Fachverband Physik der Hadronen und Kerne (HK)

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Übersicht der Hauptvorträge und Fachsitzungen

(Hörsäle HZ 1+2, HZ 3-10; Poster HZ)

Plenarvorträge

PV I	Mo	11:30–12:30	HZ 1+2	**Erkenntnisvermittlung aus erster Hand** — •Michael Kobel
PV II	Di	9:00– 9:45	HZ 1+2	**ALICE: Past, Present, and Future** — •Dariusz Miskowiec
PV III	Di	9:45–10:30	HZ 1+2	**XYZ: Charmonium- und Bottomoniumspektroskopie an e+e- Beschleunigern** — •Jens Sören Lange
PV IV	Mi	9:00– 9:45	HZ 1+2	**Das Gerda Experiment zum neutrinolosen doppelten Betazerfall in ^{76}Ge** — •Peter Grabmayr
PV V	Mi	9:45–10:30	HZ 1+2	**100 Jahre Franck-Hertz-Experiment** — •Hartmut Hotop
PV VI	Mi	20:00–21:00	HZ 1+2	**Naturwissenschaftliche Methoden zur Steuerung von Banken** — •Wilfried Paus
PV VII	Do	9:00– 9:45	HZ 1+2	**Neutron-rich matter from chiral EFT interactions** — •Kai Hebeler
PV VIII	Do	9:45–10:30	HZ 1+2	**Revealing New Hadronic States and Properties of Mesons with COMPASS** — •Stephan Paul
PV IX	Fr	9:00– 9:45	HZ 1+2	**Perturbative QCD: from pp to AA collisions** — •Michael Klasen
PV X	Fr	9:45–10:30	HZ 1+2	**Modern Real Photon Experiments: Illuminating the Structure and Excitations of the Nucleon** — •Sven Schumann

Hauptvorträge

HK 16.1	Di	11:00–11:40	HZ 1+2	**Laser Spectroscopic Determination of Nuclear Ground-State Properties** — •Wilfried Nörtershäuser
HK 16.2	Di	11:40–12:20	HZ 1+2	**The origin of heavy elements** — •Almudena Arcones
HK 16.3	Di	12:20–13:00	HZ 1+2	**Thermalization Dynamics in Ultra-Relativistic Nuclear Collisions** — •Juergen Berges
HK 29.1	Mi	11:00–11:40	HZ 1+2	**Physics of Heavy Quarks in Nuclear Collisions at the LHC** — •Raphaelle Bailhache
HK 29.2	Mi	11:40–12:20	HZ 1+2	**Electric Dipole Moment Measurements at Storage Rings** — •Jörg Pretz
HK 29.3	Mi	12:20–13:00	HZ 1+2	**Faster and further, masses and more: Latest developments and results from ISOLTRAP** — •Robert Wolf
HK 36.1	Do	11:00–11:30	HZ 1+2	**Testing the Standard Model at the precision frontier: The anomalous magnetic moment of the muon** — •Andreas Hafner
HK 36.2	Do	11:30–12:00	HZ 1+2	**The muon g-2 and the Adler function from lattice QCD** — •Gregorio Herdoiza
HK 36.3	Do	12:00–12:30	HZ 1+2	**Reviewing hadron production in the SIS energy regime using new HADES Au+Au data** — •Manuel Lorenz
HK 36.4	Do	12:30–13:00	HZ 1+2	**Encounters with Di-Baryons – from the ABC Effect to a Resonance in the Neutron-Proton System*.** — •Mikhail Bashkanov

Fachsitzungen

HK 1.1–1.6	Mo	14:00–16:00	HZ 1+2	**Hadronenstruktur und -spektroskopie**

HK 2.1–2.6	Mo	14:00–16:00	HZ 3	**Hadronenstruktur und -spektroskopie**
HK 3.1–3.7	Mo	14:00–16:00	HZ 4	**Struktur und Dynamik von Kernen**
HK 4.1–4.7	Mo	14:00–16:00	HZ 6	**Schwerionenkollisionen und QCD Phasen**
HK 5.1–5.8	Mo	14:00–16:00	HZ 7	**Schwerionenkollisionen und QCD Phasen**
HK 6.1–6.6	Mo	14:00–15:30	HZ 8	**Instrumentierung**
HK 7.1–7.8	Mo	14:00–16:00	HZ 9	**Instrumentierung**
HK 8.1–8.7	Mo	16:30–19:00	HZ 1+2	**Hadronenstruktur und -spektroskopie**
HK 9.1–9.8	Mo	16:30–19:00	HZ 3	**Fundamentale Symmetrien**
HK 10.1–10.8	Mo	16:30–19:00	HZ 4	**Struktur und Dynamik von Kernen**
HK 11.1–11.9	Mo	16:30–19:00	HZ 5	**Struktur und Dynamik von Kernen**
HK 12.1–12.9	Mo	16:30–19:00	HZ 6	**Schwerionenkollisionen und QCD Phasen**
HK 13.1–13.9	Mo	16:30–19:00	HZ 7	**Schwerionenkollisionen und QCD Phasen**
HK 14.1–14.9	Mo	16:30–19:00	HZ 8	**Instrumentierung**
HK 15.1–15.7	Mo	16:30–19:00	HZ 9	**Astroteilchenphysik**
HK 16.1–16.3	Di	11:00–13:00	HZ 1+2	**Hauptvorträge I**
HK 17.1–17.7	Di	14:00–15:45	HZ 1+2	**Hadronenstruktur und -spektroskopie**
HK 18.1–18.5	Di	14:00–15:30	HZ 3	**Hadronenstruktur und -spektroskopie**
HK 19.1–19.7	Di	14:00–16:00	HZ 6	**Schwerionenkollisionen und QCD Phasen**
HK 20.1–20.8	Di	14:00–16:00	HZ 7	**Schwerionenkollisionen und QCD Phasen**
HK 21.1–21.5	Di	14:00–15:30	HZ 8	**Instrumentierung**
HK 22.1–22.8	Di	14:00–16:00	HZ 9	**Instrumentierung**
HK 23.1–23.7	Di	16:30–18:45	HZ 1+2	**Hadronenstruktur und -spektroskopie**
HK 24.1–24.8	Di	16:30–18:45	HZ 4	**Struktur und Dynamik von Kernen**
HK 25.1–25.8	Di	16:30–19:00	HZ 5	**Struktur und Dynamik von Kernen**
HK 26.1–26.9	Di	16:30–19:00	HZ 6	**Schwerionenkollisionen und QCD Phasen**
HK 27.1–27.9	Di	16:30–19:00	HZ 8	**Instrumentierung**
HK 28.1–28.7	Di	16:30–19:00	HZ 9	**Astroteilchenphysik**
HK 29.1–29.3	Mi	11:00–13:00	HZ 1+2	**Hauptvorträge II**
HK 30.1–30.8	Mi	16:30–18:45	HZ 1+2	**Hadronenstruktur und -spektroskopie**
HK 31.1–31.8	Mi	16:30–19:00	HZ 4	**Struktur und Dynamik von Kernen**
HK 32.1–32.9	Mi	16:30–19:00	HZ 5	**Struktur und Dynamik von Kernen**
HK 33.1–33.9	Mi	16:30–19:00	HZ 6	**Schwerionenkollisionen und QCD Phasen**
HK 34.1–34.8	Mi	16:30–19:00	HZ 8	**Instrumentierung**
HK 35.1–35.9	Mi	16:30–18:45	HZ 9	**Astroteilchenphysik**
HK 36.1–36.4	Do	11:00–13:00	HZ 1+2	**Hauptvorträge III**
HK 37.1–37.7	Do	14:00–15:45	HZ 1+2	**Hadronenstruktur und -spektroskopie**
HK 38.1–38.7	Do	14:00–16:00	HZ 3	**Hadronenstruktur und -spektroskopie**
HK 39.1–39.7	Do	14:00–16:00	HZ 4	**Struktur und Dynamik von Kernen**
HK 40.1–40.6	Do	14:00–16:00	HZ 5	**Nukleare Astrophysik**
HK 41.1–41.7	Do	14:00–16:00	HZ 6	**Schwerionenkollisionen und QCD Phasen**
HK 42.1–42.7	Do	14:00–16:00	HZ 7	**Schwerionenkollisionen und QCD Phasen**
HK 43.1–43.7	Do	14:00–16:00	HZ 8	**Instrumentierung**
HK 44.1–44.7	Do	14:00–15:45	HZ 9	**Instrumentierung**
HK 45.1–45.6	Do	14:00–15:45	HZ 10	**Instrumentierung**
HK 46.1–46.91	Do	16:00–18:00	HZ Poster	**Poster**
HK 47.1–47.8	Do	16:30–19:00	HZ 1+2	**Hadronenstruktur und -spektroskopie**
HK 48.1–48.8	Do	16:30–19:00	HZ 4	**Struktur und Dynamik von Kernen**
HK 49.1–49.7	Do	16:30–18:30	HZ 5	**Nukleare Astrophysik**
HK 50.1–50.8	Do	16:30–19:00	HZ 8	**Instrumentierung**
HK 51.1–51.8	Do	16:30–18:45	HZ 9	**Instrumentierung**
HK 52.1–52.7	Fr	11:00–13:00	HZ 1+2	**Hadronenstruktur und -spektroskopie**
HK 53.1–53.6	Fr	11:00–12:45	HZ 3	**Hadronenstruktur und -spektroskopie**
HK 54.1–54.6	Fr	11:00–12:45	HZ 4	**Nukleare Astrophysik**
HK 55.1–55.8	Fr	11:00–13:00	HZ 5	**Beschleuniger und Anwendungen kernphysikalischer Methoden**
HK 56.1–56.6	Fr	11:00–12:45	HZ 8	**Instrumentierung**
HK 57.1–57.7	Fr	11:00–13:00	HZ 9	**Instrumentierung**
HK 58.1–58.8	Fr	11:00–13:00	HZ 10	**Instrumentierung**
HK 59.1–59.7	Fr	14:00–16:00	HZ 1+2	**Hadronenstruktur und -spektroskopie**
HK 60.1–60.6	Fr	14:00–15:45	HZ 3	**Hadronenstruktur und -spektroskopie**
HK 61.1–61.6	Fr	14:00–15:45	HZ 4	**Nukleare Astrophysik**

HK 62.1–62.6	Fr	14:00–15:45	HZ 5	**Nukleare Astrophysik**
HK 63.1–63.8	Fr	14:00–16:00	HZ 6	**Schwerionenkollisionen und QCD Phasen**
HK 64.1–64.8	Fr	14:00–16:00	HZ 9	**Instrumentierung**

Mitgliederversammlung des Fachverbandes Physik der Hadronen und Kerne

Donnerstag 19:15 HZ 3

HK 1: Hadronenstruktur und -spektroskopie

Zeit: Montag 14:00–16:00 Raum: HZ 1+2

Gruppenbericht HK 1.1 Mo 14:00 HZ 1+2

Photoproduction of π^0-Mesons off Neutrons in the Nucleon Resonance Region — •Dieterle Manuel for the A2-Collaboration — Department of Physics, University of Basel, Klingelbergstrasse 82, 4056 Basel, Switzerland

Severe differences between the experimentally observed excitation spectrum of the nucleon and the theoretically predicted results require detailed investigation. Meson photoproduction offers the nice possibility to measure the electromagnetic properties of the nucleon and thereby provides stringent tests to the nucleon models.

π^0 photoproduction is in particular interesting as neutral pions couple only weakly to photons so that non-resonant background contributions become negligible. Although pion photoproduction off the free proton is well known the isospin decomposition also requires measurements on the free neutron. However, this can only be investigated with quasi-free neutrons bound in light nuclei, i.e. the deuteron.

We will present final results of the first measurement of precise angular distributions for π^0 photoproduction off neutrons bound in the deuteron. Effects from nuclear Fermi motion have been removed by a complete kinematic reconstruction of the final state. An attempt to remove the final state interactions reveals first conclusions about the reaction on the free neutron and will put stringent tests on future nucleon models.

Gruppenbericht HK 1.2 Mo 14:30 HZ 1+2

The BGO-OD experiment: data analysis in preparation for physics proposals — •Thomas Jude for the BGO-OD-Collaboration — Physikalisches Institut, University of Bonn, Bonn, Germany

The BGO-OD experiment at the ELSA accelerator facility, Bonn, consists of the highly segmented BGO calorimeter with a particle tracking magnetic spectrometer at forward angles. This allows the investigation of final states of mixed charge with nearly 4π acceptance, with very high precision at forward angles for charged particles.

An extensive physics programme using an energy tagged bremsstrahlung photon beam is planned using this unique setup. This includes measurements of associated strangeness, vector meson and pseudoscaler meson photoproduction.

The commissioning phase of the experiment is almost complete. This talk focuses on analysis of the commissioning data, which includes particle track reconstruction in the forward spectrometer and momentum reconstruction with the BGO calorimeter. Comparisons are made with simulated data, and analysis results relevant to the physics proposals are presented.

Supported by DFG (SFB/TR-16).

HK 1.3 Mo 15:00 HZ 1+2

Impulsrekonstruktion im Vorwärtsspektrometer des BGO-OD-Experiments — •Paul-Fiete Hartmann für die BGO-OD-Kollaboration — Universität Bonn

Das neue BGO-OD-Experiment am ELSA-Beschleuniger der Universität Bonn dient der systematischen Untersuchung der Photoproduktion von Mesonen. Es besteht aus einem hochsegmentierten BGO-Ball als Zentraldetektor in Kombination mit einem offenen Magnetspektrometer in Vorwärtsrichtung. Für die geplanten Messungen ist hier eine hohe Impulsauflösung von entscheidendender Bedeutung.

Vorgestellt werden Weiterentwicklungen des Rekonstruktionsalgorithmus mit dem Ziel einer verbesserten Impuls- und Vertexbestimmung sowie Teilchenidentifikation: Für die Driftkammern wurde ausgehend von einer Rekonstruktion, welche lediglich die Position der Signaldrähte (Abstand 1,7 cm) berücksichtigt, zusätzlich die gemessenen Driftzeiten in die Analyse einbezogen. Des Weiteren werden die Effekte des Streufelds des Dipolmagneten für die Spurbestimmung berücksichtigt.

Gefördert durch die DFG (SFB/TR-16).

HK 1.4 Mo 15:15 HZ 1+2

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

The measurement of single and double polarization observables gives information about the different resonance contributions in the cross section and hence leads to a better understanding of the nucleon and its excited states. The double π^0-photoproduction is one of the most interesting reaction for the measurement of these observables. It allows to search for excited nucleon states which decay preferentially via cascades involving intermediate excited states. Furthermore, the background from non-resonant terms is small since the photon does not couple directly to neutral pions.

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

HK 1.5 Mo 15:30 HZ 1+2

Measurement of the double polarization observable E in η'-photoproduction — •Farah Noreen Afzal for the CBELSA/TAPS-Collaboration — HISKP, Uni Bonn

The goal of the CBELSA/TAPS experiment located at the electron stretcher accelerator ELSA lies in the better understanding of the dynamics of the nucleon constituents by investigating the nucleon excitation spectrum through photoproduction of mesons off the nucleon. The study of η'-photoproduction gives information of the high mass region ($m_{N^*} > 1892$ MeV) of the nucleon excitation spectrum which is poorly understood. In order to determine all contributing resonances in the underlying process, the measurement of well chosen single and double polarization observables apart from the unpolarized cross section is needed. For this purpose, a linearly or circularly polarized photon beam and longitudinally or transversely polarized target are used at the CBELSA/TAPS experiment. The setup provides with the Crystal Barrel and the MiniTAPS calorimeters a nearly full 4π angular coverage and has therefore a high detection efficiency for neutral final states. In this talk, preliminary results of the double polarization observable E in the photoproduction reaction $\gamma p \to \eta' p$ are presented. Supported by the Deutsche Forschungsgemeinschaft (SFB/TR16).

HK 1.6 Mo 15:45 HZ 1+2

Analysis of $\pi N \to 2\pi N$ reactions within the Giessen coupled-channel model — •Vitaly Shklyar, Horst Lenske und 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 three-body unitarity is approximately maintained up to interference between different isobar channels in Bethe-Salpeter equation. Results of the analysis of the $\pi^- p \to \pi^0\pi^0 n$ reaction in the first resonance energy region are presented and discussed.

Supported by DFG SFB/TR 16, project B7 and DFG grant Le439/7.

HK 2: Hadronenstruktur und -spektroskopie

Zeit: Montag 14:00–16:00 Raum: HZ 3

Gruppenbericht HK 2.1 Mo 14:00 HZ 3

Determining the Two-Photon Contribution to Elastic ep Scattering — •Jürgen Diefenbach for the OLYMPUS-Collaboration — Institut für Kernphysik, Universität Mainz

To determine the two-photon exchange contribution to the elastic electron-proton scattering cross section, the OLYMPUS experiment was carried out at the DORIS storage ring at DESY in Hamburg in 2012. Measuring the elastic scattering cross sections from hydrogen,

alternating daily between electron and positron beams, along with a redundant determination of the luminosity, will yield a ratio between the positron and electron cross sections at the one percent level. This will help resolve the puzzle in the proton form factor ratio between Rosenbluth and polarization transfer measurements. The talk will give a review of the experiment as well as report on the current status of the data analysis.

Gruppenbericht HK 2.2 Mo 14:30 HZ 3

MUSE: Measuring the proton radius with muon-proton scattering — •Jan Christopher Bernauer — Massachusetts Institute of Technology, Cambridge, USA

The proton radius has been measured so far using electron-proton scattering, electronic Hydrogen spectroscopy and muonic Hydrogen spectroscopy, the latter producing a much more accurate, but seven sigma different, result, leading to the now famous proton radius puzzle. The MUSE collaboration aims to complete the set of measurements by using muon scattering to determine the proton radius and to shed light on possible explanations of the discrepancy. The talk will give an overview of the experiment motivation and design and a status report on the progress.

HK 2.3 Mo 15:00 HZ 3

Symmetric Møller/Bhabha luminosity monitor for the OLYMPUS experiment — •Perez Benito Roberto for the OLYMPUS-Collaboration — Helmholtz-Institut Mainz, Germany

The OLYMPUS experiment ran on the DORIS storage ring at DESY, Hamburg to measure the elastic cross sections for both positron and electron scattering from hydrogen to quantify the two-photon contribution to elastic ep scattering. Two-photon exchange is widely considered to be responsible for the the discrepancy in the proton form factor ratio determined using the Rosenbluth technique and polarization transfer. The experiment alternated daily between positron and electron beams at 2.01 GeV incident on an unpolarized, internal, hydrogen gas target. The luminosity delivered to the experiment was monitored by a redundant set of detectors: a high precision, symmetric Møller / Bhabha calorimeter and a tracking telescope at 12 degrees. The symmetric Møller/Bhabha calorimeter was built at Mainz and consisted of two symmetric arrays of lead fluoride crystals. Results on the performance of the SYMB luminosity monitor will be presented together with an overview of the OLYMPUS experiment.

HK 2.4 Mo 15:15 HZ 3

The OLYMPUS radiative *ep* generator — •Rebecca Russell for the OLYMPUS-Collaboration — MIT, Cambridge, USA

The OLYMPUS experiment at DESY has collected datasets with positrons and electrons incident on hydrogen which, in combination, allow a precise determination of the contribution of hard two-photon exchange to elastic *ep* scattering. This radiative correction could explain the discrepancy between measurements using Rosenbluth separation and those using polarization techniques of the proton form factor ratio G_E/G_M. Additional radiative corrections to the final result need to be carefully taken into account as they may be larger than hard two-photon exchange itself. As some radiative corrections are sensitive to detector acceptances, resolutions, and analysis cuts, a radiative generator for use with the OLYMPUS Geant4 Monte Carlo has been developed. This generator includes full elastic corrections and an exact calculation of first order bremsstrahlung. A general description of the generator, its special features, and its usage in the OLYMPUS analysis will be presented.

HK 2.5 Mo 15:30 HZ 3

Two-photon exchange corrections in elastic electron-proton scattering. Dispersion theory — •Oleksandr Tomalak and Marc Vanderhaeghen — Johannes Gutenberg- Universität Mainz, Germany

The recent measurements of the proton charge radius from the Lamb shift of energy levels in muonic hydrogen are in strong contradiction, by 5-7 standard deviations, with the value obtained with electronic hydrogen and the value extracted from the unpolarized electron-proton scattering data. The precise determination of the proton radius from scattering experiments can be taken only with account of the higher order corrections, like two photon exchange diagram and 2-loops QED corrections. Two photon exchange correction was studied with the fixed momentum transfer dispersion relations. It was shown that the dispersion relations calculation of the two- photon exchange processes in elastic electron-proton scattering requires one subtraction. Theoretical predictions of elastic contribution of TPE corrections to the unpolarized elastic electron-proton scattering and polarization transfer were made.

