to combine the data from approximately 1000 input links to self-contained, overlapping processing intervals and distribute them to compute nodes. A high-bandwidth COTS network as well as dedicated custom FPGA boards providing time-addressed access to buffered data are needed. Subsequently, specialized event selection algorithms analyze these processing intervals in 4-D, identify events, and select those relevant for storage. Depending on the chosen CBM subsystem setup and selection scenario, two-staged interval building and event selection are foreseen.

An overview of the considered FLES architecture and studies on interval building are presented.

HK 12.7 Mo 18:15 P 3

Entwicklung der CBM-RICH Prototyp Kamera basierend auf H8500 MAPMTs und nXYter-Auslese * — •Christian Pauly für die CBM-RICH-Kollaboration — Universität Wuppertal

Das Compressed Baryonic Matter Experiment (CBM) ist eines der großen Experimente, welches im Rahmen des Facility for Antiproton and Ion research, FAIR, entwickelt wird. Ziel ist die Untersuchung des QCD Phasendiagramms insbesondere im Bereich hoher Baryonendichte anhand von Schwerionenkollisionen in fixed target Experimenten bei Strahlenergien im Bereich 8-45 GeV/Nukleon. Eine der wesentlichen Detektorkomponenten zur Teilchenidentifikation stellt ein RICH-Detektor mit CO2 Gas Radiator und Photomultiplier Auslese dar. Ein erster Prototyptest dieses Detektors erfolgte im Herbst 2011 am CERN PS Teststrahl. Hierfür wurde ein Prototyp des Photodetektors mit 16 Hamamatsu H8500 MAPMTs und insgesamt 1024 Kanälen entwickelt. Die kompakte Ausleseelektronik basiert auf dem nXYter Chip [1], einem custom-ASIC mit 128 Kanälen Zeit- und Amplitudenmessung, ursprünglich für die Auslese von Silizium-Detektoren entwickelt.

Zur exakten Spurrekonstruktion während dieser, wie auch weiterer Teststrahlzeiten wurden ausserdem zwei kompakte, ortsaufgelöste Faserhodoskope entwickelt, die Auslese basiert ebenfalls auf dem H8500 MAPMT in Verbindung mit dem nXYter. Wir berichten über Details dieser Entwicklungen, insbesondere auch in Hinsicht auf die notwendige Anpassung der Ausleseelektronik.

[1] A.S.Brogna et al, Nucl. Instr. Meth. A 568 (2006) 301.

* gefördert durch BMBF Verbundforschung 06WU9195I

HK 12.8 Mo 18:30 P 3

Strahlenhärte eines hochohmigen CMOS Monolithic Active Pixel Sensors bis $3 \cdot 10^{14} n_{eq}/cm^2$***** — •Dennis Doering — Goethe-Universität, Frankfurt

Die Strahlenhärte von monolithischen CMOS-Pixelsensoren (MAPS), wie sie im ILC, im Heavy-Flavour-Tracker von STAR und Mikro-Vertex-Detektor von CBM verwendet werden sollen, ist im vergangenem Jahrzehnt stark verbessert worden. So konnte vor kurzem unter Verwendung eines hochohmigen aktiven Volumens die Strahlenhärteanforderungen des CBM-Experimentes von $10^{13} n_{eq}/cm^2$ erfüllt werden. Dadurch motiviert, wurde mit Hilfe des hochohmigen Sensors MIMOSA-18AHR die Strahlenhärte als Funktion der Pixelgröße vermessen.

Die Ergebnisse dieser Studie legen nahe, dass bei geeigneter Kühlung und einer kleinen Pixelgröße ($10 \mu m$) eine Strahlenhärte von mindestens $3 \cdot 10^{14} n_{eq}/cm^2$ erreicht worden ist, was eine neue Größenordnung in Bezug auf Strahlenhärte von CMOS-Sensoren darstellt.

*gefördert durch das BMBF (06FY9099I), HIC for FAIR und GSI.

HK 12.9 Mo 18:45 P 3

Low-mass Aluminum Microstrips for Data Transmission in the $\overline{\text{P}}$ANDA MVD — •Tommaso Quagli[1,2], Daniela Calvo[2], Paolo De Remigis[2], Marco Mignone[2], Robert Schnell[1], and Richard Wheadon[2] — [1]Helmholtz-Institut für Strahlen- und Kernphysik, Rheinische Friedrich-Wilhelms-Universität Bonn, Nussallee 14-16, D-53115, Bonn, Germany — [2]Istituto Nazionale di Fisica Nucleare, Sezione di Torino, Via Pietro Giuria 1, 10125 Torino, Italy

Among the requirements of the $\overline{\text{P}}$ANDA Micro-Vertex-Detector (MVD) there are the capability to handle a high data rate with a continuous readout and a low material budget. These requirements, together with the layout constraints, demand dedicated low-mass cables for data transmission. Differential microstrips, realized with aluminum tracks laminated on a polyimide support, have been produced and experimentally tested for both electrical functionality and radiation hardness, using signal integrity techniques. Furthermore, the capability of the cables to cope with the SLVS signaling standard has been investigated. An overview of the results will be presented, examining the upper frequency limits of the samples and the dependences on layout and track width.

Finally, special focus will be given to the results of the radiation hardness measurements, performed with neutron irradiation at the research reactor at LENA (Pavia) and with proton irradiation at the cyclotron in Bonn.

Supported by INFN and BMBF.

HK 13: Struktur und Dynamik von Kernen

Zeit: Montag 16:30–19:00 Raum: P 4

Gruppenbericht HK 13.1 Mo 16:30 P 4

Experimental Studies of Pygmy and Giant Resonances in Exotic Nuclei - Status and Perspectives — •Dominic Rossi[1], Thomas Aumann[2], Konstanze Boretzky[1], Roman Gernhäuser[3], Jens Volker Kratz[4], Reiner Krücken[3], Christoph Langer[5], Tudi Le Bleis[3], Olga Lepyoshkina[3], Ralf Plag[1], and Rene Reifarth[5] for the R3B-Collaboration — [1]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt — [2]Technische Universität Darmstadt — [3]Technische Universität München — [4]Johannes Gutenberg-Universität, Mainz — [5]Goethe-Universität, Frankfurt am Main

Coulomb excitation is a powerful tool to investigate the collective response of exotic nuclei, providing a unique insight into the dynamical properties of nuclei located far from stability. Using this technique, their dipole strength can be measured, providing valuable information not only for the nuclear equation-of-state through the observation of the Pygmy Dipole Resonance (PDR), but also for nucleosynthesis scenarios, such as the rp-process.

Several experiments have been carried out in the past years using the R^3B-LAND setup at GSI in Darmstadt, in which the Coulomb excitation of unstable nuclei has been investigated in a kinematicaly complete manner. Selected results of these campaigns will be presented, with a main focus on the PDR mode. The experimental goals of future experiments at the R^3B setup will be discussed as well, revealing a strategy to not only gain a deeper understanding of the PDR, but also to disentangle the dipole and quadrupole contributions in exotic nuclei.

HK 13.2 Mo 17:00 P 4

Nuclear Breakup of 17Ne and its Two-Proton Halo Structure — •Felix Wamers[1], Thomas Aumann[1], Carlos Bertulani[2], Leonid Chulkov[3], Michael Heil[3], Justyna Marganiec[4,5], Ralf Plag[3,6], and Haik Simon[3] for the R3B-Collaboration — [1]Institut für Kernphysik, TU Darmstadt, Darmstadt, Germany — [2]Texas A&M University-Commerce, Commerce, USA — [3]Kernreaktionen und Nukleare Astrophysik, GSI, Darmstadt, Germany — [4]ExtreMe Matter Institute, GSI, Darmstadt, Germany — [5]JINA, Notre Dame, USA — [6]Goethe Universität, Frankfurt, Germany

17Ne is a proton-dripline nucleus that has raised interest in nuclear-structure physics in recent years. As a (15O+2p) Borromean 3-body system, it is often considered to be a 2-proton-halo nucleus, yet lacking concluding experimental quantification of its structure. We have studied breakup reactions of 500 AMeV 17Ne secondary beams in inverse kinematics using the R3B-LAND setup at GSI. The foci were on (p,2p)

quasi-free scattering on a CH2 target, and on one-proton-knockout reactions on a carbon target. Recoil protons have been detected with Si-Strip detectors and a surrounding 4pi NaI spectrometer. Furthermore, projectile-like forward protons after one-proton knockout from 17Ne have been measured in coincidence with the 15O residual core. The resulting relative-energy spectrum of the unbound 16F, as well as proton-removal cross sections with CH2 and C targets, and the transverse-momentum distributions of the residual fragments will be presented. Conclusions on the ground-state structure of 17Ne will be discussed. This work was supported by HIC for FAIR.

HK 13.3 Mo 17:15 P 4

Exclusive measurements of (p,pX) neutron and proton knockout reactions on ^{57}Ni — •Alina Movsesyan for the LAND-R3B-Collaboration — TUD, Schlossgartenstr.9, 64289 Darmstadt, Germany

In this presentation, an exclusive experimental approach for the investigation of the shell structure of exotic nuclei using proton-induced knockout reactions is discussed. The experiment performed at the LAND-R^{3}B facility at GSI allowed for an analysis of (p,2p) as well as for the first time (p,pn) reactions in inverse kinematics from kinematically complete measurements of the incoming and outgoing channels. Hereby, results for one-proton and one-neutron knockout reactions on the radioactive isotope ^{57}Ni will be discussed. The quasi-free-knockout character of the reactions was identified event-by-event by the reconstructed angular correlations of the scattered nucleons. Inclusive momentum distributions of the residual ^{56}Co and ^{56}Ni fragments and corresponding (p,2p) and (p,pn) reaction cross sections were deduced. The experimental setup is also capable to distinguish different reaction channels by observing the gamma decay of excited fragments. Particularly, an analysis of excited ^{56}Ni residues was carried out, allowing the separation of different angular momentum states of the knocked-out neutron in the ^{57}Ni ground state. The results will be compared to knockout reactions induced by a Be target and to theoretical estimates.

This work is supported by HIC for FAIR and EMMI.

HK 13.4 Mo 17:30 P 4

Quasi-free knock-out reactions in inverse kinematics at R3B/LAND-setup — •Valerii Panin[1], Thomas Aumann[1], and Jonathan Taylor[2] for the LAND-R3B-Collaboration — [1]TU Darmstadt, Germany — [2]University of Liverpool, UK

An important part of the physics program at the future R3B (Reactions with Relativistic Radioactive Beams) experiment at FAIR will be based on the study of a kinematical complete measurement of proton-induced reactions. These are in particular the quasi-free scattering processes of the type (p,2p), (p,pn), (p,pα) etc, which will be used to study the single-particle and cluster structure of neutron-proton asymmetric nuclei and the role of nucleon-nucleon correlations in nuclei. A prototype setup for the detection of high-energy protons in (p,2p) reactions in coincidence with forward emitted light particles and heavy fragments has been built based on an array of Si micro-strip detectors for tracking and thick NaI scintilators for energy measurements. In the present bemchmark experiment with ^{12}C the knock-out reactions from different single-particle states have been identified, including knock-out from the 0s state by reconstructing the excitation-energy spectrum of residual ^{11}B utilizing γ spectrometry and the invariant-mass method. This work is supported by the Hessian LOEWE initiative through HIC for FAIR.

HK 13.5 Mo 17:45 P 4

Gesamte Dipolstärke in ^{120}Sn mit polarisierter Protonenstreuung — •Anna Maria Krumbholz[1], Peter Neumann-Cosel[1], Iryna Poltoratska[1], Andreas Krugmann[1], Johannes Simonis[1] und AtsushiT Tamii[2] — [1]TU Darmstadt — [2]Research Center for Nuclear Physics, Osaka, Japan

Mit Protonenstreuung unter extremen Vorwärtswinkeln lassen sich elektrische und magnetische Dipolanregungen ober- und unterhalb der Neutronenseparationsenergie messen [1]. Durch experimentelle Entwicklungen am Research Center for Nuclear Physics in Osaka, Japan [2] kann bei mittlerer Energie von 300 MeV mit einem polarisierten Protonenstrahl unter 0° gemessen werden. Dabei wird eine hohe Energieauflösung von 25 keV erreicht. Für die Separation von E1- und M1-Anteilen werden zwei unterschiedliche Methoden eingesetzt: Eine Multipolentfaltung der Winkelverteilung der Wirkungsquerschnitte mit Hilfe von DWBA Rechnungen, und eine modellunabhängige Analyse von Polarisationstransferobservablen. Ergebnisse der aktuellen Analyse werden präsentiert.

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

* Supported by DFG under contracts SFB 634 and NE 679/3-1.

HK 13.6 Mo 18:00 P 4

Discovery and Cross-Section Measurement of Neutron-Rich Isotopes in the Element Range from Neodymium to Platinum at the FRS — •Fabio Farinon for the S392-Collaboration — GSI, Darmstadt, Germany

With a new detector setup and the high-resolution performance of the fragment separator FRS at GSI we discovered 57 new isotopes in the atomic number range of $60 \leq Z \leq 78$: $^{159-161}$Nd, $^{160-163}$Pm, $^{163-166}$Sm, $^{167-168}$Eu, $^{167-171}$Gd, $^{169-171}$Tb, $^{171-174}$Dy, $^{173-176}$Ho, $^{176-178}$Er, $^{178-181}$Tm, $^{183-185}$Yb, $^{187-188}$Lu, ^{191}Hf, $^{193-194}$Ta, $^{196-197}$W, $^{199-200}$Re, $^{201-203}$Os, $^{204-205}$Ir and $^{206-209}$Pt. The new isotopes have been unambiguously identified in reactions with a ^{238}U beam impinging on a Be target at 1 GeV/u. The isotopic production cross-section for the new isotopes have been measured and compared with predictions of different model calculations. These results will be presented.

HK 13.7 Mo 18:15 P 4

Pygmy dipole resonance and neutron skin in ^{208}Pb* — •Iryna Poltoratska[1], Peter von Neumann-Cosel[1], Vladimir Yu. Ponomarev[1], Atsushi Tamii[2], and Sergej Bassauer[1] — [1]Institut für Kernphysik, TU Darmstadt, Deutschland — [2]RCNP, Osaka University, Japan

A benchmark experiment on ^{208}Pb shows that polarized proton inelastic scattering at very forward angles including 0° is a powerful tool for studies of electric dipole ($E1$) and spin magnetic dipole ($M1$) modes in nuclei over a broad excitation energy range to test up-to-date nuclear models. For the separation of E1/M1 contributions two different independent methods are applied, viz. a multipole decomposition of the angular distribution of the cross sections utilizing DWBA calculations and a model-independent analysis based on polarization transfer coefficients. Such an experiment allows the extraction of the complete electric dipole strength including the pygmy dipole resonance and determine its global features. Utilizing recent theoretical results [1,2] in combination with the extracted electric dipole nuclear polarizability α_D one is able to constrin the neutron skin in ^{208}Pb [3] and thereby the symmetry energy relevant for the description of the neutron stars.

[1] P.-G. Reinhard and W. Nazarewicz, Phys. Rev. C **81**, 051303(R) (2010).
[2] J. Piekarewicz, Phys. Rev. C **83**, 034319 (2011).
[3] A. Tamii et al., Phys. Rev. Lett. **107**, 062502 (2011).

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

HK 13.8 Mo 18:30 P 4

Untersuchung der Pygmydipolresonanz in ^{124}Sn — •Friederike Schlüter[1], Janis Endres[1], Matthias Fritzsche[2], Norbert Pietralla[2], Christopher Romig[2], Deniz Savran[3,4], Kerstin Sonnabend[5], Andreas Zilges[1] und Markus Zweidinger[2] — [1]Institut für Kernphysik, Universität zu Köln — [2]Institut für Kernphysik, Technische Universität Darmstadt — [3]ExtreMe Matter Institute EMMI and Research Division, GSI — [4]Frankfurt Institute for Advanced Studies — [5]Institut für Angewandte Physik, Goethe Universität, Frankfurt

In den letzten Jahren wurde die elektrische Pygmydipolresonanz mit verschiedenen experimentellen Methoden erforscht. Die Pygmydipolresonanz des Kerns ^{124}Sn wurde anhand eines $(\alpha, \alpha'\gamma)$ Experiments untersucht [1], wobei Zustände beobachtet wurden, die aus einem vorherigen (γ, γ') Experiment [2] nicht bekannt waren. Aus diesem Grund wurde der Kern ^{124}Sn in einem Kernresonanzfluoreszenz-Experiment erneut untersucht. Das Experiment wurde am supraleitenden Darmstädter Elektronen-Linearenbeschleuniger S-DALINAC mit einer Endpunktsenergie von 7,8 MeV durchgeführt. Die zuvor in (γ, γ') unbeobachteten Zustände konnten in diesem neuen Experiment beobachtet werden. Für alle Übergänge wurde die $B(E1)\uparrow$-Stärke berechnet und mit einer QPM Rechnung [1] verglichen und bezüglich ihrer Fragmentierung und Verteilung der $B(E1)\uparrow$-Stärke analysiert.

Gefördert durch die DFG (ZI 510/4-1), SFB 634 und EMMI.

[1] J. Endres *et al.*, Phys. Rev. Lett. **105** (2010) 212503.
[2] K. Govaert *et al.*, Phys. Rev. C **57** (1998) 2229.

HK 13.9 Mo 18:45 P 4

Search for pygmy resonances in proton-rich Argon isotopes — •Olga Lepyoshkina[1,2] and Christoph Langer[2,3] for the LAND-R3B-Collaboration — [1]Physik Department TU München, Garching,

Germany — [2]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany — [3]IKP Institut für Kernphysik, Universität Frankfurt am Main, Germany

Since the discovery of pygmy resonances in neutron-rich nuclei a particular attention was paid to their analogues in proton-rich nuclei. Conceptually, RQRPA calculations predict the appearance of dipole strength for proton-rich nuclei like ^{32}Ar in the low-energy region between 8-10 MeV excitation energy. However a significant drop of resonance strength is expected for the ^{34}Ar. In contrast to the neutron-rich nuclei for which the existence of the pygmy resonances was justified by both theory and experiment, the proton-rich nuclei study is lacking a clear experimental confirmation yet. Aiming on the observation of the proton pygmy resonances, we have performed an experiment with a production of radioactive isotopes ^{32}Ar and ^{34}Ar via fragmentation of a 800 AMeV primary ^{36}Ar beam on a beryllium target. The produced proton-rich isotopes are subsequently sent onto a lead target of the LAND-R3B setup. The dipole response is observed using the Coulomb excitation method in inverse and complete kinematics. Current status of the data analysis and preliminary results will be presented.
This work was supported by GSI F&E and BMBF.

HK 14: Schwerionenkollisionen und QCD Phasen

Zeit: Montag 16:30–19:00 Raum: P 5

Gruppenbericht HK 14.1 Mo 16:30 P 5

Fractional electric charge and quark confinement — •Sam R. Edwards[1], André Sternbeck[2], Johannes Weyrich[1], Philipp Scior[1], and Lorenz von Smekal[1] — [1]Institut für Kernphysik, TU Darmstadt, Germany — [2]Institut für Theoretische Physik, Universität Regensburg, Germany

It is usual to treat quantum chromodynamics (QCD) as an isolated theory when studying non-perturbative phenomena such as quark confinement. The finite temperature deconfinement transition of the pure gauge theory (i.e. static quarks) is then characterized by the breaking of center symmetry. It mirrors the order-disorder transition of a 3-state Potts model, with center vortices playing the role of spin interfaces. This elegant description is spoiled by the introduction of dynamical quarks, which explicitly break center symmetry. Note, however, that quarks also carry fractional electric charge. This bestows the Standard Model with a hidden global symmetry that combines the centers of the color and electroweak gauge groups. A color center phase may be compensated by an electromagnetic one. The corresponding combined defects may be relevant for confinement, much like ordinary center vortices are in pure SU(N) gauge theories. We explore this possibility in a 2-color model with dynamical Wilson quarks carrying half-integer electric charge.

HK 14.2 Mo 17:00 P 5

Wechselspiel zwischen inhomogenen chiral gebrochenen Phasen und farbsupraleitenden Phasen stark wechselwirkender Materie — •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. Kürzlich wurde für ein solches Modell gezeigt, dass neben den bekannten homogenen Phasen auch inhomogene Phasen auftreten können, in denen der chirale Ordnungsparameter räumlich variiert. In diesem Vortrag diskutieren wir, inwieweit das Auftreten von farbsupraleitenden Phasen diese inhomogenen Regionen beeinflusst. In einem ersten Schritt beschränken wir uns dabei auf eindimensionale räumliche Modulationen des chiralen Ordnungsparameters und betrachten für den farbsupraleitenden Fall nur die homogene 2SC-Phase. Für realistische Parameter finden wir, dass die 2SC-Phase bei niedrigen Temperaturen gegenüber der inhomogenen chiral gebrochenen Phase energetisch bevorzugt ist. Bei höheren Temperaturen gibt es dagegen Bereiche im Phasendiagramm, in denen die inhomogene chiral gebrochene Phase favorisiert ist. Als Ausblick diskutieren wir die möglichen Auswirkungen inhomogener farbsupraleitender Kondensate auf das Phasendiagramm.

HK 14.3 Mo 17:15 P 5

Chiral crystals and inhomogeneous islands — •Stefano Carignano and Michael Buballa — Institut fuer Kernphysik, TU Darmstadt

I will discuss some recent developments in the study of inhomogeneous chiral symmetry breaking phases within the Nambu–Jona-Lasinio model. In particular, after briefly introducing the formalism, I will compare different kinds of possible crystalline shapes for a spatially modulated chiral condensate, in order to determine which is the energetically favored way for the system to spontaneously break chiral symmetry.

HK 14.4 Mo 17:30 P 5

Chiral and deconfinement transitions in QCD with 2 **and** 2 + 1 **flavours** — Christian S. Fischer[1,2] and •Jan Luecker[1] — [1]Institut für Theoretische Physik, Justus-Liebig-Universität Gießen, Heinrich-Buff-Ring 16, D-35392 Gießen, Germany — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Planckstr. 1 D-64291 Darmstadt, Germany.

We investigate quantum chromodynamics at finite temperature and chemical potential by solving the truncated Dyson-Schwinger equations for the quark and gluon propagator. In this setup we study chiral and deconfinement transitions, from which the critical endpoint and the existence of a quarkyonic phase can be determined. Since we explicitly take unquenching effects in the gluon into account, we are able to include strange quarks and to study the gluon propagator in vicinity of the phase transition.

HK 14.5 Mo 17:45 P 5

The thermal transition from twisted mass lattice QCD — Owe Philipsen and •Christopher Pinke — Goethe Universität Frankfurt am Main

We report on present investigations of the QCD phase diagram using lattice QCD with two flavours of twisted mass fermions. In particular, the determination of the thermal tranistion will be discussed.

HK 14.6 Mo 18:00 P 5

Propagatoren zwei-dimensionaler Yang-Mills-Theorie in Landau Eichung — •Markus Huber[1], Axel Maas[2] und Lorenz von Smekal[1] — [1]Institut für Kernphysik, Technische Universität Darmstadt, Schlossgartenstr. 9, 64289 Darmstadt — [2]Theoretisch-Physikalisches Institut, Friedrich-Schiller Universität Jena, Max-Wien-Platz 1, 07743 Jena

Funktionale Methoden wie die funktionale Renormierungsgruppe und Dyson-Schwinger-Gleichungen sind sehr vielversprechend zur Untersuchung des QCD-Phasendiagramms insbesondere bei endlichen Dichten, weil es kein Vorzeichenproblem gibt, wie es bei Monte-Carlo-Simulationen auftritt. Gleichzeitig stellen letztere aber auch eine wichtige komplementäre Methode dar, welche zum Teil die Möglichkeit eines direkten Vergleichs grundlegender Größen wie der Propagatoren bietet. Eine Schwierigkeit am Gitter ist es, niedrige Impulse zu erreichen. Deswegen werden oft auch Simulationen in zwei und drei Dimensionen durchgeführt, wo größere Gitter verwendet werden können. Dabei stellte sich heraus, dass das Verhalten in zwei Dimensionen qualitativ anders ist als in drei und vier Dimensionen. Hier untersuchen wir die Propagatoren zwei-dimensionaler Yang-Mills Theorie mit Dyson-Schwinger-Gleichungen, um das Zusammenspiel der beiden Methoden nicht nur in drei und vier Dimensionen sondern auch in zwei Dimensionen zu verstehen.

HK 14.7 Mo 18:15 P 5

Yang-Mills and QCD Thermodynamics from Functional Methods — •Leonard Fister and Jan Martin Pawlowski — Universität Heidelberg

We study the temperature dependence of correlators in Yang-Mills theory and QCD. For this purpose we utilise a purely thermal renormalisation group flow equation, and obtain the full thermal propagators. Interestingly, the electric screening mass is sensitive to the confinement-deconfinement phase transition. We also compute thermodynamic quantities such as the pressure for Yang-Mills theory, and discuss first results of a computation of correlation functions and thermodynamics in full QCD.

HK 14.8 Mo 18:30 P 5

The Thirring Model at Finite Density with Stochastic Quantization — •Christian Zielinski, Jan Martin Pawlowski, and Ion-Olimpiu Stamatescu — Institute for Theoretical Physics, University of Heidelberg, Heidelberg, Germany

The Thirring model at finite density is suffering from a severe sign problem. G. Parisi proposed already in 1983 that stochastic quantization, namely a complex Langevin evolution, could solve this problem. In the literature there are both positive and negative results known regarding the correctness of the method, but to this day solid theoretical foundations are missing. We aim to check for the applicability of complex Langevin evolutions to the Thirring model by comparing analytical with numerical results. In 0+1 dimensions we solve the lattice model exactly, in 2+1 dimensions we derive an approximate partition function by employing the heavy dense limit. We present and discuss our recent findings.

HK 14.9 Mo 18:45 P 5

Polyakov-Quark-Meson-Modell mit skalenabhängiger Polyakov-Loop-Variablen — •Piotr Piasecki und Lorenz von Smekal — Institut für Kernphysik, Technische Universität Darmstadt

Wir untersuchen ein zwei-Flavor Polyakov-Quark-Meson-Modell für die QCD mit Hilfe der funktionalen Renormierungsgruppe in der sogenannten Local-Potential-Approximation. Dabei werden die Flussgleichungen schrittweise unter Berücksichtigung der Skalenabhängigkeit der Polyakov-Loop-Variablen Φ für kleine Skalenintervalle gelöst. Auf diese Weise demonstrieren wir die Effekte des Renormierungsgruppenflusses von Φ durch Vergleich thermodynamischer Variablen mit herkömmlichen Rechnungen für skalenunabhängiges Φ.

HK 15: Hadronenstruktur und -spektroskopie

Zeit: Dienstag 16:30–19:00 Raum: RW 1

Gruppenbericht HK 15.1 Di 16:30 RW 1

Messung von Doppelpolarisationsobservablen mit dem CBELSA/TAPS-Experiment — •Jan Hartmann für die CBELSA/TAPS-Kollaboration — HISKP, Nussallee 14-16, 53115 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 Ergebnisse der am CBELSA/TAPS-Experiment gemessenen Doppelpolarisationsobservablen präsentiert.
Gefördert durch die Deutsche Forschungsgemeinschaft (SFB/TR 16).

HK 15.2 Di 17:00 RW 1

Messung von Polarisationsobservablen in der ω Photoproduktion* — •Holger Eberhardt für die CBELSA/TAPS-Kollaboration — Physikalisches Institut der Universität Bonn

Ziel des Crystal-Barrel/TAPS-Experimentes am Bonner Elektronen-Beschleuniger ELSA ist die Untersuchung von spezifischen Nukleon-Resonanzzuständen durch Photoproduktion von Mesonen. Zu diesem Zweck ist die Messung von Polarisationsobservablen unabdingbar. Aus diesem Grund werden zur Zeit Doppelpolarisationsexperimente mit polarisiertem Target und polarisierten Photonen durchgeführt. Dieser Vortrag befasst sich mit meiner Analyse der Reaktion $\vec{\gamma}\vec{p} \to p\omega \to p3\gamma$ unter Verwendung linear bzw. zirkular polarisierter Photonen, sowie einem longitudinal polarisierten Target. Die extrahierten Observablen Σ, Σ_π, G, G_π und E tragen zur Aufklärung des Produktionsmechanismus des ω-Mesons bei.
* gefördert durch die Deutsche Forschungsgemeinschaft (SFB/TR-16)

HK 15.3 Di 17:15 RW 1

Parity-violating asymmetry in $d(\vec{e}, e)np$ and measurement of the axial vector form factor at $Q^2 = 0.23$ (GeV/c)^2 — •David Balaguer Rios — Institut für Kernphysik, Mainz, Deutschland

The A4 collaboration at the MAMI facilities has measured the parity-violating asymmetry in the quasi-elastic scattering of longitudinally polarized electron on deuteron at backward angles and at a four momentum transfer of $Q^2 = 0.23$ (GeV/c)^2. This measurement is sensitive to a linear combination of the strange magnetic vector form factor G_M^s and the axial form factor G_A. Combined with the measurement of the parity-violating asymmetry on proton at backwards and at the same four momentum transfer it allows the experimental determination of the axial form factor G_A.

HK 15.4 Di 17:30 RW 1

Neue Resultate vom A4-Paritätsexperiment an MAMI — •Sebastian Baunack für die A4-Kollaboration — Institut für Kernphysik, Universität Mainz

Die A4-Kollaboration am Elektronenbeschleuniger MAMI mißt paritätsverletzende Asymmetrien im Wirkungsquerschnitt der elastischen Streuung polarisierter Elektronen an Protonen oder Deuteronen. Hieraus lassen sich die Beiträge von Strangequarks zu den Formfaktoren des Nukleons bestimmen.

Im Jahre 2011 wurde die Apparatur für Messungen unter Rückwärtswinkel umgebaut und Daten bei niedrigen Impulsüberträgen (Q^2=0.1 GeV^2) genommen. Die Messungen werden vorgestellt und erste Ergebnisse präsentiert.

HK 15.5 Di 17:45 RW 1

Messung der Polarisationsobservablen T in der $\pi^0\pi^0$ Photoproduktion am Proton — •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 erste Ergebnisse der Messung der Targetasymmetrie T in der Reaktion $\vec{\gamma}\,\vec{p} \to p\pi^0\pi^0$ vorgestellt.

Gefördert durch die Deutsche Forschungsgemeinschaft (SFB/TR16).

HK 15.6 Di 18:00 RW 1

Measurement of the Double Polarization Observable E in Photoproduction of η and $2\pi^0$ Mesons off Quasi-Free Protons and Neutrons — •Lilian Witthauer and Manuel Dieterle for the CBELSA/TAPS-Collaboration — Department of Physics, University of Basel, Klingelbergstrasse 82, 4056 Basel, Switzerland

Meson-Photoproduction is widely used to investigate the properties of the nucleon and its excited states. Since the nucleon resonances are broad and overlapping, it is very difficult to unravel the different resonance contributions. An adequate Partial Wave Analysis that would yield the complete information about any reaction requires the determination of single and double polarization observables. In case of the free proton such experimental programs are well developed at the JLAB, ELSA, and MAMI facilities, while so far much less is known for the neutron, which can be studied only in quasi-free production

reactions off light nuclei.
We will present very preliminary results of an ongoing experiment with the Crystal-Barrel/TAPS setup at the ELSA electron accelerator facility in Bonn to determine the double polarization observable E in photoproduction of η and $2\pi^0$ mesons of protons and neutrons, using a polarized D-butanol target.

HK 15.7 Di 18:15 RW 1

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

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.

HK 15.8 Di 18:30 RW 1

Measurement of the Beam Asymmetry in Neutral Pion Photoproduction from the Proton near Threshold — •David Hornidge for the A2-Collaboration — Department of Physics, Mount Allison University, Sackville, NB, Canada

A precise measurement of neutral pion photoproduction with a linearly polarized, tagged, photon beam and almost 4-pi detector in the threshold region (and higher) was performed at the Mainz Microtron. The Glasgow-Mainz tagged photon facility along with the Crystal Ball/TAPS detector system and a cryogenic liquid hydrogen target were used to obtain the total and differential cross sections simultaneously with the photon-beam asymmetry. This allowed for a precise determination of the S-wave amplitude, all three P-wave amplitudes and, for the first time, their energy dependence. The unitary cusp in the S-wave amplitude arising from charged pion re-scattering was also examined, leading to the extraction of the cusp function for the real part of the electric dipole amplitude. Results for the photon-beam asymmetry differ from the only previous measurement, which was done with the TAPS detector alone (PRL 87 232501). These data provide the most stringent test to date of the predictions of Chiral Perturbation Theory and its energy region of convergence.

HK 15.9 Di 18:45 RW 1

First results of the Jülich-COSY Spin-Filtering experiment — •Dieter Oellers for the PAX-Collaboration — Universita di Ferrara, Dipartimento di Fisica, 44122 Ferrara Italy — Institut für Kernphysik, Forschungszentrum Jülich, 52428 Jülich

The **P**olarized **A**ntiproton E**X**periments (PAX)-Collaboration proposes to polarize an antiproton beam. Spin dependent attenuation of a stored beam (spin-filtering) - proven to work with protons - is the only method which has the capability to also work for antiprotons.
The machine, the experimental setup and the detection system has been installed and commissioned at Jülich-COSY. In September 2011 a spin-filtering experiment at $T = 49.3\,\mathrm{MeV}$ has been performed at Jülich-COSY with a stored proton beam.
With the achieved long beam lifetime of $\tau \approx 8000\,\mathrm{s}$ and a polarized internal target with a density of $d_t = 4.5 \cdot 10^{13}/cm^2$ the sensitivity of the detection system on the spin dependent cross section can be tested. This talk will show a sketch of the experimental setup and focuses on the analysis. The sensitivity of the polarimeter and it's systematic effects are discussed in detail.
Supported by ERC Advanced Grant "Polpbar".

HK 16: Hadronenstruktur und -spektroskopie

Zeit: Dienstag 16:30–19:00 Raum: RW 2

Gruppenbericht HK 16.1 Di 16:30 RW 2

Strangeness with HADES - past, present, future — •Eliane Epple — Excellence Cluster "Universe", 85748 Garching

The HADES collaboration has studied strangeness production at SIS energies in different reactions: from medium-size collision systems (Ar+KCl) to proton induced reactions on heavy nuclei (p+Nb) and elementary reactions (p+p). Depending on the system, strange particles can be used to probe different physics cases.

From the Ar+KCl data sample, the up to now most complete set of strange particle species in the 1-2A GeV energy regime could be measured, including: K^0_S, K^+, K^-, ϕ, Λ and the deeply sub-threshold Ξ^-. Also in a p+p run at a beam kinetic energy of 3.5 GeV the reconstruction of several strange particles has been carried out. The $\Sigma(1385)^+$-resonance and the $\Lambda(1405)$-resonance have been reconstructed in an exclusive analysis and the investigation of differential K^0_S yields, performed previously for Ar+KCl has been continued. The aim hereby is to compare the K^0_S production to a p+Nb collision measured at the same beam kinetic energy in context of the kaon nucleon potential. Overall a broad spectrum of measurements will be presented which show the importance of strange probes for understanding the behaviour of nuclear matter and production processes.

In the future of HADES, data from Au+Au and pion-induced reactions will be available and this will allow to continue the differential studies of strangeness under various conditions.

HK 16.2 Di 17:00 RW 2

Lambda- und phi - Produktion in Reaktionen von p + Nb bei E_{kin} = 3.5 GeV — •Christian Wendisch für die HADES-Kollaboration — Helmholtz-Zentrum Dresden-Rossendorf

Zum Verständnis des Verhaltens von Strangeness tragenden Teilchen in Kernmaterie sind neben dem Studium von Schwerionenkollisionen insbesondere auch Untersuchungen von Nukleon-Kern-Stößen geeignet, die mit den Ergebnissen aus elementaren Nukleon-Nukleon Reaktionen verglichen werden können. Wir haben mit dem HADES Spektrometer am Schwerionensynchrotron SIS18 der GSI Darmstadt dazu insgesamt $4 \cdot 10^9$ p + Nb Reaktionen bei $E_{kin} = 3.5$ GeV vermessen und im Hinblick auf die Produktion von Λ-Hyperonen und ϕ-Mesonen untersucht. Hier stellen wir die entscheidenden Stufen der Teilchenidentifikation vor und präsentieren die beobachteten Phasenraumverteilungen. Die noch vorläufigen Ergebnisse werden mit Daten anderer Experimente sowie Modellrechnungen verglichen.

Diese Arbeit wurde unterstützt durch BMBF.

HK 16.3 Di 17:15 RW 2

Neutral Kaon Production in p+p and p+^{93}Nb Reactions at 3.5 GeV with HADES* — •Jia-Chii Berger-Chen for the HADES-Collaboration — TU München, Boltzmannstr. 2, 85748 Garching, Germany

The kaon nucleus interaction is a subject of interest for experimental and theoretical study. A number of experiments have measured the kaon-nucleon/nucleus potential at normal nuclear density in p+A [1] and π^-+A [2] reactions and in heavy ion collisions [3] all obtaining a slightly repulsive potential. However, the determined strengths of the potential are not consistent with each other. Therefore we propose to analyse the K^0_S production in p+p and p+^{93}Nb collisions at a kinetic beam energy of 3.5 GeV measured with HADES. The good event statistics of low p_t-kaons ($p_t < 100\,\mathrm{MeV}$) ensure the sensitivity of our measurements to the nuclear matter effects. The comparison of the K^0_S differential yields may then provide access to the in-medium kaon nucleus potential at normal nuclear density. We present the data analysis method and preliminary results.
[1]M. Büscher et al. (ANKE), Eur. Phys. J. A 22, 301-317 (2004).
[2]M.L. Benabderrahmane et al. (FOPI), PRL 102, 182501 (2009).
[3]G. Agakishiev et al. (HADES), Phys. Rev. C 82:044907 (2010).
* supported by BMBF and Excellence Cluster “Universe”

HK 16.4 Di 17:30 RW 2

Production of Strangeness in π^- induced Reactions — •Olaf N. Hartmann for the FOPI-Collaboration — Stefan-Meyer-Institut der ÖAW, Wien

The FOPI Collaboration has acquired data in π^- induced reactions on nuclear targets. Beam momenta of 1.15 and 1.7 GeV/c have be used. The measurements were done at the SIS accelerator of the GSI Darmstadt.

The production of strange particles, $K^0_S, \Lambda, K^\pm$, is studied as a function of the target mass number. Possible in-medium modifications in the production and/or particle properties are addressed by comparing the experimental results to transport model calculations.

The presentation will summarize the current status of the analysis including preliminary results and discuss the possibility of further experiments with the pion beam.

HK 16.5 Di 17:45 RW 2

Measurement Of The Baryonic Λ(1520) Resonance With The ALICE Apparatus At The LHC — •Benjamin Dönigus for the ALICE-Collaboration — Research Division and ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany — Helmholtz Research School H-QM, Frankfurt, Germany

The measurement of resonances can help significantly in disentangling the different phases of the fireball evolution in heavy-ion collisions. Due to their lifetimes of the order of the fireball lifetime (the lifetime of the Λ(1520) is 12.6 fm/c) they can be used as probes for the phase between the chemical and the kinetic freeze-out where rescattering and re-generation can change the observed particle yields [1,2]. To test this and to compare to the up to now very successful description of hadron abundances within the statistical model (for example [3]) we will study resonance to stable particle ratios, e.g. Λ(1520)/Λ. For this we use the transverse momentum spectrum of the Λ(1520) in 7 TeV proton-proton collsions as it will be presented here. This study will be used as a baseline for the analysis of heavy-ion data. Further we discuss the latest results on the H-Dibaryon, the postulated bound state of two Λ hyperons [4].

[1] G. Torrieri and J. Rafelski, J. Phys. G **28**, 1911 (2002)
[2] M. Bleicher and J. Aichelin, Phys. Lett. B **530**, 81 (2002)
[3] A. Andronic, P. Braun-Munzinger, J. Stachel, Phys. Lett. B **673**, 142 (2009); Erratum-ibid. B **678**, 516 (2009); arXiv:0812.1186
[4] R.L. Jaffe, Phys. Rev. Lett. **38**, 195 (1977)

HK 16.6 Di 18:00 RW 2

Quasifree Photoproduction of Pion Pairs off Nucleons bound in the Deuteron — •Markus Oberle for the A2-Collaboration — Departement of Physics, University of Basel, CH-4056, Switzerland

The study of photoproduction of pion pairs allows to investigate nucleon resonances which decay not directly to the nucleon ground state but via a cascade involving an intermediate excited state. During the last few years such reactions have been studied in quite some detail for the free proton. Their interpretation requires the measurement not only of angular - and invariant mass distributions of the pion pairs but also of polarization observables. More recently, a similar program has been launched for photoproduction off quasifree neutrons to explore the isospin degrees of freedom.
Preliminary results for the beam-helicity asymmetry measured with circularly polarized photons on unpolarized neutrons at MAMI with the Crystal Ball/TAPS setup will be discussed. Furthermore, first data have been taken at MAMI with a transversely polarized D-Butanol target to measure the target asymmetry T and the double polarization observable F for $\gamma n \rightarrow n\pi^0\pi^0$.

HK 16.7 Di 18:15 RW 2

Analyse von zentral diffraktiven Ereignissen in Proton-Proton Kollisionen bei $\sqrt{s} = 7$ TeV im ALICE Experiment — •Felix Reidt für die ALICE-Kollaboration — Physikalisches Institut, Universität Heidelberg

Das ALICE Experiment besteht aus dem zentralen Barrel im Pseudorapiditätsbereich $-0.9 < \eta < 0.9$, und weiteren Detektoren in den Bereichen $-3.7 < \eta < -0.9$ und $0.9 < \eta < 5.1$. Mit dieser Detektoranordnung lassen sich zentral diffraktive Ereignisse an Hand ihrer Topologie erkennen, die durch hadronische Aktivität im zentralen Barrel und fehlende Aktivität in den übrigen Detektoren, den sogenannten Pseudorapiditätslücken, definiert ist. Durch die niedrige Transversalimpuls-Schwelle im zentralen Barrel eignet sich ALICE gut zur Analyse zentral diffraktiv produzierter leichter Mesonresonanzen. Dieser Vortrag gibt eine Zusammenfassung der Analyse zentral diffraktiver Ereignisse aus Minimum-Bias Daten, sowie auch aus Daten, die mit einem speziellen Topologie-basierenden Trigger aufgenommen wurden.

HK 16.8 Di 18:30 RW 2

Photon Fusion Reactions in Chiral Perturbation Theory — •Maximilian Duell and Norbert Kaiser — Physik Department, Technische Universität München, 85747 Garching

Motivated by the proposal of the ALICE-collaboration at CERN to measure cross sections for photon-photon fusion $\gamma\gamma \rightarrow$ hadrons in ultraperipheral heavy-ion collisions, the reaction $\gamma\gamma \rightarrow \pi^+\pi^-$ is revisited in chiral perturbation theory. The NLO corrections to scalar QED are given by the pion electric and magnetic polarizabilities and chiral pion rescattering terms of combined magnitude $10-15$ percent with respect to LO.

At leading order we extend these calculations to the radiative process $\gamma\gamma \rightarrow \pi^+\pi^-\gamma$ and compute the corresponding photon spectrum $\mathrm{d}\sigma/\mathrm{d}\omega$. We study the influence of pion structure effects and compare to the soft photon approximation $\mathrm{d}\sigma/\mathrm{d}\omega = \sigma_{\mathrm{soft}}/\omega$. We also calculate the total cross section for the 4-body process $\gamma\gamma \rightarrow \pi^+\pi^-\pi^+\pi^-$.

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

HK 16.9 Di 18:45 RW 2

Single π^0-Photoproduction off Quasi-Free Protons and Neutrons — •Manuel Dieterle for the A2-Collaboration — Department of Physics, University of Basel, Klingelbergstrasse 82, 4056 Basel, Switzerland

Meson photoproduction allows a detailed investigation of the excitation spectrum of the nucleon and of the interactions of mesons with nucleons and nuclei. In order to understand the isospin decomposition of the electromagnetic excitations, it is necessary to measure the reaction not only on the proton, but also on the neutron. Since there exists no free neutron target, the sole experimental possibility to investigate this subject is the quasi-free photoproduction of mesons off neutrons bound in nuclei, in particular in the deuteron. As a consequence the production cross section will of course be influenced by nuclear Fermi motion and possibly also by nuclear final state interaction effects (FSI). However, such effects can be studied by a comparison of the free proton cross section to the quasi-free cross section measured in coincidence with recoil protons.

We will report preliminary results of a high statistics measurement of single π^0-photoproduction off quasi-free protons and neutrons from the deuteron with the Crystal-Ball/TAPS setup at the MAMI electron accelerator facility in Mainz. Preliminary differential and total cross sections covering the full angular range and photon energies up to the second and third resonance region have been measured to point out the possible significance of FSI effects of order of 25% of magnitude.

HK 17: Anwendungen kernphysikalischer Methoden

Zeit: Dienstag 16:30–19:00 Raum: RW 3

Gruppenbericht HK 17.1 Di 16:30 RW 3

Nuclear Photonics — •Dietrich Habs[1], Peter G. Thirolf[2], Marc Guenther[1], and Michael Jentschel[3] — [1]MPI f. Quantenoptik, Garching — [2]LMU München — [3]ILL Grenoble

With the planned new γ beam facilities like MEGa-ray at LLNL (USA) or ELI-NP at Bucarest (Rumania) with $10^{13}\gamma$/s and a band width of $\Delta E_\gamma/E_\gamma \approx 10^{-3}$ a new era of γ beams comes into operation, compared to the present best HIγS facility at Duke University (USA) with $10^7\gamma/s$ and $\Delta E_\gamma/E_\gamma \approx 3 * 10^{-2}$. At the same time new exciting possibilities open up to focus γ beams orders of magnitude better than at present, where we observed for the first time, that the index of refraction for γ beams is determined by virtual pair creation. Also several orders of magnitude more efficient monochromators for γ beams are being developed. Thus we have to optimize the total system: the γ beam facility, the γ beam optics and γ detectors in an integrated way. We can trade γ intensity for band width and address individual nu-

clear levels. Here it is important, that we can address with γ beams individual nuclear isotopes and not elements like with X-ray beams. Furthermore γ beams can penetrade much deeper into big samples like radioactive waste barrels, motors or batteries, compared to X-rays. We discuss the main strong M1 and E1 excitations under the new facet of applications. We find many new applications in biomedicine, green energy, radioactive waste management or homeland security. Also many orders of magnitude more brilliant secondary beams of neutrons and positrons can be produced.

HK 17.2 Di 17:00 RW 3

Planung und Fortschritt eines Teststandes für Neutronenabschirmungen im COBRA-Experiment — •Jan H. K. Timm für die C0BRA-Kollaboration — Universität Hamburg
Institut für Experimentalphysik
22761 Hamburg, D

Das COBRA-Experiment sucht mit CdZnTe–Halbleiterdetektoren nach dem neutrinolosen Doppel–Beta Zerfall in ^{116}Cd. Die erwartete Halbwertszeit dieses Zerfalls ist mit 10^{26} Jahren sehr hoch. Für die damit verbundenen niedrigen Zählraten ist die Reduzierung der Untergrundrate von entscheidender Bedeutung. An ^{116}Cd angereichertes Cadmium enthällt einen nicht vernachlässigbaren Anteil an ^{113}Cd mit einem sehr hohen Einfangwirkungsquerschnitt für thermische Neutronen. Die beim Einfang erzeugte Gammakaskade ($E_{ges} \approx 9\,\mathrm{MeV}$) trägt zum Untergrund bei.
In diesem Vortrag wird ein Teststand vorgestellt, der verschiedene Neutronenabschirmungen untersuchen soll.

HK 17.3 Di 17:15 RW 3

Charakterisierung der C0BRA Coplanar-Grid Detektoren — •Arnd Sörensen für die C0BRA-Kollaboration — IKTP, TU Dresden

Das COBRA-Experiment nutzt CdZnTe-Halbleiter-Detektoren um den erwarteten 0vbb-Zerfall verschiedener Isotope nachzuweisen und deren Halbwertzeit zu bestimmen. Grundlegend für dieses Experiment ist neben einem möglichst untergrundfreien Betrieb auch die genaue Kenntnis der Charakteristiken der eingesetzten CZT CPG-Detektoren. Da die Ladungsträgerbeweglichkeiten der Elektronen und Löcher um fast 2 Größenordnungen voneinander abweichen, und mikroskopische Störungen im Detektorkristall die Nachweiseffizienz eines Ereignisses (charge collection efficiency - CCE) negativ beeinflussen, ist es notwendig, die Detektoren nach ihrer Güte zu gruppieren und an den geeigneten Positionen im Experiment zu platzieren.

Dieser Vortrag zeigt, wie die Detektoren dafür eine Reihe von Untersuchung durchlaufen um die optimalen Arbeitsparameter zu bestimmen, ortsaufgelöst Effizienzverteilungen innerhalb der Detektoren vermessen werden, und die totale Effizienz der einzelnen Detektoren ermittelt wird.

HK 17.4 Di 17:30 RW 3

Pulsformen-Analyse mit Coplanar-Grid CdZnTe-Detektoren für das C0BRA Experiment — •Thomas Wester für die C0BRA-Kollaboration — IKTP, TU Dresden

Das C0BRA Experiment sucht mit Hilfe von CdZnTe-Detektoren nach neutrinolosen Doppel-Beta-Zerfällen von Cd-, Zn- und Te-Isotopen. Eine der zwei zur Wahl stehenden Detektortypen sind CdZnTe-Kristalle mit koplanarem Anodendesign.

Nach dem 2011 erfolgtem Upgrade der DAQ-Elektronik des C0BRA Experimentes, stehen nun auch die kompletten Pulsformen der Detektorsignale für die Datenanalyse zur Verfügung. Anhand dieser Pulsformen können unphysikalische Störsignale erkannt und herausgefiltert werden. Zusätzlich lassen sich weitere Informationen über die Wechselwirkungen der Teilchen im Detektor gewinnen. Diese Information können helfen, die Untergrundrate des Experimentes zu verringern. Unter anderem ist es möglich, die Tiefe der Teilchenwechselwirkungen im Detektor zu rekonstruieren um damit zum Beispiel Alpha-Zerfälle an der Detektoroberfläche auszugrenzen.

Der Vortrag stellt einige der Möglichkeiten vor, die sich für das C0BRA Experiment aus der Analyse von Pulsformen ergeben.

HK 17.5 Di 17:45 RW 3

Giove - Ein neues hochsensitives Germanium-Spektrometer mit aktiver Untergrundabschirmung — •Dominik Stolzenburg, Marc Weber, Gerd Heusser, Hardy Simgen und Manfred Lindner — Max-Planck Institut für Kernphysik, Heidelberg

Für hochsensible Experimente, wie die Suche nach dem neutrinolosen Doppelbetazerfall oder die Suche nach Dunkler Materie, wird ein effektives Material-Screening benötigt. Dabei müssen verschiedene Materialien auf ihre intrinsische Radioaktivität untersucht werden. Das neue Gamma-Spektrometer Giove (Germanium Inner and Outer Veto) soll dabei auch in geringer Labortiefe konkurrenzfähig bleiben und geringste Radioaktivitäten auf dem mBq/kg-Level nachweisen können. Dazu ist eine effiziente Untergrundabschirmung unabdingbar. Hierfür wird ein neues Myonvetosystem eingesetzt, um den durch kosmische Myonen induzierten Untergrund zu reduzieren und im Zusammenspiel mit weiteren Absorberschichten aus boriertem Polyethylen auch den Untergrund durch induzierte Neutronen zu verringern.

HK 17.6 Di 18:00 RW 3

Experimenteller Test der winkel-kontinuierlichen DSA-Methode (caDSAM): Messung von Zustands-Lebensdauern in ^{86}Kr, ^{136}Xe, ^{140}Ba — •C. Stahl, J. Leske, M. Reese, P.R. John und N. Pietralla — Institut für Kernphysik, Technische Universität Darmstadt

Im Rahmen des GSI-Experimentes U246 wurden angeregte Zustände des Kerns ^{86}Kr durch Coulomb-Anregung bevölkert. Bei einer Neu-Bestimmung der Lebensdauer des 2_1^+-Zustands mit simultanem Fit aller experimentell aufgenommenen Spektren unter verschiedenen Polarwinkeln im Rahmen der winkel-kontinuierlichen DSA-Methode[1] ergab sich ein sowohl vom vorherigen Ergebnis als auch vom Literaturwert abweichender Wert, anhand dessen die Stärken der neuen Methode demonstriert werden.
Im Rahmen des Experiments 09.08 wurden am LNL, Italien, Zustände mit niedrigem Drehimpuls der Kerne ^{136}Xe und ^{140}Ba durch Projektil-Coulombanregung bzw. Alpha-Transfer angeregt. Charakteristische Gammastrahlung wurde mit dem AGATA-Demonstrator spektroskopiert und Target-ähnliche Rückstoßkerne mit einem Si-'CD'-Detektor nachgewiesen. Lebensdauern der angeregten Zustände sollen mit der neu entwickelten caDSA-Methode extrahiert werden, um die Ortsempfindlichkeit des AGATA Detektorsystems optimal auszunutzen. Dies soll in Verbindung mit der bekannten Lebensdauer des 2_1^+-Zustands von ^{136}Xe als weiterer Benchmark der caDSA-Methode dienen.
Gefördert vom BMBF unter Förder-Nr. 06DA9040I und 06DA9041I.
[1]C. Stahl, Master-Thesis, TU Darmstadt, Oktober 2011

HK 17.7 Di 18:15 RW 3

Eigenschaften der Rb/Kr Quelle 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 0,2 eV/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, auch einem MAC-E-Filter, monoenergetische Konversionselektronen einer festen, ionenimplantierten Rb/Kr Quelle gemessen. Dieser Vortrag gibt einen Überblick über die bisherigen Messungen zur Charakterisierung Rb/Kr Quelle und ihre Eignung als nuklearer Standard. Gefördert durch das BMBF unter der Kennzeichnung 05A11VK3 und der Helmholtz-Gemeinschaft.

HK 17.8 Di 18:30 RW 3

Seeded quantum FEL at 478 keV — •Marc Günther[1], Peter Thirolf[2], Thorben Seggebrock[2], and Dietrich Habs[1,2] — [1]Max-Planck-Institut für Quantenoptik, D-85748 Garching, Germany — [2]Ludwig-Maximilians-Universität München, D-85748 Garching, Germany

We present for the first time a concept for a seeded γ quantum Free Electron Laser (QFEL) at 478 keV (transition in 7Li). To produce a highly intense and coherent γ beam, we intend to use a seeded FEL scheme. Important for the production of a highly brilliant and coherent γ beam are novel refractive γ lenses for focusing and an efficient monochromator, allowing to generate a very intense and coherent seed beam. To realize such a coherent γ beam at 478 keV (1/38 Å), it is suitable to use a quantum FEL design based on a new "asymmetric" laser-electron Compton back scattering scheme as pursued for the MeGaRay and ELI-NP facilities [1]. Here the pulse length of the laser is much longer than the electron bunch length, equivalent to a γ-FEL with laser wiggler. The coherence of a seeded QFEL can open up to-

tally new areas of fundamental physics and applications. Especially, 478 keV can be attractive for "green energy" and life-science research, such as the detection of Li deposition in the brain for manic-depressive psychosis treatment with high spatial resolution or isotope-specific nuclear waste management and treatment.

[1] http://www.eli-np.ro/gamma-beam-meeting-august-presentation.php

HK 17.9 Di 18:45 RW 3

Submillimeter medical imaging in emission tomography* — •C. Lang[1], D. Habs[1,2], P.G. Thirolf[1], and A. Zoglauer[3] — [1]LMU, München — [2]MPQ, Garching — [3]SSL, Berkeley

We present a nuclear medical imaging technique, capable to reach submillimeter spatial resolution in 3 dimensions with a short exposure time and a low radioactive dose compared to conventional PET. This 'γ-PET' technique takes advantage of specific e^+ sources which simultaneously with the β^+ decay emit an additional photon. Exploiting the triple coincidence between the positron annihilation and the additional emitted γ, it is possible to separate the reconstructed 'true' events from background. Thus the spatial uncertainty introduced by the motion of the e^+ or by Compton scattering within the patient can be strongly reduced in the direction normal to the annihilation. MC-simulations and image reconstruction studies have been performed using the library MEGAlib, which we modified to realize an event reconstruction using the $\beta^+\gamma$ coincidences. The simulated geometry consists of 4 $LaBr_3$ scintillator crystals ($5 \times 5 \times 3$ cm^3) read out by a 2D-segmented photomultiplier (64 pixels, each 6×6 mm^2) and 4 double-sided silicon strip detectors (each with 2×128 strips, active area of 5×5 cm^2, thickness 0.5 mm), positioned around an H_2O sphere of 6 cm diameter. Inside are two ^{22}Na point-like test sources, placed at a distance of 0.4 mm. The resolution results in 0.2 mm (FWHM) in each direction, surpassing the performance of conventional PET by about an order of magnitude.

*Supported by the DFG Cluster of Excellence "Munich-Centre for Advanced Photonics" (MAP).

HK 18: Instrumentation

Zeit: Dienstag 16:30–19:00 Raum: P 2

Gruppenbericht HK 18.1 Di 16:30 P 2

Status des Doppel-Beta-Experiments C0BRA — •Daniel Gehre für die C0BRA-Kollaboration — TU Dresden, IKTP

Das C0BRA-Experiment hat das Ziel, den neutrinolosen doppelten Betazerfall nachzuweisen und seine Halbwertzeit zu bestimmen. Durch den Nachweis dieses Zerfallskanals kann aus seiner Halbwertszeit die effektive Majorana-Masse des Elektron-Neutrinos abgeleitet werden.

Um dieses Ziel zu erreichen, werden Raumtemperatur-Halbleiter-Detektoren aus CdZnTe (CZT) im Untergrundlabor LNGS betrieben. Dabei dient das Detektormaterial gleichzeitig auch als Quelle des Zerfalls, da in CZT insgesamt neun Isotope enthalten sind, die einen solchen Doppel-Beta-Zerfall durchlaufen koennen. Zur Zeit wird die Eignung von zwei verschiedenen Detektor-Konfigurationen untersucht. Zum einen sind dies grossvolumige CoPlanar Grid Detektoren und zum anderen pixilierte Detektoren, die neben der Energieinformation auch eine Identifikation des wechselwirkenden Teilchens ueber die Auswertung der Spurinformation ermoeglichen. In diesem Vortrag werden der Aufbau des C0BRA-Experiments skizziert, die Aktivitaeten des vergangenen Jahres zusammengefasst und aktuelle Ergebnisse vorgestellt.

Gruppenbericht HK 18.2 Di 17:00 P 2

A liquid argon scintillation veto for GERDA and LArGe — •Jozsef Janicsko Csathy for the GERDA-Collaboration — Technische Universitaet Muenchen, James-Frank str. , Garching 85748

Gerda is an experiment to search for the neutrinoless double beta decay of ^{76}Ge. Bare germanium detectors are operated in a cryostat with 64 m^3 of liquid argon (LAr). It has been demonstrated in the LArGe test facility, that the detection of argon scintillation light can be used to effectively suppress background events in the germanium, that simultaneously deposit energy in LAr (LAr veto). Suppression factors up to 10^3 have been achieved for individual sources. Based on these results, Gerda pursues several options for the light instrumentation of LAr, which have to be compatible with the stringent radiopurity requirements of the experiment and should provide a significant suppression of the background in the region of interest around $Q_{\beta\beta}$ at 2039 keV.

This talk gives an account of the competing design options under investigation in the Gerda collaboration. Our main design options using photomultiplier tubes (PMT) and silicon photomultipliers (SiPM) are discussed. Their expected performance and progress of development is reported. In addition, results of the LArGe test facility are presented, along with the design criteria that follow for light instrumentation in Gerda.

HK 18.3 Di 17:30 P 2

Analyse von kosmischer Höhenstrahlung mit Hilfe eines segmentierten HPGe-Detektors — •David Schneiders, Benedikt Birkenbach, Jürgen Eberth, Herbert Hess, Gheorghe Pascovici, Peter Reiter und Andreas Wiens — IKP, Universität zu Köln

Der neu entwickelte Dual-Core-Vorverstärker der AGATA-HPGe-Detektoren ermöglicht mit Hilfe eines Time-over-Threshold-Verfahrens den Nachweis von hochenergetischen γ-Quanten und geladenen Teilchen. Zusätzlich reduziert die Messmethode die Totzeit des Detektors in diesem Energiebereich signifikant. Eine umfassende Studie von geladenen Teilchen aus der kosmischen Höhenstrahlung erweitert den Energiebereich der Detektoren auf über 150 MeV. Neben der Energiedeposition wird Ortsinformation durch die Segmentierung des Detektors genutzt, um die Trajektorie der einfallenden Höhenstrahlungsteilchen zu bestimmen. Sehr gute Übereinstimmung mit bekannten Ergebnissen zur Höhenstrahlung wurde erzielt. Wichtige zukünftige Anwendung ist die Unterdrückung von unerwünschten hochenergetischen Teilchen bei der in-beam γ-Spektroskopie mit radioaktiven Strahlen bei FRS/GSI und NUSTAR/FAIR.

Gefördert durch das BMBF (06K-167, 06KY205I).

HK 18.4 Di 17:45 P 2

Aufbereitung und Analyse der C0BRA-LNGS-Daten von 2008 bis 2010 — •Oscar Reinecke für die C0BRA-Kollaboration — Institut für Kern- und Teilchenphysik, Dresden, Deutschland

Von 2008 bis 2010 wurden im italienischen Untergrundlabor LNGS sowohl vier, als auch acht Koplanar-Grid-Detektoren betrieben. Die akquirierte Datenmenge beträgt insgesamt 11,4 Kilogrammtage. Bei der untersuchten Energie von 2,807 MeV befinden sich die Untergrundraten zwischen 0,01 und 0,2 (keV×kg×d)$^{-1}$, und die Energieauflösung zwischen 1% und 8%.

Mit einer statistischen Sensitivitätsoptimierung wird verhindert, dass Laufzeiten mit schlechter Auflösung und hoher Untergrundrate die gemessene Grenze der ^{116}Cd-Halbwertszeit schmälern. Im Weiteren geht der Vortrag auf die Bereinigung von unphysikalischen Ereignissen ein, und es werden wichtige Untergrundquellen diskutiert.

HK 18.5 Di 18:00 P 2

Design und Aufbau einer Frisch-Gitterionisationskammer für Low Level Alphaspektroskopie* — •Felix Krüger[1], Kai Zuber[1], Arnd Junghans[2] und Manfred Sobiella[2] — [1]Institut für Kern- und Teilchenphysik, TU Dresden — [2]Abteilung Strahlungsphysik, Helmholtz-Zentrum Dresden-Rossendorf

Für die Bestimmung der Halbwertszeit von langlebigen Alpha-Emittern ist es wichtig, Detektoren mit guter Untergrunddiskriminierung und großen aktiven Flächen einzusetzen. Aus diesem Grund wird in Dresden eine Frisch-Gitterionisationskammer konstruiert, die es möglich macht, Alphaproben mit einem Durchmesser bis zu 225 mm spektroskopisch zu vermessen. Um den intrinsischen Untergrund der Kammer zu minimieren, wurden Konstruktionsmaterialien auf ihre Kontamination hin untersucht. Durch Pulsformanalyse und eine gute Energieauflösung wird es möglich sein, Untergrundereignisse vom Messeffekt zu unterscheiden.

*Dieses Projekt wird gefördert durch das BMBF-Verbundprojekt TRAKULA FKZ: 02NUK013B

HK 18.6 Di 18:15 P 2

Gas Purity Analysis for the Xenon Dark Matter Project — Ethan Brown, Sonja Esch, Volker Hannen, Christian Huhmann, •Hans Kettling, Stephan Rosendahl, Johannes Schulz, and Christian Weinheimer — Institut für Kernphysik, Universität

Münster

The XENON Project searches for Dark Matter by detecting the nuclear recoil signal induced by a Weakly Interacting Massive Particle (WIMP) in a 2 phase xenon time projection chamber (TPC). The efficiency of the detector strongly depends on the purity of the xenon. Therefore the Muenster group develops among other things a Krypton distillation column in order to reduce the level of Krypton contamination to the low ppt range. This is necessary, as β-decay of ^{85}Kr constitutes one of the dominant backgrounds of the experiment.

In my talk a purity analysis of Xenon gas will be presented. In particular a mass spectrometry technique for measuring trace amounts of Krypton in Xenon down to the ppb and sub ppb range will be explained. The Sensitivity of the spectrometer is enhanced by orders of magnitude by the use of a cold trap with liquid nitrogen, exploiting the difference in vapor pressures of Krypton and Xenon at a temperature around 77 Kelvin.

This work has been supported by DFG (for XENON100, GZ: WE1 843/7-1) and BMBF (for XENON1T, GZ: 05A11PM1).

HK 18.7 Di 18:30 P 2

The inner electrode system of the KATRIN main spectrometer — •Michael Zacher, Björn Hillen, Hans-Werner Ortjohann, Christian Weinheimer, and Volker Hannen 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, KATRIN offers a model independent way to determine m($\overline{\nu}_e$) and therefore delivers an important piece in the puzzle of modern cosmology and particle physics.

With an energy resolution of Δ E<1 eV the 23 m long main spectrometer (MAC-E filter type) is one of the central parts of the experiment. For improved background reduction and the ability to shape the electric field inside the spectrometer an inner electrode system is installed with stringent requirements regarding precision, reliability and vacuum requirements. This electrode system, especially in the high-B-field regions at both spectrometer ends, has to be designed carefully to avoid particle traps which could lead to an increased background rate. The talk will give an overview about the electromagnetic design and the status of the electrode installation.

This project is supported by the BMBF contract number 05A11PM2.

HK 18.8 Di 18:45 P 2

Simulation der Penningfalle zwischen den KATRIN-Spektrometern und deren Visualisierung mit VTK — •Jan David Behrens, Björn Hillen, Michael Zacher und Christian Weinheimer für die KATRIN-Kollaboration — Westfälische Wilhelms-Universität, Münster

Durch das **KA**rlsruhe **TRI**tium **N**eutrinomass-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 Tandem aus zwei Spektrometern, die nach dem Prinzip des MAC-E-Filters arbeiten. Zwischen den Spektrometern existiert eine intrinsische Penningfalle, die den Untergrund der Messung ohne weitere Maßnahmen stark erhöhen würde. Die in der Kollaboration entwickelte Software *Kassiopeia* erlaubt die Simulation von Elektronenbahnen im KATRIN-Aufbau und eignet sich auch für die Untersuchung von gespeicherten Teilchen. Mit der Programmbibliothek *VTK* lassen sich die Simulationsergebnisse anschaulich visualisieren. Dieser Vortrag stellt erste Ergebnisse von Simulationen der Penningfalle zwischen den Spektrometern vor und zeigt deren Visualisierung mit VTK.

Dieses Projekt wird unter dem Kennzeichen 05A11PM2 durch das BMBF gefördert.

HK 19: Instrumentation

Zeit: Dienstag 16:30–19:00 Raum: P 3

Gruppenbericht HK 19.1 Di 16:30 P 3

The PANDA 3D Disc DIRC — •Benno Kröck, Michael Düren, Avetik Hayrapetyan, Klaus Föhl, Peter Koch, Oliver Merle, Daniel Mühlheim, and Julian Rieke for the PANDA-Collaboration — Justus-Liebig-Universität Gießen

A 3D Disc DIRC detector is foreseen to provide particle identification in the endcap region of the PANDA experiment at the future FAIR facility. The 3D-DIRC is a synthesis of the previously proposed FL-DIRC and TOP-DIRC at PANDA. It is based on the measurement of the internally reflected Cherenkov light in a 2 cm thick fused silica plate. Position sensitive single photon detectors—either MCP-PMTs or SiPMs—are placed in the focal plane of small focussing light guides and will provide a measurement of a projection of the Cherenkov angle. A precise determination of the time-of-propagation of the photons will allow to extract additional information of the Cherenkov angle and it will improve the identification of the signal pattern in a high luminosity, high background environment. Dichroic mirrors will be used to handle dispersion effects in the generation and propagation of the photons. The detector is expected to separate pions and kaons up to a momentum of ≈ 4 GeV/c. First Cherenkov patters were measured in 2011 using a glass prototype of the 3D disc DIRC.

HK 19.2 Di 17:00 P 3

Erste Analyse der DIRC-Testmessungen für WASA-at-COSY — •Klaus Föhl, Irina Brodski, Michael Düren, Avetik Hayrapetyan, Peter Koch, Kristof Kreuzfeld, Benno Kröck, Oliver Merle, Daniel Mühlheim und Julian Rieke für die WASA-at-COSY-Kollaboration — II. Physikalisches Institut, Justus-Liebig-Universität, Heinrich-Buff-Ring 16, 35392 Gießen

Für das Experiment WASA-at-COSY am Forschungszentrum Jülich ist ein Scheiben-DIRC-Detektor vorgeschlagen worden, um mittels einer genauen Geschwindigkeitsmessung der Protonen im Vorwärtswinkelbereich eine verbesserte Energieauflösung zu erreichen. Im DIRC-at-WASA-Projekt ist von den Universitäten Erlangen und Tübingen jeweils ein Detektorquadrant als Prototyp gebaut worden. Diese wurden im Oktober 2011 im TOF-Areal in Jülich mit Protonteststrahlen vermessen. Erste Analysen der Photonenmuster werden vorgestellt, die beiden unterschiedlich gestalteten Prototypen miteinander verglichen und weitere Schritte im Rahmen der Detektorentwicklung aufgezeigt.

HK 19.3 Di 17:15 P 3

Erweiterte Prototypentests des DIRC Detektors für das WASA@COSY Experiment — •Adrian Schmidt, Christoph Adolph, Wolfgang Eyrich, Florian Hauenstein und Liwen Li — Physikalisches Institut IV, Universität Erlangen-Nürnberg, Deutschland

Mit dem 4π Detektor des WASA@COSY Experiment am Forschungszentrum Jülich lassen sich ein Reihe von Mesonen Zerfällen in Proton(Deuteron)-Proton(Deuteron) Kollisionen untersuchen. Simulationen zeigen, dass ein zusätzlicher DIRC Detektor (Detector of Internally Reflected Cherenkov light) im Vorwärtsbereich eine signifikante Verbesserung der Teilchenidentifikation und Energieauflösung ermöglicht.
Nachdem erste Prototypentests die Machbarkeit eines derartigen Detektors aus Plexiglas zeigten, wurde ein Viertel des kompletten Detektors mit über 900 Photomultiplierkanälen aufgebaut und mit Protonen von 1 GeV/c und 2,7 GeV/c Impuls beschossen. Die Ergebnisse dieser Messungen, die auch für das PANDA DIRC Programm von Interesse sind, werden präsentiert und diskutiert.

Gefördert durch BMBF und FZ Jülich

HK 19.4 Di 17:30 P 3

Prototype for the PANDA Barrel DIRC — Andreas Gerhardt[1], Roland Hohler[1,2], •Grzegorz Kalicy[1,2], Dorothee Lehmann[1], Klaus Peters[1,2], Georg Schepers[1], and Carsten Schwarz[1] for the PANDA-Collaboration — [1]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt — [2]Goethe-Universität, Frankfurt

The design of the Barrel DIRC (Detector of Internally Reflected Cherenkov light) detector for the future PANDA experiment at GSI 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 build and successfully tested in 2011 during test beam times at GSI and CERN.

The prototype comprises a radiator bar, focusing lens, mirror, and oil-filled expansion volume. An array of micro-channel plate photomultiplier tubes measures the location and arrival time of the Cherenkov photons with a resolution of 100–200ps. During the beam tests the angle between bar and particle direction was varied. Different focusing optics and radiator bars were tested.