HK 2.6 Mo 15:45 HZ 3

Untersuchungen zur Messung des axialen und magnetischen Strangeness-Formfaktors mit einem P2-Rückwärtswinkel-Setup — •Sebastian Baunack — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz

Am geplanten supraleitenden Elektronenbeschleuniger MESA in Mainz wird das Experiment P2 eine hochpräzise Messung der schwachen Ladung des Protons durchführen. Den Zugang hierzu liefert eine Messung der paritätsverletzenden Asymmetrie im Wirkungsquerschnitt der elastischen Elektron-Proton-Streuung.

Die hadronische Struktur des Protons geht bei der Interpretation der gemessenen Asymmetrie in Form von Formfaktoren ein. Die größten Beiträge zur hieraus resultierenden Unsicherheit liefern die Unsicherheiten im axialen Formfaktor und im magnetischen Strangeness-Formfaktor. Eine Messung unter Rückwärtswinkeln an MESA könnte dazu beitragen, diese Unsicherheiten deutlich zu reduzieren. Überlegungen hierzu werden vorgestellt.

HK 3: Struktur und Dynamik von Kernen

Zeit: Montag 14:00–16:00 Raum: HZ 4

Gruppenbericht HK 3.1 Mo 14:00 HZ 4

Low-energy enhancement of M1 strength — •Ronald Schwengner[1], Stefan Frauendorf[2], and Ann-Cecilie Larsen[3] — [1]Institute of Radiation Physics, Helmholtz-Zentrum Dresden-Rossendorf, 01328 Dresden — [2]Department of Physics, University of Notre Dame, Notre Dame, Indiana 46556, USA — [3]Department of Physics, University of Oslo, 0316 Oslo, Norway

Magnetic dipole strength functions have been deduced from averages of a large number of $M1$ transition strengths calculated within the shell model for the nuclides ^{90}Zr, ^{94}Mo, ^{95}Mo, and ^{96}Mo. An enhancement of $M1$ strength toward low transition energy has been found for all nuclides considered. Large $M1$ strengths appear for transitions between close-lying states with configurations including proton as well as neutron high-j orbits that re-couple their spins and add up their magnetic moments coherently. The $M1$ strength function deduced from the calculated $M1$ transition strengths is compatible with the low-energy enhancement found in (^{3}He,^{3}He') and (d, p) experiments. The present work presents an explanation of the experimental findings.

HK 3.2 Mo 14:30 HZ 4

Untersuchung der Dipolstärkeverteilung im Kern ^{92}Zr bis 8.6 MeV* — •Markus Zweidinger[1], Jacob Beller[1], Norbert Pietralla[1], Christopher Romig[1], Marcus Scheck[1,2,3] und Volker Werner[1] — [1]Institut für Kernphysik, Technische Universität Darmstadt — [2]School of Engineering, University of the West of Scotland, Paisley, UK — [3]SUPA, Scottish Universities Physics Alliance, Glasgow, UK

Am Darmstädter supraleitenden Elektronen-Linearbeschleuniger S-DALINAC wurde ein Kernresonanzfluoreszenz-Experiment am Kern ^{92}Zr durchgeführt. Die Anregung der Targetkerne erfolgte mit Hilfe eines energie-kontinuierlichen Bremsstrahlungsspektrums mit einer Endpunktsenergie von $E_0 = 8.6$ MeV. Die resultierende Dipolantwort wurde mittels großvolumiger HPGe-Detektoren spektroskopiert. Für eine Vielzahl der angeregten Zustände konnte erstmals die Spinquantenzahl und die Übergangsstärke in den Grundzustand bestimmt werden. Die Ergebnisse werden in Bezug auf die Dipolstärkeverteilung diskutiert und mit Daten der Isotope ^{94}Zr und ^{96}Zr verglichen.

* Gefördert durch die DFG im Rahmen des SFB 634

HK 3.3 Mo 14:45 HZ 4

Mehrfache Coulomb-Anregung von 72Zn mit einem neuen Coulex-Aufbau an ISOLDE — •Stefanie Hellgartner[1], Dennis Mücher[1], Roman Gernhäuser[1], Reiner Krücken[2], Katharina Nowak[1] und Sebastian Reichert[1] für die IS510-Kollaboration — [1]Technische Universität München — [2]TRIUMF, Vancouver

Im Herbst 2012 wurde die Coulomb-Anregung von einem ^{72}Zn Strahl an REX-ISOLDE mit einem auf dem Transfer-Setup T-REX basierenden Aufbau untersucht. Dieser neue Setup verfügt über einen einstellbaren Abstand zwischen dem Target und dem vorwärtsgerichteten Silizium-CD-Detektor, so dass auch die hohe Strahlintensität von ^{72}Zn mit 10^7 pps verarbeitet werden konnte. Zusätzlich wurden Silizium-Detektoren in Rueckwärtsrichtung montiert, die eine besonders hohe Sensitivität auf die mehrfache Coulomb-Anregung haben.

Im Rahmen dieses Vortrages werden erste differentielle Wirkungsquerschnitte von den ersten beiden 2^+ Zuständen und dem ersten angeregten 4^+ Zustand von ^{72}Zn gezeigt. Daraus ergeben sich vorläufige B(E2)-Werte, die einen weiteren Einblick in das kontroverse Bild der Übergangsstärken in den neutronen-reichen Zink-Isotopen bieten.

Diese Arbeit wird gefördert durch BMBF (06MT9156), DFG (EXC 153) und ENSAR.

HK 3.4 Mo 15:00 HZ 4

Isoscalar giant resonance studies from a stored-beam experiment for the EXL project — •J.C. Zamora for the EXL E105-Collaboration — Institut für Kernphysik, TU Darmstadt

The objective of the EXL project is the investigation of nuclear structure of EXotic nuclei, in Light-ion induced reactions, by using the future storage ring NESR at FAIR. In this project a universal detector system will provide high resolution and large solid angle coverage for kinematically complete measurements.
In a recent experiment at the present Experimental Storage Ring (ESR) at GSI, the collaboration has performed feasibility studies and first experiments by using a dedicated UHV capable detector setup. With this setup the interaction of a ^{58}Ni beam with an internal helium gas-jet target was investigated. The aim of the present experiment is to study the Isoscalar Giant Monopole Resonance (ISGMR) and the Isoscalar Giant Dipole Resonance (ISGDR) from inelastic alpha scattering. In this talk, simulation results and the current status of the data analysis will be discussed. This work is supported by BMBF (06DA9040I and 05P12RDFN8) and HIC for FAIR.

HK 3.5 Mo 15:15 HZ 4

Nuclear Thermodynamics with Chiral Low-Momentum Interactions — •Corbinian Wellenhofer[1], Jeremy Holt[2], and Norbert Kaiser[1] — [1]1Physik Department, Technische Universität München, D-85747 Garching, Germany — [2]2Physics Department, University of Washington, Seattle, Washington 98195, USA

In chiral effective field theory, the low-energy constants (LECs) which parametrize nuclear two- and many-body forces are usually determined in fits to few-body observables. This fitting procedure is however not unique, and there exist various different sets of LECs in the literature, all leading to consistent results in few-body calculations. However, this does not mean that the same has to be true regarding nuclear matter properties.
We present results for the thermodynamical nuclear equation of state (EoS), calculated by considering all contributions up to second order in many-body perturbation theory. The results for the pressure $P(\rho, T)$ obtained by using different chiral low-momentum interactions are reasonably similar in the case of zero temperature, however, they differ with respect to their temperature behaviour, leading to deviating thermodynamical properties. The model-dependence of the different NN and 3N contributions to the nuclear EoS is then investigated in detail, and we find that the differences are predominently due to the different values of the LECs that parametrize the 3N force. The value of the critical temperature of the nuclear liquid-gas phase transition is determined for all sets of potentials.

HK 3.6 Mo 15:30 HZ 4

Suche nach magnetischen Dipol-Anregungen in ^{48}Ca aus Protonenstreuung unter extremen Vorwärtswinkeln — •Michael Mathy[1], Jonny Birkahn[1], Peter von Neumann-Cosel[1], Hiroaki Matsubara[2] und Atsushi Tamii[3] — [1]Institut für Kernphysik, TU Darmstadt, Germany — [2]NIRS, Chiba, Japan — [3]RCNP, Osaka University, Japan

Wie in einem ^{48}Ca(e,e')-Experiment gezeigt wurde, gibt es in ^{48}Ca neben dem prominenten M1 Spinflip-Übergang bei $E = 10.23$ MeV zusätzlich mehrere schwächere M1-Anregungen zwischen 9 und 13 MeV [1]. Obwohl die individuellen Anregungen schwach sind und experimentell nahe der Nachweisgrenze liegen, ist ihr Beitrag zur Gesamtstärke nicht vernachlässigbar und damit wichtig für eine Interpretation des Quenchings. Diese M1-Anregungen sollen nun zur Überprüfung mit Daten eines ^{48}Ca(p,p')-Experiment verglichen werden, welches am RCNP in Japan durchgeführt wurde. Wie in [2,3] gezeigt wurde, erlaubt die Analyse inelastischer Protonenstreuung unter extremen Vorwärtswinkeln die Extraktion von E1- und M1-Stärkeverteilungen. Es werden die Ergebnisse einer Multipolentfaltung der Wirkungsqeurschnitte diskutiert.

[1] W. Steffen et al., Phys. Lett. B 95, 23 (1980). [2] A. Tamii, et al., Phys. Rev. Lett. 107, 062502 (2011). [3] I. Poltoratska et al., Phys. Rev. C 85, 041304(R) (2012)

HK 3.7 Mo 15:45 HZ 4

Spin-Flip M1 Stärke und elektrische Polarisierbarkeit aus inelastischer Protonenstreuung unter extremen Vorwärtswinkeln am ^{48}Ca — •Jonny Birkhan[1], Hiroaki Matsubara[2], Peter von Neumann-Cosel[1], Norbert Pietralla[1], Vladimir Ponomarev[1], Achim Richter[1] und Atsushi Tamii[2] — [1]Institut für Kernphysik, TU Darmstadt — [2]RCNP, Osaka University, Japan

Die inelastische Protonenstreuung unter extremen Vorwärtswinkeln ist hervorragend geeignet, um $E1$- und $M1$-Anregungen in Kernen mit hoher Energieauflösung zu untersuchen, wie am Beispiel ^{208}Pb gezeigt wurde [1]. Am ^{48}Ca kann zum einen die M1-Stärke des prominenten Spin-Flip Übergangs bei 10.2 MeV bestimmt und mit den sich widersprechenden Ergebnissen aus $(\mathrm{e}, \mathrm{e}')$- und (γ, n)-Experimenten ([2][3]) verglichen werden. Zum anderen läßt sich die Polarisierbarkeit aus der B(E1)-Stärkeverteilung ermitteln und daraus die Dicke der Neutronenhaut. Zusammen mit dem Ergebnis für das ^{208}Pb kann so zwischen EDFs unterschieden werden, die alle eine Korrelation zwischen beiden Größen, aber unterschiedliche absolute Werte vorhersagen [4]. Die Ergebnisse eines Experiments an ^{48}Ca werden vorgestellt. – Gefördert von der DFG im Rahmen der Projekte SFB634 und NE 679/3-1 – [1] A. Tamii et al., Phys. Rev. Lett. 107, 062502 (2011). [2] W. Steffen et al., Nucl. Phys. A 404, 413 (1983). [3] J.R. Tompkins et al, Phys. Rev. C 84, 044331 (2011). [4] J. Piekarewicz et al., Phys. Rev. C 85, 041302 (2012).

HK 4: Schwerionenkollisionen und QCD Phasen

Zeit: Montag 14:00–16:00 Raum: HZ 6

Gruppenbericht HK 4.1 Mo 14:00 HZ 6

Jet reconstruction and measurement of identified fragmentation functions in Pb-Pb and pp collisions with the ALICE experiment — •Xianguo Lu and Oliver Busch for the ALICE-Collaboration — Physikalisches Institut, Heidelberg, Germany

Jets are defined in QCD as cascades of consecutive emission of partons from an initial hard scattering. The process of parton showering and subsequent hadronisation is broadly known as fragmentation. High energy nucleus-nucleus collisions allow us to probe parton fragmentation within a QCD medium and the properties of this medium via the modification of the jet spectrum and jet structure. Jet reconstruction in pp collisions provides an elementary baseline and allows to investigate perturbative and non-perturbative aspects of particle production. In addition to inclusive probes, identified particles in the final states provide an enhanced sensitivity to the flavor dependence of fragmentation and nuclear modifications.

ALICE at the CERN LHC is a general-purpose heavy ion experiment designed to study the physics of strongly interacting matter and the Quark-Gluon-Plasma. It has an excellent tracking and particle identification performance over a wide momentum range. In this talk we present results on inclusive jet observable as well as the novel measurements of identified fragmentation functions in pp and Pb-Pb collisions. The results are confronted with theory predictions.

HK 4.2 Mo 14:30 HZ 6

Azimuthal Jet Tomography at RHIC and LHC — •Barbara Betz[1] and Miklos Gyulassy[2] — [1]Johann Wolfgang Goethe-University, Frankfurt am Main, Germany — [2]Columbia University, New York, USA

Recent data on the azimuthal and transverse momentum dependence of high-pT pion nuclear modification factors and high-pT elliptic flow in nuclear collisions at RHIC and LHC are analyzed in terms of a wide class of jet-energy loss models, ranging from running coupling pQCD based prescriptions to AdS/CFT-inspired models, coupled to state of the art (2+1)-dimensional viscous hydrodynamic fields. RHIC data are found to be surprisingly consistent with most models, but with parameters fixed at RHIC, extrapolations to LHC energies favor only running coupling QCD based energy-loss models, while conformal AdS holography models are inconsistent with the measured data. However, recent non-conformal generalizations of AdS holography may provide an alternative description.

HK 4.3 Mo 14:45 HZ 6

Initial state effects in p+Pb collisions at 5.02 TeV from the PHSD transport approach — •V.P. Konchakovski[1], W. Cassing[1], and V.D. Toneev[2] — [1]Institute for Theoretical Physics, University of Giessen, Giessen, Germany — [2]Joint Institute for Nuclear Research, Dubna, Russia

We study initial state effects for different observables in p+Pb collisions at 5.02 TeV using event-by-event simulations within the Parton Hadron String Dynamics (PHSD) transport approach which incorporates both hadronic and partonic degrees of freedom and successfully describes heavy-ion collisions in a wide range of energies. We compare our results with data from the ALICE Collaboration as well as with calculations using Glauber and Color-Glass-Condensate (CGC) initial conditions and find that our results for fluctuations and distributions are close to the CGC assumptions. We additionally investigate the effects of color field fluctuations in the initial phase of the collision that emerge from the non-abelian dynamics of the chromo fields.

HK 4.4 Mo 15:00 HZ 6

Charged Jets in Minimum Bias p-Pb Collisions at $\sqrt{s_{\mathrm{NN}}} = 5.02$ TeV with the ALICE Detector — •Rüdiger Haake — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, Germany

Highly energetic jets are sensitive probes for the kinematics and the topology of high energy collisions. They are produced in an early stage of the collision from hard scattered partons that hadronize and eventually form jets as a spray of charged and neutral particles.

The measurement in p-Pb provides an important reference to study the effects of cold nuclear matter on jet production and hadronization. This is possible because the formation of a hot and dense medium like in Pb-Pb is not expected. Besides the comparison to Pb-Pb collisions, p-Pb analyses can also be an important constraint for the nuclear parton density functions.

In terms of analysis techniques, the exact evaluation of the background from the underlying event is an important ingredient. It is much smaller than in Pb-Pb so that the methods for background estimation need to be refined.

Our jet analysis of p-Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 5.02$ TeV is performed on data taken by the ALICE detector at the LHC in the beginning of 2013. The focus of our analysis lies on the minimum bias jet spectra and their comparison to the spectra from pp collisions. For this analysis various estimates for the background and its fluctuations have been tested in p-Pb and PYTHIA MC simulations. Also, different unfolding settings have been evaluated.

HK 4.5 Mo 15:15 HZ 6

Jet reconstruction with background subtraction in a partonic transport model — •Florian Senzel[1], Jan Uphoff[1], Oliver Fochler[1], Zhe Xu[2], and Carsten Greiner[1] — [1]Institut für Theoretische Physik, Johann Wolfgang Goethe-Universität Frankfurt, Germany — [2]Department of Physics, Tsinghua University, Beijing, China

Experimental data measured in $\sqrt{s} = 2.76\,A$TeV Pb+Pb collisions by the LHC experiments showed a significant imbalance in the transverse momenta of the two reconstructed jets with the highest transverse momenta. This momentum imbalance is assumed to be caused by the different in-medium path lengths and thereby different energy and momentum loss of the di-jets within the dense medium. To investigate this momentum loss we extended the transport model BAMPS which solves the full 3+1D Boltzmann equation for partons based on pQCD cross sections. One feature of BAMPS is the stochastic modeling of both 2→2 and 2↔3 scattering processes by employing a new, improved Gunion-Bertsch matrix element. We will show our results for the momentum asymmetry A_J using well-established experimental subtraction methods and have a closer look at the role of further recoil scattering processes of the initial shower partons on the momentum loss of the reconstructed jets. Thereby we will emphasize that for this investigation a careful consideration of the subtraction of the soft underlying background medium becomes crucial.
Supported by HGS-HIRe.

HK 4.6 Mo 15:30 HZ 6

Fragmentation of jets into hadrons with strangeness in Pb-Pb collisions in ALICE at the LHC — •Alice Zimmermann for the ALICE-Collaboration — Physikalisches Institut Heidelberg

The research programme of the ALICE experiment at the LHC focuses on the so-called Quark-Gluon Plasma, a state of matter where quarks and gluons are deconfined.

The measurement of particle jets from fragmentation of hard scatterings of partons in the colliding nuclei allows to study parton energy loss in the hot and dense medium and constrains the modelling of such a phenomenon.

By measuring yields of particles like K^0_s, Λ and $\bar{\Lambda}$ of low to intermediate momenta within jet cones, fragmentation into strange hadrons, as well as the baryon-meson ratio in jets can be studied.

In this contribution we present first results on K^0_s, Λ and $\bar{\Lambda}$ production in jets in Pb-Pb collisions at $\sqrt{s_{NN}} = 2.76$ TeV. The analysis is further performed in different centrality classes, representing collisions with different impact parameters. The strangeness identified fragmentation distributions are compared to first results on inclusive fragmentation in Pb-Pb collisions.

HK 4.7 Mo 15:45 HZ 6

Jet-hadron correlations in Pb-Pb collisions with ALICE at the LHC — •Jochen Klein for the ALICE-Collaboration — Physikalisches Institut, University of Heidelberg

A Large Ion Collider Experiment (ALICE) allows for excellent particle identification in Pb-Pb collisions recorded in 2010 and 2011 at the LHC. We discuss how this could help to observe the response of a strongly interacting medium to the traversal of hard partons.

Hard partons from interactions at high scales fragment into jets. In PbPb collisions, the partons interact strongly with the produced medium. This leads to a modification of the jet but also a response of the medium. We discuss the correlation of a trigger jet and hadrons. We want to exploit the different proton fraction in jet fragmentation and bulk hadronisation to disentagle jet and medium hadronisation. The response from a quenched jet on the away-side of a trigger jet results from a longer path length and is of particular interest.

HK 5: Schwerionenkollisionen und QCD Phasen

Zeit: Montag 14:00–16:00 Raum: HZ 7

HK 5.1 Mo 14:00 HZ 7

A Bayesian approach to PID in ALICE, as studied in the channel D0 -> Kπ — •Jeremy Wilkinson — Physikalisches Institut, University of Heidelberg, Im Neuenheimer Feld 226

The standard particle identification (PID) method in ALICE uses a frequentist, or nσ, approach. In this method, particles are accepted via a selection on the number of standard deviations by which a signal differs from the expected detector response. This works well for most particle species, but in some cases, such as the non-resonant decay of Λc -> pKπ, the combinatorial background is too high to make a significant measurement. The usage of an alternative Bayesian approach, based on a combination of the measured dE/dx and time-of-flight of the daughter tracks, will be presented here. The Bayesian method bases

its response on prior probabilities of a given particle species being produced with a given momentum, allowing a calculation of the probability for a daughter particle to belong to each species (π, K, p, etc.) based on the detector response seen. In order to check the validity of this method, various decay channels were tested and compared to the nσ method. Among these was the channel D0 -> Kπ, which provides a valuable cross-check of both the kaon and pion responses in this approach. In addition to considering the differences in signal-to-background ratio and significance obtained when applying the various methods, a comparison will be shown between the yield obtained without PID and those found when using Bayesian and nσ approaches after being corrected for their respective PID efficiencies.

HK 5.2 Mo 14:15 HZ 7

The Parallel Cellular Automaton track finder for the CBM experiment — •Valentina Akishina[1,2,4] and Ivan Kisel[1,2,3] for the CBM-Collaboration — [1]Goethe-Universität Frankfurt am Main, Frankfurt am Main, Germany — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany — [3]Frankfurt Institute for Advanced Studies, Frankfurt am Main, Germany — [4]JINR Joint Institute for Nuclear Research, Dubna, Russia

The CBM experiment at FAIR is being designed to study heavy-ion collisions at extremely high interaction rates. The event selection has to be done online and requires full event topology reconstruction, therefore fast and efficient reconstruction algorithms are needed.