The performance of the prototype during the beam tests will be presented including results of the measurement of the 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 19.5 Di 17:45 P 3

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

Für das PANDA-Experiment am HESR/FAIR-Komplex der GSI in Darmstadt ist der Einsatz von zwei DIRC (Detection of Internally Reflected Cherenkov Light) Detektoren zur Teilchenidentifikation geplant. Dazu werden die Öffnungswinkel des beim Durchlauf eines relativistischen Teilchens durch einen Radiator emittierten Cherenkov-Kegels bestimmt. In Vorwärtsrichtung wird dies durch einen Scheiben-DIRC erfolgen, um den Wechselwirkungspunkt wird ein Barrel-DIRC zum Einsatz kommen.

Für letzteren sind Sensoren notwendig, die eine sehr gute Zeitauflösung von <100 ps für einzelne Photonen in Magnetfeldern über 1 Tesla erreichen. Außerdem werden niedrige Dunkelzählraten, eine hohe Ratenstabilität und eine lange Lebensdauer verlangt. Desweiteren ist eine gute Oberflächenuniformität bezüglich der Verstärkung und den Zählraten, sowie geringes Pixelübersprechen notwendig.

Diese Anforderungen werden bisher von keinem Photosensor vollständig erfüllt. Als vielversprechende Kandidaten werden zur Zeit Microchannel-Plate Photomultiplier (MCP-PMTs) mit verbessertem inneren Aufbau von Hamamatsu und Photonis untersucht. Unsere neuesten Ergebnisse hierzu werden vorgestellt.

- Gefördert durch BMBF und GSI -

HK 19.6 Di 18:00 P 3

Lifetime measurements of MCP-PMTs of the latest generation — •Alexander Britting, Wolfgang Eyrich, Albert Lehmann, and Fred Uhlig for the PANDA-Collaboration — Physikalisches Institut, Universität Erlangen-Nürnberg

Particle identification for the PANDA experiment will be acomplished by the usage of DIRC detectors (Detection of Internally Reflected Cherenkov Light). In these the guidance of the Cherenkov photons will be done by total reflection inside the radiator to the photon sensors.

Prospective sensor candidates are microchannel-plate photomultipliers (MCP-PMTs), since they achieve excellent time resolutions of about 30-50ps, high rate stabilities of a few $MHz\,cm^{-2}$ and can be operated in magnetic fields, which are expected to be up to 2T in PANDA.

The high PANDA luminosity of $2 \cdot 10^{32}\,cm^{-2}s^{-1}$ results in detected photon rates of about 200 $kHz\,cm^{-2}$ for the barrel DIRC. This accumulates to an integrated charge of about 1 $C\,cm^{-2}\,a^{-1}$ at the MCP anode assuming 100% duty cycle. Former MCP devices were not able to fulfill such lifetime requirements. However, the latest developments in the production of MCP-PMTs tremendously pushed this barrier. In Erlangen we are investigating new devices of different manufacturers of either multi-anode or single-anode designs. The results of the latest lifetime measurements will be presented.

- supported by BMBF and GSI -

HK 19.7 Di 18:15 P 3

Ein RICH Prototyp Detektor für CBM* — •Tariq Mahmoud für die CBM-RICH-Kollaboration — II. Physikalisches Institut, JLU Gießen, 35392 Gießen, DE

Das CBM(Compressed BaryonicMatter) 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 untersucht werden. Der zentrale Detektor zur Identifizierung der Elektronen wird ein RICH Detektor sein. 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 an der CERN PS getestet.

In diesem Beitrag sollen das Design, der Bau und Ergebnisse dieses Prototyps vorgestellt werden. Dabei werden die mechanische Konstruktion, insbesondere auch der Spiegelhalterungen, die eine verzerrungsfreie Aufhängung gewährleisten, erläutert. Mit den sogenannten D0 Messungen konnte dies überprüft werden. Ein vollständiges Gassystem wurde aufgebaut, das mit 80 ppm O_2 und 200 ppm H_2O betrieben wurde. Ergebnisse der Ringabbildung und Rekonstruktion im Hinblick auf die Güte der Spiegeljustierung, der Position des Cherenkovlichtkegels auf der Spiegelebene und des O_2 Gehalts des Radiatorgases werden vorgestellt. (*Gefördert durch das LOEWE Zentrum HIC for FAIR)

HK 19.8 Di 18:30 P 3

Charakterisierung von Spiegeln für den RICH-Detektor von CBM — •Sascha Reinecke für die CBM-RICH-Kollaboration — Bergische Universität Wuppertal

In Darmstadt an der GSI befindet sich derzeit das Facility for Antiproton and Ion Research (FAIR) im Aufbau. Eines der Projekte, die in diesem Zusammenhang aufgebaut werden, ist das Schwerionenexperiment Compressed Baryonic Matter (CBM). Mit diesem soll unter anderem das Phasendiagramm der QCD im Bereich hoher Baryonendichten und der Übergang der hadronischen Materie zum Quark-Gluon Plasma untersucht werden. Eine wesentliche Komponente des CBM-Detektors ist ein Ring-abbildender Cherenkov-Detektor (RICH), in welchem die Cherenkov-Kegel von schnellen Teilchen ($v > c_n = c/n$), die bei den Kollisionen entstehen, mit Hilfe sphärischer Spiegel ringförmig auf den Photodetektor abgebildet werden.

Zur Auswahl eines geeigneten Spiegel-Herstellers wurden Prototyp-Spiegel der Firmen SLO Olomouc, Flabeg und Compass beschafft und charakterisiert. Hierzu wurden mehrere Messstände aufgebaut, mit denen verschiedene Eigenschaften der Spiegel bestimmt werden können: die Reflektivität sowie die Homogenität (d.h. die Reflektivität ortsaufgelöst gemessen), jeweils wellenlängenabhängig zwischen 200 nm und 800 nm. Wir berichten über die Ergebnisse dieser Arbeiten.

HK 19.9 Di 18:45 P 3

A CBM-RICH prototype photo-detector: performance and beam test results* — •Jan Kopfer for the CBM-RICH-Collaboration — Bergische Universität Wuppertal

The Compressed Baryonic Matter Experiment (CBM) at the future Facility for Antiproton and Ion Research will explore the phase diagram of strongly interacting matter at high net-baryon densities. A Ring Imaging Cherenkov Detector (RICH) is developed for clean and efficient electron identification. It will consist of a gaseous radiator volume, high UV-reflectivity mirrors, and a photo-detector which is foreseen to be built of Hamamatsu H8500 multianode photomultiplier tubes.

A prototype RICH detector with self triggered readout electronics has been built and was tested at the Cern PS/T9 beamline. We will discuss the performance of the photo-detector in terms of number of detected photons per Cherenkov ring, single photon spectra, crosstalk, and electron pion separation capability.

* supported in part by GSI project WKAMPE1012 and by BMBF grant 06WU9195I

HK 20: Struktur und Dynamik von Kernen

Zeit: Dienstag 16:30–19:00 Raum: P 4

Gruppenbericht HK 20.1 Di 16:30 P 4

Characterization of shell closures and the role of the monopole interaction and the symmetry energy of nuclei — •Dennis Mücher[1], Reiner Krücken[1,2], Roman Gernhäuser[1], Jan Jolie[3], Stefanie Klupp[1], Katharina Nowak[1], Norbert Pietralla[4], and Steven W. Yates[5] for the IS510-Collaboration — [1]Technische Universität München — [2]TRIUMF, Canada — [3]IKP Köln — [4]TU Darmstadt — [5]University of Kentucky

One of the main goals of modern nuclear structure research is to identify changes in the mean field or residual interaction when going towards exotic systems. To track such changes, different observables are available for the experimentalist, like effective single particle energies for odd nuclei or values for the electric quadrupole transition strength in even-even nuclei. In this talk we show that the isospin degree of freedom gives a similar sensitivity to changes in shell structure. In this case the observable is the low-lying magnetic transition strength. A smooth contribution from the symmetry energy is needed to develop a consistent picture, especially going towards light nuclei or close to the N=Z line. We demonstrate the sensitivity to (sub)shell closures in case of e.g. N=16 (^{24}O) or N=40 (^{68}Ni). We give an overview about our actual activities at ISOLDE as well as future plans towards HIE-ISOLDE related to such questions. Supported under BMBF (06MT9156), DFG (EXC153) and ENSAR.

HK 20.2 Di 17:00 P 4

Low density behaviour of nuclear symmetry energy — •Urnaa Badarch and Horst Lenske — Institut für Theoretische Physik, Universität Giessen

The nuclear symmetry energy is a fundamental quantity important for studying the structure of systems as diverse as the atomic nucleus and the neutron star. Considerable efforts have been made to ascertain the symmetry energy and its dependence on nuclear density. The theoretical studies are in agreement in general but differences in detail e.g. at sub- and supra-saturation density. The density behavior of the symmetry energy with respect to charge asymmetric nuclear matter is studied within the density functional derived from Density-Dependent Relativistic Hadron field (DDRH) theory. We explored the genuine contribution of the isovector and isoscalar mesons to the symmetry energy and the isospin dynamics of nuclear matter. The results of our calculation for the isospin dependence of nuclear symmetry energy and the effective pairing interaction in comparison to phenomenological approaches will be presented.

HK 20.3 Di 17:15 P 4

Isospin symmetry in the sd shell — •Andreas Wendt[1], Peter Reiter[1], and Jan Taprogge[2] for the S377-Collaboration — [1]Institut für Kernphysik, Universität zu Köln — [2]CSIC Madrid, Spain

Very neutron deficient sd-shell nuclei may exhibit large distortions of the isospin symmetry. Differences in transition matrix elements between mirror nuclei provide access to changing collective behavior, expected by recent theoretical calculations. For the $T = -3/2$ isotope ^{33}Ar matrix elements were deduced from relativistic Coulomb excitation using the PRESPEC setup at GSI. The ^{33}Ar ions were produced by fragmentation of a high-energy ^{36}Ar beam impinged on a secondary Au target at an energy of ≈150 AMeV. Gamma-rays were observed by the Ge Cluster detectors of the PRESPEC setup and recorded together with particle information obtained with *LYCCA*. The $B(E2)$ values of ^{33,36}Ar will be compared to results of new shell model calculations.

Supported by the German BMBF (06KY9136 TP7+TP1) and by the "Helmholtz Graduate School for Hadron and Ion Research (HGS-HIRe)".

HK 20.4 Di 17:30 P 4

Search for mixed-symmetry states in ^{98}Mo — •Tim Thomas[1,2], Volker Werner[2], Tan Ahn[2], Christian Bernards[1,2], Nathan Cooper[2], Matthew Hinton[2,3], Gabriela Ilie[2,4], Jan Jolie[1], and Desiree Radeck[1] — [1]IKP, Universität zu Köln — [2]WNSL, Yale University, USA — [3]University of Surrey, UK — [4]NIPNE, Măgurele-Ilfov, Români

In the framework of the sdf-IBM-2 excited 2+ and 3- mixed-symmetry states are predicted in the molybdenum isotopes [1,2]. Signatures for these states are strong M1 decays to the first excited 2+ state or to the first excited octupole state, respectively. Therefore, the knowledge of multipole mixing ratios is essential. In search for such signatures we investigated ^{98}Mo populated via the reaction ^{96}Zr$(\alpha, 2n)$ at the Wright Nuclear Structure Laboratory. The depopulating γ transitions were detected with the highly efficient Yrast Ball γ spectrometer which allowed for the analysis of the $\gamma\gamma$ angular correlation analysis. We present multipole mixing ratios, spins and branching ratios and discuss the results in comparison with neighboring nuclei.

[1] N. A. Smirnova et al., Nucl. Phys. A 678, 235 (2000)
[2] M. Scheck et al., Phys. Rev. C 81, 064305 (2010)

HK 20.5 Di 17:45 P 4

Quadrupolanregung gemischter Proton-Neutron Symmetrie des Kerns ^{132}Ba — •Thomas Möller[1], Christopher Bauer[1], Giulia Guastalla[2], Jörg Leske[1], Norbert Pietralla[1], Georgi Rainovski[3,1], Dariusz Seweryniak[4], Johannes Wiederhold[1] und Shaofei Zhu[4] — [1]Institut für Kernphysik, TU Darmstadt — [2]Gesellschaft für Schwerionenforschung, Darmstadt — [3]St. Kliment Ohridski Universität, Sofia, Bulgarien — [4]Argonne National Laboratory, Argonne, USA

Zur Untersuchung der Evolution der Quadrupolanregung gemischter Proton-Neutron Symmetrie, des $2^+_{1,\mathrm{ms}}$-Zustandes [1], in den Ba-Isotopen unterhalb N=78 wurde ein Experiment in inverser Coulomb-Anregung am Kern ^{132}Ba durchgeführt. Ionen dieses Kerns wurden durch den ATLAS Beschleuniger des Argonne National Laboratory auf 445 MeV beschleunigt und in einem dünnen ^{12}C Target angeregt. Gammaquanten wurden mit dem Gammasphere Spektrometer detektiert. Aus den beobachteten relativen Anregungswirkungsquerschnitten der beobachteten Zustände und deren elektromagnetischen Zerfällen wurden die Stärken der entvölkernden Übergänge bestimmt. Aus der $B(M1; 2^+_i \rightarrow 2^+_1)$-Verteilung wurden Fragmente des gemischt symmetrischen Zustandes identifiziert. Die Ergebnisse werden vorgestellt und diskutiert. Gefördert von der DFG unter Pi 393/2-2 und vom Land Hessen im Rahmen von HIC for FAIR.

[1] N. Pietralla *et al.*, Prog. Part. Nucl. Phys. **60** (2008) 225 - 282

HK 20.6 Di 18:00 P 4

Gorkov-Green's function calculations of open-shell nuclei — •Vittorio Soma — Extreme Matter Institute (EMMI) — TU-Darmstadt

Ab-initio approaches - starting from the sole knowledge of a realistic nuclear force - aim at eventually achieving parameter-free predictions of nuclear properties. Although considerable progress has been made in recent years, e.g. using couple-cluster or self-consistent Dyson-Green's function methods, ab-initio nuclear structure calculations of medium-mass and heavy nuclei are still restricted to a limited number of (doubly-magic) nuclei. Besides the challenging numerical scaling, one reason is the inadequate account of pairing correlations that is essential to any realistic treatment of single- and doubly-open shell nuclei.

We are currently developing an ab-initio many-body method based on Green's function theory in the Gorkov formalism that allows for an explicit treatment of pairing correlations. Such approach is therefore applicable to a much larger set (˜500) of semi-magic nuclei, including systems up to, e.g., the tin isotopic chain. The talk will introduce the context within which such nuclear calculations take place, describe the many-body method and present the first results in the calcium isotopes.

HK 20.7 Di 18:15 P 4

Transition radii from electron scattering at low momentum transferand the structure of 2^+ mixed-symmetry states — •Abdulrahman Scheikh Obeid, Andreas Krugmann, Peter von Neumann-Cosel, Norbert Pietralla, Iryna Poltoratska, Vladimir Ponomarev und Christopher Walz — Institut für Kernphysik, TU Darmstadt, Germany

A measurement of charge transition radii differences of 2^+ one-phonon states of vibrational nuclei deduced from electron scattering at low momentum transfer provides information about the different interferences of the dominant valence shell components [1]. It is demonstrated in a case of ^{92}Zr that the method based in model independent PWBA analysis is applicable in heavy nuclei and furthermore permits a precise

determination of the B(E2) strength of the 2^+ mixed-symmetry states. The results will be also compared to experimental results extracted using the QPM and to the result extracted using a (n,n′γ)experiment. [1] C. Walz et al., Phys. Rev. Lett. 106, 062501 (2011).

HK 20.8 Di 18:30 P 4

shell evolution in neutron-rich Al isotopes around N=20 — •chiara nociforo for the FRS-S322-Collaboration — GSI, Darmstadt, Germany

The structure of nuclei in the region commonly referred as island of inversion has been extensively studied because of the anomalous breakdown of the N = 20 shell closure. Differently than in Ne, Na and Mg isotopes, the experimental two-neutron separation energy of the Al isotopes do not show anomalies and are well reproduced by large scale shell model calculations involving the full *sd* proton shell and the *pf* neutron shell as valence space. Recent magnetic moment measurements performed on the ^{33,34}Al isotopes have shown large discrepancies with shell model predictions, in the *sd* and *sdpf* model spaces, implying a possible extension of a deformed region beyond Z = 12. In order to study the evolution of the single particle occupancy in the Al isotopes we have measured the longitudinal momentum distributions of the ^{33,34,35}Al from one-neutron removal reactions and the corresponding cross sections at the Fragment Separator at GSI. The beam energy was around 900 MeV/u. The momentum distribution analysis has been performed in the eikonal framework. Comparing our results with shell model predictions, the inferred $2s_{1/2}$ neutron occupancy in the ^{33}Al ground state wave function is 20-40% lower than the predicted one. The inclusive data do not exclude the presence of intruder states. Some intruder l=1 occupancy is found in ^{34}Al although it is smaller than in ^{33}Mg.

HK 20.9 Di 18:45 P 4

Anregungsenergien von Teilchen-Loch-Zuständen in ^{208}Pb und die SDI Wechselwirkung — •Andreas Heusler[1], Rotislav V. Jolos[2] und Peter von Brentano[3] — [1]MPI-Kernphysik HD — [2]Joint Institute for Nuclear Research, RU-141980 Dubna, Russia — [3]Institut für Kernphysik, Universität zu Köln

Im schematischen Schalenmodell (SSM) haben alle Teilchen-Loch-Zustände mit einer bestimmten Konfiguration die gleiche Anregungsenergie. Im doppelt-magischen Kern ^{208}Pb sind 40 Zustände bekannt, welche die volle Stärke einer Teilchen-Loch-Konfiguration enthalten. Die Anregungsenergien dieser Zustände unterscheiden sich von der Vorhersage des SSM um −200 bis +600 keV. Von vielen weiteren Zuständen sind Spin, Parität und hauptsächliche Teilchen-Loch-Konfiguration bekannt. Die SDI Wechselwirkung (surface delta interaction) beschreibt die Aufspaltung der Teilchen-Loch-Multipletts im ^{208}Pb. Der einzige Parameter wird aus der Aufspaltung des $h^{+2\nu}_{9/2}$ Multipletts in ^{210}Po bestimmt. Die Anregungsenergien für beinahe 100 Zustände mit $E_x < 6.1$ MeV im ^{208}Pb werden mit der Vorhersage des erweiterten SSM verglichen.

HK 21: Schwerionenkollisionen und QCD Phasen

Zeit: Dienstag 16:30–19:00 Raum: P 5

Gruppenbericht HK 21.1 Di 16:30 P 5

Quark-meson-diquark model for two-color QCD — •Nils Strodthoff[1], Bernd-Jochen Schaefer[2,3], and Lorenz von Smekal[1] — [1]Institut für Kernphysik, TU Darmstadt, Germany — [2]Institut für Physik, Karl-Franzens-Universität Graz, Austria — [3]Institut für Theoretische Physik, Universität Gießen, Germany

We introduce a two-flavor quark-meson-diquark model for two-color QCD and its extensions to include gauge-field dynamics as described by the Polakov loop. Grand potential and phase structure are being studied both in mean-field approximation and with the functional renormalization group. The model provides an explicit example for the importance of baryonic degrees of freedom: When they are omitted, the phase diagram closely resembles that of the corresponding (Polyakov)-quark-meson models for QCD, in particular including their critical endpoint. In order to reproduce the well established main features based on the symmetries and breaking patterns of two-color QCD, however, they must be included and there is no critical endpoint.

HK 21.2 Di 17:00 P 5

Quark-Meson Model and Functional Renormalization Group — •Matthias Drews, Bertram Klein, and Wolfram Weise — Physikdepartment Technische Universität München, 85747 Garching

By coupling pions and the sigma boson to quarks, the quark-meson model serves to study the chiral phase transition. Our method is the functional renormalization group that interpolates in a non-perturbative way between the theory in the ultraviolet and in the infrared regime.

Quantum fluctuations are taken into account, which allow to treat the chiral phase transition at finite temperature and chemical potential beyond the mean-field approximation. In addition the model can be extended by the Polyakov-loop potential to include a notion of confinement.

Further novel steps towards inclusion of derivative couplings are discussed, with emphasis on an improved treatment of low-energy pion-pion interactions.

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

HK 21.3 Di 17:15 P 5

The QCD deconfinement transition for heavy quarks and all baryon chemical potentials I — •Jens Langelage — Max-von-Laue-Str. 1, 60438 Frankfurt am Main

Using combined strong coupling and hopping parameter expansions, we derive an effective three-dimensional theory from thermal lattice QCD with heavy Wilson quarks. The theory depends on traced Polyakov loops only and correctly reflects the centre symmetry of the pure gauge sector as well as its breaking by finite mass quarks. As an application, we determine the deconfinement transition and its critical end point as a function of quark mass and all chemical potentials.

In this first part, we derive the effective lattice action and present details of the calculation.

HK 21.4 Di 17:30 P 5

The QCD deconfinement transition for heavy quarks and all baryon chemical potentials II — •Stefano Lottini — ITP Goethe Universität, Frankfurt am Main, Deutschland

Using combined strong coupling and hopping parameter expansions, we derive an effective three-dimensional theory from thermal lattice QCD with heavy Wilson quarks. The theory depends on traced Polyakov loops only and correctly reflects the centre symmetry of the pure gauge sector as well as its breaking by finite mass quarks. It is valid up to certain orders in the lattice gauge coupling and hopping parameter, which can be systematically improved. As an application, we determine the deconfinement transition and its critical end point as a function of quark mass and all chemical potentials. In this part we discuss the numerical analysis of the model and draw the conclusions.

HK 21.5 Di 17:45 P 5

Finite-volume effects in the chiral phase diagram — •Ralf-Arno Tripolt[1], Bernd-Jochen Schaefer[2,3], and Lorenz von Smekal[1] — [1]Institut für Kernphysik, Technische Universität Darmstadt, Germany — [2]Institut für Physik, Karl-Franzens-Universität Graz, Austria — [3]Institut für Theoretische Physik, Justus-Liebig-Universität Giessen, Germany

We investigate effects of a finite volume on the phase diagram of a two-flavor quark-meson model. Using a non-perturbative functional renormalization group approach, both quark and meson fluctuation effects are inlcuded. The corresponding flow equation for a finite system is presented and solved numerically with the grid technique.

In particular, we show results for the critical endpoint and thermodynamic observables. Moreover, critical properties of the finite-volume phase structure are studied by calculating the quark number denstiy and quark number susceptibility [1].

[1] Ralf-Arno Tripolt, Jens Braun, Bertram Klein, Bernd-Jochen Schaefer, in preparation.

HK 21.6 Di 18:00 P 5

Event-by-event mean p_T fluctuations in pp and Pb–Pb collisions 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

Non-statistical event-by-event fluctuations of the mean transverse momentum of charged particles in pp and Pb–Pb collisions are studied using the ALICE experiment at the LHC. The analysis is performed at $|\eta| < 0.8$ and $0.15 < p_T < 2$ GeV/c. Multiplicity dependent results are obtained for pp collisions at $\sqrt{s} = 0.9$, 2.76 and 7 TeV. Pb–Pb collisions at $\sqrt{s_{NN}} = 2.76$ TeV are analysed in intervals of multiplicity and centrality, the latter in bins of 5%. Little collision energy dependence is observed in pp collisions. The data indicate 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. The results are compared to measurements in Au–Au collisions at lower collision energies and to Monte Carlo simulations with PYTHIA and HIJING.

HK 21.7 Di 18:15 P 5

The role of fluctuations in the phase diagram of QC_2D — •Naseemuddin Khan[1,2], Lisa M. Haas[1,2], Jan M. Pawlowski[1,2], Michael M. Scherer[3], and Fabian Rennecke[1,2] — [1]Institut für Theoretische Physik, Universität Heidelberg, Philosophenweg 16, 62910 Heidelberg, Germany — [2]ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung, Planckstr. 1, 64291 Darmstadt, Germany — [3]Institut für Theoretische Festkörperphysik, RWTH Aachen, Otto-Blumenthal-Straße, 52074 Aachen, Germany

We apply the Functional Renormalization Group equation to Quantum Choromodynamics with two colours and two quark flavours. Diquark states can form colour singlets and hence a vacuum state with nonzero baryon number can be realized. We explore the phase diagram for various regions of temperature and chemical potential, and evaluate the behavior of the chiral condensate, the diquark condensate and the mass spectrum by including bosonic and fermionic fluctuations.

HK 21.8 Di 18:30 P 5

Critical point in the QCD phase diagram: effects of vector interaction and axial U(1) anomaly at finite chemical potential — •Nino Bratovic[1,2], Wolfram Weise[1], and Tetsuo Hatsuda[2] — [1]Institut für Theoretische Physik T39, Physik-Department der TU München, James-Franck-Straße 1, 85747 Garching, Deutschland — [2]Quantum Hadron Physics Laboratory, RIKEN, Wako-shi, Saitama-ken, Japan

The Nambu-Jona-Lasinio model extended by Polyakov-loop dynamics (PNJL model) for 2 + 1 flavors is used in order to study the QCD phase diagram and associated thermodynamic quantities. In this approach, spontaneous chiral symmetry breaking as well as color singlet suppression in the hadronic phase are realized dynamically in terms of the respective order parameters. We investigate in detail the effects of a vector-type interaction in this model, particularly in combination with the U(1)A symmetry breaking Kobayashi-Maskawa-*t Hooft interaction. We show phase diagrams in the temperature-density plane and discuss possible constraints on the model from our knowledge of nuclear physics. The question of the existence and possible locations of the critical point within our framework is discussed as well.

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

HK 21.9 Di 18:45 P 5

Thermalized or not thermalized? The SHM at SIS energies. — •Manuel Lorenz[1], Romain Holzmann[2], and Joachim Stroth[1,2] for the HADES-Collaboration — [1]Goethe -Universität, Frankfurt — [2]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt

With the HADES detector we have investigated in great detail the collision system Ar+KCl at 1.76 AGeV. From the data, the up to now most complete set of particle species in the 1-2A GeV energy regime could be reconstructed. This allows for a stringent test of various phenomenological models, in particular statistical hadronization models. SHM have indeed been successful in extracting the freeze-out line in the T – μ_b plane of the nuclear phase diagram by fitting particle yields from relativistic and ultrarelativistic heavy ion collisions [1]. At energies of a few GeV, however, the validity of these models is not so well established, since it remains unclear whether chemical equilibrium can be reached, and therefore the question arises whether a statistical treatment of particle production is at all meaningful. The situation is further complicated by the need for strangeness suppression, which is handled differently in the various implementations of the SHM. In this contribution, we compare the measured particle yields to an SHM fit and discuss the results critically with respect to the various signatures of thermalization of the collision system, in particular the strong deviation observed for double strange particles. This work has been supported by BMBF (06 FY 9100 I), HIC for FAIR, EMMI and GSI. [1] A. Andronic, P. Braun-Munzinger and J. Stachel, Nucl. Phys. **A 772**, (2006) 167.

HK 22: Hadronenstruktur und -spektroskopie

Zeit: Mittwoch 14:00–16:00 Raum: RW 1

Gruppenbericht HK 22.1 Mi 14:00 RW 1

Partialwellenanalysen für PANDA und BESIII — •Bertram Kopf[1], Miriam Fritsch[2], Klaus Götzen[3], Anastasia Karavdina[2], Helmut Koch[1], Mathias Michel[2], Christof Motzko[1], Sebastian Neubert[4], Marc Pelizäus[1], Klaus Peters[3], Julian Pychy[1], Jan Schulze[1], Matthias Steinke[1] und Ulrich Wiedner[1] — [1]Ruhr-Universität Bochum — [2]Johannes Gutenberg-Universität Mainz — [3]GSI Darmstadt — [4]Technische Universität München

Im Frühjahr 2010 hat sich innerhalb der PANDA-Kollaboration eine Gruppe formiert, die zum Ziel hat, eine benutzerfreundliche, performante und modulare Software für Partialwellenanalysen (PWA) zu entwickeln. Sie soll Anwendung in sämtlichen Bereichen der PANDA-Physik finden, und so flexibel sein, dass auch Daten von anderen Hadronenspektroskopie-Experimenten analysiert werden können.

Zu Beginn des Vortrags werden kurz die Pläne zum Funktionsumfang und zur Struktur der Software vorgestellt. Das Grundgerüst der Software konnte bereits realisiert und mit diesem erste PWA-Analysen durchgeführt werden. Ein Fokus wurde auf Analysen älterer Crystal Barrel@LEAR-Daten gelegt, um wichtige Aspekte zum $\bar{p}p$-Annihilationsprozess zu studieren. Darüber hinaus werden erste vorläufige Resultate von Partialwellenanalysen von BESIII-Daten präsentiert, die zum Ziel haben, Resonanzen aus radiativen Charmoniumzerfällen zu identifizieren.

Gefördert durch das BMBF.

HK 22.2 Mi 14:30 RW 1

Status der Framework-Entwicklung für die PANDA-Partialwellenanalyse — •Mathias Michel[1], Miriam Fritsch[1,2], Klaus Götzen[3], Anastasia Karavdina[2], Bertram Kopf[4], Prometeusz Jasinski[1,2], Sebastian Neubert[5], Klaus Peters[3] und Matthias Steinke[4] für die PANDA-Kollaboration — [1]HI Mainz — [2]Universität Mainz — [3]GSI Darmstadt — [4]Universität Bochum — [5]TU München

Ein Großteil des Physikprogramms des PANDA-Experiments an FAIR (Darmstadt) beschäftigt sich mit der Suche nach neuen konventionellen und exotischen hadronischen Zuständen wie z.B. Hybriden oder Gluebällen. Zur Identifizierung möglicher Kandidaten und zur eindeutigen Einordnung bereits bekannter Zustände wird bei PANDA in mehr als 80% aller Analysen eine Partialwellenanalyse (PWA) benötigt.

Zu diesem Zweck wird ein neues, flexibles und effizientes PWA-Framework entwickelt. Es wird modular gestaltet, was 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. Dies gewährleistet, dass Erfahrungen mit anderen PWA-Programmen genutzt und Limitierungen dieser umgangen werden.

Im Vortrag wird das Konzept des Software-Frameworks für die PANDA-PWA vorgestellt sowie als Beispielanwendung ein modellunabhängiger Dalitzplot-Fit präsentiert.

HK 22.3 Mi 14:45 RW 1

Partial-Wave Analysis of the Centrally Produced $\pi^+\pi^-$ System in pp Reactions at COMPASS — •Alexander Austregesilo[1], Boris Grube[1], Stephan Paul[1], and Tobias Schlüter[2] for the COMPASS-Collaboration — [1]Technische Universität München — [2]Ludwig-Maximilians-Universität München

COMPASS is a fixed-target experiment at CERN SPS which investigates the structure and spectroscopy of hadrons. During 9 weeks in 2008 and 2009, a 190 GeV/c proton beam impinging on a liquid hydrogen target was used in order to study the production of exotic mesons and glueball candidates at central rapidities. As no bias on the production mechanism was introduced by the trigger system, the contribution from diffractive dissociation of the beam proton poses a challenge. Several approaches were tried to disentangle a clean, centrally produced sample. A model to describe the data in terms of partial-waves will be introduced. Furthermore, preliminary fits will be presented and compared to results from previous experiments. Particular attention has to be paid to the ambiguities in the amplitude analysis of the two-pseudoscalar final state.

HK 22.4 Mi 15:00 RW 1

SU(3) breaking corrections to the D, D^*, B and B^* decay constants — •Michael Altenbuchinger[1], Lisheng Geng[2,1], and Wolfram Weise[1] — [1]Physik Department, Technische Universität München, D-85747 Garching — [2]School of Physics and Nuclear Energy Engineering, Beihang University, Beijing 100191, China

We report on a first next-to-next-to-leading order calculation of the decay constants of the $D\,(D^*)$ and $B\,(B^*)$ mesons using a covariant formulation of chiral perturbation theory. It is shown that, using the state-of-the-art lattice QCD results on f_{D_s}/f_D as input, one can predict quantitatively the ratios of $f_{D_s^*}/f_{D^*}$, f_{B_s}/f_B, and $f_{B_s^*}/f_{B^*}$ taking into account heavy-quark spin-flavor symmetry breaking effects on the relevant low-energy constants. The predicted relations between these ratios, $f_{D_s^*}/f_{D^*} < f_{D_s}/f_D$ and $f_{B_s}/f_B > f_{D_s}/f_D$, and their light-quark mass dependence should be testable in future lattice QCD simulations, providing a stringent test of our understanding of heavy quark spin-flavor symmetry, chiral symmetry and their breaking patterns.

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

HK 22.5 Mi 15:15 RW 1

Messung des Verzweigungsverhältnisses im Kanals $\mathbf{D^0 \to K^0_S K^+ K^-}$ — Wolfgang Gradl und •Peter Weidenkaff — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz

Das BES-III Experiment am BEPCII e^+e^--Speicherring hat seit dem Start der Datennahme im Frühjahr 2009 bis zum Mai 2011 bereits einen 2.9 fb^{-1} großen Datensatz an $\psi(3770)$ Zerfällen gesammelt. D-Mesonen aus $\psi(3770)$ Zerfällen werden in einem kohärenten Zustand erzeugt und legen somit wechselseitig den Teilchentyp fest. Durch die Rekonstruktion eines D-Zerfalls kann der anti-D Zerfall mit geringem Untergrundbeitrag untersucht werden. BES-III bietet damit ideale Bedingungen, um Zerfälle von D-Mesonen zu studieren.

Wir stellen vorläufige Ergebnisse zur Messung des Verzweigungsverhältnisses im Kanals $D^0 \to K^0_S K^+ K^-$ vor. Es wird auf die Selektion der Signalereignisse und die Bestimmung der Anzahl an Signalzerfällen eingegangen, sowie die vorläufigen Ergebnisse zu systematischen Studien vorgestellt.

HK 22.6 Mi 15:30 RW 1

Chiral SU(3)-Dynamics and Baryon-Baryon Interactions — •Stefan Petschauer, Norbert Kaiser, and Wolfram Weise — Physik-Department, Technische Universität München, D-85747 Garching, Germany

Using SU(3) chiral perturbation theory we calculate hyperon-nucleon and hyperon-hyperon interactions at next-to-leading order. The constructed potentials in momentum space include all one- and two-meson exchange terms generated by the SU(3) chiral Lagrangian. Effects from intermediate decuplet baryons are considered as well. Together with additional contact terms at the same order these chiral baryon-baryon potentials provide a new baseline for systematic studies of hyperon-nucleon scattering and light hypernuclei (few-baryon systems with strangeness).

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

HK 22.7 Mi 15:45 RW 1

Dalitz-Plot-Analyse des $D^+ \to K^-\pi^+\pi^+$ Zerfalls bei $\overline{\text{P}}$ANDA * — •Andreas Pitka, Ralf Kliemt, Simone Bianco, Kai-Thomas Brinkmann, Robert Schnell, Thomas Würschig und Hans-Georg Zaunick — Helmholtz-Institut für Strahlen- und Kernphysik, Rheinische Friedrich-Wilhelms-Universität Bonn, Nussallee 14-16, D-53115, Bonn, Germany

Am $\overline{\text{P}}$ANDA-Experiment in Darmstadt wird bei einem Antiprotonenimpuls von bis zu $p_{\overline{p}} = 15$ GeV/c die Produktion von Zuständen mit offener Charm-Quantenzahl möglich sein. Die zu erwartende hohe Rekonstruktionseffizienz von D-Mesonen erlaubt dabei auch die Dalitz-Plot-Analyse von deren Dreikörperzerfällen. Der hier untersuchte Kanal $D^+ \to K^-\pi^+\pi^+$ ist ganz wesentlich durch angeregte Kaonen im Zwischenzustand bestimmt.

Im Rahmen des PandaRoot Frameworks wird anhand von Monte-Carlo-Simulationen gezeigt, dass es möglich ist mittels einer χ^2-Minimierung der rekonstruierten Dalitz-Plots die komplexen Amplituden der indermediären Kaonen zu bestimmen und sich das Ergebnis mittels einer Akzeptanzkorrektur verbessern lässt.

* gefördert durch BMBF

HK 23: Hadronenstruktur und -spektroskopie

Zeit: Mittwoch 14:00–16:00 Raum: RW 2

Gruppenbericht HK 23.1 Mi 14:00 RW 2

Messungen zu den Meson-Polarisierbarkeiten und zu chiraler Dynamik in Pion-Photon-Reaktionen an COMPASS — •Jan Friedrich für die COMPASS-Kollaboration — TU München

Das COMPASS-Experiment am CERN bietet weltweit einzigartige Bedingungen zur Untersuchung von Meson-Photon-Reaktionen in einem weiten kinematischen Bereich. Die hochgenaue Messung der Endzustände von Pion- und Kaonstrahlen mit 190 GeV Einschussenergie auf ruhende Kerne erlaubt die Identifikation von Wechselwirkungen mit dem Coulombfeld bei kleinsten Impulsüberträgen $Q^2 < 0.001\,\text{GeV}^2/c^2$ und Schwerpunktsenergie des Meson-Photon-Systems im Bereich $\lesssim$ 1 GeV.

Die Bestimmung der Polarisierbarkeiten durch die Comptonreaktion $\pi\gamma \to \pi\gamma$ ist das wichtigste Ziel der Messungen. Nach einer kurzen Strahlzeit im Jahr 2009, deren aktuellste Ergebnisse vorgestellt werden, ist für 2012 Datennahme mit sehr hoher Statistik geplant, die neben Termen höherer Ordnung für Pionen auch eine erste Messung der Kaonpolarisierbarkeit zum Ziel hat.

Weitere Aspekte der untersuchten Reaktionen sind die Bestimmung der chiralen Anomalie in $\pi\gamma \to \pi\pi^0$, sowie die chirale Dynamik von $\pi\gamma \to 3\pi$. Der Vergleich der Ladungszustände $\pi^-\pi^-\pi^+$ und $\pi^-\pi^0\pi^0$ erlaubt detaillierte Aussagen über Schleifen-Beiträge, die von der chiralen Störungsrechnung vorhergesagt werden.

HK 23.2 Mi 14:30 RW 2

Cross section for quasi-real photo-production of charged hadrons with high transverse momenta in muon-deuteron scattering — •Christian Höppner for the COMPASS-Collaboration — Physik-Department E18, Technische Universität München

The measurement of unpolarized high-p_T hadron-production cross sections provides an important benchmark for the applicability of perturbative QCD (pQCD) calculations, especially at lower center-of-mass energies, where corrections beyond the next-to-leading order could become important. These calculations rely on the factorization of unpolarized and polarized cross sections into non-perturbative parton distribution functions, which parametrize the structure of the nucleon, hard scattering cross sections, calculable in pQCD, and non-perturbative fragmentation functions. In this contribution we shall present the first measurement of the unpolarized cross section for the quasi-real photo-production of charged hadrons with high transverse momenta from muon-deuteron scattering data at $\sqrt{s} = 17.4$ GeV at COMPASS. The

dependence of the cross section on p_T for forward and central rapidities is discussed. The presented cross section results are compared to recent NLO pQCD calculations.

HK 23.3 Mi 14:45 RW 2

Diffractive Dissociation into 3 Pion Final States at COMPASS — •Florian Haas for the COMPASS-Collaboration — Technische Universität München

Diffractive dissociation reactions studied at the COMPASS experiment, CERN, provide access to the light meson spectrum. During a pilot run in 2004, using a pion beam and a lead target, 500k events of $\pi^-\pi^-\pi^+$ final state events with masses below 2.5 GeV/c^2 were recorded, yielding a significant signal for the $\pi_1(1600)$ spin-exotic resonance. After a significant upgrade of the spectrometer in 2007, the following two years were dedicated to meson spectroscopy. Using again a pion beam, but now with a liquid hydrogen target, an unique statistics of $\sim$ 60M events of the same final state was gathered in 2008. During a short campaign in 2009, the liquid target was exchanged by several solid state targets in order to compare final states produced on targets with different atomic numbers. After a short summary of a partial wave analysis (PWA) of 2004 data, the focus will be on a PWA of 2008 data in the same kinematic range of momentum transfer ($0.1\ \mathrm{GeV}^2/c^2 < t' < 1.0\ \mathrm{GeV}^2/c^2$). In addition the progress of the analysis of data recorded with solid state targets in 2009 and a comparison with 2008 and 2004 data will be presented.

HK 23.4 Mi 15:00 RW 2

Single-Hadron transverse target spin asymmetries at COMPASS — •Christoph Adolph — Physikalisches Institut IV der Universität Erlangen-Nürnberg

The quark content of the nucleon at twist-two level in the collinear case can be fully characterized 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. COMPASS is a fixed target experiment at CERN where the nucleon spin structure is investigated using a 160 GeV/c polarized μ^+ beam and polarized solid state targets. The measurements 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. After taking data in the years 2002-2004 using a transversely polarized ^{6}LiD (deuteron) target, in 2007 and 2010 data were collected on a transversely polarized NH_3 (proton) target. The data allows to investigate the transversity distribution function, e.g. coupled to the Collins fragmentation function, as well as transverse momentum dependent distribution functions, like the Sivers distribution function, by measuring azimuthal asymmetries in hadron production. In this contribution we present the results on one hadron spin asymmetries from the 2010 data for the Collins and Sivers asymmetries.

supported by German BMBF

HK 23.5 Mi 15:15 RW 2

OZI rule violation and spin alignments in vector meson production at COMPASS — •Johannes Bernhard — for the COMPASS collaboration — Institut für Kernphysik, Johannes-Gutenberg-Universität, Johann-Joachim-Becher-Weg 45, 55099 Mainz

The COMPASS collaboration at CERN dedicated the 2008 and 2009 run time to meson spectroscopy measurements. At 190 GeV/c beam momentum, both diffractice and double-diffractice production mechanisms overlap which can be explored with vector meson production studies. We present results for spin alignments of $\omega(782)$ and $\phi(1020)$ depending on x_F and t alongside with systematics of the event selection. In addition, we find an OZI rule violation of a factor of 3 in the comparision of yields for $pp \to pp\omega$ and $pp \to pp\phi$.

HK 23.6 Mi 15:30 RW 2

COMPASS results on transverse spin asymmetries in two-hadron production in SIDIS — •Christopher Braun for the COMPASS-Collaboration — Physikalisches Institut IV der Universität Erlangen-Nürnberg

At twist-two level the nucleon and its quark content can exist in three states regarding their polarizations in the collinear case: both can be unpolarized, longitudinally or transversely polarized. This refers to three independent parton distribution functions (PDF) for each quark flavour q: the quark distribution $f_1^q(x)$, the helicity distribution $g_1^q(x)$ and the transversity distribution $h_1^q(x) = q_q^{\uparrow\uparrow}(x) - q_q^{\uparrow\downarrow}(x)$. Where $\uparrow\uparrow$ means quark spin parallel and $\uparrow\downarrow$ antiparallel to the spin of the nucleon. The transversity function is chiral-odd and therefore is not accessible in deep inelastic scattering (DIS). However, $h_1^q(x)$ can be observed in semi-inclusive DIS in combination with another chirally odd function like the two-hadron interference fragmentation function (IFF) $H_{1,q}^{\sphericalangle}$ in two-hadron production, which is the subject of this contribution. 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. After taking the first data on a transversely polarized proton target (NH_3) in 2007, a full year of data taking followed in 2010 to increase precision. In this contribution the latest results from the 2010 data for the azimuthal asymmetries in two-hadron production are presented. An extraction of $h_1^q(x)$ via a coupling to the two-hadron IFF $H_{1,q}^{\sphericalangle}$ has been carried out for the 2007 data.

supported by German BMBF

HK 23.7 Mi 15:45 RW 2

Hard exclusive ρ^0 production to constrain generalized parton distributions — •Katharina Schmidt, Steffen Bauer, Horst Fischer, Tillmann Guthörl, Kay Königsmann, Frank Nerling, Christian Schill, Stefan Sirtl, 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 localization of the constituents. The exclusive production of ρ^0 mesons off a transversely polarized target allow to constrain the GPD E which is connected, according to Ji's sum rule, with the total angular momentum of quarks and gluons.

In 2007 & 2010 measurements were performed scattering a 160 GeV/c longitudinal polarized muon beam off a transversely polarized NH_3 target at the COMPASS experiment at CERN.

This talk gives an introduction to the analysis of exclusively produced ρ^0 mesons. Results for the transverse target single spin asymmetry $A_{UT}^{sin(\phi-\phi_s)}$ are presented. Supported by BMBF, DFG and EU FP7 (Grant Agreement 227431).

HK 24: Astroteilchenphysik

Zeit: Mittwoch 14:00–16:00 Raum: RW 3

Gruppenbericht HK 24.1 Mi 14:00 RW 3

Statusbericht des Niederenergie-Neutrino-Experiments SNO+ — •Belina von Krosigk, Nuno Barros, Axel Böltzig, Felix Krüger, Valentina Lozza, Laura Neumann und Kai Zuber — TU Dresden

SNO+ (Sudbury Neutrino Observatory plus Liquid Scintillator) ist ein sich im Aufbau befindliches Niederenergie-Neutrino-Experiment. Es nutzt den bis 2006 für das SNO Experiment eingesetzten Detektor, der sich im derzeit weltweit tiefsten Untergrundlabor SNOLAB in einer Mine nahe Sudbury, Kanada befindet. Der Kern des Detektors, eine Acryl-Kugel mit ca. 12 m Durchmesser, wird für SNO+ mit etwa 780 t Flüssigszintillator gefüllt, was die Lichtausbeute gegenüber dem Cherenkov-Detektor SNO um rund einen Faktor 50 erhöht und die Schwellenenergie auf unter 1 MeV senkt. Desweiteren ist durch ca. 6000 m.w.e. Überdeckung der kosmogene Untergrund stark unterdrückt. Zusammen mit der Verwendung ultra-reiner Materialien wird SNO+ dadurch sensitiv für niederenergetische Neutrinos. Von besonderem Interesse sind dabei die solaren pep- und CNO-Neutrinoflüsse. Ein weiteres wichtiges Ziel von SNO+ ist die Untersuchung des neutrinolosen doppelten Beta-Zerfalls durch Hinzufügen von rund 0.1% natürlichem Nd (entsprechend etwa 44 kg ^{150}Nd) zum Szintillator.

Der Detektor-Aufbau, physikalische Ziele so wie der Status des Experiments werden vorgestellt.

HK 24.2 Mi 14:30 RW 3

Measurement of Proton Quenching Factors and PSD-Parameters in Liquid Scintillators — •Vincenz Zimmer, Jürgen Winter, Lothar Oberauer, Judith Meyer, Randolph Möllenberg, Raimund Strauss, Christian Ciemniak, Stephan Wawoczny, and Julius Scherzinger — Technische Universität München, Physik Department E15, James Franck Straße, 85748 Garching

In liquid-scintillator detectors like Borexino, Double Chooz and the LENA (Low Energy Neutrino Astronomy) project the inverse beta decay (IBD) is used to detect electron antineurtinos $\overline{\nu}_e$. This causes a delayed coincidence signal reducing the background sources to those mimicking such a coincidence. Fast neutrons are one of the background sources by scattering off a proton followed by a capture on hydrogen or gadolinium. Therefore, it is vital to understand the nature of proton recoils in liquid scintillators. Using pulse shape discrimination (PSD) to distinguish the neutron-induced proton recoils from the prompt positron signal from the IBD this background might be reduced. Furthermore, elastic ν-p scattering is an important channel for neutrinos from a galactic core-collapse SN. In order to reconstruct the initial neutrino energy, the energy-dependent proton quenching factor has to be known. Therefore, a neutron scattering experiment at the Maier-Leibnitz-Laboratorium in Garching has been set up in order to understand the response of proton recoils in organic liquid scintillators.

This work has been supported by the Maier-Leibnitz-Laboratorium and the cluster of excellence 'Origin and Structure of the Universe'.

HK 24.3 Mi 14:45 RW 3

Proton- und α-Quenching im Flüssigszintillator von SNO+ — •Laura Neumann, Axel Boeltzig, Nuno Fiuza de Barros, Felix Krüger, Valentina Lozza, Belina von Krosigk und Kai Zuber — TU Dresden, Institut für Kern und Teilchenphysik

Die Detektion des Niederenergie-Neutrino Experiments SNO+ basiert auf einem neuartigen organischen Flüssigszintillator (lineare Alkybenzene LAB). Um aus der Detektorantwort die ursprüngliche Energie des Teilchens zu erhalten, müssen die Quenchingfaktoren, in Abhängigkeit der Teilchenart, bekannt sein. Von besonderem Interesse ist das α-Quenching, aufgrund des großen α -Hintergrunds des Nd144 in der Nd-Phase des Experiments, der durch pile-up zu Ereignissen im $0\nu\beta\beta$ Energiebereich führen kann. Protonquenching ist für die Supernova-Neutrinodetektion wesentlich, um über NC Neutrino-Proton-Streuung auf die Neutrinospektren schließen zu können. Das Messprinzip und erste Messdaten zur Berechnung der Protonen- und α-Quenchingfaktoren für den SNO+ Szintillator werden vorgestellt.

HK 24.4 Mi 15:00 RW 3

^{48}Sc as a Calibration Source for the SNO+ Experiment — •Axel Boeltzig, Nuno Barros, Felix Krüger, Valentina Lozza, Laura Neumann, Belina von Krosigk, and Kai Zuber — TU Dresden, Germany

SNO+ (Sudbury Neutrino Observatory Plus Scintillator) is the successor of the SNO experiment, and currently under construction near Sudbury, Canada. Located in a mine 2000 m underground (equivalent to a shielding of about 6000 m of water), SNO+ will be a low-background experiment studying different aspects of neutrinos.

Several sources will be employed for the detector's calibration, which is scheduled to start in mid-2013. One of the sources under development at TU Dresden uses the γ rays following the β decay of ^{48}Sc. The sum of the γ energies for the main decay branch is close to the Q value of the double beta decay of ^{150}Nd, which is planned to be measured in the second phase of SNO+.

Due to the half life of only 43.67(9) h, ^{48}Sc has to be produced shortly before the calibration. Safety, radiopurity and cleanliness are further important issues for the application of a source in a low-background experiment like SNO+. The design of the source, its production and the current status of its development will be presented.

This work is supported by the German Research Foundation (DFG).

HK 24.5 Mi 15:15 RW 3

Status und erste Resultate des EDELWEISS-3 Experiments zur Suche nach Dunkler Materie — •Klaus Eitel für die EDELWEISS-Kollaboration — Karlsruher Institut für Technologie, Institut für Kernphysik, Postfach 3640, 76021 Karlsruhe

Das EDELWEISS Experiment verwendet massive Ge-Monokristalle bei einer Operationstemperatur von 18mK, um die Streuung schwach wechselwirkender Teilchen (WIMPs) an Ge-Kernen nachzuweisen. Zur verlässlichen Detektion Dunkler Materie und zur Unterdrückung von Elektronrückstößen wird der Energieeintrag des stoßenden Teilchens als Wärmesignal über einen NTD-Thermistor und das Ionisationssignal als Parameter zur Teilchendiskriminierung über Ringelektroden ausgelesen. In der Messperiode 2009/2010 wurde mit 10 Detektoren von je 400 g Masse (ID400) mit dieser Technologie eine der weltweit besten Sensitivitäten von $\sigma_{SI} = 5 \cdot 10^{-44}\,\mathrm{cm}^2$ bei $m_\chi = 80\,\mathrm{GeV/c}^2$ erreicht [PLB 702 (2011)]. In EDELWEISS-3 werden bis Ende 2012 insgesamt 40 Detektoren mit je 800 g (FID800) installiert. Zusätzlich wird die Abschirmung erweitert sowie die Datenauslese modifiziert, sodass eine Erhöhung der Sensitivität um mehr als einen Faktor 10 bis Ende 2013 erreicht werden kann. Der Status der Umbauarbeiten sowie erste Resultate mit den FID800-Detektoren werden vorgestellt und ein Ausblick auf das EUERECA-Projekt gegeben.

Gefördert durch das BMBF (Verbundforschung Astroteilchenphysik 05A11VK2) und durch die Helmholtz-Allianz für Astroteilchenphysik HAP, ein Instrument des Impuls- und Vernetzungsfonds der Helmholtz-Gemeinschaft.

HK 24.6 Mi 15:30 RW 3

Suche nach einer jahreszeitlichen Modulation in den EDELWEISS-2 Daten — •Lukas Hehn für die EDELWEISS-Kollaboration — Karlsruher Institut für Technologie, Institut für Experimentelle Kernphysik, Postfach 3640, 76021 Karlsruhe

Das EDELWEISS Experiment benutzt kryogene Germanium-Monokristalle (T=18mK) zur direkten Suche nach Dunkler Materie. Ein Ge-Kernrückstoß aufgrund einer elastischen Streuung eines WIMPs (Weakly Interacting Massive Particle) kann dabei durch gleichzeitige charakteristische Phonon- und Ladungs-Signale identifiziert werden. In der Messphase 2009/2010 wurden Daten zur WIMP-Suche über 14 Monate mit einem Detektorfeld von 10 Ge-Detektoren aufgenommen. Unter Verwendung der Elektronendiskriminierung durch das Ladungssignal konnte eine Obergrenze auf WIMP-Streuquerschnitte von $\sigma < 5 \times 10^{44} cm^2$ [PLB702(2011)] extrahiert werden. Lässt man auch Elektronenrückstöße als potenzielles WIMP-Signal zu, so lassen sich die Daten auf eine DAMA-ähnliche jahreszeitliche Modulation hin analysieren. Die Motivation, spezielle Analysemethoden und Resultate dieser Untersuchung werden präsentiert und diskutiert.

Gefördert durch das BMBF (Verbundforschung Astroteilchenphysik 05A11VK2) und durch die Helmholtz-Allianz für Astroteilchenphysik HAP, ein Instrument des Impuls- und Vernetzungsfonds der Helmholtz-Gemeinschaft.

HK 24.7 Mi 15:45 RW 3

Measurement of neutron fluxes as a background for direct Dark Matter searches — •Valentin Kozlov for the EDELWEISS-Collaboration — Karlsruher Institut für Technologie, Institut für Kernphysik, Postfach 3640, 76021 Karlsruhe

A very low interaction rate is expected for Dark Matter candidates, so-called weakly interacting massive particles (WIMP), scattering off a nucleus of a terrestrial detector. This emphasizes the importance of a detailed understanding of all potential backgrounds. Ambient and muon-induced neutrons constitute a prominent background component. Detailed studies carried out by the Edelweiss collaboration in this respect are presented. Edelweiss is a Ge-bolometer experiment searching for WIMPs and located in the underground laboratory Laboratoire Souterrain de Modane (LSM, France). The neutron background studies include dedicated calibrations with neutron sources, monitoring the neutron flux with ^{3}He detectors and measurements with a neutron counter based on Gd-loaded liquid scintillator as well as corresponding MC simulations with full event topology. Studies of muon-induced neutrons are of particular interest and will be the main focus of the presentation. The impact of the neutron background on current Edelweiss data-taking as well as for next generation experiments such as EURECA will be discussed.

This work is supported by BMBF (Astroparticle Physics project 05A11VK2) and by the Helmholtz Alliance for Astroparticle Phyics HAP, by the French Agence Nationale pour la Recherche and the Russian Foundation for Basic Research (grant No. 07-02-00355-a).

HK 25: Fundamentale Symmetrien

Zeit: Mittwoch 14:00–16:00 Raum: P 1

Gruppenbericht HK 25.1 Mi 14:00 P 1

Lorentz invariance on trial in the weak decay of polarized atoms — •Stefan E. Mueller, Elwin Dijck, Jacob Noordmans, Gerco Onderwater, Rob Timmermans, Hans Wilschut, and Katsunori Yai — Kernfysisch Versneller Instituut, University of Groningen, The Netherlands

One of the most fundamental principles on which our current understanding of nature is based is the invariance of physical laws under Lorentz transformations. Theories trying to unify the Standard Model with Quantum Gravity may break this invariance, and dedicated high-precision experiments at low energy could be used to reveal such suppressed signals from the Planck scale.

In the framework of the TRIμP (**T**rapped **R**adioactive **I**sotopes: **m**icro-laboratories for fundamental **P**hysics) program at KVI, we will test Lorentz invariance searching for a dependence of the decay rate of spin-polarized nuclei on the daily, yearly or deliberate re-orientation of the spin. Observation of such a dependence would hint at a breakdown of Lorentz invariance.

We will present results from the first experiments using ^{80}Rb and ^{20}Na atoms produced with the AGOR cyclotron at the KVI.

HK 25.2 Mi 14:30 P 1

Lorentz non-invariance — •Jacob Noordmans — KVI, Groningen, The Netherlands

To our present understanding nature is invariant under rotations and boosts to very high precision. This Lorentz invariance is one of the cornerstones of our most important physical theories: general relativity and the standard model of particle physics. Both are tested to high accuracy. The possibility exists that the theory unifying these two theories breaks Lorentz invariance at some (high) energy scale. At energies presently reachable with experiments, small signals of this Lorentz breaking might still be detectable. We discuss an effective field theory approach to calculate observables so on can put bounds on Lorentz symmetry breaking by measuring them. In this the focus is on the weak interaction.

HK 25.3 Mi 14:45 P 1

The Enriched Xenon Observatory (EXO) for double beta decay — •Wolfhart Feldmeier for the EXO-Collaboration — TU München

The Enriched Xenon Observatory (EXO) is an experimental program designed to search for the neutrinoless double beta decay (0nbb) of Xe-136. Observation of 0nbb would determine an absolute mass scale for neutrinos and answer the question about their hypothetical Majorana nature. The current phase of the experiment, EXO-200, uses 200 kg of liquid xenon with 80% enrichment in Xe-136. The double beta decay of xenon is detected in an ultra-low background time projection chamber by collecting both, the scintillation light and the ionization charge. The detector has provided the first measurement of two neutrino double beta decay and continues to take data for a neutrinoless analysis.

HK 25.4 Mi 15:00 P 1

^{3}He/^{129}Xe Clock Comparison Experiment: Search for Spin-dependent Short-range Interaction — •Kathlynne Tullney[1], Werner Heil[1], Sergei Karpuk[1], Yuri Sobolev[1], Martin Burghoff[2], Silvia Knappe-Grüneberg[2], Wolfgang Kilian[2], Wolfgang Müller[2], Allard Schnabel[2], Frank Seifert[2], Lutz Trahms[2], and Ulrich Schmidt[3] — [1]Universität Mainz — [2]PTB Berlin — [3]Universität Heidelberg

Light pseudoscalar bosons, such as the axion that was originally proposed as a solution of the strong CP problem, would cause a new spin-dependent short-range interaction. Of interest here is the search for axion mediated short range interaction between a fermion and the spin of another fermion. To search for this effect co-located, nuclear spin polarized ^{3}He and ^{129}Xe atoms are used to get rid of magnetic field drifts. The new approach we made is to measure the free nuclear spin precession frequencies in a homogeneous magnetic guiding field of about 400 nT using LT$_C$ SQUID detectors. The whole setup is housed in a magnetically shielded room at the Physikalisch Technische Bundesanstalt (PTB) in Berlin. With this setup long nuclear-spin coherence times of several hours for both gases can be achieved.
In this talk we present results of the last run in September 2010 which gives new upper limits on the scalar-pseudoscalar coupling of axion-like particles in the axion-mass window from 10^{-2} eV to 10^{-6} eV.

HK 25.5 Mi 15:15 P 1

Test der QED in starken Magnetfeldern durch Laserspektroskopie der Hyperfeinstruktur von Bi^{82+} und Bi^{80+} — •Matthias Lochmann[1], Christopher Geppert[1,2], Rodolfo M. Sanchez[1,2], Michael Hammen[1], Nadja Frömmgen[1], Elisa Will[1], Benjamin Botermann[1], Zoran Andjelkovic[1], Raphael Jöhren[3], Jonas Mader[3], Volker Hannen[3], Christian Weinheimer[3], Danyal Winters[2], Thomas Kühl[2], Yuri Litvinov[2], Thomas Stöhlker[2,4], Andreas Dax[5], Michael Bussmann[6], Weiqiang Wen[7], Richard Thompson[8], Andrey Volotka[9] und Wilfried Nörtershäuser[1,2] — [1]Inst. f. Kernchemie, Universität Mainz — [2]GSI, Darmstadt — [3]Inst. f. Kernphysik, Universität Münster — [4]Phys. Inst., Universität Heidelberg — [5]Department of Physics, University of Tokyo — [6]Helmholtzzentrum Dresden-Rossendorf — [7]IMP Lanzhou — [8]Imperial College, London — [9]TU Dresden

Messungen der Hyperfeinaufspaltung (HFS) schwerer, hochgeladener Ionen stellen einen Test der QED in starken Feldern dar. Berechnungen der HFS haben eine relative Unsicherheit von mehr als 10^{-3} durch die unzureichend bekannte Verteilung des magnetischen Kernmomentes (Bohr-Weisskopf-Effekt). Dieser wird jedoch in einem geeigneten Vergleich von H- und Li-ähnlichen Ionen vernachlässigbar.

Jüngst ist am Experimentier-Speicherring der GSI erstmals die laserspektroskopische Beobachtung der HFS im lithiumähnlichen ^{209}Bi^{80+} gelungen. Die dabei verwendeten Techniken und gewonnenen Resultate werden vorgestellt. Ausserdem wird die Möglichkeit der Extraktion des magnetischen Kernradius $\langle r_m^2 \rangle^{1/2}$ diskutiert.

HK 25.6 Mi 15:30 P 1

Bestimmung von Verlust - und Produktionswirkungsquerschnitten für ultrakalte Neutronen in kryogenen Kovertermaterialien mittels Neutronenstreuung. — •Erwin Gutsmiedl[1], Frederic Böhle[1], Ralitsa Bozhanova[1], Andreas Frei[1], Jens Klenke[1], Christoph Morkel[1], Axel Müller[2], Andrea Orecchini[3], Stephan Paul[1], Helmut Schober[3] und Tobias Unruh[4] — [1]TU München, Garching — [2]Standford University, Standford, USA — [3]Institut Laue Langevin, Grenoble, Frankreich — [4]Universität Erlangen, Erlangen

Zurzeit sind weltweit starke Quellen zur Erzeugung von ultrakalten Neutronen (UCN) basierend auf superthermischer Konversion in kryogenen Festkörpern wie festes ortho-Deuterium oder fester alpha-Sauerstoff in Planung, oder bereits gebaut. UCN sind exzellente neutrale Teilchen für fundamentale Experimente bei sehr kleinen Energien. Beispielhaft seien die Messung des elektrischen Dipolmoments oder die Lebensdauer des Neutrons genannt. Die genaue Kenntnis der Verlustwirkungsquerschnitte für UCN in den kryogenen Festkörpern ist für die Performance dieser Quellen entscheidend. Neutronenstreuexperimente mit thermischen und kalten Neutronen können aussagekräftige Daten für diese Verluste aber auch für die UCN - Produktionswirkungsquerschnitte liefern. In diesem Vortrag sollen die Resultate für die Verlust- und Produktionswirkungsquerschnitte von festem Deuterium und Sauerstoff und deren Auswirkung auf solch potentiell starke UCN-Quellen präsentiert werden. Gefördert von MLL, DFG und der Excellenzinitiative EXC 153.

HK 25.7 Mi 15:45 P 1

Detektoren für die Suche nach dem Dunklen Photon an MESA — •Matthias Molitor für die A1-Kollaboration — Institut für Kernphysik Johannes Gutenberg-Universität Mainz Johann-Joachim-Becher-Weg 45 D 55128 Mainz

Die Vorhersage des Standardmodells für das anomale magnetische Moment des Myons, (g-2)$_\mu$, weicht von der direkten Messung um 3,6 σ ab. Ein Eichboson einer neuen U(1)-Wechselwirkung, das sog. Dunkle Photon, wird in vielen Erweiterungen des Standardmodells vorausgesagt und könnte diese Abweichung erklären.

Zur Suche nach einem solchen Dunklen Photon ist in Mainz ein dediziertes Experiment an dem geplanten Niederenergie-Beschleuniger MESA vorgesehen.

Der Vortrag befasst sich mit den Simulationen für unterschiedliche Detektorkonzepte und deren Eignung für das geplante Experiment an MESA.

HK 26: Instrumentation

Zeit: Mittwoch 14:00–16:00 Raum: P 2

Gruppenbericht HK 26.1 Mi 14:00 P 2

The HIE-ISOLDE project — •Magdalena Kowalska and ISOLDE Collaboration — CERN, Geneva, Switzerland

The HIE-ISOLDE (High Intensity Energy) Project is a major upgrade of the ISOLDE/CERN facility which will increase the energy, intensity and quality of the delivered radionuclide beams. It comprises the construction of a new superconducting linear accelerator for the energy increase and a Design Study for the intensity and quality improvements. Its science case covers many of the key questions in nuclear structure and astrophysics.

The energy of the post-accelerated beams will be increased from 3 MeV to 10 MeV thanks to a new superconducting linear accelerator made of 6 cryomodules with sputtered acceleration cavities. Transfer and fusion reactions will become accessible for the first time for many exotic nuclear species. Users are expected to design and build new instrumentation to make best use of these beams.

The new LINAC4 injector installed for the LHC combined with the upgraded PSB injector will boost the energy and intensity of the proton beams impinging on the ISOLDE targets. To profit from this for the production of beams and ensure containment of the increased radiation, a redesign of the target area and of the targets will be undertaken. Upgrades to ion sources and magnetic separators will also enhance the quality and purity of the delivered beams.

Here, we give an overview of the project, timeline, and present status, followed by a presentation of the Letters of Intent for experiments.

HK 26.2 Mi 14:30 P 2

The cluster-jet target for the PANDA experiment — •Alexander Täschner, Ann-Katrin Hergemöller, Esperanza Köhler, Hans-Werner Ortjohann, Daniel Bonaventura, and Alfons Khoukaz — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, 48149 Münster, Deutschland

The PANDA experiment will be one of the key experiments of the planned accelerator center FAIR at Darmstadt in Germany. The study of proton-antiproton annihilations at this fixed-target experiment in a dedicated storage ring will enable the precise investigation of the strong interaction, especially the QCD spectrum and the hadron structure.

In order to achieve these physics goals a hydrogen target with a high target density of up to 4×10^{15} atoms/cm^2 is needed which provides a target material of highest purity and a target density which is both constant in time and homogeneous in space. With a prototype setup at Münster it could be shown that these challenging demands can be met with a Münster type cluster-jet target which can produce cluster-jets of up to 1.5×10^{15} atoms/cm^2 at a distance of 2 m behind the nozzle. Therefore it was decided to implement a cluster-jet target at PANDA which can be interchanged with a pellet target depending on the physics program to be investigated.

In this presentation the design of the cluster-jet target for the PANDA experiment will be described. The detailed implementation into the detector setup and the expected operation properties will be shown.

Supported by EU (FP6+FP7), BMBF, and GSI F+E.

HK 26.3 Mi 14:45 P 2

Systematic Investigations on High Intense Cluster-Jet Beams for Storage Ring Experiments — •Esperanza Köhler, Ann-Katrin Hergemöller, Alexander Täschner, Hans-Werner Ortjohann, Daniel Bonaventura, and Alfons Khoukaz — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, 48149 Münster, Deutschland

A high-density cluster-jet target will be one of two planned internal target stations for the PANDA experiment at the antiproton accelerator and storage ring HESR/FAIR. For the investigation of elementary $\bar{p}$N interactions hydrogen and deuterium are of highest interest as used target material. Cluster-jet targets allow high and constant target densities at the interaction point, i.e. 2 m behind the nozzle, with the possibility of a continuous variation during operation. At the University of Münster a cluster-jet target prototype was designed, built up and set succesfully into operation. The system is installed in complete PANDA geometry, so that the observed cluster beam characteristics can be directly transferred to the later situation at PANDA. Recent optical investigations on the cluster beam directly behind the nozzle resulted in the observation of distinct density structures when the target is operated at highest densities. The development and installation of a special nozzle tilting system allows for the extraction of these high-intense core beams, leading to a significant improvement of the target density. The performance and achieved densities of cluster beams will be presented. Supported by EU (FP6+FP7), BMBF, and GSI F+E.

HK 26.4 Mi 15:00 P 2

Studies on cluster beam shapes for storage ring experiments — •Ann-Katrin Hergemöller, Esperanza Köhler, Alexander Täschner, Hans-Werner Ortjohann, Daniel Bonaventura, and Alfons Khoukaz — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, 48149 Münster, Deutschland

One of the two planned internal targets for the PANDA experiment at the accelerator center FAIR will be a cluster-jet target. With this type of 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 this cluster-jet target was built up in PANDA geometry and set successfully into operation. With this installation hydrogen target densities of 1.5×10^{15} atoms/cm^2 were achieved at 2 m behind the cluster source. 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. Since parallel to the absolute target density also a low residual gas background at the interaction region is of high interest, 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. First results of beam properties with a shaped cluster beam by slit collimators will be presented and discussed. Supported by EU (FP6+FP7), BMBF, and GSI F+E.

HK 26.5 Mi 15:15 P 2

Reliability Studies of the Nozzle/Piezo units for the WASA-at-COSY Pellet Target* — •Florian Bergmann, Christina Husmann, Kay Demmich, Paul Goslawski, Alfons Khoukaz, and Alexander Täschner for the WASA-at-COSY-Collaboration — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster

At the fixed target experiment WASA-at-COSY a pellet target provides a stream of micrometer sized frozen hydrogen particles (pellets) for hadron physics experiments. The main part of the pellet source, a glass nozzle, is driven by a piezoelectric transducer working at high frequencies ranging from 30 to 80 kHz to produce regularly shaped droplets which freeze due to evaporation cooling and form pellets. For a good performance of the pellet target the quality of the nozzle and the attached piezo are of great importance. Due to the small opening of the nozzles ($\approx 13\,\mu$m) these components are very sensitive with respect to blocking. To avoid such problems a production line has been established at the Forschungszentrum Jülich which includes several cleaning steps and quality checks for the nozzles. To further improve the reliability of the prepared nozzle/piezo unit a dedicated setup has been built up in Münster. This device allows to operate the nozzles in vacuum with typical gas input pressures and with the piezo in operation. Furthermore, beside these tests with respect to nozzle blocking this setup allows for systematic tests on the piezoelectric transducers and their influence on possible working points for target operation. The design concept and first results will be presented and discussed.

*Supported by COSY-FFE grants

HK 26.6 Mi 15:30 P 2

Konstruktion eines aktiven polarisierten Targets für das Crystal-Ball-Experiment am Mainzer Mikrotron — •Maik Biroth und Patrick Achenbach — Institut für Kernphysik, Johannes Gutenberg-Universität, Mainz

Das Crystal-Ball-Experiment am Elektronen-Beschleuniger MAMI 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 mit-

tels Wellenlängen schiebender Fasern aus dem Kältereservoir geführt und von Silizium-Photomultipliern detektiert werden.
Mehrere Prototypen aus 1 mm dünnen Plättchen wurden angefertigt, wobei die geometrischen Randbedingungen wie Biegeradius der Fasern, Breite des Photonenstrahls und verfügbarer Raum im Kryostaten das Design bestimmten. Um den optischen Kopplungsgrad an die Fasern zu studieren wurden Faserprofil, Faserdurchmesser und die Größe der Kontaktfläche variiert und mit einer ^{90}Sr-Quelle die Lichtausbeute bestimmt. Zwecks Optimierung wurde mit verschiedenen Szintillator-Ummantelungen experimentiert. Untersucht wurde auch die Temperaturabhängigkeit der Ausleseelektronik.
Diese Arbeit wurde gefördert durch die Carl Zeiss Stiftung, die inneruniversitäre Forschungsförderung und den SFB 443.

HK 26.7 Mi 15:45 P 2

A Wide Temperature Range Irradiation Cryostat for Reasearch on Solid State Targets — Scott Reeve, •Hartmut Dutz, Stefan Goertz, Stefan Runkel, and Thomas Voge — Physikalisches Institut, Universität Bonn, Nußallee 12, 53115, Bonn

To qualitatively improve the data obtained in asymmetry measurements of scattering experiments the figure of merit (FOM) plays a major role and can reduce the data acquisition time when a certain precision in the measurement is needed. One of the defining factors for the improvement of the polarised experiment lies in the target choice and preparation, in particular the method employed to introduce the paramagnetic defects for the use of dynamic nuclear polarisation (DNP). To this end the Polarized Target Group in Bonn has developed a wide range temperature cryostat for the irradiation of potential target materials in which materials can be irradiated to varying doses at specified temperatures. The stable irradiation temperature of the materials can be controlled to within $\pm 1\,\mathrm{K}$ over a range of $90\,\mathrm{K} < T < 270\,\mathrm{K}$.

HK 27: Instrumentation

Zeit: Mittwoch 14:00–16:00 Raum: P 3

Gruppenbericht HK 27.1 Mi 14:00 P 3

The Central Straw Tube Tracker for PANDA — •Marius C. Mertens for the PANDA-Collaboration — Forschungszentrum Jülich GmbH

The PANDA experiment at the future Facility for Antiproton and Ion Research (FAIR) will investigate physics in the open charm energy region using an antiproton beam and a fixed hydrogen target.

A significant part of PANDA's physics program will require the reconstruction of rare channels. Consequently, the experiment is optimized for high luminosities with a quasi-continuous beam, thus the detector must be able to process high particle rates in a continuous manner.

The central tracker of PANDA has the task to precisely measure the traversing particles' tracks as well as their energy loss in order to also contribute to the particle identification information. A Straw Tube Tracker (STT) is under development for PANDA. The detector concept has proven to be a robust device for the track reconstruction already in the COSY-TOF experiment. In PANDA, there will be higher rates and the additional energy loss information which require new readout electronics which is being tested and optimized.

After introducing the design of the PANDA STT, we will present the prototype setup and our most recent results from test measurements.

HK 27.2 Mi 14:30 P 3

Status of studies for luminosity measurement at PANDA detector* — •Anastasia Karavdina[1], Achim Denig[1,2], Miriam Fritsch[1,2], Prometeusz Jasinski[2], Mathias Michel[2], and Tobias Weber[2] for the PANDA-Collaboration — [1]Institut für Kernphysik, Universität Mainz — [2]Helmholtz-Institut Mainz

A good luminosity monitoring is crucial for the PANDA experiment at the planned antiproton accelerator HESR (FAIR, Darmstadt, Germany). For the measurement of the luminosity one can use the elastic antiproton-proton scattering at extreme forward angles. This exploits the fact that the elastic scattering in the range of very small momentum transfer (and thus very small scattering angle) can be calculated exactly from QED. At larger scattering angles the hadronic component of the elastic scattering dominates and this has to be taken from models based on measurements.

The current design for the luminosity monitor are four planes of eight thin double-sided silicon microstrip detectors with trapezoidal shape. The detector itself has an angular acceptance from 3 to 8 mrad and good spatial resolution due to using sensors with high resolution (50 um pitch). There is no particle identification foreseen yet.

In this talk an overview of the basic concept and Monte Carlo based performance studies will be presented. In more detail studies will show which number of ghost tracks and tracks from inelastic reactions are expected in the luminosity monitor and how they can be reduced or suppressed.

*supported by BMBF and HGF

HK 27.3 Mi 14:45 P 3

Neue Ansätze bei der Strahlteilchenidentifikation im COMPASS Experiment — •Tobias Weisrock für die COMPASS-Kollaboration — Institut für Kernphysik der Johannes Gutenberg-Universität Mainz

Der Hadronstrahl des COMPASS Experiments am CERN besteht zu 97% aus Pionen und zu etwa 2,5% aus Kaonen. Zur Auswertung der 2008 und 2009 aufgenommenen Daten sowie im Hinblick auf die für 2012 vorgesehene Primakoff Datennahme ist es notwendig, die Kaonen und Pionen im Hadronstrahl zu identifizieren und zu trennen.

Hierfür stehen zwei Čerenkov-Detektoren zur Verfügung, die mittels einer Blende in der Fokalebene die Čerenkov-Ringe gewünschter Teilchenmasse selektieren. Die Teilchenidentifikation erfolgt üblicherweise über ein einfaches Koinzidenzsignal der Photomultiplier (PM) hinter der Blende.

Hohe Nachweiseffizienzen werden allerdings nur für Strahlteilchen erreicht, die keine große Abweichung von der nominellen Strahlrichtung besitzen. Daher wurde eine Methode entwickelt, die zusätzlich zum PM-Signal auch die Strahldivergenz berücksichtigt. Dieser Ansatz, basierend auf statistischen Verteilungen, wird den einfachen Koinzidenzschnitten gegenübergestellt.

HK 27.4 Mi 15:00 P 3

Production and behavior studies of the new ammonia target for the COMPASS experiment — •Alexander Berlin[1], Sonja Kunkel[1], Stefan Runkel[2], Jonas Herick[1], Christian Hess[1], Werner Meyer[1], and Gerhard Reicherz[1] — [1]Lehrstuhl für Hadronen und Kerne, Ruhr-Universität Bochum — [2]Physikalisches Institut, Universität Bonn

In 2011 the COMPASS experiment at CERN ran with a fresh ammonia target, which was produced by a collaboration between the 'Polarized Target'-groups of Bonn and Bochum.
This new material was mentioned to replace the 16 years old ammonia, which was used in the foregoing experiment, the SMC. A reduced maximum polarisation and longer build-up times were observed in previous runs compared to the run in 1996. So the decision was made to produce fresh target material.
In this talk, the production routine of the target material as well as a comparison to the 16 years old material will be shown. First results from the COMPASS target in 2011 will be presented afterwards.

HK 27.5 Mi 15:15 P 3

Tracking detecors of the BGO-OD experiment — •Jürgen Hannappel for the BGO-OD-Collaboration — Physikalisches Institut, Nussallee 12, D-53115 Bonn

The BGO-OD experiment at the accelerator ELSA in Bonn uses a combination of a BGO crystal spectrometer with a magnetic forward spectrometer for charged particles to investigate multi-particle final states in meson photoproduction.

In 2011 the setup was almost completed and first test data were taken.

In this talk the status of the tracking detectors around the spectrometer magnet is shown, together with first results from the tracking software.

Supported by DFG (SFB/TR-16).

HK 27.6 Mi 15:30 P 3

Photonen Flussmonitor für das BGO-OD Experiment * —

•Thomas Zimmermann für die BGO-OD-Kollaboration — Physikalisches Institut, Universität Bonn

Das BGO-OD Experiment, welches zur Zeit an der Elektronen Strecher Anlage ELSA in Bonn die ersten Testdaten nimmt, untersucht systematisch die Photoproduktion von Mesonen am Nukleon. Unter anderem sollen absolute Wirkungsquerschnitte gemessen werden. Dazu ist die Kenntnis des Photonenflusses essentiell, weshalb ein Photonen Flussmonitor in das Experiment integriert wurde.

Der Fluss wird simultan zur Datennahme durch kombination eines total- und eines teilabsorbierenden Detektors gemessen. Zusammen können Photonenraten von bis zu 50 MHz präzise verarbeitet werden.

* gefördert durch die DFG (SFB/TR-16)

HK 27.7 Mi 15:45 P 3

Diamonds are not forever - scCVD radiation damage study with high intensity Au beam in HADES — •Jerzy Pietraszko[1] and Wolfgang Koenig[2] for the HADES-Collaboration — [1]Goethe-Universität, Frankfurt — [2]GSI Helmholtzzentum für Schwerionenforschung GmbH, Darmstadt

Since more than 10 years the HADES group has been involved in the development of diamond detectors based on pcCVD material. These detectors showed very good performance (time resolution below 100 ps sigma) and stable long term operation (over several weeks) at moderate beam (^{12}C) intensities about 10^5 particles/s/cm^2. With the recently finished upgrade of the HADES spectrometer, aimed at preparing for experiments at SIS-100 at the future FAIR facility, the DAQ performance was significantly increased allowing for high intensity beams. The upcoming Au+Au experiment, scheduled for 2012, will utilize an Au beam at intensities between 2-5*10^6 Au ions/s. Due to the requested very small target diameter, 2.2 mm, the HADES beam focus system has to provide a beam spot below 2mm^2 in the HADES focal point. During a recently conducted five day long test experiment at this beam intensity we have reached a total particle dose close to 2.37 * 10^{13} Au ions/cm^2 on our diamond start detector which was never archived before. By analysing the surface of the detector and properties like signal amplitude and time resolution we have identified significant radiation damage. In this talk the observed effects will be discussed. *This work has been supported by BMBF (06 FY 9100 I), HIC for FAIR, EMMI and GSI

HK 28: Struktur und Dynamik von Kernen

Zeit: Mittwoch 14:00–16:00 Raum: P 4

Gruppenbericht HK 28.1 Mi 14:00 P 4

Investigation of octupole vibrational states in medium mass nuclei — •Sorin Pascu, Michael Elvers, Janis Endres, Andreas Hennig, Simon Pickstone, and Andreas Zilges — Institut für Kernphysik, Universität zu Köln

The experimental and theoretical evidence for the presence of octupole vibrational states in ^{146}Sm and ^{150}Nd is presented. The first nucleus which is located only two neutrons and two protons away from the N=82 shell and Z=64 subshell closures has been investigated by means of the ^{143}Nd(α,n) and ^{144}Nd(α,2n) fusion-evaporation reactions. The structure of the possible candidates for a $2^+ \otimes 3^-$ quadrupole-octupole multiplet are discussed in terms of the harmonic vibrational model and interpreted in terms of the Interacting Boson Approximation in the *spdf* boson space (IBA-*spdf*). The latter nucleus which is a quadrupole deformed nucleus was investigated via inelastic proton scattering which is an excellent method to excite natural parity states. Using this method, $B(E1)$ ratios of the decaying transitions for the octupole vibrational states were determined and compared to the Alaga rule and with the IBA-*spdf* model. A general good agreement was found between experimental data and theoretical calculations.

Supported by the DFG (ZI 510/4-1). A.H. and S.P. are members of the Bonn-Cologne Graduate School of Physics and Astronomy.

HK 28.2 Mi 14:30 P 4

Non-yrast bands in a coherent quadrupole-octupole model — •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

A model assuming coherent quadrupole-octupole vibrations and rotations is applied to describe non-yrast energy sequences with alternating parity in several even-even nuclei from different regions. The energies are calculated from an analytically known formula in which for the first time we consider states with arbitrary large quantum numbers, allowing, as a new feature, to describe higher lying bands. A fit of the model parameters is performed for each nucleus in order to reach the best agreement with the experiment. The mass dependence of the parameters will be discussed. The model reproduces the structure of the spectra together with the observed B(E1), B(E2) and B(E3) reduced transition probabilities in the considered nuclei ^{152,154}Sm, ^{154,156,158}Gd, ^{236}U and ^{100}Mo.

Aided by HIC for FAIR.

HK 28.3 Mi 14:45 P 4

Untersuchung von einsetzender Deformation und Formkoexistenz in ^{46}Ar durch (t,p) Reaktion in inverser Kinematik — •Katharina Nowak für die IS499-Kollaboration — E12, Technische Universität München, Garching

Diverse Experimente und theoretische Rechnungen deuten auf ein kontinuierliches Aufweichen des klassischen N=28 Neutronen-Schalenabschlusses bei sinkender Protonenzahl hin. Nur zwei Protonen unterhalb von ^{48}Ca, zeigt auch ^{46}Ar Anzeichen für einsetzende Deformation und Formkoexistenz. Die ideale Methode um dies genauer zu untersuchen ist das 2-Neutronentransfer Experiment t(^{44}Ar,p)^{46}Ar in inverser Kinematik, welches an REX-ISOLDE mithilfe des MINIBALL Spektrometers und dem positionssensitiven Si-Detektorarray T-REX durchgeführt wurde. Erste Winkelverteilungen der Protonen werden gezeigt und mit DWBA Rechnungen verglichen.
Im Hinblick auf HIE-ISOLDE mit hohen Strahlenergien von 5.5 - 10 MeV/Nukleon ist eine Unterscheidung zwischen Transfer- und Fusionsevents nötig. Um dies zu ermöglichen wurde ein Fusionsveto entwickelt. Dieses wird vorgestellt und erste Testdaten erläutert. Diese Arbeit wurde durch BMBF (06MT9156), DFG (EXC153) und ENSAR unterstützt.

HK 28.4 Mi 15:00 P 4

Untersuchung der vibrationären Eigenschaften von ^{62}Ni durch Kernresonanzfluoreszenz — •Sebastian Reichert[1], Dennis Mücher[1], Ronald Schwengner[2], Paul Garrett[3], Stefanie Klupp[1], Reiner Krücken[1,4], Joseph Lichtinger[1], Katharina Nowak[1], Andreas Wagner[2], Steven W. Yates[5], Ralph Massarczyk[2] und Marko Röder[2] — [1]Technische Universität München — [2]Helmholtz Zentrum Dresden Rossendorf — [3]University of Guelph — [4]TRIUMF, Canada — [5]University of Kentucky

Das vibrationäre Modell der Kernstrukturphysik beschreibt Atomkerne durch Oberflächenschwingungen. Bei kleinen Anregungsenergien dominiert hierbei meist der Quadrupol-Anteil, was zur Ausbildung des typischen Phononen-Spektrums eines sphärischen gerade-gerade Kerns führt. Das energetische Schema des halbmagischen Kerns ^{62}Ni weist eine solche Struktur bis zur dritten Ordnung auf. Neue Messungen haben jedoch gezeigt, dass insbesondere die E2-Zerfallsstärken zum Zustand 0_2^+ deutlich unterdrückt sind. Unklar blieb die Rolle eines Zustandes bei etwa 3 MeV Anregungsenergie mit Spin J=1 oder J=2. Ein Kernresonanzfluoreszenz-Experiment am Beschleuniger ELBE (HZDR) wurde durchgeführt um den Spin eindeutig zu bestimmen. Wir diskutieren die Ergebnisse der gemessenen Winkelverteilungen nach γ-Zerfall. Wir präsentieren weiterhin eine systematische Studie zur Güte des einfachen vibrationären Modells in Abhängigkeit der Kerndeformation. Die Resultate zu ^{62}Ni fügen sich in die gefundenen systematischen Zusammenhänge zwanglos ein. Gefördert unter DFG (EXC153).

HK 28.5 Mi 15:15 P 4

Angular-Momentum Projection for Hartree-Fock and RPA with Realistic Interactions — •Bastian Erler and Robert Roth — Institut für Kernphysik, TU Darmstadt

Hartree-Fock (HF) with a Hamiltonian constructed from similarity transformed realistic NN potentials plus 3N contact interactions provides a good starting point for the description of closed shell nuclei. In conjucntion with Many-Body-Perturbation-Theory, experimental

ground-state energies and radii are well reproduced. To describe collective excitations, the Random-Phase-Approximation (RPA) is the method of choice.

Beyond closed shells, e.g. in the sd-shell region, ground-states might exhibit intrinsic deformation, resulting in HF states where angular-momentum ceases to be a good quantum number. Lab-frame observables, like ground-state energies or rotational bands can be recovered from the intrinsic states via angular-momentum projection.

We study axially deformed even-even sd-shell nuclei, namely ^{20}Ne, ^{28}Si and ^{32}S. Starting from a HF ground state obtained by exact angular-momentum projection, we use the RPA to study collective excitations. The transition strengths obtained from the RPA are projected to good angular momentum in an exact formalism, without resorting to popular approximations. We investigate the effect of deformed intrinsic states on giant resonances.

Supported by the DFG (SFB 634), HIC for FAIR and the BMBF (06DA9040I).

HK 28.6 Mi 15:30 P 4

Modellunabhängige Bestimmung von Übergangsbreiten in den Grundzustand mit der Methode der Selbstabsorption* — •Christopher Romig[1], Jacob Beller[1], Matthias Fritzsche[1], Johann Isaak[1], Norbert Pietralla[1], Deniz Savran[2,3], Marcus Scheck[1], Linda Schnorrenberger[1], Kerstin Sonnabend[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 — [4]Institut für Angewandte Physik, Goethe-Universität Frankfurt

Die wesentliche Unsicherheit bei der Analyse von Kernresonanzfluoreszenz (KRF)-Messungen ist das Verzweigungsverhältnis Γ_i/Γ_0 von Zerfällen in angeregte Zustände relativ zum Grundzustandsübergang. Um dies zu testen, wurde eine Selbstabsorptionsmessung am Nuklid ^{140}Ce am Darmstädter S-DALINAC durchgeführt. Die Methode der Selbstabsorption erlaubt es, Grundzustandsübergangsbreiten Γ_0 und darüber hinaus in Kombination mit KRF-Messungen Verzweigungsverhältnisse Γ_0/Γ in den Grundzustand zu bestimmen. Für den Kern ^{140}Ce konnte auf diese Weise zahlreichen Übergängen Werte für Γ_0 sowie Γ_0/Γ zugeordnet werden. Die Ergebnisse werden präsentiert und diskutiert.

* Gefördert durch die DFG im Rahmen des SFB 634.

HK 28.7 Mi 15:45 P 4

Experimental determination of the time behavior of the unobserved level feeding — •Thomas Braunroth, Alfred Dewald, Enrico Ellinger, Christoph Fransen, Matthias Hackstein, Jan Jolie, and Julia Litzinger — Institut für Kernphysik, Universität zu Köln

The Recoil Distance Doppler Shift (RDDS) technique is a powerful tool to determine lifetimes of excited nuclear states in the picosecond region. Especially when populating the state of interest by means of fusion evaporation reactions detailed level feeding has to be considered in order to obtain precise and correct level lifetimes with this technique. This includes also the time behavior of the unobserved level feeding which remains normally undetermined. The problem is solved completely by using gamma-gamma coincidence data by which the level lifetimes of interest are determined by selecting suitable feeding branches. Knowing the correct level lifetime and also the discrete level feeding, the time behavior of the unobserved feeding becomes experimentally accessible. In this paper we report on the method used and present results on the time behavior of the unobserved feeding of several yrast and non-yrast states in ^{124}Xe and ^{156}Dy which were populated using the reactions ^{124}Sn(^{36}S,4n)^{156}Dy and ^{110}Pd(^{18}O,4n)^{124}Xe, respectively. The results are suited to shed some light on the feeding pattern of the states considered. In the future the results can also be used to test statistical model calculations employed to describe fusion evaporation reactions.

HK 29: Schwerionenkollisionen und QCD Phasen

Zeit: Mittwoch 14:00–16:00 Raum: P 5

Gruppenbericht HK 29.1 Mi 14:00 P 5

CBM-Physik am SIS-100 — •Volker Friese für die CBM-Kollaboration — GSI Darmstadt

Das Ziel des Compressed Baryonic Matter-Experiment (CBM) an FAIR ist die Erforschung des Phasendiagramms stark wechselwirkender Materie im Bereich hoher Nettobaryonendichten. Sein Alleinstellungsmerkmal beruht auf der Fähigkeit, sehr hohe Kollisionsraten zu verarbeiten, die den Zugang zur Messung auch seltener Observablen, wie Hadronen mit Charm-Quarks oder mehrfach seltsame Hyperonen, ermöglichen.

Die Realisierung des vollen CBM-Physikprogrammes erfordert Schwerionenstrahlen vom SIS-300-Synchroton im Endausbau von FAIR. Teile des Programmes werden jedoch schon mit Strahlen aus dem SIS-100 in Angriff genommen werden. Sowohl dieser Beschleuniger als auch das CBM-Experiment sind Bestandteile der FAIR-Startversion. Der SIS-100-Energiebereich (bis zu 11A GeV für schwere Kerne, 14A GeV für leichte Kerne und 29 GeV für Protonen) erlaubt Zugang zu den Fragen nach der Zustandsgleichung komprimierter Kernmaterie, der Eigenschaften von Hadronen im dichten Medium, der Produktion und Propagation von Charm nahe der Produktionsschwelle und der dritten, seltsamen Dimension der Nuklidkarte. In diesem Vortrag diskutieren wir das Physikprogramm und den Aufbau des CBM-Experiments an SIS-100.

HK 29.2 Mi 14:30 P 5

CBM Benchmark Observables — •Iouri Vassiliev for the CBM-Collaboration — Goethe-Universität, Institut für Kernphysik, Frankfurt am Main, Germany

The main goal of the CBM experiment is to study the behaviour of nuclear matter at very high baryonic density in which the transition to a deconfined and chirally restored phase is expected to happen. One of the promissing signatures of this new state is the enhanced production of multi-strange particles, therefore the reconstruction of multi-strange hyperons is essential for the understanding of the heavy ion collision dynamics. Another experimental challenge of the CBM experiment is online selection of open charm particles via the displaced vertex of the hadronic decay in the environment of a heavy-ion collision. This task requires fast and efficient track reconstruction algorithms and high resolution secondary vertex determination.

Results of feasibility studies of these benchmark observables in the CBM experiment will be presented.

HK 29.3 Mi 14:45 P 5

Electron reconstruction and identification capabilities of the CBM Experiment at FAIR — Andrey Lebedev[1,3], •Semen Lebedev[2,3], Claudia Höhne[2], and Gennady Ososkov[3] for the CBM-Collaboration — [1]Frankfurt University, Germany — [2]Giessen University, Germany — [3]Joint Institute for Nuclear Research, Russia

The Compressed Baryonic Matter (CBM) experiment at the future FAIR facility at Darmstadt will measure dileptons emitted from the hot and dense phase in heavy-ion collisions. In case of an electron measurement, a high purity of identified electrons is required in order to suppress the background. Electron identification in CBM will be performed by a Ring Imaging Cherenkov (RICH) detector and Transition Radiation Detectors (TRD).

In this contribution, algorithms which were developed for the electron reconstruction and identification in RICH and TRD detectors are presented. A fast RICH ring recognition algorithm based on the Hough Transform was implemented. An ellipse fitting algorithm was elaborated because most of the CBM RICH rings have elliptic shapes. An efficient algorithm based on the Artificial Neural Network is implemented for electron identification in RICH. In TRD track reconstruction algorithm which is based on track following and Kalman Filter methods was implemented. Several algorithms for electron identification in TRD were developed and investigated. The best-performed algorithm is based on the special transformation of energy losses measured in TRD and usage of the Boosted Decision Tree as classifier. Results and comparison of different methods are presented.

HK 29.4 Mi 15:00 P 5

Parallel Kalman filter track fitting library for the CBM experiment — •Maksym Zyzak[1,2], Ivan Kisel[3], Igor Kulakov[1,2], and Hans Pabst[4] for the CBM-Collaboration — [1]Goethe-Universität

Frankfurt am Main — [2]National Taras Shevchenko University of Kyiv, Ukraine — [3]GSI Helmholtzzentrum für Schwerionenforschung GmbH — [4]Intel GmbH

The CBM experiment at FAIR is being designed to study heavy-ion collisions at extremely high interaction rates. The experiment requires the full on-line event reconstruction, therefore the speed of the algorithms is crucial.

A library for track fitting based on the Kalman filter (KF) has been developed for the CBM experiment. The library includes: track fitting procedures based on the conventional Kalman filter, the square root Kalman filter and the UD Kalman filter; the Kalman filter based smoother; the deterministic annealing filter.

The whole functionality is implemented using 3 approaches: simple headers, which overload SIMD intrinsics; Vc library; Intel ArBB library. The KF library has been tested with icc and gcc compilers on different many-core CPU platforms. The library shows a strong scalability with the number of CPU cores that is both independent of the platform, the compiler as well as independent of the supplied implementations.

Supported by EU-FP7 HadronPhysics3, HICforFAIR and HGS-HIRe for FAIR. Das Projekt wird vom Hessischen Ministerium für Wissenschaft und Kunst gefördert.

HK 29.5 Mi 15:15 P 5

Application of a Kalman Filter in Track Reconstruction* — •Erik Krebs[1], Jochen Markert[1,2], and Joachim Stroth[1,2] — [1]Goethe-Universität, Frankfurt am Main — [2]GSI Helmholtzzentum für Schwerionenforschung GmbH, Darmstadt

The Kalman filter is a mathematical method to estimate the evolution of linear, dynamical systems and has become an established method for track reconstruction. The Deterministic Annealing Filter is an extension of the Kalman filter that introduces competition between measurements and allows rejection of fake measurements.

An extended Kalman filter that takes multiple scattering and energy loss into account has been implemented for the HADES-experiment. The filter works with position information from reconstructed drift chamber segments and the results have been compared to a global Runge-Kutta track fit. To reduce systematic errors of the segment reconstruction for highly curvilinear tracks the Kalman filter has been revised to work directly with the wire information of the drift chambers. Additionally, track candidates may include measurements from multiple tracks. For these reasons, an extension of the Kalman filter, the Deterministic Annealing Filter, is used to discriminate measurements that do not belong to a track. Measurements are assigned weights and an annealing process is introduced to avoid local optima in measurement assignments.

*supported by BMBF grant 06 FY 9100 I, HIC for FAIR, EMMI and GSI

HK 29.6 Mi 15:30 P 5

Pattern Recognition for a Continuously Operating GEM-TPC — •Johannes Rauch for the GEM-TPC-Collaboration — Technische Universität München

A pattern recognition software for a continuously operating high rate Time Projection Chamber with Gas Electron Multiplier amplification (GEM-TPC) has been designed and tested. A track-independent clustering algorithm delivers space points. A true 3-dimensional track follower combines them to helical tracks, without constraints on the vertex position. Fast helix fits, based on a conformal mapping on the Riemann sphere, are the basis for deciding whether points belong to one track.

The software has been tested on simulated as well as on real data taken in a physics run of the GEM-TPC prototype installed in the FOPI detector at GSI facility, Germany. To assess the performance of the algorithm in a high-rate environment, $\bar{p}p$-interactions corresponding to a maximum average track density of $0.5\,\mathrm{cm/cm^3}$ have been simulated.

The pattern recognition is capable of finding all kinds of track topologies with high efficiency and provides excellent seed values for fitting or online event selection. Computational costs are $\mathcal{O}(50)\,\mathrm{ms/track}$ on a 3.1 GHz office PC. Parallel implementation of the code on a graphics processing unit (GPU) is under investigation.

Structure, functioning and benchmark results of the algorithm will be presented.

HK 29.7 Mi 15:45 P 5

Standalone FLES Package for Event Reconstruction and Selection in CBM — Ivan Kisel[1], •Igor Kulakov[2,3], and Maksym Zyzak[2,3] for the CBM-Collaboration — [1]GSI Helmholtzzentrum fur Schwerionenforschung GmbH — [2]Goethe-Universitat Frankfurt am Main — [3]National Taras Shevchenko University of Kyiv, Ukraine

The main objective of the CBM experiment at FAIR is the measurement of extremely rare signals, therefore collision rates up to 10 MHz and correspondent First Level Event Selection (FLES) is required. Since there are no simple trigger criteria, a full event reconstruction is needed in FLES.

The FLES package has been initially developed in the CBMROOT simulation and reconstruction framework. A standalone version of the FLES package adds flexibility with respect to different modern and future many-core CPU/GPU architectures. That is important for further development, optimization and testing of the package on various CPU/GPU hardware. The package is parallelized both at the data (using the SIMD instruction set) and the task (using the Threading Building Blocks library) levels.

Extensive tests with simulated Au-Au collisions at 25 GeV have been performed. The reconstruction efficiencies for tracks and short-lived particles are presented and discussed. The FLES package shows a strong scalability on various many-core systems.

Supported by EU-FP7 HadronPhysics3, HIC for FAIR and HGS-HIRe for FAIR. Das Projekt wird vom Hessischen Ministerium fuer Wissenschaft und Kunst gefoerdert.

HK 30: Hadronenstruktur und -spektroskopie

Zeit: Mittwoch 16:30–18:45 Raum: RW 1

Gruppenbericht HK 30.1 Mi 16:30 RW 1

Hadronic Molecules with Open or Hidden Heavy Flavor — •Martin Cleven[1], Feng-Kun Guo[2], Christoph Hanhart[1], and Ulf-G. Meissner[1,2] — [1]Institute for Advanced Simulation and Jülich Center for Hadron Physics, Institut für Kernphysik, Forschungszentrum Jülich, D-52425 Jülich, Germany — [2]Helmholtz-Institut für Strahlen- und Kernphysik and Bethe Center for Theoretical Physics, Universität Bonn, D-53115 Bonn, Germany

We present techniques to identify molecular states in the spectrum of hadrons. As an example we study the bottomonia states $Z_b(10610)$ and $Z_b(10650)$ which have recently been discovered in the $\Upsilon(5S) \to \pi^+\pi^- h_b$ and $\Upsilon(5S) \to \pi^+\pi^-\Upsilon(nS)$ decays. Their masses are located very close to the $B\bar{B}$ and $B^*\bar{B}^*$ thresholds. It will be shown that the assumption that the $Z_b(10610)$ and $Z_b(10650)$ are $B\bar{B}^* + \text{c.c.}$ and $B^*\bar{B}^*$ bound states, respectively, with very small binding energies is consistent with the data.

HK 30.2 Mi 17:00 RW 1

Precise spectroscopy of pionic atoms at RIKEN — •H. Weick[1], G.P.A. Berg[2], H. Fujioka[3], H. Geissel[1], R.S. Hayano[4], S. Hirenzaki[5], N. Ikeno[5], N. Inabe[6], K. Itahashi[6], S. Itoh[4], D. Kameda[6], T. Kubo[6], H. Matsubara[4], S. Michimasa[4], K. Miki[7], H. Miya[4], M. Nakamura[6], T. Nishi[4], S. Noji[4], S. Ota[4], K. Suzuki[8], H. Takeda[6], K. Todoroki[4], K. Tsukada[9], T. Uesaka[6], and K. Yoshida[6] — [1]GSI, Darmstadt — [2]Notre Dame University, USA — [3]Kyoto University, Japan — [4]University of Tokyo, Japan — [5]Nara Women's University, Japan — [6]RIKEN, Japan — [7]Osaka University, Japan — [8]SMI Vienna, Austria — [9]Tohoku University, Japan

Precision spectroscopy of pionic atoms provides unique information on the isovector πN interaction connected to the reduction of the chiral symmetry breaking at normal nuclear density. Experiments at GSI on Sn isotopes yielded the first quantitative estimation of its reduction to be about 33% compared to that in the vacuum [PRL92(2004)072302].

The pionic atoms are formed on the target nucleus in a Sn(d,^{3}He) reaction. The new BigRIPS separator can accept much more ^{3}He and the RIKEN SRC cyclotron can deliver much higher deuteron beam in-

tensity than in the former experiments, but require a careful dispersion matching in the spectrometer to achieve the resolution despite a much worse momentum spread and position detectors for MHz count rate.

The results of bound states in ^{122}Sn from the 2010 experiment at RIKEN will be discussed with respect to the achievable resolution as well as the necessary calibration steps be explained.

HK 30.3 Mi 17:15 RW 1

Precise spectroscopy of pionic atoms at RIKEN (2) — •K. Suzuki[1], G.P.A. Berg[2], H. Geissel[3], R.S. Hayano[4], S. Hirenzaki[5], N. Ikeno[5], N. Inabe[6], K. Itahashi[6], S. Itoh[4], D. Kameda[6], T. Kubo[6], H. Matsubara[7], H. Michimasa[7], K. Miki[7], H. Miya[7], M. Nakamura[8], T. Nishi[4], S. Noji[7], S. Ota[6], H. Takeda[6], K. Todoroki[4], K. Tsukada[6], T. Uesaka[7], H. Weick[3], and K Yoshida[6] — [1]SMI, Vienna, Austria — [2]JINA, University of Notre Dame, Indiana, USA — [3]GSI, Darmstadt, Germany — [4]Department of Physics, University of Tokyo, Tokyo, Japan — [5]Nara Women's University, Nara, Japan — [6]RIKEN Nishina Center, RIKEN, Saitama, Japan — [7]Center of Nuclear Study, University of Tokyo, Tokyo, Japan — [8]Tokyo Institute of Technology, Tokyo, Japan

Following the successful observation of deeply-bound pionic states at GSI that lead to the precise determination of the s-wave π-nucleus interaction and the deduction of the chiral order parameter at normal nuclear density, we started a new series of experiments at RIKEN, exploiting the high intensity deuteron beam (about 10^{12}/s) from the Superconducting Ring Cyclotron (SRC) and the high acceptance fragment separator (BigRIPS). A pilot experiment in October 2010 using the ^{122}Sn(d, ^{3}He) reaction was successful in establishing the dispersion matching optics and to observe the deeply-bound pionic 1s states in ^{121}Sn.

The results of the experiment will be compared with the previous experiments at GSI and the theoretical prediction, and their possible interpretation and the future outlook of the project will be discussed.

HK 30.4 Mi 17:30 RW 1

Search for ω-mesic states* — •Stefan Friedrich for the CBELSA/TAPS-Collaboration — II. Physikalisches Institut, Universität Gießen, Heinrich-Buff-Ring 16, 35392 Gießen

Experiments searching for the existence of ω-mesic states are presented, using the tagged photon beam at the ELSA accelerator in Bonn. The combined setup of the Crystal Barrel and MiniTAPS detector systems, which form a 4π electromagnetic calorimeter, was used for detecting 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 a reference measurement on LH_2. The status of the analysis will be presented.

*Funded by DFG (SFB/TR16)

HK 30.5 Mi 17:45 RW 1

Search for the ^{4}He $-$ η bound state with WASA-at-COSY — •Wojciech Krzemien[1], Pawel Moskal[1,2], Jerzy Smyrski[1], and Magdalena Skurzok[1] for the WASA-at-COSY-Collaboration — [1]Jagiellonian University, Krakow, Poland — [2]Institut für Kernphysik, and Jülich Center for Hadron Physics, Forschungszentrum

We conduct a search for the ^{4}He $-$ η bound state with WASA-at-COSY facility, via a measurement of the excitation functions for the $dd \to {}^3$He$p\pi$ reaction, where the outgoing $p-\pi$ pairs originate from the conversion of the η meson on a nucleon inside the He nucleus.

In June, 2008 first measurements of the excitation functions for the $dd \to {}^3$He$p\pi$ reaction were performed. In the experiment we used a slowly ramped COSY deutron beam, scanning the range of momenta corresponding to the variation of the excess energy for the $^4He-\eta$ system from - 51 MeV to 22 MeV.The results from the analysis will be presented.

This work has been supported by FFE funds of Forschungszetrum Juelich, grant No 41831803 (COSY-107), by the European Commission under the 7th Framework Programme through the 'Research Infrastructures' action of the 'Capacities' Programme. Call: FP7-INFRASTRUCTURES-2008-1, Grant Agreement N. 227431 and by the Polish Ministry of Science and Higher Education under grants No. 2367/B/H03/2009/37 and 0320/B/H03/2011/40.

HK 30.6 Mi 18:00 RW 1

Scalar tetraquark boundstates in a covariant DSE-BSE approach — •Walter Heupel, Christian Fischer, and Gernot Eichmann — Institut fuer Theoretische Physik I, Justus-Liebig Universitaet Giessen, Deutschland

The bound state of the scalar tetraquark with quantum numbers 0^+ is solved via a Fadeev-like equation. The genuine four-body equation is reduced to an effective two-body problem using a meson-meson/antidiquark-diquark picture. All ingredients of the bound-state equation are calculated in a covariant Dyson-Schwinger/Bethe-Salpeter approach employing a rainbow-ladder truncation together with the Maris-Tandy effective interaction. First results hinting at a bound mass in the 450 MeV region are presented.

HK 30.7 Mi 18:15 RW 1

Search for ppK^- - Status of the FOPI p-p Experiment* — •Robert Münzer für die FOPI-Kollaboration — 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). The possible creation of the ppK^- has been investigated at the FOPI spectrometer at GSI in proton-proton-collisions at 3.1 GeV. This reaction should favour the formation of the ppK^-, according to some theoretical predictions (3). Due to the RPC detector embedded in the FOPI spectrometer an excellent identification of K^+ has been achieved for this data set. Additionally, a silicon detector system placed close to the target, has been constructed and employed to improve the vertex determination and used as an online trigger for the selection of Lambda hyperons. About $70 \cdot 10^6$ events have been collected after the second level trigger selection.

This contribution will show the status of the ongoing analysis.

*supported by BMBF and Excellence Cluster Universe

(1) J. Siebenson, L. Fabbietti / in press.
(2) T. Yamazaki, M. Maggiora, P. Kienle / PRL 104 / 132502 (2010)
(3) T. Yamazaki, Y. Akaishi / PRC 76 / 045201 (2007)

HK 30.8 Mi 18:30 RW 1

Performance of a TPC with GEM amplification in the FOPI spectrometer.* — •Martin Berger for the GEM-TPC-Collaboration — TU München, Boltzmannstr. 2, 85748 Garching, Germany

A GEM-TPC can exploit the intrinsic suppression of back drifting ions from the amplification stage of the GEM foils to overcome the problem of drift-field distortions in an ungated operation. To explore the possibility of a continuously running TPC (Time Projection Chamber) with GEM (Gas Electron Multiplier) foils instead of MWPC's as amplification stage a prototype detector was built. This prototype with a drift length of 728 mm and a radius of 308 mm and a total of 10254 electronic channels was designed as an upgrade for the FOPI experiment at GSI to improve the secondary vertex resolution especially for K^0_S and Λ and the PID capabilities for $K^+$and K^- fit into the FOPI spectrometer. Several measurements with cosmic rays, ion beams colliding with solid targets [1] and physics run with a π-beam were carried out. During these tests different gain settings, drift fields and gas mixtures have been used to study systematically the response of the chamber. The signal pattern and the spatial resolution extracted by the differential analysis of cosmics data will be discussed in this contribution.

*Supported by BMBF and DFG Cluster of Excellence "Universe" (Exc153).

[1]L. Fabbietti, Nucl. Instr. and Meth. A, 628 204-208 (2011)

HK 31: Nukleare Astrophysik

Zeit: Mittwoch 16:30–19:00 Raum: RW 2

Gruppenbericht HK 31.1 Mi 16:30 RW 2

Investigation of decays of r-process nuclei — •Michele Marta[1,2], Iris Dillmann[1,2], and Alexey Evdokimov[1,2] for the S323-S410-Collaboration — [1]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany — [2]II. Physikalisches Institut, Justus-Liebig Universität Giessen, Germany

The r-process nucleosynthesis accounts for about half of the solar abundances beyond the iron peak. A complete understanding of the process is complicated by the scarce experimental information of the many short-lived neutron-rich nuclei of interest along the r-process path. Particularly, non-zero β-delayed neutron branchings divert the material flow back to stability during the freeze-out phase and provide additional neutrons which can be recaptured. A recent experimental campaign at the fragment separator FRS facility at GSI has investigated decay half-lives and following neutron emission of unstable nuclei close to the neutron shell closure N = 82 and N = 126. The fragments produced by a 1 A·GeV primary beam of uranium on a ^{9}Be target have been separated in-flight, identified, and implanted in a segmented Si array detector. Thirty ^{3}He counters in a polyethylene matrix surrounded the implantation station and detected the delayed neutrons in coincidence with β-decays in the Si detector. The status of the ongoing analysis and an outlook are presented.

Gruppenbericht HK 31.2 Mi 17:00 RW 2

Konsistente Beschreibung des Strahlungseinfangs schneller Neutronen und der Photonanabsorption durch schwere Kerne. — •Eckart Grosse[1,2], Arnd R. Junghans[1], Ralph Massarczyk[1,2] und Ronald Schwengner[1] für die ERINDA-Kollaboration — [1]Helmholtz Zentrum Dresden Rossendorf — [2]IKTP, Technische Universität Dresden

Sowohl für die Transmutation radioaktiven Abfalls als auch für das Verständnis der kosmischen Synthese der schweren Kerne ist der Strahlungseinfang von Neutronen im Energiebereich stark überlappender Resonanzen von entscheidender Bedeutung. Es wurde deshalb versucht, kürzlich zusammengestellte Einfangdaten (http://www.kadonis.org) unter Berücksichtigung neuer Informationen zur Photonen-Stärkefunktion zu analysieren. Es werden hierbei sowohl kürzlich mit neuen Methoden - teilweise von Mitgliedern der ERINDA-Kollaboration - gewonnene Daten verwendet als auch kernspektroskopische Publikationen. Da die schlecht messbare Niveaudichte unterhalb der Neutronenseparationsenergie empfindlich eingeht, ergibt sich die Möglichkeit, verschiedene Modellannahmen zu überprüfen. Es wird diskutiert, inwieweit auf Kerne außerhalb des Stabilitätstals extrapoliert werden kann, was sowohl für die Transmutation als auch für den r-Prozess von Bedeutung sein kann.

HK 31.3 Mi 17:30 RW 2

Nuclear correlations and the r-process — •Almudena Arcones[1,2,3] and George F. Bertsch[4] — [1]Technische Universitaet Darmstadt Institut fuer Kernphysik (Theoriezentrum) Schlossgartenstr. 2, 64289 Darmstadt — [2]Department of Physics, University of Basel, Klingelbergstrasse 82, 4056 Basel, Switzerland — [3]GSI Helmholtzzentrum fuer Schwerionenforschung, 64291 Darmstadt — [4]Department of Physics and Institute for Nuclear Theory, University of Washington, Seattle, Washington 98915, USA

We show that long-range correlations for nuclear masses have a significant effect on the synthesis of heavy elements by the r-process. As calculated by Delaroche et al., these correlations suppress magic number effects associated with minor shells. This impacts the calculated abundances before the third r-process peak (at mass number A=195), where the abundances are low and form a trough. This trough and the position of the third abundance peak are strongly affected by the masses of nuclei in the transition region between deformed and spherical. Based on different astrophysical environments, our results demonstrate that a microscopic theory of nuclear masses including correlations naturally smoothens the separation energies, thus reducing the trough and improving the agreement with observed solar system abundances.

HK 31.4 Mi 17:45 RW 2

s-Prozess Simulationen in AGB Sternen — •Alexander Koloczek für die NuGrid-Kollaboration — Goethe Universität Frankfurt a. M.

Um den s-Prozess zu simulieren, braucht man einerseits ein Modell für TP-AGB Sterne und andererseits ein vollständiges Reaktionsnetzwerk, das mit experimentellen Daten untermauert werden muss. 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 unterschiedliche Reaktionsnetzwerke können problemlos für das gleiche Sternmodell verwendet werden.

Hier werden Sensitivitätsstudien präsentieren, welche die Auswirkungen von Änderungen des Reaktionsnetzwerks auf die Elementverteilung in einem Stern mit 3 Sonnenmassen zeigen. Dies hilft dabei, entscheidende Reaktionsraten zu identifizieren, die in zukünftigen Experimenten gemessen werden sollten.

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

HK 31.5 Mi 18:00 RW 2

^{13,14}B(n,γ) via Coulomb dissociation in inverse kinematics for the r-process nucleosynthesis — •Sebastian Altstadt for the R3B-Collaboration — Goethe Universität, Frankfurt

Model calculations of r-process nucleosynthesis in a neutrino-driven wind scenario with a short dynamical timescale indicate, that light, neutron-rich nuclei may have a crucial influence on final r-process abundances [M. Terasawa et al., ApJ, 2001]. However, nuclear reaction rates of unstable nuclei far from stability are rarely known and extremely difficult to determine. Therefore, a kinematically complete measurement was performed with the R^{3}B/LAND setup at GSI. To obtain the neutron capture cross sections of ^{13}B and ^{14}B, which are thought to be on the main flow path among the light elements with Z<10 [T. Sasaqui et. al, ApJ, 2005], the time-reversed reactions ^{14}B(γ,n) and ^{15}B(γ,n) were measured via Coulomb dissociation. The presentation focuses on the current status of the analysis and will discuss first results.
This project was supported by the Helmholtz International Center for FAIR and the Helmholtz Young Investigator Group VH-NG-327.

HK 31.6 Mi 18:15 RW 2

^{59}Fe(n,γ)^{60}Fe constrained by Coulomb Dissociation — •Tanja Heftrich for the s389-Collaboration — Goethe Universität Frankfurt a. M., Germany

One of the fundamental signatures for active nucleosynthesis in our galaxy is the observation of long-lived radioactive elements using γ-ray observatories such as INTEGRAL. Of particular importance are the two long-lived radioactive isotopes ^{26}Al and ^{60}Fe. The production of ^{60}Fe is associated with the Helium shell burning phase in AGB stars or with the hot carbon/oxygen shell burning phase in massive presupernova stars. Very little is known about the reactions associated with the nucleosynthesis of ^{60}Fe. The production rate ^{59}Fe(n,γ)^{60}Fe is very difficult to measure directly because of the short half-life of ^{59}Fe ($t_{1/2}$=44.5 d). Coulomb dissociation measurements of ^{59}Fe and ^{60}Fe were performed at the R^{3}B/LAND setup at GSI. The unstable iron isotopes were produced by fragmentation of a 660 AMeV primary beam of ^{64}Ni on a 4 g/cm^2 Be target. The dissociation cross section ^{60}Fe(γ, n)^{59}Fe allows to constrain the theoretical estimates of the inverse neutron capture reaction ^{59}Fe(n,γ)^{60}Fe via detailed balance. In order to prove this method, ^{59}Fe(γ, n)^{58}Fe was studied in addition to compare with the already directly measured ^{58}Fe(n,γ)^{59}Fe cross section. The astrophysical motivation, an overview of the experimental setup and the status of the analysis will be presented. This project is supported by the HGF Young Investigator Project VH-NG-327.

HK 31.7 Mi 18:30 RW 2

Messung der ^{63}Ni(n,γ)-Reaktion mit dem 4π-BaF$_2$-Kalorimeter DANCE — •M. Weigand[1], T.A. Bredeweg[2], A. Couture[2], M. Jandel[2], F. Käppeler[4], G. Korschinek[3], J.M. O'Donnell[2], R. Reifarth[1], J.L. Ullmann[2] und A. Wallner[5] — [1]Goethe Universität, Frankfurt, Germany — [2]LANL, Los Alamos, USA — [3]TUM, Garching, Germany — [4]FZK, Karlsruhe, Germany — [5]Universität Wien, Austria

Die kosmische Häufigkeitsverteilung der Elemente und Isotope hängt von den Reaktionraten während verschiedener Syntheseprozesse ab. Die meisten Elemente schwerer als Eisen wurden und werden durch Neutroneneinfänge in Sternen verschiedener Entwicklungsphasen pro-

duziert. Etwa die Hälfte davon entsteht während des langsamen Neutroneneinfangprozesses, dem s-Prozess. Der genaue Verlauf der Nukleosynthese hängt dabei von Temperatur, Neutronendichte und Wirkungsquerschnitten ab. Hierbei sind Verzweigungspunkte von besonderem Interesse, an denen verschiedene mögliche s-Prozess-Pfade konkurrieren. Einen solchen Verzweigungspunkt stellt das radioaktive Isotop ^{63}Ni mit $t_{1/2} \approx 100$ Jahren dar. Hier konkurriert der β^--Zerfall mit dem Neutroneneinfang; je nach Verzweigungrate beeinflusst dies beispielsweise die Häufigkeiten der Kupfer-Isotope. Daher ist es notwendig, den Wirkungsquerschnitt für die ^{63}Ni(n,γ)-Reaktion möglichst genau zu kennen. Ein Experiment zu dessen Bestimmung fand am Los Alamos National Laboratory mit dem kalorimetrischen 4π-BaF_2-Aufbau DANCE statt. Hierzu werden vorläufige Resultate präsentiert. Unterstützt durch das HGF Nachwuchsgruppen-Projekt VH-NG-327.

HK 31.8 Mi 18:45 RW 2

The ^{152}Sm(p,n) reaction measurements in inverse kinematics — •Moritz Pohl for the s405-Collaboration — Goethe Universität Frankfurt am Main, Germany

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 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. Preliminary results will be presented. This project was supported by the Helmholtz International Center for FAIR and the Helmholtz Young Investigator Group VH-NG-327.

HK 32: Struktur und Dynamik von Kernen

Zeit: Mittwoch 16:30–19:00 Raum: RW 3

Gruppenbericht HK 32.1 Mi 16:30 RW 3

Neutron rich calcium isotopes studied with two- and three-body forces — Jason Davidson Holt[1,2], •Javier Menéndez[3,4], and Achim Schwenk[4,3] — [1]Department of Physics and Astronomy, University of Tennessee, Knoxville, USA — [2]Physics Division, Oak Ridge National Laboratory, Oak Ridge, USA — [3]Institute für Kernphysik, Technische Universität Darmstadt, Darmstadt, Germany — [4]ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

Three-body (3N) forces have been shown to be essential to the description of light nuclei. Recently, Shell Model calculations based on chiral EFT interactions have also been applied to explain features (the oxygen dripline, the magic number N=28) that couldn't be explained by microscopic NN-only interactions. I will present new results that follow this framework, regarding the ground and excited states of neutron rich calcium isotopes. In particular, I will focus on the importance of including 3N forces in binding energies, pairing gaps and spectroscopic factors. These can be related to the existence (or not) of non-standard magic numbers N=32, 34 or 40.

HK 32.2 Mi 17:00 RW 3

First observation of isomeric state in ^{97}Rb — •Matthias Rudigier[1], Andrey Blazhev[1], Jean-Marc Regis[1], Nigel Warr[1], Jan Jolie[1], Christoph Fransen[1], Matthias Hackstein[1], Michael Pfeiffer[1], Wolfram Rother[1], Tim Thomas[1], Gary Simpson[2], Mourad Ramdhane[2], Ulli Köster[3], Thomas Materna[3], Waldemar Urban[3], and Jean-Michel Daugas[4] — [1]IKP, Uni Köln, Germany — [2]LPSC, Grenoble, France — [3]ILL, Grenoble, France — [4]CEA, DAM, DIF, Arpajon, France

Data on a new microsecond isomer in ^{97}Rb will be presented. The measurement was conducted at the LOHENGRIN mass separator at the ILL, Grenoble. We were able to deduce the level energy and lifetime of the state. The multipolarity of the transition to the ground state was determined using conversion electron spectroscopy. This information enabled us to assign a spin and parity to the state, based on quasi-partice-rotor model calculations. The nucleus ^{97}Rb has neutron number 60, and is thus situated in the shape-phase transition line of the mass 100 nuclei. It will be discussed how the new state fits into the region and the Rb-isotopic chain. Furthermore some new results on the decay of the $9/2^+$ microsecond isomer of 97Sr will be presented and discussed.

HK 32.3 Mi 17:15 RW 3

Photoneninduzierte γ-γ Koinzidenzmessungen am γ^3-Setup bei HIγS* — •B. Löher[1,2], T. Aumann[5], N. Cooper[6], V. Derya[3], J. Endres[3], E. Fiori[1,2], J. Kelley[4], N. Pietralla[5], R. Raut[4], G. Rusev[4], D. Savran[1,2], A. Tonchev[4], W. Tornow[4], V. Werner[6] und A. Zilges[3] — [1]ExtreMe Matter Institute EMMI and Research Division, GSI Helmholtzzentrum, Darmstadt, Germany — [2]Frankfurt Institute for Advanced Studies FIAS, Frankfurt — [3]Institut für Kernphysik, Universität zu Köln, Köln — [4]Department of Physics, Duke University, Durham, USA — [5]Institut für Kernphysik, Technische Universität Darmstadt, Darmstadt — [6]WNSL, Yale University, USA

Die Methode der Kernresonanzfluoreszenz wird in der Kernphysik zur Untersuchung von Zuständen mit Spin = 1, 2 unterhalb der Teilchenschwellen verwendet. Bisherige Messungen waren meist nicht sensitiv genug, um Übergänge mit geringer Intensität in angeregte Zustände zu beobachten. Die Kenntnis des Zerfallsverhaltens ist aber für den Test von Kernstrukturmodellen von großem Interesse. Eine Messung von γ-γ Koinzidenzen erhöht deutlich die Sensitivität und ermöglicht die Analyse der entsprechenden Übergangswahrscheinlichkeiten. Ein neuer experimenteller Aufbau, das γ^3-Setup bestehend aus schnellen $LaBr_3$ und hochauflösenden HPGe Detektoren, mit besonders hoher Effizienz wird zu diesem Zweck an der High Intensity γ-ray Source der Duke Universität installiert. Erste Ergebnisse werden präsentiert.

* Supported by the DFG (SFB 634 and ZI 510/4-1), U.S. DOE grant no. DE-FG02-91ER-40609 and the Alliance Program of the Helmholtz Association (HA216/EMMI).

HK 32.4 Mi 17:30 RW 3

Verzögerte γ-Spektroskopie der neutronenarmen Massenregion um A=100 — •Matthias Dewald[1], Andrey Blazhev[1], Jan Jolie[1], Hubert Grawe[2] und Magdalena Górska[2] — [1]IKP, Univerität zu Köln — [2]GSI, Darmstadt

Das Ziel einer Messung von 2001 am EUROBALL IV Spektrometer in Straßbourg war das Untersuchen von prompter und verzögerter γ-Strahlung des Kerns ^{98}Cd [1], das über den Reaktionskanal $\alpha 2n$ der Fusions-Verdampfungs-Reaktion ^{46}Ti+^{58} Ni $\rightarrow^{104}$ Sn* erzeugt wurde. Da über diese Reaktion viele weitere Kerne der neutronenarmen Massenregion um $A = 100$ produziert werden, wurden im Rahmen einer Bachelorarbeit nun die Isomer- und β^+-verzögerten γ-Zerfälle dieser Kerne untersucht. Die Daten wurden durch entsprechende Sortierungen von verschiedenen γ-γ-Koinzidenzmatrizen, γ-Zeit- oder γ-γ-Zeit-Matrizen analysiert.

Durch die bisherige Auswertung dieser Daten konnten große Teile der verzeichneten Niveau-Schemata systematisch überprüft und in den meisten Fällen bestätigt werden. Hierbei wurden für ^{100}Cd und ^{102}Cd präzisere Lebensdauern der jeweiligen 8^+-Isomere bestimmt und im Falle von ^{102}Cd auch das Anregungsspektrum unterhalb dieses Zustandes korrigiert. Ein erstes Ergebnis liefert für die Lebensdauer des isomeren Zustands bei 74 keV in ^{100}Rh einen Wert, der von der Literatur abweicht, jedoch mit großem statistischen Fehler. Vorläufige Ergebnisse der laufenden Auswertung werden präsentiert.

[1] A. Blazhev *et al.*, Phys. Rev. C **69**, 064304 (2004)

HK 32.5 Mi 17:45 RW 3

Winkelkorrelationsexperiment an ^{198}Hg und Vergleich mit supersymmetrischen Vorhersagen — •Pierre Thöle, Christian Bernards, Jan Jolie, Christoph Fransen, Stefan Heinze, Desiree Radeck und Tim Thomas — Institut für Kernphysik, Universität zu Köln, Zülpicher Straße 77, D-50937 Köln, Germany

In der Gold-Platin Massenregion liegen sogenannte Supermultipletts der $U_\nu(6/12) \bigotimes U_\pi(6/4)$ Supersymmetrie. In [1] wurde ^{198}Hg als zwei-Fermionen-vier-Bosonen Mitglied des Supermultipletts von ^{196}Pt beschrieben. Zur Überprüfung der Vorhersagen wurden zwei $\gamma\gamma$ Winkelkorrelationsexperimente am HORUS-Würfelspektrometer mit dem FN Tandem-Beschleuniger des Instituts für Kernphysik der Universität zu Köln durchgeführt. Mittels des β Zerfalls nach der ^{198}Hg(p,n)^{198}Tl Reaktion, konnten die Daten aus einem (α,2n) Experiment [2] erweitert werden. Hierbei erhielten wir Multipolmischungsverhältnisse, γ Übergänge, Energieniveaus und Zerfallsverzweigungsverhältnisse. Wir präsentieren die neuen Ergebnisse und vergleichen diese mit den Vorhersagen der Supersymmetrie für ^{198}Hg.
[1] J. Jolie, PhD thesis, Rijksuniversiteit Gent, 1986. [2] C. Bernards et al., Phys. Rev. C 79, 054307, 2009.

HK 32.6 Mi 18:00 RW 3

Bestimmung der Lebensdauer des ersten 2^+-Zustandes in ^{126}Cd unter Verwendung der DSA Methode — •Michael Thürauf, Sabine Bönig, Thorsten Kröll und Marcus Scheck für die IS477-Kollaboration — Technische Universität Darmstadt

Übergangsstärken stellen neben der Anregungsenergie eine exzellente Testmöglichkeit für theoretische Kernmodelle wie das Schalenmodell dar. Für die damit verbundene Lebensdauer angeregter Zustände gibt es in der Region um den doppeltmagischen Kern $^{132}_{50}$Sn$_{82}$ wenige direkte Messungen. Als Fortsetzung der Coulombanregungsstudien neutronenreicher Cadmium-Isotope wurde im Rahmen von IS477 (Juli 2011) an REX-ISOLDE, CERN, mit MINIBALL ein Experiment zur Lebensdauerbestimmung in ^{126}Cd mit der Doppler-Shift Attenuation Method (DSAM) durchgeführt. Hierzu werden die ersten vorläufigen Ergebnisse vorgestellt. Gefördert durch BMBF (Nr. 06 DA 9036I), HIC for FAIR und EU durch ENSAR (No. 262010).

HK 32.7 Mi 18:15 RW 3

Energiedifferenz des 1+/1- Paritätsdupletts in Ne-20* — •Jacob Beller[1], D. Deleanu[2], D.M. Filipescu[2], T. Glodariu[2], J. Isaak[1], N. Pietralla[1], R. Raut[3], C. Romig[1], G. Rusev[3], M. Scheck[1], A. Tonchev[3], W. Tornow[3], J. Wagner[1], H.R. Weller[3], N.-V. Zamfir[2] und M. Zweidinger[1] — [1]Institut für Kernphysik, TU Darmstadt — [2]NIPNE, Bucharest, Romania — [3]Duke University, Durham, USA

Das Paritätsduplett von $1^+/1^-$ Zuständen bei 11.26 MeV in ^{20}Ne ist eines der besten bekannten Testfälle, um Paritätsverletzung in Atomkernen z.B. mittels Streuung zirkular polarisierter Photonen zu studieren [1]. Die Sensitivität eines solchen Experiments hängt von dem so genannten *effective nuclear enhancement factor* $|R_N/\Delta E|$ ab, der anti-proportional zu der Energiedifferenz der Duplettzustände ist. Für das Duplett in ^{20}Ne ein sehr großer Wert von $|R_N/\Delta E| = (670 \pm 700)$ bekannt. Die große Unsicherheit rührt im wesentlichen von der Aufspaltung von $\Delta E = 7.7 \pm 5.5$ keV des $1^-/1^+$ Paritätsdupletts her. Ein Kernresonanzfluoreszenz-Experiment mit quasi-monoergetischen, linear polarisierten Photonen an der High Intensity $\overrightarrow{\gamma}$-Ray Source (HIγS) der Duke University erlaubte eine präzisere Bestimmung der Energiedifferenz. Hierbei wurde die unterschiedliche azimuthale Winkelverteilung der $0^+ \to 1^- \to 0^+$ und $0^+ \to 1^+ \to 0^+$ Kaskaden betrachtet.

*Gefördert durch die DFG im Rahmen des SFB 634.
[1] A. I. Titov *et al.*, J. Phys. G: Nucl. Part. Phys. **32** (2006) 1097.

HK 32.8 Mi 18:30 RW 3

Energieabhängigkeit des Screening-Enhancement-Faktors für d+d-Fusionsreaktionen bei sehr niedrigen Energien - eine mögliche neue Resonanz in ^{4}He — •Daniel Weissbach[1,2], Konrad Czerski[1,2,3], Armin Huke[2,3], Götz Ruprecht[2] und Sabine Engel[2] — [1]Instytut Fizyki Wydział Matematyczno-Fizyczny, Uniwersytet Szczeciński, ul. Wielkopolska 15, 70-451 Szczecin, Poland — [2]Institut für Festkörper-Kernphysik, Leistikowstraße 2, 14050 Berlin — [3]IOAP, Technische Universität Berlin, Hardenbergstraße 36, 10623 Berlin

Es wurden Yield-Verhältnisse der Reaktion d(d,p/t/τ) im Energiebereich 6 bis 20 keV in metallischen Umgebungen unter Ultrahochvakuumbedingungen (UHV, 10^{-9} mbar) gemessen. Das Metalltarget (Ta, Zr) wurde dabei durch den Ionenstrahl deuterisiert. Wegen der UHV-Umgebung erfolgt die störende Beschichtung (O, C) langsam, was durch Auger-Spektroskopie überprüft und ggf. durch Sputtern mit Ar beseitigt wurde.

Aus den Protonen-Yields bei verschiedenen Winkeln konnte die Deuteriumdichte im Target online gemessen und damit eine vollständige Sättigung sowie eine konstante, tiefenunabhängige Deuterisierung des Targets sichergestellt werden. Die so erhaltene, präzise gemessene Energieabhängigkeit des Screening-Enhancement-Faktors zeigt im unteren Bereich eine Abweichung von der üblichen, einparametrigen Screening-Enhancement-Kurve. Der Kurvenverlauf ließe sich durch eine schmale Resonanz in ^{4}He an der d+d-Reaktionsschwelle erklären.

HK 32.9 Mi 18:45 RW 3

Role of the momentum transfer in the quenching of the Gamow-Teller strength — •Tomislav Marketin[1,2], Gabriel Martínez-Pinedo[1], Nils Paar[2], and Dario Vretenar[2] — [1]Institut für Kernphysik, Technische Universität Darmstadt, D-64289 Darmstadt, Germany — [2]Physics Department, Faculty of Science, University of Zagreb, 10000 Zagreb, Croatia

A fully consistent calculation of the Gamow-Teller strength is presented, based on a microscopic theoretical framework. Nuclear ground state is determined using the relativistic Hartree-Bogoliubov (RHB) model with density dependent meson-nucleon coupling constants, and transition rates are calculated via proton-neutron relativistic quasiparticle RPA using the same interaction as in the RHB equations.
The (p, n) probe has a similar spin-isospin operator structure to the Gamow-Teller (GT) operator. However, they become comparable only if the GT cross section is measured at a very small momentum transfer q. At higher momentum transfer the isovector spin monopole (IVSM) mode occurs, with the $r^2\boldsymbol{\sigma}\tau$ transition operator. Unlike the Gamow-Teller operator which excites only the $0\hbar\omega$ transitions, the isovector spin monopole operator can also excite $2\hbar\omega$ transitions and can change the strength distribution at high excitation energies. We explore the strength beyond the resonance, examine the effect of momentum transfer on the total strength and compare the results with recent measurements.

HK 33: Fundamentale Symmetrien

Zeit: Mittwoch 16:30–19:00 Raum: P 1

Gruppenbericht HK 33.1 Mi 16:30 P 1

Progress report on the nEDM project at the Paul Scherrer Institut, Switzerland — •Martin Fertl for the nEDM-Collaboration — Paul Scherrer Institut, Villigen, Switzerland

The Standard Model (SM) of Particle Physics predicts a permanent electric dipole moment for the neutron (nEDM), breaking time reversal and parity symmetry. The electroweak prediction is several orders of magnitude below the current best experimental limit $d_\mathrm{n} < 2.9 \times 10^{-26}$ecm (90 % CL, ILL-RAL-Sussex). Many SM extensions predict a nEDM in the range of current experimental sensitivity. Improving the upper experimental limit restricts the allowed parameter space of these models. In a first step the nEDM collaboration has installed the upgraded ILL-RAL-Sussex instrument at the new ultra-cold neutron (UCN) source at the Paul Scherrer Institut (PSI), Switzerland. The collaboration aims at increasing the experimental sensitivity by a factor of five due to the expected higher UCN density and improved control of systematic effects. In parallel a new apparatus is developed for a next measurement phase aiming at another order of magnitude improvement. The experiment employs the Ramsey method of separated oscillatory fields to detect a shift of the Larmor precession frequency of UCN in a parallel and an anti-parallel configuration of very homogeneous magnetic and electric fields. In 2010/2011, the nEDM apparatus has been characterized in detail. The polarized UCN infrastructure was studied and significant progress in the homogeneity of the magnetic field was achieved. Preliminary results of dedicated measurements related to the major systematic false effects will be presented.

Gruppenbericht HK 33.2 Mi 17:00 P 1

The new neutron EDM experiment at the FRM-II — •Tobias Lins — Technische Universität München, Physikdepartment, James-Franck-Str. 1, 85748 Garching, Germany

Since the 1950's people have been searching for electric dipole moments (EDMs) of fundamental paticles. This is a very promising approach to find yet unknown manifestations of broken underlying symmetries in the early Universe. Although these experiments are among the most precise in physics, no EDM has been observed so far. In this talk a next generation approach with a sensitivity of < 5.10-28 ecm (3 sigma) for the neutron EDM based at the FRM-II neutron source will be presented. Ramsey's method of separated oscillatory fields is applied to trapped ultra-cold neutrons (UCNs) in vacuum. For the investigation of systematic effects a sophisticated strategy of various means to control ambient parameters on an unprecedented level of accuracy is currently being set up. The construction is planned to be finished by end of 2013, followed by the first measurements with UCNs in 2014. An overview of the overall strategy, main systems for magnetic field control and magnetometry, as well as the current status of the ongoing implementation on site will be shown.

HK 33.3 Mi 17:30 P 1

Uncompensated magnetic field drifts in the nEMD experiment at Paul Scherrer Institute — •Johannes Zenner for the nEDM-Collaboration — Johannes Guttenberg Universität, Mainz, Deutschland — Paul Scherrer Institut, Villigen, Schweiz

A non-zero value of the neutron electric dipole moment (nEDM) would violate both time (T) and parity (P) symmetry. The current experimental upper limit is $d_n < 2.9 \text{ x } 10^{-26}$ e cm, 90 % CL [C. A. Baker et al., PRL 97, 131801 (2006)]. The nEDM collaboration installed the experiment that has set the current limit at the new source for ultracold neutrons (UCN) at the Paul Scherrer Institute. Our goal is to increase the sensitivity by two orders of magnitude. That way one could confirm or exclude extensions of the standard model which introduce new sources of CP violation. To make use of the increased neutron intensity at the new UCN source a crucial task is to understand systematic effects at a corresponding level. A major systematic uncertainty is related to magnetic fields that could be created by the high voltage system of the experiment and are not fully compensated with the mercury co-magnetometer. This talk will cover our studies of this influence using an array of optical Cesium magnetometers.

HK 33.4 Mi 17:45 P 1

Erste Messung eines ^{35}Ar-Rückstoßspektrums und Bestimmung von a mit dem WITCH-Experiment — •Peter Friedag[1], Anna Bakenecker[1], Marcus Beck[1], Martin Breitenfeldt[2], Simon van Gorp[2], Tomica Porobic[2], Nathal Severijns[2], Christian Weinheimer[1] und Dalibor Zakoucky[3] für die WITCH-Kollaboration — [1]Institut für Kernphysik, Westfälische Wilhelms-Universität Münster — [2]Institut voor Kern een Stralenfysika, Katholieke Universiteit Leuven — [3]Nuclear Physics Institute of ASCR, Rez near Prague

Mit dem WITCH-Experiment wird der Kern-Beta-Zerfall von Ionen in einer Penningfalle unter Verwendung eines Retardierungsspektrometers untersucht. Damit wird ein Rückstoßenergie-Spektrum gemessen, aus welchem sich die Beta-Neutrino-Winkelkorrelation a extrahieren läßt. Das Ziel des WITCH-Experiments ist es, a mit einer Genauigkeit von $\Delta a < 0,5\,\%$ zu bestimmen, was Rückschlüsse auf eine skalare Komponente in der schwachen Wechselwirkung erlaubt.

2011 fanden drei Strahlzeiten statt in denen erstmals ^{35}Ar-Rückstoßspektren mit guter Statistik gemessen wurden. In diesem Beitrag werden die Messungen vorgestellt und die Analyse der Daten diskutiert. Diese Auswertungsmethode stützt sich wesentlich auf weitreichende Bahnverfolgungs- und Penningfallensimulationen, deren Ergebnisse mit den Messungen verglichen werden, um die Winkelkorrelation a zu extrahieren und systematische Unsicherheiten zu bestimmen. Dieses Projekt wird vom BMBF unter der Nummer 06MS9151I unterstützt.

HK 33.5 Mi 18:00 P 1

A novel approach to measure the electric dipole moment of 129Xenon — •Florian Kuchler, Wolfhardt Feldmeier, Peter Fierlinger, and Bernd Taubenheim — 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. 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. Employing superconducting pick-up coils and highly sensitive LTc-SQUIDs, a large array of independent measurements can be performed simultaneously with different field configurations. With our novel approach we aim to be sensitive to an EDM of 129-Xe on the order of 10^{-30} ecm. The talk will give an update on the current status of the xenon EDM experiment.

HK 33.6 Mi 18:15 P 1

Bound Beta-Decay: BOB — •Josephine McAndrew — TU München

For many years exotic decay modes of the neutron have been investigated as possible doorways to the exploration of new physics. The bound beta-decay (BOB) of the neutron into a hydrogen atom and an anti-neutrino offers a very elegant method to study neutrino helicities. However, this rare decay has not yet been observed for the free neutron, owing to the challenge of measuring a decay involving only electrically neutral particles and with an estimated branching ratio of only a few 10^6 of the three-body decay mode. During the past few years scientists from the TUM E18 Group have developed a novel experimental scheme which addresses all necessary problems associated with the observation of this two-body neutron decay in a very coherent way. The BOB experiment shall be installed at a tangential beam tube of a powerful research reactor such as the SR6 at the FRMII in Garching or H6-H7 beam tube at ILL. This talk will provide insights and ideas on how such an experiment is to be performed.

HK 33.7 Mi 18:30 P 1

Investigation of the reaction $dd \to {}^3He n\pi^0$ with WASA-at-COSY — •Paweł Podkopał for the WASA-at-COSY-Collaboration — Institut für Kernphysik and Jülich Center for Hadron Physics, Forschungszentrum Jülich, Germany.

Investigations of charge symmetry breaking in dd collisions is one of the most important topics of the physics programme for the WASA-at-COSY. One of the planned studies focuses on the charge symmetry forbidden reaction $dd \to {}^4He\pi^0$. Theoretical calculations based on existing data still lack precise information for determining low-level χPT parameters as well as for the description of dd initial state interaction and $4N$ final state interaction. New data should comprise the measurement of p-wave pion production in the $dd \to {}^4He\pi^0$ and of the charge symmetry conserving $dd \to {}^3He n\pi^0$ reaction. The latter measurement is especially necessary in order to study the relevance of initial and final state interaction. The reaction has been measured at a beam momentum of $p_d = 1.2$ GeV/c, using the WASA-at-COSY facility. For the first time data on the total cross section as well as differential distributions were obtained. The data are described with a phenomenological approach based on the combination of a quasi-free model and partial wave expansion model for the three-body reaction. Data analysis and results will be discussed.

Supported by COSY-FFE (FZ Jülich)

HK 33.8 Mi 18:45 P 1

Improvements of the aSPECT retardation spectrometer — •Alexander Wunderle 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 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 determined with a precision of $\frac{\Delta a}{a} \approx 5$ %, whereas aSPECT aims for a precision of $\frac{\Delta a}{a} \approx 0.3$ %. To achieve this precision a new detector electronics has been developed and implemented, which avoids a previously observed saturation effect. Also, the main electrode has been redesigned and their surface treatment/coating has been improved. Compared to the previous electrode this leads to a smaller fluctuation of the work function, hence to a more precise determination of the potential. Furthermore, the collimation system for the neutron beam has been coated with a conductive layer to avoid a potential charging of the system.