The Cellular Automaton track finder is fast and robust and thereby will be used for the online and offline track reconstruction. In order to fully utilise the processing power provided by modern computer architectures, parallelism is to be implemented for the reconstruction.

The CA track finder was fully parallelised inside the event. Since the CBM beam will have no bunch structure, but continuous, the reconstruction of time slices rather than events is needed. Thus, the parallel version of the algorithm was optimised for reconstruction of groups of minimum bias events packed in slices.

The parallel version of the algorithm shows the same efficiency as a single core one and achieves a speed up of about 10 while parallelising between 10 Intel Xeon physical cores with a hyper-threading.

Supported by FIAS, HICforFAIR and HGS-HIRe for FAIR and Hessischen Ministerium für Wissenschaft und Kunst.

HK 5.3 Mo 14:30 HZ 7

Stability of the CBM CA based Track Finder with Respect to Number of Stations — Ivan Kisel[1,2,3] and •Igor Kulakov[1,2,3] for the CBM-Collaboration — [1]Goethe-Universitat Frankfurt am Main — [2]Frankfurt Institute for Advanced Studies — [3]GSI Helmholtzzentrum fur Schwerionenforschung GmbH

The main tracking detector in the CBM experiment (FAIR, Darmstadt, Germany) is the Silicon Tracking System (STS). A number of conditions complicates the track reconstruction in STS: up to 1000 tracks per event, up to 10^7 events per second, non-homogeneous magnetic field, up to 85% fake combinatorial space points in double-sided strip detectors.

The cellular automaton (CA) based track reconstruction performs with efficiency of 98% and time of 12 ms with standard STS setup, consisting of 8 stations. The detector is placed in a dipole magnet and the space available for STS is limited. Therefore geometries with different number of stations required to be considered additionally.

Tests of the CA based reconstruction have been performed with data simulated in 7 different STS setups, changing number of STS stations from 4 to 8. The track reconstruction efficiencies for majority of the signal tracks stays on the level of 90-100% for all setups for minimum bias events. Momentum resolution stays on the same level of 1.3% for all STS setups, which has at least 70 cm length.

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

HK 5.4 Mo 14:45 HZ 7

Full kinematic reconstruction of B^+ mesons with the upgraded ALICE inner tracker — •Johannes Stiller for the ALICE-Collaboration — Physikalisches Insitut, Heidelberg

During the second long shutdown of the LHC in 2018, the ALICE experiment will undergo major detector upgrades, including the installation of a new high-granularity silicon pixel inner tracker in the central barrel. A single-hit resolution of 4 μm close to the interaction point and a readout rate capability of up to 50 kHz in Pb-Pb collisions will allow new and unique measurements in the heavy-quark sector. In this talk we focus on the performance of full kinematic reconstruction down to lowest p_T in the channel $B^+ \to \overline{D}^0\pi^+$ and $\overline{D}^0 \to K^+\pi^-$ with branching ratios of 0.5 % and 3.9 % respectively, using detailed Monte Carlo simulations of high-multiplicity Pb–Pb collisions. Topologic and kinematic criteria are used to select the rare signal. Furthermore, the track rotation method is used to improve the background statistics estimate in order to give a first outlook on the expected signal-to-background ratio and statistical significance.

HK 5.5 Mo 15:00 HZ 7

Feasibility study on χ_c identification with ALICE at the LHC — •Steffen Weber for the ALICE-Collaboration — Research Division and ExtreMe Matter Institute, GSI Helmholtzzentrum für Schwerionenforschung, Planckstr. 1, 64291 Darmstadt — Institut für Kernphysik, Technische Universität Darmstadt, Schlossgrabenstr. 9, 64289 Darmstadt

At the high energies of the LHC, $c\bar{c}$ pairs are abundantly produced. As they are produced in initial hard collisions, they probe the deconfined medium in Pb-Pb collisions over its entire lifetime.

Charmonium, a bound state of c and $\bar{c}$ quarks, is a special probe of deconfinement and also a subject of research in elementary hadronic collisions.

Excited states of charmonium, like the $\psi(2S)$ and χ_c, are observables which could help to distinguish between regeneration and statistical hadronization models, which currently describe successfully the J/ψ data measured at the LHC. We present a study on the feasibility of identifying the χ_c charmonium state in ALICE, in pp, p-Pb and Pb-Pb collisions.

HK 5.6 Mo 15:15 HZ 7

Reconstruction of π^0 mesons via conversion method in Au+Au at 1.23AGeV with HADES — •Claudia Behnke for the HADES-Collaboration — Institut für Kernphysik, Goethe Universität Frankfurt

Lepton pairs emerging from decays of virtual photons are one of the most promising probes of compressed hadronic matter. The HADES experiment at GSI Helmholtzzentrum für Schwerionenforschung in Darmstadt studies di-electron radiation as well as strangeness production in various reactions, i.e. pion, proton, deuteron and heavy-ion induced reactions. The understanding of the corresponding experimental results calls for supporting studies from various model calculations. For a model-independent understanding of the dilepton cocktail the production cross sections of particles decaying during the freeze-out is crucial. In this contribution the capability of HADES to detect e^+e^- pairs from conversion of real photons will be demonstrated. We will present results from a two-photon analysis of Au+Au collisions at 1.23 GeV/u providing information on π^0 and η mesons. Supported by BMBF (05P12RFGHJ), Helmholtz Alliance EMMI, HIC for FAIR, HGS-HIRe

HK 5.7 Mo 15:30 HZ 7

Lepton identification performance in Au+Au at 1.23 GeV/u in HADES — •Szymon Harabasz for the HADES-Collaboration — TU Darmstadt

The High Acceptance Di-Electron Spectrometer, installed at GSI Helmholtzzentrum für Schwerionenforschung in Darmstadt, has measured rare penetrating probes and strange particles production in elementary as well as in heavy ion collisions. The heaviest system, Au+Au at a maximum available at SIS18 beam kinetic energy of 1.23 GeV/u has been measured by HADES in April - May 2012. In such collisions, extracting a sample of very rare di-electrons radiated from a dense fireball plays a crucial role. Therefore, a pure electron identification is necessary. This is achieved by exploring information from the Ring Imaging Cherenkov detector in combination with the time-of- flight measurement and with an evidence of an electromagnetic shower formation. A sequence of one- or two-dimensional cuts does not meet requirements. Therefore lepton identification has to be done using a multi-dimensional condition calculated by an artificial neural network. In this contribution I will present results on efficiency and purity of electron identification obtained using multi-variate analysis method.

Supported by: ViP-QM/VH-NG-823, BMBF (05P12RFGHJ), Helmholtz Alliance EMMI, HIC for FAIR, HGS-HIRe.

HK 5.8 Mo 15:45 HZ 7

Charged Pion Production and V0 Reconstruction in Au+Au-Collisions at 1.23 AGeV with HADES — •Timo Scheib for the HADES-Collaboration — Goethe-Universität Frankfurt

In heavy ion collisions at beam energies of 1-2 AGeV, strange particles are produced below their elementary production threshold which results in a steep excitation function.

In April and May 2012, 7.3 billion Au(1.23 GeV per nucleon)+Au collisions have been recorded by the HADES detector, installed at the Helmholtzzentrum fuer Schwerionenforschung (GSI) in Darmstadt, Germany. In this collision system the weakly decaying strange hadrons K_s^0 and Λ were measured and reconstructed. In order to draw conclusions on strangeness production mechanisms in heavy ion collisions the yields can be compared to non-strange particle production, i.e. charged pions.

In this contribution preliminary particle spectra of charged pions, Λ hyperons and K_s^0 mesons measured in these collisions will be presented. Supported by BMBF (05P12RFGHJ), Helmholtz Alliance EMMI, HIC for FAIR, HGS-HIRe and H-QM.

HK 6: Instrumentierung

Zeit: Montag 14:00–15:30 Raum: HZ 8

HK 6.1 Mo 14:00 HZ 8

TDC for the front end architecture in the PANDA MVD — •Alberto Riccardi[1], Kai Thomas Brinkmann[1], Valentino Di Pietro[1], Sara Garbolino[2], Angelo Rivetti[2], and Manuel Rolo[2] for the PANDA-Collaboration — [1]II Physikalisches Institut Justus-Liebig-Universität Giessen, Giessen, Germany — [2]INFN Sezione di Torino, Torino, Italy

In nuclear detectors the information on the energy of the particle is usually obtained by measuring the amplitude of the signal delivered by the sensor. The low voltage power supply used in modern deep submicron technologies constrains the maximum dynamic range of the ADC. So we can obtain the energy information with time-based techniques, in which the energy is associated with the duration of the signal through the Time over Threshold method. This work is focused on the PANDA Micro Vertex Detector and explores the possibility of applying a time-based readout approach for the microstrip sensors. In PANDA , the strip system must cope with hit rates up to 50 kHz per channel. Therefore, the front-end output must be relatively short. This implies that the clock resolution is not enough to measure the signal duration, so it is necessary to use a Time to Digital Converter. The front-end and the TDC structure are designed in a 0.11um CMOS process. The TDC chosen is based on an analog clock interpolator because it combines good time resolution with a fairly simple implementation and low power consumption. In the presentation the architectures with their will be described and the challenges associated to its implementation discussed. Supported by BMBF, HGS-HIRe and JCHP.

HK 6.2 Mo 14:15 HZ 8

TRB3-based DAQ systems - A collaborative approach — •Jan Michel for the TRB3-Collaboration — Goethe-Universität Frankfurt

Modern detector systems have become complex and the demands on data- and event-rates made designing a fitting data acquisition scheme a major task. On the other hand, many small research groups need a fast way to set up a small system for testing of detector prototypes.

During the past years, the data acquisition system of the HADES detector at GSI has been upgraded. Within this project, a huge set of electronic components, a network data transport protocol and software for data storage as well as control and monitoring of the detector were developed. This framework has been further extended, a new versatile FPGA platform (TRB3) has been built and can be adapted to many different needs by AddOn and front-end modules.

The full toolchain has been successfully used by various sub-groups of the FAIR experiments CBM, PANDA and HADES. Several other detector groups are interested in the project and are actively contributing. This talk will focus on the advantages such a collaborative community has for all partners. Among these is the small amount of work to be contributed by the individual, the fast installation time of new set-ups and the versatile software environment to which all users contribute.

This work has been supported by BMBF, HIC for FAIR, and GSI.

HK 6.3 Mo 14:30 HZ 8

Upgrade of the Data Acquisition System for the A2 Experiment at MAMI — •Andreas Neiser and Wolfgang Gradl for the TRB3-Collaboration — Institut für Kernphysik, Johann-Joachim-Becher-Weg 45, Mainz

The A2 collaboration at the electron accelarator MAMI in Mainz uses energy-tagged photons to produce light mesons off the nucleon. Its current data acquisition system is the major performance bottleneck under typical trigger conditions. Furthermore, the availability of spare parts is limited, which renders the maintainability for the next decade difficult. Thus, an upgraded system is desirable for A2 to achieve the upcoming experimental goals. For this upgrade, an FPGA-based solution using the TRB3 is being considered.

The TRB3 is a multi-purpose $4 + 1$ FPGA board and implements a $4 \times 65 + 4 = 264$ channel time-to-digital converter (TDC) with 11 ps RMS precision between two channels. It was developed at GSI in Darmstadt including different front-ends for signal discrimination and charge measurements. For the precursor TRB2, a charge-to-digital precision of 0.2 % was shown. Owing to its flexible design, it is an attractive upgrade option for A2.

We present the successful integration of the TRB3 into the existing A2 data acquisition system at the trigger and the data read-out interface. First test measurements at our 4π NaI calorimeter Crystal Ball with up to 16 channels yielded promising results. The performance of the TRB3 platform seems to be sufficient for the future requirements of A2. An outlook on upscaling and deploying the system is given.

HK 6.4 Mo 14:45 HZ 8

Frontend Electronics for high-precision single photo-electron timing using FPGA-TDCs — •Matteo Cardinali for the PANDA Cherenkov-Collaboration — Helmholtz Institut Mainz

The next generation of high-luminosity experiments requires excellent Particle Identification (PID) detectors which calls for Imaging Cherenkov counters with fast electronics to cope with the expected data rates. The planned PANDA experiment at FAIR expects average interaction rates of 20MHz. A Barrel DIRC will provide PID in the central region of the Target Spectrometer. A single photo-electron timing resolution of better than 100ps is projected for the Barrel DIRC to disentangle the complicated patterns created by the focusing optics on the image plane. The typically large amount of readout channels (approx 15,000 in case of the PANDA Barrel DIRC) places non-negligible limits on size and power consumption of the Front-End Electronics (FEE). The proposed design is based on the TRBv3 readout using FPGA-TDCs with a precision better than 20ps RMS and custom FEE with high-bandwidth pre-amplifiers and fast discriminators. Two types of FEE cards optimised for reading out 64-channel Photonis Planacon MCP-PMTs were tested: one based on the NINO ASIC developed for the ALICE RPC readout and the other, called PaDiWa, using FPGA-based discriminators. Both types of FEE cards were tested with a small DIRC prototype comprising a radiator bar with focusing lens and an oil-filled expansion volume instrumented with 6 Planacon 64-channel MCP-PMTs. In the presentation the result of a test experiment performed at MAMI B, Mainz, will be addressed.

HK 6.5 Mo 15:00 HZ 8

Development of a digital trigger system to identify recoil protons at COMPASS-II — Maximilian Büchele, Horst Fischer, •Matthias Gorzellik, Tobias Grussenmeyer, Florian Herrmann, Philipp Jörg, Kay Königsmann, Paul Kremser, and Sebastian Schopferer — Albert-Ludwigs-Universität Freiburg

The GANDALF framework has been developed to deliver a high precision, high performance detector readout and trigger system for particle physics experiments such as the COMPASS-II experiment at CERN. Combining the high performance pulse digitization and feature extraction capabilities of twelve GANDALF modules, each comprising a Virtex-5 SX95T, with the strong computation power of a Virtex-6 SX315T FGPA operated on the TIGER module, we present a digital trigger system for a recoil proton detector.

The trigger system was setup and commissioned successfully during a data taking period in 2012. It was mainly used for the calibration of the recoil proton detector and in tagging mode to identify proton tracks online.

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

HK 6.6 Mo 15:15 HZ 8

Self-triggering readout system for the neutron lifetime experiment PENeLOPE — •Dominik Steffen for the PENeLOPE-Collaboration — Technische Universität München

Modern experiments permanently improve the precision of parameters in nuclear and particle physics. Besides high-performance detectors, state-of-the-art readout electronis and recent data acqusition systems contribute substantially to the increasingly better accuracy. This talk will therefore present the readout system, which is being designed for the neutron lifetime experiment PENeLOPE, currently under construction at Technische Universität München.

The system*s readout chain involves preamplifier, shaper, sampling ADC, and a data processing stage implemented on field programmable gate arrays (FPGAs). The FPGAs perform the task of online data analysis and formatting and are able to transfer data to a computer via a high-speed Ethernet connection. An advanced algorithm enables them to calculate the pedestal for every single channel online, and to reliably detect all signals above noise. Due to this incorporated signal detection, the triggerless system is able to process and to format pulse shapes from around 1,000 channels simultaneously, each of which is hit by 10 particles/sec. This corresponds to a data rate of 1.5 MB/sec, which is read out to a computer where the pulse shapes are available for further analysis. In the talk, performance and first tests of this readout system will be presented in detail.

HK 7: Instrumentierung

Zeit: Montag 14:00–16:00 Raum: HZ 9

HK 7.1 Mo 14:00 HZ 9

Technical design of the PANDA Disc DIRC Detector — •Erik Etzelmüller, Klim Biguenko, Michael Düren, Klaus Föhl, Avetik Hayrapetyan, Benno Kröck, Oliver Merle, and Julian Rieke for the PANDA-Collaboration — Jusust-Liebig-Universität, Gießen

The physics program of the PANDA detector at the future FAIR facility at GSI requires excellent particle identification. In the forward angular region between 5 and 22 degrees, this will be achieved by a DISC DIRC detector that detects internally reflected Cherenkov light in order to separate pions, kaons and other hadrons. It will be the first time that a Disc-DIRC is used in a high performance 4π detector. Technical challenges such as radiation hardness of used materials and sensors, the presence of a strong magnetic field and limited space for mechanics which arise from constraints of the PANDA environment, had to be overcome in the detector design. The actual detector design and solutions to the formerly mentioned challenges will be presented and discussed.

HK 7.2 Mo 14:15 HZ 9

A new prototype for the PANDA Disc DIRC Detector — •Julian Rieke, Michael Düren, Avetik Hayrapetyan, Klaus Föhl, Benno Kröck, Oliver Merle, Erik Etzelmüller, and Klim Biguenko for the PANDA-Collaboration — Justus Liebig Universität, Gießen, Germany

The PANDA experiment at the future FAIR facility needs excellent particle identification to do precision studies of antiproton-proton reactions in the 1.5-15 GeV/c momentum range. To fulfill this need, two Cherenkov detectors will be installed in the PANDA target spectrometer, both based on the DIRC concept that uses internally reflected Cherenkov light to perform particle identification, with a focus on the separation of pions and kaons. The Disc-DIRC is designed to cap the forward region of theta angles between 5 and 22 degrees. It will be the first time that a 3D-Disc-DIRC is used for PID in a real physics experiment beyond prototyping.

A new prototyping Disc-DIRC apparatus has been constructed at the JLU Giessen. Unlike previous prototypes, this one features a radiator as well as focusing elements made out of fused silica. The Cherenkov light is detected with 22 multi-anode-phototubes and 4 MCP-PMTs, totalling 608 individual pixels. Timing information for each of the latter is generated using the novel TRB3 system developed at GSI. The entire prototype was tested with an electron beam of several GeV/c provided by DESY in Hamburg. The components, their setup and a first analysis of the recorded data will be presented.

HK 7.3 Mo 14:30 HZ 9

Untersuchung eines Flugzeitspektrometers auf Basis von MCP-PMTs — •Fred Uhlig, Alexander Britting, Wolfgang Eyrich und Albert Lehmann — Physikalisches Institut, Universität Erlangen-Nürnberg

Microchannel-Plate Photomultiplier (MCP-PMTs) zeichnen sich unter anderem durch eine sehr gute Zeitauflösung von kleiner als 50ps für einzelne Photonen aus. Da sich die Zeitauflösung für Messungen mit mehreren Photonen entsprechend $\sigma_N = \frac{\sigma_0}{\sqrt{N}}$ verbessert, sollte es möglich sein mit passender Elektronik Zeitauflösungen im Bereich einiger 10ps zu erreichen.

In einem Radiator (z.B. Plexiglas) lassen sich mit Hilfe eines geladenen Teilchenstrahls mehrere Cherenkov-Photonen erzeugen. Durch die Kombination zweier Systeme aus jeweils einem Radiator und einem MCP-PMT kann man die Flugzeit von Teilchen, und damit deren Identität bestimmen. Zusätzlich kann mit Multianoden MCP-PMTs Teilchenspurrekonstruktion (Tracking) betrieben werden.

Zur Untersuchung dieser sogenannten MCP-TOF Methode wurden an Teststrahlzeiten am CERN und FZ Jülich im Rahmen von Detektortests für die DIRC-Detektoren (Detection of Internally Reflected Cherenkov Light) am PANDA-Experminent Messungen durchgeführt. Die Ergebnisse hieraus werden vorgestellt.

- Gefördert durch BMBF und GSI -

HK 7.4 Mo 14:45 HZ 9

Measurements of recent microchannel-plate photomultipliers with significantly increased lifetime — •Alexander Britting, Wolfgang Eyrich, Albert Lehmann, and Fred Uhlig for the PANDA-Collaboration — Physikalisches Institut, Universität Erlangen-Nürnberg

Due to their usability in high magnetic fields of up to 2 Tesla and a time resolution of better than $\sigma = 50$ ps microchannel-plate photomultipliers (MCP-PMT) are the favored sensors for the DIRC detectors (Detection of Internally Reflected Cherenkov light) of the PANDA experiment. The anticipated average luminosity of $2 \cdot 10^{32}\ \ cm^{-2}s^{-1}$ in the detector requires a rate capability high enough to withstand a detected photon rate of about 200 $kHz\ cm^{-2}$ at the MCP-PMTs surface. This rate accumulates to an integrated anode charge for the MCP-PMTs of $\approx 5\ C/cm^2$ for the Barrel DIRC and even more for the Endcap Disc DIRC after a 10 years operation time of PANDA.