These and further improvements will be presented and discussed in this talk.

HK 34: Instrumentation

Zeit: Mittwoch 16:30–19:00 Raum: P 2

Gruppenbericht HK 34.1 Mi 16:30 P 2

Trigger-less readout of the PANDA Electromagnetic Calorimeter — Myroslav Kavatsyuk, Johan G. Messchendorp, Hossein Moeini, •Ganesh Tambave, and Herbert Loehner for the PANDA-Collaboration — KVI, University of Groningen, Zernikelaan 25, NL-9747AA Groningen

Charm-meson resonances and yet undiscovered glueballs might reveal the origin of the hadronic mass spectrum. To this end the PANDA collaboration at FAIR will exploit antiproton annihilations for precision studies of e.g. charmonium resonance states. In order to achieve a highly flexible event selection, a trigger-less data-acquisition system is currently being developed. We have constructed the prototype of a readout chain for the PANDA Electromagnetic Calorimeter (EMC), in order to demonstrate the feasibility of a fast online event selection on basis of high-level physics information. The readout is based on intelligent front-end electronics which autonomously recognises valid hits and extracts the relevant information. The EMC employs a sampling-ADC readout incorporating a pulse-processing algorithm [1], which is able to process data at hit rates up to 500 kHz, and includes the recovery of pile-up pulses. The developed algorithm was applied in the EMC prototype detector[2]. We will describe the functionality of the developed readout chain, present results of test experiments revealing the accuracy of time synchronisation, discuss the performance of the pile-up recovery algorithm, and report on the validation studies of the simulation package. [1] E. Guliyev, et al., NIM A 664 (2012) 22; [2] M. Kavatsyuk et al., NIM A 648 (2011) 77.

Gruppenbericht HK 34.2 Mi 17:00 P 2

Progress on the Compute Node based DAQ System for PANDA — •Björn Spruck[1], Sören Fleischer[1], Thomas Gessler[1], Wolfgang Kühn[1], Jens Sören Lange[1], Zhen'An Liu[2], David Münchow[1], Hao Xu[1,2], and Jingzhou Zhao[2] for the PANDA-Collaboration — [1]II. Physikalisches Institut, Universität Gießen — [2]IHEP, Beijing

The PANDA detector will be located at the future FAIR facility in Darmstadt. As PANDA has been designed without a global trigger, a large amount of data ($\leq$200 GB/s @ $2 \cdot 10^7$/s interaction rate) has to be distributed and processed in real time. A hardware platform capable of processing this amount of data is the ATCA based Compute Node (CN) developed in close cooperation between IHEP Beijing and our institute. Each node consists of an xTCA carrier board and four AMC/μTCA daughterboards. The carrier board supplies the high bandwidth connectivity between the daugtherboards and the other CNs in the shelf by RocketIO links. In the current prototype design, each AMC board is equipped with a Virtex5FX70T, 4 GB of memory, GBit ethernet and two optical links which allow for high data transfer rate. Beside the event builing, the CNs will run algorithms for cluster finding in the calorimeter data, online tracking and based on these make trigger decisions.

This talk will not only focus on the current hardware and future developments, but also on the setup and performance of our test system, including the status of the algorithm developments.

Supported by BMBF (06GI9107I) und HIC for FAIR.

HK 34.3 Mi 17:30 P 2

Data Transport Challenge at ALICE HLT - Summary and Outlook — •Timo Breitner and Udo Kebschull for the ALICE-Collaboration — Institut für Informatik, Universität Frankfurt, Germany

The ALICE High Level Trigger (HLT) is used for on-line monitoring, filtering, and compression of raw detector data from the ALICE experiment at CERN LHC. A self-developed data-transport framework is used to route the incoming data stream to thousands of different processes distributed on hundreds of computing nodes. Towards the end of 2011, during the Pb-Pb beam period of LHC, we encountered the so-far biggest data challenge while running in compression mode: a large event size, combined with a high luminosity and hence event rate led to an input data rate of up 12 GB/s, and in turn to an output data rate of about 3 GB/s. Future upgrades to LHC and ALICE will lead to even bigger challenges, especially in terms of higher event rates.

The demand for a hardware upgrade at the HLT is obvious, but even more importantly the software has to be made ready for this challenge. The performance of the current software framework in past runs was therefore evaluated and the results shall be presented. Based on the experience of several years of running a new concept shall be proposed, which takes recent and expected future developments in software and hardware technologies into account.

HK 34.4 Mi 17:45 P 2

A Common Read-Out Receiver Card for ALICE DAQ and HLT — •Heiko Engel and Udo Kebschull for the ALICE-Collaboration — IRI, Goethe-Universität Frankfurt

In the ALICE read-out chain, both Data Acquisition (DAQ) and High Level Trigger (HLT) use FPGA-based Read-Out Receiver Cards (RORCs) as interface between the optical Detector Data Link (DDL) and the DAQ and HLT cluster machines. A new version of these cards is currently being developed as a common project of both groups. This new RORC will have a fast PCIe interface, high density parallel optical DDL connections and will combine several of the old cards into one new device. Due to the increased link density and the changed interface to the host machine a completely new read-out architecture has to be connected to the existing software framework. This work includes a custom linux device driver, a scatter-gather based DMA firmware and a software library to interface the new hardware to the existing software framework. All layers can be verified with a custom hardware/software co-simulation environment.

HK 34.5 Mi 18:00 P 2

Der GANDALF 128-Kanal Time-to-Digital Converter — Tobias Baumann, •Maximilian Büchele, Horst Fischer, Matthias Gorzellik, Florian Herrmann, Philipp Jörg, Kay Königsmann, Tobias Kunz, Christoph Michalski, Christian Schill, Sebastian Schopferer und Tobias Szameitat — Physikalisches Institut der Albert-Ludwigs-Universität Freiburg.

Das GANDALF VXS-Modul wurde zur Digitalisierung und Echtzeitanalyse von Detektorsignalen entwickelt. Um die FPGA-Architektur des Mainboards für vielfältige Anwendungen zu erschließen, sind die Signaleingänge auf dedizierten Aufsteckkarten angeordnet. Digitale Aufsteckkarten ermöglichen die Implementierung eines 128-Kanal Time-to-Digital Converters (TDC) in einen Virtex-5 FPGA auf dem GANDALF-Modul. Aufgrund der begrenzten Logikresourcen des FPGAs wird zur Zeitmessung ein Shifted-Clock-Sampling Algorithmus verwendet. Dabei wird das TDC-Register von 16 äquidistant phasenverschobenen Taktsignalen getaktet, die mit zwei PLLs im FPGA generiert werden. Bei dieser Methode muss eine minimale Laufzeitdifferenz des Datensignals zu den 16 Flipflops des TDC-Registers gewährleistet sein. Das Signalrouting kann bei der Implementierung des FPGA-Entwurfs nur indirekt beeinflusst werden. Eine Herausforderung des Projektes liegt daher im homogenen Placement und Routing der Komponenten des TDC-Registers für alle 128 Eingangssignale. Es werden Messungen zur differentiellen und integralen Nichtlinearität sowie der Zeitauflösung von 56 ps des 128-Kanal TDCs vorgestellt. Dieses Projekt wird vom BMBF und EU FP7 unterstützt.

HK 34.6 Mi 18:15 P 2

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

The Compressed Baryonic Matter (CBM) experiment will be built at the new Facility for Antiproton and Ions Research (FAIR) in Darmstadt, Germany. This fixed target experiment will investigate Heavy Ion collision up to 35 AGeV for Au beams and 89 GeV for protons beams, with high interactions rates: up to 10MHz in Au+Au collision at 25 AGeV. To avoid the limitations of triggered systems at such rates, most CBM detectors will operate a free-streaming readout.

Charged hadrons identification, especially a Kaons-Pions separation up to 3.5 GeV/c, is provided by its Time of Flight wall. This requires a time resolution for the full system in the order of 80ps. The wall is made of MRPC detectors with resistive materials and channel layout adapted to the different rates found in polar angles of 2.5° to 25°. Hit rates up to 200 kHz/channel are expected. Thus electronic with a time resolution of 30 to 40ps, Time over Threshold capability and free-streaming readout is required. This free-streaming mode also require a special care in the synchronization of the system and the data

analysis.

A first prototype of the full high resolution, free-streaming chain was build in Heidelberg, from differential detector to dedicated softwares. It was tested in beam at COSY in Jülich last November, in a hybrid system with triggered systems. It will be described in this contribution and its first in-beam performances will be presented.

Supported by EU/FP7 WP2 and BMBF 06HD9121I.

HK 34.7 Mi 18:30 P 2

SPADIC – Self triggered readout ASIC for the CBM transition radiation detectors — Tim Armbruster, Peter Fischer, •Michael Krieger, and Ivan Peric — ZITI, Universität Heidelberg

For the readout of the transition radiation detectors of the planned CBM experiment at FAIR, the self-triggered SPADIC mixed signal ASIC for signal amplification and digitization is under development.

The chip has 32 channels, each composed of a low-noise and low-power charge sensitive amplifier, a 9 bit pipelined ADC running at 25 MHz sampling rate, a programmable digital signal processing unit with 16 bit internal resolution for detector specific tasks such as ion tail cancellation and baseline correction, as well as hit detection logic, which triggers the readout of whole signal snapshots. Data will be sent out in a message-based format through an arbitrated inter-channel network preserving the temporal order of recorded events.

We will show lab and test beam measurements of the available SPADIC prototype chips and present the first version of a full scale chip.

HK 34.8 Mi 18:45 P 2

Comparision of self-triggering front-end electronics for CBM detector prototyping — •Tomas Balog for the CBM-Collaboration — GSI, Darmstadt, Germany — Comenius University, Bratislava, Slovakia

The CBM experiment requires high-rate capable readout electronics. Since the Poisson-distributed collisions of nuclei are not correlated to a global trigger signal, the readout chips as well as the complete data acquisition system must be self-triggered. The n-XYTER chip was developed for neutron experiments and is also used for early prototyping of CBM detectors. The SPADIC chip has been designed for the readout of gaseous detectors of CBM. Their main difference is in the data storing and ordering mechanisms. The n-XYTER chip uses a Token Ring while the SPADIC chip has an ordering FIFO. Simulation studies have been done for both chips in the SystemC hardware description language. In order to achieve a proper comparision, both chips had the same number of channels with the same FIFO depth per channel, and both were simulated at the same bandwidth and hit rates. Resutlts of the simulations are presented including the proper size of the ordering FIFO and a comparision of the performance of both front-end chips.

Supported by HadronPhysics3 and EU-FP7 MC-PAD.

HK 35: Instrumentation

Zeit: Mittwoch 16:30–19:00 Raum: P 3

Gruppenbericht HK 35.1 Mi 16:30 P 3

PRESPEC-AGATA: New prespectives for γ-spectroscopy. — F. Ameil[1], •P. Boutachkov[2], M.L. Cortes[2], J. Gerl[1], A. Givechev[2], N. Goel[1], M. Gorska[1], E. Gregor[2], G. Guastalla[2], T. Habermann[3], I. Kojouharov[1], V. Lushta[2], E. Merchan[1,2], T. Moeller[2], P.T. Patchakui[2], N. Pietralla[2], S. Pietri[1], D. Ralet[2], M. Reese[2], H. Schaffner[1], P.P. Singh[2], B. Szczepanczyk[2], H.J. Wollersheim[1], A. Gadea[4], and W. Korten[5] for the PRESPEC-AGATA-Collaboration — [1]GSI — [2]IKP, TU Darmstadt — [3]Uni. of Frankfurt — [4]Uni. of Valencia, Spain — [5]CEA Saclay, France

The PRESPEC-AGATA setup is a unique combination of the GSI accelerator facility, the Fragment Separator(FRS), the Advanced Gamma Tracking Array(AGATA), the HECTOR array and the LYCCA-0 Calorimeter. With this setup high-resolution in-flight spectroscopy of relativistic($\beta \sim$0.4-0.5) exotic nuclei will be performed. A thick target positioned at the final focal plane of the FRS will be used for Coulomb excitation or fragmentation of the exotic ions separated with the FRS. The γ-rays emitted in these reactions will be detected by the AGATA and HECTOR arrays. The fragments produced at the secondary target will be identified and tracked by LYCCA-0. Compared to the RISING array, the improved energy resolution and efficency of the AGATA array is expected to lead to a gain in sensitivity of a factor of 10 and 100 for γ-particles and γ-γ-particle coincidences, respectively. The perspectives of the new setup will be discussed. *Supported by the BMBF under 06DA9040I, by HICforFAIR, and by the HGF under VH-VI-417.*

HK 35.2 Mi 17:00 P 3

AGATA in-beam commissioning at the GSI fragment separator — Alejandro Algora[1], Frederic Ameil[2], Plamen Boutachkov[2], Cesar Domingo Pardo[1], Jürgen Gerl[2], Tobias Habermann[2], Ivan Kojouharov[2], Edana Merchan[2], Norbert Pietralla[3], Stephane Pietri[2], Damian Ralet[2], •Michael Reese[3], and Henning Schaffner[2] for the PRESPEC-AGATA-Collaboration — [1]Univ. Valencia — [2]GSI, Darmstadt — [3]TU-Darmstadt

Spectroscopic investigation of exotic nuclei is of large current interest. In-flight γ-ray spectroscopy after the Fragment Separator (FRS) at GSI is one possible experimental tool. This was successfully shown in the past during the RISING campaign [1]. The availability of the Advanced Gamma-ray Tracking Array (AGATA) at GSI will allow even more ambitious experiments. In order to commission the performance of the gamma-ray detection system, an in-beam test of a single AGATA crystal was performed in 2011 to measure count rates and background conditions to be expected for the upcoming PreSPEC campaign for in-flight γ-ray spectroscopy experiments at GSI in 2012. The experimental setup will be described and the results will be discussed.

Supported by the BMBF under 06DA9040I and by HIC for FAIR.

[1] H.J.Wollersheim et al., NIM A 537 (2005) 637

HK 35.3 Mi 17:15 P 3

AGATA-PreSpec Commissioning: Zeitauflösung der AGATA HPGe-Detektoren — •Michael Schlarb, Roman Gernhäuser, Stefanie Klupp und Reiner Krücken für die AGATA-Kollaboration — Physik-Department E12, TU München

Im Rahmen der AGATA-PreSPEC Kampagne wird eine hochauflösende in-flight γ-Spectroskopie von exotischen Kernen mit relativistischen Energien ($\beta \sim 0.4 - 0.5$) durchgeführt. Die Kerne werden in Fragmentations- bzw. Spaltreaktionen aus relativistischen Projektilen erzeugt und die gewünschten Fragmente durch den GSI Fragment Separator (FRS) selektiert. AGATA wird in der letzten Fokalebene (S4) des FRS aufgebaut werden. Zur Inbetriebnahme wird anschließend eine Reihe von speziellen Testexperimenten durchgeführt. Diese dienen zum einen der Optimierung der Ortsauflösung und Untergrundunterdrückung als auch zur Kalibrierung mit bekannten Reaktionen aus Primär- und Sekundärstrahlen. Um den Untergrund aus parasitären Targets vom eigentlichen Signal unterscheiden zu können wird eine gute Zeitauflösung der AGATA Detektoren benötigt. Die komplett digitale Datenaufnahme von AGATA ermöglicht die genaue Bestimmung des Startzeitpunktes t_0 des HPGe-Signals zum einen über ein neuronales Netz und zum anderen über einen Geraden-Fit an ein adäquates Summensignal. Wir messen vorab die erreichbare Zeitauflösung mit Hilfe einer ^{22}Na-Quelle und geben einen Ausblick auf die verschiedenen Testexperimente.

* gef. d. BMBF(06MT9156), DFG (Exz-Clust 153-Universe)

HK 35.4 Mi 17:30 P 3

Aufbau einer Compton-Kamera basierend auf einem hochsegmentierten HPGe-Detektor und digitaler Spektroskopieelektronik — •Tim Steinbach[1], Lars Lewandowski[1], Benedikt Birkenbach[1], Jürgen Eberth[1], Roman Gernhäuser[2], Herbert Hess[1], Ludwig Maier[2], Peter Reiter[1], Michael Schlarb[2], Benedikt Weiler[2], Andreas Wiens[1] und Max Winkel[2] — [1]IKP Universität zu Köln — [2]E12 Technische Universität München

Im Rahmen des TRAKULA-Projektes wird eine neue Compton-Kamera, bestehend aus einem hochsegmentierten HPGe-Detektor und einem Double Sided Silicon Strip Detector, DSSSD entwickelt. Für das γ-ray imaging wird zum einen der Nachweis der individuellen Wechselwirkungsorte und Energien nach einer Compton-Streuung innerhalb des Ge-Kristalls genutzt. Zum anderen wird eine optimierte Winkelauflösung durch den Einsatz des Si-Detektors in Koinzidenz

mit dem Ge-Detektor erzielt. Für das Funktionsprinzip ist eine hohe Energieauflösung der Detektoren und eine optimale Bestimmung der Wechselwirkungsorte mit Hilfe von Pulsformanalyse und γ-ray-Tracking notwendig. Im letzten Jahr wurde ein 36-fach segmentierter HPGe-Detektor und ein DSSSD erfolgreich mit digitaler Spektroskopieelektronik (PIXIE-16 Module) in Betrieb genommen. Erste Ergebnisse werden vorgestellt und diskutiert. Gefördert durch BMBF Projekt 02MUK013D und 02NUK013F.

HK 35.5 Mi 17:45 P 3

Digitale Signalverarbeitung mit Halbleiterdetektoren — •Andreas Hennig, Michael Elvers, Janis Endres, Christoph Fransen, Jan Mayer, Lars Netterdon, George Pascovici, Simon Pickstone, Philipp Scholz, Nigel Warr und Andreas Zilges — Institut für Kernphysik, Universität zu Köln

Das HORUS Spektrometer am Kölner Tandembeschleuniger besteht aus 14 hochreinen Germaniumdetektoren. Für die Teilchenspektroskopie wird das Spektrometer zusätzlich um eine Siliziumstreukammer mit acht ΔE-E Detektoren erweitert. Um die Vielzahl von Detektorsignalen zu verarbeiten wurde die analoge Datenaufnahme durch digitale DGF-4C Module der Firma XIA ersetzt.

Durch den Einsatz dieser Module kann bei vergleichbarer Energie- und Zeitauflösung eine höhere Datenrate gegenüber der analogen Datenaufnahme verarbeitet, sowie eine höhere Stabilität erreicht werden. Die Offline-Behandlung von Veto-Bedingungen, wie beispielsweise durch BGO-Signale, ermöglicht darüberhinaus eine höhere Flexibilität bei der Datenanalyse.

In diesem Beitrag wird die neue digitale Datenaufnahme am HORUS Spektrometer vorgestellt und ein Vergleich mit der analogen Technik hinsichtlich der Energie- und Zeitauflösung, sowie der Datenrate gezeigt. Darüberhinaus werden erste Ergebnisse der digitalen Signalverarbeitung von Siliziumdetektoren präsentiert.

Gefördert durch die DFG (ZI-510/4-1 und ZI-510/5-1). A.H., J.M., S.P. und P.S. sind Mitglieder der Bonn-Cologne Graduate School of Physics and Astronomy.

HK 35.6 Mi 18:00 P 3

Zeitdiskrete Pulsformanalyse von Detektorsignalen in Echtzeit — Tobias Baumann, Maximilian Büchele, Horst Fischer, Matthias Gorzellik, Florian Herrmann, •Philipp Jörg, Kay Königsmann, Tobias Kunz, Christoph Michalski, Christian Schill, Sebastian Schopferer und Tobias Szameitat — Physikalisches Institut, Universität Freiburg

Die Identifikation von Rückstoßprotonen wird am COMPASS-II Experiment mit dem CAMERA-Detektor mittels der Flugzeitmessung und der Messung des spezifischen Energieverlusts der Protonen stattfinden. Die Verarbeitung der Szintillatorsignale in Echtzeit übernimmt hierbei das GANDALF System mit einer Auflösung von 12 bit und bis zu 1 GS/s. Im Hinblick auf eine Selektion der Protonereignisse werden Algorithmen zur Messung verschiedener Pulscharakteristika untersucht. Im Vordergrund der Pulsformanalyse stehen die Extraktion von Maximalamplitude, Integral und Eingangsszeitpunkt eines Pulses und auch die Untersuchung des Seperationsvermögens nahe aufeinander folgender Pulse. Auch der Einfluss von Reflektionen in den Szintillatoren und Lichtleitern auf die Pulsform wird untersucht. Zur Bestimmung des Eingangszeitpunktes eines Pulses wurde unter anderem im Zuge einer Monte Carlo Simulation der digital Constant Fraction Algorithmus betrachtet und mit anderen Methoden, die ebenfalls auf der diskreten Ableitung des Pulses basieren, verglichen. Desweiteren wird untersucht inwiefern es möglich ist, mit diesen Algorithmen die Rückstoßprotonen aufgrund ihrer Pulsform von anderen Ereignissen unterscheiden zu können. Dieses Projekt wird vom BMBF und EU FP7 unterstützt.

HK 35.7 Mi 18:15 P 3

Feasibility Studies for the EXL Project at FAIR — •K. Yue[1,2], S. Bagchi[3], S. Diebold[4], C. Dimopoulou[1], P. Egelhof[1], V. Eremin[5], S. Ilieva[6], N. Kalantar-Nayestanaki[3], O. Kiselev[1,6], T. Kröll[6], Y.A. Litvinov[1], M. Mutterer[1], M.A. Najafi[3], N. Petridis[7], U. Popp[1], C. Rigollet[3], M. von Schmid[6], M. Steck[1], and B. Streicher[3] — [1]GSI, Darmstadt — [2]IMP, Lanzhou — [3]KVI, Groningen — [4]PIT, Tübingen — [5]PTI, St. Petersburg — [6]TU, Darmstadt — [7]Goethe Universität, Frankfurt a.M.

This contribution presents the results of feasibility measurements performed for the EXL (EXotic nuclei studied in Light-ion induced reactions at the NESR storage ring) project at the Experimental Storage Ring (ESR) at GSI, Darmstadt. The stored 400 MeV/u ^{40}Ar beam impinged on an internal hydrogen gas-jet target. An UHV (Ultra High Vacuum) compatible single-sided Si strip detector was used to detect recoil protons. The proton elastic-scattering cross section obtained using the recoil detector is compared with theoretical predictions. The results on target and beam performance as well as the background conditions for the recoil detector will also be presented. In order to investigate the response of DSSD (Double-Sided Silicon Strip Detector) prototype detectors to very low-energy (74 keV to 1.5 MeV) protons, another detector test was performed at the Van-de-Graaff accelerator at Tübingen University. An energy resolution of 20 keV (FWHM) has been obtained for the slowest protons. This work was supported by BMBF (06DA9040I) and HIC for FAIR.

HK 35.8 Mi 18:30 P 3

Status der Siliziumdetektorentwicklung für das EXL-Projekt — •M. von Schmid[1], D. Ackermann[2], J. Dueñas[3], P. Egelhof[2], V. Eremin[4], S. Ilieva[1], N. Kalantar[5], A. Kluttig[5], H. Kollmus[2], T. Kröll[1], M. Lindemulder[5], G. May[2], M. Mutterer[2], C. Rigollet[5], B. Streicher[5,2], M. Träger[2] und K. Yue[2,1] — [1]IKP, TU Darmstadt — [2]GSI, Darmstadt — [3]Universidad de Huelva — [4]PTI, St. Petersburg — [5]KVI, Groningen

EXL, „**EX**otic nuclei studied in **L**ight-ion induced reactions“, ist ein Projekt innerhalb von NuSTAR bei FAIR. Der Detektor für targetähnliche, leichte Ionen 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.

Für das EXL-Projekt liegt seit Kurzem eine neue, zweite Serie großflächiger DSSD-Prototypen vor. Die 285 μm dicken Detektoren verfügen über eine aktive Fläche von 6,5 × 6,5 cm^2 und 128 × 64 Streifen. Im Vortrag gezeigt werden die Ergebnisse erster spektroskopischer Tests mit Alphaquellen. Gleichzeitig wurde mit diesen DSSDs verifiziert, Siliziumdetektoren als aktives Vakuumfenster für den Betrieb im Ultrahochvakuum einzusetzen. Dies wurde bisher nur an deutlich kleineren Detektoren demonstriert [1]. Ebenfalls erläutert wird der Stand des laufenden EXL-Experimentprogrammes am existierenden ESR, bei denen die hier diskutierten DSSDs zum Einsatz kommen werden.

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

[1] B. Streicher et al., Nucl. Instr. and Meth. A 654 (2011) 604.

HK 35.9 Mi 18:45 P 3

Tagging and tracking of fission products with large scale emissive foil detectors — •Michael Pfeiffer[1], Eleonora Gregor[2], Plamen Boutachkov[2], Gheorghe Pascovici[1], Nigel Warr[1], Stefan Thiel[1], and Jan Jolie[1] — [1]IKP, Universität zu Köln — [2]GSI, Darmstadt

In the context of the future HISPEC/DESPEC facility at the the low energy branch of the Super-FRS at FAIR a setup for slowed down beams is planned. With this facility, short lived, fast decaying radionuclides far off the valley of stability will become accessible. In order to open certain reaction channels with a high cross section at lower energies, the fast extracted beams have to be slowed down by a degrader, which will induce a certain amount of spallation products and the primary ions themself will undergo energy and spatial straggeling. Thus one needs to know wether one of the desired ions is hitting the target or not. To adress this problem, a detector capable of measuring the time of flight and the trajectory of each ion is to be placed between the degrader and the target. This detector has to introduce as less material as possible in the beam. The solution we are inverstigating uses an emissive foil detector with an active area of 80x100mm^2 and a timing resolution of $\approx$ 210ps. This prototype has been tested and included in the GSI data acquisition system to tag and track fission products from an open Cf-source. The results and a planned future setup for FAIR will be presented.

HK 36: Struktur und Dynamik von Kernen

Zeit: Mittwoch 16:30–18:45 Raum: P 4

Gruppenbericht HK 36.1 Mi 16:30 P 4

Die Synthese neuer superschwerer Elemente an der GSI: Suche nach Element 120 am Rückstoßseparator TASCA — •Christoph E. Düllmann für die TASCA Element 120-Kollaboration — Institut für Kernchemie, Universität Mainz — GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt — Helmholtz-Institut Mainz

Die Suche nach neuen Elementen jenseits von Element 118 ist ein Forschungsschwerpunkt an der GSI Darmstadt. Basierend auf theoretischen Vorhersagen führen die erfolgsversprechendsten Wege über Ti-50-induzierte Kernfusionsreaktionen mit Bk-249 (für Element 119) und Cf-249 (für Element 120) Targets. Am gas-gefüllten Rückstoßseparator TASCA wurde 2011 ein erstes mehrwöchiges Experiment zur Suche nach Element 120 erfolgreich durchgeführt. Dabei resultierte ein niedriger Wirkungsquerschnittsbereich. Die gewonnenen Daten werden momentan ausgewertet und auf der Tagung präsentiert, zusammen mit einem Ausblick auf das Programm für 2012, das die Suche nach Element 119 in einer mehrmonatigen Experimentkampagne vorsieht.

Gruppenbericht HK 36.2 Mi 17:00 P 4

Untersuchungen transmutationsrelevanter Kernreaktionen im Rahmen des TRAKULA Verbundprojekts — •Toni Kögler für die TRAKULA-Kollaboration — Helmholtz-Zentrum Dresden-Rossendorf — Technische Universität Dresden

Für eine zukünftige Transmutation langlebiger hochradioaktiver Abfälle werden genaue Kernreaktionsdaten insbesonders von Kernreaktionen, wie der neutroneninduzierten Spaltung und der inelastischen Neutronenstreuung benötigt. Am neuen Zentrum für Hochleistungsstrahlungsquellen des HZDR wird für diese Messungen eine Photoneutronenquelle im Energiebereich von ca. 0.1 bis 10 MeV mit einer untergrundarmen Neutronenflugstrecke gebaut. Zum Nachweis der neutroneninduzierten Spaltung von Uran- und Plutonium-Isotopen befindet sich ein Experimentaufbau mit Spaltionisationskammern in Vorbereitung. Durch Verwendung dünner Probenschichten und separater digitaler Datenauslese soll eine Pulshöhenseparation der Spaltfragmente von den pile-up Ereignissen aus dem α-Zerfall der Aktiniden erreicht werden. Aktinidenschichten aus ^{238}U und ^{nat}U sind bereits am Institut für Kernchemie der Universität Mainz hergestellt worden. Ausgewählte Aktivitäten des TRAKULA Verbundprojekts, wie Entwicklung einer Compton-Kamera zur hochaufgelösten MeV γ-Spektroskopie, Beschleunigermassenspektrometrie langlebiger Spaltprodukte, Entwicklung eines Untergrundlabors zur Messung sehr niedriger α-Aktivitäten werden präsentiert. Das TRAKULA Projekt (www.hzdr.de/trakula) wird unterstützt durch das Bundesministerium für Bildung und Forschung (PTKA-WTE 02NUK13A).

HK 36.3 Mi 17:30 P 4

Massenmessungen und Zerfallsspektroskopie an n-armen Tl-Isotopen an ISOLTRAP — •Juliane Stanja für die ISOLTRAP Kollaboration-Kollaboration — TU Dresden

Am Penningfallen-Massenspektrometer ISOLTRAP ist es dank der erreichbaren Genauigkeit von $\delta m/m = 1 \cdot 10^{-8}$ möglich, isomere Zustände in exotischen Kernen im Bereich von wenigen 100 keV aufzulösen. Allerdings war es bisher nicht möglich, Zugang zum Spinzustand des untersuchten Kerns zu bekommen. Da sich Grundzustand und isomere Zustände durch ihr Zerfallsschema unterscheiden, wurde ISOLTRAP durch ein Zerfallsspektroskopiesystem erweitert. In der Penningfalle wird ein reines Ionenensemble des Grund- oder isomeren Zustandes vorbereitet, welches anschließend auf ein aluminisiertes Mylarband aufgebracht wird. Die so erzeugte Quelle ist von einem Plastikszintillator umgeben, welcher die emittierten β-Teilchen detektiert. Die den Zerfall begleitende Gammastrahlung wird durch 2 HPGe-Detektoren aufgenommen. Vom beobachteten Gammaspektrum kann der Spinzustand abgeleitet und so eindeutig dem von der Falle kommenden Zustand zugeordnet werden.
In diesem Beitrag soll das erfolgreiche Zusammenspiel von Massenspektrometrie und Zerfallsspektroskopie an ISOLTRAP in den neutronenarmen Tl-Isotopen ^{194}Tl und ^{190}Tl demonstriert werden.

HK 36.4 Mi 17:45 P 4

Multi-Nucleon Transfer Experiments in the Actinide Region — •Kerstin Geibel[1], Peter Reiter[1], Jose Javier Valiente-Dobon[2], Francesco Recchia[2], Benedikt Birkenbach[1], Andres Gadea[4], and Silvia Lenzi[3] — [1]Institut für Kernphysik, Universität zu Köln, Deutschland — [2]Istituto Nazionale di Fisica Nucleare, Laboratori Nazionali di Legnaro, Italy — [3]Dipartimento di Fisica, University of Padova, Italy — [4]IFIC, CSIC-Universidad de Valencia, Spain

Two experiments at the PRISMA-CLARA-Setup at the LNL in Legnaro were analysed focussing on the target-like reaction products in the actinide region after multi-nucleon transfer reactions. Both experiments use ^{238}U as target; a ^{70}Zn-beam with 460 MeV and a ^{136}Xe-beam with 926 MeV were employed. Kinematic correlations between the reaction partners are used to obtain information about the unobserved target-like reaction products by the analysis of the beam-like particles identified with the PRISMA-spectrometer. Clean γ-spectra from neutron-rich actinide nuclei are obtained with the CLARA-array. An extension of the ground state rotational band in ^{240}U and insights in neutron-rich Th-isotopes were achieved. Based on relative cross section distributions for various reaction channels the perspectives and limitations for in-beam γ-spectroscopy with this experimental method in this mass region will be discussed. Supported by BMBF 06K-167 und 06KY205I.

HK 36.5 Mi 18:00 P 4

Ab-initio Spectroscopy of p- and sd-Shell Nuclei with Chiral Two- plus Three-Body Interactions — •Joachim Langhammer, Angelo Calci, Sven Binder, and Robert Roth — Institut für Kernphysik, Technische Universität Darmstadt

Chiral effective field theory provides the most systematic QCD-based interaction for nuclear structure calculations. We present ab-initio calculations of spectra and spectroscopic observables for p- and sd-shell nuclei obtained within the importance-truncated no-core shell model (IT-NCSM) using chiral two-body (NN) plus three-body (3N) interactions. To improve the convergence of the IT-NCSM calculations, we soften the nuclear NN+3N interactions via a consistent Similarity Renormalization Group transformation at the three-body level. The comparison of our predictions for spectra and spectroscopy to experimental data provides new benchmarks of the quality of chiral interactions. Furthermore, we study the sensitivity of the spectroscopy for $A \geq 10$ including the carbon isotopic chain to the parameters of the chiral forces, e.g. the low-energy constants (LECs) or the cut-off. With these results we investigate the propagation of the uncertainties of the LECs into nuclear structure.

Supported by DFG (SFB 634), HIC for FAIR, and BMBF (06DA9040I).

HK 36.6 Mi 18:15 P 4

Polarisationstransferobservablen aus inelastischer Streuung polarisierter Protonen unter 0° * — •Johannes Simonis[1], Andreas Krugmann[1], Anna Maria Krumbholz[1], Dirk Martin[1], Peter von Neumann-Cosel[1], Iryna Poltoratska[1] und Atsushi Tamii[2] — [1]Institut für Kernphysik, TU Darmstadt — [2]Research Center for Nuclear Physics, Osaka, Japan

Hochauflösende Streuexperimente mit einem polarisierten Protonenstrahl wurden am Research Center for Nuclear Physics (RCNP) in Osaka, Japan durchgeführt. Polarisationstransferobservable (PT) wurden mit einer Protonenstrahlenergie von 295 MeV unter 0° mit einem Fokalebenenpolarimeter gemessen [1]. Diese bieten eine modellunabhängige Möglichkeit den Spinflip-Charakter von Übergängen zu untersuchen und eine Trennung von Nicht-Spinflip-E1 und Spinflip-M1-Anteilen am Wirkungsquerschnitt bei 0° vorzunehmen. Ergebnisse für die Kerne ^{12}C und ^{120}Sn werden vorgestellt und diskutiert.

* Gefördert von der DFG durch den SFB 634 und 446JAP 113/267/0-2.

[1] A. Tamii et al., Nucl. Instrum. Methods A 605, 326 (2009).

HK 36.7 Mi 18:30 P 4

High Resolution Decay-Pion Spectroscopy of light Hypernuclei at MAMI — •Anselm Esser for the A1-Collaboration — Institut für Kernphysik, Johannes Gutenberg-Universität, Mainz

The high-resolution decay-pion spectroscopy of electro-produced hypernuclei offers a new way of precisely measuring their ground-state masses.

At the Mainz Microtron MAMI hypernuclei production by (e,e'K)

reactions was studied. A dedicated kaon spectrometer located at 0° was used to detect kaons emitted in forward direction therefore tagging events involving strangeness. Excited hypernuclei created in the primary reaction 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 their decay. Mesonic two-body weak decays of these hyperfragments 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. A ground-state mass determination with a precision of < 30 keV/c^2 is expected.

The status of the experiment and the data analysis of the pioneering experiment will be discussed.

Supported by DFG (SFB 443 + 1044) and EU HadronPhysics2 (SPHERE)

HK 37: Schwerionenkollisionen und QCD Phasen

Zeit: Mittwoch 16:30–19:00 Raum: P 5

Gruppenbericht HK 37.1 Mi 16:30 P 5

Particle Production in p+p and A+A and the Maximum-Entropy Principle — •Klaus Reygers[1], Hans-Jürgen Pirner[2], and Boris Kopeliovich[3] — [1]Physikalisches Institut, Universität Heidelberg — [2]Institut für Theoretische Physik, Universität Heidelberg — [3]Departamento de Fisica, Universidad Tecnica Frederico Santa Maria

We deduce the maximum-entropy state of partons created in proton-proton and nucleus-nucleus collisions. This state is characterized by a distribution function $n(x, \vec{p}_\perp)$ depending on the light-cone fraction x and the transverse momentum $\vec{p}_\perp$ of forward or backward particles, respectively. The mean transverse momentum $\langle|\vec{p}_\perp|\rangle$ determines the single parameter of the maximum-entropy distribution which is constrained by the sum of all light-cone momentum fractions being unity. The total multiplicity is related to the transverse area of the colliding Lorentz-contracted hadrons. Assuming parton-hadron duality we can compare the model to data from RHIC and LHC. In heavy-ion collisions, the shape of the $\frac{dN}{d\eta}$ distributions as functions of the number of participants has a universal shape common to RHIC and LHC which is of geometric origin.

HK 37.2 Mi 17:00 P 5

Produktion leichter Fragmente in Ar+KCl Kollisionen bei 1.756A GeV — •Heidi Schuldes, Manuel Lorenz, Jochen Markert, Christian Muentz und Joachim Stroth für die HADES-Kollaboration — Goethe-Universität, Frankfurt

Die Schwerionenreaktion Ar+KCl bei 1,756A GeV ist das bisher schwerste von dem HADES-Detektor an der GSI in Darmstadt gemessene Massensystem. Der Fokus der Hadronen-Analyse lag bisher auf leichteren geladenen Teilchen mit Massen unterhalb von 1 GeV/c^2. Darüber hinaus wird zum ersten mal eine Analyse der leichten Fragmente Deuteronen, Tritonen und ^{3}Helium mit HADES durchgeführt. In diesem Beitrag wird die Teilchenidentifikation der Fragmente anhand ihrer Flugzeit und ihres Energieverlustes präsentiert. Es werden die vorläufigen m_t-Spektren der Teilchen und die daraus resultierenden Verteilungen der Rapidität vorgestellt. Die über Anpassung der Spektren mit Boltzmann-Funktionen ermittelten inversen Steiungsparameter werden denen der leichteren Teilchen und der chemischen Ausfriertemperatur des Systems gegenübergestellt. Die Resultate werden auch im Hinblick auf die Thermalisierung des Systems und die Rolle des radialen Flusses diskutiert.

Unterstützt von: BMBF (06 FY 9100 I), HIC for FAIR, EMMI und GSI

HK 37.3 Mi 17:15 P 5

In-medium effects of strange particles in π-induced reactions measured with the FOPI detector — •Victoria Zinyuk and Norbert Herrmann for the FOPI-Collaboration — Physikalisches Institut der Universität Heidelberg

Indication for density dependent in-medium modifications of $K^{0/\pm}$ and Λ^0 properties have been found in several observables. In SIS energy regime, strange particles are connected by their production mechanism(i.e. strangeness exchange reactions, associated production). Therefore possible modifications of their properties influence the dynamics of the corresponding production partner.

Up to the present no definite conclusion could be drawn on the strength of $K^{\pm}N$- and ΛN-potentials.

In π-induced reactions the in-medium potential can be investigated at normal nuclear matter density ($\rho = \rho_0$). The FOPI collaboration has performed two experiments bombarding Carbon, Copper and Lead targets with π^- at beam momenta of 1.15 GeV/c and 1.7 GeV/c.

In this presentation we show the differences in population of the phase space(evaluating the momentum distributions) for $K^{0/\pm}$-mesons and Λ^0-baryons produced in heavy and light targets. The results are compared to recent versions of transport model calculations.

This work was supported by BMBF 06HD9121I.

HK 37.4 Mi 17:30 P 5

Status of the experiment ASYEOS — •Sebastian Kupny for the ASYEOS-Collaboration — GSI Helmholtzzentrum GmbH Darmstadt

Neutron-proton squeeze-out is predicted to provide quantitative information on the symmetry term of the nuclear Equation of State at supra-saturation densities. Hence we designed an experiment consisting out of the CHIMERA charged particle detector for impact parameter determination and reaction plane reconstruction, the LAND neutron detector to measure neutron and proton squeeze-out and a Triple Telescope Array to identify light fragments. Measurements of 197Au+197Au, 96Ru+96Ru and 96Zr+96Zr collisions at 400 A MeV have been accomplished in May 2011 at the GSI facility. Current status of the analysis, first results and future plans will be presented.

HK 37.5 Mi 17:45 P 5

Rekonstruktion seltener, seltsamer Objekte in Schwerionenkollisionen mit HADES — •Timo Scheib, Laura Rehnisch, Manuel Lorenz, Jochen Markert und Joachim Stroth für die HADES-Kollaboration — Goethe-Universität, Frankfurt

Bei einer kinetischen Strahlenergie von 1,756 AGeV wurden im Stoßsystem Ar+KCl bisher eine Vielzahl seltsamer Teilchen erfolgreich mit dem HADES Detektor gemessen und rekonstruiert. In diesen Energiebereichen ist die Produktion von Seltsamkeit ein stark assoziierter Prozess, weshalb eine exakte Vermessung möglichst vieler Teilchen mit seltsamen Quarks sowie deren angeregte Zustände notwendig ist, um daraus Schlüsse auf die Produktion und Propagation von Seltsamkeit im Medium ziehen zu können.

Zu diesen seltsamen Objekten zählt die Sigma(1385)-Resonanz, ebenso wie das Hypertriton, welches im Kern neben einem Neutron und einem Proton auch ein Lambda-Hyperon enthält und damit den leichtesten bisher bekannten Hypernukleus bildet.

In diesem Vortrag präsentieren wir den Status laufender Untersuchungen zur Rekonstruktion dieser Zustände, wobei besonderer Fokus auf das Hypertriton gelegt wird.

Unterstützt von: BMBF (06 FY 9100 I), HIC for FAIR, EMMI und GSI

HK 37.6 Mi 18:00 P 5

Modifikation von Λ und K^0_s Transversalimpuls-Spektren in Pb–Pb Kollisionen bei ALICE am LHC — •Simone Schuchmann für die ALICE-Kollaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

Bei hohen Transversalimpulsen wurde vom ALICE Experiment für unidentifizierte, geladene Teilchen eine starke Unterdrückung in Pb-Pb gegenüber pp Kollisionen gemessen. Die entsprechende Größe zur Messung der Unterdrückung als Funktion des Transversalimpulses ist der nukleare Modifikationsfaktor. Zum Verständnis der Modifikation und den entsprechenden Unterdrückungsmechanismen kann die Analyse von Spektren identifizierter Teilchen beitragen. Insbesondere der Unterschied der Modifikation zwischen Baryonen und Mesonen sowie zwischen verschiedenen Flavours könnte Informationen zur unterschiedlichen Fragmentation von Quarks und Gluonen liefern.

In diesem Vortrag wird die Produktion von Λ und K^0_s in Pb–Pb und pp Kollisionen bei einer Schwerpunktsenergie von $\sqrt{s_{NN}} = 2.76$ TeV, gemessen mit dem ALICE Detektor, vorgestellt und der daraus resultierende nukleare Modifikationsfaktor für verschiedene Zentralitätsintervalle diskutiert. Die Identifikation von Λ und K^0_s erfolgt über ihren

schwachen Zerfallskanal in geladene Hadronen mit Hilfe der Trackingmöglichkeiten des inneren Detektorsystems.

HK 37.7 Mi 18:15 P 5

Proton-Lambda Correlations in Pb-Pb Collisions at $\sqrt{s_{NN}}$ = 2.76 TeV — •Hans Beck — Institut für Kernphysik, Goethe Universität Frankfurt am Main

Proton-lambda correlations at small momentum differences resulting from final-state strong interactions allow to extract source sizes in nuclear collisions [1]. This contribution presents an analysis of pΛ correlations in Pb-Pb collisions at $\sqrt{s_{NN}}$ = 2.76 TeV registered by ALICE at the CERN LHC. The influence of imperfect particle selection, contributions from decays, finite two track and momentum resolution effects will be discussed. Fully corrected correlation functions will be shown and source sizes will be extracted and be put in the context of other measurements (e.g. [2,3]). The large number of pΛ pairs produced at LHC energies allows for the first time the study of the pΛ correlations as a function of centrality. pΛ correlations extend the $\langle m_t \rangle$ reach of extracted source radii and are therefore a good test for hydrodynamics-motivated models - which expect a decrease of the source size as a function of $\langle m_t \rangle$ [4].

[1] F. Wang and S. Pratt, Phys. Rev. Lett. **83**, 3138 (1999).
[2] T. Anticic et al. (NA49), Phys. Rev. C **83**, 054096 (2011).
[3] K. Aamondt et al. (ALICE), Phys. Lett. B **696**, 328 (2011).
[4] U. Wiedemann and U. Heinz, Phys. Rep. **319**, 145 (1999).

HK 37.8 Mi 18:30 P 5

Untersuchung leichter (Anti-)Kerne und (Anti-)Hyperkerne mit dem ALICE Experiment am LHC — •Nicole Martin für die ALICE-Kollaboration — GSI Helmholtzzentrum für Schwerionenforschung GmbH , Planckstr. 1, 64291 Darmstadt

Die hohe Statistik und die hohe Energie von Pb-Pb Kollisionen ermöglicht es, eine signifikante Anzahl von leichten Kernen und Antikernen wie (Anti-)Deuteronen, (Anti-)Tritonen, (Anti-)^{3}He sowie (Anti-)^{4}He und (Anti-)Hypertritonen nachzuweisen. Die Untersuchung der Produktion dieser Kerne in Pb-Pb Kollisionen wird den Bereich der Hadronenmassen, die benutzt werden, um die Teilchenproduktion an der QCD Phasengrenze zu testen, substanziell erweitern. Die Messung dieser (Anti-)Kerne in Pb-Pb Kollisionen bei $\sqrt{s_{\mathrm{NN}}}$ = 2.76 TeV, die mit Hilfe des in der Zeitprojektionskammer gemessenen spezifischen Energieverlusts $\mathrm{d}E/\mathrm{d}x$ identifiziert werden, wird präsentiert. Das Innere Spurrekonstruktionssystem erlaubt eine präzise Bestimmung des Kollisionsvertex, wodurch primäre Teilchen von sekundären Teilchen aus Reaktionen im Detektormaterial separiert werden können. Dies hilft zum Beispiel, den Zerfallsvertex des (Anti-)Hypertritons zu bestimmen und damit den Untergrund deutlich zu reduzieren.

HK 37.9 Mi 18:45 P 5

Mean Transverse Momentum in pp and Pb-Pb Collisions with ALICE — •Marco Marquard — Institut für Kernphysik, Universität Frankfurt am Main, Germany

The ALICE experiment at the CERN-LHC has been designed to investigate the properties of the Quark-Gluon Plasma (QGP), a state of matter produced in central Pb-Pb collisions. The combined tracking of the two innermost detector systems (ITS and TPC) provides the possibility to measure the transverse momentum (p_T) distribution of unidentified charged particles over a wide p_T range, down to $p_T = 150 MeV/c$. A characteristic quantity to describe the p_T spectra is the mean transverse momentum ($\langle p_T \rangle$). It has been suggested that a phase transition to the QGP may lead to a modified $\langle p_T \rangle$ dependence on the particle multiplicity in pp and Pb-Pb.

In this talk we discuss the $\langle p_T \rangle$ evolution with multiplicity and centrality of the collisions. Furthermore $\langle p_T \rangle$ in Pb-Pb collisions is compared to $\langle p_T \rangle$ in pp at the same center-of-mass energy.

HK 38: Hadronenstruktur und -spektroskopie

Zeit: Donnerstag 16:30–19:00 Raum: RW 1

Gruppenbericht HK 38.1 Do 16:30 RW 1

Threshold photoproduction of η and η' mesons off light nuclei - search for mesic nuclei — •Irakli Keshelashvili for the A2-Collaboration — University of Basel

The interaction of mesons with nuclei is a major source for our understanding of the strong interaction. In the case of short lived neutral mesons the only access is indirect, making use of final-state interaction. The mesons are produced with some initial reaction in the nucleus and then there interaction with the same nucleus is studied. It much discussed wether it is possible to form, via the strong interaction, quasi-bound states of mesons and nuclei, which would be the ideal tool for such studies. In particular, the case of η and η' mesons is of large interest and controversially discussed in the literature. Experimentally, signatures signatures for such states have been sought in the threshold behavior of meson production reactions, using different probes. We will present new results from the Crystal Ball/TAPS experiment at the Mainz MAMI accelerator for coherent photoproduction of η mesons from ^3He and ^7Li nuclei showing strong threshold enhancement in particular for the ^3He case and discuss there relevance for the formation of an η-mesic state. Furthermore a fist attempt has been made to measure the threshold behavior of the photoproduction ot η' mesons from the deuteron and ^3He. Preliminary results will be discussed.

Gruppenbericht HK 38.2 Do 17:00 RW 1

Production of η mesons and pion pairs in dp scattering at COSY-ANKE — •Michael Papenbrock, Paul Goslawski, Alfons Khoukaz, Malte Mielke, Daniel Schröer, and Alexander Täschner for the ANKE-Collaboration — Westfälische Wilhelms-Universität, Münster, Germany

Detailed measurements on the reaction $dp \to {}^3\mathrm{He}\eta$ with unpolarized particles have been performed at the COSY-ANKE spectrometer. The rapid rise of the total cross section within the first 0.5 MeV above threshold implies a very strong final state interaction and might indicate the presence of a quasi-bound η-mesic state close to threshold. To further investigate this issue, measurements with a polarized deuteron beam have been performed in order to determine tensor analyzing powers in the near-threshold region. Furthermore, the reaction $dp \to {}^3\mathrm{He}\eta$ has been used to perform a high precision measurement on the η meson mass by a model independent method based on pure kinematics.

Parallel to measurement on the η meson, data on the production of charged pion pairs have been taken. In the studied energy region, the reaction $dp \to {}^3\mathrm{He}\pi^+\pi^-$ allows for further investigation on the ABC effect, a phenomenon which enhances the two pion invariant mass distribution at low values.

Recent results on these topics will be presented and discussed.

Supported by the COSY-FFE program.

HK 38.3 Do 17:30 RW 1

ω Photoproduction off Protons and Neutrons with CBELSA-TAPS* — •Frida Dietz for the CBELSA/TAPS-Collaboration — II. Physikalisches Institut, Heinrich-Buff-Ring 16, 35392 Giessen

ω photoproduction off LH_2 and LD_2 targets has been studied with the tagged photon beam of the ELSA accelerator in Bonn. The combined setup of the Crystal Barrel and TAPS detecting systems, which formed a 4π electromagnetic calorimeter, was used for detecting the ω meson via the $\omega \to \pi^0\ \gamma$ decay mode. The aim of this study is to determine the ω photoproduction cross section on the neutron, which has not been measured so far but is an important prerequisite for studying the in-medium properties of the ω meson. The quasi-free production channels of the ω off the proton and neutron were studied with both exclusive and inclusive analyses. Preliminary results on both the total and differential cross sections will be presented.

* supported by the DFG (SFB/TR-16)

HK 38.4 Do 17:45 RW 1

In-Medium Properties of the η' Meson* — •Mariana Nanova for the CBELSA/TAPS-Collaboration — II. Physikalisches Institut, Universität Giessen, Heinrich-Buff-Ring 16, 35392 Giessen

The attenuation of η'-meson in cold nuclear matter has been studied in photonuclear reactions off LH_2, LD_2, ^{12}C, ^{40}Ca, ^{93}Nb and ^{208}Pb nuclei. The experiment was performed at the ELSA accelerator in Bonn with the combined setup of the Crystal Barrel and TAPS detectors. The inelastic $\eta' N$ cross section and the in-medium width are deduced

and compared to theoretical predictions. Effects of photon shadowing and secondary production processes are discussed. Momentum distributions of η'-mesons are compared for the different targets. The feasibility of planned experiments searching for η'-mesic states is analyzed.
⋆Funded by DFG(SFB/TR-16)

HK 38.5 Do 18:00 RW 1

Medium modifications of mesons with charm — •Thomas Hilger[1], Burkhard Kämpfer[1], Sergey Dorkin[2], Leonid Kaptari[2], and Stefan Leupold[3] — [1]Helmholtz-Zentrum Dresden-Rossendorf, PF 510119, 01314 Dresden — [2]Joint Institute for Nuclear Research Joliot-Curie 6 141980, Dubna Moscow Region, Russia — [3]Univ. of Uppsala Box 256 S-75121 Uppsala, Sweden

The in-medium behavior of pseudo-scalar and vector mesons is investigated with QCD sum rules. The rho meson is considered within a scenario where the chirally odd condensates are zero. The interplay of mass shift and broadening of the spectral function is highlighted and compared to NA60 data. We apply finite density QCD sum rules to mesons consisting of a heavy and a light quark (D, Ds and B) and investigate their sensitivity to the chiral condensate and consider the splitting of particle and antiparticle spectral functions with increasing density of the ambient nuclear matter [1]. In order to gain a more direct dependence on the chiral condensate and other potential order parameters of chiral symmetry we present a series of Weinberg-Shuryak type sum rules for heavy-light systems at finite densities [2].

[1] T. Hilger, R. Thomas, B. Kämpfer, Phys.Rev. C79 (2009) 025202.
[2] T. Hilger, B. Kämpfer, S. Leupold, Phys.Rev. C84 (2011) 045202.

HK 38.6 Do 18:15 RW 1

In search of the box anomaly by studying $\eta \to \pi^+\pi^-\gamma$ — •Daniel Lersch[1] and Frank Goldenbaum[1,2] — [1]Institut für Kernphysik and 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 branching (done by CLEO and KLOE) or (ii) the distribution of the single photon energy.

Recently, the reaction $pd \to^3 He[\eta \to \pi^+\pi^-\gamma]$ has been measured with WASA-at-COSY.

The aim of this work is to measure the branching ratio and the single photon energy distribution in one experiment using the reaction: $pp \to pp[\eta \to \pi^+\pi^-\gamma]$, using the data acquired during spring 2010.

As a first step in the recent analysis the channel $\eta \to \pi^+\pi^-\pi^0$ has been investigated, because it is important for determining the relative branching ratio $\frac{\Gamma(\eta\to\pi^+\pi^-\gamma)}{\Gamma(\eta\to\pi^+\pi^-\pi^0)}$ and also because it contributes to the background of the decay $\eta \to \pi^+\pi^-\gamma$.
First results will show how the channel of interest is extracted from data and how the remaining background is determined.

HK 38.7 Do 18:30 RW 1

Measurement of the Rare Decay $\eta \to \pi^+\pi^-e^+e^-$ with WASA-at-COSY — •Daniel Coderre[1,2] and James Ritman[1,2] for the WASA-at-COSY-Collaboration — [1]Institut für Kernphysik and Jülich Center for Hadron Physics, Forschungszentrum Jülich — [2]Institut für Experimentalphysik I, Ruhr-Universität-Bochum

One focus of the WASA-at-COSY physics program is the testing of fundamental symmetries by measuring decays of light mesons. The decay $\eta \to \pi^+\pi^-e^+e^-$ has been measured with two main goals. First, to use a high-statistics sample of events to determine the branching ratio and second, to probe possible violation of CP-symmetry. It has been suggested that interference terms involving the CP-violating E1 transition could contribute to the decay rate. This would induce an asymmetry in the angle between the electron and π decay planes that could be an observable for CP-violation outside of the standard model. The theoretical upper limit for this asymmetry is 1%.

At WASA η mesons are produced in the $pd \to^3 He\eta$ and $pp \to pp\eta$ reactions. Preliminary results for the branching ratio and the CP-violating asymmetry term have been obtained from the proton-deuteron data, which features relatively low backgrounds but limited rates of η production. In the proton-proton data, which features significantly higher rates of η production but also higher backgrounds, the signal decay has been identified with improved statistics and extraction of the physics observables is in progress. This presentation will describe the analysis process with a focus on current and future results.

HK 38.8 Do 18:45 RW 1

Analysis of the ω and $\phi \to 3\pi$ Dalitz plot — •Franz Niecknig, Sebastian P. Schneider, and Bastian Kubis — Helmholtz-Institut für Strahlen- und Kernphysik (Theorie), Nussallee 14-16, D-53115 Bonn

The theoretical description of vector meson interactions in hadron physics remains a challenge. With the ongoing experimental interest in $\omega \to 3\pi$ and $\phi \to 3\pi$ decays the need for equally precise theoretical predictions remains. The prevailing treatments all lack a thorough inclusion of final state interactions.

In this talk we will introduce a dispersive approach to these decays and study how crossed-channel rescattering effects shape the Dalitz plot.

HK 39: Hadronenstruktur und -spektroskopie

Zeit: Donnerstag 16:30–19:00 Raum: RW 2

Gruppenbericht HK 39.1 Do 16:30 RW 2

Kaon pair production in pp, pd, dd and pA collisions at COSY — •Michael Hartmann[1], Andrey Polyanskiy[1], and Qiujian Ye[1,2] for the ANKE-Collaboration — [1]Institut für Kernphysik, Forschungszentrum Jülich, 52425 Jülich, Germany — [2]Physics Department, Duke University, Durham, NC 27708, USA

The near-threshold production of ϕ-mesons decaying into K^+K^-, as well as non-resonant $(K\bar{K})$ pairs, has been investigated in proton-proton, proton-deuteron and deuteron-deuteron collisions at the Cooler Synchrotron COSY. These data are sensitive to some of the interactions in the $\bar{K}p$, $K\bar{K}$, and ϕp channels. Studies of ϕ production in proton-nucleus collisions have also been recently undertaken. A review of the results obtained over the last few years will be given, together with a forward look on the ongoing investigations.

Supported by DFG and the COSY-FFE program.

HK 39.2 Do 17:00 RW 2

Strangeness production in antiproton-nucleus reactions — •Alexei Larionov[1,2], Theodoros Gaitanos[1], and Ulrich Mosel[1] — [1]Institut für Theoretische Physik, Universität Giessen, Germany — [2]Russian Research Center Kurchatov Institute, Moscow, Russia

The future $\overline{\mathrm{P}}$ANDA experiment at FAIR has a strong potential to study particle production in $\bar{p}$-nucleus collisions. We perform the Giessen Boltzmann-Uehling-Uhlenbeck model simulations of $\bar{p}$ -nucleus interactions at the beam momenta from zero to about 10 GeV/c [1,2]. The different mechanisms of the hyperon and hypernuclei production are studied, including the $\Lambda\Lambda$ hypernuclei production by Ξ^- interactions with a secondary target. We find a systematic overprediction of experimental data on K^0_S production in our calculations, in-particular, for light targets. The $\Lambda + \Sigma^0$ hyperon yields are described rather well. Their rapidity spectra at several GeV/c beam momentum are shown to be quite sensitive to the hyperon-nucleon cross sections. Finally, we discuss the Ξ (S=-2) hyperon production and argue that the Ξ^- rapidity spectra can serve as a very sensitive test for a hypothetic QGP-fireball scenario of $\bar{p}$ annihilation on a nucleus.
Work supported by BMBF.
[1] A.B. Larionov, T. Gaitanos, U. Mosel, arXiv:1107.2326
[2] T. Gaitanos, A.B. Larionov, H. Lenske, U. Mosel, arXiv:1111.5748

HK 39.3 Do 17:15 RW 2

Reconstruction of the $pp \to nK^+\Sigma^+$ reaction at COSY-TOF — •Pawel Klaja for the COSY-TOF-Collaboration — Erlangen-Nuremberg University

The COSY-TOF detector setup was upgraded with a new tracking system. A high statistics measurement with this setup in August 2010 was dedicated to hyperon production with a polarized proton beam of 2.95 GeV/c momentum. The main goal of this measurement was to measure the spin triplet $p\Lambda$ scattering length, the spin transfer coefficient of the $pp \to pK^+\Lambda$ reaction and the investigation of N^* resonances.
In addition the $pp \to nK^+\Sigma^+$ reaction is examined at an excess energy of Q = 128.7 MeV.
The current status of the data analysis in view of $pp \to nK^+\Sigma^+$ reaction identification will be presented. The procedure of data selection as well as the reconstruction method will be discussed.
Supported by FZ-Jülich.

HK 39.4 Do 17:30 RW 2

Endzustandswechselwirkung und Polarisationsobservablen im Prozess $\vec{p}p \to pK\Lambda$ — •Matthias Röder, Peter Wintz, and James Ritman for the COSY-TOF-Collaboration — Forschungszentrum Jülich

Ein Straw Tube Tracker(STT) wurde im COSY-TOF Detektor installiert. Damit wird für die vollständige Rekonstruktion der Reaktion $\vec{p}p \to pK\Lambda \to pKp\pi$ eine Nachweiswahrscheinlichkeit von 20% erreicht und somit gegenüber dem alten Experimentaufbau vervierfacht. Die Auflösung der rekonstruierten $p\Lambda$ invarianten Masse beträgt nun $\sigma = 1,1\,\mathrm{MeV}/c^2$.

Diese Präzision ermöglicht, zum ersten Mal an COSY-TOF, die Bestimmung der effektiven $p\Lambda$-Streulänge anhand von Endzustandswechselwirkungen. In Kombination mit dem polarisierten Protonenstrahl kann die Spin-Triplett Streulänge mit Hilfe der Kaon Analysierstärke extrahiert werden. In diesem Vortrag werden die Ergebnisse der ersten Strahlzeit mit dem STT vorgestellt. Der Strahlimpuls betrug 2,95 GeV/c und die Strahlpolarisation 60%.

Desweiteren ermöglicht die volle azimutale Akzeptanz und Symmetrie des COSY-TOF Detektors in Verbindung mit dem polarisierten Protonenstrahl und dem selbstanalysierenden Λ-Zerfall die Bestimmung einer Vielzahl von Polarisationsobservablen. Dieser Vortrag konzentriert sich auf die Λ-Depolarisation. Diese trägt zum Verständnis des Produktionsprozesses bei und konnte bisher außer von COSY-TOF nur vom DISTO Experiment nahe an der Schwelle gemessen werden.

HK 39.5 Do 17:45 RW 2

Study of the pn→K^+nΛ reaction near threshold — •Yury Valdau for the ANKE-Collaboration — Forschungszentrum Jülich, Leo-Brandt-Strasse, 52428 Jülich, Germany — Helmholtz-Institut für Strahlen- und Kernphysik, Nussallee 14-16, 53115 Bonn, Germany

A significant data base on kaon production in pp collisions has been accumulated over the last few years. In contrast, there is very little information about close-to-threshold K^+ production in pn interactions.

At ANKE-COSY the energy dependence of $K^+\Lambda$ production in quasi-free pn interactions in a deuterium target has been studied during a dedicated beam-time in March 2011. In this measurement, two Silicon Tracking Telescopes (STTs) were used to identify spectator protons and determine the excess energy. The proton beam momentum (2.6 GeV/c) was optimized to favour in the STT only protons associated with the $pn \to K^+n\Lambda$ reaction. The identification in coincidence of a single K^+ in the ANKE positive detector system is sufficient for the total cross section determination. The kaon identification at ANKE was done using the so-called delayed-veto technique, which allows measurements of inclusive K^+ production even if the background from π^+ and protons is 10^5 higher. In addition to data on the $pn \to K^+n\Lambda$ reaction, calibration data on a hydrogen target will allow one to judge the feasibility of studying the $n\Lambda$ final-state interaction using the ANKE magnetic spectrometer.

The status of the analysis and experimental results will be presented.

Supported by the COSY–FFE program.

HK 39.6 Do 18:00 RW 2

Recent Results from the Measurement of Polarization Observables in the $\vec{p}p \to pK^+\Lambda$ Reaction at COSY-TOF — •Florian Hauenstein for the COSY-TOF-Collaboration — Universität Erlangen-Nürnberg

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. Also 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 especially be used to determine contributions of N^* resonances.

Data from 2010 at 2.95 GeV/c beam momentum has already been analyzed. In fall 2011 a dedicated measurement with a polarized proton beam of 2.70 GeV/c momentum was performed to investigate the $p\Lambda$ final state interaction in detail.

In this talk the status of the analysis for this recent data will be presented.

Supported by FZ-Jülich.

HK 39.7 Do 18:15 RW 2

Hyperon production in the reactions $pn(p) \to K^0\Lambda p(p)$ and $pp \to K^+\Lambda p$ — •Martin Krapp, Wolfgang Eyrich, and Florian Hauenstein for the COSY-TOF-Collaboration — Universität Erlangen-Nürnberg

The near threshold production of hyperons by using a liquid hydrogen target is one of the main topics studied at the time-of-flight spectrometer COSY-TOF. Up to now the reactions $pp \to K^+\Lambda p$, $K^0\Sigma^+p$ and $K^+\Sigma^0p$ have been investigated in detail and led to an essential information gain about the reaction mechanism. In order to achieve more complete information about hyperon production near threshold in nucleon-nucleon reactions, the investigation has been extended to pn reactions by using a liquid deuterium target. The current status of the analysis of the reaction channel $pn(p) \to K^0\Lambda p(p)$ will be presented. This includes reconstruction techniques, preliminary results from real data as well as Monte Carlo simulation including Fermi motion. The achieved cross section is compared to theoretical predictions and related reaction channels.

Supported by BMBF and FZ Jülich.

HK 39.8 Do 18:30 RW 2

Results for the $K^0\Sigma^+$ photoproduction off the proton in the energy range from threshold to 2250 MeV — •O. Jahn for the CBELSA/TAPS-Collaboration — Physikalisches Institut, Nussallee 12, Bonn

The reaction $\gamma + p \to K^0 + \Sigma^+$ is studied in the photon energy range from threshold to 2250 MeV at the electron accelerator facility ELSA, Bonn. The differential cross section shows increasing forward-peaking with rising photon energy up to K^* threshold exhibiting a sudden flattening and drop by a factor of four above this threshold. This results in a pronounced structure in the total cross section which may hint to a change from t-channel exchange below K^* threshold to an s-channel mechanism above this threshold. In addition, results for the photon beam asymmetry Σ and the recoil polarization P are presented and discussed. Gefördert durch die / supported by the DFG (SFB/TR-16)

HK 39.9 Do 18:45 RW 2

Study of Σ^+ hyperon production with the upgraded COSY-TOF detector — •Roman Dzhygadlo, Albrecht Gillitzer, Eduard Roderburg, and James Ritman for the COSY-TOF-Collaboration — Forschungszentrum Jülich, Germany

Within the COSY-TOF hyperon production studies the reaction $\vec{p}p \to pK_s\Sigma^+$ was measured. The reaction products of the interaction of a 2.95 GeV/c polarized proton beam with a liquid hydrogen target were detected by the COSY-TOF detector. The azimuthal symmetry and large acceptance of the detector as well as an excellent tracking capability introduced by silicon quirl and straw tube trackers allows measuring the complete $pK_s\Sigma^+$ final state distribution. A new event reconstruction algorithm was developed to gain maximum reconstruction efficiency. All steps were controlled by Monte Carlo simulations.

The results including the tree-body final state distribution and polarization observables (P, A_N, D_{NN}) will be presented.

HK 40: Astroteilchenphysik

Zeit: Donnerstag 16:30–18:45 Raum: RW 3

Gruppenbericht HK 40.1 Do 16:30 RW 3

A nuclear physics view at the ^{71}Ga$(\nu, e^-)^{71}$Ge reaction. — •Annika Lennarz[1], Dieter Frekers[1], Peter Puppe[1], Jan Thies[1], and Michael Holl[2] — [1]Inst. f. Kernphysik, 48149 Münster — [2]Inst. f. Theor. Physik, 48149 Münster

In this contribution we will present results from two separate experiments dealing with the neutrino response on ^{71}Ga. Both experiments provide input into the calibration of the SAGE and GALLEX solar neutrino detectors and address a long-standing discrepancy between the measured and evaluated capture rates from the ^{51}Cr and ^{37}Ar neutrino calibration sources. First, we report on a ^{71}Ga(^{3}He,t)^{71}Ge charge-exchange experiment performed at RCNP, Osaka, with the objective to extract with high precision the Gamow-Teller transition strengths to the three lowest-lying states in ^{71}Ge, i.e., the ground state ($1/2^-$), the 175 keV ($5/2^-$) and the 500 keV ($3/2^-$) excited states. These are the states, which are populated via a charged-current reaction induced by neutrinos from terrestrial ^{51}Cr and ^{37}Ar sources. In the second part we present a new precision Q-value measurement for the ^{71}Ga$(\nu, e^-)^{71}$Ge reaction using the TITAN mass measurement facility at TRIUMF. From the results of the two experiments we may now conclude that there are no further unknowns in the nuclear structure, which could remove the persistent discrepancy in the SAGE and GALLEX calibration measurement performed with neutrinos from ^{51}Cr and ^{37}Ar sources.

Gruppenbericht HK 40.2 Do 17:00 RW 3

The GERDA experiment on the 0nbb decay — •Fabiana Cossavella for the GERDA-Collaboration — Max-Plank-Institut für Physik, München

The Germanium Detector Array (GERDA) experiment searches for neutrinoless double beta decay of ^{76}Ge, a test of whether neutrinos are identical with their anti-particles, i.e. of Majorana type, or distinct from them, i.e. of Dirac type. Neutrinoless double beta decay could not only establish the charge-conjugation character of neutrinos, but also place a limit on the effective neutrino mass and probe the neutrino mass hierarchy.

Germanium crystals enriched in ^{76}Ge, acting as source and detector, will be submerged in an ultra-pure cryogenic liquid that serves as cooling medium and shields against radiation. This allows for a background reduction of up to two orders of magnitude better than earlier experiments.

GERDA started the technical runs in 2010, with a pilot string of 3 non-enriched Ge detector. In 2011 measurements with enriched germanium detectors have been started: the results from the first years of data taking will be presented.

HK 40.3 Do 17:30 RW 3

Data processing and analysis of the GERDA experiment — •Matteo Agostini for the GERDA-Collaboration — Lehrstuhl für experimentelle Physik und Astroteilchenphysik E15, Physikdepartment der Technischen Universität München

The Gerda experiment searches for the neutrinoless double beta decay of ^{76}Ge using an array of high-purity germanium detectors isotopically enriched in ^{76}Ge. Gerda started the first physical data taking in November 2011, operating eight enriched coaxial detectors (approximately 15 kg of ^{76}Ge). The talk will present the Gerda reference off-line analysis of the Ge detector signals. The Ge detector pulses are processed through sequences of algorithms and digital shaping filters to extract information concerning the signal shape, e.g. maximum amplitude, rise time, baseline slope. These parameters are subsequently used for monitoring the data quality and reconstructing the event features (including the event energy). Eventually the data surviving the quality cuts are used for the physical analysis.

This work was supported by BMBF (05A11W01) and by the Munich Cluster of Excellence "Origin and Structure of the Universe".

HK 40.4 Do 17:45 RW 3

Investigations of the ^{42}Ar background in the LArGe test facility for the GERDA experiment — •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 to search for the neutrinoless double beta decay of ^{76}Ge. The main concept of Gerda is the operation of naked HPGe detectors made from enriched ^{76}Ge, which are immersed in liquid argon (LAr). During the first commissioning runs it was found that cosmogenically produced ^{42}Ar can contribute considerably to the background near the region of interest and the count rate due to decay of its daughter isotope ^{42}K is much higher than expected. It can happen when charged ^{42}K ions are collected by the applied electric field on the detector surfaces. Detailed investigations of the distribution and the behaviour of ^{42}K ions in the LAr under different configurations of the electric field were performed in the low-background test facility LArGe. For this purpose the encapsulated germanium detector GTF-44 was operated in 1 m^3 of LAr in the LArGe setup. By applying different voltage on the encapsulation it is possible to attract or repel charged ions. Moreover, particle decays which deposit part of their energy in LAr can be detected by the scintillation signal using 9 PMTs. In order to increase the statistics and clearly see the effects the LAr was spiked with about 5 Bq of specially produced ^{42}Ar. This allowed to investigate the collection process of ^{42}K and to optimize methods for the suppression of the background from ^{42}Ar.