The major drawback up to now was the limited lifetime of MCP-PMTs, which seems to be solved for the most recent MCP prototype devices. The main aging parameter is the quantum efficiency as a function of the integrated anode charge. We performed lifetime measurements for several MCP-PMTs, which correspond to different stages of lifetime enhancement. Results of these measurements will be presented. The achieved lifetimes now match the PANDA requirements for the Barrel-DIRC.

- supported by BMBF and GSI -

HK 7.5 Mo 15:00 HZ 9

Simulation and Construction of MWPCs without drift region for the CBM-TRD — •Florian Roether for the CBM-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

The Compressed Baryonic Matter (CBM) experiment at the future Facility for Antiproton and Ion Research (FAIR) will explore the QCD phase-diagram in the region of high net-baryon densities. The Transition Radiation Detector (TRD) with its multi-layer-design will provide electron identification and contribute to particle tracking.

Each TRD module consists of a radiator and a Read Out Chamber (ROC). The Frankfurt prototypes are narrow Multiwire Proportional Chambers (MWPC) without a drift region and have therefore a short signal collection time, in order to handle the high event rates of up to 10 MHz in the experiment. The loss of transistion radiation is minimized by using an entrance window made of a thin foil. As a deformation of the entrance window could influence the performance of the detector, different methods to minimize this effect have been studied. In this

talk the construction of an alternative prototype wire-geometry and simulations of gain variations are presented and different approches to stabilize the gas gain are discussed.

This work is supported by BMBF and the Helmholtz Association.

HK 7.6 Mo 15:15 HZ 9

Vergleich verschiedener Photosensoren anhand der CBM-RICH Strahlzeit 2012* — •Sascha Reinecke für die CBM-Kollaboration — Bergische Universität Wuppertal

In Darmstadt an der GSI wird derzeit die Facility for Antiproton and Ion Research (FAIR) gebaut. Eines der dort geplanten Projekte ist das Schwerionenexperiment Compressed Baryonic Matter (CBM). Ziel ist die Vermessung des QCD-Phasendiagramms bei hohen Netto-Baryonendichten und moderaten Temperaturen sowie die Charakterisierung des Phasenübergangs hadronischer Materie zum Quark-Gluon Plasma. Eine wesentliche Komponente des CBM-Detektors ist ein Ring-abbildender Cherenkov-Detektor (RICH), in welchem das Cherenkov-Licht schneller Teilchen ($v > c_n = c/n$) über sphärische Spiegel ringförmig auf den Photodetektor abgebildet wird.

Im Rahmen einer im Oktober 2012 durchgeführten Teststrahlzeit am CERN-PS Beschleuniger konnten wichtige Informationen u.a. für den Aufbau des Photodetektors des RICH gewonnen werden. Ein Ziel der Strahlzeit war die Charakterisierung von neuen Hamamatsu Multi-Anoden PMTs des Typs R11265 sowie von Micro-Channel-Plates (MCP) des Typs XP85012 der Firma Photonis sowie der jeweilige Vergleich mit den Hamamatsu H8500 MAPMTs. Eine wichtige Eigenschaft ist die Anzahl an detektierten Photonen pro Cherenkov-Ring, bei der Crosstalk eine erhebliche Rolle spielt. Wir berichten über fortgeschrittene Methoden zur Crosstalk-Bestimmung sowie weitere Resultate aus den bei dieser Strahlzeit gewonnenen Daten.

*gefördert durch BMBF 05P12PXFCE, und GSI

HK 7.7 Mo 15:30 HZ 9

Commissioning of the new Photon Tagger of the BGO-OD Experiment at ELSA — •Andreas Bella for the BGO-OD-Collaboration — Physikalisches Institut, Bonn, Deutschland

The BGO-OD Experiment, currently under construction at ELSA at the University of Bonn, is setup to investigate the photoproduction of mesons. Therefore, an electron beam provided by ELSA is used to produce Bremsstrahlung on a thin radiator. To determine the energy of the Bremsstrahlung, the electrons momenta are analysed through a dipole magnet which bends them into a hodoscope. It consists of 120 coincidence channels which cover an energy range from 10% to 90% of the incoming electron beam energy E_0. Due to geometrical constraints, the expected energy width of two overlapping scintillators varies from 0.4% to 1.7% of E_0. The optimum positions of the scintillators and the expected energy resolution were determined via Virtual Monte Carlo/Geant4.

The commissioning of the tagger hodoscope was finished with a final energy calibration, the results of which agree perfectly with simulations.

*Supported by DFG (SFB/TR-16)

HK 7.8 Mo 15:45 HZ 9

NeuLAND prototype: response to fast neutrons — •Simon Jährling[1], Thomas Aumann[1,2], Konstanze Boretzky[2], Igor Gasparic[1,3], Michael Heil[2], Dmytro Kresan[2], Heiko Scheit[1], and Haik Simon[2] for the R3B-Collaboration — [1]Technische Universität Darmstadt, Germany — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany — [3]Rudjer Boskovic Institute, Zagreb, Croatia

Within the R3B collaboration (Reactions with Relativistic Radioactive Beams), a new neutron detector NeuLAND (New Large Area Neutron Detector) is being developed. It will be a fully active scintillation detector consisting of 3000 scintillator bars, arranged in 30 double layers. Within a double layer 50 bars are horizontal and 50 vertical orientated. The whole detector measures $2.5 \times 2.5 \times 3$ m^3. A prototype with 150 NeuLAND bars was tested at GSI using quasi-mono-energetic neutrons with different energies from 200 to 1500 MeV stemming from quasi-free deuteron breakup reactions on a CH_2 target. The experimental setup will be described and preliminary results for the time resolution and efficiency of the NeuLAND prototype detector will be presented.

Supported by LOEWE (HIC for FAIR), GSI, and the BMBF project 06DA7047I.

HK 8: Hadronenstruktur und -spektroskopie

Zeit: Montag 16:30–19:00 Raum: HZ 1+2

Gruppenbericht HK 8.1 Mo 16:30 HZ 1+2

Messung von Doppelpolarisationsobservablen mit dem CBELSA/TAPS-Experiment — •Tobias Seifen für die CBELSA/TAPS-Kollaboration — Helmholtz-Institut für Strahlen- und Kernphysik, 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 meist stark. Um die Beiträge einzelner Resonanzen mittels einer Partialwellenanalyse eindeutig aus den Daten extrahieren zu können, ist die Messung von Einfach- und Doppelpolarisationsobservablen 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 Targets ist die Messung von Doppelpolarisationsobservablen über einen weiten Energiebereich möglich. Dabei werden Resonanzen mit Massen von bis zu 2.5 GeV zugänglich.

Im Vortrag werden Ergebnisse der am CBELSA/TAPS-Experiment gemessenen Polarisationsobservablen vorgestellt. Diese schließen die Observablen E, G, T, P und H für $\gamma p \to p\pi^0$ ebenso ein wie verschiedene Polarisationsobservablen für die η und $2\pi^0$ Photoproduktion am Proton.

Gefördert durch die Deutsche Forschungsgemeinschaft (SFB/TR16).

Gruppenbericht HK 8.2 Mo 17:00 HZ 1+2

Transversale Targetasymmetrien in der Meson-Photoproduktion — •Peter-Bernd Otte für die A2-Kollaboration — Institut für Kernphysik, Mainz

Die Partialwellenstruktur der Meson-Photoproduktion ist auch bei niedrigen Energien nach wie vor nur teilweise verstanden. Die modellunabhängige Bestimmung der Partialwellenamplituden ist Voraussetzung für signifikante experimentelle Tests von effektiven Feldtheorien und für ein Verständnis von Nukleonen-Resonanzen.

Die Bestimmung der Multipolamplituden für photoinduzierte Pion und Eta Produktion ist eines der Ziele des experimentellen Programms mit dem Crystal Ball Detektor am Mainzer Mikrotron MAMI.

In diesem Zusammenhang wurden in den letzten Jahren Doppelpolarisationsexperimente mit polarisiertem Strahl und transversal polarisiertem Target bis zu Energien von $W = 1{,}9$ GeV durchgeführt.

In diesem Vortrag gebe ich einen Überblick über die Durchführung und Analyse dieser Experimente. Erste Ergebnisse werden vorgestellt, diskutiert und mit effektiven Feldtheorien und dynamischen Modellen verglichen.

Gruppenbericht HK 8.3 Mo 17:30 HZ 1+2

Baryon and meson phenomenology in the extended Linear Sigma Model — •Francesco Giacosa[1], Anja Habersetzer[1], Khaled Teilab[1], Walaa Eshraim[1], Florian Divotgey[1], Lisa Olbrich[1], Susanna Gallas[1], Peter Kovacs[2], Gyuri Wolf[2], Denis Parganlija[3], Thomas Wolkanowski[1], Stanislaus Janowski[1], Achim Heinz[1], Werner Deinet[1], and Dirk H. Rischke[1] — [1]Institute for Theoretical Physics, J. W. Goethe University, Max-von-Laue-Str. 1, 60438 Frankfurt am Main — [2]Institute for Particle and Nuclear Physics, Wigner Research Center for Physics, Hungarian Academy of Sciences, H-1525 Budapest, Hungary — [3]Institute for Theoretical Physics, Vienna University of Technology, Wiedner Hauptstr. 8-10, A-1040 Vienna, Austria

The vacuum phenomenology obtained within the so-called extended Linear Sigma Model (eLSM) is presented. The eLSM Lagrangian is constructed by including from the very beginning vector and axial-vector d.o.f., and by requiring dilatation invariance and chiral symmetry. After a general introduction of the approach, particular attention

is devoted to the latest results. In the mesonic sector the strong decays of the scalar and the pseudoscalar glueballs, the weak decays of the tau lepton into vector and axial-vector mesons, and the description of masses and decays of charmed mesons are shown. In the baryonic sector the omega production in proton-proton scattering and the inclusion of baryons with strangeness are described.

HK 8.4 Mo 18:00 HZ 1+2

Baryon Spectroscopy at COMPASS — •Tobias Weisrock — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz

The COMPASS 2009 data taking with a 190 GeV/c proton beam impinging on a liquid hydrogen target offers the possibility to study baryon resonances in different channels. These data obtained from hadron-induced reactions are complementary to the ones obtained from electro- and photoproduction due to the different production mechanism.

Only exclusive events will be used for analyses, therefore the recoiling target proton has to be measured using a recoil proton detector. First studies of $p_f\pi^0 p_{\mathrm{rec}}$ and $p_f\eta p_{\mathrm{rec}}$ final states will be presented and an outlook on further analyses given.

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

HK 8.5 Mo 18:15 HZ 1+2

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

The study of the nucleons excitation spectrum by meson photoproduction has developed to a powerful tool in order to test QCD in the non-pertubative regime where effective quark models and lattice QCD become relevant. On the path towards a complete understanding also a minimal set of polarization observables has to be measured, from which one can deduce the J^P configurations of the resonances through partial wave analysis. Moreover, to decode the isospin decomposition of excited states it is necessary to measure on both the proton and the neutron. Eta-photoproduction is of special interest in two ways: First, since η has isospin $I = 0$, only N^* resonances can contribute. Second, the polarization observables can give further information about the narrow structure around 1670 MeV which has been observed in the cross section of the neutron channel in recent experiments.

Eta-photoproduction off a transversally polarized D-Butanol target has been measured using circularly polarized bremsstrahlung photons produced by the MAMI-C electron microtron with incident energies up to 1.5 GeV. Due to the nearly 4π acceptance of the combined Crystal Ball/TAPS setup it is possible to extract the double polarization observable F and the target asymmetry T for polarized, quasi-free protons and neutrons over a wide energy and angular range. Preliminary results for T and F are presented.

HK 8.6 Mo 18:30 HZ 1+2

Bestimmung der Polarisationsobservablen Σ und G in der Reaktion $\gamma\ p\ \rightarrow\ p\ \pi^0\ \pi^0$ mit dem CBELSA/TAPS-Experiment — •Karsten Spieker für die CBELSA/TAPS-Kollaboration — Helmholtz-Institut für Strahlen- und Kernphysik, Universität Bonn

Das Anregungsspektrum der Nukleonen gibt wichtige Informationen über die Dynamik und Wechselwirkungen zwischen den Konstituenten im Innern des Nukleons. Die $2\pi^0$ Photoproduktion ist optimal dafür geeignet Baryonresonanzen zu untersuchen, da Untergrundreaktionen wie die direkte $\Delta\pi$ Produktion, Meson-Austausch im t-channel und Born-Terme stark unterdrückt sind. Hinzu kommt, dass durch die Erhaltung des Isospins, Anteile durch das $\rho(770)$-Meson nicht vorhanden sind.
Um Informationen wie Masse, Zerfallsbreite und Helizitätsamplituden der Baryonresonanzen zu ermitteln ist eine eindeutige Partialwellenanalyse notwendig. Die dazu erforderlichen Einzel- und Doppelpolarisationsobservablen werden mit dem CBELSA/TAPS-Experiment an ELSA in Bonn gemessen, in dem polarisierte Photonen mit einen polarisierten Target wechselwirken können. Mit einer nahezu 4π Winkelabdeckung ist das CBELSA/TAPS-Experiment ideal geeignet für die $2\pi^0$ Photoproduktion.
Vorläufige Ergebnisse für die Polarisationsobservablen Σ und G in $2\pi^0$ Photoproduktion mit linearpolarsierten Photonenstrahl und einem longitudinalenpolarisierten Target werden vorgestellt und ihren Einfluß auf Resonanzinformationen diskutiert.
Gefördert durch die Deutsche Forschungsgemeinschaft (SFB/TR16).

HK 8.7 Mo 18:45 HZ 1+2

Helicity Dependent Cross Sections in Meson Photoproduction off Quasi-Free Protons and Neutrons — •Lilian Witthauer and Manuel Dieterle for the A2-Collaboration — Department of Physics, University of Basel, Klingelbergstrasse 82, 4056 Basel, Switzerland

Single and double polarization experiments of photoproduction reactions are a crucial step towards the complete experiment in order to reveal quantum numbers of the contributing nucleon resonances. Whereas there is much progress on the free proton the situation on the neutron is more complicated.

The longitudinally polarized deuterated butanol target and the high quality circularly polarized tagged photon beam at the electron accelerator facility MAMI in Mainz give the opportunity to measure helicity dependent photoproduction cross sections off quasi-free protons and neutrons. The combined detector setup of Crystal Ball and TAPS together with the charged particle identification detectors allows the registration of different mesons as η, $2\pi^0$, $\eta\pi^0$ and even charged pions.

We will present helicity dependent cross sections $\sigma_{1/2}$ (photon and target spin anti-parallel) and $\sigma_{3/2}$ (photon and target spin parallel) and results for the double polarisation observable E off quasi-free protons and neutrons from a new experiment carried out at MAMI in Mainz.

HK 9: Fundamentale Symmetrien

Zeit: Montag 16:30–19:00 Raum: HZ 3

Gruppenbericht HK 9.1 Mo 16:30 HZ 3

Electric Dipole Moments of Light Nuclei in Effective Field Theory — •Jan Bsaisou[1,2], Christoph Hanhart[1,2,3,4], Susanna Liebig[1,2], Ulf-G. Meissner[1,2,3,4,5,6], David Minossi[1,2], Andreas Nogga[1,2,3,4], Jordy de Vries[1,2,3,4], and Andreas Wirzba[1,2,3,4] — [1]Institut für Kernphysik, Forschungszentrum Jülich, D-52425 Jülich, Germany — [2]Jülich Center for Hadron Physics, Forschungszentrum Jülich, D-52425 Germany — [3]Institute for Advanced Simulation, Forschungszentrum Jülich, D-52425 Germany — [4]JARA - Forces And Matter Experiments, Forschungszentrum Jülich, D-52425 Germany — [5]Helmholtz-Institut für Strahlen und Kernphysik, Universität Bonn, D-53115 Bonn, Germany — [6]Bethe Center for Theoretical Physics, Universität Bonn, D-53115 Bonn, Germany

Electric dipole moments (EDMs) break parity (P) and time-reversal (T) symmetry and thus, by the CPT-theorem, CP-symmetry. Once measured, they will be unambiguous signs of new physics since CP-violation from the standard mechanism predicts EDMs that are experimentally inaccessible in the foreseeable future. We calculate within the framework of effective field theory the two-nucleon contributions to the EDMs of the deuteron, helion, and triton induced by P- and T-violating terms that arise from the QCD θ-term or dimension-6 sources of physics beyond the Standard Model (SM). We demonstrate what insights into physics beyond the SM can be gained from a suitable combination of measurements and, if needed, supplementary lattice QCD calculations.

Gruppenbericht HK 9.2 Mo 17:00 HZ 3

New limit on Lorentz and *CPT* violating neutron spin interactions using a free precession ^{3}He-^{129}Xe co-magnetometer — •Fabian Allmendinger[1], Ulrich Schmidt[1], Werner Heil[2], Sergei Karpuk[2], Anja Scharth[2], Yuri Sobolev[2], Kathlynne Tullney[2], and Stefan Zimmer[2] for the He-Xe-comagnetometer-Collaboration — [1]Physikalisches Institut, Ruprecht-Karls-Universität, 69120 Heidelberg, Germany — [2]Institut für Physik, Johannes Gutenberg-Universität, 55099 Mainz, Germany

We performed a search for a *CPT* and Lorentz invariance violating coupling of the ^{3}He and ^{129}Xe nuclear spins (each largely determined by a valence neutron) to background tensor fields which permeate the

universe. Our experimental approach is to measure the free precession of nuclear spin polarized ^{3}He and ^{129}Xe atoms in a homogeneous magnetic guiding field of about 400 nT using LT_C SQUIDs as low-noise magnetic flux detectors. As the laboratory reference frame rotates with respect to distant stars, we look for a sidereal modulation of the Larmor frequencies of the co-located spin samples. As a result we obtain an upper limit on the equatorial component of the background field interacting with the spin of the bound neutron $\tilde{b}_\perp^n < 6.7 \cdot 10^{-34}$ GeV (68% C.L.). Our result improves our previous limit (data measured in 2009) by a factor of 30 and the world's best limit by a factor of 5. In the talk we will give an overview of the principle of measurement and current results.

HK 9.3 Mo 17:30 HZ 3

Parity Violation in Hydrogen and Deuterium Spectroscopy: A new Approach — •Philipp Weiss — Institut für Kernphysik, Forschungszentrum Jülich, 52425 Jülich, Germany

The planned experiment provides an opportunity to measure the four weak coupling constants and the weak mixing angle with high precission by the use of an atomic physics method. Hereby, it is possible to prove the predictions given by the Standard Model.

In the Breit-Rabi diagram (binding energy as function of external magnetic field) for hydrogen and deuterium there are crossings between the β hyperfine substates of the $2S_{1/2}$ state and the e and f substates of the $2P_{1/2}$ states. Direct transitions at these crossings are forbidden by parity conservation. However, the Standard Model predicts a small admixture of the parity-violating weak force due to the nonvanishing probability density function of the $2S$ electron inside the nucleus.

With the knowledge about spinfilters used in a Lamb-shift polarimeter it is possible to provide a beam of hydrogen or deuterium atoms in one single metastable substate. In a modified spinfilter the interesting transitions can be induced and observed. This seems to be a feasible way to measure the effect of parity violation due to the weak force and to test the Standard Model.

HK 9.4 Mo 17:45 HZ 3

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

At the Cooler Synchrotron COSY a null test of time-reversal invariance to an accuracy of 10^{-6} is planned as an internal target transmission experiment. The parity conserving time-reversal violating observable Ay,xz (P-even, T-odd) will be measured using a proton beam energy of 135 MeV. In this experiment, a total double polarized cross section will be measured observing a beam current change due to the interaction of a polarized proton beam with an internal tensor polarized deuterium target from the PAX atomic beam source. Thus, one of the most crucial systems for this experiment is a high precision beam current measurement system, which is in preparation now. The status of this activities, as well as status of the TRIC experiment will be presented in this contribution.

HK 9.5 Mo 18:00 HZ 3

Bestimmung des Spintunes am COSY Speichering — •Dennis Eversmann für die JEDI-Kollaboration — RWTH Aachen

Eine notwendige Bedingung für die Entstehung der Baryonenasymmetrie im Universum während der Baryongenese ist die CP Verletzung. Daher wird nach weiteren CP-Invarianz verletztenden Effekten gesucht, die sich in permanenten elektrischen Dipolmomenten (EDM) von Elementarteilchen bemerkbar machen könnten. Ziel der JEDI Kolaboration (Jülich Electric Dipole moment Investigations) ist es, die Stärke des elektrischen Dipolmoments von Proton, Deuteron und Helium-3 in einem Speichering zu vermessen. Am Cosy Speicherring werden dazu momentan Machbarkeitsstudien durchgeführt, die zum einen eine möglichst lange Erhaltung der Polarisation anvisieren und zum anderen untersuchen mit welcher Präzision der Spintune der Teilchen bestimmt werden kann. Der Spintune ν_s ist definiert als die Anzahl der Spinumdrehungen während eines Teilchenumlaufs durch den Speichering und ist in erster Ordnung durch den Lorentzfaktor γ und das anomale magnetische Moment G gegeben: $\nu_s = \gamma G$. Ein mögliches EDM würde diese Relation geringfügig modifizieren, womit eine präzise Spintunemessung eine Möglichkeit darstellt das EDM eines der oben genannten Teilchen zu bestimmen. Im Vortrag zur DPG wird gezeigt, dass eine relative Genauigkeit von 10^{-9} auf die Bestimmung des Spintunes am COSY Speichering für polarisierte Deuteronen in einer Messzeit von etwa 100 Sekunden erreicht wurde.