HK 40.5 Do 18:00 RW 3

Measuring optical properties of LAr in GERDA — •Björn Scholz — TU Dresden, Germany

The GERDA experiment is attempting to measure neutrinoless double beta decay by using Germanium semiconductor detectors which are deployed naked in a volume of liquid Argon (LAr), which acts both as cryogenic cooling and background shield. The experiment recently started its first phase with eight enriched ^{76}Ge detectors and is aiming to test the claims from parts of the Heidelberg Moscow Collaboration. The experiment is now exploring the possibility for instrumenting the LAr as an active veto using the scintillation light produced from energy deposition of background events. In order to optimize the veto design, an accurate knowledge of the LAr optical properties has to be achieved for the specific composition used in GERDA, as these are strongly affected by impurities.

This talk will cover the steps taken in the design of a method to perform the measurement of the LAr properties in GERDA, with particular emphasis on the in-situ measurement of the LAr attenuation length and light yield.

This talk is funded by the BMBF.

HK 40.6 Do 18:15 RW 3

MC Benchmarks for GERDA LAr Veto Designs — •Bjoern Lehnert — TU-Dresden

The GERmanium Detector Array (GERDA) experiment is designed to search for neutrinoless beta decay in ^{76}Ge and is able to directly test the present claim by parts of the Heidelberg-Moscow Collaboration. The experiment started recently its first physics phase with eight enriched detectors, after a 17 month long commissioning period. GERDA operates an array of HPGe detectors in liquid argon (LAr), which acts both as a shield for external backgrounds and as a cryogenic cooling. Furthermore, LAr has the potential to be instrumented and therefore be used as an active veto for background events through the detection of the produced scintillation light. In this talk, Monte Carlo studies for benchmarking and optimizing different LAr veto designs will be presented. LAr scintillates at 128 nm which, combined with the cryogenic temperature in which the detector is operated and its optical properties, poses many challenges in the design of an efficient veto that would help the experiment to reduce the total background level by one order of magnitude, as it is the goal for the second physics phase of the experiment. This work was supported by BMBF.

HK 40.7 Do 18:30 RW 3

Ergebnisse des KASCADE-Grande Experimentes — •Donghwa Kang for the KASCADE-Grande-Collaboration — Karlsruher Institut für Technologie (KIT)

Das KASCADE-Grande Experiment besteht aus einem Array von 37 Detektorstationen auf einer Nachweisfläche von etwa 0.5 km^2. Es untersucht ausgedehnte Luftschauer von Primärteilchen mit Energien von 10^{16} bis 10^{18} eV, wobei sowohl die geladene Komponente der Luftschauer als auch die Gesamtmyonzahl unabhängig davon nachgewiesen

werden. Im Energiespektrum der kosmischen Strahlung bei ungefähr 10^{17} eV werden sowohl ein Eisenknie als auch der Übergang von galaktischer zu extragalaktischer kosmischer Strahlung erwartet.

Basierend auf der gemessenen Anzahl der Elektronen und Myonen können die Energiespektren für leichte und schwere Primärteilchen bestimmt werden. Dabei konnte ein Knick im Spektrum schwerer Primärteilchen eindeutig nachgewiesen werden. In diesem Vortrag werden das Gesamtenergiespektrum und verschiedene Analysemethoden der Massentrennung vorgestellt.

HK 41: Instrumentation

Zeit: Donnerstag 16:30–19:00 Raum: P 2

Gruppenbericht HK 41.1 Do 16:30 P 2

The Micro-Vertex-Detector of the PANDA Experiment — •Tobias Stockmanns for the PANDA-Collaboration — Forschungszentrum Jülich GmbH, Institut für Kernphysik 1, 52425 Jülich

The Micro-Vertex-Detector (MVD) is the key component of the PANDA experiment to identify open charm and strangeness by detecting secondary decays of particles displaced from the primary interaction point. These decay lengths vary from a few 100 micro meter for charmed mesons and baryons up to several cm for strange hadrons. In addition, the MVD significantly improves the momentum resolution of the large volume central tracker.

The MVD is made of silicon strip and pixel detectors with more than 10 million readout channels. With the necessity of a continuous untriggered readout and the highest requirements for spatial resolution and material budget the MVD is one of the most demanding detectors within PANDA.

End of last year the TDR of the MVD was successfully completed. The outcome of the intense R&D project and the results of a detailed detector simulation program will be presented in this talk.

Gruppenbericht HK 41.2 Do 17:00 P 2

Status des Mikro-Vertex-Detektors des CBM-Experiments* — •Michael Deveaux für die CBM-MVD-Kollaboration — Goethe-Universität, Frankfurt

Das CBM-Experiment wird das Phasendiagramm hadronischer Materie im Bereich höchster Netto-Baryonendichten untersuchen. Diese dichte Kernmaterie soll an der FAIR-Beschleunigeranlage mit Schwerionenkollisionen im Energiebereich von 10-40 AGeV erzeugt und ihre Eigenschaften mit zahlreichen Sonden untersucht werden. Erstmals in diesem Energiebereich sollen hierzu auch Open-Charm-Teilchen zum Einsatz kommen. Um diese Teilchen anhand ihrer Zerfallstopologie zu rekonstruieren, wird ein Mikro-Vertex-Detektor (MVD) mit ungewöhnlich guter Ortsauflösung (wenige μm) sowie einem sehr geringen Materialbudget ($\lesssim 0,3\ X_0$) und hoher Strahlentoleranz ($> 10^{13}\ n_{eq}/cm^2$) benötigt. Dieser wird derzeit am Institut für Kernphysik Frankfurt auf Basis der am IPHC Straßburg konstruierten CMOS Monolithic Active Pixel Sensoren entwickelt.

Im Beitrag wird das Konzept des MVD diskutiert und der Status der F&E-Arbeiten an Sensoren und Detektor-Prototyp zusammengefasst.
*gefördert durch das BMBF (06FY9099I), HIC for FAIR und GSI.

HK 41.3 Do 17:30 P 2

In-beam tests of prototype silicon strip tracking detectors for the CBM experiment — •Iurii Sorokin for the CBM-Collaboration — Goethe University Frankfurt — Kiev Institute for Nuclear Research

The CBM experiment will explore the phase diagram of nuclear matter at high net baryon densities and moderate temperatures. This will be done in collisions of heavy-ion beams of energies up to $35A$ GeV with fixed nuclear targets. The CBM experiment will comprise several detector systems for charged particle tracking, micro-vertex determination, particle identification and calorimetry. The CBM Silicon Tracking System is required to cope with up to 1000 charged particles per central collision, to measure their momenta with 1% resolution and to stand $10^{14}\mathrm{cm}^{-2}$ neutron equivalent dose. A demonstrator setup consisting of three tracking stations has been successfully tested on a 2.4 GeV/c proton beam. Each station is based on a double-sided silicon microstrip detector with 256 strips per side and 50 μm pitch. Self-triggering front-end electronics based on the n-XYTER chip is used for their readout. Straight-line tracks were reconstructed and the position resolution as well as detection efficiency determined. Systematic amplitude response studies of neutron-irradiated detectors were performed, including charge collection at various beam incidence angles and bias voltages. Supported by EU-FP7 HadronPhysics3, HICforFAIR and HGS-HIRe for FAIR.

HK 41.4 Do 17:45 P 2

Übersicht über das finale Auslesesystem des Micro-Vertex-Detektors für SIS100 — •Christoph Schrader, Borislav Milanovic, Bertram Neumann, Michael Wiebusch, Samir Amar-Youcef, Tobias Tischler, Christian Müntz, Michael Koziel und Joachim Stroth für die CBM-MVD-Kollaboration — Goethe Universität, Frankfurt

Monolithic Active Pixel Sensoren (MAPS) bieten einen hervorragenden Kompromiss zwischen Ortsauflösung, einem geringen Materialbudget, einer hohen Auslesegeschwindigkeit sowie Strahlenhärte. Diese Sensoren eignen sich somit besonders gut für die Rekonstruktion des Zerfallvertices von open-charm beinhaltenden Teilchen, mit einer Vertexauflösung von besser als 70 μm entlang der Strahlachse.

In diesem Zusammenhang wird an der Goethe-Universität Frankfurt auf Basis der hoch parallelisierten, digitalen MAPS ein skalierbares Auslesesystem für den Micro-Vertex-Detektor (MVD) des zukünftigen CBM Experimentes entwickelt.

Der Beitrag diskutiert das Auslesesystem von der Prototypenphase bis hin zur Realisierung der ersten beiden Stationen des MVDs. Es werden Lösungen für die finale MVD-Auslese bezüglich der Echtzeitdatenverarbeitung, der Datenprotokolle, der Netzwerkstruktur und geeigneter Hardware aufzeigt. Dabei werden Aspekte aus der bereits realisierten Prototypenphase besonders verdeutlicht.
*supported by HIC for FAIR, the GSI Helmholtzzentrum für Schwerionenforschung, BMBF grant 06FY9099I

HK 41.5 Do 18:00 P 2

The MVD-Prototype readout network — •Borislav Milanovic, Christoph Schrader, Bertram Neumann, Michael Wiebusch, Ingo Fröhlich, Samir Armar-Youcef, and Joachim Stroth for the CBM-MVD-Collaboration — Goethe Universität, Frankfurt

The Micro-Vertex-Detector (MVD) detector will be used in the CBM-Experiment for secondary vertex reconstruction of open charm measurements at large baryonic densities. Recent occupancy studies are indicating data rates of several GByte/s. Moreover, the detector will run as a trigerless system which requires to capture all data at all times. Such huge, continuous data streams demand a cutting edge, fast speed readout system with fully synchronized detector operation. The synchronization of all MVD sensors has been accomplished within few nanoseconds.

The implementation uses a modified version of the HADES-Experiment readout network (TrbNet). The MVD network implements TrbNet as a secure network protocoll for data acquisition, monitoring and slow-control of MVD-Prototype studies. The main difference to HADES is the triggerless data acquisition. Data is pre-processed on-the-fly and allows no large buffers. The network is highly scalable and suitable for the entire MVD station and will also be maintained in the final MVD stage for slow-control and monitoring.
*supported by HIC for FAIR, the GSI Helmholtzzentrum für Schwerionenforschung, BMBF grant 06FY9099I

HK 41.6 Do 18:15 P 2

Vertex reconstruction and measurements with the PANDA Micro-Vertex-Detector * — •Simone Bianco, Max Becker, Kai-Thomas Brinkmann, Ralf Kliemt, Karsten Koop, Andreas Pitka, Robert Schnell, Thomas Würschig, and Hans-Georg Zaunick — Helmholtz-Institut für Strahlen- und Kernphysik, Rheinische Friedrich-Wilhelms-Universität Bonn, Nussallee 14-16, D-53115, Bonn, Germany

The Micro-Vertex-Detector (MVD) of the PANDA experiment is designed to achieve vertex resolutions in the order of 100 μm. This will

allow to carry out systematic studies about short-lived particles such as D mesons. Therefore, a detailed characterization of the vertex reconstruction performance is needed. Different kinematic scenarios have been studied within the PANDA simulation framework, in order to describe the response of the detector. Maps of the vertex and momentum resolutions achieved in different regions of the MVD volume were determined and will be shown in the presentation. Furthermore, examples of fully reconstructed events will be presented, highlighting the importance of the MVD in terms of vertex selection, momentum resolution and background suppression. A comparison of simulations and measurements performed with a silicon-strip telescope with different particle beams will be discussed, proving the simulation framework to be a reliable tool to characterize the detector response and performance.

* Supported by BMBF and BCGS.

HK 41.7 Do 18:30 P 2

Rückstoß-Protonen-Polarisationsmessung am BGO-OD-Experiment mit Silizium-Streifen-Sensoren* — •Max Becker, Karsten Koop und Gordon Diefenthal — Rheinische Friedrich-Wilhelms-Universität Bonn, Helmholtz-Institut für Strahlen- und Kernphysik, Nussallee 14-16, 53115 Bonn

Das BGO-OD-Experiment beschäftigt sich mit der Photoproduktion von Mesonen an der Teilchenbeschleunigeranlage ELSA in Bonn. Um eine Messung der Rückstoßpolarisation von bei der Reaktion entstehenden Protonen zu ermöglichen, wird das Experiment einen Spurdetektor nahe am Target erhalten.

Das Layout dieses Spurdetektors sieht mehrere Lagen aus Silizium-Streifen-Sensoren vor. Diese sollen unmittelbar hinter dem Flüssig-Wasserstofftarget in den Aufbau integriert werden. Ein sekundäres Kohlenstofftarget zwischen zwei Lagen sorgt für die Streuung der Rückstoß-Protonen. Durch die Vermessung der Protonspuren vor dem Sekundärtarget und der Vermessung der azimutalen Asymmetrie hinter dem spinabhängigen Streuprozess lässt sich die Rückstoßpolarisation der Protonen ermitteln.

In dem Vortrag soll zunächst die physikalische Motivation des Projektes näher erläutert werden. Dann werden der erste Prototyp für den Spurdetektor sowie erste Testmessungen mit radioaktiven Quellen und am Elektronenbeschleuniger ELSA vorgestellt.

*gefördert durch die DFG (SFB/TR-16)

HK 41.8 Do 18:45 P 2

A new silicon drift detector array for low energy proton detection — •Martin Simson[1], Marcus Beck[2], Heinz Lenk[2], Romain Maisonobe[1], Adrian Niculae[3], Felix Rosenau[1], Torsten Soldner[1], Heike Soltau[3], Alexander Wunderle[2], and Oliver Zimmer[1] — [1]Institut Laue-Langevin, Grenoble, France — [2]Institut für Physik, Universität Mainz — [3]PN Sensor GmBH, München

The detection of low energy protons is a common problem in fundamental neutron physics. Neutrons decay into an electron, an antineutrino, and a proton. The latter has a rather low energy between 0 and ∼750 eV. On the one hand, this low energy allows to use electric and magnetic fields to guide and analyse the protons with high precision. On the other hand, protons with such low energies cannot be directly detected. In experiments this is typically circumvented by putting the detectors to high voltage to post-accelerate the protons. However, this may lead to problems like penning discharges and even destruction of detectors and read-out electronics by high voltage breakdowns.

Silicon drift detectors (SDDs) are a good choice for the detection of low energy protons. They have superior noise characteristics compared to a conventional semiconductor PIN diode detector and thus allow to reduce the acceleration voltage to about 10 to 15 kV. For both aSPECT (retardation spectrometer for proton spectrum measurement) and HOPE (magnetic trap for neutron lifetime measurement) an array of 3×3 SDDs with an active surface of 900 mm^2 has been developed. In the talk the detector array, as well as possible read-out electronics will be presented.

HK 42: Instrumentation

Zeit: Donnerstag 16:30–19:00 Raum: P 3

Gruppenbericht HK 42.1 Do 16:30 P 3

First results of the new UCN source D at the TRIGA Mainz reactor — •Thorsten Zechlau, Werner Heil, Thorsten Lauer, Christian Plonka-Spehr, Yury Sobolev, and Norbert Trautmann — Universität Mainz, Institut für Physik

Research in fundamental physics with the free neutron is one of the key tools for testing the Standard Model at low energies. Significant improvements of the experimental performance using ultracold neutrons (UCN) require reduction of both systematic and statistical errors. The development of new UCN sources based on the superthermal concept is therefore an important step. Besides the construction of new huge UCN sources at several big research centers around the world, there exists also the idea of competitive UCN sources using pulsed reactors of the TRIGA type. To demonstrate the feasibility of a UCN source at these reactors, a superthermal UCN source based on solid deuterium was built at the tangential beamport C of the reactor TRIGA Mainz. Based on the experience obtained during three years of successfull operation, a second upgraded source was built for the radial beamport D which should increase the UCN output by at least one order of magnitude. This talk will give an overview on the first UCN storage results at "UCN D" ,obtained during source commissioning in 2011.

HK 42.2 Do 17:00 P 3

Das CASCADE-Projekt: Neutronendetektion mittels Bor-10 als Alternative zu Helium-3 — •Markus Köhli, Martin Klein und Ulrich Schmidt — Physikalisches Institut, Universität Heidelberg, 69120 Heidelberg

Bisher werden zum effizienten Nachweis von thermischen Neutronen Detektoren auf Basis von Helium-3 eingesetzt, welches sowohl als Neutronenkonverter wie auch als Zählgas dient. Die weltweit gestiegene Nachfrage verlangt, einhergehend mit der limitierten Verfügbarkeit, nach der Entwicklung alternativer Technologien.
Die Heidelberger Forschung zielt auf die Entwicklung neuartiger Systeme, welche zur Detektion von thermischen Neutronen eingesetzt werden können. Der hier vorgestellte hochratentaugliche und zweidimensional ortsaufgelöste Detektor CASCADE nutzt bis zu zehn mit festem Bor-10 beschichtete Gas Electron Multiplier (GEM) Folien, mittels deren Neutronenkonversion und nachfolgend Gasverstärkung der entstehenden Primärionisation erfolgt. Für die Anwendung in Spinechomessungen (MIEZE) mit langsamen Neutronen ist es darüber hinaus gelungen, durch Auslesen des Ladungssignals an einzelnen GEM-Folien die Konversionsschicht eindeutig zu identifizieren und somit präzise die Neutronflugzeiten zu bestimmen.

HK 42.3 Do 17:15 P 3

Bestimmung der Neutronennachweiseffektivität von Plastik-Szintillationsdetektoren — Roland Beyer[1], Evert Birgersson[1], •Roland Hannaske[1], Arnd R. Junghans[1], Toni Kögler[1] und Ralf Nolte[2] — [1]Helmholtz-Zentrum Dresden-Rossendorf — [2]Physikalisch-Technische Bundesanstalt Braunschweig

Der *Rossendorf Low-Amplitude-Neutron Detector (RoLAND)* besteht aus $1000 \times 42 \times 11\,mm^3$ großen Streifen des Materials EJ-200, dessen Szintillationslicht mit hoch-verstärkenden Photomultipliern an zwei Seiten detektiert wird. Durch koinzidenten Nachweis von Signalen geringer Amplitude liegt die Nachweisschwelle für Neutronen bei weniger als 10 keV. Zur Bestimmung absoluter Wirkungsquerschnitte von (γ, n)- und $(n, n'\gamma)$-Reaktionen, wie sie in den Bereichen nukleare Astrophysik oder Transmutation benötigt werden, wurden am supraleitenden Elektronen-Linearbeschleuniger ELBE Experimente durchgeführt, bei denen sich die Detektoren im Gegensatz zu einer früheren Bestimmung der Effektivität [1] in einem wesentlich kleineren Abstand und in einer Abschirmung aus Blei befanden. Ein Vergleich der Neutronennachweiseffektivität mit Simulationen und neueren Messungen relativ zu einer ^{235}U-Spaltkammer zeigten deutliche Abweichungen insbesondere nahe der Schwelle. Daher wurde an der PTB Braunschweig eine weitere Kalibrierung im Energiebereich 20 − 5000 keV durchgeführt, deren Ergebnisse vorgestellt werden.
[1] R. Beyer et al., Nucl. Instr. Meth. A 575 (2007) 449.
Gefördert durch das BMBF (TRAKULA Projekt, PTKA-WTE 02NUK13A).

HK 42.4 Do 17:30 P 3

Fortschritte bei der Entwicklung eines hochsegmentierten Neutronendetektors — •Matthias Schoth für die A1-Kollaboration — Institut für Kernphysik, Johannes Gutenberg-Universität, Mainz

Für den elektrischen und magnetischen Formfaktor des Neutrons, G_E^n und G_M^n, liegen jeweils über einen weiten Q^2-Bereich nicht genügend Daten vor, um eine konsistente Charakterisierung seiner elektrischen und magnetischen Ladungsverteilung zu ermöglichen. Um das Potential der MAMI-Beschleunigeranlage mit ihrer hohen Luminosität für ein weites Messprogramm mit Neutronen im Endkanal voll nutzen zu können, ist es nötig, Neutronen mit einer hohen Effizienz und Rate nachzuweisen. Hierfür wird im Rahmen der A1-Kollaboration an der Entwicklung eines neuen Neutronendetektors gearbeitet. Ein großes Detektorvolumen ermöglicht die nötige Nachweiseffizienz von min. 80 %, wohingegen einer hohen Untergrundratenbelastung mit einer starken Segmentierung begegnet werden kann. Der Detektor soll daher aus 2304 Modulen bestehen, die insgesamt ein aktives Detektorvolumen von 0.96 m^3 besitzen. Das im Szintillator erzeugte Licht wird über eine wellenlängenschiebende Faser ausgekoppelt und beidseitig mit Multipixelphotodioden oder Multianodenphotomultipliern nachgewiesen. Dieser Vortrag beschäftigt sich mit Messergebnissen zur Charakterisierung der Eigenschaften von verschiedenen Szintillatoren in Zusammenspiel mit verschiedenen Fasern und Photodetektoren, sowie dem derzeitigen Stand der Entwicklung des Detektors.

HK 42.5 Do 17:45 P 3

Konzepte zur Protonendetektion im Neutronenlebensdauerexperiment PENeLOPE — •Christian Tietze für die PENeLOPE-Kollaboration — Technische Universität München, Physik-Department

Obwohl die Lebendauer τ_n des freien Neutrons eine wichtige Rolle im Standardmodell der Teilchenphysik spielt, ist sie bisher nur unzureichend genau bekannt. Es besteht eine große Diskrepanz zwischen zurückliegenden Messungen, sodass der Fehler des gewichteten Mittelwertes von der Particle Data Group (PDG) um den Faktor 2,7 skaliert wurde. Schon bevor die PDG dringend neue Experimente zur Neutronenlebensdauer empfahl, wurde an der TU München das Experiment PENeLOPE entwickelt, um τ_n auf 0,1s genau zu bestimmen. Dazu werden ultrakalte Neutronen in einer supraleitenden Multipolanordnung gespeichert. Neben dem Nachweis der nach einem Speicherzyklus überlebenden Neutronen sollen hier auch die beim Betazerfall während der Speicherphase entstehenden Protonen beschleunigt, extrahiert und zur Bestimmung der Lebensdauer herangezogen werden. Zum Nachweis dieser niederenergetischen Protonen muss der Detektor einige spezielle Anforderungen erfüllen, da er zwischen supraleitenden Spulen im Magnetfeld und bei kryogenen Temperaturen betrieben werden soll. Der Beitrag diskutiert verschiedene Detektorkonzepte und geht insbesondere auf die Verwendung von Avalanche-Photodioden für die direkte Protonendetektion ein. Das Projekt wird gefördert vom Maier-Leibnitz-Laboratorium, der Deutschen Forschungsgemeinschaft sowie dem Exzellenzcluster „Origin and Structure of the Universe“.

HK 42.6 Do 18:00 P 3

Polarization of ultra-cold neutrons at PENeLOPE — •Daria Margiotta for the PENeLOPE-Collaboration — Technische Universität München, Physics Department

The project PENeLOPE is currently under development at the Physics Department of Technische Universität München. It uses a magneto-gravitational trap for ultra-cold neutrons and aims to measure the lifetime of the free neutron with an accuracy equal to or better than 0,1 s.

One source of systematic errors is the presence of neutrons in the trap with "wrong" polarization. These neutrons are accelerated by the magnetic field towards the walls of the storage volume and will be lost.

Several possibilities have been investigated to get neutrons with the "right" spin direction. One of the examined options is using a magnetized foil. In order to not interfere with the magnetic field generated inside PENeLOPE, the positions of these polarizing devices within the experiment have been carefully evaluated.

In this talk a description of selected spin-flipping systems will be given, then issues related to their installation into the experiment will be discussed, together with calculations showing their effects on the measurement of neutron lifetime.

This work is supported by the Excellence Cluster "Origin and Structure of the Universe", the Deutsche Forschungsgemeinschaft and the Maier-Leibnitz-Laboratorium Garching.

HK 42.7 Do 18:15 P 3

Optimization of the neutron lifetime experiment PENeLOPE with Monte-Carlo simulations — •Wolfgang Schreyer for the PENeLOPE-Collaboration — Technische Universität München, Physik-Department E18

Complementary to high-energy experiments, precision measurements with ultra-cold neutrons (UCN) contribute substantially to particle physics and cosmology. Both fields are nowadays heavily supported by computer simulations.

At the Physik-Department of Technische Universität München the neutron lifetime experiment PENeLOPE is planned. A Monte-Carlo simulation code developed in house is used to simulate PENeLOPE, including UCN source, transport and storage in material bottles as well as in magnetic and gravitational fields. Additionally, the program is able to simulate the trajectories of the neutron decay products protons and electrons in electric and magnetic fields.

The results that will be presented led to several changes and optimizations of the experiment design and enabled to predict the overall performance of the measurement.

The project is supported by the Maier-Leibnitz-Laboratorium (Garching), the Deutsche Forschungsgemeinschaft and the Excellence Cluster "Origin and Structure of the Universe".

HK 42.8 Do 18:30 P 3

Depolarization in Polarizing Neutron Supermirrors — •Christine Klauser[1,2], Thierry Bigault[1], Pierre Courtois[1], David Jullien[1], Alexander Petoukhov[1], Nataliya Rebrova[3], and Torsten Soldner[1] — [1]Institut Laue-Langevin, F-38042 Grenoble, France — [2]Atominstitut, Vienna University of Technology, Stadionallee 2, A-1020 Vienna, Austria — [3]Physikalisches Institut, University of Heidelberg, D-69120 Heidelberg, Germany

Absolute measurements of correlation coefficients in neutron beta decay are presently limited to a relative accuracy in the orders of 10^{-3} by systematics and statistics. Next-generation instruments aim for 10^{-4} accuracy. This requires a 10^{-4} accuracy for the polarization for a large cold neutron beam. State-of-the-art polarizing super mirrors in X-SM geometry deliver about 99.7% polarization only. It appears that depolarization by the supermirrors is a limitation to the performance of this type of device.

We present a systematic study of depolarizing effects in polarizing supermirrors. Cold neutrons with a wavelength of 5.3 Å are polarised to 99.98 % by a ^{3}He spin filter and their polarisation after one reflection on a polarizing supermirror is measured with another ^{3}He spin filter; the set-up uses the highly sensitive opaque test bench. Varying parameters such as the magnetizing field (from 0.02 T to 0.82 T) and materials (Co-Ti, Fe-Si), we find the number of layers and the field strength to be important factors in depolarization. Other parameters such as the scattering angle and the wavelength only have little effect on the amount of depolarization.

HK 42.9 Do 18:45 P 3

Investigations of the Patch Effect with a Scanning Kelvin Probe and their Applications to Neutron Decay Experiments — •Gertrud Konrad[1,2], Stefan Baessler[3], Iain Baikie[4], Henry Bonner[3], Werner Heil[2], Rachel Hodges[3], Thorsten Lauer[2], Sean McGovern[3], and Xuying Tong[3] — [1]Atominstitut, TU Wien, Austria — [2]Universität Mainz, Germany — [3]University of Virginia, Charlottesville, USA — [4]KP Technology Ltd., Wick, UK

Precision measurements of neutron decay observables address important open questions of particle physics and are generally complementary to direct searches for BSM physics in high-energy physics.

The analysis of the decay protons is based on a precise energy measurement, by means of an electrostatic filter or by TOF measurement. Then the electric potential between the decay and filter regions has to be known with an accuracy of better than 10 mV. Possible inhomogeneities of the work function (WF) at the electrode surface vary the electric field distribution. On the inside of a cylindrical electrode, a spatial variation of order of 100 meV over a distance of several cm was found. A scanning Kelvin probe (SKP) has been used to map the WF. To minimize the WF variations, different surface materials, treatments, and coatings are being investigated. A platinized surface yielded a RMS WF of better than 10 meV. Coating adhesion and surface roughness have a significant influence on the measured WF values.

The physics motivation, the SKP technique, the status of the investigation as well as the impact on neutron decay correlations from the knowledge of the WF will be presented in this talk.

HK 43: Struktur und Dynamik von Kernen

Zeit: Donnerstag 16:30–19:00 Raum: P 4

Gruppenbericht HK 43.1 Do 16:30 P 4

Determination of the B(E3, $0^+ \rightarrow 3^-$) strength in the strongly octupole correlated nucleus ^{224}Ra using Coulomb excitation at REX-ISOLDE — •Marcus Scheck[1,2], Liam Paul Gaffney[2], Peter Anthony Butler[2], and Thorsten Kroell[1] for the IS475-Collaboration — [1]TU Darmstadt — [2]University of Liverpool

Exploiting the unique capabiltities of REX-ISOLDE to provide intense post-accelerated ^{224}Ra radioactive ion beams we were able to Coulomb excite low-lying, low-spin levels of ^{224}Ra. The previously accessible observables, such as the excitation energies of negative parity levels, and theoretical calculations using various models locate this nucleus to be situated in a mass-region with enhanced octupole correlations. Our collaboration was for the first time capable to Coulomb excite opposite parity levels in a post-accelerated radioactive nucleus. Indeed, apart from quasi-stable Uranium isotopes, ^{224}Ra is the so far heaviest post-accelerated nucleus ever. A first, preliminary, B(E3, $0^+ \rightarrow 3^-$) value provides quantitative information about the octupole correlations in this nucleus. The results will be discussed within the context of a possible stable octupole deformation in the ground state of this nucleus. An observation, that is implicating a CP-violating nuclear Schiff moment. The latter has a strong impact on the search for CP-violating physics in the atomic system of the neighbouring odd-mass Ra-isotopes.

Financial support by the BMBF under grant 06DA9036I, HIC for FAIR and the ENSAR programme is gratefully acknowledged.

HK 43.2 Do 17:00 P 4

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] und Nigel Warr[1] — [1]IKP, Universität zu Köln — [2]IKP, TU Darmstadt — [3]IKS, K.U. Leuven — [4]CERN, Genf — [5]CSNSM, Orsay

Für aktuelle Schalenmodellrechnungen ist ein detailliertes Verständnis der Island of Inversion von höchstem Interesse. Übergangsmatrixelemente und Anregungsenergien in Na-Isotopen ermöglichen einen Einblick in die zugrunde liegende Einteilchenstruktur. Zur Überprüfung moderner Schalenmodellrechnungen wurde ein Experiment zur Coulombanregung des $T_z = 2$ Kerns ^{26}Na an REX-ISOLDE durchgeführt. Die Strahlenergie betrug 2,82 MeV/u bei einer Intensität von ca. 3×10^4 Ionen/s. Durch Nachweis der gestreuten Strahlteilchen mittels eines segmentierten Si-Detektors ist die selektive Auswertung der vom MINIBALL-Spektrometer detektierten koinzidenten γ-Strahlung möglich. Dadurch konnten erstmals reduzierte Übergangswahrscheinlichkeiten angeregter Zustände in ^{26}Na bestimmt werden und ermöglichen einen Vergleich mit Schalenmodellrechnungen.

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

HK 43.3 Do 17:15 P 4

Coulomb excitation of ^{140}Nd - measuring the B(E2) value of the first 2^+ state at REX-ISOLDE * — •Christopher Bauer[1], Georgi Rainovski[2], Norbert Pietralla[1], Andrey Blazhev[3], Timo Bloch[1], Sabine Bönig[1], Antoaneta Damyanova[2], Miroslav Danchev[2], Kalin Gladnishki[2], Thorsten Kröll[1], Jörg Leske[1], Kevin Moschner[3], Janne Pakarinen[4], Marcus Scheck[1], Christian Stahl[1], Robert Stegmann[1], and Volker Werner[5] — [1]IKP, TU Darmstadt, Germany — [2]University of Sofia, Bulgaria — [3]IKP, Universität zu Köln, Germany — [4]CERN, Geneve, Switzerland — [5]WNSL, Yale University, New Haven, United States

A radioactive beam of ^{140}Nd was impinging on a 1.40mg/cm^2 ^{48}Ti as well as a 1.55mg/cm^2 ^{64}Zn target. Gamma rays were detected by the MINIBALL array and a DSSD was used for particle identification. The transition strength of the first 2^+ state to the 0^+ ground state of neutron-deficient ^{140}Nd was measured to be 30(5) W.u. This result deviates from empirical rules for quadrupole collectivity and microscopic predictions (Quasiparticle-phonon model for N=80 predicts 17 W.u. with parameters from [1]). This unexpected behavior prompts for new, refined microscopic calculations and might be related to the shell stabilization of the quadrupole isovector valence shell excitations. The result is important for the planned experiment at HIE-ISOLDE, which aims to identify the one-phonon mixed-symmetry 2^+ state of ^{140}Nd.

[1] N. Lo Iudice, Ch. Stoyanov, D. Tarpanov, Phys. Rev. C77 (2008)
* supported by the State of Hesse within HIC for FAIR, BMBF (06DA9041I), EU (ENSAR) and the DAAD

HK 43.4 Do 17:30 P 4

Studium der Proton-Neutron-Wechselwirkung in neutronenreichen Zink-Isotopen an ISOLDE — •Stefanie Klupp[1], Dennis Mücher[1], Roman Gernhäuser[1], Reiner Krücken[1,2], Katharina Nowak[1], Vinzenz Bildstein[3] und Kathrin Wimmer[4] — [1]Technische Universität München — [2]TRIUMF, Vancouver — [3]Univ. of Guelph — [4]NSCL, Michigan State Univ.

Bis heute ist noch nicht vollständig geklärt, inwiefern es sich bei ^{68}Ni um einen doppelt magischen Kern handelt. Hierbei ist die komplizierte Rolle der pn-Wechselwirkung wesentlich, da sie die relative Lage der Einteilchenorbitale in der Nähe von ^{68}Ni bestimmt. Dieser Vortrag befasst sich mit der experimentellen Charakterisierung des exotischen ^{72}Zn-Kerns, der 2p und 2n mehr aufweist als ^{68}Ni. Gleichzeitig wurde der Kern ^{74}Zn durch 2n-Transfer studiert.

Das Experiment wurde unter Verwendung eines radioaktiven ^{72}Zn-Strahls bei REX-ISOLDE mit dem T-REX- und dem MINIBALL-Spektrometer durchgeführt. Als Target diente eine Ti-Folie (Coulomb-Streuung), die mit ^{3}H geladen ist (2n-Transfer).

Ziel der Coulombanregung ist die Charakterisierung tiefliegender offyrast Zustände, welche besonders sensitiv auf die pn-Wechselwirkung sind. Mit dem 2n-Transfer soll die Anregungsstärke des 0_2^+-Zustandes in ^{74}Zn vermessen werden, aus welchem sich die Besetzungszahlen der Neutronenorbitale extrahieren lassen.

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 43.5 Do 17:45 P 4

Probing the Quadrupole Collectivity of ^{128}Cd using Coulomb Excitation — •Sabine Bönig, Thorsten Kröll, Marcus Scheck, and Michael Thürauf for the IS477-Collaboration — Technische Universität Darmstadt

^{128}Cd is only two proton and two neutron holes away from the doubly magic nucleus ^{132}Sn. The excitation energy of the first excited 2^+-state decreases when approaching the neutron shell closure. This unexpected behaviour makes this nucleus interesting for investigation. So far, contradicting theoretical predictions for the B(E2,$0^+ \rightarrow 2^+$) value of ^{128}Cd exist. While shell model calculations conclude an almost spherical shape of ^{128}Cd, beyond mean field calculations predict an already considerable quadrupole collectivity. In this contribution the experimental details of the Coulomb excitation of ^{128}Cd at REX-ISOLDE, investigated with MINIBALL (experiment IS477), will be presented. Furthermore the current status of the analysis to determine the transition strength of the ground state into the first excited 2^+ state will be shown. This project is supported by BMBF (No. 06 DA 9036I), HIC for FAIR and EU through ENSAR (No. 262010).

HK 43.6 Do 18:00 P 4

Kollineare Laserspektroskopie an neutronenreichen Cadmiumisotopen — •Nadja Frömmgen für die COLLAPS-Kollaboration — Institut für Kernchemie, Johannes Gutenberg-Universität Mainz, Germany

Mittels kollinearer Laserspektroskopie kann die Hyperfeinstruktur und die Isotopieverschiebung exotischer Kerne sehr präzise vermessen werden. Dies ermöglicht die Bestimmung der entsprechenden Kerngrundzustandseigenschaften wie Spins, magnetische Momente, elektrische Quadrupolmomente und Ladungsradien. Für die Untersuchung der Schalenstruktur weit ab der Stabilität ist die Region rund um die doppelt magischen Kerne ^{100}Sn$_{50}$ und ^{132}Sn$_{82}$ hierbei von besonderem Interesse. Auf der neutronenreichen Seite trägt dies zum besseren Verständnis des r-Prozesses entlang N=82 bei. Mit nur zwei fehlenden Protonen in der Z=50 Schale ist die Bestimmung der Kernstruktur der Cadmiumisotope daher sehr interessant.

Erste Ergebnisse der Spektroskopie an $^{106-124,126}$Cd an der COLLAPS Apparatur an ISOLDE werden vorgestellt.

HK 43.7 Do 18:15 P 4

Collinear Laser Spectroscopy of Potassium Isotopes Beyond

the N=28 Shell Closure — •Kim Kreim for the COLLAPS-Collaboration — Max-Planck-Institut für Kernphysik, Heidelberg, Germany

Thanks to a newly developed light collection region for the collinear laser spectroscopy beam line at ISOLDE/CERN, we have successfully measured the hyperfine structures and isotope shifts from $N = 19$ to $N = 32$ ($^{38,39,42,44,46,47,48,48,50,51}K$). From these we extracted spins, magnetic moments and changes in root mean square charge radii $\delta\langle r^2\rangle$.

These nuclear observables provide information about the evolution of the proton sd-orbits as the neutron $p_{3/2}$ orbit is being filled towards $N = 32$. A clear shell effect is observed in $\delta\langle r^2\rangle$ at $N = 28$.

The measured spins, magnetic moments and $\delta\langle r^2\rangle$ will be presented.

HK 43.8 Do 18:30 P 4

Status und Entwicklung von TRIGA-LASER — •Michael Hammen[1], Nadja Frömmgen[1], Christopher Geppert[1,2], Andreas Krieger[1] und Wilfried Nörtershäuser[1,2] für die TRIGA-SPEC-Kollaboration — [1]Institut für Kernchemie, Universität Mainz — [2]GSI Helmholtzzentrum, Darmstadt

TRIGA-LASER ist ein Experiment zur kollinearen Laserspektroskopie, das am Forschungsreaktor der Universität Mainz im Rahmen des TRIGA-SPEC Experiments aufgebaut wird. Dieses verwendet die neutroneninduzierte Spaltung von Uran-235 oder Californium-249, um kurzlebige radioaktive Isotope für die Massenspektrometrie an TRIGA-TRAP bzw. für die kollineare Laserspektroskopie an TRIGA-LASER zur Verfügung zu stellen. Letztere hat das Ziel, Kerngrundzustandseigenschaften der Nuklide zu bestimmen. Der aktuelle Status und die neuesten technischen Entwicklungen von TRIGA-LASER werden vorgestellt.

HK 43.9 Do 18:45 P 4

Status of the CRIS experiment — •Hossein Aghai for the CRIS-Collaboration — Cern — Max Planck Institut fur Quantenoptik

The new CRIS experiment at ISOLDE will combine collinear laser spectroscopy and resonant ionization spectroscopy. For this laser radiation will be used to resosnantly excite and subsequently ionize atomic beams. The CRIS beam line routinely operates below $5{\cdot}10^{-9}$ mbar, a region where background events are highly surpressed. Thus the sensitivity of CRIS will allow hyperfine structure measurements of the rarest isotopes produced at ISOLDE. Furthermore collinear resonant ionization spectroscopy at CRIS offers the ability to purify ion beams from isobaric and isomeric contaminants, which allows for sensitive secondary experiments to be performed.
This talk will report on the current status of CRIS. The results of a proof of principle measurement of ^{207}Fr will be presented.
The experiments will look at neutron deficient Francium isotopes where a $(\pi s_{1/2}^{-1})1/2^+$ intruder state has been identified in ^{201}Fr and tentatively in ^{203}Fr using α-decay spectroscopy. CRIS may provide further evidence of $(\pi s_{1/2}^{-1})1/2^+$ intruder states in neutron deficient francium isotopes.

HK 44: Schwerionenkollisionen und QCD Phasen

Zeit: Donnerstag 16:30–19:00 Raum: P 5

Gruppenbericht HK 44.1 Do 16:30 P 5

Jet Reconstruction in Pb-Pb Collisions at $\sqrt{s_{\rm NN}} = 2.76$ TeV with ALICE — •Bastian Bathen[1], Christian Klein-Bösing[1,2], and Markus Zimmermann[1] for the ALICE-Collaboration — [1]Institut für Kernphysik, WWU Münster — [2]ExtreMe Matter Institute EMMI, GSI, Darmstadt

The Large Hadron Collider (LHC) at CERN delivered in 2010 and 2011 heavy-ion collisions (Pb-Pb) with collision energies per nucleon pair of $\sqrt{s_{\rm NN}} = 2.76$ TeV. The ALICE experiment studies those collisions to explore the quark-gluon plasma (QGP), a state of matter where the color confinement of the quarks and gluons, which constrains them in hadrons, does not exist anymore.

Initial, hard scattered partons, with large momentum transfer in transverse direction, can be used as probes to study properties of the QGP since they traverse the medium before they fragment into a spray of hadrons ("jets"). Thereby the partons strongly interact with the medium and exchange momentum. That results in a modified fragmentation pattern compared to jets in proton-proton collisions.

The aim of jet measurements is an unbiased reconstruction of the parton properties and jet structure. The main issue in central heavy-ion collisions is the large amount of soft background from subleading processes. We present the current status of jet reconstruction based on charged particles with the ALICE experiment and we discuss the impact of the underlying event for the jet reconstruction.

Supported by BMBF and HA216/EMMI.

HK 44.2 Do 17:00 P 5

A study of jet fragmentation properties in proton-proton collisions at $\sqrt{s} = 7$ TeV with ALICE at the LHC — •Hermes Leon Vargas and Christoph Blume for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt am Main

The excellent tracking capabilities of the ALICE experiment provide an ideal tool to study the properties of charged jets. These are characterized in this study via two observables: $NT90$ and the second moment of the jet profile. $NT90$ is defined as the minimum number of tracks inside the jet cone that are necessary to recover 90% of the jet transverse momentum. The second moment of the jet profile quantifies the spatial distribution of the tracks around the jet axis, weighted by their transverse momentum. The jet properties are presented as a function of the jet transverse momentum and as a function of the underlying charged particle multiplicity. The latter is measured by the detectors in the central barrel of the experiment, selecting a subset of the total event multiplicity. This subset is chosen such that any bias due to the hard scattering that initiated the jets is minimized. The selection is based on track transverse momentum cuts and event geometry. A comparison with Monte Carlo generators is presented.

HK 44.3 Do 17:15 P 5

Separation of decay photons and prompt photons in ALICE using a neural network — •Thomas Keuter for the ALICE-Collaboration — Institut für Kernphysik, WWU Münster, Deutschland

In this talk, the separation of decay photons and prompt photons in simulated proton-proton collisions at $\sqrt{s} = 7$ TeV in the ALICE experiment will be presented. The ALICE experiment investigates the quark-gluon plasma (QGP), created in central Pb-Pb-collisions at the LHC. Prompt photons are an ideal probe to investigate the QGP, since they do not interact strongly and are therefore mostly unaffected by a strongly interacting medium. They can be used as a reference for single particle spectra, because their R_{AA} should be equal to one. Moreover, the fragmentation function of hadrons can be calculated in γ-jet events if prompt photons can be identified and also jet-quenching in Pb-Pb collisions can be investigated. Photons from particle decays (mainly π^0 and η) form a large background and these decay photons have to be separated from the prompt photons. In this talk, a neural network is used to distinguish between the photons on an event-by-event basis. The network can be trained with decay photons which are identified using an invariant mass analysis and with prompt photons using so-called random cones in minimum bias events.

HK 44.4 Do 17:30 P 5

Anisotropy of Neutral Pion production in Pb-Pb collisions at $\sqrt{s_{NN}} = 2.76TeV$ measured by ALICE — •Daniel Lohner for the ALICE-Collaboration — Physikalisches Institut, Universitaet Heidelberg

The ALICE PbPb research program focusses on the quark-gluon plasma, a state of matter in which quarks and gluons are no longer confined in hadrons. The in-medium energy loss of partons is referred to as jet quenching and can be observed in experiments as a suppression of the particle production (R_{AA}). Furthermore, the asymmetric shape of the reaction plane in non-central collisions leads to an azimuthal anisotropy of the particle production. The neutral pion dominantly decays into two photons. Those are measured via their conversion in the detector material using the ALICE Inner Tracking System and Time Projection Chamber or by the ALICE calorimeters, PHOS and EMCAL. The neutral pion yield is studied as a function of the emission

angle with respect to the reaction plane. The anisotropy is measured by the second harmonic Fourier component v_2. At low transverse momentum, v_2 can be described by collective expansion of the medium (elliptic flow), at high transverse momentum v_2 provides insights into the path-length dependence of QCD energy loss.

HK 44.5 Do 17:45 P 5

Messung von π^0 und η Mesonen in ALICE in pp und Pb–Pb-Kollisionen am CERN LHC — •Friederike Bock für die ALICE-Kollaboration — Physikalisches Institut, Heidelberg, Deutschland

Der Large Hadron Collider (LHC) am CERN lieferte bis Ende 2011 pp-Kollisionen bei Schwerpunktsenergien von $\sqrt{s} = 0.9$, 2.76 und 7 TeV, darüber hinaus Pb–Pb-Kollisionen bei einer Energie von $\sqrt{s_{NN}} = 2.76$ TeV. Die präzise Messung der Transversalimpulsspektren von π^0 und η-Mesonen ist von besonderer Wichtigkeit für die Ermittlung des Wirkungsquerschnitts dieser Teilchen im jeweiligen Kollisionssystem. Diese Messung erlaubt eine Überprüfung der pQCD -Berechnungen in pp-Kollisionen bei verschiedenen Energien. Der nukleare Formveränderungsfaktor R_{AA} in Pb–Pb-Kollisionen repräsentiert die Unterdrückung der Teilchenproduktion bei hohem transversalem Impuls und trägt somit zur Charakterisierung des erzeugten Mediums bei.
In ALICE ist die Messung von π^0 (η)-Mesonen auf zwei unterschiedlichen Wegen möglich, über Kalorimeter und über die Messung konvertierter Photonen in den Spurdetektoren. Die kombinierten Ergebnisse sollen in diesem Vortrag gezeigt werden. Mit der Konversions Methode wird eine sehr gute Auflösung bei sehr kleinen p_t (0.3 GeV/c) erreicht, während die Kalorimeter bei höheren Energien eine bessere Auflösung haben. Desweiteren können die mit Konversionen gemessenen π^0 Mesonen auf Grund ihren guten räumlichen Auflösung mit Jets korreliert werden, was die Messung von Fragmentationsfunktionen erlaubt, auch hierzu werden erste Ergebnisse präsentiert.

HK 44.6 Do 18:00 P 5

Measurement of the J/ψ inclusive production cross section in pp collisions with ALICE at the LHC — •Jens Wiechula for the ALICE-Collaboration — Physikalisches Institut, Universität Tübingen

The measurement of the J/ψ production cross section in pp collisions is crucial for testing pQCD models of quarkonium production in the new energy regime provided by the LHC. In addition, the cross section in pp is important as reference for the heavy-ion program, for which J/ψ is an essential observable for the deconfined matter.

ALICE measures the J/ψ production at midrapidity ($|y| < 0.9$) in the di-electron channel as well as at forward rapidity ($2.5 < y < 4.0$) with a dedicated muon spectrometer. In both channels J/ψ mesons are reconstructed down to zero transverse momentum. This kinematical reach is unique among the LHC experiments.

We will present the rapidity dependence of the inclusive J/ψ production cross section and transverse momentum spectra at a centre of mass energy of $\sqrt{s} = 7$ TeV as well as at $\sqrt{s} = 2.76$ TeV. In addition, polarisation measurements and the contribution of decays from B-hadrons will be addressed.

HK 44.7 Do 18:15 P 5

Centrality dependent J/ψ production in Pb-Pb collisions at $\sqrt{s_{NN}}$ =2.76 TeV with ALICE — •Ionut-Cristian Arsene — Research Division and ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum fürSchwerionenforschung, Darmstadt, Germany

The hot and dense nuclear matter formed in ultra-relativistic nuclear collisions is one of the testing grounds for the theory of strong interactions. The J/ψ meson is a very interesting probe for understanding the properties of the medium created by such collisions. It was predicted that at high temperature the J/ψ state is melting leading to the suppression of this particle with respect to pp. However it was also predicted that high production rates of charm quarks at RHIC and LHC energies will make possible (re)combination of charmonium states thus leading to J/ψ enhancement. In the ALICE detector, J/ψ is measured at mid-rapidity, $|y| < 0.9$, and forward-rapidity, $2.5 < y < 4.0$, down to zero transverse momentum. The reconstruction is done via the di-electron channel at mid-rapidity and the di-muon channel at forward-rapidity. The electron identification is done using linear energy loss in gaseous detectors, Time Projection Chamber (TPC), Transition Radiation Detector(TRD), and the time of flight method, Time Of Flight(TOF) detector. The muon identification is done using the MUON spectrometer where the tracking devices are placed behind thick hadronic absorbers. We will present J/ψ production densities as a function of rapidity and collision centrality. Furthermore, using the cross-sections measured by ALICE in pp collisions at the same energy we will show and discuss the nuclear modification factor.

HK 44.8 Do 18:30 P 5

J/ψ Production as a Function of Charged Particle Multiplicity in pp Collisions at $\sqrt{s}$ = 7 TeV — •Julian Book for the ALICE-Collaboration — 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, bound states of heavy (charm or bottom) quarks such as the J/ψ, are expected to be produced in the first hard scattering. Thus they will provide insights into the earliest and hottest stages of collisions where the formation of a Quark-Gluon Plasma is expected.
The measurement of quarkonia in pp collisions will help to understand the production mechanisms of quarkonia in hadronic collisions and give the possibility to test different pQCD production models. At the new energy regime reached by the LHC, the underlying event should be affected by Multi-Parton Interactions (MPI). If the effect of MPI extends to hard processes, a non-trivial dependence of quarkonia production on the charged particle multiplicty might result.
We will present the first measurement of J/ψ production as a function of the charged particle multiplicity in pp collisions at $\sqrt{s} = 7$ TeV at the LHC.

HK 44.9 Do 18:45 P 5

J/Ψ-Hadron-Korrelationen in Proton-Proton-Kollisionen bei 7 TeV Schwerpunktenergie mit dem ALICE-Detektor — •Michael Winn für die ALICE-Kollaboration — Physikalisches Institut, Universität Heidelberg

Die Produktion von J/Ψ-Teilchen in Proton-(Anti-)Proton-Kollisionen ist Gegenstand aktueller Forschungsbemühungen auf experimenteller als auch theoretischer Seite. Insbesondere verspricht die Untersuchung von J/Ψ-Hadron-Korrelationen, ein besseres Verständnis des zu Grunde liegenden Produktionsmechanismus und der damit verknüpften Ereignistopologie zu gewinnen. Des Weiteren besteht hierdurch ein Zugang zur Abschätzung des Beitrags durch nicht prompte J/Ψ-Teilchen aus B-Zerfällen.
Im ALICE-Experiment am LHC können J/Ψ-Teilchen aus dem Dielektronenzerfallskanal im zentralen Detektorsystem rekonstruiert werden. Die im Fortschritt begriffene Analyse von Proton-Proton-Kollisionen bei 7 TeV Schwerpunktenergie umfasst Azimutal- und Pseudorapididitäts-Korrelationen zwischen J/Ψ-Kandidaten und Spuren geladener Teilchen als auch mit dem geladenen Teilchen, das den größten transversalen Impuls im jeweiligen Ereignis aufweist.

HK 45: Poster – Hadronenstruktur und -spektroskopie

Zeit: Donnerstag 14:00–16:00 Raum: P Foyer

HK 45.1 Do 14:00 P Foyer

Dalitz Decay of the ω Meson with WASA-at-COSY — •Farha Anjum Khan for the WASA-at-COSY-Collaboration — IKP and JCHP, Forschungszentrum Juelich

Two sets of experiments have been performed with the WASA detector at COSY using two reaction mechanisms. The intention is to compare the quality of the data between the pd→^{3}He ω (at 1.45 GeV and 1.5 GeV beam energy) and pp→pp ω (at 2.063 GeV beam energy) reactions, in the sense of a feasibility and background study for $\omega \to \pi^0 e^+ e^-$ decays. The aim is to measure the transition form factor of the ω meson which does not agree with standard Vector Meson Dominance. The first analysis is performed using the pd reaction for the $\omega \to \pi^0 \gamma$ decay. ^{3}He has been detected in the forward part of the detector using the ΔE-E method and the decay particles i.e. e^+,e^-,γ have been identified in the central part of the detector. The ω is fully

reconstructed with the missing mass of ^{3}He and invariant mass of decay products. The number of expected ω Dalitz decays is being estimated using the number of ω in the $\pi^0\gamma$ channel for two energies in the pd reaction. The experiment conditions for the high statistics beam time will be decided based on the analysis of both reactions.

HK 45.2 Do 14:00 P Foyer

Das P2-Experiment: Messung der schwachen Ladung des Protons — •Dominik Becker für die A4-Kollaboration — Institut für Kernphysik, Mainz

Das sich in der Planungsphase befindliche P2-Experiment in Mainz ist auf eine hochpräzise Bestimmung der schwachen Ladung des Protons bei niedrigem Impulsübertrag ausgelegt. Hiezu ist eine sehr genaue Messung der paritätsverletzenden Asymmetrie der elastischen Elektron-Proton-Streuung notwendig. Wir geben einen kurzen Überblick über die theoretischen Aspekte und präsentieren eine mögliche Detektorkonfiguration. Des Weiteren werden Resultate von Monte-Carlo-Simulationen bezüglich der erreichbaren Unsicherheiten bei der Bestimmung der schwachen Ladung des Protons vorgestellt.

HK 45.3 Do 14:00 P Foyer

Feasibility studies of proton FF measurements in $\bar{p}p$-collisions at PANDA — •Iris Zimmermann for the PANDA-Collaboration — Helmholtz-Institut Mainz

The investigation of the time-like electromagnetic form factors is one important goal of the PANDA-Experiment at the Facility of Antiproton and Ion Research (FAIR) at GSI. The data taking with high statistics at PANDA will allow the independent extraction of the time-like form factors from the study of the angular distribution of $\bar{p}p$-collisions into a pair of charged leptons. The muonic channel contains the same physical information on the form factors as the electronic channel, but the difficult separation from the strong hadronic background makes that channel a big challenge. On the other hand the measurement of the muonic channel is a good opportunity to cross-check the results of the electronic channel. Therefore detailed simulation studies for both the muonic channel and the hadronic background (mostly pion production) are needed. First studies have been carried out to get a better understanding of the kinematical aspects of the muonic channel. The detailed simulation of those processes will be done using the software package PANDA Root taking the geometry and properties of the PANDA-Detector into account. Therefore an event generator for muons is under development.

HK 45.4 Do 14:00 P Foyer

Detector development for in-trap decay studies in a Penning trap* — •Peter Müller, Jasmin Moazzami-Fallah, Peter Thirolf, and Christine Weber — LMU München

The precision of decay spectroscopy experiments is limited due to scattering 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 α decays, the ring electrode is replaced by a detector array, also providing the trapping potential. This "Detector-Trap" is developed at MLLTRAP to be implemented in the future MATS facility at FAIR. It consists of a cubic array of 4 single-sided silicon strip detectors, which measure energy and polar angle of the α particles, released in the trap centre. Each sensor contains 30 strips with 1mm pitch, totally covering a solid angle of 67%. UHV and cryogenic conditions inside the trap require customized solutions for all individual components of the detector trap. The Si sensors are glued on ceramic circuit boards; glue and ceramics being selected due to their thermal properties (matched to silicon) and their low outgassing rate. The Capton insulated multiwire signal cables are connected to the circuit boards via customized PEEK (a low outgassing polymer) connectors and flexible spring contacts. The cubic detector array is mounted via grooves in the adjacent trap electrodes.

* Supported by BMBF(06ML9148)

HK 45.5 Do 14:00 P Foyer

Commissioning experiment of the polarized internal gas target with deuterium at ANKE/COSY — •Boxing Gou for the ANKE-Collaboration — Institut für Kernphysik, Forschungszentrum Jülich,D-52425 Jülich, Germany — Institute of Modern Physics, Chinese Academy of Sciences, 509 Nanchang Road, Lanzhou, 730000, P.R.China

In order to conduct the production experiments with polarized deuterium target and (un)polarized proton beam at ANKE/COSY, a commissioning experiment of the polarized internal target with deuterium is imperative. The commissioning experiment includes the measurements of both the vector (Qy) and tensor (Qyy) polarization of the deuterium gas target through the nuclear reactions with large and well known analyzing powers, which can be detected in ANKE. The dependence of the polarizations along the storage cell will also be determined. The poster presents the physics case for the experiments with deuterium polarized internal target and the apparatus needed for the commissioning experiment, as well as the procedure of extraction for spin observables.

Supported by CSC program.

HK 45.6 Do 14:00 P Foyer

Total and Differential Cross Sections of the Reaction pd $\rightarrow$ ^{3}He + η **at 49 an 60 MeV Excess Energy*** — •Florian Bergmann, Annika Passfeld, Kay Demmich, Paul Goslawski, Christina Husmann, Alfons Khoukaz, and Alexander Täschner for the WASA-at-COSY-Collaboration — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster

The p + d $\rightarrow$ ^{3}He + η reaction has been used recently for various precision experiments, e.g. for the investigation of the η-nucleus final state interaction, the search for possible η-mesic nuclei as well as for the η-mass determination with highest accuracy. A remarkable feature of this reaction is the unexpected shape of the excitation function which is strongly influenced by the η-^{3}He final state interaction. While close to threshold ($Q \leq 11$ MeV) a rich data sample has been provided a short time ago, only limited information are available at higher excess energies. Therefore, new measurements at $Q = 49$ and 60 MeV with high statistics have been performed at the WASA-at-COSY experiment. Final results on total and differential cross sections will be presented and discussed.

*Supported by COSY-FFE grants

HK 45.7 Do 14:00 P Foyer

Future experiments with Pion Beams* — Johannes Siebenson and •Rafal Lalik for the HADES-Collaboration — TU München, Boltzmannstr. 2, 85748 Garching, Germany

New experiments exploiting secondary pion beams with incoming momenta varying from 0.8 to 1.7 GeV/c are planned for the HADES spectrometer at GSI, SIS18. This will provide a unique possibility to study a variety of physics observable exploiting both hadronic and leptonic probes.

For this a new beam detector, based on large area silicons, for the measurement of the incoming pion momentum is under construction. The detector readout system is based on the n-XYTER ASIC (DETNI, GSI Darmstadt) and Exploder (GSI Darmstatd) boards. The status of the project will be described in this contribution.

Additionally full scale simulations with a pion beam momentum of 1.75 GeV have been analyzed with focus on the production of the $\Lambda(1405)$ hyperon. At the moment this resonance is of large interest, as its formation is highly influenced by the $\bar{K}N$ dynamics. The rather low cross section of the reaction $\pi + p \rightarrow \Lambda(1405) + K^0$ and the decay into $\Sigma\pi$ pairs make the reconstruction of this particle a challenging task. We present our results on the $\Lambda(1405)$ analysis and estimations of the expected yields for the upcoming beam time.

*) supported by BMBF and Excellence Cluster "Universe"

HK 45.8 Do 14:00 P Foyer

A Kinematic Refit for the analysis of the reaction $pp \rightarrow pK^+\Lambda$ at 3.1 GeV with FOPI* — •Dominik Pleiner for the FOPI-Collaboration — Excellence Cluster Universe, TU München, Boltzmannstr. 8, D-85748 Garching

In order to study the existence of the ppK^- kaonic bound state, the FOPI experiment at GSI took data with a 3.1 GeV/c proton beam hitting a LH_2 target in August 2009. The reaction of interest is $pp \rightarrow pK^+\Lambda$, where the Λ further decays into a proton and a π^-. In order to improve the momentum and mass resolution of the reconstructed Λ, a kinematic refit was developed. The refit imposes the knowledge of several physical processes on the track-fitting by introducing certain constraints on the reconstructed tracks of the final reaction $pp \rightarrow pK^+p\pi^-$. In addition to several non-vertex constraints (e.g. energy/momentum conservation, invariant mass), also vertex constraints are applied.

The improvement of the momentum resolution of the refitted particles is quantified via elastic pp reactions, exploiting the ability to precisely predict the theoretical momentum of the protons by measuring their polar angles.

The poster will present the basic functioning as well as tests and preliminary results of the kinematic refit.
* supported by BMBF and Excellence Cluster "Universe"

HK 45.9 Do 14:00 P Foyer

Statistic decay of slightly excited hyperfragments — •Alicia Sanchez Lorente for the A1-Collaboration — HIM, Mainz, Deutschland — Institut fuer Kernphysik, Mainz, Deutschland

Combining the unique features of the hypernuclear electro-production mechanism and the high precision in magnetic spectroscopy, the proposed E-08-012 experiment at Jefferson Lab, Virginia, and the scheduled hypernuclear experiment at MAMI, Germany, focus on the high-resolution spectroscopy of weak two-body decay pions from hypernuclei. These experiments will provide insight on a wide range of light hypernuclei via the production of hyperfragments from ^{6,7}Li, ^{9}Be and ^{12}C targets. In the present work we explore the production of Λ-hypernuclei following the micro-canonical break-up of an excited hypernucleus which is created by the electro/photo-production reaction. This method has already been successfully used for the PANDA experiment to determine to what extent excited states of a produced doubleΛ-Hypernucleus can be produced. Accordingly the model is used to predict the pionic decay spectra and relative fragmentation yields for the planned hypernuclear experiment at MAMI.

HK 45.10 Do 14:00 P Foyer

The OLYMPUS Experiment at DESY — •Lauren Ice for the OLYMPUS-Collaboration — Arizona State University, Tempe, AZ, USA

The OLYMPUS experiment underway at the DESY laboratory in Hamburg will determine the two-photon contribution to electron-proton elastic scattering by measuring the cross section ratio between electron and positron elastic scattering from the proton. The experiment utilizes the storage ring DORIS at DESY with an internal gas target and a large acceptance magnetic spectrometer. An overview of the physics motivation for the experiment plus a description of the detector system will be presented. The first data run was completed in February, 2012 and preliminary results on the experimental operation and performance will also be discussed.

HK 46: Poster – Schwerionenkollisionen und QCD Phasen

Zeit: Donnerstag 14:00–16:00 Raum: P Foyer

HK 46.1 Do 14:00 P Foyer

Gluodissociation of bottomonium states in PbPb collisions at LHC energies — •Felix Brezinski and Georg Wolschin — Institut für Theoretische Physik der Universität Heidelberg, Philosophenweg 16, D-69120 Heidelberg, Germany, EU

We suggest that gluon-induced dissociation and screening of the Υ(nS) states explain the suppression of the Υ(2S+3S) states relative to the Υ(1S) ground state that has been observed by CMS in PbPb collisions at $\sqrt{s_{NN}} = 2.76$ TeV at the CERN LHC. The minimum-bias gluodissociation cross sections of the 1S - 3S states are calculated using a screened Cornell potential and a thermal gluon distribution. The 3S state dissolves due to screening before sizeable gluodissociation occurs, but for the 2S and 1S states there is an interplay between screening, gluodissociation, and feed-down from the χ_b(2P) and χ_b(1P) states. The calculated suppression of the Υ(2S) and Υ(3S) states relative to Υ(1S) is consistent with the CMS result, but allows for additional suppression mechanisms. The Υ(1S) suppression through gluodissociation is in excellent agreement with the CMS data.

HK 46.2 Do 14:00 P Foyer

The p-T-diagram of QCD — •Klaus Heckmann, Jochen Wambach, and Michael Buballa — Institut für Kernphysik, TU Darmstadt

We present a novel form of displaying the phase diagram of QCD matter. Rather than representing the phase diagram in terms of temperature and baryo-chemical potential or density, we choose to plot pressure vs. temperature. This has the advantage of a more direct comparison with other substances such as water or Helium. We include results from lattice QCD, nuclear astrophysics, model calculations of color superconductors and empirical input from heavy-ion collisions for quantitative statements. Due to relativistic effects there is an unphysical region in the p-T plane in which QCD matter cannot exist in equilibrium.

HK 46.3 Do 14:00 P Foyer

New HADES taking off — •Katharina Gill[1], Tetyana Galatyuk[1,2], Olga Pechenova[1], Vladimir Pechenov[3], and Joachim Stroth[1,3] for the HADES-Collaboration — [1]Goethe-Universität, Frankfurt — [2]ExtreMe Matter Institute EMMI, Darmstadt — [3]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt

The HADES detector, installed at the GSI Helmholtzzentrum für Schwerionenforschung, is a unique apparatus to search for new states of matter with rare and penetrating probes. So far, due to the limited granularity of the inner time-of-flight system, measurements were restricted to medium size collision systems. The combined measurement of di-electrons and strangeness in Ar+KCl collisions has provided intriguing results and ask for a heavier collision systems and a higher statistics. A mayor improvement of the spectrometer in terms of granularity and particle identification capability is achieved with the new RPC time-of-flight detectors. The data acquisition was fully replaced introducing a modular system integrating trigger distribution, data transfer and a slow control data traffic to a single optical link. During the 64 hours of the commissioning beam time in August 2011, 17 TByte of data were taken for Au+Au collisions at $E_{kin} = 1.24$ GeV/u.
We present a study of the particle identification capabilities of the new HADES spectrometer. Electrons, pions, kaons, protons and light nuclei can be identified over a broad momentum range after a precise detector alignment and calibration.
Supported by BMBF (06 FY 9100 I), HIC for FAIR, EMMI and GSI.

HK 46.4 Do 14:00 P Foyer

Charged-hadron pseudorapidity distributions at LHC energies in the RDM — •David Roehrscheid and Georg Woslchin — Institut für theoretische Physik, Philosophenweg 16, 69120 Heidelberg

We present calculations for pseudorapidity distributions of charged hadrons in Pb-Pb collisions at LHC in the relativistic diffusion model. Drawing on earlier work on similar distributions at RHIC, we predict RDM parameters and the pseudorapidity distributions of charged hadrons for the next LHC run at 5.52 TeV center of mass energy per nucleon pair.

HK 47: Poster – Struktur und Dynamik von Kernen

Zeit: Donnerstag 14:00–16:00 Raum: P Foyer

HK 47.1 Do 14:00 P Foyer

A next-generation experiment on the Pygmy Dipole Resonance in neutron-rich nuclei — •Philipp Schrock for the R3B-Collaboration — Institut für Kernphysik, Technische Universität Darmstadt, Deutschland

The Pygmy Dipole Resonance (PDR) is a dipole excitation of exotic nuclei occuring at energies around the neutron separation threshold. Though often interpreted as an oscillation of the neutron skin against the core nucleus, the collective nature of PDRs is not definitely proven.

A new experiment on neutron-rich Sn isotopes will be performed with the upgraded R3B-LAND setup at GSI to study the nature of the PDR. The interpretation will be based on a complete-kinematics measurement of all reaction participants. Presented are the main features of the experiment and the analysis concept.

This work is supported by HIC for FAIR.

HK 47.2 Do 14:00 P Foyer

Development of an on-line high-temperature ion source for neutron-rich fission products at TRIGA-SPEC — •Dennis Renisch for the TRIGA-SPEC-Collaboration — Institut für Kernchemie, Johannes Gutenberg-Universität, Mainz, Germany

The TRIGA-SPEC experiment at the TRIGA Mainz research reactor aims to determine ground-state properties of exotic nuclides. It includes the Penning-trap mass spectrometer TRIGA-TRAP and the collinear laser spectroscopy setup TRIGA-LASER. Nuclides of interest are produced in the neutron-induced fission of suitable actinoide isotopes, thermalized in a gas-filled volume and transported to an on-line ion source with a gas-jet. The ion source being constructed has two operation modes: a high-temperature surface ionization mode and a hollow cathode plasma mode. It is expected that the surface mode will yield a high ionization efficiency for certain elements, in the order of at least several percent, whereas the plasma mode has the advantage, that more elements can be ionized but with lower efficiency compared to the surface ionization mode. The current status of the TRIGA-SPEC experiments and the present performance of the on-line ion source will be presented.

HK 47.3 Do 14:00 P Foyer

Investigation of the reaction ^{144}Sm(p,p') under extreme forward angles ⋆ — •Dirk Martin[1], Carlos Bertulani[3], Belash Bozorgian[1], Andreas Krugmann[1], Anna Maria Krumbholz[1], Peter von Neumann-Cosel[1], Norbert Pietralla[1], Iryna Poltoratska[1], Johannes Simonis[1], and Atsushi Tamii[2] — [1]Institut für Kernphysik, TU Darmstadt — [2]Research Center for Nuclear Physics, Osaka, Japan — [3]Texas A&M University, USA

Recent experimental progress and development at RCNP Osaka, Japan [1], allows measurements with intermediate-energy proton beams at very forward angles combined with high energy resolution of the order $\Delta E/E \approx 8 \cdot 10^{-5}$. Using this setup, the total electric and magnetic dipole strength distributions can be extracted. In comparison with a simultaneous measurement on the well-deformed nucleus ^{154}Sm, an experimental study of ^{144}Sm allows to investigate the influence of the deformation on these strength distributions. Differential cross sections under 0° – 4° were determined. By comparison to theoretical predictions of Coulomb excitation using the eikonal approximation [2], the E1 character of the cross sections in the region of the GDR can be confirmed. A qualitative comparison to E1 strength obtained in ^{144}Sm(γ,γ') experiments at the S-DALINAC [3] is discussed.

[1] A. Tamii et al., Nucl. Inst. Meth. A 605, 326 (2009).
[2] C. A. Bertulani et al., Comp. Phys. Comm. 152 (2003) 317-340.
[3] S. Volz et al., Nucl. Phys. A 779 (2006) 1.

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

HK 47.4 Do 14:00 P Foyer

Anregung der Pygmydipolresonanz in ^{140}Ce in einem $(p,p'\gamma)$-Experiment — •Jan Mayer, Vera Derya, Michael Elvers, Janis Endres, Andreas Hennig, Sorin Pascu, Simon Pickstone, Mark Spieker und Andreas Zilges — Institut für Kernphysik, Universität zu Köln

Am Wright Nuclear Structure Laboratory wurde ein Protonenstreuexperiment mit E_p=10,4 MeV am N=82-Kern ^{140}Ce durchgeführt. Die mit Hilfe von neun HPGe-Cloverdetektoren sowie fünf Siliziumdetektoren aufgenommenen Daten wurden auf Anregung der Pygmydipolresonanz (PDR) untersucht. Die Auswertung der $p\gamma$-Koinzidenzmatrix mit Hilfe diagonaler Schnitte zeigt Zerfälle in den Grund- sowie den 2_1^+-Zustand. Für den stark angeregten niederenergetischen Teil der PDR zwischen 3,5 und 5 MeV konnte auf diese Weise ein Branching beobachtet werden.

Gefördert durch die DFG (ZI 510/4-1). J.M., V.D., A.H., S.P. und M.S. sind Mitglieder der Bonn-Cologne Graduate School of Physics and Astronomy.

HK 47.5 Do 14:00 P Foyer

Untersuchung der Pygmydipolresonanz mit unterschiedlichen Sonden — •Janis Endres, Vera Derya, Jan Mayer, Sorin Pascu, Friederike Schlüter, Philipp Scholz, Mark Spieker, Simon Pickstone und Andreas Zilges — Institut für Kernphysik, Universität zu Köln

Die Pygmydipolresonanz is eine Anhäufung von elektrischer Dipolstärke unterhalb und teilweise oberhalb der Teilchenschwelle. Diese Resonanz wird häufig als Oszillation einer Neutronenhaut gegen den Rumpf des Kerns interpretiert. Sowohl zahlreiche Experimente als auch theoretische Berechnungen versuchen, die zugrunde ligende Struktur dieser Resonanz zu untersuchen. Dieser Beitrag gibt eine Übersicht über verschiedene experimentelle Methoden, um die Pygmydipolresonanz anzuregen und nachzuweisen. Neben Experimenten mit reellen Photonen [1,2] werden inelastische Streuexperimente mit hadronischen Sonden vorgestellt [3,4]. Des weiteren werden die Ergebnisse einer Transfer-Reaktion gezeigt. Abschließend werden die Vor- und Nachteile der verschiedenen Methoden diskutiert.

Diese Arbeit ist durch die DFG (ZI 510/4-1) gefördert. V.D., J.M., P.S., M.S. und S.P. sind Mitglieder der Bonn-Cologne Graduate School of Physics and Astronomy.

[1] U. Kneissl *et al.*, J. Phys. G **32** (2006) R217.
[2] D. Savran *et al.*, Phys. Rev. Lett. **100** (2008) 232501.
[3] D. Savran *et al.*, Phys. Rev. Lett. **97** (2006) 172502.
[4] J. Endres *et al.*, Phys. Rev. Lett. **105** (2010) 212503.

HK 47.6 Do 14:00 P Foyer

Investigation of $\omega \to \pi^0\pi^+\pi^-$ in p-p Collisions — •Siddhesh Sawant for the WASA-at-COSY-Collaboration — Indian Institute of Technology Bombay, Mumbai, India

The decay mechanism of the ω meson into $\pi^0\pi^+\pi^-$ can be investigated by comparing the experimentally obtained Dalitz plot with that of theoretical predictions. In order to obtain a high-statistics Dalitz plot, ω mesons are produced in proton beam – proton target collisions at T_p=2.063 GeV and in proton beam – deuteron target collisions at T_p=1.45 GeV and 1.5 GeV at the WASA-at-COSY facility. The poster presents the current status of the analysis with pp collision data.

HK 47.7 Do 14:00 P Foyer

Direct reactions with light neutron-rich nuclei — •Leyla Atar for the LAND-R3B-Collaboration — TU Darmstadt

Quasifree (p,2p) and (p,pn) knockout reactions with radioactive beams in inverse kinematics allow 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 current status of the analysis.
This work is supported by HIC for FAIR.

HK 47.8 Do 14:00 P Foyer

Oblate Deformation des ersten angeregten 2^+ Zustands des radioaktiven Isotops ^{142}Ba mit Hilfe von Coulomb-Anregung an REX-ISOLDE — •Robert Stegmann, Christopher Bauer, Jörg Leske und Norbert Pietralla für die IS411-Kollaboration — Institut für Kernphysik, TU Darmstadt, Germany

Ein Strahl des radioaktiven Isotops $^{142}_{56}$Ba$_{86}$ wurde an einem 0.9 mg/cm^2 dicken ^{96}Mo-Target gestreut. Gamma-Strahlung aus der Coulomb-Anregung wurde mit dem MINIBALL-Array spektroskopiert und die gestreuten Teilchen mit Hilfe eines DSSSD identifiziert. Das spektroskopische Quadrupolmoment des 2_1^+-Zustandes des neutronenreichen ^{142}Ba konnte dabei im Vergleich zu Berechnungen des rein elektromagnetischen Anregungsmechanismus zu $-0.51\,(38)$ eb bestimmt werden. Dieses Ergebnis komplettiert die Untersuchungen zu den Quadrupolmomenten der Barium-Isotopenkette. Es bestätigt Monte-Carlo-Schalenmodellrechnungen [1,2], was am Nachbarisotop ^{140}Ba nicht der Fall war [3].

[1] N. Shimizu, T.Otsuka et al., PRL 86, 1171 (2001)
[2] N. Shimizu, Private Mitteilung
[3] C. Bauer, M.Sc.-Thesis und DPG-Konferenz 2011

Gefördert vom BMBF unter 06DA9041I und vom Land Hessen im Rahmen von HIC for FAIR.

HK 47.9 Do 14:00 P Foyer

Fragment properties from fission of ^{234,238}U induced by 6 -10 MeV bremsstrahlung — •Alf Göök[1], Christian Eckardt[1], Joachim Enders[1], Martin Freudenberger[1],

Franz-Josef Hambsch[2], Peter von Neumann-Cosel[1], Andreas Oberstedt[3,4], Stephan Oberstedt[2], and Achim Richter[1,5] — [1]Institut für Kernphysik, Technische Universität Darmstadt, Germany — [2]EC-JRC IRMM, Geel, Belgium — [3]Akademin för Naturvetenskap och Teknik, Örebro Universitet, Sweden — [4]Fundamental Fysik, Chalmers Tekniska Högskola, Göteborg, Sweden — [5]ECT*, Villazzano (Trento), Italy

Experiments to investigate the photon-induced fission of actinide nuclei at excitation energies in the vicinity of the fission barrier are carried out at the super conducting Darmstadt linear electron accelerator S-DALINAC. A twin Frisch grid ionization chamber is used to deduce mass, total kinetic energy, and angular distributions of the fission fragments. In this contribution results on fission fragment mass and total kinetic energy distributions from ^{234,238}U will be presented along with the currently on-going investigation of ^{234}U and ^{232}Th fragment angular distributions.

Supported by DFG through SFB 634 and by the state of Hesse through the LOEWE center HIC for FAIR.

HK 47.10 Do 14:00 P Foyer

Teilchenidentifikation für In-Beam-Gammaspektroskopie neutronenreicher Aktinide — •Andreas Vogt, Peter Reiter, Benedikt Birkenbach und Kerstin Geibel für die LNL 11.22-Kollaboration — IKP, Universität zu Köln

Am AGATA/PRISMA-Aufbau am INFN Legnaro wurde ein Experiment zur Messung angeregter Zustände der neutronenreichen Aktiniden $^{234-238}$Th und $^{240-242}$U nach Multinukleonentransfer-Reaktionen durchgeführt. Hierzu wurde mit dem TANDEM-ALPI-Beschleuniger ein 1-GeV-Strahl von ^{136}Xe auf ein ^{238}U-Target geschossen. Die strahlähnlichen Reaktionsprodukte werden mit dem PRISMA-Spektrometer, welches unter dem Grazing-Winkel zur Strahlachse stand, nachgewiesen. Zusätzlich wurden drei positionsempfindliche DANTE-MCPs innerhalb der Targetkammer für die Messung von kinematischen Koinzidenz zwischen binären Reaktionsprodukten eingesetzt. Für die Selektion der In-Beam-Gammaspektren von targetähnlichen Kernen werden die PRISMA-Parameter Kernladung Z, Masse m und Energie E der strahlähnlichen Isotope genutzt. Ziel der vorgestellten Analyse ist die optimale Kalibrierung aller Komponenten des PRISMA-Spektrometers um eine bestmögliche Identifikation der schwer zugänglichen neutronenreichen Aktinidenisotope zu erreichen. Wirkungsquerschnitte für die Produktion der seltenen Reaktionskanäle und erste Beispiele für die In-Beam-Gammaspektroskopie in der Th-U-Region werden vorgestellt.

Gefördert unter BMBF 06K-167 und 06KY205I.

HK 47.11 Do 14:00 P Foyer

Messung der Protonen-Neutron Struktur von gerade-gerade Kernen nahe ^{48}Ca am MLL Tandem Labor München — •Hannes Schmeiduch[1], Dennis Mücher[1], Karl-Heinz Speidel[2], Shawn Bishop[1], Roman Gernhäuser[1], Clemens Herlitzius[1], Stefanie Klupp[1], Jörg Leske[3], Katharina Nowak[1], Norbert Pietralla[3] und Dominik Seiler[1] — [1]Physik Department E12, Technische Universität München — [2]Universität Bonn — [3]IKP, Technische Universität Darmstadt

Am Tandem-Beschleuniger des Meier-Leibnitz-Labor Münchens wurde ein Setup zur Messung magnetischer Momente kurzlebiger Zustände durch die Methode der transienten Magnetfelder wieder aufgebaut und verbessert. Zur Teilchenidentifikation Coulomb-gestreuter Teilchen kommen nun positions-sensitive Silizium-Detektoren zum Einsatz. Ziel einer ersten Messung sind die Kerne ^{48}Ti und ^{52}Ti. Es soll untersucht werden, in wie weit der doppelt-magische Kern ^{48}Ca die Kopplung von Proton-und Neutronenpaaren polarisiert. Hierzu soll insbesondere das magnetische Moment des gemischt-symmetrischen Zustandes in ^{48}Ti bestimmt werden. Aufgrund der sehr kurzen Lebensdauer wird das ferromagnetische Target gleichzeitig als Coulomb-Anregungsschicht verwendet. Die Studien sind wichtig um das energetische Verhalten der gemischt-symmetrischen Zustände in dieser Region zu verstehen.

HK 48: Poster – Nukleare Astrophysik

Zeit: Donnerstag 14:00–16:00 Raum: P Foyer

HK 48.1 Do 14:00 P Foyer

Geant4 Simulation eines 4π-Cloveraufbaus — •Christian Ritter, Clemens Beinrucker, Jan Glorius, Konstantin Landwehr, Rene Reifarth und Kerstin Sonnabend — Goethe-Universität Frankfurt

Um das Verhalten der nuklearen Prozesse und somit die Entstehung von Elementen innerhalb von Sternen zu verstehen, ist das Wissen über die Wirkungsquerschnitte der Reaktionen von besonderer Bedeutung. Im Rahmen der Aktivierungsmethode zur Wirkungsquerschnittsbestimmung werden häufig präzise Aktivitätsmessungen mittels Germanium-Detektoren durchgeführt. Ein untergrundoptimierter 4π-Aufbau bestehend aus zwei Clover-Detektoren zur Messung von γ-Quanten wird vorgestellt. Die gute Raumwinkelabdeckung in Kombination mit der Möglichkeit einer kalorimetrischen Messung ermöglicht vergleichsweise hohe Detektionswahrscheinlichkeiten. Eine Monte-Carlo-Simulation des Detektoraufbaus mit Geant4 wird gezeigt und deren Resultate präsentiert. Dazu wurden Kaskaden aus dem Zerfall von ^{60}Co abstandsabhängig simuliert und Effizienzbestimmungen durchgeführt. Außerdem wurde die Energieabhängigkeit der Effizienzen mit monoenergetischen Quellen analysiert. Die Resultate werden im Rahmen des Posters vorgestellt. Dieses Projekt wurde durch die Helmholtznachwuchsgruppe VH-NG-327 unterstützt.

HK 48.2 Do 14:00 P Foyer

Vorbereitung zur Bestimmung des thermischen Wirkungsquerschnitts von ^{60}Fe — •Marcus Mikorski, Clemens Beinrucker, Micaela Fonseca, Tanja Heftrich, Konstantin Landwehr, Rene Reifarth, Christian Ritter, Stefan Schmidt und Kerstin Sonnabend — Institut für Angewandte Physik, Goethe Universität Frankfurt a. M.

Das langlebige ^{60}Fe Isotop ist für die Astrophysik von Interesse, es wird hauptsächlich im s-Prozess in schweren Sternen produziert und kann im All produziert werden. Der thermische Neutroneneinfang von ^{60}Fe soll bei einer Aktivierungsmessung am TRIGA Forschungsreaktor Mainz mit einer ^{60}Fe-Probe, aus dem ERAWAST Programm des PSI in Villigen gewonnen, ermittelt werden.

Hierfür muss im Vorfeld der Aktivierung die Teilchenzahl der Probe, die genaue Effizienz der Detektoren, sowie während der Aktivierung der Neutronenfluss mit Monitoren bestimmt werden.

Es wurden zwei Clover-Detektoren zur Messung der Aktivität der bestrahlten Probe benutzt, um eine 4π Raumabdeckung zu erreichen. Außerdem eignen sich Cloverdetektoren gut für die bei der Messung zu erwartenden hohen Untergundraten der aktivierten Probe. Um die Effizienz der Detektoren zu ermitteln wird eine ^{60}Co-Eichquelle verwendet. Die Vorbereitungen, der Aufbau und die Ergebnisse der Aktivierungsmessung werden vorgestellt.

Dieses Projekt wurde durch die Helmholtznachwuchsgruppe VH-NG-327 unterstützt.

HK 48.3 Do 14:00 P Foyer

Kalibration und Test eines 4π-Bariumfluoriddetektors — •Max Gilbert, Jan Glorius, Tanja Heftrich, Rene Reifarth, Stefan Schmidt und Kerstin Sonnabend — Goethe Universität Frankfurt

Der Karlsruhe-4π-Bariumfluoriddetektor soll für Experimente mit der Frankfurter Neutronenquelle FRANZ, unter anderem zur Bestimmung von Wirkungsquerschnitten bei Nukleosyntheseprozessen eingesetzt werden. Als Vorbereitung darauf wurde er hinsichtlich Energie- und Zeitauflösung getestet und optimiert. Das Szintillationslicht von Bariumfluorid hat zwei Komponenten. Die schnelle Komponente ($t_{1/2}$=600 ps) enthält etwa 15 % der Energie. Die verbleibenden 85% werden in der langsamen Komponente emittiert ($t_{1/2}$=600 ns). Es ist deshalb wichtig, die schnelle Komponente für gute Zeitauflösung und die langsame Komponente für gute Energieauflösung zu detektieren. Aufbau und Ergebnisse sowie Einsatzmöglichkeiten mit FRANZ werden präsentiert.
Dieses Projekt wurde durch die Helmholtznachwuchsgruppe VH-NG-327 unterstützt.

HK 48.4 Do 14:00 P Foyer

Entwicklung eines Hochstromtargets zur Neutronenproduk-

tion für FRANZ — •Stefan Schmidt, Micaela Fonseca, Oliver Meusel, Thomas Metz, René Reifarth und Kerstin Sonnabend — Goethe Universität Frankfurt a. M.

Am Institut für Angewandte Physik der Goethe Universität Frankfurt a. M. wird derzeit die Neutronenquelle FRANZ (Frankfurter Neutronenquelle am Stern-Gerlach-Zentrum) entwickelt. Mit einem Aktivierungs- und einem Flugzeitmodus ermöglicht sie die Messung von Wirkungsquerschnitten für wichtige s-Prozess-Nuklide. Für die Neutronenerzeugung werden Protonen auf Energien zwischen 1,8 und 2,2 MeV bei einer Energieunschärfe von 0,02 MeV beschleunigt und treffen dann auf eine Lithiumschicht, in der durch die Reaktion ^{7}Li(p,n)^{7}Be Neutronen entstehen. Bei Strahlströmen von bis zu 20 mA entstehen hohe Belastungen am Target, das mehrere Kilowatt thermische Strahlleistung abführen muss. Ein am Karlsruhe Van-de-Graaff getesteter Prototyp konnte bereits Aufschluss über mögliche Lösungen zur Kühlung geben, jedoch erforderte die tragende Kupfer-Schicht in diesem Entwurf aufwändige Vorbereitung. Dieser Beitrag soll den momentanen Target-Entwurf mit einem Kühlsystem, das den Neutronenstrahl minimal stört und gleichzeitig die Kühleffizienz maximiert, vorstellen sowie erste Ergebnisse von thermischen Belastungstests zeigen.

Dieses Projekt wird gefördert durch den GIF Research Grant No. G -1051-103.7/2009.

HK 48.5 Do 14:00 P Foyer

Cloveraufbau — •Konstantin Landwehr, Clemens Beinrucker, Jan Glorius, Tanja Heftrich, René Reifarth, Christian Ritter, Stefan Schmidt und Kerstin Sonnabend — Goethe Universität Frankfurt

Neutroneneinfangquerschnitte werden oft mithilfe der Aktivierungsmethode bestimmt. Hierbei wird eine zu untersuchende Probe mit Neutronen der gewünschten Energie bestrahlt und danach in einem untergrundoptimierten Labor ausgezählt. Am Institut für Angewandte Physik der Goethe Universität Frankfurt wurde ein solcher Aufbau realisiert. Er besteht aus zwei Clover Detektoren, die gegenüberliegend in enger Geometrie angeordnet sind. Die aktivierte Probe wird mittels spezieller Probenhalter reproduzierbar und zentriert zwischen den Detektoren platziert. Die Clover Detektoren sind mit passiven Schilden (Pb) und einer aktiven Abschirmung (BGO) umgeben. Die unterschiedlichen Abschirmungen wirken sich in verschieden Energiebereichen jeweils anders aus.

Dieses Poster umfasst die astrophysikalische Motivation und den Aufbau, mit dem später die Ausbeute einer neutronenaktivierten Probe bestimmt werden kann. Ausserdem werden die Ergebnisse der verschiedenen Untergrundmessungen miteinander verglichen. Dieses Projekt wurde durch die Helmholtznachwuchsgruppe VH-NG-327 unterstützt.

HK 48.6 Do 14:00 P Foyer

Simulation von LENA Detektoren — •Susanne Kräckmann[1], Christoph Langer[2], Rene Reifarth[1] und Attila Krasznahorkay et al.[3] — [1]Goethe Universität Frankfurt — [2]GSI Darmstadt — [3]ATOMKI, Debrecen, Ungarn

Das Low Energy Neutron Detector Array (LENA) ist ein neu entwickelter Szintillationsdetektor für niederenergetische Neutronen bis zu einer unteren Schwelle von 100 keV, einem für Ladungsaustauschreaktionen mit niedrigem Energieübertrag interessanten Energiebereich. LENA bietet eine gute Orts- und Zeitauflösung zum Nachweis von Neutronen an Beschleunigerexperimenten im Bereich niedriger Neutronenenergien. Der Detektor wurde in Zusammenarbeit von ATOMKI (Debrecen, Ungarn), der Goethe Universität Frankfurt und der GSI in Darmstadt entwickelt und wurde für das S405- sowie das S408-Experiment am LAND/R^{3}B -Setup der GSI eingesetzt. Um die Detektoreffizienz sowie Orts- un Zeitauflösung der einzelnen Detektoren genauer zu untersuchen, wurden Simulationen mit GEANT4 durchgeführt und diese mit den Ergebnissen der Vorgängerversion GEANT3 verglichen, um Rückschlüsse auf die Genauigkeit der GEANT4-Simulation zu ziehen. Im Rahmen einer Strahlzeit an der PTB in Braunschweig wurden Bestrahlungen des Detektors mit Neutronen verschiedener Energien durchführt. Der Vergleich der experimentellen Daten mit den Simulationen erlaubt Rückschlüsse auf die Neutrondetektionseffizienz sowie die Zeitauflösung als Funktion der Neutronenenergie. Dieses Projekt wurde durch die Helmholtznachwuchsgruppe VH-NG-327 unterstützt.

HK 48.7 Do 14:00 P Foyer

Präzisionsmessung der Photodissoziation des Deuterons bei Energien im Bereich der Big-Bang-Nukleosynthese — •Roland Hannaske[1], Daniel Bemmerer[1], Roland Beyer[1], Evert Birgersson[1], Anna Ferrari[1], Eckart Grosse[1,2], Arnd R. Junghans[1], Mathias Kempe[1], Toni Kögler[1], Krasimir Kosev[1], Michele Marta[1], Ralph Massarczyk[1], Andrija Matic[1], Klaus-Dieter Schilling[1], Georg Schramm[1], Ronald Schwengner[1], Andreas Wagner[1] und Dmitry Yakorev[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, deren Effektivität 2011 an der PTB Braunschweig bestimmt wurde. Wechselwirkungen der emittierten Neutronen mit dem Targetmaterial (23 Schichten aus Aluminium und deuteriertem Polyethylen) wurden simuliert. Der Photonenfluss wurde mit Hilfe der resonanten Streuung an Aluminiumkernen bei Energien von 2,2 und 3,0 MeV bestimmt. Der experimentelle Aufbau, die Datenanalyse sowie vorläufige Ergebnisse werden präsentiert.
[1] R. Hannaske et al., PoS(NIC XI)090 (2010).
Gefördert durch die DFG (JU 2705/1-1).

HK 48.8 Do 14:00 P Foyer

Digitale Auslese eines 4π Clover-Aufbaus — •Clemens Beinrucker, Tanja Heftrich, Konstantin Landwehr, Rene Reifarth, Christian Ritter und Kerstin Sonnabend — Goethe Universität, Frankfurt a. M.

Eine Möglichkeit, kleine, neutroneninduzierte Wirkungsquerschnitte zu messen, ist die Aktivierungsmethode. Die zu untersuchende Probe wird im ersten Schritt mit Neutronen bestrahlt und im zweiten Schritt die induzierte Aktivität bestimmt. Die Messung dieser kleinen Aktivität erfolgt oft mit Germaniumdetektoren mit hoher Raumwinkelabdeckung.

An der Goethe Universität Frankfurt wurde kürzlich ein solcher Aufbau mit zwei Clover-Detektoren in Betrieb genommen. Die Detektoren bestehen jeweils aus vier Germaniumkristallen und sind in enger Geometrie angeordnet, um eine Abdeckung des Raumwinkels von 4π zu erreichen.

Falls die zu untersuchende Probe selbst radioaktiv ist, erhöht dies die Anzahl an Photonen, die im Detektor registriert werden. Zur Messung ist es nötig ein Datenaufnahmesystem zu benutzen, das bei diesen hohen Zählraten mit geringer Totzeit und Pile-Up-Korrektur arbeitet. Eine Möglichkeit zur Realisierung besteht in der Verwendung von Flash Analog-to-Digital-Convertern (FADC) mit hoher Digitalisierungsrate.

Der Aufbau und Messergebnisse werden vorgestellt.

Dieses Projekt wurde durch die Helmholtznachwuchsgruppe VH-NG-327 unterstützt.

HK 48.9 Do 14:00 P Foyer

Proton-induced experiments in storage rings — •Bo Mei[1,2], Ganna Rastrepina[1,2], Rene Reifarth[1,2], and Michael Heil[2] — [1]Goethe Universität Frankfurt a. M. — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH

It is crucial to determine the cross sections of (p, γ) reactions experimentally in Gamow window of p process in order to understand the nucleosynthesis of 35 stable proton-rich nuclides between ^{74}Se and ^{196}Hg, which can neither be produced by s process nor by r process [1]. Storage rings, such as ESR at GSI [2] and CSRe at IMP [3], as a kind of precise spectrometer, can be used to measure cross sections of (p, γ) reactions in Gamow window in inverse kinematics. The advantages of this method are the universality for both stable and unstable nuclides, the low background, and the high efficiency. Recently, a proof-of-principle experiment has been performed successfully at ESR, where the preliminary result about the cross section of proton induced reaction ^{96}Ru(p, γ)^{97}Rh at energy of about 10 AMeV is given in Ref. [4]. A new experiment at ESR has been proposed to measure the cross section of proton induced reaction ^{112}Sn(p, γ)^{113}Sb near Gamow window of p process. 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] B. Franzke, Nucl. Instr. and Meth. B 24/25 (1987) 18.
[3] J. W. Xia et al., Nucl. Instr. and Meth. A 488 (2002) 11.
[4] Q. Zhong et al., Journal of Physics: Conference Series 202 (2010) 012011.

HK 48.10 Do 14:00 P Foyer

Decay investigation of neutron-rich isotopes around the third

r process peak — •Alexey Evdokimov[1,2], Iris Dillmann[1,2], and Michele Marta[1,2] for the S323-S410-Collaboration — [1]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany — [2]II. Physikalisches Institut, Justus-Liebig Universität Giessen, Germany

The "rapid neutron capture" (r) process plays an important role in stellar nucleosynthesis and is responsible for about 50% of the solar abundances beyond iron. The solar r-abundance curve has three maxima at A∼80, 130 and 195, corresponding to neutron-rich precursors around N=50, 82, and 126. Up to now experiments close to the r process path were carried out only for A<150, leaving the region above as "terra incognita". We have for the first time investigated neutron-rich Tl, Hg, Au, and Pt isotopes "south-east" of the N=126 shell closure for β-delayed neutron emission and their half-lives. The experiments were carried out with FRS at GSI with implantation set up consisting of a Si array surrounded by neutron detectors.

These heavy neutron-rich isotopes are also well-suited for a proposed proof-of-principle measurement of β-delayed neutron emitters in a storage ring. Since their half-lives are in the order of seconds, electron cooling can be applied, and the decay half-life and the neutron-emission probability could be deduced from the detection of decay daughters with a particle detector. This method is complementary to the standard method via detection of the neutron. The two experimental approaches are described and compared.

HK 49: Poster – Astroteilchenphysik

Zeit: Donnerstag 14:00–16:00 Raum: P Foyer

HK 49.1 Do 14:00 P Foyer

Tests of High QE PMTs for the Water Cherenkov Muon Veto of XENON1T — •Daniel Pätzold, Serena Fattori, Cyril Grignon, and Uwe Oberlack for the XENON-Collaboration — Johannes Gutenberg Universität Mainz, Germany

The XENON Dark Matter program aims at directly detecting dark matter through the scattering of WIMPs off xenon nuclei. The detection principle is based on the concept of a dual phase xenon time projection chamber. The current experiment XENON100 is a leading dark matter experiment today, and its planned XENON1T successor aims at improving the sensitivity by another two orders of magnitude. A water cherenkov muon veto will be employed to achieve the required background suppression at the depth of the Gran Sasso National Laboratory (LNGS) in Italy. Here we discuss tests performed on high quantum efficiency 8 inch PMTs that will be used for the muon veto system.

HK 49.2 Do 14:00 P Foyer

Assembling and Improvement of a 2-phase Xe TPC for electron drift length measurements — •Sonja Esch, Ethan Brown, Volker Hannen, Christian Huhmann, Hans Kettling, Stephan Rosendahl, Johannes Schulz, and Christian Weinheimer — Institut für Kernphysik, Universität Münster

About 22 % of the universe consists of a new undetected form of matter called dark matter(DM). One highly theoretically motivated candidate for dark matter is the Weakly Interacting Massive Particle (WIMP) from super symmetry. The XENON program looks for these particles by nuclear recoils in liquid xenon in a 2-phase time projection chamber(TPC).

Particle interactions in liquid xenon produce scintillation and ionization. The ionization is drifted then converted to secondary scintillation signal and both are detected by photo multiplier tubes (pmts). Electronegative impurities inhibit the detection of these signals, and radioactive impurities can mimic a DM signal. A small TPC has been built in Münster and implemented in a cryogenic purification system.

The efficiency of purification is tested using γ-sources and measuring the resulting signals. The evolution of purity over time is analyzed. A characterization of the TPC is possible by introducing radioactive tracers to the liquid phase. For reduction of radioactive impurities a distillation column is planned. Its efficiency can be tested using the TPC. First results of the characterization of the TPC will be shown. This project is supported by DFG and the state NRW, contract number INST 211/528-1 FUGG and by BMBF under 05A11PM1 .

HK 50: Poster – Fundamentale Symmetrien

Zeit: Donnerstag 14:00–16:00 Raum: P Foyer

HK 50.1 Do 14:00 P Foyer

Experimental setup for photodetachment studies of the negative positronium ion† — •Stefan Gärtner[1], Hubert Ceeh[2], Christoph Hugenschmidt[2], Klaus Schreckenbach[2], Dirk Schwalm[3], and Peter Thirolf[1] — [1]LMU München, Garching — [2]TU München and FRM II, Garching — [3]MPI für Kernphysik, Heidelberg and Weizmann Institute, Rehovot, Israel

After the recent successful high-precision measurement of the Ps^- ion ($e^+e^-e^-$) decay rate by our group ($\Gamma = 2.0875(50)\,ns^{-1}$ [1]), an experimental setup has been devised for photodetachment studies of this fundamental three-body system at the NEPOMUC high-flux positron source at the FRM II reactor in Garching. Theoretical calculations for the photodetachment cross section [2] will be tested in the off-resonant regime at the two wavelengths (532 nm and 1064 nm) provided by a high-power, high-repetition Nd:YAG laser (100 W average power, 10 kHz repetition rate). The principal feasibility has been shown in [3] using a reflection geometry. By employing a transmission geometry, we aim at a quantitative result and in a later stage at the production of an energy-variable pure ortho-positronium beam, which then can drive further experiments, e. g. spectroscopy of the $1^3S_1 \rightarrow 2^3S_1$ transition in positronium. First experimental results are expected mid of 2012, when the NEPOMUC upgrade to yield an intensity significantly higher than the current $\approx 9 \cdot 10^8$ moderated e^+/s will be completed.
[1] H. Ceeh *et al.*, Phys. Rev. A **84**, 062508 (2011). [2] A. Igarashi *et al.*, New J. Phys. **2**, 17 (2000). [3] K. Michishio *et al.*, Phys. Rev. Lett. **106**, 153401 (2011). †Supported by DFG under contract HA1101/13-1.

HK 50.2 Do 14:00 P Foyer

A Kelvin Probe set-up to measure the work function for *a*SPECT — •Christian Schmidt for the aSPECT-Collaboration — Institut für Physik, Johannes Gutenberg-Universität Mainz

*a*SPECT is a high precision experiment testing and looking for physics beyond the standard model. It utilizes a retardation spectrometer of MAC-E type to measure the proton recoil spectrum in free neutron decay in order to determine the electron antineutrino angular correlation coefficient a. Currently a is determined with a precision of $\frac{\Delta a}{a} \approx 5\%$, whereas *a*SPECT aims for a precision of $\frac{\Delta a}{a} \approx 0.3\%$. For *a*SPECT the potential difference between the decay volume and the retardation electrode has to be known better than 10 mV. The same limit have to be fulfilled for the spatial fluctuations of the potential. The electrode system used for *a*SPECT is made of gold-coated copper. The work function of gold surfaces exhibits fluctuations at a level of 100-200 mV. These fluctuations must be quantified, understood and minimised. Therefore we have set up a Scanning Kelvin Probe System. This Kelvin Probe set-up will also be used to measure the work function of other precision experiments like KATRIN. This poster will present the first measurements and results.

HK 51: Poster – Anwendungen physikalischer Methoden

Zeit: Donnerstag 14:00–16:00 Raum: P Foyer

HK 51.1 Do 14:00 P Foyer

Ortsaufgelöster Lithiumnachweis im menschlichen Gehirn — •Josef Lichtinger[1], Reiner Krücken[1], Roman Gernhäuser[1], Michael Bendel[1], Matthias Graw[2], Elisabeth Mützel[2], Jutta Schöpfer[2], Zsolt Revay[3], Petra Kudejova[3], Lea Canella[3] und Karl Zeitelhack[3] — [1]TU-München, Physik-Dept. E12, D-85748 Garching — [2]LMU-München, Institut für Rechtsmedizin, D-80336 München — [3]FRM II, D-85747 Garching

Die Anzahl der an affektiven Störungen erkrankten Menschen stieg in den letzten Jahren immer mehr an. Diese Erkrankung ist auch die häufigste Ursache für Arbeitsunfähigkeit. Die biologische Ursache der affektiven Störungen ist jedoch nur teilweise bekannt. Lithium wird bei der Behandlung von affektiven Störungen als Antidepressiva-unterstützendes Medikament eingesetzt. Außerdem findet es bei der Prophylaxe von neurodegenerativen Erkrankungen Anwendung. Die genaue Wirkungsweise des Lithiums, kritische Konzentrationen und lokale Anreicherungen im Gehirn sind jedoch bisher noch ungeklärt. Aus diesem Grund wurde eine Messmethode entwickelt, um kleinste Lithiumspuren post mortem im menschlichen Gehirn ortsaufgelöst, mit der Hilfe von Neutronen aus der Forschungs-Neutronenquelle Heinz Maier-Leibnitz (FRM II), nachzuweisen. Für diesen Messaufbau konnte eine Nachweisgrenze für Lithium von 300 $\frac{fg}{cm^2}$ bestimmt werden. Wir stellen das grundsätzliche Konzept der Messmethode und die Targetpräparation vor und zeigen die Rekonstruktion der, in den Gewebeproben enthaltenen, Lithiumkonzentration anhand erster Messergebnisse. Diese Arbeit wird durch DFG (GE2296/1) unterstützt.

HK 51.2 Do 14:00 P Foyer

Die Winkel-kontinuierliche DSA-Methode: Lebensdauer-Messungen mit ortssensitiven Detektorsystemen — •C. Stahl, J. Leske und N. Pietralla — Institut für Kernphysik, Technische Universität Darmstadt

Die Sensitivität der Doppler-Shift-Attenuation-Method (DSAM) für die Bestimmung von Zustands-Lebensdauern unterhalb von ca. 10 ps kann u. A. durch kontaminante Linien, die den untersuchten Übergang überlappen, sowie durch ein Verschmieren des Spektrums aufgrund eines endlichen Detektor-Öffnungswinkels und der Unkenntnis des exakten Nachweisortes der Strahlung im Detektor beschränkt sein.
Mit ortssensitiven HPGe-Detektoren wie dem Advanced Gamma-ray Tracking Array (AGATA) können experimentelle Spektren aufgenommen werden, die (quasi-)kontinuierlich sowohl in Energie als auch Polarwinkel des Nachweisortes im Laborsystem sind. Die Extraktion von Zustands-Lebensdauern aus solchen 2D-Spektren stellt eine neue Qualität von DSAM Lebensdauer-Messungen dar, die insbesondere für Spektren niedriger Intensität Vorteile verspricht, wie sie bei Experimenten mit exotischen, radioaktiven Ionen zu erwarten sind. Für diesen Zweck wurde die winkel-kontinuierliche DSA-Methode entwickelt[1] und in einer Analyse-Software implementiert, die auch für Experimente mit nicht-ortssensitiven Detektoren genutzt werden kann. Coulomb-Anregung und Abbremsverhalten der untersuchten Ionen in Materie wird auf Basis von Geant4 simuliert.
Gefördert vom BMBF unter der Fördernummer 06DA9041I
[1] C. Stahl, Master-Thesis, TU Darmstadt, Oktober 2011

HK 51.3 Do 14:00 P Foyer

Activation of copper by nitrogen and argon beams — •Vera Chetvertkova[1,2], Edil Mustafin[2], Anton Belousov[3], Ludmila Latysheva[4], Ulrich Ratzinger[1], Nikolai Sobolevsky[4], and Ivan Strasik[2] — [1]IAP, Goethe-University, Frankfurt am Main — [2]GSI, Darmstadt — [3]TU, Darmstadt — [4]INR RAS, Moscow

Monte Carlo transport codes are widely used for various purposes in nuclear physics, radiation protection, medical applications, accelerator design etc. Code verification by experiments is needed to be sure that the codes give accurate results. New data on the activation of copper by a nitrogen beam of 500 MeV/u is presented and compared with FLUKA and SHIELD simulation results. The activation of copper by a nitrogen beam is compared to activation by an argon beam and respective simulations. This gives a chance to see the accuracy of the codes at different projectile masses. Correspondences and discrepancies of calculations and experiments are discussed.

HK 52: Poster – Beschleuniger

Zeit: Donnerstag 14:00–16:00 Raum: P Foyer

HK 52.1 Do 14:00 P Foyer

Production of short lived radioactive molecular Carbon beams at ISOLDE/CERN — •Christoph Seiffert[1,2], Thierry Stora[2], Thorsten Kroell[1], Bernard Crepieux[2], and Pekka Suominen[2] — [1]TU Darmstadt — [2]CERN

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 poster presents the progress on this topic and shows results from on-line measurements.

HK 52.2 Do 14:00 P Foyer

Kicker für den FRANZ-ARMADILLO — •Markus Basten, Long Phi Chau, Oliver Meusel, Holger Podlech und Ulrich Ratzinger — Institut für Angewandte Physik, Goethe-Universität Frankfurt am Main

Die Frankfurter Neutronenquelle FRANZ [1] befindet sich im Aufbau. Dabei werden 140 mA Protonen mit einen 175MHz-LINAC auf 2 MeV beschleunigt. In einer Repetitionsrate von 250 kHz verlassen 45.6 ns lange Teilchen-Makro-Pulse den LINAC, welche aus 9 Mikro-Pulsen bestehen. Mit dem ARMADILLO-Bunchkompressor [2] des Mobley-Typs wird der Makro-Puls über Laufzeitdifferenz auf etwa eine Nanosekunde longitudinal komprimiert. Dabei werden maximale Ströme von bis zu 7.7 A am Li-Target erwartet. Über die (p,n)-Reaktion werden Neutronen im astrophysikalisch relevanten Energie-Bereich bis 500 keV produziert. Ein Bestandteil des ARMADILLOs ist der Kicker, welcher die Mikro-Pulse auf Bahnen mit unterschiedlichen Längen ablenkt. Die individuale Winkeldifferenz zwischen den Bahnen wird durch eine angepasste Kickerplatte-Auslegung erreicht. Die Ansätze und Ergebnisse der Auslegung-Studie wird in diesem Beitrag präsentiert.

[1] U. Ratzinger et al., The Driver Linac of the Neutron Source FRANZ, Proc. of IPAC*11, WEPS040 (2011).

[2] L.P. Chau et al., Bunch Compressor for intense Proton Beams, Proc. of LINAC*10, TH203 (2010).

HK 52.3 Do 14:00 P Foyer

Das 1:2-Modell der gekoppelten RFQ-IH-Kombination für FRANZ — •M. Schwarz, M. Heilmann, D. Mäder, O. Meusel, U. Ratzinger und A. Schempp — Institut für Angewandte Physik, Goethe-Universität Frankfurt am Main

Die Frankfurter Neutronenquelle am Stern-Gerlach-Zentrum (FRANZ) ist eine im Aufbau befindliche Forschungsanlage zur Messung von Wirkungsquerschnitten des langsamen Neutroneneinfangs. Dies soll zum genaueren Verständnis der Nukleosyntheseprozesse in Roten Riesen und somit zum Ursprung von rund der Hälfte der schweren Elemente jenseits von Fe-56 beitragen. Weiterhin lassen sich Rückschlüsse auf die Physik von heißen Plasmen unter dem Einfluss von Konvektion, Rotation und magnetischen Feldern ziehen, deren Erkenntnisse u.a. auch für die Forschung an Fusionsreaktoren und zur Transmutation

radioaktiver Abfälle Relevanz haben.

Zwei Linearbeschleuniger (4-Rod-RFQ und IH-DTL) sollen bei FRANZ gekoppelt betrieben, d.h. nur über einem Hochfrequenzsender mit Leistung versorgt werden. Diese Kombination ermöglicht eine Beschleunigung des Protonenstrahls von 120 keV auf 2,03 MeV bei 175 MHz und einer Verlustleistung um 200 kW. Um das Verhalten im gekoppelten Betrieb genauer vorhersagen zu können wurden Modelle im Maßstab 1:2 gebaut und vermessen. Parallel laufende Computersimulationen ermöglichten Vergleiche zu den realen Messwerten und zeigten die hier liegenden Herausforderungen und Lösungsansätze bezüglich Hochfrequenzabstimmung und Feldoptimierungen.

HK 52.4 Do 14:00 P Foyer

Status des Experiments zum Strahltransport in toroidalen Magnetfeldern an der Goethe Universität Frankfurt — •Adem Ates, Martin Droba, Heiko Niebuhr, Oliver Meusel, Ulrich Ratzinger und Joschka Wagner — Institut für Angewandte Physik, Goethe Universität, Frankfurt am Main

Ein niederenergetischer Ionenstrahl wurde im vorgestellten Experiment mit toroidalen magnetischen Feldern durch einen 60° Umlenkbogen transportiert. Es wurde ein starker Einfluss von Feldvariationen sowohl auf die Strahleigenschaften als auch auf die Verteilung der Sekundärelektronen festgestellt. Diese Effekte sollten minimiert werden, um die Injektion in den geplanten Speicherring unter Anwendung von starken ExB-Driften zu gewährleisten. Zerstörungsfreie Diagnosemethoden wurden für das Experiment entwickelt und erfolgreich zur Untersuchung des niederenergetischen Ionenstrahls in der toroidalen Magnetfeldkonfiguration angewandt. Dieser Beitrag präsentiert experimentelle als auch numerische Ergebnisse.

HK 52.5 Do 14:00 P Foyer

Numerische Simulation für niederenergetischen Hochstromspeicherring mit Stellarator-Konfiguration — •Joschka Wagner, Adem Ates, Martin Droba, Heiko Niebuhr, Oliver Meusel und Ulrich Ratzinger — Institut für Angewandte Physik, Goethe Universität, Frankfurt am Main

Die Speicherung von niederenergetischen Ionenstrahlen in einem Hochstromspeicherring mit magnetischen Führungsfeldern wird numerisch untersucht. Die Motivation ist die gespeicherten Strahlen für Messungen von primären Fusions- und multiplen Ionisationsquerschnitten zu verwenden.

Die natürliche Driftkompensation wird in der vorgeschlagenen Struktur mit Figure-8 Konfiguration gewährleistet. Es ist wichtig die gesamte magnetische Struktur zu optimieren und die auftretenden Variationen im Magnetfeld zwischen den Segmenten zu minimieren, um die Einschlusszeiten zu erhöhen. Die berechneten magnetischen Flussflächen und die dazugehörigen Boozer-Koordinaten werden vorgestellt.

HK 52.6 Do 14:00 P Foyer

Elektrische Ablenkung intensiver niederenergetischer Ionenstrahlen — •Hannes Dinter, Martin Droba, Oliver Meusel, Ilja Müller, Daniel Noll, Ulrich Ratzinger, Philipp Schneider, Christopher Wagner und Christoph Wiesner — Institut für Angewandte Physik, Goethe-Universität Frankfurt/Main.

Die Frankfurter Neutronenquelle FRANZ wird Neutronenpulse für Experimente der nuklearen Astrophysik über die 7Li(p,n)-Reaktion bereitstellen. Dazu wird ein primärer Protonenstrahl mit einer Energie von 2 MeV und einem Strom von bis zu 200 mA benötigt, dem bereits im Niederenergiebereich ein Vorpuls mit einer Plateaulänge von 100 ns aufgeprägt wird. Dies gewährleistet ein ExB-Chopper, der am IAP entwickelt wird. Wegen der hohen Ionenstrahlintensitäten und der daraus resultierenden Eigenfelder muss die Feldverteilung des Choppersystems präzise auf die Strahldynamik abgestimmt sein, um Abbildungsfehler und eine Verschlechterung der Strahlqualität zu vermeiden. Eine weitere Herausforderung besteht in einem robusten Design, um den zuverlässigen Einsatz des Choppers für den Strahlbetrieb zu gewährleisten und den Einfluss strahlinduzierter Effekte zu minimieren. Dies betrifft den Schutz der Isolatoren vor Sputtern, die Kühlung der Deflektorplatten sowie die Vermeidung von Hochspannungsdurchbrüchen.

An einem Teststand wurden Helium-Strahlen mit einem elektrischen Deflektor statisch ausgelenkt und die experimentellen Ergebnisse theoretischen Berechnungen und numerischen Simulationen gegenübergestellt. Im Pulsbetrieb wurden Ionenstrahlen verschiedener Energien abgelenkt und die Ionenpulse mit einem Strahltransformator vermessen.

HK 52.7 Do 14:00 P Foyer

Untersuchungen zu Elektronenverlusten in einer Gabor-Plasmalinse — •Stephan Klaproth, Kathrin Schulte, Oliver Meusel, Martin Droba, Benjamin Glaeser und Ulrich Ratzinger — Institut für Angewandte Physik, Goethe-Universität Frankfurt/Main

Durch das elektrische Raumladungsfeld der in der Gabor-Plasmalinse eingeschlossenen Elektronenwolke, können, unter Voraussetzung einer homogenen Elektronendichteverteilung, Ionenstrahlen aberrationsfrei abgebildet werden.

Um die Fokussierqualität der Gabor-Plasmalinse beim Transport hochintensiver Schwerionenstrahlen zu optimieren, ist die Kenntnis der Plasmaparameter in Abhängigkeit von den externen Parametern von entscheidender Bedeutung.

Dabei sind die Elektronenverluste eng gekoppelt mit der Temperatur und Elektronendichte des eingeschlossenen nichtneutralen Plasmas. Über das durch die Elektronen erzeugte Bremsstrahlungsspektrum, können die Verlustkanäle, aber auch die Änderung der Verlustraten in Abhängigkeit der einschließenden Felder, evaluiert werden.

In dem eingereichten Beitrag werden erste Ergebnisse dazu vorgestellt und im Vergleich zu numerischen Simulationen diskutiert.

HK 52.8 Do 14:00 P Foyer

CH-Rebuncher-Kavität für FRANZ — •Anja Seibel, Manuel Heilmann, Oliver Meusel, Holger Podlech und Ulrich Ratzinger — Institut für Angewandte Physik, Goethe Universität Frankfurt am Main

Die CH-Rebuncher-Kavität schließt die Linac-Sektion, bestehend aus einer 4-Rod-RFQ-IH-Struktur des FRANZ-Projektes ab. Der CH-Rebuncher sorgt dabei für die nötige Energievariation im Aktivierungsmode, wobei die finale Energie des Protonenstrahls variabel zwischen 1,8 und 2,2 MeV liegt. Dagegen dient der CH-Rebuncher im Kompressormode dazu die Teilchenpakete in Strahlrichtung zusammenzuhalten, also die Phasenbreite des Strahls zu reduzieren. Es handelt sich um einen 5-Spalt CH-Rebuncher mit einer Betriebsfrequenz von 175 MHz. Das Tuning erfolgt über zwei zylinderförmige Vakuumtuner, wobei einer dynamisch und einer statisch sein wird. Die effektive Shuntimpedanz liegt im Bereich von 70-80 MΩ/m. Insgesamt hat die Kavität eine Verlustleistung von rund 5 kW. Die CH-Kavität braucht eine effiziente Wasserkühlung aller Oberflächen. In der Präsentation wird die Bauweise sowie das Justier-, Einschweiß- und Kühlkonzept der Driftröhren und Stems gezeigt. Bei der Kühlung des Tankmantels wird auf eine doppelwandige Wand zurückgegriffen.

HK 52.9 Do 14:00 P Foyer

Performance of and Atomic Hydrogen Cleaning for Semiconductor-Photocathodes at the S-DALINAC — •Neeraj Kurichiyanil[1], Kurt Aulenbacher[2], Christian Eckardt[1], Joachim Enders[1], Martin Espig[1], Yuliya Fritzsche[1], and Markus Wagner[1] — [1]Institute for Nuclear Physics, TU Darmstadt — [2]Institute for Nuclear Physics, University of Mainz

We report on the performance of semiconductor photocathodes at the source of polarized electrons at the Darmstadt superconducting electron linear accelerator S-DALINAC. Vacuum lifetimes of above 1000 hours and charge lifetimes of 54 C have been achieved between repeated activation cycles. A standalone photocathode-rejuvenating system using atomic hydrogen is being designed for use at the S-DALINAC. In the present two-chamber design cleaning and activation of the cathodes will be carried out in a single chamber and a high-voltage (<10 kV) electrode in the second chamber will be used to test the cathodes. Inclusion of a transport vessel to the system enables fast transfer of cleaned photocathodes to main source of the accelerator. A beam of up to 10 keV polarized electrons will be available for performing quantum efficiency measurements and additional experiments. Improvement of vacuum and charge lifetimes of the cathode through systematic study of the factors causing cathode-deterioration is one of the objectives. Cathode performance is crucial for future applications of high-brightness polarized beams such as energy-recovery accelerator schemes or polarized electron targets. Supported by DFG through SFB 634 and by the state of Hesse within the LOEWE centre HIC for FAIR.

HK 52.10 Do 14:00 P Foyer

Optische Ionenstrahldiagnose — •Christopher Wagner, Oliver Meusel, Ulrich Ratzinger und Hermine Reichau — Institut für Angewandte Physik, Goethe Universität, Frankfurt

In modernen Beschleunigerexperimenten werden immer höhere Strahlintensitäten benötigt. Die Leistungsdeposition in klassischen Messinstrumenten wie z.B. einer Schlitz-Gitter-Emittanzmessanlage würde

zu dessen Zerstörung führen. Daher ist es für die Diagnose hochintensiver Ionenstrahlen notwendig, neue, zerstörungsfreie Methoden zu entwickeln. Eine Möglichkeit bietet die optische Messung der Restgas-Fluoreszenzprofile. Zu diesem Zweck wurde ein Rotationstank entwickelt, mit dessen Hilfe optische Profile in 270 Grad um den Ionenstrahl aufgenommen werden können. Unter Zuhilfenahme tomographischer Algorithmen kann der Orts- und Phasenraum rekonstruiert werden. Erste Untersuchungen finden an einem Heliumstrahl bei Intensitäten kleiner als 1mA statt, um die Genauigkeit der Methode zu bestimmen und die Funktionalität der Algorithmen zu validieren. Diese Methode wird am niederenergetische Protonenstrahl der Frankfurter Neutronenquelle am Stern-Gerlach-Zentrum (FRANZ) bei 120 keV mit 150 mA zur Anwendung kommen.

HK 52.11 Do 14:00 P Foyer

Status Report of Superconducting CH Cavities for the Low and Medium Energy Range — Florian Dziuba[1], •Marco Busch[1], Michael Amberg[3], Holger Podlech[1], Ulrich Ratzinger[1], Winfried Barth[2], Sascha Mickat[2], and Kurz Aulenbacher[3] — [1]IAP, Uni Frankfurt — [2]GSI, Darmstadt — [3]HIM, Mainz

To demonstrate the operation ability of superconducting (s.c.) CH cavity technology two structures of this type are under development at the Institute for Applied Physics (IAP) of Frankfurt University. The construction of a s.c. 325 MHz CH cavity with 7 cells and an envisaged design gradient of 5 MV/m is finished and will be tested in the next months under cryogenic conditions with full RF power.

Furthermore, the production study of a 217 MHz CH structure with 15 accelerating cells and a design gradient of 5.1 MV/m is finished. This cavity will serve as demonstrator for the planned s.c. cw LINAC at GSI. The proposed cw LINAC is highly requested to fulfil the requirements of nuclear chemistry and especially for a competitive production of new Super Heavy Elements (SHE) in future. A full performance test by injecting and accelerating a beam from the GSI High Charge Injector (HLI) is planned in 2013/14.

The current status of both s.c. CH cavities is presented.

HK 53: Poster – Instrumentation

Zeit: Donnerstag 14:00–16:00 Raum: P Foyer

HK 53.1 Do 14:00 P Foyer

Charged Particle Identification in Reactions with Open Strangeness 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, including elementary kaon production as well as decay-pion spectroscopy of electro-produced Λ-hypernuclei.

For charged particle detection three high-resolution magnetic spectrometers and the Kaos spectrometer, specially dedicated to the detection of kaons, are used. The detector system of Kaos was upgraded for these experiments to operate even at very forward scattering angles with respect to the 1.5 GeV electron beam. It features a set of multiwire proportional chambers, a TOF system with two scintillator walls and a Cherenkov detector of $n = 1.05$ aerogel.

Single-arm particle identification with Kaos for momenta up to 1.2 GeV/c as well as the timing performance in coincidence measurements will be presented, including the separation of $e^{\pm}$, μ^{-}, $\pi^{\pm}$, K^{+} and p from nuclear targets. Where the identification of kaons on top of a huge background of positrons is one of the major challenges of the experiment.

This project is supported by EU HadronPhysics2 (SPHERE).

HK 53.2 Do 14:00 P Foyer

Antiproton-proton elastic scattering as a day-one experiment at HESR — •Huagen Xu[1], James Ritman[1], and Qiang Hu[2] — [1]Forschungszentrum Jülich — [2]Institute of Modern Physics CAS

The conceptual design of the luminosity monitor for the PANDA experiment is based on measuring the differential elastic Antiproton-Proton scattering rate. The detector will be located at about 10m downstream of the target and will measure forward outgoing antiprotons which are emitted at angles of 3-8 mrad relative to the beam axis. The polar angle of the scattered antiproton will be reconstructed by measuring its track with 4 planes of silicon strip detectors. The absolute precision is limited by the lack of existing data on this system in the relevant momentum region, therefore a day-one experiment at HESR dedicated to antiproton-proton elastic scattering has been proposed. The goal of this experiment is to measure a wide range of 4-momentum transfer t (0.0008-0.1 GeV^2) so that the contribution of the physical differential distributions to the absolute luminosity uncertainty is less than 1%. The polar angle of scattered antiprotons and the energy of recoil protons will be measured at forward angles by tracking detectors and by thick energy detectors near 90°, respectively. The conceptual design of the day-one experiment is finished. Part of device has been fabricated and commissioning of them with proton-proton elastic scattering will take place at COSY in the upcoming years.

HK 53.3 Do 14:00 P Foyer

Eine schnelle Ausleseelektronik für das A4 Experiment an MAMI — •Boris Gläser für die A4-Kollaboration — Institut für Kernphysik, Universität Mainz, Deutschland

Die Entwicklung schneller Elektronik spielt eine wichtige Rolle in der Physik, da experimentell messbare Raten generell von der verwendeten Ausleseelektronik begrenzt werden. Im Rahmen der A4 Kollaboration wurde eine schnelle, parallele und hochgradig vernetzte Ausleseelektronik für das aus 1022 PbF2 Kristallen bestehende A4-Kalorimeter entwickelt, die in der Lage ist, die auftretende Ereignisrate von über 100 MHz ohne nennenswerte Totzeitverluste zu verarbeiten. Die Ausleseelektronik spaltet sich in zwei Hauptbereiche auf. Im ersten werden die die eingehenden Photomultipliersignale analog mit einer Bandbreite von 1 GHz verarbeitet, wobei hier die Triggerbedingungen festgelegt werden und die zu verarbeitenden Signale analog summiert und mit schnellen Flash-ADCs digitalisiert werden. Ein Kanal ist hierbei einem Detektorkristall zugeordnet und mit seinen Nachbarkanälen vernetzt. Der zweite Teil ist für die Histogrammierung der digitalen Signale zuständig. Anwendung findet das System im A4-Experiment am Mainzer Mikrotron (MAMI), an dem die Strangeness-Beiträge zu den Vektor-Formfaktoren des Nukleons untersucht werden. Dies geschieht über die Messung der paritätsverletzenden Asymmetrie in der elastischen Streuung longitudinal polarisierter Elektronen an unpolarisierten Protonen.

Der Beitrag veranschaulicht die Funktion und Realisierung der entwickelten Ausleseelektronik sowie deren Verhalten im experimentellen Betrieb.

HK 53.4 Do 14:00 P Foyer

Charakterisierung von Silizium-Streifendetektoren für den PANDA MVD* — •Hans-Georg Zaunick[1], Dariusch Deermann[1,2], Robert Schnell[1] und Juraphan Tummo[1] — [1]Helmholtz-Institut für Strahlen- und Kernphysik, Rheinische Friedrich-Wilhelms-Universität Bonn, Nussallee 14-16, 53115 Bonn — [2]Forschungszentrum Jülich GmbH, Institut für Kernphysik 1, 52425 Jülich

Im Rahmen des PANDA-Experimentes am zukünftigen Beschleunigerzentrum FAIR sollen Vernichtungsreaktionen des Antiprotonenstrahls mit Protonen des stationären Targets (Wasserstoff und schwere Kerne) untersucht werden. Der Mikro-Vertex-Detektor (MVD) als Teil des Trackingdetektorsystems soll hoch aufgelöste Spurvermessung und das Erkennen sekundärer Vertizes ermöglichen. Die hohe Wechselwirkungsrate von bis zu $2{\cdot}10^7$ Ereignissen pro Sekunde bewirkt eine hohe Strahlenbelastung der eingesetzten Komponenten über die Betriebszeit des Detektors. Dieser Beitrag betrachtet Tests von doppelseitigen Silizium-Streifendetektoren aus der Prototypenproduktion für den PANDA MVD. Charakterisierungen über Leckstrom- und Kapazitätsmessungen sowie Ergebnisse von Bestrahlungen am Bonner Zyklotron werden vorgestellt.

*Unterstützt vom BMBF, GSI FEE und JCHP, Jülich.

HK 53.5 Do 14:00 P Foyer

Simulation of the material budget of the CBM-MVD for the SIS-100* — •Tobias Tischler, Samir Amar-Youcef, Michael Deveaux, Michal Koziel, Christian Müntz, Christoph

Schrader, 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.

We present a design study of the MVD for SIS-100 and its implementation into the CBM simulation package CbmRoot. Based on that a realistic estimation of the material budget of the SIS-100 MVD will be presented and discussed.

*supported by HIC for FAIR, the GSI Helmholtzzentrum für Schwerionenforschung, BMBF grant 06FY9099I, ULISI (EU-FP7)

HK 53.6 Do 14:00 P Foyer

Upgrade of the Jülich Digital Readout System for the Development of the $\overline{\text{P}}$ANDA-MVD — •Simone Esch[1], Tobias Stockmanns[1], Marius C. Mertens[1], Michael Ramm[2], Wilhelm Erven[2], and James Ritman[1] for the PANDA-Collaboration — [1]IKP Forschungszentrum Jülich — [2]ZEL 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 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, 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 control these devices under test (DUT) 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 DUTs. To meet the requirements of an upcoming full size ToPix prototype and online analysis an upgrade of the Jülich Digital Readout System was developed. The Xilinx ML605 evaluation board with the Virtex 6 is the main hardware component of the upgraded system providing a 1 GBit/s optical connection and 2 Gb DDR3 RAM. The DUT can be connected via a 160 pin free configurable connector to the FPGA. An overview about the system componentens and measurements of the ToPix prototype with the new readout system will be shown.

HK 53.7 Do 14:00 P Foyer

Investigation of the Position-Resolved Timing Performance of a Time-of-Flight Detector for IMS at the FRS-ESR — •Wayne Lippert[1], Marcel Diwisch[1], Hans Geissel[1,2], Ronja Knöbel[1,2], Natalia Kuzminchuk[1,2], Wolfgang Plass[1,2], and Christoph Scheidenberger[1,2] — [1]Justus-Liebig-Universität Gießen — [2]GSI, Darmstadt

High-precision mass measurements of exotic nuclei can be performed using Isochronous Mass Spectrometry at the FRS-ESR facility at GSI. The mass values are obtained from the revolution time measurement by a time-of-flight detector placed in the storage ring. In the detector the ions pass a thin carbon foil and release secondary electrons, which are then transported to micro channel plates by magnetic and electric fields. The timing performance of the detector is of high importance because it directly influences the mass measurement accuracy.

The timing accuracy of the detector has been investigated. An aperture assembly enabling measurement of the spatially resolved accuracy was constructed and mounted inside the detector. The setup consists of a Si detector and a movable aperture. Only those ions that pass through the aperture and impinge on the Si detector are considered for the time determination. First measurements are in good agreement with previous studies and allow one to understand the spatial contribution to the timing resolution. The design of the assembly as well as the first measurement results will be presented.

HK 53.8 Do 14:00 P Foyer

GANDALF Framework - Auslese und Triggereinheit für den CAMERA Detektor — Tobias Baumann, Maximilian Büchele, Horst Fischer, Matthias Gorzellik, •Florian Herrmann, Philipp Jörg, Kay Königsmann, Tobias Kunz, Christoph Michalski, Christian Schill, Sebastian Schopferer und Tobias Szameitat — Physikalisches Institut, Universität Freiburg

Am COMPASS-II Experiment müssen Rückstoßprotonen unter großen Winkeln identifiziert werden. Mit dem dafür entwickelten CAMERA Detektor wird die Flugzeit der Protonen und deren Energiedeposition in Szintillatorstreifen gemessen. Das GANDALF Framework stellt ein elektronisches Auslesesystem dar, das in der Lage ist die benötigte Zeit- und Amplitudeninformation zu extrahieren und ebenfalls aus diesen Informationen in Echtzeit eine Triggerentscheidung zu fällen. Dafür werden auf GANDALF Modulen Pulsformalgorithmen auf die mit bis zu 1GS/s und 12bit digitalisierten Daten online angewendet. Für die Berechnung der Zeitpunkte mit einer Auflösung von besser als 50ps sind die GANDALF Module mit Virtex-5 FPGAs ausgestattet. Zusätzlich erlaubt das VXS Interface eine Kommunikation zur zentralen TIGER Einheit des Crates. Diese ermöglicht die gemeinsame Verarbeitung aller Detektorkanäle zu einem Protontrigger. Für die Umsetzung einer schnellen Triggerentscheidung ist das TIGER Modul mit einem Virtex-6 SXT FPGA und einer MXM GPU ausgestattet. Die Datenauslese der angeschlossenen Detektorkanäle kann über SFP+ Schnittstellen des TIGER Moduls erfolgen. Dieses Projekt wird vom BMBF und EU FP7 unterstützt.

HK 53.9 Do 14:00 P Foyer

Tagger electronics for the BGO-OD experiment* — •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 128 channel hodoscope with an expected rate up to 10MHz per single channel and 50MHz for the total detector. A coincidence between two neighbouring 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. The final prototype for the Front-End electronics was designed and tested. The tests results will be presented in this poster.

*Supported by the DFG (SFB/TR-16)

HK 53.10 Do 14:00 P Foyer

Implementation of a High Resolution (<11 ps RMS) Time-to-Digital Converter in a Field Programmable Gate Array — Cahit Ugur[1], Eugen Bayer[2], Nikolaus Kurz[3], •Jan Michel[4], and Michael Traxler[3] — [1]Helmholtz-Institut Mainz, Johannes Gutenberg-Universität Mainz, Mainz, Germany — [2]Department for Digital Electronics, University Kassel, Kassel, Germany — [3]GSI Helmholtz Centre for Heavy Ion Research, Darmstadt, Germany — [4]Institute for Nuclear Physics, Goethe University Frankfurt, Frankfurt, Germany

A high resolution time-to-digital converter (TDC) was implemented in a general purpose field-programmable gate array (FPGA), a re-programmable digital chip. RMS and the time resolution of different channels are calculated for one clock cycle (5 ns) interval and a minimum of 10.3 ps RMS on two channels is achieved, which yields to a time resolution of 7.3 ps (10.3 ps/$\sqrt{2}$) on a single channel. The TDC can be used in time-of-flight, time-over-threshold, drift time measurement applications as well as many other measurements with specific Front-End Electronics (FEE), e.g. charge measurements with charge-to-width (Q2W) FEE. The re-programmable flexibility of FPGAs also allows to have application specific features, e.g. trigger window, zero dead time etc.

HK 53.11 Do 14:00 P Foyer

Entwicklung eines Datenaufnahmekonzeptes für das QCLAM-Spektrometer am S-DALINAC — •Andreas Köhler, Simela Aslanidou, Jonny Birkhan, Uwe Bonnes, Joachim Enders, Christoph Kremer, Andreas Krugmann, Peter von Neumann-Cosel und Norbert Pietralla — Institut für Kernphysik, Technische Universität Darmstadt, Germany

Das existierende Datenaufnahmesystem des QCLAM-Magnetspektrometers für Elektronenstreuexperimente am supraleitenden Darmstädter Linearbeschleuniger S-DALINAC geht zurück auf die 1990er Jahre. Gestiegene Anforderungen und Weiterentwicklungen von Hard- und Softwarekomponenten machen eine Neukonzeption erforderlich. Wir stellen ein Konzept vor, das die Integration der Driftkammer-Daten des Spektrometers im Rahmen des GSI-Multi-Branch-Systems vor-

sieht, unter Verwendung einer Eigenentwicklung von Diskriminatoren und TDCs auf FPGA-Basis. Dieses System erlaubt, weitere Detektorsysteme für Koinzidenzexperimente einzubinden und die Daten den Speichermedien sowie einer Online-Analyse zuzuführen. 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 53.12 Do 14:00 P Foyer

A Disc-DIRC for Experiments at WASA and as a Test Detector for PANDA* — •Evgueny Doroshkevich for the WASA-at-COSY-Collaboration — Physikalisches Institut, Univ. Tübingen

For a precise measurement of the velocity of highly relativistic particles the detection of Cherenkov light is very attractive. Detectors based on the Detection of Internally Reflected Cherenkov Light (DIRC) - first built and used in the BaBar experiment - are also planned for the PANDA detector at FAIR, both in form of a barrel-DIRC and in form of a disc-DIRC. In both cases the Cherenkov rings are reconstructed from the internally reflected Cherenkov light deflected into position sensitive detectors.

For the WASA Forward Detector setup a Disc-DIRC quarter has been built, which serves both as a test module for PANDA and an important upgrade of the WASA detector [1]. For an optimal performance at WASA the Disc-DIRC-Quarter is tilted by 20° out of the vertical plane. The internally reflected Cherenkov light is guided to multi-anode photomultipliers by focussing light guides, which are made of plexiglass, *i.e.* the same material the radiator is made of. Results from first tests in the COSY beam will be reported.

[1] M. Bashkanov et al., JINST **6**, C10002 (2011)

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

HK 53.13 Do 14:00 P Foyer

Interpretation von Strahlenschäden bei mit Reaktorneutronen bestrahlten MAPS* — •Paul Scharrer für die CBM-MVD-Kollaboration — Goethe-Universität, Frankfurt

CMOS Monolithic Active Pixel Sensoren (MAPS) sollen als Sensoren in den Mikro-Vertex-Detektoren der Schwerionenexperimente STAR und CBM eingesetzt werden. Um dies zu ermöglichen, wurde ihre Toleranz gegen nicht-ionisierende Strahlung um etwa zwei Größenordnungen von $\sim 10^{12}$ n_{eq}/cm^2 auf $\sim 10^{14}$ n_{eq}/cm^2 gesteigert.

Diese Strahlentoleranz wird durch Bestrahlung der Sensoren mit Reaktor-Neutronen geprüft. Bei der Interpretation der Ergebnisse der nachfolgenden Tests wurde bisher angenommen, dass die durch parasitäre Gammastrahlung des Reaktors erzeugten Oberflächenschäden im Sensor vernachlässigt werden können. Beobachtete Effekte wurden folglich den durch die Neutronen verursachten Volumenschäden zugeordnet.

Die vorliegende Studie prüft die Gültigkeit dieser Annahme für die bei aktuellen Bestrahlungen anfallenden parasitären Dosen von bis zu 3 MRad und entwickelt Empfehlungen zur Verbesserung des Messverfahrens.

*gefördert durch das BMBF (06FY9099I), HIC for FAIR und GSI (F&E)

HK 53.14 Do 14:00 P Foyer

Modernisierung der Anlage zur 180° Streuung am QClam-Spektrometer des S-DALINAC — •Christoph Kremer, Belash Bozorgian, Sebastian Heil und Peter von Neumann-Cosel — Institut für Kernphysik, TU Darmstadt

Elektronenstreuexperimente unter 180° eignen sich hervorragend für die Untersuchung transversaler Kernanregungen. Seit Mitte der 1990er Jahre ermöglicht ein spezielles Magnetsystem am supraleitenden Darmstädter Linearbeschleuniger S-DALINAC die Durchführung solcher Experimente am QClam-Spektrometer. Der bisherige Separationsmagnet erzeugte durch seine begrenzte vertikale Öffnung Untergrund durch Wechselwirkung mit dem Strahlhalo [1]. Der geringe Abstand der Polschuhe beschränkte zusätzlich den Raumwinkelbereich der Messung. Um die Inbetriebnahme eines neuen Separationsmagneten mit vergrößertem Polschuhabstand vorzubereiten wurden die Abbildungseigenschaften des resultierenden Gesamtsystems mit CST Particle Studio simuliert[2]. Der Einfluss des neuen Separationsmagneten auf die Abbildungseigenschaften des Spektrometers wird illustriert. Gefördert durch die DFG (SFB 634).

[1] F. Neumeyer, *Untersuchung magnetischer Kernanregungen in ^{48}Ca und ^{90}Zr mit hochauflösender Elektronenstreuung unter 180° am S-DALINAC*, Dissertation, TU Darmstadt (1997)
[2] S. Heil, *Simulation des Magnetsystens des 180° Streuexperiments am QClam-Spektrometer in CST Studio*, Bachelor-Thesis, TU Darmstadt (2011)

HK 53.15 Do 14:00 P Foyer

Entwicklung und Bau eines DIRC-Detektors für das WASA@COSY Experiment — •Liwen Li, Adrian Schmidt, Wolfgang Eyrich, Christoph Adolph und Florian Hauenstein — Physikalisches Institut IV, Universität Erlangen-Nürnberg, Deutschland

Am COSY-Speicherring lassen sich mit dem WASA Detektor die diversen Mesonen Zerfälle in Proton-Proton-Kollisionen untersuchen. Simulationen haben bereits die Möglichkeit zur Verbesserung des Missing Mass Spektrums durch den Einbau eines ringabbildenden DIRC (Detection of internally reflected Cherenkov Light) im Raumbereich des WASA-Vorwärtsdetektors gezeigt.
Nach positiven Messergebnissen eines Viertel-DIRC-Detektor-Prototypen an einen externen Messplatz soll nun ein Demonstrationsdetektor parallel zum vorhandenen Forward Range Hodoskope in das WASA Experiment integriert werden. Dieser dient ebenfalls als Testdetektor für das PANDA-DIRC-Projekt. Präsentiert werden das mechanische Design des Detektors sowie die Performance der einzelnen Komponenten, insbesonders der Multianoden-Photomultiplier Hamamatsu R8900-100-M16 mit erhöhter Quanteneffizienz in Hinblick auf die Anforderungen des Experiments.

Gefördert durch BMBF und FZ Jülich

HK 53.16 Do 14:00 P Foyer

APDs as Single-photon detectors for visible and near infrared wavelengths at SPECTRAP — Wladimir Buglak[1], Volker Hannen[1], •Raphael Jöhren[1], Jonas Mader[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, detectors with single-photon counting capability in the visible and near-infrared regime are required. For the wavelength region from 300 nm up to 1100 nm we investigate the performance of 2×2 mm^2 silicon avalanche photo diodes (APDs) of type S0223 manufactured by Radiation Monitoring Devices. To minimize thermal noise, the APDs are cooled to approximately -170°C using liquid nitrogen. By operating the diodes close to the breakdown voltage it is possible to achieve gains in excess of $2 \cdot 10^4$. Extremely low-noise preamplifiers are used to read out the devices. The poster will present recent measurements that have been obtained with a gain of $2.2 \cdot 10^4$. At a discriminator threshold of 6 mV the resulting dark count rate is in the region of 200 s^{-1} with a photodetection efficiency of (67 ± 7)% at 628 nm. Tests at 1020 nm result in a photodetection efficiency of (13 ± 3)% which, like the results at shorter wavelength, is in the order of the APD's quantum efficiency.

Supported by BMBF under contract number 06MS9152I.

HK 53.17 Do 14:00 P Foyer

Weiterentwicklung des experimentellen Aufbaus für Experimente der Form (e,e'p) und (e,e'pp) an ^{3}He — •Simela Aslanidou[1], Jonny Birkhan[1], Thorsten Kröll[1], Peter v. Neumann-Cosel[1], Gabriel Schaumann[1] und McLean Taylor[2] — [1]Institut für Kernphysik, Technische Universität Darmstadt — [2]University of Saskatchewan

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 wird aktuell ein Detektorball aus Siliziumzählern aufgebaut, 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 Fagestellungen 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] Oliver Schmitt, Diplomarbeit, TU-Darmstadt (2005)

HK 53.18 Do 14:00 P Foyer

Ein optimierter Algorithmus zur Simulation des Signalladungstransports in MAPS* — •Jonathan Enders für die CBM-MVD-Kollaboration — Goethe-Universität, Frankfurt

Um den Mikro-Vertex-Detektor des CBM-Experimentes auslegen zu können, werden GEANT-Simulationen benötigt. Diese müssen das Ansprechverhalten der im Detektor verbauten CMOS Monolithic Active Pixel Sensoren (MAPS) präzise wiedergeben. Hierzu wurde in der Vergangenheit ein Digitizer entwickelt und erfolgreich eingesetzt.