HK 9.6 Mo 18:15 HZ 3

Current status of aSPECT — •Alexander Wunderle for the aSPECT-Collaboration — Johannes Gutenberg-Universität, Mainz

The aSPECT retardation spectrometer measures the β-$\bar{\nu}_e$ angular correlation coefficient a in the β-decay of the free neutron. This measurement can be used to determine the ratio $\frac{g_A}{g_V}$ of the weak coupling constants, as well as to search for physics beyond the Standard Model.

In spring/summer 2013 aSPECT had a successful beamtime at the Institut Laue-Langevin in Grenoble (France). The goal of this run is to improve the current uncertainty of a from $\frac{\Delta a}{a} \approx 5\,\%$ to about 1 %. To achieve this goal the systematics have to be understood accordingly. This is achieved on the one hand with different configurations during the beamtime (like different beam profiles or electrode settings), which is possible, as a statistical sensitivity of 1 % was reached within a few days. On the other hand the spectrometer and its systematics are precisely characterised with work function measurements of the electrodes and the experimental determination of the magnetic field ratio of the MAC-E filter. Furthermore, simulations of the field distribution and the particle transport in the spectrometer are used to quantify and reduce the systematic uncertainties of the measurements further.

In this talk we will present an overview of the systematics of aSPECT and their investigations.

HK 9.7 Mo 18:30 HZ 3

Precision NMR measurement of the magnetic field ratio of the aSPECT spectrometer — •Christian Schmidt for the aSPECT-Collaboration — Johannes Gutenberg-Universität, Mainz

The aSPECT retardation spectrometer measures the e-$\bar{\nu}_e$ angular correlation coefficient a in free neutron β decay by utilizing a MAC-E filter. 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.

In spring/summer 2013 aSPECT had a successful beamtime at the Institut Laue-Langevin, Grenoble (France). The goal of this beamtime is to improve the current uncertainty of a from $\frac{\Delta a}{a} \approx 5\,\%$ to about 1%. To achieve this goal the systematics of aSPECT have to be understood accordingly. One sensitive parameter to the systematic error of a is the knowledge of the magnetic field ratio, since this directly enters into the transmission function of our spectrometer. To determine the ratio with high precision two NMR probes were designed and implemented inside aSPECT.

In this talk we will present the design, the implementation inside aSPECT and the first results of the measurements.

HK 9.8 Mo 18:45 HZ 3

tau-SPECT: Neutron lifetime measurement at TRIGA Mainz — Marcus Beck[1], Simo Dragisic[1], Klaus Eberhardt[2], Werner Heil[1], •Jan Peter Karch[1], Fabian Kories[1], Yury Sobolev[1,2], Dietmar Stepanow[1], and Norbert Trautmann[2] — [1]Institut für Physik, University of Mainz, Germany — [2]Institut für Kernchemie, University of Mainz, Germany

The decay of the free neutron into a proton, electron and antineutrino is the prototype of the semi-leptonic weak decay and plays a key role in particle physics and astrophysics. The accuracy in the experimental determination of the neutron lifetime could be steadily improved over the last 60 years. Nowadays, the achieved accuracy is limited by systematic errors, mainly caused by anomalous losses during storage of neutrons (ultracold neutrons) in material vessels. With the magnetic storage of neutrons one would like to avoid these systematic limitations and to reach an accuracy of 0.1-0.3 s in the lifetime of the neutron. In the talk, the magnetic spectrometer tau-SPECT is presented, which uses a combination of magnetic multipole fields for radial storage and the field configuration of the superconducting aSPECT magnet [1] for longitudinal storage of ultracold neutrons. This storage experiment benefits greatly from the new ultracold neutron source at the pulsable TRIGA reactor Mainz. [1] S. Baeßler et al., Eur. Phys. J. A 38, 1726 (2008)

HK 10: Struktur und Dynamik von Kernen

Zeit: Montag 16:30–19:00 Raum: HZ 4

Gruppenbericht HK 10.1 Mo 16:30 HZ 4

Dipole Polarizability and Neutron Skin in ^{68}Ni — Dominic Rossi[1,2,3], Thomas Aumann[4], and •Konstanze Boretzky[1] for the R3B-Collaboration — [1]GSI Darmstadt, Germany — [2]Univ. Mainz, Germany — [3]NSCL, MSU, USA — [4]TU Darmstadt, Germany

The symmetry energy term E_{sym} of the nuclear equation-of-state describes fundamental phenomena both in nuclear physics and in astrophysics. The electric dipole (E1) response of nuclei as a function of the isospin asymmetry is driven by E_{sym}. Studies of the Pygmy Dipole Resonance (PDR) in exotic nuclei have been used to constrain E_{sym} or the neutron skin thickness $\Delta R_{n,p}$. The electric dipole polarizability α_D, being very sensitive to the low-lying E1 strength, is correlated to $\Delta R_{n,p}$ in a robust and only moderately model-dependent manner [PRC 81, 051303 (2010)]. Here, a first experimental determination of α_D in an unstable nucleus and the derivation of its $\Delta R_{n,p}$ will be reported [PRL 111, 242503 (2013)]. From the E1 strength distribution in ^{68}Ni measured using the R3B-LAND setup at GSI, the resonance parameters for the observed PDR at 9.55(17) MeV and the giant dipole resonance at 17.1(2) MeV are determined. In combination with results from Wieland et al. [PRL 102, 092502 (2009)] an unexpectedly large direct photon-decay branching ratio of 7(2)% is observed for the PDR. The measured α_D of 3.40(23) fm^3 is compared to relativistic RPA calculations yielding $\Delta R_{n,p}$ of 0.17(2) fm for ^{68}Ni. This work was supported by HIC for FAIR, EMMI, the GSI-TU Darmstadt cooperation agreement, the Helmholtz-CAS Joint Research Group HCJRG-108 and BMBF grants 06MZ222I, 05P12RDFN8 and 06MT9156.

Gruppenbericht HK 10.2 Mo 17:00 HZ 4

Nuclear deformation and neutron excess as competing effects for the pygmy dipole strength — •Ralph Massarczyk[1,2], Ronald Schwengner[1], Friedrich Dönau[1], and Stefan Frauendorf[3] — [1]Helmholtz-Zentrum Dresden-Rossendorf, 01328 Dresden, Germany — [2]Technische Universität Dresden, 01062 Dresden, Germany — [3]University of Notre Dame, Notre Dame, Indiana 46556, USA

The electromagnetic dipole strength below the neutron-separation energy has been studied for the xenon isotopes with mass numbers A = 124, 128, 132, and 134 in nuclear resonance fluorescence experiments using the γELBE bremsstrahlung facility at Helmholtz-Zentrum Dresden-Rossendorf and the HIγS facility at Triangle Universities Nuclear Laboratory Durham. The systematic study gained new information about the influence of the neutron excess as well as of nuclear deformation on the strength in the region of the pygmy dipole resonance. The results are compared with those obtained for the chain of molybdenum isotopes and with predictions of a random-phase approximation in a deformed basis. It turned out that the effect of nuclear deformation plays a minor role compared with the one caused by neutron excess. A global parametrization of the strength in terms of neutron and proton numbers allowed us to derive a formula capable of predicting the summed $E1$ strengths in the pygmy region for a wide mass range of nuclides.

HK 10.3 Mo 17:30 HZ 4

Cluster correlations on the surface of nuclei and the neutron skin thickness — •Stefan Typel — GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt

Correlations are an essential feature in nuclear many-body systems. The attractive nucleon-nucleon interaction, in particular, causes the formation of clusters in matter below nuclear saturation density. Adapting a generalized relativistic density functional approach with explicit cluster degrees of freedom, which is used in the description of the nuclear matter equation of state [1,2], the appearance of α particles on the surface of nuclei can be studied. It affects the neutron and proton radii and thus the neutron skin thickness of nuclei. A tight correlation between this quantity and the density dependence of the nuclear symmetry, which is important for the prediction of the equation of state of neutron rich matter in compact stars, has been observed in conventional mean-field models. The formation of α particles in the nuclear skin systematically modifies this correlation and has to be considered when conclusions on the slope of the symmetry energy are drawn from the measurement of the neutron skin thickness of neutron-rich heavy nuclei.

[1] S. Typel, G. Röpke, T. Klähn, D. Blaschke, H.H. Wolter, Phys. Rev. C 81 (2010) 015803

[2] S. Typel, H.H. Wolter, G. Röpke, D. Blaschke, accepted for publication in Eur. Phys. J. A

HK 10.4 Mo 17:45 HZ 4

Reactions of neutron-rich Sn isotopes investigated at relativistic energies at R^{3}B — •Fabia Schindler for the R3B-Collaboration — TU-Darmstadt, IKP

Reactions of neutron-rich Sn isotopes have been measured in inverse kinematics at the R^{3}B setup at GSI in Darmstadt in 2012. Due to the neutron excess, which results also in a weaker binding of the valence neutrons, such isotopes are expected to form a very neutron-rich surface, which is called the neutron skin. The investigation of this phenomenon is one of the main goals of the experiment. The reaction products of the isotopes ^{124}Sn to ^{134}Sn have been measured at beam energies of 300 AMeV to 600 AMeV in a kinematically complete way. Different reaction channels will be analyzed, therefore information about the neutron skin can be obtained from different methods. These are in particular the neutron removal cross sections and the dipole polarizability of the nucleus, which are both sensitive to the neutron-skin thickness. The latter will be obtained from the differential cross section of electromagnetic excitation measured in a wide excitation-energy range including the Pygmy and Giant Dipole Resonances.

This work is supported by the BMBF project 06 DA 7047, the GSI TU-Darmstadt Cooperation, HIC for FAIR and NAVI.

HK 10.5 Mo 18:00 HZ 4

Chiral four-body interactions in nuclear matter — •Kaiser Norbert — Physik-Department, Technische Universität München

The effects of chiral four-nucleon interactions in nuclear and neutron matter are studied. The leading-order terms arising from pion-exchange in combination with the chiral 4π-vertex and the chiral NN3π-vertex are found to be very small. The contributions of reducible four-nucleon interactions generated by the method of unitary transformations are included as well. We consider also the four-nucleon interaction induced by pion-exchange and twofold Δ-isobar excitation of nucleons. For most of the closed four-loop diagrams the occurring integrals over four Fermi spheres can either be solved analytically or reduced to one- or two-parameter integrals. After summing the individually large contributions from 3-ring, 2-ring and 1-ring diagrams of alternating signs, one obtains at nuclear matter saturation density $\rho_0 = 0.16\,\mathrm{fm}^{-3}$ a moderate contribution of about 2 MeV to the energy per particle. The curve $\bar{E}(\rho)$ rises rapidly with density, approximately as ρ^3. In pure neutron matter the chiral four-body interactions lead to a repulsive contribution that is about half as strong.

HK 10.6 Mo 18:15 HZ 4

Are the pygmy resonances important for astrophysics? — •Nadia Tsoneva and Horst Lenske — Institut für Theoretische Physik, Universität Giessen

The precise knowledge of nuclear response functions plays a key role in the determination of n-capture reaction rates of importance for the nucleosynthesis of heavier elements. In this connection information on low-energy excitations located around the neutron threshold is needed. Recently, new low-energy modes called pygmy resonances which reveal new aspects on the isospin dynamics of the nucleus have been observed. Their distinct feature is the close connection to nuclear skin oscillations which become visible in transition densities and currents. A successful description of the pygmy resonances could be achieved in our microscopic theoretical approach [1-6]. The method incorporates the density functional theory and QRPA formalism extended with multiphonon degrees of freedom which are found of crucial importance for the understanding of the fine structure of nuclear electric [1-5] and magnetic excitations at low energies [6]. Corresponding theoretical response functions are implemented in the studies of n-capture reaction rates of astrophysical importance [7]. Supported by BMBF project 06GI9109. [1] N. Tsoneva et al., PLB 586 (2004) 213. [2] N. Tsoneva et al. PRC 77, 024321 (2008). [3] N. Tsoneva et al., PLB 695 (2011) 174180. [4] A. Tonchev et al., PRL 104 (2010) 072501. [5] R. Schwengner et al., PRC 87, 024306 (2013). [6] G. Rusev et al., PRL 110, 022503 (2013). [7] R. Raut et al., PRL 111, 112501 (2013).

HK 10.7 Mo 18:30 HZ 4

Investigation of low-lying dipole strength in ^{124}Sn — •D. Symochko[1], T. Aumann[1], M. Bhike[2], V. Derya.[3], M. Duchêne[1], J. Isaak[4], J. Kelley[2], M. Knörzer[1], B. Löher[4], N. Pietralla[1], D. Savran[4], H. Scheit[1], A. Tonchev[5], W. Tornow[2], V. Werner[1,6], and A. Zilges[3] — [1]Institut für Kernphysik, Technische Universität Darmstadt, Germany — [2]Department for Physics, Duke University, USA — [3]Institut für Kernphysik, Universität zu Köln, Germany — [4]ExtreMe Matter Institute EMMI and Research Division, Darmstadt, Germany — [5]Lawrence Livermore National Laboratory, USA — [6]WNSL, Yale University, USA

Dipole excitations in the semi-magic ^{124}Sn nucleus were studied in (γ,γ') reactions using the γ^3 - high-efficiency detector setup [1]. The experiment was carried out with quasimonoenergetic photon beams provided by the HIγS facility at the TUNL in the energy range from 5.2 to 8.6 MeV at 15 different energies. Measurements allowed to identify near 80 new transitions to the ground state, obtain reduced transition probabilities and assign parity quantum numbers to the observed excited states. Besides, the γ-γ coincidence technique gave access to the γ-decay pattern of the Pygmy Dipole Resonance, e.g. it was possible to analyse the branching ratios to the first excited 2+ state. Investigations were made as a part of the experimental campaign aimed to obtain a complete picture of dipole strength function evolution in Sn isotopes - from stable ^{112}Sn to short-lived ^{134}Sn.

Supported by DFG (SFB 634 and ZI 510/4-2).

1. B. Löher et al. Nucl. Instr. Meth. 723, P. 136 (2013).

HK 10.8 Mo 18:45 HZ 4

Relative Selbstabsorptionsmessung an ^{140}Ce zur modellunabhängigen Bestimmung von Übergangsbreiten in den Grundzustand* — •Christopher Romig[1], Jacob Beller[1], Jan Glorius[2], Johann Isaak[3,4], Norbert Pietralla[1], Anne Sauerwein[2], Deniz Savran[3,4], Marcus Scheck[1,5,6], Kerstin Sonnabend[2] und Markus Zweidinger[1] — [1]Institut für Kernphysik, Technische Universität Darmstadt — [2]Institut für angewandte Physik, Goethe-Universität Frankfurt — [3]ExtreMe Matter Institute EMMI and Research Divison, GSI, Darmstadt — [4]Frankfurt Institute for Advanced Studies FIAS, Goethe-Universität Frankfurt — [5]School of Engineering, University of the West of Scotland, Paisley, UK — [6]SUPA, Scottish Universities Physics Alliance, Glasgow, UK

Am Darmstädter S-DALINAC wurde erstmals eine relative Selbstabsorptionsmessung am Nuklid ^{140}Ce durchgeführt. Die Methode der Selbstabsorption erlaubt es, Übergangsbreiten Γ_0 angeregter Zustände in den Grundzustand modellunabhängig zu bestimmen. In Kombination mit Kernresonanzfluoreszenzmessungen (KRF) ist es darüber hinaus möglich, auch das Verzweigungsverhältnis Γ_0/Γ in den Grundzustand zu extrahieren. Letzteres stellt eine wesentliche Unsicherheit bei der Analyse von KRF-Messungen dar und kann somit überprüft werden. Die Methode und gewonnenen Ergebnisse werden vorgestellt und diskutiert. Das Verzweigungsverhältnis Γ_0/Γ wird mit entsprechenden Ergebnissen aus Simulationen im statistischen Modell verglichen.

*Gefördert durch die DFG im Rahmen des SFB 634.

HK 11: Struktur und Dynamik von Kernen

Zeit: Montag 16:30–19:00 Raum: HZ 5

Gruppenbericht HK 11.1 Mo 16:30 HZ 5

First results of the (n,gamma) EXILL campaigns at the Institut Laue Langevin — •Jan Jolie[1], Jean-Marc Régis[1], Dennis Wilmsen[1], Samer Ahmed[1], Michael Pfeiffer[1], Nima Saed Samii[1], Nigel Warr[1], Peter Thirolf[2], Dieter Habs[2], EXILL Collaboration[3], and FATIMA Collaboration[3] — [1]Institut für Kernphysik, Universität zu Köln, Zülpicher Str 77, 50937 Köln — [2]Fakultät für Physik, Ludwig Maximilian Universität, 85748 Garching — [3]Siehe Kollaborationliste

At the PF1B cold neutron beam line at the Institut Laue Langevin the EXILL array consisting of EXOGAM, GASP and LOHENGRIN detectors was used to perform (n,gamma) measurements under very high coincidence rates. About ten different reactions were then measured in autumn 2012. In spring 2013 the EXOGAM array was combined with 16 LaBr3(Ce) scintillators in the FATIMA@EXILL campaign for the measurement of lifetimes using the generalised centroid difference method. We report on the properties of both set-ups and present first results on Pt isotopes from both campaigns. This work was supported by NUPNET by contract 05P12PKNUF (BMBF) and DNC7RP01/4, by the Science and Technology Facilities Councils (UK), by the DFG cluster of Excellence Origin and Structure of the Universe.

HK 11.2 Mo 17:00 HZ 5

Gamma ray spectroscopy of neutron-rich actinides after multi-nucleon transfer reactions — •Andreas Vogt, Benedikt Birkenbach, Peter Reiter, Herbert Hess, Lars Lewandowski, and Tim Steinbach for the LNL 11.22-Collaboration — Institut für Kernphysik, Universität zu Köln

Excited states in neutron-rich Th and U nuclei were investigated after multi-nucleon transfer reactions employing the AGATA demonstrator and PRISMA setup at LNL (INFN, Italy). A primary ^{136}Xe beam of 1 GeV hitting a ^{238}U target was used to produce the nuclei of interest in the actinide region. Beam-like reaction products in the Xe-Ba-region were identified and selected by the PRISMA spectrometer. Kinematic coincidences between the binary reaction products of beam-like and target-like nuclei are detected with an additional MCP detector. Those coincidences allow clean conditions for in-beam γ-ray spectroscopy. Background contributions from excited fission fragments are successfully discriminated. γ-rays from excited states in beam- and target-like particles were measured with the position sensitive AGATA HPGe detectors. Improved energy resolution after Doppler correction is based on the novel γ-ray tracking technique which was successfully exploited to increase the quality of the γ-spectra. γ-ray spectra of the produced beam-like isotopes in the one-proton and two-proton transfer channels will be presented. Corresponding results from the hard-to-reach neutron-rich isotopes beyond ^{232}Th will focus on their collective properties and cross section limits for their production. Supported by the German BMBF (05P12PKFNE TP4), ENSAR-TNA03, BCGS.

HK 11.3 Mo 17:15 HZ 5

Bestimmung von Paritätsquantenzahlen dipolangeregter Zustände des mittelschweren Kerns ^{40}Ar* — •Udo Gayer[1], Jacob Beller[1], Vera Derya[2], Matthew Gooden[3], Johann Isaak[4,5], Bastian Löher[4,5], Norbert Pietralla[1], Christopher Romig[1], Marcus Scheck[1,6,7], Werner Tornow[3] und Markus Zweidinger[1] — [1]Institut für Kernphysik, TU Darmstadt — [2]Institut für Kernphysik, Universität zu Köln — [3]Duke University, Durham, NC, USA — [4]ExtreMe Matter Institute EMMI and Reasearch Division, GSI, Darmstadt — [5]Frankfurt Institute for Advanced Studies FIAS, Goethe-Universität Frankfurt — [6]School of Engineering, University of the West of Scotland, Paisley, UK — [7]SUPA, Scottish Universities Physics Alliance, Glasgow, UK

An der High-Intensity $\vec{\gamma}$-Ray Source der Duke University in Durham, NC, USA wurde ein Kernresonanzfluoreszenz-Experiment mit einem polarisierten, quasimonochromatischen Photonenstrahl an einem Argon-Target durchgeführt. Ziel war die Bestimmung von Paritätsquantenzahlen dipolangeregter Zustände im Isotop ^{40}Ar im Bereich zwischen 5.4 MeV und 7.6 MeV als systematische Fortsetzung vorheriger Experimente in umliegenden Energiebereichen [1]. Die Paritätsbestimmung erfolgt über die Untersuchung der Winkelverteilung der Zerfallsstrahlung. Die Messmethode wird vorgestellt und die Ergebnisse anhand eines Vergleichs mit theoretisch berechneten Werten für Energien und Übergangsstärken der Dipolübergänge diskutiert.