Um die für die Simulationen benötigte Rechenzeit zu senken, wurde in dieser Arbeit der Digitizer weiter auf Geschwindigkeit optimiert. Hierzu wurden Algorithmen zur Darstellung des Transports der Signalelektronen im aktiven Volumen des Sensors entwickelt und getestet. Die Vor- und Nachteile dieser Algorithmen im Hinblick auf genaue Beschreibung der Physik und benötigte Rechenzeit werden diskutiert.

*gefördert durch das BMBF (06FY9099I), HIC for FAIR und GSI

HK 53.19 Do 14:00 P Foyer

Abhängigkeit der Spurrektionstruktionseffizienz des CBM Mikro-Vertex-Detektors (MVD) von der Anzahl der Detektorstationen* — •Christian Trageser für die CBM-MVD-Kollaboration — Goethe-Universität, Frankfurt

Das CBM-Experiment strebt es an, Open-Charm-Teilchen durch Auffinden ihres sekundären Zerfallsvertex zu rekonstruieren. Dies erfordert eine besonders effiziente Spurrekonstruktion bei Spurdichten von $\sim 10/\mathrm{mm}^2$. Eine besondere Herausforderung für die Spurverfolgung stellt dabei der mit 20 cm ungewöhnlich hohe Abstand zwischen dem MVD und dem Silicon Tracking System (STS) von CBM dar.

Die vorliegende Simulationsstudie befasst sich mit der Frage, ob das aktuelle, kostengünstige Systemdesign für eine zuverlässige Spurverfolgung hinreichend ist. Gleichzeitig wurde quantitativ geprüft, welche Effizienzgewinne durch eine mögliche Ergänzung von zusätzlichen Detektorebenen zwischen beiden Detektorsystemen zu erwarten sind.

*gefördert durch HIC for FAIR, GSI Helmholtzzentrum für Schwerionenforschung und BMBF (06FY9099I)

HK 53.20 Do 14:00 P Foyer

PANDA DIRC Simulation and Reconstruction — 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

At the future facility for anti-proton and ion research (FAIR) at GSI, Darmstadt the PANDA experiment will study the physics of strong interactions. A dedicated system is required which provides excellent particle identification at a large angular and momentum range. A ring imaging Cherenkov detector based on the BABAR DIRC (Detection of Internally Reflected Cherenkov Light) will be used in the barrel region around the main interaction point. Long rectangular bars with a cross section of 17 mm × 32 mm, made from synthetic fused silica, serve as radiators and light guides.

An alternative design based on wide fused silica plates (≈ 160 mm) offers potential cost savings compared to bars. We will present a study of the performance of this design using Geant4 simulation and a fast reconstruction algorithm to determine the single photon Cherenkov angle resolution and the light yield.

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 53.21 Do 14:00 P Foyer

Performance simulation studies of a realistic model of the CBM Silicon Tracking System — •Anna Kotynia for the CBM-Collaboration — GSI Darmstadt

One of the most challenging fields of modern high-energy physics is exploration of the phase diagram of strongly interacting matter. In order to study the dynamics of phase diagram at high net baryon densities, the CBM experiment will be performed with high-energy nucleus-nucleus collisions. Efficient charged particle tracking and high momentum resolution are central performance requirements of the CBM Silicon Tracking System (STS). The aim of ongoing layout studies is to design a highly granular and low mass detector system that can track the 1000 charged particles that are typically generated in Au+Au collisions at 25 GeV/u projectile energy. A low mass detector is required to achieve a momentum resolution down to 1%. The simulations of detector responce which have been developed include of detector responce include complete chain of physical processes caused by a charged particle traversing the detector - from charge creation in the silicon to the digital output signals. We will present the concept of STS geometry, tools used for simulation of realistic detector responce together with discussion about results of such simulations. Supported by EU-FP7 HadronPhysics3 and HGS-HIRe for FAIR.

HK 53.22 Do 14:00 P Foyer

Polarisationssensitivität eines segmentierten HPGe-Kristalls vom AGATA-Typ — •B. Alikhani[1], A. Givechev[1], A. Heinz[2], P.R. John[1], J. Leske[1], M. Lettmann[1], O. Möller[1], N. Pietralla[1] und C. Röder[1] — [1]Institut für Kernphysik, Technische Universität Darmstadt, Germany — [2]Subatomic Physics division, Chalmers University of Technology, SE-412 96 Gothenburg, Sweden

Die Parität angeregter Kernzustände ist neben Anregungsenergie und Spin eine wichtige Observable für die Kernstruktur. Zu ihrer Bestimmung wird in der sog. Compton-Polarimetrie die Compton-Streuung der aus den angeregten Zuständen ausgesendeten Quanten genutzt[1]. Das Darmstadt GAmma-ray Tracking Assembly (DAGATA), das zu diesem Zweck in KRF-Experimenten am Darmstädter S-DALINAC verwendet werden soll, besteht zurzeit aus einem 36-fach segmentierten HPGe AGATA-Kristall. Die hohe Orts-, Energieauflösung und Nachweiseffizienz führen zu einer größeren Polarisationssensitivität im Vergleich zu konventionellen Compton-Polarimetern. Ein Formalismus für die Polarisationsanalyse für ein hoch segmentiertes Polarimeter wurde hergeleitet[2]. Dieser Formalismus und die Ergebnisse eines Kalibrierungsexperiments mit einer ^{60}Co-Quelle zur Bestimmung der Polarisationssensitivität des DAGATA-Polarimeters werden präsentiert.

*Gefördert durch DFG (SFB 634) und LOEWE (HIC for FAIR)

[1] U. Kneissl, N. Pietralla, Andreas Zilges, J. Phys. G: Nucl. Part. Phys. 32 R217 [2] B. Alikhani et al, Nucl. Instr. Meth. Phys. Res. A (subm. 2011)

HK 53.23 Do 14:00 P Foyer

Time of flight with a segmented plastic finger detector at high particle rate — •Frederic Ameil[1], Miroslav Danchev[2], Plamen Boutachkov[3], Jan Kurcewicz[1], Stephane Pietri[1], Damian Ralet[1], Jürgen Gerl[1], and Norbert Pietralla[3] — [1]GSI, Darmstadt, Germany — [2]University, Sofia, Bulgaria — [3]TU, Darmstadt, Germany

Improved primary beam intensities and implementation of fast ramping time converts directly into higher yields of exotic nuclei. Improvements to tracking detectors are necessary to allow for higher rates.

The segmented plastic finger detector was refurbished, tested and used in several beam times at the FRS and a better resolution was obtained compared to conventional scintillator detectors especially at high particle rate ($> 10^6$ Hz).

A new finger detector with higher segmentation is under development, it can allow for still higher rate and can be also used as tracking detector for the SuperFRS.

HK 53.24 Do 14:00 P Foyer

Test and characterization of a trigger loggic firmware for a VME module. — •Damian Ralet[1], Hakan T. Johansson[2], Stephane Pietri[1], Juergen Gerl[1], and Norbert Pietralla[3] for the AGATA-Collaboration — [1]GSI, Darmstadt, Germany — [2]Chalmers University, Goeteborg, Sweden — [3]TU, Damstadt, Germany

For the PRESPEC collaboration and for the preparation of the AGATA campaign at GSI a firmware called TRigger LOgic (TRLO) was installed on the FPGA (Field Programmable Gate Array) of the VME module, the VULOM4. This software was configured to mimic the PRESPEC trigger, and was tested during summer 2011. The purpose of the test were:

(i) to check if the generation of triggers were coherent with the one made with NIM electronics.

(ii) to compare the required time to generate the readout gates.

(iii) to test the integration of the module in the PreSPEC DAQ.

The results confirmed our expectations, and this module will be used for the AGATA campaign at GSI.

HK 53.25 Do 14:00 P Foyer

Temperature dependent gain stabilization of CsI(Tl) detectors using Pulse Shape Analysis * — •Joel Silva[1,2], Enrico Fiori[1,2], Bastian Löher[1,2], Deniz Savran[1,2], and Matjaz Vencelj[3] — [1]ExtreMe Matter Institute EMMI and Research Division, GSI Helmholtzzentrum, Darmstadt, Germany — [2]Frankfurt Institute for Advanced Studies FIAS, Frankfurt — [3]Institut Jožef Stefan, Ljubljana, Slovenia

For accurate Energy measurements in γ-ray spectroscopy with CsI(Tl) detectors temperature variations have to be precisely monitored because of the temperature-dependent scintillation properties of CsI(Tl) Crystals and the temperature-dependent gain of photo-sensors. Since the time constant in the scintillation process also depends on the temperature, these effects can be compensated by analyzing the time dependent pulse shape of detector signals. The method uses the correlation between the gain and the pulse-shape to correct the effect of the temperature. The aim of this method is to conserve good energy resolution in a temperature varying environment, without the need to measure the temperature of the detector systems externally. The suitability of the method was investigated using in addition also external temperature measurements of the crystal in the temperature range of 0°C to 60°C. First results will be presented.

* Supported by the Alliance Program of the Helmholtz Association (HA216/EMMI)

HK 53.26 Do 14:00 P Foyer

Coil Tests for the Neutron Lifetime Experiment PENeLOPE — •Andreas Senft for the PENeLOPE-Collaboration — Technische Universität München, Physik Department

The lifetime τ_n of the free neutron provides important information for cosmological models as well as for tests of the Standard Model of particle physics. The current PDG average value includes measurements which scatter by about 6σ. Thus, at the Physik Department of Technische Universität München, PENeLOPE, a novel experiment in order to determine τ_n and to clarify the situation, is under way. Ultra-cold neutrons (UCNs) will be trapped in a magnetic gradient field, which is produced by superconducting coils in a multipole configuration. The poster will explain the particular requirements for the coils due to the special coil geometry and polarity employed as well as the recently installed test facility, which is used for prototype tests and will afterwards be used to test and train the coils installed in PENeLOPE. In addition, a quench monitoring and protection system to analyze the voltage signal and to protect the experimental setup in case of a quench will be presented. Finally, the tests with a prototype solenoid, which showed promising results, as the required values were reached and even exceeded, will be presented.

The project is supported by the Excellence Cluster "Origin and Structure of the Universe", Deutsche Forschungsgemeinschaft and Maier-Leibnitz-Laboratorium Garching.

HK 53.27 Do 14:00 P Foyer

Development of a time projection chamber for Crystal Ball at MAMI — •Oliver Steffen, Martin Hattemer, 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 study the possibility to construct a small Time Projection Chamber with triple GEM readout as a replacement. Besides higher rate capabilities, such a detector allows real track reconstruction with better angular resolution and may contribute to particle identification. A small TPC prototype with triple-GEM readout is used together with simulation studies to investigate track resolution and detector geometry in order to build a new compact tracking device meeting the stringent space requirements for a tracking detector for the Crystal Ball experiment. This poster will give an overview of the current status of the project.

HK 53.28 Do 14:00 P Foyer

Optical Properties of Radiators for the PANDA Barrel DIRC — Roland Hohler[1,2], •Grzegorz Kalicy[1,2], Dorothee Lehmann[1], Klaus Peters[1,2], Georg Schepers[1], and Carsten Schwarz[1] for the PANDA-Collaboration — [1]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt — [2]Goethe-Universität, Frankfurt

PANDA is a next generation hadron physics detector under design for the Facility for Antiproton and Ion Research (FAIR) at Darmstadt, Germany. The main system responsible for charged particle identification in the barrel part of the detector will be the Cherenkov counter DIRC (Detector of Internally Reflected Cherenkov light).

The performance of the Barrel DIRC strongly depends on the surface quality and optical properties of long, rectangular bars made from synthetic fused silica, which are used as radiators and light guides to transmit the Cherenkov photons over long optical pathlengths with a large number of internal reflections.

A motion-controlled laser setup was built to check the optical properties of the DIRC bars. Results of the measurements of the bulk attenuation and reflection coefficient at multiple wavelengths will be presented for bars produced by several manufacturers using different polishing methods.

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 53.29 Do 14:00 P Foyer

Eine automatische Schwellwertkalibrierung für den Prototypensensor des Mikro-Vertex-Detektors am CBM-Experiment — •Michael Wiebusch, Christoph Schrader, Bertram Neumann, Borislav Milanovic, Christian Müntz und Joachim Stroth für die CBM-MVD-Kollaboration — Goethe Universität, Frankfurt

Aufgrund ihrer besonderen Eigenschaften werden digitale Monolithic Active Pixel Sensoren (MAPS) in dem Micro-Vertex-Detektor (MVD) des zukünftigen CBM Experimentes eingesetzt.

Hinsichtlich der Kalibrierung dieser Sensoren besteht das Problem, einen geeigneten Schwellwert (Threshold) zu setzen, ab dem ein Pixel als ausgelöst gilt. Diese Schwellwerte werden durch sensorinterne Digital-Analog-Converter (DAC) programmiert, welche zusätzlich die analoge Spannung als Referenz ausgeben. Fertigungsbedingt besitzen die DACs gewisse Toleranzen, die ein Ausmessen ihres individuellen Verhaltens erfordern. Weiter ist es von Nöten die Reaktion der DACs auf Temperaturschwankungen und radioaktive Strahlung zu untersuchen.

Dieser Beitrag stellt den Aufbau und die Funktionsweise einer hochintegrierten Messaparatur dar, welche die automatische Kalibrierung der Schwellwerte in das Auslesekonzept des MVDs integriert.

*supported by HIC for FAIR, the GSI Helmholtzzentrum für Schwerionenforschung, BMBF grant 06FY9099I

HK 53.30 Do 14:00 P Foyer

Data Acquisition System for DAGATA Compton Polarimeter — •A. Givechev[1], B. Alikhani[1], A. Heinz[2], J. Leske[1], O. Möller[1], N. Pietralla[1], and C. Röder[1] — [1]Institute for Nuclear Physics, Darmsatdt, Germany — [2]Subatomic Physics Devision, Chalmers University of Technology, Gothenburg, Sweden

Polarization measurements of high-energy gamma-rays require a polarimeter with high polarization sensitivity. To achieve this a complex detector array has been designed. To setup and operate such a detector array a special data acquisition system is required. The DArmstat GAmma-ray Tracking Assembly (DAGATA) is a detector array based on three highly segmented HPGe detectors of the AGATA type[1]. Its 36-fold segmented germanium crystals significantly enhance the polarization sensitivity. For its readout a new type of data acquisition system was designed. It includes commercially available flash-ADC modules. The new system is based on Digital Signal Processing technology and replaces all standard analog modules used up to now. Controlled by a computer with specially designed software it provides the necessary data for the polarization measurements. The Data Acquisition System was tested in a polarization measurement[2] in IKP of Technical University Darmstadt . The structure and performances of the Data Acquisition System for the polarization measurements will be presented.

* Funded by DFG (SFB 634) and LOEWE (HIC for FAIR)

[1] S. Akkoyun et al, Nucl. Instr. Meth. Phys. A, In Press (2011)

[2] B. Alikhani, A. Givechev et al, subm. Nucl. Instr. Meth. Phys. A (2011)

HK 53.31 Do 14:00 P Foyer

Entwicklung des experimentellen Aufbaus zur Spektroskopie von Doppel-Λ-Hyperkernen am PANDA-Experiment

— Sebastian Bleser[1], Felice Iazzi[2], Ivan Kojouharov[3], Josef Pochodzalla[1], Alicia Sanchez Lorente[4] und •Marcell Steinen[1] für die PANDA-Kollaboration — [1]Institut für Kernphysik, JGU Mainz — [2]Politecnico di Torino and INFN, Sez. di Torino, Italien — [3]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt — [4]Helmholtz-Institut Mainz

Einer der Schwerpunkte des PANDA-Experiments wird die γ-Spektroskopie von Doppel-Λ-Hyperkernen sein. Dazu ist eine Modifikation des Standard-PANDA-Detektors nötig. Diese besteht aus einem speziellen internen Kohlenstofftarget, einem aktiven sekundären Target, aufgebaut aus alternierenden Schichten aus Siliziumstreifendetektoren und Absorbermaterialien, und einem Array aus hochauflösenden Germaniumdetektoren. Diese Komponenten müssen im starken Magnetfeld und im hohen Teilchenfluss innerhalb des PANDA-Detektors betrieben werden können.

Dieser Beitrag zeigt den aktuellen Entwicklungsstand der Komponenten des PANDA-Hyperkern-Experiments.

Dieses Projekt wird unterstützt durch das BMBF (Vörderprogramm: 06MZ9182) und EU HadronPhysics2 (SPHERE).

HK 53.32 Do 14:00 P Foyer

Design of a Condensed Krypton Source (CKrS) at the cryopumping section of KATRIN — Stephan Bauer, Richard Bottesch, •Benjamin Grees, Daniel Spitzer, and C. Weinheimer for the KATRIN-Collaboration — Institut für Kernphysik, Universität Münster

The **KA**rlsruhe **TRI**tium **N**eutrino experiment will measure the endpoint of the tritium-β-spectrum by means of an electrostatic retarding spectrometer (MAC-E-Filter), which will allow determination of the mass of the $\bar{\nu}_e$ with 200meV/c^2 sensitivity (90% C.L.). To achieve this, it is necessary to monitor the retarding voltage of the spectrometer with 3ppm precision, which is realized using a combination of a high voltage divider and a monoenergetic source of conversion electrons (^{83m}Kr). For this purpose, a condensed Krypton source (CKrS) will be installed at the **C**ryogenic **P**umping **S**ection (CPS) of the KATRIN experiment. The CKrS will be mounted on an UHV manipulator to be able to scan the whole flux tube of KATRIN. To control the thickness of the condensed gas in the source, a specialized ellipsometry setup with analyser and detector in the vacuum has been developed. Another upgrade to the CKrS is the installation of an ablation laser, to remove residual gas contaminations from the substrate. This project is funded by the BMBF under contract number 05A11PM2.

HK 53.33 Do 14:00 P Foyer

Methoden zur geometrischen Charakterisierung eines großflächigen Szintillationsfaser-Detektors — Maik Biroth, Anselm Esser und •Pepe Gülker — Institut für Kernphysik, Johannes Gutenberg-Universität, Mainz

Am Mainzer Mikrotron MAMI wird im Elektronenarm des KAOS-Spektrometers ein großflächiger Szintillationsfaser-Detektor betrieben. Die bei einem Faserdetektor mit 9216 Fasern pro Ebene herstellungsbedingten Schwankungen in geometrischen Größen, wie die genaue Position der verschiedenen Fasern eines Kanals, der relative Versatz der Faserbündel untereinander und die Ausrichtung der Photomultiplier in 3 Freiheitsgeraden, sollen quantifiziert und in Korrekturen eingebracht werden. Hierzu wurden verschiedene Methoden entwickelt: In einem Kalibrierungsaufbau werden mittels einer ^{90}Sr-Quelle automatisiert die absoluten Positionen der einzelnen Fasern trianguliert. Unter Zuhilfenahme einer kalibrierten Kamera sowie Techniken aus der Bildverarbeitung (Harris-Detektor, Hough-Transformation) können optisch der Versatz einzelner Faserbündel, sowie die Scherung einer ganzen Ebene vermessen und korrigiert werden.

Dieses Poster stellt die entwickelten Methoden und Messungen, deren Analyse, sowie die Berechnungen von Korrekturfaktoren vor.

Gefördert durch EU HadronPhysics2 (SPHERE)

HK 53.34 Do 14:00 P Foyer

Implementation of a Forward Tracking System for $\bar{\text{P}}$ANDA* — •Martin Johannes Galuska[1], Radosław Karabowicz[2], Wolfgang Kühn[1], Jens Sören Lange[1], and Björn Spruck[1] for the PANDA-Collaboration — [1]II. Physik. Inst., JLU Gießen — [2]GSI

The $\bar{\text{P}}$ANDA experiment at the future FAIR facility at GSI Darmstadt is planned to start operation in 2017 utilizing antiproton beams with beam momentum resolutions of $\Delta p/p \leq 2 \cdot 10^{-5}$. In particular, $\bar{\text{P}}$ANDA is well fit to perform resonance scans of exclusively produced charmonium(-like) states and thus provide absolute measurements of resonance widths.

In this poster we will report on the current status of the implementation of a forward tracking system for the $\bar{\text{P}}$ANDA detector. The forward tracking is of particular importance as $\bar{\text{P}}$ANDA is a fixed target experiment, and thus in charmonium production a large fraction of final state particles will be boosted toward forward angles. The key challenges for the implementation of a forward track finder and track fitter arise from a complicated magnetic field map as $\bar{\text{P}}$ANDA is comprised of a barrel part with a solenoid field of $B_z = 2$ T and a forward detector part with a dipole field of $B \cdot L = 2$ Tm. The interference of the magnetic fields has to be taken into account. Furthermore, the forward tracking requires a matching of hits from numerous subdetectors (e.g. axial and stereo straw tubes, straw tube planes perpendicular to the beam axis, GEM tracker, etc.) with high accuracy.

* This work was supported in part by BMBF (06GI9107I) and the LOEWE-Zentrum HICforFAIR.

HK 53.35 Do 14:00 P Foyer

Vienna Progress Report on the New Facility PERC — •Gertrud Konrad for the PERC-Collaboration — Atominstitut, TU Wien, Austria

Measurements of neutron decay observables address important open questions of particle physics and are generally complementary to direct searches for new physics beyond the Standard Model (SM) in high-energy physics. Main emphasis lies on the search for evidence of possible extensions to the SM and searches for new symmetry concepts.

PERC will perform high-precision measurements of neutron decay correlations at the beam facility MEPHISTO of the FRM-II in Garching. We will present

a) a novel spatial magnetic neutron spin resonator, MONOPOL. High-precision measurements with PERC require a perfect knowledge and control of the key parameters of the neutron beam, i.e., wavelength distribution, degree of polarization, and time structure.

b) a superconducting magnet system. PERC is designed as a source of neutron decay products. The charged decay products are collected by a strong magnetic field directly from inside a neutron guide.

c) a system for particle spectroscopy. Depending on the decay parameters studied, the analysis of the decay products must be performed with different and specialized detectors.

HK 53.36 Do 14:00 P Foyer

Development of a routing/switching mechanism for a Compute Node system — •Sören Fleischer[1], Wolfgang Kühn[1], Jens Sören Lange[1], Thomas Gessler[1], David Münchow[1], and Hao Xu[1,2] — [1]II. Physikalisches Institut, Uni Giessen — [2]IHEP, China

Our group is currently developing an ATCA based system of compute nodes (CN), which is proposed for data readout and online data processing at PANDA and the BELLE-2 PXD. Each CN is equipped with 4 Virtex-5 FPGAs running algorithm IP cores. In order for these cores to communicate with each other over RocketIO and/or serial link, a routing and switching mechanism is to be developed. The system should automatically recognize the map of the network as well as changes to it and build/update the routing information accordingly.

Management of the routing information will be done using a computer connected to the ATCA shelf managers over ethernet to retrieve information about which algorithm IP cores are present in which location, and to update the switch IP cores' routing/forwarding tables.

HK 53.37 Do 14:00 P Foyer

Eigenschaften von ^{238}UF$_6$ als Detektorgas in einer Ionisationskammer — •Martin Freudenberger[1], Christian Eckardt[1], Joachim Enders[1], Alf Göök[1], Jörg Hehner[2], Peter von Neumann-Cosel[1], Andreas Oberstedt[3,4], Stephan Oberstedt[5] und Haik Simon[2] — [1]Institut für Kernphysik, TU Darmstadt — [2]GSI-Helmholtzzentrum für Schwerionenforschung, Darmstadt — [3]Akademin för Naturvetenskap och Teknik, Örebro Universitet, Schweden — [4]Fundamental Fysik, Chalmers Tekniska Högskola, Göteborg, Schweden — [5]EC-JRC IRMM, Geel, Belgien

Die experimentelle Untersuchung von Photonen-induzierter Kernspaltung an verschiedenen Uran-Isotopen bietet eine Fülle an Informationen, die für eine mikroskopische Beschreibung des Spaltprozesses in Aktiniden-Kernen von Bedeutung sind. Einige dieser Informationen, wie die Energieabhängigkeit der Spaltmoden, die Massen-und Winkelverteilung der Spaltfragmente oder die Untersuchung paritätsverletzender Effekte, sind derzeit Gegenstand aktueller Forschung. Um die Targetmasse möglichst hoch und den Energieverlust der Fragmente

im Target möglichst gering zu halten, wurde ein aktives Gas-Target entwickelt. Dazu wurde zunächst das Verhalten von UF_6 als mögliche Zählgaskomponente sowohl qualitativ als auch quantitativ untersucht.

Diese Arbeit wurde in Teilen unterstützt durch den SFB 634 der DFG, den Kooperationsvertrag zwischen der TU Darmstadt und der GSI sowie das LOEWE-Zentrum HIC for FAIR des Landes Hessen.

HK 53.38 Do 14:00 P Foyer

Design of a pulsed angular selective electron gun for the KATRIN main spectrometer — •Daniel Winzen, Volker Hannen, Hans-Werner Ortjohann, Michael Zacher, and Christian Weinheimer for the KATRIN-Collaboration — Institut für Kernphysik, Westfälische Wilhelms-Universität, Münster

The KATRIN (KArlsruhe TRItium Neutrino mass) experiment will study the tritium β-spectrum near the endpoint of 18.6 keV, aiming to measure the mass of the electron antineutrino. Using an electrostatic retarding spectrometer (MAC-E-Filter), the projected sensitivity for m_{ν_e} is 200 meV/c^2 at 90% C.L..
In order to map out the electric and magnetic fields in the main spectrometer, an angular selective electron gun is currently being developed. The e-gun uses an UV-Laser to produce electrons via the photoelectric effect from a copper substrate which are then accelerated electrostatically. It features a small energy spread of approx. 0.1 eV, a sharp emission angle and will be able to cover the whole magnetic flux tube of KATRIN. Using a pulsed laser it is also possible to investigate the time of flight (TOF) of electrons through the spectrometer, offering enhanced sensitivity to spectrometer properties far away from the analysing plane. By comparing information from transmission function measurements and TOF data with Monte Carlo simulations of the setup, one will be able to achieve a detailed understanding of the spectrometer properties.
This project is funded by the BMBF under contract number 05A11PM2.

HK 53.39 Do 14:00 P Foyer

Investigation of surface homogeneity of mirrors for the CBM-RICH detector and low-mass di-electron feasibility studies* — •Elena Lebedeva for the CBM-RICH-Collaboration — GSI, Darmstadt, Germany

The Compressed Baryonic Matter (CBM) experiment at the future FAIR facility will study compressed nuclear matter at moderate temperature and high net-baryon density. The created matter will among other things be studied via the di-lepton decay channels of rare probes such as low-mass vector mesons. The vector mesons are an ideal tool to study the properties of the medium as they are penetrating probes not interacting with the medium. A clean and efficient identification of lepton pairs is therefore indispensable. The CMB RICH detector is the central di-electron identification detector. It will be operated with CO2 radiator gas, MAPMTs as photodetector and spherical glass mirrors as focussing element. A high quality of the mirrors in terms of reflectivity and surface homogeneity is required. In this contribution D0 measurements to quantify the surface homogeneity will be presented. Furthermore, implementing realistic detector responses, the feasibility of low-mass di-electron measurements will be shown.

*supported by the LOEWE center HIC for FAIR

HK 53.40 Do 14:00 P Foyer

Scintillating screens for high current ion beam diagnostics — •Eiko Gütlich[1] and Oliver Kester[1,2] — [1]Goethe Universität Frankfurt am Main, Deutschland — [2]GSI, Darmstadt, Deutschland

Scintillating screens are commonly used at accelerator facilities, however their imaging qualities are not well understood, especially for high current ion beam operation. Several types of radiation-hard inorganic-materials were investigated for various ion species and energies of 4.8 and 11.4 MeV/u. Ceramic Al2O3 showed the best results compared to other ceramics like ZrO2 : Y or quartz glass Herasil 102. A model for the response to an ion beam has been developed. It is based on the radial dose distribution of the ions, estimations concerning the behavior in the overlapping regions and a maximal energy dose which can be converted inside the material, as proposed by Michaelian et al. This model was applied to Al2O3, can describe the observed saturation effect and is able to reconstruct saturated images. Detailed spectroscopic investigations were performed, to determine the influence of the ion beam intensity on the luminescence spectra emitted by the materials. Further more, the imaging properties of Al2O3 was investigated for different emission wavlenght. The F+-emission (340 nm) of the Al2O3 is more stable over time compared to the F0-emission (420 nm).

HK 54: Hadronenstruktur und -spektroskopie

Zeit: Freitag 11:00–13:00 Raum: RW 1

Gruppenbericht HK 54.1 Fr 11:00 RW 1

Hadron physics with WASA-at-COSY — •Patrick Wurm for the WASA-at-COSY-Collaboration — Institut für Kernphysik and Jülich Center for Hadron Physics, Forschungszentrum Jülich, Germany

The Wide Angle Shower Apparatus (WASA) is a close to 4π detector which is used to study the hadronic production and the decays of light mesons. Extended beam times at high luminosities enable to measure rare meson decays, which are used to scrutinize symmetries and symmetry breaking mechanisms in hadronic systems and to test Chiral Perturbation Theory, for example with $\eta \to \pi^+\pi^-\pi^0$ and $\eta \to \pi^+\pi^-\gamma$. The electron and pion decay plane of the decay $\eta \to \pi^+\pi^-e^+e^-$ is sensitive to a possible flavor conserving CP violation. A better understanding of the hadron structure can be achieved by a precise determination of transition form factors, which can be measured in the decays $\eta \to e^+e^-\gamma$, $\eta \to e^+e^-e^+e^-$ or $\omega \to \pi^0e^+e^-$. Additionally, the branching ratio of $\eta \to e^+e^-e^+e^-$ is measured, since there exists currently only one experimental value. Signs for new physics beyond the Standard Model is searched for in π^0 and η decays into a single lepton pair. The talk will give an overview of these WASA-at-COSY activities and also about other topics like the ABC effect.

HK 54.2 Fr 11:30 RW 1

Meson Transition Form Factors at BABAR — •Konrad Griessinger for the BABAR-Collaboration — Institut für Kernphysik, Universität Mainz, Deutschland

At electron-positron colliders like the PEP-II rings at SLAC (Stanford), meson transition form factors can be accessed through $\gamma^{(*)}\gamma^{(*)}$-processes. We present recent BABAR results for the cross sections of the $\gamma\gamma^*$-fusion reaction resulting in either π^0, η or η', where one of the photons is quasi-real ($Q^2 \approx 0$). The $\gamma\gamma^*$ production cross section in such a single-tag measurement is proportional to the transition form factor $F(Q^2)$. After extracting $F(Q^2)$, models to compute the contribution of the hadronic light-by-light scattering process to the standard model predicition of the muon anomaly $(g_\mu - 2)$ can be tested via the transition form factor's Q^2 dependence.

HK 54.3 Fr 11:45 RW 1

Analyse des Zerfallskanals $\psi(2S) \to \gamma(\pi^+\pi^-\eta)$ bei BES-III — •Michael Leyhe für die BES III-Kollaboration — Lehrstuhl für Experimentalphysik I, Ruhr-Universität Bochum

Das BES-III Experiment, welches am Beijing-Elektron-Positron-Speicherring BEPCII aufgebaut ist, konnte bisher unter anderem einen Datensatz von mehr als 100 Millionen $\psi(2S)$-Zerfällen aufzeichnen. Mit diesem weltgrößten Datensatz ist es möglich, auch Reaktionskanäle mit geringen Wirkungsquerschnitten zu untersuchen.
In diesem Vortrag wird die Analyse des radiativen Zerfallskanals $\psi(2S) \to \gamma(\pi^+\pi^-\eta)$ vorgestellt.Es werden die beobachteten, in $\pi^+\pi^-\eta$ zerfallenden Resonanzen diskutiert, und hierbei insbesondere der Fokus auf den Glueball-Kandidaten $\eta(1405)$ gelegt.

HK 54.4 Fr 12:00 RW 1

Central and spin-spin heavy-quark potentials from QCD — •Alexander Laschka, Norbert Kaiser, and Wolfram Weise — Physik Department, Technische Universität München, D-85747 Garching, Germany

Potential models with several free parameters have been used in the past to reproduce the experimentally observed charmonium and bottomonium spectra. Nowadays heavy-quark potentials can be derived in QCD from first principles. The spin-dependent heavy-quark potential, necessary to describe the hyperfine splittings, has been studied recently in a new lattice QCD approach. We show that the spin-spin potential,

as well as the central potential, can be extended to short distances by matching the lattice results to the corresponding potentials derived in perturbative QCD. These matched potentials have only a single free parameter, an overall additive constant, and can be used to calculate quarkonium spectra. We find that the empirical hyperfine splittings in the ground states of charmonium and bottomonium can be accurately reproduced. Furthermore, we extract values for the charm and bottom quark masses and compare to other mass schemes.

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

HK 54.5 Fr 12:15 RW 1

Dynamical light vector mesons in low-energy scattering of Goldstone bosons. — •Igor Danilkin, Laura Gil, and Matthias Lutz — GSI, Planck Str. 1, 64291 Darmstadt, Germany

We present a study of Goldstone boson scattering based on the flavor SU(3) chiral Lagrangian formulated with vector mesons in the tensor field representation [1]. A coupled-channel channel computation is confronted with the empirical s- and p-wave phase shifts, where good agreement with the data set is obtained up to about 1.2 GeV. There are two relevant free parameters only, the chiral limit value of the pion decay constant and the coupling constant characterizing the decay of the rho meson into a pair of pions. We apply a recently suggested approach that implements constraints from micro- causality and coupled-channel unitarity. Generalized potentials are obtained from the chiral Lagrangian and are expanded in terms of suitably constructed conformal variables. The partial-wave scattering amplitudes are defined as solutions of non-linear integral equations that are solved by means of an ND ansatz.

[1] I.V. Danilkin, L.I.R. Gil, M.F.M. Lutz, Phys.Lett. B703 (2011) 504-509

HK 54.6 Fr 12:30 RW 1

GPDs measurement using DVCS process at ENC/FAIR — •Donghee Kang — Institut für Kernphysik, Universität Mainz, Germany

Generalized Parton Distributions (GPDs) describe simultaneously distributions for the transverse position and longitudinal momentum of partons inside the nucleon. The Deeply Virtual Compton Scattering (DVCS) process on the proton, $ep \to e'p'\gamma$, is the simplest and pormising reaction channel to access GPDs. An Electron Nucleon Collider (ENC) using the High Energy Storage Ring (HESR)/FAIR and utilizing the high resolution PANDA spectrometer is proposed to investigate the DVCS process. We demonstrate this specific advantage from the collider kinematic. In a feasibility study, we have estimated the acceptance and resolution for the DVCS process assuming 15 GeV proton beam and 3 GeV electron beam in collision.

HK 54.7 Fr 12:45 RW 1

Monte Carlo event generators for Panda — •Manuel Zambrana — Institut fuer Kernphysik, Mainz University and Helmholtz Institut Mainz, Mainz, Germany

Lepton production in proton-antiproton annihilation is one of the main channels to access the proton form factors in the timelike region. The development of Monte Carlo event generators for $\bar{p}p \to e^+e^-$ is described. The used cross section results from a leading order calculation, the so called one-photon exchanged approximation. In addition, a Monte Carlo event generator for the main background channel, i.e. $\bar{p}p \to \pi^+\pi^-$ is also described. In this case, the parametrisation of the cross section comes from a polynomial fit and from a Regge description in the low and high energy regime, respectively. Preliminary results on the channel $\bar{p}p \to e^+e^-\pi^0$, which opens the possibility of accessing the unphysical region $q^2 < 4M^2$, are discussed.

HK 55: Hadronenstruktur und -spektroskopie

Zeit: Freitag 11:00–13:00 Raum: RW 2

Gruppenbericht HK 55.1 Fr 11:00 RW 2

On the Observation of a Narrow Resonance Structure in pn-scattering and Two-Pion Production* — •Mikhail Bashkanov for the WASA-at-COSY-Collaboration — Physikalisches Institut, Univ. Tübingen

Whereas for the **isovector** two-pion production in NN-collisions a smooth energy dependence is observed, which is well described by t-channel meson exchange, the purely **isoscalar** reaction $pn \to d\pi^0\pi^0$ exhibits a pronounced narrow resonance structure at m = 2.37 GeV = $2m_\Delta$ - 90 MeV, which is strictly correlated with the appearance of a large low-mass enhancement (ABC-Effect) in the $\pi^0\pi^0$-invariant mass spectrum. From the angular distributions we deduce $I(J^P) = 0(3^+)$ for the resonance structure [1].

If this structure originates from a genuine pn resonance, then it has to be sensed also in other two-pion production channels with isoscalar contributions as well as in pn scattering. Indeed, the pn total cross section exhibits a structure at the energy of interest, which is well described by inclusion of the hypothetical resonance.

Experimental results are shown for the two-pion channels $d\pi^0\pi^0, d\pi^+\pi^-$ and $pp\pi^0\pi^-$. Scheduled measurements on quasifree $\vec{p}n$-scattering and the $\vec{p}n \to pn\pi^0\pi^0$ reaction are discussed.

The fact that the ABC effect is observed also for double-pionic fusion processes to heavier nuclei, suggests that this resonance structure is robust enough to survive even in nuclei.

* supported by BMBF and COSY-FFE

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

HK 55.2 Fr 11:30 RW 2

Double-Pionic Fusion to ^{3}He – ABC-Effect and Resonance Structure* — •Elena Perez del Rio for the WASA-at-COSY-Collaboration — Physikalisches Institut, Univ. Tübingen

The double-pionic fusion to ^{3}He was historically the reaction, where the ABC effect (low-mass enhancement of the $\pi\pi$-invariant mass spectrum) was observed in inclusive measurements more than 50 years ago for the first time. Meanwhile we know from exclusive and kinematically complete high-statistics maesurements with WASA at COSY that there is a strict correlation between the ABC effect and a narrow resonance structure with $I(J^P) = 0(3^+)$ in the total cross section of the most basic double-pionic fusion, the $pn \to d\pi^0\pi^0$ reaction [1].

In order to investigate the situation in the double-pionic fusion to ^{3}He we have measured the energy dependence of the ABC effect in the fusion to ^{3}He by fixed energy measurements of the type $pd \to {}^3\mathrm{He}\pi\pi$ and by quasifree and coherent measurements of the type $dd \to {}^3\mathrm{He}\pi\pi n$.

The experimental results for the different reaction scenarios will be discussed.

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

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

HK 55.3 Fr 11:45 RW 2

In Search of the ABC Resonance Structure in the Reactions $pn \to pp\pi^0\pi^-$ and $pn \to pn\pi^0\pi^0$ * — •Tatiana Skorodko for the WASA-at-COSY-Collaboration — Physikalisches Institut der Universität Tübingen

As we have shown recently [1] the basic double-pionic fusion reaction $pn \to d\pi^0\pi^0$ exhibits a pronounced narrow resonance structure with m = 2.37 GeV, Γ = 70 MeV and $I(J^P) = 0(3^+)$, which is correlated with a low-mass enhancement in the $\pi^0\pi^0$-invariant mass distribution, the so-called ABC effect. If the scenario of a s-channel resonance with a reaction process $pn \to d^* \to \Delta^+\Delta^0 \to d\pi^0\pi^0$ is correct, then the resonance should be observed also in pn scattering as well as in other two-pion production channels like $pn\pi^0\pi^0$ and also $pp\pi^0\pi^-$. These channels can be accessed in quasifree proton reactions on the deuteron. The latter channel is particularly well suited for a reliable data analysis, since the four-momenta of all ejectiles can be detected in WASA.

A corresponding WASA run at T_p = 1.2 GeV has been analyzed providing first results for the $pn \to pp\pi^0\pi^-$ reaction, which cover also the region of the putative ABC resonance.

The experimental results exhibit surprisingly large cross sections at low energies pointing to so far unknown processes. In the ABC region neither an ABC effect nor a resonance behavior is observed, which is understood by the fact that the $\pi^0\pi^-$ pair must be in relative p-wave, whereas the pp pair prefers to be in the ^{1}S$_0$ state.

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

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

HK 55.4 Fr 12:00 RW 2

Double pion photoproduction off nuclei — •Yasser Maghrbi for the A2-Collaboration — Departement Physik, Basel, Switzerland

The study of the invariant mass distributions of pion pairs produced in atomic nuclei has been intensively discussed in view of a possible in-medium modification of the σ meson, related to partial chiral restoration effects. The interpretation of the results from both hadron- and photon-induced reactions is complicated by final-state interaction (FSI) effects of the pions. New, precise results have been obtained with the Crystal Ball/TAPS experiment at the Mainz MAMI accelerator. Invariant mass distributions of the $\pi^0\pi^0$ and $\pi^0\pi^\pm$ pairs have been studied for ^{2}H, ^{7}Li, ^{12}C, ^{40}Ca, ^{nat}Pb targets with much improved statistical quality compared to previous experiments. The results allow for the first time to study these distributions also close to threshold for very low energetic pions, which are not much affected by FSI and thus has to separate FSI effects from σ-in-medium effects. As a preliminary result the dominating effect seems to be due to FSI.

HK 55.5 Fr 12:15 RW 2

Efimov Effect for P-wave Interactions — Eric Braaten[1], •Philipp Hagen[2], Hans-Werner Hammer[2], and Lucas Platter[3] — [1]Department of Physics, The Ohio State University, Columbus, OH 43210, USA — [2]Helmholtz-Institut für Strahlen- und Kernphysik and Bethe Center for Theoretical Physics, Universität Bonn, 53115 Bonn, Germany — [3]Chalmers University of Technology, Department of Fundamental Physics, SE-412 96 Gothenburg, Sweden

Nonrelativistic particles with short-range interactions that produce a P-wave threshold resonance can exhibit the Efimov effect: if the inverse scattering volume 1/a and the P-wave effective range r are simultaneously tuned to zero, there is an infinite sequence of three-body bound states called Efimov states that have an accumulation point at the threshold. The discrete scaling factor that characterizes the Efimov effect depends on the mass ratios and the symmetries of the three particles. There is no Efimov effect if all three particles are identical, but it can occur if two identical particles have a resonant P-wave interaction with a third particle. The spectrum of Efimov trimers is compatible with discrete scale invariance. The Efimov trimers disappear through the three-particle threshold at values of a and r that differ by appropriate powers of the discrete scaling factor.

HK 55.6 Fr 12:30 RW 2

Perturbative pions in chiral effective field theory for NN scattering — Evgeny Epelbaum[1] and •Jambul Gegelia[1,2] — [1]Institut fuer Theoretische Physik II, Fakultaet fuer Physik und Astronomie, Ruhr-Universitaet Bochum, 44780 Bochum, Germany — [2]High Energy Physics Institute, TSU, 0186 Tbilisi, Georgia

New approach to NN scattering problem in EFT suggested by Beane, Kaplan and Vourinen [1] exploits the fact that the convergence of perturbative series in quantum field theories depends on the choice of the renormalization condition. In particular, its is expected that by choosing a more adequate renormalization scheme one can make the perturbative expansion of the NN scattering amplitude convergent within the (modified) KSW power counting scheme, i.e. where the pions are treated perturbatively. We present our results for NN scattering amplitude obtained within this approach.

[1] S.R.Beane, D.B.Kaplan and A.Vuorinen, Phys.Rev. C 80, 011001(2009)

HK 55.7 Fr 12:45 RW 2

Giessen coupled-channel model pion and photon induced reactions — •Vitaly Shklyar, Horst Lenske, and Ulrich Mosel — Institut für Theoretische Physik, Justus-Liebig-Universität Giessen, Heinrich-Buff-Ring 16, D-35392 Giessen

An unitary coupled-channel Lagrangian model is developed for simultaneous analysis of pion- and photon-induced reactions in the resonance energy region. The πN, ρN, $\pi\Delta$, σN, ηN, ωN, $K\Lambda$, $K\Sigma$ final states are treated on the same basis. The coupling constants are constrained by comparison with the available experimental data. Recent results on η-production and the extended treatment of the two-pion channel are presented and discussed.

HK 56: Astroteilchenphysik

Zeit: Freitag 11:00–13:00 Raum: RW 3

Gruppenbericht HK 56.1 Fr 11:00 RW 3

Status of the KATRIN Experiment — •Miroslav Zbořil for the KATRIN-Collaboration — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster

The KArlsruhe TRItium Neutrino experiment (KATRIN) aims at a direct and model independent determination of the electron antineutrino mass with a sensitivity of $0.2\,\mathrm{eV}/c^2$ (90 % C.L.) via a measurement of the endpoint region of the tritium β-decay spectrum. The experiment consists of a windowless gaseous tritium source, differential and cryogenic pumping sections and a tandem of a pre- and a main spectrometer, applying magnetic adiabatic collimation (MAC-E filter concept) to guide the β-electrons with sufficient energy onto a segmented silicon PIN detector.
At present the experiment is being set up at the Karlsruhe Institute of Technology. Several major components have been installed and tested. A large range of test experiments and background studies have been performed at the pre-spectrometer. The installation of the inner wire electrode is being completed, such that the commissioning of the main spectrometer can take place in 2012. The commissioning of the 148 pixel silicon detector is currently in progress. The same holds for an additional MAC-E filter spectrometer, the monitor spectrometer, which will be utilized for continuous monitoring of the energy scale stability with the help of mono-energetic conversion electrons from a ^{83m}Kr source. The talk will present results of recent test experiments and provide an outlook on the commissioning activities.
The project is supported by BMBF under contract number 05A11PM2.

HK 56.2 Fr 11:30 RW 3

The KATRIN statistical sensitivity with various background conditions — •Ferenc Glück, Markus Hötzel, Wolfgang Käfer, and Susanne Mertens for the KATRIN-Collaboration — Karlsruhe Institute of Technology, IEKP and IK

The aim of the KATRIN experiment is to determine the absolute neutrino mass scale in a model independent way, by measuring the electron energy spectrum shape near the endpoint of tritium beta decay. An ultra-low background level of 10 mHz is necessary to reach the design sensitivity of 200 meV. The 90 % CL statistical neutrino mass upper limit depends not only on the absolute background rate but also on the background characteristics. Large fluctuations of the background over time decrease the neutrino mass sensitivity.

Magnetically stored high energy electrons, arising from single radioactive decays of radon and tritium in the KATRIN main spectrometer, lead to enhanced background rates for several hours. A stored electron cooles down via ionization of residual gas, producing several hundreds of secondary electrons which can reach the detector. This mechanism causes a background with non-Poissonian fluctuations. With this background, the statistical sensitivity depends on the detailed measurement model (length and order of the measurement intervals), and also on detailed time dependent properties of the background events. For example, the statistical sensitivity is better with smaller measurement interval lengths, with randomized (instead of ordered) measurement intervals, and with smaller residual gas pressure.

We acknowledge support by the BMBF of Nr. 05A11VK3.

HK 56.3 Fr 11:45 RW 3

Simulations on Neutrino Mass Measurements via Time-of-Flight by the KATRIN Experiment — •Nicholas Steinbrink, Volker Hannen, and Christian Weinheimer for the KATRIN-Collaboration — Institut für Kernphysik, Wilhelm-Klemm-Str. 9, 48149 Münster

The KATRIN experiment aims to measure the neutrino mass scale with a sensitivity of 0.2 eV by scanning the endpoint of the beta spectrum of T_2 using a high resolution and large acceptance electrostatic filter. In this talk an additional time-of-flight mode for the KATRIN main spectrometer will be discussed. The idea is that the time-of-flight senstivity on the spectral shape of the beta spectrum is enhanced at the endpoint with high retarding potentials. Thus the shape of the beta spectrum including the parameter "neutrino mass squared" could be

determined by fitting the time-of-flight spectrum.

A simulation was performed in order to determine the statistical power of the method. This simulation was performed for the scenario of a non-existing hypothetical 'tagging' device, delivering a start signal at the entrance of the spectrometer with minimal interference for an electron, as well for a pulsed filtering of the electron beam. It will be shown that the statistical uncertainty on $m(\nu_e)^2$ will improve if the time resolution and detecting efficiency are sufficient.

This work is supported by BMBF under contract number 05A11PM2.

HK 56.4 Fr 12:00 RW 3

Reduktion der durch Radon induzierten Untergrundprozesse in den KATRIN Spektrometern — •Stefan Görhardt für die KATRIN-Kollaboration — Karlsruher Institut für Technologie (KIT), Institut für Kernphysik (IK)

Ziel des **KA**rlsruher **TRI**tium **N**eutrino Experiments (KATRIN) ist die direkte Messung der Elektronantineutrinomasse aus der Kinematik des Tritium-β-Zerfalls mit einer bisher unerreichten Sensitivität von $0,2\,\mathrm{eV/c^2}$. Der Messaufbau setzt sich zusammen aus einer fensterlosen gasförmigen molekularen Tritiumquelle mit anschließender differentiell bzw. kryogen gepumpter Elektronen-Transportstrecke, einem elektrostatischen Tandemspektrometersystem, welches aus Vor- und Hauptspektrometer besteht, zur Analyse der Elektronenenergien und einer Detektoreinheit zum Nachweis der Zerfallselektronen. Das Erreichen einer Sensitivität von $0,2\,\mathrm{eV/c^2}$ auf die Neutrinomasse erfordert unter anderem ein sehr niedriges Untergrundniveau ($< 10\,\mathrm{mHz}$).
In diesem Vortrag werden die Erkenntnisse aus Test-Messungen am KATRIN Vorspektrometer vorgestellt. Insbesondere wird auf die Auswirkungen von Radonzerfällen im Spektrometervolumen auf das Untergrundverhalten eingegangen, sowie auf die Reduktion des durch Radon induzierten Untergrundes durch Einsatz eines Baffles in Kombination mit einer Kühlfalle im Hauptspektrometer.
Dieses Projekt wurde teilweise vom BMBF unter dem Kennzeichen 05A08VK2 und 05A08VK3 sowie der DFG im Sonderforschungsbereich Transregio 27/TPA1 gefördert.

HK 56.5 Fr 12:15 RW 3

Untersuchungen der Stabilität von ^{83m}Kr Konversionselektronenlinien am Monitorspektromter mit einen hochpräzisions Spannungsteiler — •Stephan Bauer — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster

Zur Bestimmung der Neutrinomasse im sub-eV Bereich wird beim KATRIN- (Karlsruhe Tritium Neutrino-) Experiment der Endpunkt des Tritium-β-Spektrums mit Hilfe eines elektrostatischen Gegenfeldspektrometers vom Typ MAC-E-Filter vermessen. Um die angestrebte Sensitivität des Experiments zu erreichen, wird die Retardierungsspannung von $-18,6$kV mit einem weiteren Spektrometer vom MAC-E Typ und einer implantierten ^{83m}Kr Konversionselektronenquelle als natürlichen Standard überwacht.

In diesem Vortrag wird die Untersuchung der Stabilität verschiedener Konversionselektronenlinien unterschiedlicher Energie beschrieben. Dazu werden die Lininenpositionen von unterschiedlichen Quellen mit einem der präzisesten Spannungsteiler der Welt untersucht. Die Untersuchung unterschiedlicher Linien gibt außerdem Aufschluss über eventuelle Veränderungen der Austrittsarbeit der Spektrometerelektroden oder des Teilverhältnisses des Spannungsteilers. Der für die Untersuchungen verwendete Spannungsteiler wurde in Zusammenarbeit mit der PTB Braunschweig entwickelt. Dieses Projekt wird durch das BMBF gefördert unter dem Kennzeichen 05A11PM2.

HK 56.6 Fr 12:30 RW 3

Entwicklung des Calibration and Monitoring Systems (CMS) für das KATRIN-Experiment — •Martin Babutzka für die KATRIN-Kollaboration — Karlsruher Institut für Technologie (KIT), IEKP und ITeP

Ziel des KATRIN-Experiments ist die Bestimmung der Neutrinomasse mit einer Sensitivität von $0{,}2\,\mathrm{eV/c^2}$ (90% C.L.) aus der kinematischen Untersuchung des Tritium-β-Zerfalls. Der experimentelle Aufbau basiert auf einer gasförmigen Tritium-Quelle, einer Pumpstrecke, einem Tandemspektrometer und einem Detektor. Der Aufbau wird an der Rückseite der fensterlosen Quelle durch das Calibration and Monitoring System (CMS) vervollständigt.

Als Kalibrationsquelle dient eine winkelaufgelöste Elektronenkanone, deren Elektronen ausgehend vom CMS bis hin zum Detektor magnetisch geführt werden. Um die gewünschte Präzision zu erreichen ist ein sorgfältiges elektromagnetisches Design notwendig, welches mit Hilfe von Simulationen erstellt wurde. Die andere wesentliche Komponente des CMS, die Rear Wall, wird zwischen Quelle und CMS installiert und überwacht zugleich das elektrische Potential der β-Elektronen. Optional dient die Rear Wall zur Instrumentierung um die Aktivität der Quelle zu überwachen. Der Vortrag gibt einen Überblick über den Stand der Entwicklungen bei der Elektronenkanone, der Rear Wall und dem vakuumtechnischen Design.

Dieses Projekt wird vom BMBF unter dem Kennzeichen 05A08VK2 und der Helmholtz-Gemeinschaft gefördert.

HK 56.7 Fr 12:45 RW 3

Inbetriebnahme des KATRIN Fokalebenendetektors am KIT — •Johannes Schwarz für die KATRIN-Kollaboration — Karlsruher Institut für Technologie, Institut für Experimentelle Kernphysik

Das Ziel des **Kar**lsruher **Tri**tium **N**eutrino Experiments ist die Bestimmung der Ruhemasse des Elektron-Antineutrinos mit einer bisher unerreichten Sensitivität von 0,2 $\mathrm{eV/c^2}$. Der KATRIN Fokalebenendetektor besitzt die Aufgabe, die in einem elektrostatischen Spektrometer transmittierten Beta-Elektronen aus dem Tritiumzerfall mit ihren Energien bis zum Endpunkt von 18,6 keV nahezu untergrundfrei nachzuweisen. Dazu wird u.a. eine Nachbeschleunigungselektrode, ein Vetosystem sowie rauscharme Verstärkungselektronik genutzt. Zudem ist das gesamte Detektorsystem aus Materialien mit möglichst geringer Eigenaktivität konzipiert. Der Detektor selbst ist ein großflächig segmentierter Silizium-Wafer mit einem Durchmesser von 90 mm und 148 gleichgroßen Pixeln. Das System wurde an der University of Washington entwickelt und inzwischen am KIT installiert. In diesem Beitrag wird das Gesamtsystem vorgestellt, sowie das Ergebnis der Erstinbetriebnahme und die sich daraus ergebenen Verbesserungen zur weiteren Untergrundreduzierung für den endgültigen Aufbau am KIT erläutert.

Diese Arbeit wird gefördert durch das BMBF unter Kennzeichen 05A11VK2 und die Helmholtzgesellschaft.

HK 57: Instrumentation

Zeit: Freitag 11:00–13:00 Raum: P 2

Gruppenbericht HK 57.1 Fr 11:00 P 2

Das Simulations- und Analyseframework FairRoot — •Florian Uhlig[1], Mohammad Al-Turany[1], Denis Bertini[1], Radek Karabowicz[1], Dymtro Kresan[1] und Tobias Stockmanns[2] — [1]GSI Darmstadt — [2]FZ Jülich

FairRoot ist ein auf ROOT aufbauendes objektorientiertes Software-Framework zur Simulation, Rekonstruktion und Analyse von Daten. Es stellt eine Basis- Infrastruktur zur Verfügung, die es den Usern erlaubt in sehr einfacher Weise ihre Detektorsimulationen und Datenanalysen zu erstellen.

FairRoot wird mittlerweile nicht nur von CBM, Panda, R3B and ASYEOS bei GSI/FAIR benutzt. Auch das MPD-Experiment in Dubna und die EIC Kollaboration am Brookhaven National Laboratory benutzen FairRoot für ihre Detektorsimulationen.

Da ein Teil der FAIR-Experimente keinen Trigger verwenden werden, und es so für die ersten Schritte der Datenanalyse keine zusammengefassten Ereignisse geben wird, muss die Datenanalyse einen Strom an Eingangsdaten verarbeiten können. Diese neue Art der Datenanalyse muss vorher mit Hilfe von Simulationen untersucht werden. Die gängigen Simulationspakete Geant3 und Geant4 liefern die Ergebnisse allerdings Ereignisweise. FairRoot bietet nun die Möglchkeit diese Einzelereignisse in einen Datenstrom zu überführen.

Der Vortrag wird die Möglichkeiten von FairRoot im Allgemeinen beschreiben und im besonderen ein Augenmerk auf die zeitbasierte Simulation und Datenanalyse legen.

HK 57.2 Fr 11:30 P 2

The Hierarchical CBM Network Structure and the CBMnet V2.0 Protocol — •Frank Lemke, Sven Schenk, and Ulrich Bru-

ening for the CBM-Collaboration — ZITI University of Heidelberg, Mannheim, Germany

The CBMnet V2.0 Protocol of the DAQ System within the Compressed Baryonic Matter (CBM) experiment at the Facility for Antiproton and Ion Research (FAIR) in Darmstadt has been demonstrated successfully to be a reliable solution for network communication. It delivers a unified communication over a bidirectional link containing control, data, and synchronization messages and includes clock distribution. In the most recently used setup, 20 Read-Out-Controller (ROC), 5 Data Combiner Boards (DCB), and 4 data sinks were deployed in a hierarchical network. Successful tests for a planned Spartan 6 Board, which will deliver ROC or DCB functionality, were performed and the CBMnet protocol was adapted for achieving all features for the final experiment setup. The CBMnet V2.0 implementation differs in regard to the data handling by delivering reliable data communication. It can be obtained and is easily adaptable to all CBM network parts. CBMnet V2.0 is already integrated into a first tapeout for a front-end detector ASIC. The final setup will have advantages compared to other system solutions. It is specially designed to cater to requirements of CBM. The most important features is that there will be no protocol conversion in the system. Also the hierarchical structure for CBM delivering all communication and synchronization traffic over one link together with link bundling and data rate scaling will minimize the amount of links.

HK 57.3 Fr 11:45 P 2

Cluster Usage Increasing by Virtualization for On-line Clusters — •Stefan Boettger, Udo Kebschull, Camilo Lara, and Jochen Ulrich for the ALICE-Collaboration — Infrastructure and Computer Systems for Data Processing (IRI), Goethe-University Frankfurt/Main

The ALICE HLT Cluster is a computing farm doing on-line event processing for the ALICE Experiment at CERN. It is known that at runtime of the experiment there are phases where few or no data is available for processing. The same applies for maintenance cycles of both the experiment and the cluster. With respect to the costs of maintaining and running such a cluster there is the need to maximize the usage of this computing facility. A toolset has been developed which makes free cluster resources available for third-party applications. The toolset uses virtualization to host third party applications and, most importantly, can be configured such, that the event processing is not affected by third party applications. This is achieved by both local and central resource (re)allocation mechanisms, e.g. by using suspend/resume or live-migration. In this work results like increased cluster usage are shown for the co-operation of event-processing and third party applications. Furthermore a synthezised, more general application is run together with third party applications to demonstrate the suitability of the toolset for other environments.

HK 57.4 Fr 12:00 P 2

Simulation and reconstruction of 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 GmbH, Darmstadt — [2]Göthe-Universität Frankfurt

A compact ring imaging Cherenkov detector is being developed to meet the requirements for charged particle identification for the PANDA experiment at the FAIR (Facility for Antiproton and Ion Research) project. It will cover the barrel region (large range of solid angle and momentum) of the PANDA multi-purpose detector, which will study the nature of strong interactions in detail. The concept and the current design of the PANDA Barrel DIRC were inspired by the successful BABAR DIRC with some important improvements, such as fast photon timing, a compact expansion volume, and focusing optics. Simulation of the detector within Geant4 is an essential acpect of the R&D of the PANDA Barrel DIRC, which focuses on cost optimization and performance improvement. Several design options were implemented in the simulation, and a fast reconstruction procedure based on look-up tables was used to determine the photon yield per particle and the single photon Cherenkov angle resolution. We present the detatils of comparison of these designs.

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 57.5 Fr 12:15 P 2

Entwicklung eines Simulationsmodells für bestrahlte Monolithic Active Pixel Sensoren * — •Melissa Domachowski für die CBM-MVD-Kollaboration — Goethe-Universität, Frankfurt

Um den Anforderungen von zukünftigen Experimenten, wie dem CBM-Experiment, gerecht zu werden, wurde die Strahlentoleranz von Monolithic Active Pixel Sensors (MAPS) in den letzten Jahren deutlich gesteigert. Dies gelang durch die Absenkung der Dotierung des sensitiven Volumens der Pixelsensoren, welche eine teilweise Verarmung dieses Volumens ermöglicht. Die hierdurch beschleunigte Ladungssammlung wirkt der durch Volumenschäden verursachten Rekombination der Signalladungsträger entgegen.

Bislang existierte kein Digitizer, der eine Beschreibung der neuen MAPS-Generation mit Simulationsprogrammen wie GEANT oder CBMRoot erlaubte. Zu diesem Zweck wurde das Ansprechverhalten der Sensoren für verschiedene Bestrahlungsstufen vermessen und ein existierender Digitizer für den Fall strahlentoleranter MAPS erweitert.

Dieser Beitrag stellt die Funktionsweise des CBM-MVD Digitizers vor und präsentiert aktuelle Ergebnisse, die dessen Gültigkeit für strahlentolerante MAPS belegen.

*gefördert durch das BMBF (06FY9099I), HIC for FAIR und GSI

HK 57.6 Fr 12:30 P 2

Experimental Tests and GEANT4 Simulations of Detectors for the EXL — •J. C. Zamora[1], T. Kröll[1], M. v. Schmid[1], T. Davinson[2], P. Egelhof[3], V. Eremin[4], S. Ilieva[1], N. Kalantar[5], M. A. Najafi[5], M. Mutterer[3], C. Rigollet[5], J. A. Scarpaci[6], B. Streicher[3,5], J. Van de Walle[5], and P. J. Woods[2] — [1]IKP, TU Darmstadt — [2]University of Edinburgh — [3]GSI, Darmstadt — [4]PTI, St. Petersburg — [5]KVI, Groningen — [6]IPN, Orsay

The aim of the EXL project is the investigation of light-ion reactions in inverse kinematics by using the storage ring NESR (at FAIR) and a universal detector system providing high resolution and large solid angle coverage in kinematically complete measurements. The design of this detector system includes different silicon (Si(Li) and DSSD) detectors for tracking and energy measurements, as well as CsI scintillators for an external calorimeter shell. Prototypes of these detectors have already been constructed and tested in experiments, e.g., one performed at KVI with 135 MeV protons. Nevertheless, some questions have arisen regarding the complete understanding of the single detector response, and also, the possible influence in neighbor ones. In order to comprehend the experimental response of these detectors, we have performed GEANT4 simulations for the different tested devices. Simulations describe the experimental results successfully, what will help us to investigate more complex processes, such as light cross-talk between scintillation crystals or charge cross-talk in DSSD. Current status of the simulations and comparison with the experimental results will be discussed. Work supported by HIC for FAIR and BMBF (06DA9040I).

HK 57.7 Fr 12:45 P 2

Optimization of Atomic Beam Sources for Polarization Experiments — •Martin Gaisser, Alexander Nass, and Hans Ströher — IKP, Forschungszentrum Jülich, Germany

For experiments with spinpolarized 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. The goal is to include important effects like deflection from a magnetic field, 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.

HK 58: Instrumentation

Zeit: Freitag 11:00–13:00 Raum: P 3

Gruppenbericht HK 58.1 Fr 11:00 P 3

Das R^3B-Kalorimeter CALIFA — •Michael Bendel[1], Roman Gernhäuser[1], Walter F. Henning[1], Reiner Krücken[1,2], Tudi Le Bleis[1] und Max Winkel[1] für die R3B-Kollaboration — [1]Technische Universität München, Physik-Department E12 — [2]TRIUMF, Vancouver, Kanada

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 vielseitiges Instrument, das eine Schlüsselrolle in der Realisation von kinematisch vollständigen Messungen spielt. Die wesentlichen Anforderungen sind eine hohe Effizienz, eine gute Energieauflösung im Bereich von 5% bei 1MeV γ-Strahlung und ein riesiger dynamischer Bereich, der es erlaubt gleichzeitig γ-Quanten mit wenigen 100keV, aber auch gestreute Teilchen mit mehreren 100MeV nachzuweisen. Die spezielle Kinematik von hochenergetischen Reaktionen mit Dopplerverschiebung und -verbreiterung durch den Lorentz-Boost bestimmen wesentlich die Geometrie des Detektoraufbaus. Dieser Vortrag gibt einen Überblick über die physikalischen Anwendungsbereiche des CALIFA Barrels anhand von GEANT4 Simulationen. Darüber hinaus werden die Ergebnisse der ersten Experimente mit kleineren Prototypen zusammengefasst. Diese Arbeit wurde durch BMBF (06MT9156) und DFG (EXC153) unterstützt.

HK 58.2 Fr 11:30 P 3

NEULAND at R^{3}B: Multi-Neutron Response and Resolution of the Novel Neutron Detector — •Dmytro Kresan[1], Thomas Aumann[1], Konstanze Boretzky[2], Denis Bertini[2], Michael Heil[2], Dominic Rossi[2], and Haik Simon[2] — [1]Technische Universität Darmstadt, Darmstadt, Germany — [2]GSI Helmholzzentrum für Schwerionenforschung, Darmstadt, Germany

NEULAND (New Large Area Neutron Detector) will serve for the detection of fast neutrons (200 - 1000 MeV) in the R3B experiment at the future FAIR. A high detection efficiency (>90%), a high resolution (down to 20 keV) and a large multi-neutron-hit resolving power ($\geq$5 neutrons) are demanded. The detector concept forsees a fully active and highly granular design of plastic scintillators. We present the detector capabilities, based on simulations performed within the FairRoot framework. The relevance of calorimetric properties for the multi-hit recognition is discussed, and examplarily the performance for specific physics cases will be presented.

HK 58.3 Fr 11:45 P 3

LaBr$_3$(Ce)-Detektortest und Entwicklung eines LED-Testsystems für das CALIFA-Kalorimeter (R3B, FAIR)* — •Timo Bloch[1], Michael Bendel[2], Roman Gernhäuser[2], Alexander Ignatov[1], Thorsten Kröll[1], Tudi Le Bleis[2], Olof Tengblad[3] und Max Winkel[2] für die R3B-Kollaboration — [1]Institut für Kernphysik, TU Darmstadt — [2]Physik-Department E12, TU München — [3]Instituto de Estructura de la Materia, CSIC Madrid

Im Rahmen von FAIR bei GSI entsteht das R3B-Experiment, welches mithilfe des CALIFA-Kalorimeters die vollständige Kinematik relativistischer Schwerionenreaktionen rekonstruieren soll. Während für das Barrel des Kalorimeters CsI(Tl)-Szintillatoren verwendet werden, bestehen für den hinter dem Target liegenden Teil aufgrund der starken Vorwärtsfokussierung der Reaktionsprodukte und die Nähe zum GLAD-Magneten besondere Anforderungen. Ein möglicherweise geeignetes Detektormaterial stellt LaBr$_3$(Ce) dar. Im Juli 2011 wurde am Tandembeschleuniger des MLL in Garching eine Strahlzeit durchgeführt, bei der ein zylindrischer LaBr$_3$(Ce)-Szintillator B380 von Saint-Gobain, zusammen mit einer Hamamatsu-APD S86664-1010 getestet wurde. Teilchen- und γ-Strahlung konnten simultan nachgewiesen werden, die Ergebnisse werden vorgestellt und diskutiert. Im zweiten Teil des Vortrags wird der Stand der Entwicklung eines Systems präsentiert, welches durch Einkopplung von LED-Licht in die Szintillatoren eine Überprüfung der Stabilität von optischer Kopplung und Elektronik sowie eine Energiekalibrierung ermöglichen soll.

* Gefördert durch BMBF unter 06 DA 9040I und HIC for FAIR.

HK 58.4 Fr 12:00 P 3

Web-Controlled Pulse Generator for Energy Calibration of γ-Calorimeter — •Tudi Le Bleis, Max Winkel, Michael Bendel, Michael Böhmer, Roman Gernhäuser, and Ludwig Maier — E12, T.U. München, Garching bei München, Deutschland

The CALIFA Barrel will be part of the CALIFA γ-ray detector with a high granularity for the R^{3}B Collaboration at FAIR. The Barrel is composed of about 2000 large crystals of CsI readout by APDs.

The signals are processed by a preamplifier and a fast-sampling ADC coupled to an FPGA. Whence designing the detector, a special care has been made of calibration methods. In particular how to continuously calibrate the detector during the experiment?

The electronic chain of the detector will be continuously monitored by a versatile pulse generator based on an FPGA and a 12 bits 20 MHz DAC.

The pulses will be generated at a variable frequency low enough not to disturb the beam measurement, but high enough to allow a monitoring of the response of the system. Each group of preamplifiers will get a separate pulser that also allows to monitor the electronics during and in between the beam pulses to monitor load dependent effects.

In the presentation, one implementation of the hardware of the pulse generator will be presented together with the web-based slow-control system developed for a good portability.

This work was supported by BMBF(06MT9156) and DFG (EXC153).

HK 58.5 Fr 12:15 P 3

Testmessungen der neuen Ausleseelektronik des Crystal-Barrel-Kalorimetes — •Christian Honisch für die CBELSA/TAPS-Kollaboration — Helmholtz-Institut für Strahlen- und Kernphysik, Nußallee 14-16, 53115 Bonn, Germany

Am CBELSA/TAPS-Experiment werden durch Photoproduktion Doppelpolarisationsobservablen im Rahmen der Baryonenspektroskopie gemessen sowie Eigenschaften von Mesonen untersucht.
Zurzeit ist die Triggereffizienz des Experiments für vollständig neutrale Reaktionen wie z. B. $\gamma n \rightarrow n\pi^0$ eingeschränkt, da das CB-Kalorimeter als Hauptkalorimeter nur in der zweiten Triggerstufe eingebunden ist. Im anstehenden Umbau wird die Kalorimeterelektronik ausgetauscht, um die Triggereffizienz zu verbessern. Momentan werden PIN-Photodioden verwendet, um die Lichtsignale der CsI(Tl)-Szintillatorkristalle in elektrische Signale umzuwandeln.
Um ein besseres Signal-zu-Rausch-Verhältnis (SNR) zu erreichen, gleichzeitig die Betriebsfähigkeit unter Magnetfeldern bis 2T zu erhalten, werden die Photodioden durch Avalanche-Photodioden ersetzt.
Zur Verarbeitung der Signale in der ersten Triggerstufe wird die Elektronik um einen Zeitzweig erweitert, wobei die verwendeten Analogfilter Signale mit hinreichend kurzer Anstiegszeit erzeugen.
Durch das verbesserte SNR ist es möglich, Zeitsignale ab einer Energiedeposition von 10 MeV pro Kristall zu erhalten.
Eine Untersektion des Kalorimeters wurde mit der neuen Elektronik ausgerüstet. Dieser Vortrag stellt Ergebnisse der Testmessungen vor.
Unterstützt durch DFG Sonderforschungsbereich TR16.

HK 58.6 Fr 12:30 P 3

Development of Inorganic Scintillating Fibers Made of LuAG:Ce and LYSO:Ce*) — •Stefan Diehl[1], Didier Perrodin[2], and Rainer Novotny[1] — [1]2nd Physics Institute, Uni Giessen, Germany — [2]FiberCryst S. A. S, Lyon, France - and for the HP2-WP21 collaboration

Similar to the field of application of fibers based on plastic scintillators, there is a strong interest to replace the materials by inorganic crystals. They will provide significantly higher light yield, an efficient interaction with electromagnetic probes due to the content of high-Z elements, a wider range of emission wavelength to adapt to the appropriate photo sensors and remain more resistant to radiation damage for long-term applications. Based on the micro-pulling down technique the collaboration has focused on the optimisation of the technology and the quality inspection of fibres based on LuAG:Ce and LYSO:Ce. There has been significant progress in the growing procedure, the optimisation of the crucibles and the growing efficiency. LYSO:Ce as an very radiation hard and bright scintillator material appears to be very attractive for many applications in particular due to its very short radiation length. Fibres with 1mm diameter and more than 100cm length have been successfully produced and show a very promising performance. The talk will discuss in detail measurements of the achieved

light output and homogeneity. In addition, several prototypes for detector applications will illustrate the field of application ranging from hadron- and high-energy physics to medical applications. *)The work is supported by EC-Research Infrastruct. Act. FP7:HP2, WP21

HK 58.7 Fr 12:45 P 3

Aufbau eines modularen Faserdetektors mit SiPM-Auslese und Tests von monokristallinen Kristallfasern mit Elektronen — •Matthias Kube, Christoph Wendel, Christoph Schmidt und Ulrike Thoma — Helmholtz-Institut für Strahlen- und Kernphysik, Universität Bonn

Für Prototypentests des elektromagnetischen Kalorimeters des PANDA Experimentes an FAIR wurde ein modularer und kompakter Szintillationsfaserdetektor mit SiPM-Auslese entwicklet und aufgebaut. Die Aufgabe des Detektors ist es, bei Testmessungen einen Durchstoßpunkt der einfallenden Teilchen zu definieren und einen unabhängigen Trigger zu liefern. Jede der 100 mm x 100 mm großen Detektorlagen besteht aus 14 organischen Fasern mit einem Durchmesser von 2 mm und 2 Plastik-Streifen. Die Auslese erfolgt durch 1 mm^2 SiPMs. Der Detektor wurde in dieser Form u.a. erfolgreich in einer Teststrahlzeit am CERN mit Positronen und Myonen eingesetzt.
Durch den vollständig modularen Aufbau des Detektors war es ebenfalls möglich, einen Teil der Fasern durch 20 monokristalline LuAG:Ce-Fasern zu ersetzen um Tests dieser durchzuführen. Da sich monokristalline anorganische Fasern noch in einem frühen Prototypenstatus befinden, ist es von großem Interesse ihre charakteristischen Eigenschaften experimentell zu bestimmen. Zu diesem Zweck wurden Tests mit Elektronen am Taggingsystem des CBELSA/TAPS-Experimentes durchgeführt. In diesem Vortrag werden sowohl die Konstruktion des Detektors, die Auswahl der SiPMs, als auch die erzielten Ergebnisse vorgestellt. Gefördert durch das BMBF und die EU.

HK 59: Struktur und Dynamik von Kernen

Zeit: Freitag 11:00–13:00 Raum: P 4

Gruppenbericht HK 59.1 Fr 11:00 P 4

^{270}Ds und seine Zerfallsprodukte — •Dieter Ackermann für die SHIP-Ds270-Kollaboration — GSI Helmholtzzentrum für Schwerionenforschung Darmstadt, Germany

Im Jahr 2000 wurden in der Reaktion ^{64}Ni + ^{207}Pb am Geschwindigkeitsfilter SHIP der GSI erstmals das Isotop ^{270}Ds und seine Zerfallsprodukte ^{266}Hs und ^{262}Sg mit dem zusätzlichen Nachweis des K-Isomers ^{270m}Ds beobachtet. In einem zweiten Experiment in 2010 wurden zu den 8 Zerfallsketten aus der ersten Untersuchung weitere 25 Zerfallsketten detektiert. Dabei konnten erstmals Spontanspaltung von ^{266}Hs und ein α-Zerfallszweig für ^{262}Sg nachgewiesen werden. Letzterer stellt das fehlende Bindeglied zu ^{258}Rf und ^{254}No dar. Für ^{254}No wurde vor kurzem eine präzise Massemessung am Penningfallenaufbau SHIPTRAP durchgeführt. Dadurch konnte über Q_α-Werte eine experimentelle Masse für ^{270}Ds ermittelt werden. Des Weiteren wurde für ^{266}Hs ein α-Zerfall mit einer um nahezu zwei Größenordnungen längeren Zerfallszeit von 105 ms und einer um etwa 200 keV höheren α-Zerfallsenergie beobachtet, der dem Zerfall des K-Isomers ^{266m}Hs zugeschrieben wird.

HK 59.2 Fr 11:30 P 4

Towards In-Trap-Spectroscopy at MATS/FAIR — •Christine Weber, Jasmin Moazzami-Fallah, Peter Müller, Jurek Szerypo, and Peter Thirolf — Fakultät für Physik, LMU - München, 85748 Garching

A novel in-trap spectroscopy setup is developed at MLL-TRAP/Garching to be implemented in the future MATS facility at FAIR/GSI. It combines the high-resolution purification capabilities of a Penning trap with a customized detector trap setup, providing both, storage and detection. In this way, decay-spectroscopy experiments of purified nuclides, free from any background or scattering effects, will become feasible. Here, the main trapping electrodes are replaced by position-sensitive Si-strip detectors and emitted electrons are efficiently guided by the strong field of the trap magnet towards distant electron detectors. Possible experiments are conversion-electron spectroscopy and intrap α-decay experiments of heavy actinides. Moreover, a coincident detection of an α decay with an electron detection allows to reconstruct the original positions of electron clouds initiated by shake-off as well as from subsequent conversion decay. Via this decay length, the half-lives of excited (2^+) states populated by α decay can be derived in a unique type of recoil-distance method. In this presentation, possible physics experiments and the design of the setup are presented.

[*] Supported by the BMBF (06ML9148), DFG (HA 1101/14-1), and MLL.

HK 59.3 Fr 11:45 P 4

Double-beta transition Q-value and direct mass measurements with TRIGA-TRAP — •Christian Smorra for the TRIGA-SPEC-Collaboration — Max-Planck-Institut für Kernphysik, Saupfercheckweg 1, D-69117 Heidelberg — Institut für Kernchemie, Johannes Gutenberg-Universität, Fritz-Strassmann-Weg 2, D-55128 Mainz — Fakultät für Physik und Astronomie, Ruprecht-Karls-Universität, Philosophenweg 12, D-69120 Heidelberg

Neutrinoless double-beta transitions are difficult to observe due to their long half-lives. In case of neutrinoless double-electron capture, a resonant enhancement of the decay rate by several orders of magnitude occurs if the energy levels of initial and final state are degenerate in energy. In order to search for nuclides undergoing a resonantly-enhanced double-electron capture the Q-values of the transitions in ^{106}Cd, ^{108}Cd, and ^{184}Os were determined by the double-Penning trap mass spectrometer TRIGA-TRAP with a precision better than 1 keV. The double-beta decay Q-value of ^{110}Pd was investigated as well. The recent results will be presented.

HK 59.4 Fr 12:00 P 4

Multi-Coincidence Spectroscopy of SHE using TASISpec — •Lise-Lotte Andersson for the TASISpec-Collaboration — Helmholtz-Institut Mainz

The isotope ^{253}No was produced in the two neutron evaporation channel using the ^{48}Ca + ^{207}Pb reaction. The structure of both mother and daughter nuclei was studied with TASISpec [1], a compact spectroscopy set-up placed in the focal plane of the gas-filled separator TASCA at GSI, Darmstadt. TASISpec allows for multi-coincidence spectroscopy including correlations between implanted nuclei, α particles, electrons, X- and γ rays. For example, electron lines originating from internal conversion can, for the very first time, be observed in the Si-strip box detectors at the same time as γ-rays are observed in the surrounding Ge detectors. This is a unique strength of TASISpec, which here provides the possibility to determine the multipolarities of these transitions, using conversion coefficient systematics.

Results from experimental studies will be presented together with GEANT4 simulations of the setup and theoretical predictions of the nuclear structure.

[1] L.-L. Andersson et al., Nucl. Instr. Meth. A 622, 164, (2010).

HK 59.5 Fr 12:15 P 4

Entwicklung digitaler Signalverarbeitung zur Untersuchung superschwerer Kerne — •Ron Mändl für die SHIP-Kollaboration — Fachhochschule Frankfurt am Main, Germany — Helmholtz Institut Mainz, Germany

Die Anforderungen an die Datenaufnahmeelektronik für Teilchen- und Photonenzähler sind durch die Form der zu erwartenden Signale definiert. In Experimenten am Geschwindigkeitsfilter SHIP bei GSI für die Synthese und Kernstrukturuntersuchungen von superschweren Kernen sind das Signale von Spaltfragmenten (E $\leq$ 250 MeV), von Reaktionsprodukten (E $\approx$ (10-50) MeV), von α-Teilchen (E $<$ 15 MeV) und von Elektronen (E $\leq$ 1 MeV). Zerfallszeiten im Bereich von μs und die Untersuchung kurzlebiger Isomere machen die Verwendung digitaler Elektronik zur Signalverarbeitung notwendig. Dazu wurden zwei Konfigurationen auf Basis der bei GSI entwickelten digitalen FEBEX ADC-Module mit komplementären Eigenschaften im Vergleich mit einem analogen Aufbau untersucht, die bezüglich der spezifischen Anwendung dem breiten dynamischen Signalbereich Rechnung tragen. Die erste verwendet konventionelle ladungsempfindliche Vorverstärker mit zwei unterschiedlichen, schaltbaren Verstärkungsfaktoren, welche den Amplitudenhub der FEBEX-Module optimal ausnutzen. Sie ist auf hohe Zeitauflösung optimiert. Die zweite, auf hohe Energieauflösung op-

timierte Konfiguration, verwendet einen hoch integrierten Schaltkreis, den sogenannten APFEL-Chip, der für jeden Eingangskanal zwei bereits geformte Ausgangssignale unterschiedlicher Verstärkung mit 250 ns Integrationszeit anbietet.

HK 59.6 Fr 12:30 P 4

Towards Photofission Studies with highly-brilliant γ beams — •Lorant Csige[1], Dieter Habs[1], Attila Krasznahorkay[2], Janos Gulyas[2], Peter G. Thirolf[1], and Tamas G. Tornyi[2] — [1]Ludwig Maximilians Universität München, Garching, Germany — [2]Inst. Nucl. Res. of Hung. Acad. Scienc. (ATOMKI), Debrecen, Hungary

Using highly brilliant γ beams, which will be soon available at the MEGa-Ray facility (Livermore) and at ELI-NP (Bucharest), a new experimental campaign on photofission studies can be envisaged to study extremely deformed nuclear states of the light actinides and their multiple-humped potential energy surface in a highly-selective way. The experimental technique of these studies is based on the observation of transmission resonances in the prompt fission cross section; the fission decay channel can be expressed as a tunneling process of gateway states in the 2nd and 3rd minimum through the multiple-humped fission barrier. Until now all photofission measurements at sub-barrier energies have been performed with bremsstrahlung photons, where the fission cross-section was folded by the increasing gamma-ray spectrum. Compared to the presently available gamma bandwidth of 100 keV, the soon available improved energy resolution of 1 keV will allow resolving the "isomeric shelf" in the photofission cross-section into underlying predicted individual resonances. Moreover, as a result of the strong spin selectivity of the photo-induced reactions, the states in the 2nd and 3rd minimum can be populated with much larger intensities compared to former methods (light-ion induced reactions), hence a detailed gamma-spectroscopy in these minima will be enabled.

HK 59.7 Fr 12:45 P 4

Preparations for an optical access to the lowest excited nuclear state in ^{229m}Th* — •Lars von der Wense, Peter Thirolf, Dominik Kalb, and Mustapha Laatiaoui — LMU München, Am Coulombwall 1, 85748 Garching

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 ^{229m}Th, a quadrupole mass spectrometer (QMS) is under construction, aiming at an optimum mass resolution and transmission efficiency. Following the QMS, the Thorium isomers will be collected on a $40\mu m$ needle tip. The decay of these isomers can then be detected using deep UV optics, presently under construction based on extensive simulations.

* Supported by DFG Cluster of Excellence MAP.

HK 60: Schwerionenkollisionen und QCD Phasen

Zeit: Freitag 11:00–13:00 Raum: P 5

HK 60.1 Fr 11:00 P 5

Transverse Momentum Spectra of Unidentified Charged Particles in pp Collisions at the ALICE Experiment — •Philipp Lüttig for the ALICE-Collaboration — Institut für Kernphysik, Goethe University Frankfurt, Germany

The ALICE experiment at the CERN-LHC has accumulated a wealth of data on pp and Pb–Pb collisions in the past two years. Designed for exploring the properties of hot and dense matter formed in heavy-ion-collisions, the ALICE Time Projection Chamber (TPC) has the capability to measure the transverse momentum (p_T) of charged particles in a broad p_T range for $p_T > 150$ MeV/c.
In this talk the transverse momentum spectra of unidentified charged particles for pp collisions at $\sqrt{s} = 0.9$, 2.76 and 7 TeV are presented. The extraction of a pp baseline for the calculation of the nuclear modification factor R_{AA} at $\sqrt{s} = 2.76$ TeV is discussed and compared to alternative approaches to construct a baseline. In addition, the dependence of the average transverse momentum of these spectra on center-of-mass energy and multiplicity is reviewed and compared to measurements by other experiments.

HK 60.2 Fr 11:15 P 5

Charged particle production at large transverse momentum in Pb-Pb collisions at $\sqrt{s}$=2.76 TeV measured with ALICE at the LHC — •Michael Linus Knichel — Research Division and ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany

The suppression of high-p_T particle production in heavy-ion collisions is generally attributed to energy loss of partons as they propagate in the hot and dense QCD medium. Inclusive transverse momentum spectra of primary charged particles in Pb-Pb collisions at $\sqrt{s}$=2.76 TeV have been measured by the ALICE Collaboration at the LHC. The measurements in the central pseudorapidity region $|\eta| < 0.8$ cover a transverse momentum range of $0.15 < p_T < 50$ GeV/c. Charged particle spectra in Pb-Pb collisions are compared to those measured in inelastic pp collisions at the same collision energy, scaled by the number of nucleon-nucleon collisions in Pb-Pb. This comparison is expressed in terms of the nuclear modification factor $R_{\rm AA}$. The evolution of particle spectra and $R_{\rm AA}$ as a function of collision centrality will be presented. $R_{\rm AA}$ as a function of p_T will be compared to calculations from different energy loss models.

HK 60.3 Fr 11:30 P 5

Elliptic flow of heavy-flavor electrons in Pb-Pb collisions at 2.76 TeV with ALICE — •Raphaelle Bailhache and Theodor Rascanu for the ALICE-Collaboration — Institut für Kernphysik, Universität Frankfurt, Germany

In ultra-relativistic heavy-ion collisions, heavy quarks, i.e charm and beauty, are produced in the early stage of the reaction. Therefore, they are uniquely suited to probe the Quark-Gluon-Plasma (QGP), which is formed in such reactions. The properties of the QGP can be studied via the azimuthal anisotropy of the heavy-quark emission in the transverse plane, quantified by the elliptic flow v_2. Experimentally, this anisotropy can be measured indirectly via the semi-electronic decays of heavy-flavor hadrons.
We present the measured elliptic flow of inclusive electrons in Pb-Pb collisions at 2.76 TeV with the ALICE detector. Electrons are identified using the Time Projection Chamber and the Time-Of-Flight detector. The elliptic flow analysis is performed with methods based on two-particle correlations, i.e. the event plane method and second order cumulant, as well as four-particle correlations, i.e; fourth order cumulant. We show the elliptic flow of inclusive electrons as function of transverse momentum and the centrality of the collision for the different methods. At high p_t the contribution of electrons from heavy-flavour decays is expected to be dominant, whereas at low p_t most electrons come from Dalitz decay of π^0 and gamma conversion in the detector material. We compare the inclusive electron v_2 with the elliptic flow of electrons from the Dalitz decay of π^0.

HK 60.4 Fr 11:45 P 5

Open charm elliptic flow from hadronic decays of D-mesons — •Robert Grajcarek for the ALICE-Collaboration — University of Heidelberg, Physikalisches Institut,Philosophenweg 12, Heidelberg, Germany

A Large Ion Collider Experiment (ALICE) at the Large Hadron Collider (LHC) has been built in order to identify and characterize the quark gluon plasma (QGP) created in high-energy nuclear collisions. As charm quarks are produced at the early stage of the collision, they serve as ideal probes for a QGP. It is still an open question whether charm quarks take part in the collective motion of the expanding fireball in ultrarelativistic heavy ion collisions. The ALICE detector with its powerful capabilities such as particle identification, secondary vertexing at sub-millimeter precision and tracking in a high multiplicity environment addresses the charm sector in nuclear collisions.
We report latest news on the measurment of open charm elliptic flow.

HK 60.5 Fr 12:00 P 5

Azimuthal emission patterns of K^+ and K^- mesons in Ni+Ni collisions near thresholds — •Tae Im Kang for the FOPI-Collaboration — Physikalisches Institut, Heidelberg, Germany

Kaons, which are produced in nucleus-nucleus collisions at subthreshold energies at SIS/GSI, are expected to be a very sensitive probe to investigate in-medium effects on hadrons. The microscopic transport models suggest that kaon properties are modified in dense nuclear matter. The modification can be understood as a consequence of a density dependent kaon-nucleon potential. Therefore, the measurement of charged kaon azimuthal emission patterns can provide important information on such an in-medium potential.

Here we are presenting results from measurements of sideward flow of K^+ and K^- mesons in Ni+Ni collisions. Data are compared to transport models, Hadron String Dynamics and Isospin Quantum Dynamics, to investigate KN potentials in the dense nuclear medium.

This work was supported by BMBF 06HD9121I

HK 60.6 Fr 12:15 P 5

Shear Viscosity of Pion Gases — •Robert Lang, Norbert Kaiser, and Wolfram Weise — Physik Department, Technische Universität München, D-85747 Garching, Germany

Experiments at RHIC suggest that the quark-gluon plasma created in heavy-ion collisions is an almost-perfect fluid. Furthermore, the η/s ratio (shear viscosity per entropy density) turns out to be minimal at the phase transition. We discuss the formalism which connects quantum field theory at finite temperature and the macroscopic transport coefficients for dissipative hydrodynamical systems. Within the framework of ChPT we compute the shear viscosity of an interacting pion gas in the confined phase. The results are compared to the AdS/CFT bound of $1/4\pi$.

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

HK 60.7 Fr 12:30 P 5

Computation of the 2nd order transport coefficient κ in the gluon plasma — Owe Philipsen and •Christian Schäfer — Goethe Universität, Frankfurt, Deutschland

From heavy-ion collision experiments we know that the quark-gluon plasma behaves almost like an ideal fluid and can be described by hydrodynamics. The dynamic properties of the quark-gluon plasma are determined by transport coefficients.

The second order transport coefficient κ is related to a momentum expansion of the euclidean energy-momentum tensor correlator at vanishing Matsubara frequency. The computation of the Fourier-transformed correlator in lattice gauge theory allows the determination of κ from first principles. We present the results obtained by pure Yang-Mills lattice simulations in comparison to a computation in quasi-free lattice perturbation theory.

HK 60.8 Fr 12:45 P 5

Maximum entropy study of viscous coefficients in gauge theory plasmas — •Michael Haas — Institut fuer theoretische Physik, Universitaet Heidelberg

The applicability of laws of fluid dynamics to high energy gauge theory matter as the quark-gluon plasma placed the focus on the calculation of viscous coefficients. Via Kubo relations these dynamic quantities are related to the static spectral functions. A maximum entropy (ME) approach allows to find the spectral functions from imaginary-time correlation functions both at zero and finite temperature by inverting an integral transform. An important feature of ME is its independence on priori parametrizations of the spectral functions, by including the the broadest function space supported by the input data. Both accomplishments and future challenges will be discussed.

HK 61: Hadronenstruktur und -spektroskopie

Zeit: Freitag 14:00–16:00 Raum: RW 1

Gruppenbericht HK 61.1 Fr 14:00 RW 1

Das OLYMPUS-Experiment an DORIS — •Alexander Winnebeck für die OLYMPUS-Kollaboration — Massachusetts Institute of Technology, Cambridge, MA, USA

Mit dem am DESY in Hamburg betriebenen OLYMPUS-Experiment wird der Beitrag des Zweiphotonenaustauschs in elastischer Elektron-Protonstreuung durch Messung des Verhältnisses der Wirkungsquerschnitte von elastischer Elektron- zu Positron-Protonstreuung untersucht. Im DORIS-Speicherring, der sowohl Elektronen- als auch Positronenstrahlen zur Verfügung stellt, wurde ein internes H_2-Gastarget installiert, welches von einem magnetischen Spektrometer mit großer Akzeptanz umgeben ist.
In diesem Vortrag wird eine Übersicht über die physikalische Motivation und den experimentellen Aufbau gegeben. Die erste Datennahme wurde im Februar 2012 beendet und erste vorläufige Ergebnisse werden präsentiert.

HK 61.2 Fr 14:30 RW 1

Luminosity determination at COMPASS — •Nicolas du Fresne von Hohenesche — for the COMPASS collaboration - Institut für Kernphysik der Johannes Gutenberg-Universität Mainz and CERN

In 2009, a Deep Virtual Compton Scattering test run with a 160 GeV muon beam impinging on a liquid hydrogen target was performed at the COMPASS experiment at CERN. The data were acquired using a system of inclusive muon triggers, consisting of scintillator hodoscopes. As a first step of the analysis the inclusive cross section will be extracted. To achieve this aim, the luminosity is needed which is proportional to the beam flux in a fixed-target experiment. The flux is determined by two methodes: counting tracks using a random trigger or using the Scaler information of the scintillating fibre station in the beam telescope of the experiment. By calculating the cross section for Deep Inelastic Scattering and the structure function F_2^p, the results will be cross checked with results from NMC which cover a similar kinematic range.

HK 61.3 Fr 14:45 RW 1

Symmetric Moller/Bhabha luminosity monitor for the Olympus experiment — •Perez Benito Roberto Francisco — Helmholtz-Institut Mainz

Recent determinations of the proton electric to magnetic form factor ratio indicate an unexpected discrepancy between the obtained ratio using polarization transfer measurements and the ratio from Rosenbluth separation technique in unpolarized cross section measurements. This discrepancy has been explained as the effect of two-photon exchange. OLYMPUS experiment at DESY has been proposed to measure the ratio of positron-proton and electron-proton elastic scattering cross sections. The experiment will utilize intense beams of electrons and positrons in the DORIS ring incident on an internal hydrogen gas target. Results of the performance of the Symmetric Moller and Bhabha Luminosity Monitor will be presented in this contribution together with the physics case for the OLYMPUS and the current status of the project.

HK 61.4 Fr 15:00 RW 1

OLYMPUS Luminosity Monitoring — •Ozgur Ates for the OLYMPUS-Collaboration — Hampton University, Hampton, VA, USA

The OLYMPUS experiment at DESY will measure 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. The production, installation, and commissioning of the OLYMPUS GEM luminosity monitors will be presented.

HK 61.5 Fr 15:15 RW 1

Studie der Energie-Scan-Messung des X(3872) bei PANDA und Einfluss der Präzision der Luminositätsmessung* — •Tobias Weber, Miriam Fritsch, Prometheusz Jasinski, Anastasia Karavdina und Mathias Michel — 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 Charmoniumspektroskopie optimiert. Ein Großteil des Physikprogramms beschäftigt sich mit der Suche nach neuen konventionellen und exotischen Zuständen wie z.B. Hybriden oder Gluebällen, aber auch mit der exakten Vermessung der Linienform von bekannten Zuständen wie z.B. des X(3872), um dessen interne Struktur aufzuklären.

Eine zentrale experimentelle Technik von PANDA ist die Energie-Scan-Methode, um Linienformen zu vermessen. Neben exzellenter Strahlqualität, wie sie vom High Energy Storage Ring zur Verfügung stehen wird, ist die Messdauer der einzelnen Scan-Punkte und die Genauigkeit der Luminositätsmessung maßgeblich für die Genauigkeit der Messung.

Vorgestellt wird eine Optimierung der Vermessung der Linienform des X(3872) im Endzustand $J/\psi\pi\pi$ bei Verwendung der Energie-Scan-Methode für verschiedene theoretische Vorhersagen von Wirkungsquerschnitt und Breite der Resonanz. Außerdem wird der Einfluss der Präzision der Luminositätsmessung auf die rekonstruierte Breite des X(3872) diskutiert.

*gefördert durch BMBF und HGF

HK 61.6 Fr 15:30 RW 1

OLYMPUS tracking — •Axel Schmidt for the OLYMPUS-Collaboration — Massachusetts Institute of Technology, Cambridge, MA, USA

The OLYMPUS Experiment, underway at DESY, in Hamburg, Germany, is measuring the cross-section ratio between electron and positron elastic scattering from protons to definitively determine the two-photon contribution to lepton-proton scattering. Elastic events are selected by tracking the outgoing leptons and protons with a large acceptance magnetic spectrometer to determine the scattering angles, momenta, and vertex. Two large drift chambers each with 18 planes of sense wires are used to determine the particle trajectories. Hits in each sense wire plane are combined to form a three dimensional track through the detector. The design of the OLYMPUS drift chambers, as well as a description of the track reconstruction will be presented.

HK 61.7 Fr 15:45 RW 1

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

The PANDA detector is a state-of-the-art general-purpose detector for physics with high luminosity cooled antiproton beams, planed to operate at the FAIR facility in Darmstadt, Germany. 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 Hough transformation is shown. The MVD (Micro Vertex Detector) and STT (Straw Tube Tracker) are used in this algorithm.

* This work was supported in part by BMBF (06GI9107I) and the LOEWE-Zentrum HICforFAIR.

HK 62: Nukleare Astrophysik

Zeit: Freitag 14:00–16:15 Raum: RW 2

Gruppenbericht HK 62.1 Fr 14:00 RW 2

Study of the ^{2}H(α,γ)^{6}Li reaction and recent progress at LUNA — •Daniel Bemmerer for the LUNA-Collaboration — Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Dresden, Germany

In addition to the well-known ^{7}Li problem of Big Bang nucleosynthesis, observations of ^{6}Li in very metal poor stars hint at a possible Big Bang ^{6}Li problem. Network calculations show that the ^{2}H(α,γ)^{6}Li reaction dominates ^{6}Li production in the Big Bang, but there are no direct experimental data on this reaction at relevant energies. An experiment on this reaction is underway at the 400 kV underground accelerator LUNA in Gran Sasso/Italy, and preliminary data will be shown. In addition, recent LUNA work on the ^{15}N(p,γ)^{16}O, ^{17}O(p,γ)^{18}F, and ^{25}Mg(p,γ)^{26}Al reactions and a planned ^{22}Ne(p,γ)^{23}Na study will be briefly discussed, and an outlook will be given. – Supported in part by INFN and by DFG (BE 4100/2-1).

Gruppenbericht HK 62.2 Fr 14:30 RW 2

High resolution (^{3}He,t) reaction on the $\beta\beta$ decaying nucleus ^{136}Xe — •Peter Puppe[1], Dieter Frekers[1], Annika Lennarz[1], Jan Thies[1], and Michael Holl[2] — [1]Inst. f. Kernphysik, 48149 Münster — [2]Inst. f. Theor. Physik, 48149 Münster

A (^{3}He,t) charge-exchange reaction experiment on the $\beta\beta$ decaying nucleus ^{136}Xe has been performed at an incident energy of 420 MeV. The objective was to identify the Gamow-Teller (GT) strength distribution in ^{136}Cs in an attempt to understand the long $2\nu\beta\beta$ decay half-life of ^{136}Xe. The measurements have been carried out at the Grand Raiden spectrometer of the RCNP in Osaka, where an energy resolution of 42 keV was achieved. A new gas cell with thin windows made of polyethylene naphthalate has been employed as a target.

We find that the GT$^-$ strength distribution even at low excitation energies exhibits a rather normal behaviour compared to neighbouring nuclei like ^{128,130}Te. A number of well isolated states up to about 4 MeV concentrated in two separate clusters have been resolved carrying a total B(GT$^-$) strength of order unity. We argue that assuming exceptionally weak transitions from the GT$^+$ side would be a rather improbable cause for the long half-life, whereas phase-cancelation effects for the $2\nu\beta\beta$ decay nuclear matrix elements seem to be a more natural and likely scenario. The data are confronted with the half-life measurement recently communicated by the EXO-Collaboration [1] and with recent theoretical calculations. The impact of phase cancellation on the neutrinoless decay will also be discussed.

[1] N. Ackerman et al., Phys. Rev. Lett. 107, 212501 (2011)

HK 62.3 Fr 15:00 RW 2

Properties of Nuclei in Dense Matter and Equation of State — •Stefan Typel[1], Thomas Klähn[2], and Gevorg Poghosyan[3] — [1]GSI, Darmstadt, Germany — [2]IFT, University of Wrocław, Poland — [3]SCC, KIT, Karlsruhe, Germany

The detailed chemical composition of dense matter is relevant for simulations of astrophysical objects such as neutron stars or core-collapse supernovae. It depends strongly on the density and temperature of the environment and affects the thermodynamic properties encoded in the equation of state. In many applications, a simple nuclear statistical equilibrium description is used assuming an ideal mixture of nuclei with experimental masses in chemical equilibrium. However, the binding energies of nuclei are modified considerably in a medium. We calculate the change of nuclear properties with density and temperature in a relativistic density functional approach using the Thomas-Fermi approximation in a spherical Wigner-Seitz cell. Both the stabilization and the dissolution of nuclei are observed depending on the thermodynamic conditions. A parametrization of the binding energy shifts can be employed in the construction of improved equation of state tables. The results are also of interest for the analysis of fragment distributions in heavy-ion collisions.

HK 62.4 Fr 15:15 RW 2

Constraining mean-field models of the nuclear matter equation of state at low densities — •Maria Voskresenskaya and Stefan Typel — GSI, Darmstadt

The description of thermodynamical properties and the composition of dense nuclear matter for astrophysical applications requires the knowledge of the equation of state in a wide range of densities and temperatures. In this work we extend a generalized relativistic mean-field (gRMF) model with density dependent couplings by considering bound states of nuclei and two-nucleon scattering correlations as explicit degrees of freedom in the thermodynamical potential. These quasiparticles are characterized by medium dependent effective resonance energies with temperature dependent effective degeneracy factors. The model interpolates between the correct low-density limit, the model independent virial equation of state (VEoS), and the RMF description around nuclear saturation density where clusters are dissolved. From

the comparison of the fugacity expansions of the VEoS and the gRMF model consistency relations between the quasiparticles properties, the nucleon-nucleon scattering phase shifts and the meson-nucleon couplings of the gRMF model at zero density are derived. Relativistic effects are found to be important at temperatures that are typical in astrophysical applications. The example of neutron matter is studied in detail for different temperatures.

HK 62.5 Fr 15:30 RW 2

Quark Stars in the Quark-Meson-Model — •Margit Maly, Rainer Stiele, and Jürgen Schaffner-Bielich — Institute for Theoretical Physics, Heidelberg University, Philosophenweg 16, Heidelberg, D-69120

Compact stellar objects are nature's laboratory for probing QCD in the high density, low temperature regime. For exploring the properties of compact stars made of pure quark matter, we use an effective model for the quark interaction respecting the chiral symmetry of the original QCD-Lagrangian. This linear sigma model including quark degrees of freedom is complemented by an repulsive interaction coming in through vector meson exchange. By varying the free parameters of the model one can set up several different equations of state which result in various mass-radius-relations for quark stars.

By using the recent new mass limit for compact stars from pulsar PSR J1614-2230 of M=(1.97 ± 0.04)$M_\odot$, we constrain the possible parameter space of our model and discuss implications for the possible existence of selfbound quark stars.

HK 62.6 Fr 15:45 RW 2

Fission-Fusion: a new Reaction Mechanism for Nuclear Astrophysics based on Laser-Ion Acceleration* — •P.G. Thirolf[1], D. Habs[1,2], K. Allinger[2], J. Bin[2], W. Ma[2], J. Schreiber[1], and H. Wong[2] — [1]LMU München — [2]MPI f. Quantenoptik, Garching

High power short-pulse lasers with peak powers presently reaching up to PW levels routinely reach focal intensities of 10^{18} - 10^{21} W/cm^2. These lasers are able to produce a variety of secondary radiation, from relativistic electrons to multi-MeV/nucleon ion beams. Compared to ion beams generated by conventional accelerators, laser-accelerated ion bunches can reach ultra-high densities around solid-state density, exceeding classical ion beams by up to 10^{15}. These properties will allow to investigate a new reaction mechanism, 'fission-fusion', opening the perspective to generate extremely neutron-rich fusion products e.g. towards the N=126 waiting point of the r process path. Laser-accelerated ^{232}Th ions pass through a second Th foil, where target-like and beam-like Th nuclei will desintegrate into heavy and light fission fragments. Due to the high beam density, subsequent fusion between two light (neutron-rich) fission fragments can occur, resulting in a very neutron rich fusion product. A new EU-funded large-scale research infrastructure ELI-NP (Extreme Light Infrastructure) will be built until 2016 in Bucharest for high-power laser-based nuclear physics. This facility with an unprecedented laser intensity of 10^{24} W/cm^2 will allow to exploit the new fission-fusion reaction mechanism.

*supported by DFG Clusters of Excellence 'Universe' and 'MAP'

HK 62.7 Fr 16:00 RW 2

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

The neutrino driven wind from core collapse supernova is considered as one of the sources of elements heavier than iron. However, its contribution to different elements and its dependence with progenitor mass has not yet been determined. We perform a detailed nucleosynthesis study based on recent long-time simulations using Boltzmann neutrino transport. These simulations have been performed for stars of different progenitor masses (8.8, 10.8 and 18.0 $M_\odot$) and for times of several tens of seconds after the onset of the explosion. The ejected matter is always proton rich. Using an extended nuclear network that includes all relevant nuclear and weak processes, we have determined the integrated nucleosynthesis outcome and its sensitivity to the progenitor mass. We show that proton rich winds can account for the metal-poor star observations of light r-process elements, $Z < 56$. Furthermore depending on the late time dynamics of the ejecta, we find that after the freeze-out of proton captures at temperatures around 1 GK, there is a phase dominated by neutron captures that drives material to the neutron rich side of stability. During this phase the elemental abundances do not change, but the resulting isotopic abundances are in agreement with solar system abundances.

HK 63: Astroteilchenphysik

Zeit: Freitag 14:00–16:00 Raum: RW 3

HK 63.1 Fr 14:00 RW 3

PERC, a clean, bright and versatile source of neutron decay products — •Bastian Märkisch for the PERC-Collaboration — Physikalisches Institut, Universität Heidelberg

Within the Standard Model of particle physics, neutron β-decay is described by only three parameters, whereas there are many more observables accessible to experiments. Precision measurements on neutron decay observables make it therefore an ideal candidate in the search for physics beyond the SM.

We present the new facility PERC (Proton Electron Radiation Channel), a novel source of neutron decay products. PERC will be installed at the Forschungs-Neutronenquelle Heinz Maier-Leibnitz. Decay rate is largely increased compared to existing instruments like e.g. Perkeo III 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 filter 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}. We give an overview on the concept of the PERC instrument, observables accessible and its present status.

HK 63.2 Fr 14:15 RW 3

Superconducting magnet system for PERC — •Carmen Drescher for the PERC-Collaboration — Physikalisches Institut, Universität Heidelberg

The new PERC (Proton Electron Radiation Channel) instrument will be an extremely bright and versatile source of neutron decay products. It will feed several novel precision experiments of spectra and correlation measurements in neutron decay. Its main component is a more than 11 m long superconducting magnet system. The neutron decay volume is located inside an 8 m long neutron guide in a strong longitudinal magnetic field of 1.5T. A variable magnetic barrier of 3T to 6T serves to precisely limit the phase space of the emerging electrons and protons to control systematic errors on the 10^{-4}level. The instrument is currently under development and will be installed at the neutron-beamline Mephisto at the FRM II, Garching. In this talk we give an overview on the special characteristics and advantages of PERC's field design. We will show that with our design we can prevent magnetic traps in magnetic field and achieve a clean separation of neutrons and decay-products.

HK 63.3 Fr 14:30 RW 3

Development of non-magnetic neutron guide for PERC — •Nataliya Rebrova for the PERC-Collaboration — Physikalisches Institut, Universität Heidelberg

The future cold neutron beam station PERC (Proton Electron Radiation Channel) is developed for measurements of angular correlation coefficients in β-decay of free polarized neutrons with precision of about 10-4. The neutron guide within PERC (where the 'active decay volume' lies) should be non-depolarizing on the same level of 10-4. We present the current status of the development of non-magnetic neutron guides. We discuss possible non-magnetic supermirror coatings with nickel-molybdenum or nickel-vanadium alloys and titanium, or copper and titanium. We demonstrate the feasibility of using copper and titanium supermirrors. We present first results of depolarization measurements at the opaque test bench obtained with cold polarized neutrons, which are reflected once from a multilayer copper-titanium sample placed inside strong magnetic field.

HK 63.4 Fr 14:45 RW 3

Studies on Liquid Xenon Low Energy Scattering for Dark Matter Applications — •Pierre Sissol, Bastian Beskers, Cyril Grignon, Uwe Oberlack, and Rainer Othegraven — Johannes Gutenberg Universität Mainz

The concept of a dual-phase Xenon time projection chamber realizes with XENON100 the currently most sensitive dark matter search experiment. Its successor XENON1T is already in development phase, and detectors at the 10 ton scale (e.g. DARWIN) are being envisioned. Background suppression and discrimination are driving forces in the design of these experiments. Currently, this is accomplished by fiducialization using position sensitivity and light/charge discrimination. Additional discrimination may be achieved by pulse-shape discrimination.
The Mainz group is setting up a small 3D position-sensitive two-phase Xenon-TPC to measure charge and scintillation yield at recoil energies of a few keV and to study the liquid Xenon scintillation pulse shape. We employ MC simulations to study low energy scattering of gamma-rays and neutrons to optimize the experimental setup. Here we discuss the planned experiments and identify the dominant systematic errors.

HK 63.5 Fr 15:00 RW 3

Dark Matter Search Results from the XENON100 Experiment — •Ethan Brown for the XENON-Collaboration — Institut fuer Kernphysik, WWU Muenster

The XENON100 Experiment looks for a new unknown form of matter called Dark Matter in the form of Weakly Interacting Massive Particles (WIMPs) by looking for nuclear recoils off of a target of liquid xenon. By utilizing a dual phase Time Projection Chamber (TPC) to measure the scintillation and ionization signals, event localization and discrimination of backgrounds due to electron recoils is possible. By operating a detector with a large active mass of 62kg in an ultra-low background environment, XENON100 has achieved excellent sensitivity to the WIMP-nucleon cross section, and is capable of probing much of the favored phase space predicted by theorists.

The results of a 100 live day dark matter search with the XENON100 detector will be presented, with an emphasis on background studies and detector characterization via calibrations. Additionally, the Profile Likelihood Analysis method will be discussed in the context of applying a statistical analysis of the experimental results, which allows for a robust statement of the interpretation of the results.

The work of the author has been supported by DFG (for XENON100, GZ: WE1 843/7-1) and BMBF (for XENON1T, GZ: 05A11PM1).

HK 63.6 Fr 15:15 RW 3

Determining the reflectivity of PTFE in the VUV — •Karen Bokeloh for the XENON-Collaboration — IKP, WWU Münster

In the hunt for dark matter the XENON collaboration searches for weakly interacting massive particles (WIMPS) by detecting their recoil from Xenon nuclei in a dual phase time-projection chamber (TPC). The ratio between the emitted light S1 and charge - the latter is converted into a second light signal S2 by electroluminescence - allows to discriminate nuclear recoils as caused by WIMPS or neutrons against electron recoils, the main background stemming from γs and electrons. For this separation it is essential that the complete primary light signal S1, that intrinsically is very low in intensity, is collected from the entire of the TPC with high efficiency. PTFE panels are implemented as boundaries of the TPC for two purposes - as electric insulator it is used to place wires for the electric field shaping and as reflector for the vacuum-UV light emitted in the Xenon scintillation process.

The reflection properties of the PTFE used in the Xenon100 experiment are not known in detail. In addition studies need to be conducted to evaluate the reflection properties of different low radioactivity PTFE samples as well as their mechanical and chemical treatment for use in the successor experiment Xe1t. Therefore, an ultrahigh vacuum reflection chamber has been designed and commissioned with a wavelength selective VUV light source. First measurements to show the functionality of the experiment will be presented. This work has been supported by DFG (for XENON100, GZ: WE1 843/7-1) and BMBF (for XENON1T, GZ: 05A11PM1).

HK 63.7 Fr 15:30 RW 3

Purification Methods for Xenon — •Stephan Rosendahl, Ethan Brown, Volker Hannen, Christian Huhmann, Hans Kettling, Johannes Schulz, and Christian Weinheimer — Institut für Kernphysik, Universität Münster

The Xenon Project uses a 2 phase time projection Chamber (TPC) to search for dark matter by detecting a nuclear recoil signal, induced by Weakly Interacting Massive Particles (WIMPs). An interaction between WIMPS and the target nuclei produces scintillation and charge signals. The electrons are drifted in an electric field to the gas phase where they are extracted to produce fluorescence light in xenon gas. Both light signals are detected by arrays of photomultiplier tubes on the top and bottom of the detector. The drift length of the electrons in liquid xenon strongly depends on the content of electronegative impurities. Furthermore Kr-85, which contributes to radioactive backgrounds, must be removed from the commercial xenon to the ppt level.

In Münster we set up a system to remove the electronegative impurities with a zirconium purifier and using cryogenic distillation to remove Kr-85 isotopes from the xenon. The quality of the xenon is investigated, using a dual phase xenon TPC, in combination with a laser based moisture analyzer and a quadrupol mass filter to have a complementary setup of different tools. The whole system is designed to perform R&D studies for the Xenon1T experiment, which is the next generation of direct dark matter detectors.

The project is supported by DFG and the state NRW, contractnumber INST 211/528-1 FUGG and by BMBF, number 05A11PM1.

HK 63.8 Fr 15:45 RW 3

Study of a Muon Veto Cherenkov Detector for the XENON1T Experiment — •Serena Fattori for the XENON-Collaboration — Johannes Gutenberg-Universität: Institut für Physik, Mainz, Deutschland

XENON is a dark matter direct detection experiment, consisting of a time-projection chamber (TPC) using xenon in double phase as sensitive detector medium. The XENON project is currently taking dark matter data at the Gran Sasso Underground Laboratory (Italy) with the XENON100 experiment (100 kg scale mass of target volume) devoted to explore the spin-independent elastic WIMP-nucleon scattering cross section at the sensitivity in the order of $\sim 10^{-45} cm^2$. In parallel to the operation of XENON100 an intensive R&D program for the next generation experiment (of ton scale mass) of the XENON project, XENON1T, is currently taking place. XENON1T will have a goal to reduce the background by two orders of magnitude compared to XENON100, pointing to a sensitivity in the order of $10^{-47} cm^2$. In order to achieve this background level the employment of a passive shield is not sufficient and it must be complemented with an active system able to veto the underground residual muon flux. In this study we optimized, with a series of Monte Carlo simulations based on the toolkit GEANT4, a water Cherenkov detector for the XENON1T experiment. Results showed the possibility to reach very high detection efficiencies in tagging the passage of both the muon and the shower secondary particles coming from the interaction of the muon in the rock.

HK 64: Instrumentation

Zeit: Freitag 14:00–16:15 Raum: P 2

Gruppenbericht HK 64.1 Fr 14:00 P 2

First Online Test of the Cryogenic Stopping Cell for the Super-FRS at the FRS Ion Catcher at GSI — •Timo Dickel for the FRS Ion Catcher-Collaboration — Justus-Liebig-Universität Gießen — GSI, Darmstadt

At the FRS, GSI, exotic nuclei can be produced and separated. After production and separation of the nuclei of interest, they are slowed down from relativistic energies and are thermalized to a few eV with a cryogenic gas-filled stopping cell. To achive high stopping efficiencies, the cryogenic stopping cell is operated at highest densities (5 mg/cm^2). This is possible due to the use of a fine structured RF carpet (4 electrodes per mm). After extraction from the cryogenic stopping cell the ions are guided through an RF quadrupole system

to a multiple-reflection time-of-flight mass spectrometer (MR-TOF-MS). The MR-TOF-MS is used for high precision mass measurements ($\delta m/m \approx 10^{-7}$), to remove isobaric contaminants from the ions of interest and as a broadband mass spectrometer to investigate and optimize the operation of the stopping cell and the range bunching. Results from the first online test of the FRS-Ion-Catcher, such as the highly efficient stopping and extraction of ^{223}Th, will be shown.

HK 64.2 Fr 14:30 P 2

Simulations of the new cryogenic gas filled stopping cell for the low energy branch of the Super-FRS at FAIR — •Moritz Pascal Reiter[1], Timo Dickel[1,2], Wolfgang Plass[1,2], Hans Geisel[1,2], Daniel Schäfer[1], and Christoph Scheidenberger[1,2] for the FRS Ion Catcher-Collaboration — [1]Justus-Liebig-University, Giessen — [2]GSI, Darmstadt

At the low energy branch of the Super-FRS at FAIR exotic nuclei will be produced at relativistic energies, slowed down, thermalized and provided as a low energy beam to high precision experiments. The ions are stopped in a cryogenic stopping cell in high density helium gas.

In order to guide the development of the new cryogenic stopping cell and to study the performance of the new techniques used, numerical simulations of the stopping cell have been performed. A parameter study of the RF carpet has been done and optimized working parameters for the stopping cell have been found. The simulation results show good agreement with the first offline and online experiments of the cryogenic stopping cell obtained at the FRS Ion Catcher at GSI. For the first time cryogenic operation of a stopping cell with a radio frequency carpet and hitherto unreached helium densities have been demonstrated.

HK 64.3 Fr 14:45 P 2

Commissioning of the Cryogenic Buffer-Gas Stopping Cell at SHIPTRAP* — •Christian Droese[1], Klaus Blaum[2], Michael Block[3], Sergey Eliseev[2], Frank Herfurth[3], Mustapha Laatiaoui[4,5], Felix Lautenschläger[4], Enrique Minaya Ramirez[6], Lutz Schweikhard[1], and Peter Thirolf[5] — [1]Ernst-Moritz-Arndt-Universität Greifswald — [2]Max-Planck-Institut für Kernphysik Heidelberg — [3]GSI Helmholtzzentrum für Schwerionenforschung Darmstadt — [4]Technische Universität Darmstadt — [5]Ludwig-Maximilians-Universität München — [6]Helmholtz-Institut Mainz

The Penning-trap spectrometer SHIPTRAP (M. Block et al., Eur. Phys. J. D 45 (2007) 39) is employed to perform high-precision mass measurements of exotic nuclides, in particular above fermium. In recent experiments the masses of 252-254No and 255,256Lr were measured directly for the first time in a Penning trap (M. Block et al., Nature 463 (2010) 785). For mass measurements of heavier elements, it is crucial to further increase the overall efficiency of the setup which is mainly limited by the stopping efficiency of the fusion evaporation products in the SHIPTRAP gas cell. Therefore, a second generation gas cell with increased stopping volume was designed. In addition, the operation at cryogenic temperatures leads to a larger gas density at a lower pressure and an improved cleanliness of the helium buffer gas. With the new gas cell an increase of the overall efficiency by up to a factor of 5 is expected. The first results of the commissioning will be presented. *Supported by BMBF (06ML9148) and GSI (LMTHIR1012).

HK 64.4 Fr 15:00 P 2

Detection systems for forward emitted fluorescence photons from relativistic ion beams at storage rings — D. Anielski[1], Ch. Geppert[2,3], V. Hannen[1], R. Jöhren[1], T. Kühl[3], M. Lochmann[2,3], R. Lopéz Coto[1], •J. Mader[1], W. Nörtershäuser[2,3], H.-W. Ortjohann[1], R. Sánchez[3], Ch. Weinheimer[1], and D. Winters[3] — [1]Institut für Kernphysik, Universität Münster — [2]Institut für Kernchemie, Universität Mainz — [3]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt

Laser spectroscopy experiments with highly charged ions (HCI) enable very precise tests of QED in extremly strong electromagnetic fields by comparing hyperfine transitions in H- and Li-like heavy ions of the same isotope. In $^{209}Bi^{80+}$ the transition wavelength lies in a challenging infrared region, i.e. $\lambda_0 \approx 1555$ nm. When the ions are stored at high velocities ($\beta \approx 0.71$) at the ESR at GSI the wavelength of forward emitted photons is Doppler shifted to $\lambda \approx 640$ nm which makes them detectable with standard PMTs. The difficulty is to efficiently collect those photons without disturbing the ion beam. For this purpose, a movable parabolic mirror system with a central slit for the beam has been developed at the university of Münster and will be presented in this talk. The system has been used in the successful measurement of the hyperfine transition in Li-like Bismuth during the LIBELLE experiment. Based on this experience a detection system for forward emitted photons at XUV wavelength will be constructed and used in fine structure measurements with Be-like Krypton at ESR.
This work is supported by BMBF under contract number 06MS9152I.

HK 64.5 Fr 15:15 P 2

Performance Improvement of a Time-of-Flight detector and Longer Observation of Circulating Ions for IMS at FRS-ESR — •Marcel Diwisch[1], Natalia Kuzminchuk[1], Samuel Ayet[2], Timo Dickel[1,2], Hans Geissel[1,2], Ronja Knöbel[1,2], Wolfgang Plass[1,2], Christoph Scheidenberger[1,2], Baohua Sun[1,2], and Helmut Weick[2] for the FRS-ESR-Collaboration — [1]Justus-Liebig-Universität Gießen — [2]GSI, Darmstadt

Mass measurements of short-lived exotic nuclei can be performed using Isochronous Mass Spectrometry at the FRS-ESR facility at GSI. The mass values are obtained from the revolution time measurements using a time-of-flight detector. Ions passing the detector release secondary electrons from a thin carbon foil which are guided to micro channel plate (MCP) detectors by electric and magnetic fields. The time accuracy as well as the rate capability of the TOF detector are crucial parameters for the performance of IMS. Simulations showed that by increasing the kinetic transport energy of the secondary electrons from the foil to the MCPs the time accuracy of the detector can be improved. In measurements with a modified detector with higher kinetic transport energies the timing performance of the detector was improved by 50%. Additionally MCPs with a smaller pore size to improve the rate capability and a thinner carbon foil to reduce the energy loss in the foil were installed in the TOF detector. In an online experiment with uranium fission fragments a 10 times higher turn number of the ions could be observed than in former experiments.

HK 64.6 Fr 15:30 P 2

Aufbau und Inbetriebnahme eines Paarspektrometers zur Überwachung des hochenergetischen Photonenstrahls an MAMI — •Peter Merkel für die A2-Kollaboration — Institut für Kernphysik, Universität Mainz, 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 1,604 GeV zur Verfügung. Dieser erzeugt durch Bremsstrahlung und dem Glasgow Tagging-Spektrometer einen energiemarkierten Photonenstrahl. Ein hermetisches Detektorsystem, bestehend aus dem CB/TAPS-Kalorimeter und weiteren Detektoren, welche eine Teilchenidentifikation und Spurrekonstruktion erlauben, weist Vielkörper-Endzustände exklusiv nach. Auf Grund des polarisierten Elektronenstrahls ist die Erzeugung sowohl transversal polarisierter Photonen als auch longitudinal polarisierter kohärenter Photonen möglich.

Bei der Produktion longitudinaler Photonen mit einem Diamant als Radiator werden diese nur in einen sehr kleinen Winkel emittiert. Des Weiteren entsteht ein übliches Bremstrahlungsspektrum transversal polarisierter Photonen. Um die Rate der kohärenten Strahlung zu erhöhen wird der Strahl stark kollimiert.

Mein Vortrag beschreibt den Aufbau eines Paarspektrometers, um parallel zum laufenden Strahlbetrieb das Bremsstrahlungsspektrum direkt im Photonenstrahl zu messen. Dadurch wird es möglich den Anteil der linear polarisierten kohärenten Photonen online zu bestimmen.

HK 64.7 Fr 15:45 P 2

Status des Endpunkttaggers an MAMI-C — •Patrik Ott für die A2-Kollaboration — Institut für Kernphysik, Universität Mainz, 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 1,604 GeV zur Verfügung. Dieser erzeugt durch Bremsstrahlung und dem Glasgow Tagging-Spektrometer einen energiemarkierten Photonenstrahl. Ein hermetisches Detektorsystem, bestehend aus dem CB/TAPS-Kalorimeter und weiteren Detektoren, welche eine Teilchenidentifikation und Spurrekonstruktion erlauben, weist Vielkörper-Endzustände exklusiv nach.

Mein Vortrag beschreibt den Aufbau eines neuen Tagging-Systems zur Untersuchung der Reaktion $\gamma p \to \eta' p$, deren Schwellenenergie bei 1,447 GeV liegt. Das bisherige Tagging-Spektrometer vermag Photo-

nen bis 1,492 GeV zu markieren. Das neue Spektrometer wird den Energiebereich bis zur maximalen Strahlenergie von 1,594 GeV erweitern. Dadurch wird es möglich sein die Statistik um den Faktor acht zu erhöhen.

Das Design und der Einbau des Spektrometer-Magnet ist abgeschlossen. In diesem Vortrag gehe ich hauptsächlich auf das Detektorarray, bestehend aus 50 Szintilatoren, ein. Zum Abschluss stelle ich einige vorläufige Ergebnisse dar.

HK 64.8 Fr 16:00 P 2

Correlated prompt fission γ-ray data measurements — •Stephan Oberstedt[1], Robert Billnert[1,2], and Andreas Oberstedt[2] — [1]European Commission, Joint Research Centre, IRMM, 2440 Geel, Belgium — [2]Fundamental Fysik - Chalmers Tekniska Högskola, 41296 Göteborg, Sweden

The OECD-NEA has published in its recent high priority data request list a demand for new and precise data on prompt fission γ-ray emission for the standard actinide isotopes ^{235}U and ^{239}Pu in view of their importance for the development of future nuclear fission applications and for a responsible handling of nuclear waste during an a-priori assessment of the fission-fragments' heat production and toxicity. Prompt fission γ-rays, together with prompt neutrons, represent very powerful probes of the nuclear fission process near the scission point. They provide information to better understand how the total excitation energy available in the fissioning system gets transferred to intrinsic excitation in the fragments. Prompt fission γ-rays should preferably be known as a function of fission-fragment mass and excitation energy, but existing experimental data date back to the early 1970s for the above mentioned isotopes. We have performed a detailed feasibility study on novel lanthanum-halide and cerium-bromide detectors with a particular focus on their corresponding time and energy resolution, essential parameters to arrive at a set-up with high detection efficiency in conjunction with a high neutron/γ-ray separation power. New prompt fission γ-ray spectra from the reactions ^{252}Cf(SF) and ^{235}U(n$_{th}$, f) will be presented.

HK 65: Beschleuniger

Zeit: Freitag 14:00–16:00 Raum: P 3

Gruppenbericht HK 65.1 Fr 14:00 P 3

Weiterentwicklungen am S-DALINAC* — Thore Bahlo[1], Uwe Bonnes[1], Christoph Burandt[1], Jens Conrad[1], Lewin Eidam[1], Ralf Eichhorn[1], Ruben Grewe[1], •Florian Hug[1], Lars Jürgensen[1], Michaela Kleinmann[1], Martin Konrad[1], Thorsten Kürzeder[1], Patrick Nonn[1], Norbert Pietralla[1], Achim Richter[1,2], Sven Sievers[1] und Carina Ungethüm[1] — [1]S-DALINAC, Institut für Kernphysik, TU-Darmstadt, Schlossgartenstr. 9, 64289 Darmstadt — [2]ECT, Strada delle Tabarelle 286, I-38123 Villazano (TN), Italien

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. Der S-DALINAC und seine Infrastruktur wurden in den vergangenen drei Jahren erheblich modernisiert.

Wir berichten über unsere Erfahrungen mit der neuen, digitalen HF-Regelung im Dauerbetrieb, über das Injektorupgrade für KRF-Experimente, das intensive Bremsstrahlung bis zu 14 MeV bereitstellen wird, und über ein geplantes Scrapersystem zur Reduktion des Untergrunds an den Experimenten und zur Erhöhung der Energieschärfe des Elektronenstrahls. Auf den im nächsten Jahr geplanten Aufbau einer weiteren Rezirkulation zur Erhöhung der im Dauerstrichbetrieb erreichbaren Strahlenergie wird besonders eingegangen.

*Gefördert durch die DFG unter SFB 634

Gruppenbericht HK 65.2 Fr 14:30 P 3

The S-DALINAC Polarized Electron Injector SPIN* — •Christian Eckardt[1], Kurt Aulenbacher[2], Uwe Bonnes[1], Marco Brunken[1], Ralf Eichhorn[1], Joachim Enders[1], Martin Espig[1], Yuliya Fritzsche[1], Oliver Haas[1], Christoph Ingenhaag[1], Janina Lindemann[1], Markus Platz[1], Markus Wagner[1], Antje Weber[1], and Benjamin Zwicker[1] — [1]Institut für Kernphysik, Technische Universität Darmstadt — [2]Institut für Kernphysik, Johannes-Gutenberg-Universität Mainz

At the superconducting 130 MeV Darmstadt electron linac S-DALINAC a source of polarized electrons has been installed.

Pulsed Ti:Sapphire and diode lasers illuminate a superlattice-GaAs cathode, producing polarized electrons preaccelerated to 100 keV. A Wien filter and Mott polarimeter are used for spin manipulation and polarization measurement. Downstream of the superconducting injector linac a 5-10 MeV Mott polarimeter has been installed. A Møller polarimeter behind the main linac has been designed for energies between 50 and 130 MeV, and additional Compton-transmission polarimeters will be installed for online polarization monitoring. Photo-fission measurements of different uranium isotopes have been carried out and an active target setup is under investigation. We report on the status and performance of the source of polarized electrons and currently planned experiments with polarized beams.

*Supported by Deutsche Forschungsgemeinschaft through SFB 634.

Gruppenbericht HK 65.3 Fr 15:00 P 3

Status der Beschleunigeranlage ELSA — •D. Proft, A. Balling, O. Boldt, A. Dieckmann, F. Frommberger, D. Heiliger, N. Heurich, N. Hofmann, F. Klarner, S. Mey, S. Patzelt, O. Preisner, T. Pusch, A. Roth, D. Sauerland, M. Schedler, J. Schmidt, J.-P. Thiry, J. Wittschen, S. Zander, R. Zimmermann, W. Hillert und F. Klein — Elektronen-Stretcher-Anlage ELSA, Physikalisches Institut, Universität Bonn

Die Beschleunigeranlage ELSA liefert Hadronenphysikexperimenten einen wahlweise polarisierten oder unpolarisierten Elektronenstrahl mit einer Energie von bis zu 3,2 GeV.

Wir berichten über die Fortschritte bei der Erhöhung des im Stretcherring gespeicherten Stroms auf 200 mA. Hierzu wurde ein Feedbacksystem installiert, mit dessen Hilfe sich durch neu entwickelte Stripline-Kicker und Kicker-Cavities Multibunchinstabilitäten sowohl transversal als auch longitudinal dämpfen lassen. Weiterhin wurde ein Monitorsystem zur Lokalisation von Strahlverlusten in Betrieb genommen. Erste Erfolge mit einem neuen Hochstrominjektor am Linearbeschleuniger wurden ebenfalls erzielt.

HK 65.4 Fr 15:30 P 3

Nondestructive monitoring of proton beam emittance — Roman Dzhygadlo, •Kurt Kilian, James Ritman, Eduard Roderburg, Matthias Röder, Thomas Sefzick, and Peter Wintz — Forschungszentrum Jülich

The geometry of an elastic scattering event deals with the primarily unknown track of the beam proton and the two measurable tracks of the scattered protons. With the high precision of the new straw tracker in COSY TOF we can determine (for a small fraction) precise beam particle tracks and "see" the beam emittance.

The transverse position of a beam particle in the target plane is obtained reconstructing the interaction point $I = (x, y, z_{tgt})$ as intersection of the two measured tracks of the scattered protons. They make a plane, containing I, with a normal n derived from the vector product of the scattering directions. The unknown beam particle directional vector b lies in this plane and is orthogonal to n. Therefore n provides one of the two angular informations of the beam particle direction. Even the second angular information for b can be determined in the same event in some cases if we are in the regime of relativistic kinematics. From the measured sum of the scattering angles $(\theta_1 + \theta_2)$ and with known beam momentum we calculate θ_1 and θ_2.

Such an emittance measuring system will also work behind a very thin internal cluster target in an accelerator ring. It can also give time correlations and beam polarization.

HK 65.5 Fr 15:45 P 3

Erste Messungen an einer gekoppelten CH Leistungskavität für den FAIR Protonen Injektor — •Robert Brodhage[1], Holger Podlech[1], Ulrich Ratzinger[1], Gianluigi Clemente[2] und Lars Groening[2] — [1]IAP, Uni Frankfurt — [2]GSI, Darmstadt

Im Rahmen des Forschungsprogramms mit Antiprotonen für FAIR ist es nötig einen dedizierten 70 MeV, 70 mA Protonen Injektor neu aufzubauen. Die Hauptbeschleunigung dieses normal leitenden Linear-

beschleunigers wird von sechs CH-Kavitäten übernommen, die bei 325MHz betrieben werden. Jede dieser Kavitäten wird von einem 2.5 MW Klystron versorgt. Für die zweite Beschleunigerstruktur von 11.7 bis 24.3 MeV wurde ein 1:2 Modell gebaut und mit HF Messungen untersucht, um die wesentlichen Parameter zu bestimmen und das Konzept der gekoppelten CH-Kavitäten zu prüfen. Weitere technische und mechanische Untersuchungen wurden für diesen zweiten Tank durchgeführt, um ein vollständiges Fertigungskonzept zu entwickeln. Im Frühjahr 2011 begannen die Konstruktion des ersten Prototypen, welcher seit Herbst 2011 für die ersten Messungen bereit steht. Zu diesem Zeitpunkt wurde der Prototyp mit einer Aluminium Driftröhrenstruktur bestückt, welche es erlaubt präzise Frequenz und Feldmessungen durchzuführen. Es werden die neusten technischen Entwicklungen gezeigt und das Konzept für die Inbetriebnahme dieses neuartigen Driftröhrenbeschleunigers wird erklärt. Ebenfalls werden die letzten vielversprechenden HF-Messungen des Prototypen zu sehen sein.

HK 66: Struktur und Dynamik von Kernen

Zeit: Freitag 14:00–15:30 Raum: P 4

Gruppenbericht HK 66.1 Fr 14:00 P 4

The R3B experiment at FAIR — •Heiko Scheit — TU Darmstadt

The experiment Reactions with Relativistic Radioactive Beams (R^3B) at the FAIR facility will be installed at the high-energy branch of the Super-FRS. It allows for kinematically complete nuclear reaction studies with short-lived radioactive ion beams in inverse kinematics, utilizing a wide beam energy range from about 100–1000 MeV/u covering the full mass range up to uranium. Experimental programs will address fundamental questions in nuclear structure and reaction physics, as well as nuclear astrophysics.

Recently, after a long research and development phase, important milestones toward the realization of the R^3B experiment have been reached with the completion of the technical design reports for two core components of the R^3B setup: the NeuLAND high-resolution neutron time-of-flight spectrometer and the CALIFA Barrel, which serves as a γ-ray spectrometer, calorimeter and, together with the Si-tracker, as a target-recoil detector. In addition, the construction of the superconducting large-acceptance dipole magnet R^3B-GLAD, used for the magnetic rigidity analysis of beam-rapidity charged fragments, is well underway with an expected delivery at GSI in summer 2013.

First commissioning and physics experiments at GSI with R3B-GLAD and 20%-versions of NeuLAND and the CALIFA Barrel will be carried out in 2014. Until 2016 the setup will be largely completed at GSI and moved to the new high-energy cave at FAIR in 2017/8.

I will give an update on the current status of the project.

HK 66.2 Fr 14:30 P 4

Tracking am LAND/R^3B Setup an der GSI — •Ralf Plag für die R3B-Kollaboration — Goethe Universität Frankfurt am Main, Germany — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

Das LAND/R^3B Setup an der GSI in Darmstadt ist eine leistungsfähige Anlage für die Durchführung von Coulomb-Aufbruch Experimenten. Damit können neben (γ,n)-Wirkungsquerschnitten unter anderem auch (γ,p)- und (γ,2p)-Wirkungsquerschnitte von radioaktiven Kernen vermessen werden, sowie mittels Zeitumkehrtheorem auch die Einfangquerschnitte für die inversen Prozesse.

Für die Messung energieabhängiger Wirkungsquerschnitte müssen allerdings alle Reaktionsprodukte identifiziert und deren Impulsvektoren mit hoher Genauigkeit bestimmt werden. Dazu wird die Ablenkung der Teilchen im Magnetfeld eines Dipols untersucht und rekonstruiert.

In diesem Vortrag wird der aktuelle Stand der Tracking-Algorithmen für die Bestimmung von Ladung, Masse und Impuls der Reaktionsprodukte anhand mehrerer Beispiele bisher durchgeführter Experimente präsentiert.

Dieses Projekt wurde vom HGF Young Investigators Project VH-NG-327 unterstützt.

HK 66.3 Fr 14:45 P 4

Beyond the neutron drip-line - superheavy oxygens — •Christoph Caesar for the R3B-Collaboration — TU Darmstadt, Institut für Kernphysik, Germany

The neutron-unbound ground state of ^{25}O was recently observed for the first time in a proton knock-out reaction from a ^{26}F beam on a beryllium target at the NSCL[1]. One single resonance was observed in the ^{24}O+n relative-energy spectrum. Shell-model calculations which describe known properties of neighboring oxygen isotopes, however, fail in reproducing the surprisingly low energy of the observed resonance.

The R3B-collaboration has studied the ^{26}F(p,2p)^{25}O reaction utilizing a kinematically complete measurement at relativistic beam energies with the R3B-LAND-setup. This measurement provides improved data in several respects. The reaction was measured fully exclusive (including γ-ray detection) and with much larger acceptance. In addition, a sufficient number of events have been recorded which populate the ^{26}O ground state in order to estimate its mass. First results on the ^{26}F(p,2p)^{25}O as well as the ^{27}F(p,2p)^{26}O channel will be presented.

This work is supported by the Hessian LOEWE initiative through HIC for FAIR.

[1] C.R. Hoffman et al. Phys.Rev.Lett 100 (2008) 152502

HK 66.4 Fr 15:00 P 4

Decay spectroscopy of neutron-rich nuclei with the CAITEN detector — •Konrad Steiger for the CAITEN-Collaboration — Physik-Department E12, Technische Universität München

An experiment in fall 2010 at the RIBF (Radioactive Ion Beam Factory at RIKEN, Japan) investigated the neutron-rich nuclei in the neighborhood of ^{30}Ne and ^{36}Mg. These nuclei were produced by relativistic projectile fragmentation of a 345 AMeV ^{48}Ca primary beam which was delivered 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 unambiguous particle identification was achieved by measuring the energy loss, time of flight and magnetic rigidity event-by-event. 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 4×10^4-fold segmented plastic scintillator with the shape of a hollow cylinder. To reduce background events the scintillator was moved continuously in axial and vertical direction (similar to a tape-transporting system). Implantations and decays were correlated in time and space. γ-rays were detected with three germanium clover detectors. For the first time β-delayed gammas were measured in the neutron-rich isotopes $^{36-38}$Si. The status of the analysis and preliminary results including new half-life values and tentative level schemes for these very exotic nuclei will be presented. Supported by BMBF (06MT9156) and DFG (EXC 153, KR2326/2-1).

HK 66.5 Fr 15:15 P 4

Quasi-Elastic Scattering of Relativistic Neutron-Deficient Carbon Isotopes — •Matthias Holl for the R3B-Collaboration — Institut für Kernphysik, Technische Universität Darmstadt, Germany

Quasi-elastic scattering of relativistic ^{11}C has been recently 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 CH2 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 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 67: Schwerionenkollisionen und QCD Phasen

Zeit: Freitag 14:00–15:30 Raum: P 5

HK 67.1 Fr 14:00 P 5

Nuclear Physics from Lattice QCD at Strong Coupling — •Wolfgang Unger — ETH Zürich

Understanding the properties of nuclear matter from first principles, starting from the QCD Lagrangian via lattice simulations, is one of the main goals of lattice QCD. Unfortunately this task is turned out to be too ambitious. However, in the limiting case of an infinite bare gauge coupling, this goal can be reached: the full phase diagram as a function of temperature and baryon chemical potential can be determined and also the nuclear potential can be obtained. I will present new results obtained from lattice QCD at strong coupling and explain in what respect this model describes some of the properties of nuclear matter, such as the origin of nuclear interactions.

HK 67.2 Fr 14:15 P 5

Systematic study of the influence of fermionic and bosonic fluctuations on the QCD phase diagram — •Fabian Rennecke and Jan Martin Pawlowski — Institute for Theoretical Physics, University of Heidelberg

We study the chiral phase transition of QCD with two quark flavors at finite temperature and density within a functional renormalization group approach. In particular, we investigate the quantitative effect of fully dressed propagators and higher order mesonic scattering processes on the phase boundary, including the critical endpoint, in a systematic way.

HK 67.3 Fr 14:30 P 5

QCD Phasen bei hohen Dichten 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 das QCD Phasendiagramm in 2+1 Flavor QCD zu untersuchen. Dabei verwenden wir eine selbstkonsistente Näherung, bei der auch die Rückwirkung der Quarks auf die Gluonen berücksichtigt wird. Wir fokussieren uns auf farbsupraleitende Phasen und finden eine dominante cfl-Phase sowie eine 2sc-Phase bei niedrigen Dichten und bei höheren Temperaturen. Verglichen mit einer einfacheren Hard-Thermal-Loop-artigen Näherung erhalten wir eine Verbesserung bei der gleichzeitigen Beschreibung von Vakuumphysik und Phasenübergängen.

HK 67.4 Fr 14:45 P 5

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

Die Zwei-Farb-QCD ist interessant, da Gitterrechnungen hier nicht unter dem Vorzeichen-Problem leiden. Wir untersuchen das Phasendiagramm der Zwei-Farb-QCD mithilfe von Dyson-Schwinger-Gleichungen, um die beiden Zugänge miteinander zu vergleichen. Die Dyson-Schwinger-Gleichungen werden hierzu geeignet trunkiert und in der Landau Eichung selbstkonsistent gelöst. Es werden neben dem chiralen Limes auch endliche Quark-Massen betrachtet und Ergebnisse der Zwei-Farb-QCD mit denen der physikalischen Drei-Farb-QCD verglichen.

HK 67.5 Fr 15:00 P 5

Hyper-trition production in Ni+Ni at 1.91A GeV — •Ya Peng Zhang and Norbert Herrmann for the FOPI-Collaboration — Physikalisches Institut, Universität Heidelberg, Germany

Production of hypernuclei in heavy-ion collisions (HIC) is a unique way to study the interaction between strange baryons and the surrounding nuclear matter. In this constribution, we present the preliminary results of reconstructing hypertritons in Ni+Ni reactions at the incident energy of 1.91A GeV in the experiment performed with FOPI detector at SIS18 in GSI. A pronounced excess at the nominal mass of the hyper-triton was found in the invarimant mass spectra of $\pi^- -^3 He$ under certain selection criteria. The reconstruction efficiency and the background are analysed by means of extensive MC simulations of the detector response.

* This work was supported by BMBF 06HD9121I.

HK 67.6 Fr 15:15 P 5

Iterative Hydrodynamics — •Falk Wunderlich and Burkhard Kämpfer — Helmholtz-Zentrum Dresden-Rossendorf

We present an analytical approach to relativistic fluiddynamics by constructing the Taylor expansion of the solution from the inital conditions. The method follows techniques taken from the AdS/CFT correspondence. Its power is demonstrated by treating the triaxial expansion in relativistic heavy ion collisions at LHC.