*Gefördert durch die DFG im Rahmen des SFB 634

[1] T.C. Li et al., Phys. Rev. C 73 (2006) 054306

HK 11.4 Mo 17:30 HZ 5

Low-lying dipole strength in the $N = 28$ shell-closure nucleus ^{52}Cr* — •Haridas Pai[1], Jacob Beller[1], Nadia Benouaret[1], Joachim Enders[1], Timo Hartmann[1], Oliver Karg[1], Peter von Neumann-Cosel[1], Norbert Pietralla[1], Vladimir Yu. Ponomarev[1], Christopher Romig[1], Marcus Scheck[1,2,3], Linda Schnorrenberger[1], Stephan Volz[1], and Markus Zweidinger[1] — [1]Institut für Kernphysik, Technische Universität Darmstadt — [2]School of Engineering, University of the West of Scotland, Paisley, UK — [3]SUPA, Scottish Universities Physics Alliance, Glasgow, UK

Low-lying electric and magnetic dipole strengths ($E1$ and $M1$, respectively) of atomic nuclei have drawn considerable attention in the last decade. The low-lying dipole strength of the $N = 28$ closed-shell nucleus ^{52}Cr was studied with nuclear resonance fluorescence up to 9.9 MeV, using bremsstrahlung at the superconducting Darmstadt electron linear accelerator S-DALINAC. Twenty-eight spin-1 states were observed between 5.0 and 9.5 MeV excitation energy, 14 of those for the first time and uncertainties for cross sections were reduced in many cases. Both, electric dipole excitations ($E1$, around 8 MeV) and magnetic dipole excitations ($M1$, around 9 MeV) were detected. Microscopic calculations within the quasiparticle-phonon nuclear model were performed using a basis which includes one-, two-, and three-phonon configurations to interpret the dipole strength distributions of ^{52}Cr and show good agreement with experimental results.

*Supported by the DFG under contract No. SFB 634 and by the Helmholtz International Center for FAIR.

HK 11.5 Mo 17:45 HZ 5

Investigation of the beta decay spectrum of ^{113}Cd with the COBRA experiment — •Fabian Heisse for the COBRA-Collaboration — Technische Universität Dresden

The investigation of the fourfold forbidden, non-unique beta decay can only be performed with three isotopes, one of them is ^{113}Cd. For this purpose, data from the COBRA experiment using CZT detectors are used.

In this talk I will present a data selection and the results from taking data in the LNGS Underground Laboratory. Based on the recorded spectrum of the detectors, the important Q_β − value = (323.6 ± 1.2) keV for beta decay and the half-life $T_{\frac{1}{2}}\left(^{113}\mathrm{Cd}\right) = (7.91 \pm 0.22) \cdot 10^{15}$ years have been determined. These values fit very well to various theory models and other existing experimental results. Furthermore, the shape of the spectrum is in good accordance to the predicted theory throughout the whole region (50 keV $< E_{\mathrm{kin}}$ (electron) $<$ 324 keV).

However, there are still some unanswered questions, such as the behavior of the rate spectrum in the low energy region down to E_{kin} (electron) = 0 keV. An outlook and further improvements between theoretical description and experimental data are given.

HK 11.6 Mo 18:00 HZ 5

Evolution of Quadrupole Collectivity in the Neutron-rich Xe Isotopes — •Stoyanka Ilieva, Corinna Henrich, Thorsten Kröll, and Sabine Bönig for the IS411 and FATIMA-Collaboration — Institut für Kernphysik, TU Darmstadt

The nuclear properties in the region around the doubly magic nucleus ^{132}Sn are of special interest. Theory relies on nuclei near closed shells for predicting other, more complex systems. The quadrupole collectivity in nuclei can be studied in Coulomb-excitation experiments. The excitation cross section depends on both transition and diagonal matrix elements, an effect known as reorientation. Therefore, direct measurements of lifetimes which depend only on one single transition matrix element, are often more precise. Furthermore, the additional constraints from lifetimes enable the better determination of quadrupole moments, a quantity otherwise hard to obtain for short-living states.

The isotopes ^{138,140,142,144}Xe were studied by means of Coulomb excitation at the REX-ISOLDE facility at CERN. Recently, these studies were complemented by a measurement of the lifetimes of excited states in the xenon isotopes ($^{138-144}$Xe), populated in neutron-induced fission of ^{235}U and ^{241}Pu. The experiment was part of the FATIMA campaign performed at ILL, Grenoble in early 2013. In this contribution we report on the results from these measurements, aiming to investigate the evolution of collectivity around $Z = 50$ and $N = 82$.

Supported by BMBF under contracts 06DA9036I, 05P12RDCIA and 05P12RDNUP, by the EU under contracts EURONS 506065 and ENSAR 262010, and by HIC for FAIR.

HK 11.7 Mo 18:15 HZ 5

Study of isomer and proton decays in N≤Z nuclei below ^{100}Sn — •Kevin Moschner[1], Andrey Blazhev[1], Plamen Boutachkov[2], Paul Davis[3], and Robert Wadsworth[3] for the EURICA-Collaboration — [1]IKP, University of Cologne, Germany — [2]GSI Darmstadt, Germany — [3]University of York, UK

The RIBF83 experiment was the first experiment performed within the EURICA project at the new-generation Radioactive Isotope Beam Facility (RIBF) at RIKEN, Japan. The aim of this experiment is to further probe the decays of known isomers in N = Z nuclei, in order to provide detailed tests of the shell model, as well as search for evidence of predicted, but as yet unobserved isomers in N ≤ Z nuclei.

To create the nuclei of interest projectile fragmentation of a 345 MeV/u ^{124}Xe beam on a ^{9}Be target was used. The fragments were then separated and identified on an event by event basis in the BigRIPS spectrometer.

The EURICA setup utilizes the γ-ray efficiency of 12 EUROBALL HPGe cluster detectors in the RISING Stopped Beam configuration and the active stopper SIMBA composed of a segmented Si-array allowing for β-calorimetry measurements of positrons emitted in decays with $Q_\beta \sim 10$ MeV.

Although data analysis is still on-going to search for unknown isomeric transitions and study the particle and particle-γ decays of the implanted nuclei, first results will be presented in this contribution.

This work is supported by the German BMBF under contract Nos. 05P09PKCI5 and 05P12PKFNE.

HK 11.8 Mo 18:30 HZ 5

Analyse von Winkelkorrelationen verschiedener Kaskaden in ^{144}Nd über die ^{143}Nd(n, $\gamma\gamma$)-Reaktion — •Oliver Kaleja — Institut für Kernphysik, Technische Universität Darmstadt, Germany

In ^{144}Nd wird ein isovektorieller Oktupolzustand vermutet, der durch einen starken $M1$-Übergang in sein symmetrisches Pendant zerfällt. Diese Klasse von Zuständen wurde im Rahmen des Interacting-Boson-Modell (IBM-2) vorhergesagt. Als Teil der EXILL-Kampagne im Jahr 2012/13 wurde daher ein Neutroneneinfangexperiment an ^{143}Nd durchgeführt. Der durch den Neutroneneinfang entstehende Kern ^{144}Nd liegt in einem angeregten Zustand vor, der in der Regel über Kaskaden in den Grundzustand zerfällt. Die Analyse der Winkelkorrelationen dieser Kaskaden stellt eine exzellente Möglichkeit dar, Multipolaritäten und Mischungsverhältnisse der Übergänge, sowie Spins der beteiligten Zustände zu bestimmen und sie so auf mögliche isovektorielle Oktupolzustände hin zu untersuchen. Die Zustände bei 2606 keV, 2779 keV und 2868 keV in ^{144}Nd stellen potenzielle Kandidaten für einen derartigen Zustand dar. Neben der Analyse dieser Zustände wurden ebenfalls die Zustände bei 2888 keV, 3027 keV und 3409 keV untersucht und unter anderem ihre bisher nicht genauer bekannten Spins bestimmt. Die Analyse basiert auf der Erstellung und Auswertung winkelabhängiger Koinzidenzmatrizen. Es werden die Herangehensweise im Hinblick auf das EXILL-Setup, sowie die Ergebnisse der Untersuchung der oben genannten Zustände diskutiert. Diese Arbeit wird durch die DFG (Nr. KR 1796/2-1) gefördert.

HK 11.9 Mo 18:45 HZ 5

Nuclear Excitation by a Strong Zeptosecond Laser Pulse in the Quasiadiabatic Regime — •Adriana Pálffy and Hans A. Weidenmüller — Max-Planck-Institut für Kernphysik, Saupfercheckweg 1, 69117 Heidelberg

The ongoing construction of the Nuclear Physics Pillar of the Extreme Light Infrastructure (ELI) offers unprecedented possibilities for nuclear physics experiments. The facility holds promise to deliver in the not-too-distant future coherent gamma ray pulses with energies of several MeV per photon. Coherence strongly amplifies nuclear dipole absorption. If that occurs comparably fast to nuclear equilibration, it leads to the formation of a compound nucleus with excitation energy several hundred MeV above yrast in a so far totally unexplored regime.

A quantitative description of the absorption and equilibration processes requires knowledge of the density of states, so far unavailable for this parameter regime. Our new approach yields approximate analytical expressions for the total and partial level densities [1,2] and makes possible the semiquantitative study of the competition between photon absorption, photon-induced nucleon emission, and neutron evaporation. With neutron evaporation overtaking photon absorption at energies below the saturation of the latter for medium-weight and heavy nuclei, we expect proton-rich nuclei far from the valley of stability to be produced. Experiments at ELI thus promise to shed light on the structure of such nuclei and the time scales and level densities involved.

[1] A. Pálffy and H. A. Weidenmüller, Phys. Lett. B 718, 1105 (2013).
[2] A. Pálffy and H. A. Weidenmüller, Nucl. Phys. A 917, 15 (2013).

HK 12: Schwerionenkollisionen und QCD Phasen

Zeit: Montag 16:30–19:00 Raum: HZ 6

Gruppenbericht HK 12.1 Mo 16:30 HZ 6

Transverse momentum distributions of identified particles in p–Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV measured with ALICE at the LHC — •Jonas Anielski for the ALICE-Collaboration — Institut für Kernphysik, WWU Münster

Recent measurements of di-hadron correlations in p–Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV revealed a double-ridge pattern, reminiscent of the one observed in Pb–Pb collisions. This raises the question of the possible existence of collective effects in high multiplicity p–Pb collisions. Further insight into the observed phenomena can be gained by studying the evolution of spectral shapes with the particle mass and particle ratios as a function of charged-particle density.

Transverse momentum (p_{T}) distributions of particles have been measured at mid-rapidity ($0. < y_{\mathrm{CMS}} < 0.5$). Particles are reconstructed with the central barrel detectors over a wide transverse momentum range (0 GeV/c up to 6 GeV/c) and different identification techniques are used. Primary charged particles ($\pi^{\pm}, \mathrm{K}^{\pm}, \mathrm{p}, \bar{\mathrm{p}}, \mathrm{d}$ and $\bar{\mathrm{d}}$) are identified by their specific energy loss ($\mathrm{d}E/\mathrm{d}x$) and time-of-flight. Weakly decaying particles ($\mathrm{K}^0_{\mathrm{s}}, \Lambda$ and $\bar{\Lambda}$) are identified by their characteristic decay topology.

Particle-production yields, spectral shapes and particle ratios are measured in several multiplicity classes and are compared with models and results obtained in Pb–Pb collisions at $\sqrt{s_{NN}} = 2.76$ TeV and pp collisions at $\sqrt{s_{NN}} = 7$ TeV at the LHC.

HK 12.2 Mo 17:00 HZ 6

Transverse Momentum Spectra of Unidentified Charged Particles in pp, p–Pb and Pb–Pb Collisions with ALICE — •Philipp Lüttig for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

To study the properties of matter created in p–Pb and Pb–Pb collisions, a common observable is the nuclear modification factor as function of the transverse momentum (p_T) of charged particles. The ALICE detector at the CERN-LHC has accumulated a wealth of data on pp, p–Pb and Pb–Pb collisions in the past years. Using a combined tracking approach based on information in the Inner Tracking System (ITS) and the Time Projection Chamber (TPC) ALICE is capable to measure the transverse momentum in a broad p_T range up to $p_T = 50$ GeV/c in these collision systems.
For the calculation of the nuclear modification factor, pp reference spectra are needed. In this talk, the extraction of the pp baseline spectra for p–Pb and Pb–Pb collisions for charged particles is discussed. The nuclear modification factor measured in Pb–Pb collisions will be presented.
Based on the same tracking approach, ALICE can measure the transverse momentum of charged particles down to $p_T = 150$ MeV/c, which is crucial for the measurement of the average transverse momentum. A systematic study of the system-size and collision energy dependence of the average transverse momentum and its correlation to charged particle multiplicity will be presented.
Supported by BMBF and the Helmholtz Association.

HK 12.3 Mo 17:15 HZ 6

LHC Predictions for Hadroproduction of Heavy Quarks using POWHEG — •Michael Topp — Institute for Theoretical Physics, WWU Münster

The POWHEG Box is an event generator that offers a framework for implementing NLO calculations in shower Monte Carlo programs like Pythia. In order to compare with experimental data I have simulated the Hadroproduction of heavy quarks (pp and pA) at $\sqrt{s} = 2.76$ TeV, $\sqrt{s} = 5.023$ TeV and $\sqrt{s} = 7$ TeV. By analysing these data, I have got p_T spectra of electrons, muons and D mesons. In my talk I present the results compared to ALICE data and other theoretical predictions (GM-VFNS and FONLL).

HK 12.4 Mo 17:30 HZ 6

Measurement of electrons from charm and beauty-hadron decays in p-Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV with ALICE at the LHC — •Jan Wagner for the ALICE-Collaboration — Research Division and ExtreMe Matter Institute EMMI, Planckstraße 1, 64291 Darmstadt — Institut für Kernphysik, Technische Universität Darmstadt, Schlossgrabenstr. 9, 64289 Darmstadt

Electrons from inclusive semileptonic heavy-flavor hadron decays are used to measure charm and beauty production. Because of their large masses, heavy quarks are mostly produced in initial hard partonic interactions and thus can be used to probe a medium created in heavy-ion collisions.

In heavy-ion collisions the p_{t}-differential heavy-flavor yields are sensitive to initial state effects of the colliding nuclei (e.g. shadowing, saturation) and to the interaction of the heavy quarks with the hot and dense medium. To distinguish these effects from each other a reference measurement using p-Pb collisions is necessary, where only initial state effects play a role.

The status of the analysis of semi-electronic heavy-flavor decays at midrapidity from p–Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV using the ALICE apparatus will be presented. $\mathrm{R_{pPb}}$ will be shown together with predictions of shadowing effects calculated on the basis of the EPS09 parametrization. The method of separating the charm and beauty contributions from each other will be explained and an outlook to upcoming results will be given.

HK 12.5 Mo 17:45 HZ 6

Improving thermal models with sequential freeze out — •Pasi Huovinen — J.W. Goethe Universität, Frankfurt am Main, Germany

Thermal models have been surprisingly successful in describing the particle ratios observed in heavy ion collisions. However, the thermal models predict more protons and less cascades than measured by the ALICE collaboration at LHC. In this contribution I discuss how to improve the fit to data by assuming that not all particle number changing processes cease at the same time, but some of them maintain relative equilibrium even after the full equilibrium has been lost.

HK 12.6 Mo 18:00 HZ 6

J/ψ Production in Pb–Pb Collisions at $\sqrt{s_{NN}} = 2.76$ TeV with the ALICE experiment — •Julian Book for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

The investigation of the properties of strongly interacting matter under extreme conditions is the aim of the ALICE experiment. Quarkonia, i.e. bound states of heavy (charm or bottom) quarks such as the J/ψ, are expected to be produced in initial hard scattering processes in hadronic collisions. Thus they will provide insights into the earliest and hottest stages of nucleus-nucleus collisions where the formation of a Quark-Gluon Plasma (QGP) is expected. A suppression of J/ψ yields due to the hot environement was proposed as a signature of the QGP.
We present the latest results on J/ψ production in Pb–Pb collisions measured by ALICE at the LHC. Clearly less suppression in comparison with SPS and RHIC results is observed. The measurement of the centrality and transverse momentum dependence of J/ψ decaying into e^+e^- at mid-rapidity ($|y| < 0.9$) will help to understand a possible contributing (re)generation mechanism. Its impact together with the results for J/ψ decaying into $\mu^+\mu^-$ measured at forward rapidities ($2.5 < y < 4.0$) will be discussed.
Supported by BMBF and the Helmholtz Association.

HK 12.7 Mo 18:15 HZ 6

Modifikation von Λ, $\overline{\Lambda}$ und $\mathrm{K^0_s}$ Transversalimpuls-Spektren in Pb–Pb Kollisionen bei ALICE am LHC — •Simone Schuchmann für die ALICE-Kollaboration — Institut für Kernphysik, Goethe-Universtität Frankfurt

Bei hohen Transversalimpulsen wurde vom ALICE Experiment für die Produktion inklusiver geladener 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 Kopplung von Quarks und Gluonen an das Medium liefern.
In diesem Vortrag wird die Produktion von Λ, $\overline{\Lambda}$ und $\mathrm{K^0_s}$ in Pb–Pb und pp Kollisionen bei einer Schwerpunktsenergie von $\sqrt{s_{NN}} = 2.76$ TeV,

gemessen mit dem ALICE Detektor, vorgestellt. Die Identifikation von Λ, $\overline{\Lambda}$ und K^0_s erfolgt über ihren schwachen Zerfallskanal in geladene Hadronen mit Hilfe der Trackingmöglichkeiten des inneren Detektorsystems. Die daraus resultierenden nuklearen Modifikationsfaktoren werden für verschiedene Zentralitätsintervalle diskutiert und mit denen anderer Teilchen mit unterschiedlichen Quarkinhalten verglichen. Unterstützt vom BMBF und der Helmholtz Gemeinschaft.

HK 12.8 Mo 18:30 HZ 6

Neutral Pion Measurement with the ALICE EMCal — •Baldo Sahlmüller for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

The quark-gluon plasma produced in heavy-ion collisions at the LHC can be studied via transverse momentum distributions of identified hadrons that are produced through different mechanisms in these collisions. The neutral pion offers a complimentary measurement to the measurement of charged hadrons with the ALICE tracking system, since it can be measured in calorimeters such as the ALICE EMCal via its two-photon-decay. The measurement in p-p collisions is a necessary baseline for interpreting the heavy-ion results. Furthermore, the π^0 can be regarded as a standard candle in the calibration of calorimeters in heavy-ion collisions. Hence, understanding the π^0 measurement is an important test for the detector.

We will present the status and first results of ongoing π^0 analyses in the ALICE p-p data with the EMCal and compare them with complimentary measurements with the ALICE PHOS and the ALICE tracking system. We will focus on technical aspects of the analysis.

Supported by BMBF and the Helmholtz Association.

HK 12.9 Mo 18:45 HZ 6

Measurement of Neutral Pions with the ALICE PHOS. — •Malte Hecker for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

For the understanding of the production of identified particles in heavy ion collisions neutral pions are complimentary to other single particle measurements as they decay predominantly into two photons which can be detected by calorimeters. The transverse momentum distributions of π^0s in p-p collisions are an important baseline to understand the results obtained in heavy-ion collisions.

The ALICE PHOS is a high resolution electromagnetic calorimeter that is used to measure the position and energy of photons, hence allowing the reconstruction of π^0s via their two photon decay.

We present the status of ongoing π^0 analyses of ALICE p-p data at $\sqrt{s}$=2.76 TeV. The peak extraction method is discussed in detail. Furthermore the acceptance and reconstruction efficiency correction calculated with both a newly developed fast Monte Carlo approach and the ALICE full Monte Carlo simulations are presented.

Supported by BMBF and the Helmholtz Association.

HK 13: Schwerionenkollisionen und QCD Phasen

Zeit: Montag 16:30–19:00 Raum: HZ 7

Gruppenbericht HK 13.1 Mo 16:30 HZ 7

The Compressed Baryonic Matter (CBM) Experiment - Status Report — •Christoph Blume for the CBM-Collaboration — Goethe-Universität Frankfurt

The CBM Experiment is one of the main four scientific pillars of the new Facility for Antiproton and Ion Research (FAIR). Its main objective is the study of the QCD phase diagram in the region of high baryon-densities. With nucleus-nucleus collisions at the SIS100 accelerator at beam energies up to 14 A GeV strongly interacting matter with densities about 10 times as high as normal nuclear matter can be produced. In a second stage at the SIS300 beam energies up to 45 A GeV will be investigated. The experimental setup is designed to cope with highest interaction rates (up to 10 MHz), which for the first time will also allow to measure rare probes (open charm, light and heavy vector mesons) in the FAIR energy regime. We will report on the current status of the CBM experiment. Many detector subsystems have already completed their technical design reports, or will finalize them in 2014. The main achievements and challenges of these developments will be discussed. Also, a lot of effort is being spend on evaluating the physics performance of the experiment. An overview on the main results in the context of the CBM physics program will be given.

Supported by BMBF, EU-FP7-HP3, and HICforFair.

HK 13.2 Mo 17:00 HZ 7

Chiral thermodynamics and fluctuations in the nuclear sector of the QCD phase diagram — •Matthias Drews[1,2] and Wolfram Weise[1,2] — [1]Technische Universität München, Germany — [2]ECT*, Trento, Italy

In order to study simultaneously the thermodynamics of nuclear matter and the question of chiral restoration, a chiral nucleon-meson model is analyzed. To describe successfully the dynamics, in particular close to the critical point of the liquid-gas phase transition, fluctuations are included within the framework of the functional renormalization group. The calculations for nuclear matter agree nicely with results obtained from in-medium chiral effective field theory. Moreover, for temperatures below 100 MeV and densities below twice the nuclear saturation density, no signs of a chiral phase transition are found.

This work is supported in part by BMBF and by the DFG Cluster of Excellence "Origin and Structure of the Universe."

HK 13.3 Mo 17:15 HZ 7

Investigations of the QCD phase diagram using Dyson-Schwinger equations — •Christian Welzbacher, Christian S. Fischer, and Jan Luecker — Institut fuer Theoretische Physik, Justus-Liebig-Universitaet Giessen, Heinrich-Buff-Ring 16, D-35392 Giessen, Germany

The Dyson-Schwinger equations as one kind of functional methods provide us with a toolbox to investigate the structure of the QCD phase diagram. By solving the carefully truncated coupled set of equations the quark and gluon propagators at finite temperature and light-quark chemical potential are obtained. Those quantities give insights about the chiral and deconfinement phase transitions and have interesting analytic properties. We present results for the phase structure of QCD with Nf=2+1 and Nf=2+1+1 flavors and discuss the location of a potential critical endpoint.

HK 13.4 Mo 17:30 HZ 7

Hadron masses and baryonic scales in G_2-QCD at finite density — •Bjoern Wellegehausen[1], Lorenz von Smekal[1], Andreas Wipf[2], and Axel Maas[2] — [1]JLU Giessen — [2]FSU Jena

Due to the fermion sign problem, the QCD phase diagram at high baryon densities is not accessible with standard lattice Monte-Carlo methods. G_2-QCD, for which the $SU(3)$ gauge group of QCD is replaced by the exceptional Lie group G_2, does not have a sign problem and can be simulated at such densities using standard lattice techniques. It thus provides benchmarks to models and functional continuum methods, and it serves to unravel the nature of possible phases of strongly interacting matter at high densities. Instrumental in understanding these phases is that G_2-QCD has fermionic baryons, and that it can therefore sustain a baryonic Fermi surface. Because the baryon spectrum of G_2-QCD also contains bosonic diquark and probably other more exotic states, it is important to understand this spectrum before one can disentangle the corresponding contributions to the baryon density. Here we present the first systematic study of this spectrum from lattice simulations at different quark masses. This allows us to relate the mass hierarchy, ranging from scalar would-be-Goldstone bosons and intermediate vector bosons to the G_2-nucleons and deltas, to individual structures observed in the total baryon density at finite chemical potential.

HK 13.5 Mo 17:45 HZ 7

The order of the chiral phase transition in an effective model for two-flavor QCD from the Functional Renormalization Group — •Mara Grahl — Institute for Theoretical Physics, Goethe University, Max-von-Laue-Str. 1, 60438 Frankfurt am Main

Quantum chromodynamics (QCD), the theory describing the strong interaction between the building blocks of hadronic matter (quarks and gluons), predicts that at high temperature and/or density hadronic matter undergoes a transition to an exotic state of matter, called quark-gluon plasma (QGP), which is associated with a chiral phase

transition. In absence of any small expansion parameter, strongly coupled systems, such as QCD near the transition to the QGP, indispensably depend on nonperturbative methods such as for example the Functional Renormalization Group (FRG) method. Very interesting to the scientific community is the order of the chiral phase transition and the critical temperature at which it takes place in effective models for QCD. The upcoming CBM experiment at GSI Darmstadt will allow to test the performance of these approaches in the near future.

Our talk is concerned with the question of which order the chiral phase transition of two-flavor QCD is. We briefly summarize the predictions as inferred from the linear sigma model and discuss our FRG results taking into account the influence of instantons which give rise to the axial anomaly.

HK 13.6 Mo 18:00 HZ 7

Thermodynamics and phase structure of the Polyakov–Quark-Meson model — Jens Braun[1,2], Eduardo S. Fraga[3,4], Lisa M. Haas[5,2], Tina K. Herbst[5], Bruno W. Mintz[6], Mario Mitter[5,4], Jan M. Pawlowski[5,2], Rudnei O. Ramos[6], Bernd-Jochen Schaefer[7,8], Jürgen Schaffner-Bielich[4], and •Rainer Stiele[5] — [1]Institut für Kernphysik (Theoriezentrum), Technische Universität Darmstadt — [2]ExtreMe Matter Institute EMMI, GSI — [3]Instituto de Física, Universidade Federal do Rio de Janeiro — [4]Institut für Theoretische Physik, Goethe-Universität Frankfurt — [5]Institut für Theoretische Physik, Universität Heidelberg — [6]Departamento de Física Teórica, Universidade do Estado do Rio de Janeiro — [7]Institut für Theoretische Physik, Justus-Liebig-Universität Giessen — [8]Institut für Physik, Karl-Franzens-Universität Graz

Polyakov-loop extended chiral effective models are important tools to describe the phase structure and thermodynamics of strongly interacting matter. We show that taking into account the backreaction of quarks onto the gauge sector is crucial in such models to achieve results for the order parameters and thermodynamics that are in line with lattice calculations. Achieving a good description of lattice data at zero density, we test the reliability of those models in systems containing other control parameters besides the temperature by confronting its results with lattice data at nonzero isospin. Furthermore, we investigate the phase structure of the three-dimensional $T - \mu_{\text{isospin}} - \mu_{\text{quark}}$ phase diagram and calculate the surface tension of the first order phase transition at small temperatures and large quark densities.

HK 13.7 Mo 18:15 HZ 7

The Parity doublet model with fluctuations — •Johannes Weyrich[1], Nils Strodthoff[2], and Lorenz von Smekal[1] — [1]TU Darmstadt — [2]Universität Heidelberg

In the 1970s the Walecka model and the chiral Walecka model were developed and have since been studied intensively. It was noted early on, however, that the chiral model leads to massless Lee-Wick nuclear matter in the chirally restored phase.

A promising variant to describe nuclear matter and chiral symmetry restoration consitently is the parity doublet model (or mirror model). It has already been treated in a mean field (MF) approach with promising results. This is motivation for us to to examine this model with functional renormalization group (FRG) methods, hence including full mesonic fluctuations.

HK 13.8 Mo 18:30 HZ 7

Constraining the nuclear matter equation of state around twice the saturation density — •Arnaud Le Fèvre[1], Yvonne Leifels[1], Willibrord Reisdorf[1], Jörg Aichelin[2], Christoph Hartnack[2], and Norbert Hermann[3] — [1]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany — [2]SUBATECH, Université de Nantes, IN2P3/CNRS, France — [3]Physikalisches Institut der Universität Heidelberg, Heidelberg, Germany

From FOPI experimental data on elliptic flow of protons, we extract constraints for the equation of state (EOS) of compressed symmetric nuclear matter using the transport code IQMD. The best agreement with the data is obtained with the soft EOS assumption, including a momentum dependent interaction. The code predicts that the mean characteristical density related to the measured flow is around twice the saturation density. It shows how important is the interplay between the fireball and the spectator matter in the relativistic heavy-ion collisions in order to have the necessary sensitivity of the elliptic flow on the stiffness of the EOS.

HK 13.9 Mo 18:45 HZ 7

Two-loop thermodynamics of warm and dense (isospin and baryo-chemical potential) perturbative QCD — •Thorben Graf[1], Juergen Schaffner-Bielich[2], and Eduardo S. Fraga[3] — [1]Institut für Theoretische Physik, Goethe Universität, Frankfurt am Main, Germany — [2]Institut für Theoretische Physik, Goethe Universität, Frankfurt am Main, Germany — [3]Instituto de Física, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brasil

We present a perturbative calculation of the thermodynamical potential of quantum chromodynamics at nonvanishing temperatures for different values of the isospin and baryo-chemical potential.

A comparison to recent lattice calculations at nonvanishing isospin is performed and the region of the break-down of the perturbative calculations are delineated.

Finally, we study the thermodynamic potential at high chemical potentials and low temperatures where the perturbative scheme should be also applicable.

HK 14: Instrumentierung

Zeit: Montag 16:30–19:00 Raum: HZ 8

Gruppenbericht HK 14.1 Mo 16:30 HZ 8

Entwicklung von DIRCs für PANDA — •Matthias Hoek — Institut für Kernphysik, JGU Mainz

Das PANDA-Experiment am FAIR Beschleunigerkomplex wird grundlegende Fragen der Hadronenphysik und der QCD untersuchen. Hierzu wird ein Antiprotonen-Strahl mit einem Impuls zwischen 1,5 und 15 GeV/c auf Wasserstoff- oder nukleare Targets gelenkt. Ausgezeichnete Teilchenidentifikation über einen großen Impulsbereich ist dabei unverzichtbar. Die Identifikation von Hadronen im Bereich des Target-Spektrometers wird von zwei Cherenkov-Detektoren gewährleistet. Beide Detektoren beruhen auf dem DIRC-Prinzip, welches eine sehr kompakte Detektorgeometrie ermöglicht. Für beide Detektoren ergeben sich ähnliche Herausforderungen: hohe Ratenfestigkeit, sowie der Betrieb im starken Magnetfeld des Target-Spektrometers. Ein Barrel DIRC, der auf dem erfolgreichen BaBar DIRC beruht, deckt den Bereich um das Target mit Polarwinkeln von 22 bis 140 Grad ab. Entscheidende Verbesserungen im Bereich der abbildenden Optik und der Photodetektoren ermöglichen es, mit höheren Untergrundraten zurechtzukommen. Ein Endcap DIRC, der eine völlig neuartige Geometrie verwendet, deckt den Vorwärtsbereich mit Polarwinkeln von 5 bis 22 Grad ab. Die neuen Designkonzepte beider Detektoren wurden in einer Reihe von Testexperimenten an verschiedenen Beschleunigern (CERN, DESY, MAMI) überprüft. Die gewonnenen Ergebnisse und der Stand der Entwicklung der DIRC-Zähler werden in diesem Beitrag dargestellt.

HK 14.2 Mo 17:00 HZ 8

Simulation and reconstruction for the PANDA Barrel DIRC — Roman Dzhygadlo[1], Klaus Götzen[1], Harphool Kumawat[1,2], •Maria Patsyuk[1,3], Klaus Peters[1,3], Carsten Schwarz[1], Jochen Schwiening[1], and Marko Zühlsdorf[1,3] for the PANDA-Collaboration — [1]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt — [2]Bhabha Atomic Research Centre, Mumbai — [3]Goethe-Universität Frankfurt

Charged particle identification for a wide momentum range is an essential task for the PANDA experiment at the future Facility for Antiproton and Ion Research (FAIR) at GSI, Darmstadt. Hadronic particle identification in the barrel region of PANDA will be performed by a DIRC (Detection of Internally Reflected Cherenkov light) counter. The design of this detector is based on the successful BABAR DIRC and has a number of key improvements, such as focusing optics, compact expansion volume, and fast timing. A detailed simulation was developed to optimize the Barrel DIRC design in terms of performance and cost.

A fast reconstruction procedure, based on the look-up tables, was used to determine the single photon Cherenkov angle resolution and photon yield. This contribution describes the procedure and presents a

quantitative comparison of the performance of several design options.

Work supported by EU FP7 grant, contract number 227431, Hadron-Physics2, and the Helmholtz Graduate School for Hadron and Ion Research HGS-HIRe.

HK 14.3 Mo 17:15 HZ 8

Performance of the PANDA Barrel DIRC Prototype — •Roman Dzhygadlo[1], Andreas Gerhardt[1], Grzegorz Kalicy[1,2], Harphool Kumawat[3], Dorothee Lehmann[1], Maria Patsyuk[1,2], Klaus Peters[1,2], Georg Schepers[4], Carsten Schwarz[1], Jochen Schwiening[1], and Marko Zühlsdorf[1,2] for the PANDA-Collaboration — [1]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt — [2]Goethe-Universität, Frankfurt — [3]Bhabha Atomic Research Centre, Mumbai — [4]FAIR Facility for Antiproton and Ion Research in Europe GmbH, Darmstadt

Hadronic particle identification in the barrel region of the PANDA experiment at the new Facility for Antiproton and Ion Research in Europe (FAIR) at GSI, Darmstadt, will be provided by a DIRC (Detection of Internally Reflected Cherenkov light) counter. To test the performance of the barrel DIRC as well as different design options a prototype was build and successfully tested using a hadronic particle beam at CERN in 2012. The prototype comprised a radiator bar, focusing lens, mirror, and compact prism-shaped expansion volume made of solid synthetic fused silica. An array of micro-channel plate photomultiplier tubes measured the location and arrival time of the Cherenkov photons with sub-nanosecond resolution. The performance of the prototype during the beam test will be presented including measurements of the photon yield and the Cherenkov angle resolution.

Work supported by EU FP7 grant, contract number 227431, Hadron-Physics2, and the Helmholtz Graduate School for Hadron and Ion Research HGS-HIRe.

HK 14.4 Mo 17:30 HZ 8

A time-based likelihood approach for the PANDA Barrel DIRC detector — Roman Dzhygadlo[1], Klaus Götzen[1], Grzegorz Kalicy[1,2], Harphool Kumawat[1,3], 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]Goethe-Universität Frankfurt — [3]Bhabha Atomic Research Centre, Mumbai

The PANDA experiment at the future Facility for Antiproton and Ion Research in Europe GmbH (FAIR) at GSI, Darmstadt will study fundamental questions of hadron physics and QCD using high-intensity cooled antiproton beams with momenta between 1.5 and 15 GeV/c. Efficient Particle Identification (PID) for a wide momentum range and the full solid angle is required for reconstructing the various physics channels of the PANDA program. Hadronic PID in the barrel region of the PANDA detector will be provided by a DIRC (Detection of Internally Reflected Cherenkov light) counter. The design is based on the successful BABAR DIRC with several key improvements.

This contribution presents simulation studies of a barrel DIRC design based on wide radiator plates instead of narrow bars and a PID method using a time-based likelihood approach to make optimum use of the precision timing of this new counter.

Work supported by EU FP7 grant, contract number 227431, Hadron-Physics2, and the Helmholtz Graduate School for Hadron and Ion Research HGS-HIRe.

HK 14.5 Mo 17:45 HZ 8

Ein DIRC Demonstrationsdetektor für das WASA-at-COSY und PANDA Experiment — •Adrian Zink, Wolfgang Eyrich, Florian Hauenstein und Liwen Li — Physikalisches Institut IV, Universität Erlangen-Nürnberg, Deutschland

Für eine signifikante Verbesserung der Energieauflösung und Teilchenidentifikation des WASA-at-COSY Experiments wurde ein zusätzlicher DIRC (Detector of Internally Reflected Cherenkov light) im Vorwärtsbereich, bestehend aus vier Viertelkreisscheiben mit fokussierenden Optiken, konzipiert.
Zur Untersuchung des Konzeptes sowie zum Studium der einzelnen Komponenten, insbesondere einer neu entwickelten Elektronik im Hinblick auf das geplante PANDA Experiment am neuen FAIR Beschleuniger, wurde ein Demonstrationsdetektor aus Acrylglas gefertigt und in zwei Strahlzeiten 2012 und 2013 mit einem Protonenstrahl von 2,95 GeV/c und 3,2 GeV/c hinter dem externen TOF Experiment am COSY Beschleuniger am Forschungzentrum Jülich getestet. Die Ergebnisse dieser Messungen sowie die Untersuchungen der einzelnen Komponenten wie Photomultiplier und der auf FPGAs basierenden Elektronik, werden präsentiert und diskutiert.

Gefördert durch BMBF und FZ Jülich

HK 14.6 Mo 18:00 HZ 8

Konzeptstudie für einen neuen Photonendetektor im HADES RICH — •Korbinian Schmidt-Sommerfeld[1], Jürgen Friese[1], Tobias Kunz[1] und Laura Fabbietti[2] für die HADES-Kollaboration — [1]Physik Dept. E12, Technische Universität München, 85748 Garching, Deutschland — [2]Excellence Cluster "Universe" , 85748 Garching

Das HADES Experiment wird zukünftig Messungen zur e^+e^- Paarproduktion in Kernreaktionen bei FAIR Energien durchführen. Dafür soll der zur Zeit für die e^+e^- Identifikation verwendete RICH Detektor modifiziert werden. In diesem Zusammenhang wurde der Austausch des photosensitiven Gasdetektors durch eine Anordnung mit ortsempfindlichen Photomultipliern bei sonst unveränderter Geometrie in ausführlichen Simulationen untersucht. Ziel ist eine deutliche Erhöhung der Anzahl registrierter Tscherenkowphotonen und damit der Nachweiswahrscheinlichkeit für die Elektronen. Wegen der unterschiedlichen spektralen Sensitivitäten der beiden Photonendetektoren muss jedoch das zu den Tscherenkowphotonen konkurrierende Szintillationslicht für mögliche Radiatorgase berücksichtigt werden, zu dem Messungen am Münchner Tandembeschleuniger durchgeführt wurden. Die Ergebnisse der Szintillationsmessungen und Simulationen werden vorgestellt.

HK 14.7 Mo 18:15 HZ 8

Single photon scans of various Multianode PMTs and XP85012 MCP * — •Christian Pauly for the CBM-Collaboration — Bergische Universität Wuppertal

Spatially resolved single Cherenkov photon detection is an essential requirement in building a Ring Imaging Cherenkov Detector (RICH).

We have set up a test stand to conduct single photon XY-scans in order to test and qualify different sensor devices for the CBM-RICH detector which is currently being designed as part of the future Compressed Baryonic Matter (CBM) experiment at FAIR.

Combining a pulsed laser source and step-motor XY-table with a self-triggered multi-channel acquisition system based on the nXYter readout ASIC allows to measure many different characteristic features of the sensor devices. Quantities like spatial resolved detection efficiency, spatial resolution, single photon response, channel-to-channel gain uniformity, after-pulsing, cross-talk, dark noise and active area can all be deduced from a single data set and thus allow for a comprehensive comparison of the evaluated sensors.

For the CBM RICH, we currently foresee the Hamamatsu H8500 2" or R11265 1" MAPMTs as baseline solution, alternatively we also consider using Photonis XP85012 MCPs. We present a detailed comparison of these sensor devices, including first measurements of the new H12700 MAPMT from Hamamatsu.

*supported by BMBF, 05P12PXFCE

HK 14.8 Mo 18:30 HZ 8

Implementation of a realisic detector response in the CBM TRD simulation framework — •Cyrano Bergmann — Institut für Kernphysik WWU, Münster, Deutschland

The Compressed Baryonic Matter (CBM) experiment is a fixed target heavy-ion experiment at the future FAIR accelerator facility. The CBM Transition Radiation Detector (TRD) is one of the key detectors to provide electron identification and charged particle tracking. Two CBM TRD prototype modules of $59\times59\,\mathrm{cm}^2$ were built in Münster. They were tested during October 2012 in beam at the CERN Proton Synchroton (PS) with electrons and pions of momenta up to 8 GeV/c. The results of this in beam test were used to define a realistic detector response in the CbmRoot simulation framework. We present a comparison of simulation benchamrks with results from the in beam tests.

HK 14.9 Mo 18:45 HZ 8

Geiger-mode Avalanche Photodiodes for the Readout of Scintillating Fibers — •Alexander Hahn — Technische Universität München

Following up on the PAMELA collaboration's detection of trapped antiprotons in low-Earth orbit, the Technische Universität München has founded a student-developed endeavor to measure the yet-unknown low-energy antiproton flux in the Van Allen belt. The satellite-borne experiment will consist of a cube of scintillating fibers, and will discern

antiprotons by detecting the pions of their characteristic annihilation. We have built a 128-channel prototype detector to test the ability to measure low-energy particles with scintillating fibers and Geiger-mode avalanche photodiodes (G-APD).

After testing several different fiber types and APD–fiber coupling methods, we built the prototype with aluminum-wrapped Kuraray fibers. Additionly we have compared and contrasted KETEK and Hamamatsu G-APDs, studying in particular their dark count rates, cross talk intensities, photo-detection efficiencies, temperature dependences, and gains. I will present our findings as well as an introduction to the experiment's aims and schematic structure.

This project is supported by the DFG Excellence Cluster Universe(Exc 153).

HK 15: Astroteilchenphysik

Zeit: Montag 16:30–19:00 Raum: HZ 9

Gruppenbericht HK 15.1 Mo 16:30 HZ 9

A liquid argon scintillation veto for the GERDA experiment — •Anne Wegmann for the GERDA-Collaboration — Max-Planck-Institut für Kernphysik, Saupfercheckweg 1, 69117 Heidelberg

GERDA is an experiment to search for the neutrinoless double beta decay of ^{76}Ge. Results of Phase I have been published in summer 2013. Currently GERDA is being upgraded to a second phase. To reach the aspired background index of $\leqslant 10^{-3}$ cts/(keV·kg·yr) for Phase II active background-suppression techniques will be applied, including an active liquid argon veto (LAr veto).

It has been demonstrated by the LArGe test facility that the detection of argon scintillation light can be used to effectively suppress background events in the germanium, which simultaneously deposit energy in LAr.

This talk focusses on the light instrumentation which is being installed in GERDA. Photomultiplier tubes (PMT) and wavelength-shifting fibers connected to silicon photomultipliers (SiPM) are combined to maximize the photoelectron-yield with respect to various background sources. Monte Carlo simulations have been performed to optimize the design for background suppression and low self-induced background. First results of the prototypes and the progress of installation are reported.

Gruppenbericht HK 15.2 Mo 17:00 HZ 9

GERDA and the search for neutrinoless double beta decay: first results and perspectives — •Matteo Agostini for the GERDA-Collaboration — Physik Department and Excellence Cluster Universe, Technische Universität München, Germany

Neutrinoless double beta decay is a lepton-number-violating nuclear transition predicted by several extensions of the Standard Model. The GERDA experiment searches for this transition in ^{76}Ge by operating bare Ge detectors in liquid Ar. The talk focuses on the results of data acquired during Phase I of the experiment, in which 21.6 kg·yr of exposure were accumulated with a background index of about 0.01 cts/(keV·kg·yr). No signal was observed and a lower limit was derived for the half-life of neutrinoless double beta decay of ^{76}Ge, $T_{1/2} > 2.1 \cdot 10^{25}$ yr (90% C.L.). The experiment is currently undergoing a major upgrade in preparation for the next phase of data taking. Thanks to an increased target mass, an improved energy resolution and the introduction of novel background reduction techniques, the sensitivity of GERDA will increase of about one order of magnitude in a few years of operation.

Gruppenbericht HK 15.3 Mo 17:30 HZ 9

Background reduction at low energies with BEGe detector operated in liquid argon using the GERDA-LArGe facility — •Dušan Budjáš for the GERDA-Collaboration — Physik-Department E15, Technische Universität München, Germany

LArGe is a low background test facility used for proving innovative approaches to background reduction in support of the neutrinoless double beta decay experiment GERDA. These approaches include an anti-Compton veto using scintillation light detection from liquid argon, as well as a novel pulse shape discrimination method exploiting the characteristic electrical field distribution inside BEGe detectors. The latter technique can identify single-site events (typical for double beta decays) and efficiently reject multi-site events (typical for backgrounds from gamma-ray interactions), as well as different types of background events from detector surfaces.

While the main focus of the LArGe facility is to assist with reaching the goal of GERDA – improving the sensitivity for ^{76}Ge neutrinoless double beta decay search, reducing the background at low energies and lowering the energy threshold is also of interest. In particular such efforts can be potentially relevant for search of dark matter or low energy neutrino interactions. In this talk I will present the experimental measurement of the low energy region with a BEGe detector operated in LArGe with the application of powerful background suppression methods. The performance will be compared to that of some dedicated dark matter detection experiments.

HK 15.4 Mo 18:00 HZ 9

BEGe detectors in GERDA Phase I - performance, physics analysis and surface events — •Andrea Lazzaro for the GERDA-Collaboration — Physik-Department E15, Technische Universität München, Germany

The Phase I of the GERDA experiment, which has concluded its data taking in Summer 2013, was based on coaxial HPGe detectors already used for IGEX and HdM experiments. In the upcoming Phase II customized Broad Energy Germanium (BEGe) detectors will provide the major contribution to the total exposure. The first set of BEGe detectors has been deployed in GERDA since June 2012.

The data collected in Phase I show the performance achieved in terms of spectroscopy and pulse shape discrimination. In particular the strongest background source, the ^{42}K beta decay from the liquid argon surrounding the detectors, has been effectively rejected. The signals due to beta decay on the detector surface are indeed characterized by a longer charge collection time. This talk will focus on this key feature of the BEGe-PSD.

This work was supported in part by BMBF (05A11W01).

HK 15.5 Mo 18:15 HZ 9

Test of GERDA Phase II Detector Assembly — Tobias Bode[1], Konstantin Gusev[1], Bernhard Schwingenheuer[2], and •Victoria Wagner[2] for the GERDA-Collaboration — [1]Technische Universität München — [2]Max-Planck Institut für Kernphysik, Heidelberg

The GERDA experiment searches for the lepton number violating neutrinoless double beta decay ($0\nu\beta\beta$) of ^{76}Ge. The experiment uses HPGe detectors enriched in ^{76}Ge as source and detection material. In GERDA Phase I five BEGe detectors were operated successfully. These detectors are distinguished for improved energy resolution and enhanced pulse shape discrimination (PSD) against background events. In Phase II additional 25 BEGe detectors will be installed. New electronics and radio-pure low-mass holders were specially designed for Phase II. Prior to the installation in GERDA all BEGe detectors are tested in their final assembly in the LNGS underground laboratory. This talk will present the mechanics and performance of the GERDA Phase II detector assembly.

HK 15.6 Mo 18:30 HZ 9

Scintillating $CaWO_4$ Crystals for the CRESST-II and EURECA Dark Matter Searches — •Moritz v. Sivers[1], Andreas Erb[2], Andreas Ertl[1], Achim Gütlein[1], Jean-Côme Lanfranchi[1], Andrea Münster[1], Felix Neumann[1], Walter Potzel[1], Sabine Roth[1], Stefan Schönert[1], Raimund Strauss[3], Stephan Wawoczny[1], Michael Willers[1], Marc Wüstrich[3], and Andreas Zöller[1] — [1]Physik Department, E15, Technische Universität München, 85748 Garching — [2]Walther-Meissner-Institut für Tieftemperatur Forschung, 85748 Garching — [3]Max-Planck-Institut für Physik, 80805 München

The CRESST-II experiment for the direct detection of WIMP dark matter uses scintillating $CaWO_4$ crystals that are operated as low-temperature detectors. EURECA is a joint collaboration of existing cryogenic direct dark matter searches to develop a future multi-material experiment with a target mass of up to one ton. While in the past crystals were obtained from external suppliers, we recently started producing $CaWO_4$ single crystals with a dedicated Czochral-

ski furnace at the Technische Universität München to have a direct influence on the radiopurity and scintillation properties. We present here an overview of the growth process as well as measurements of the crystals' scintillation properties and radiopurity. This research was supported by the DFG cluster of excellence: "Origin and Structure of the Universe", the "Helmholtz Alliance for Astroparticle Phyiscs", the "Maier-Leibnitz-Laboratorium" (Garching) and by the BMBF: Project 05A11WOC EURECA-XENON.

HK 15.7 Mo 18:45 HZ 9

Ladungstransport in Germaniumdetektoren des EDELWEISS-III Experiments — •Nadine Foerster für die EDELWEISS-Kollaboration — Karlsruher Institut für Technologie, Institut für Experimentelle Kernphysik, Postfach 3640, 76021 Karlsruhe

Ziel des EDELWEISS-III Experiments zur direkten Suche nach Dunkler Materie ist die Detektion von WIMPs unter Verwendung kryogener Germanium-Bolometer. Ein System aus Elektroden erzeugt im Inneren der Germaniumkristalle ein homogenes elektrisches Feld. Durch gleichzeitige Messung des durch eine Streureaktion verursachten Wärmeanstiegs und der erzeugten Elektronen-Loch Paare als Ionisierungssignal an den Elektroden ist eine Identifizierung von Ge-Kernrückstößen möglich. Um eine effiziente Diskriminierung zwischen Hintergrundereignissen und WIMP Kanidaten zu erhalten, ist eine möglichst vollständige Detektion aller erzeugten Ladungsträger entscheidend. In diesem Vortrag wird ein Überblick über die Modellierung des Ladungstransports in Germanium bei tiefen Temperaturen (20 mK) und niedrigen externen Feldstärken ($< 10\,\mathrm{V/cm}$) gegeben. Resultate von Spezialmessungen mit einem Testdetektor, der den selben Herstellungsprozess durchlaufen hat wie die EDELWEISS-III Detektoren, werden vorgestellt.
Die hier präsentierten Analysen werden gefördert durch die DFG Graduiertenschule KSETA (Karlsruher Schule für Elementarteilchen und Astroteilchenphysik: Wissenschaft und Technik).

HK 16: Hauptvorträge I

Zeit: Dienstag 11:00–13:00 Raum: HZ 1+2

Hauptvortrag HK 16.1 Di 11:00 HZ 1+2

Laser Spectroscopic Determination of Nuclear Ground-State Properties — •Wilfried Nörtershäuser — Technische Universität Darmtadt, Institut für Kernphysik

Ground-state properties of nuclei can be extracted from the optical spectrum of an isotope or isomer with high accurcay and independent of a specific nuclear model. Particularly for short-lived isotopes, this is the method of choice to determine spins, magnetic dipole and electric quadrupole moments, and changes in nuclear charge radii along a chain of isotopes. Spectroscopy of stable isotopes is often used to calibrate the atomic parameters required to extract the nuclear property or to determine reference values. Moreover, laser spectroscopic techniques can also be used to prepare ion beams in a specific energy level, charge state, or polarized beams. This can facilitate the determination of nuclear ground-state properties as well as other atomic physics and nuclear physics experiments. Recent progress in these fields is presented.

Hauptvortrag HK 16.2 Di 11:40 HZ 1+2

The origin of heavy elements — •Almudena Arcones — TU Darmstadt

Where in the universe are heavy elements, like gold and uranium, synthesized? How are these elements produced? These are two exciting and interdisciplinary questions in nuclear astrophysics today. The favored candidates are core-collapse supernovae and neutron star mergers where extreme conditions enable the rapid neutron capture process (r-process). Recent advance in hydrodynamic simulations with improved microphysics can be combined with observations of the oldest stars to bring new insights about the astrophysical sites of the r-process. On the experimental side of nuclear physics research, a new era for nuclear astrophysics will start with the new-generation facilities, like FAIR, which will advance the experimental frontier towards the heaviest neutron-rich isotopes. In this talk, new results on nucleosynthesis in core-collapse supernova and neutron-star mergers will be discussed together with the impact that nuclear physics has on the origin of heavy elements.

Hauptvortrag HK 16.3 Di 12:20 HZ 1+2

Thermalization Dynamics in Ultra-Relativistic Nuclear Collisions — •Juergen Berges — ITP Heidelberg

In recent years, significant progress in a first principles understanding of non-Abelian plasmas out-of-equilibrium has been achieved in two limiting cases. One of these is the study of the strong-coupling limit using gauge-string dualities in supersymmetric Yang-Mills theories. The other case that is amenable to ab initio calculations is Quantum Chromodynamics in the weak-coupling limit. The colliding nuclei in this limit are described in the Color Glass Condensate framework. The dynamics of the non-equilibrium Glasma created in such a collision is that of highly occupied gluon fields with given typical momentum. Since the characteristic occupancies are large, the gauge fields are strongly correlated even for small gauge coupling. The dynamics of highly occupied gauge fields is classical in nature and can be studied from first principles using real-time lattice gauge theory techniques. I'll report on the largest real-time simulations to date and how they provide unprecedented quantitative understanding of the thermalization process.

HK 17: Hadronenstruktur und -spektroskopie

Zeit: Dienstag 14:00–15:45 Raum: HZ 1+2

HK 17.1 Di 14:00 HZ 1+2

Strategies for Analysis of the Time-Like Form Factor of the Neutron — •Paul Larin, Cristina Morales, Dexu Lin, and Alaa Dbeyssi for the BESIII-Collaboration — Helmholtz-Institut Mainz

The first measurements of baryonic form factors were performed six decades ago by Robert Hofstadter for the proton via electron scattering in atomic nuclei and led to many breakthough results for undestanding the structure of nuclei. Since then the space-like domain was examined over a large energy range by many different experiments for both protons and neutrons. In contrast, the time-like region is almost unknown until now, especially in case of the neutron. The Beijing Electron Positron Collider II (BEPCII) is designed for center of mass energies between 2 and 5 GeV and therefore offers with the included Beijing Electron Spectrometer III (BESIII) experiment a unique possibility to measure nucleon form factors in the time-like domain with high precision. In particular measurement of the time-like form factors of the neutron would offer a significant improvement to existing results. We report on the use of modern approaches like initial state radiation (ISR) and multivariate analysis methods as a general strategy in the analysis of the channel $e^+e^- \to n\bar{n}\gamma_{ISR}$.

HK 17.2 Di 14:15 HZ 1+2

Measurements of Proton Electromagnetic Form Factors in Time-like Region at BESIII — •Dexu Lin[1,2,3], Cristina Morales[1,2,4], Frank Maas[1,2,4], and Paul Larin[1,2] — [1]Helmholtz-Institut Mainz, 55128 Mainz, Germany — [2]Institut für Kernphysik, JGU Mainz, 55099 Mainz, Germany — [3]HGS-HIRe for FAIR, 60438 Frankfurt am Mainz, Germay — [4]GSI, 64291 Darmstadt, Germay

The proton is the lightest baryon and its internal structure and dynamics can be better understood through the study of its electromagnetic(EM) form factors. In the space-like region there are plenty of statistics already collected by previous experiments and the form factors are very well known. This is not the case of the time-like(TL) region. In the TL region, the ratio of the EM form factors is only

known to 11-24% level and the form factors have never been extracted without previous assumption.

BESIII (Beijing Spectrometer III) at BEPCII (Beijing Electron Positron Collider II) is collecting large data samples at J/Ψ, Ψ′′ and XYZ energy range. These data can be used to measure proton EM form factors with ISR (Initial-State-Radiation) method $e^+e^- \to p\bar{p}\gamma_{ISR}$. In addition, an energy scan between 2.0 and 3.1 GeV is currently being considered by BESIII. This would make possible the measurement of the proton EM form factors using the process $e^+e^- \to p\bar{p}$. Both methods will be summarized in this talk.

HK 17.3 Di 14:30 HZ 1+2

Feasibility study: proton time-like electromagnetic form factors with the $\bar{\text{P}}$ANDA experiment — •Dmitry Khaneft for the PANDA-Collaboration — Helmholtz-Institut Mainz, Mainz, Germany

Perspectives of measuring the proton electromagnetic form factors in the time-like region at FAIR with the $\bar{\text{P}}$ANDA detector are presented. A number of simulations with $\bar{\text{P}}$ANDAroot framework on the signal $\bar{p}p \to e^+e^-$ efficieny as well as for the most important background $\bar{p}p \to \pi^+\pi^-$ have been performed. All three hypotheses for the $G_E/G_M = 0, 1, 3$ have been taken into account for signal simulation. A set of cuts were implemented into analysis procedure signal and background separation. Preliminary results of statistical error analysis are shown.

HK 17.4 Di 14:45 HZ 1+2

Beam-spin asymmetry of pion, kaon, proton and antiproton production in semi-inclusive deep-inelastic scattering — •Vitaly Zagrebelnyy — DESY Hamburg Notkestrasse 85

Beam-spin asymmetries in the azimuthal distribution of pions, kaons, protons and antiprotons in semi-inclusive deep inelastic scattering (SIDIS) extracted from 2000-2007 HERMES data are presented. The asymmetries were measured in the kinematic region $Q^2 > 1$ GeV^2, $W^2 > 10$ GeV^2, $0.1 < y < 0.85$. The x_B, z and $p_{h\perp}$ dependencies of the $\sin(\phi)$ modulation of the asymmetries for pions, kaons, protons and antiprotons are shown. Assuming that the SIDIS cross section factorizes to distribution (DF) and fragmentation (FF) functions that dependent on transverse quark momentum (TMD functions), one can obtain novel information about the spin-orbit correlations inside the nucleon and orbital angular momentum of quarks.

HK 17.5 Di 15:00 HZ 1+2

Status Report of K_s^0 Multiplicities from 2006 at COMPASS* — •Daniel Hahne — Universität Bonn

To describe the hadronization process of quarks into hadrons in deep inelastic scattering knowledge of parton distribution functions and fragmentation functions is necessary. Parton distribution functions can be extracted from inclusive deep inelastic scattering. To extract fragmentation functions from data taken by the COMPASS experiment final state hadrons are analyzed in addition to the incoming and scattered muon.

I will give a status report of K_s^0 multiplicities from data taken in 2006 by the COMPASS experiment which can be used to parameterize K_s^0 fragmentation functions.

*supported by BMBF, project 05P12 PDCCA

HK 17.6 Di 15:15 HZ 1+2

Hadron Multiplicities at COMPASS — •Nicolas du Fresne von Hohenesche — For the COMPASS collaboration — Institut für Kernphysik, Universität Mainz, Johann-Joachim-Becher-Weg 45, 55128 Mainz

Quark fragmentation functions (FF) $D_q^h(z, Q^2)$ describe final-state hadronization of quarks q into hadrons h. The FFs can be extracted from hadron multiplicities produced in semi-inclusive deep inelastic scattering. The COMPASS collaboration has recently measured charged hadron multiplicities for identified pions and kaons using a 160 GeV/c muon beam impinging on an isoscalar target. The data cover a large kinematical range and provide an important input for global QCD analyses of world data at NLO, aiming at the determination of FFs in particular in the strange quark sector. The newest results from COMPASS on pion and kaon multiplicities will be presented.

Supported by BMBF

HK 17.7 Di 15:30 HZ 1+2

The pion scalar radius from two-flavor Wilson Lattice QCD — •Vera Gülpers — Helmholtz-Institut Mainz, Johann-Joachim-Becherweg 36, 55128 Mainz

We calculate the scalar charge radius of the pion using $N_f = 2$ dynamical flavors of non-perturbatively $O(a)$-improved Wilson fermions in a wide range of pion masses. We find that the disconnected contribution to the scalar radius is not negligible especially for smaller pion masses, and is required in order to obtain the behavior expected from next-to-leading order (NLO) Chiral Perturbation Theory (χPT). The low energy constant $\bar{\ell}_4$ is determined from a fit to NLO χPT.

HK 18: Hadronenstruktur und -spektroskopie

Zeit: Dienstag 14:00–15:30 Raum: HZ 3

Gruppenbericht HK 18.1 Di 14:00 HZ 3

Experimental determination of the meson-nucleus potential* — •Mariana Nanova for the CBELSA/TAPS-Collaboration — II. Physikalisches Institut, Justus-Liebig-Universität Gießen

The investigation of in-medium properties of mesons is motivated by expectations to find evidence for partial restoration of chiral symmetry. In order to study the meson-nucleus interaction and the in-medium properties of mesons it is important to find experimental approaches to determine the meson-nucleus optical potential. Transparency ratio measurements provide information on the inelastic cross section and in-medium width of mesons and thereby on the imaginary part of the meson-nucleus potential. The real part of the optical potential can be deduced from measurements of the excitation function and momentum distribution which are sensitive to the sign and depth of the potential. Data taken on a carbon target at CB/TAPS@ELSA in 2009 have been analysed to determine the real part of the η'- and ω-nucleus optical potential. The results are compared to model calculations assuming different scenarios for in-medium η' and ω mass shifts. The data for both mesons are consistent with a weakly attractive potential. The formation and population of ω-nucleus and η'-nucleus bound states will be discussed. In case of the ω meson the in-medium width is larger than the potential depth which hampers a successful identification of ω-mesic states. The relatively small in-medium width of the η' meson encourages the search for η' bound states.

*Funded by DFG(SFB/TR-16)

HK 18.2 Di 14:30 HZ 3

Testing for spin dependence in the final state interaction of the reaction $\vec{d}p \to {}^3\text{He}\,\eta$ — •Michael Papenbrock[1], Alfons Khoukaz[1], Christopher Fritzsch[1], Paul Goslawski[1], Malte Mielke[1], Daniel Schröer[1], Alexander Täschner[1], and Colin Wilkin[2] for the ANKE-Collaboration — [1]Institut für Kernphysik, Westfälische Wilhelms-Universität, 48149 Münster, Germany — [2]Physics and Astronomy Department, UCL, London WC1E 6BT, UK

The $dp \to {}^3\text{He}\,\eta$ reaction is known for the unexpected energy dependence of its total cross section, which rises rapidly to its plateau value within the first 1 MeV of excess energy Q. This behaviour has been ascribed to a strong final state interaction and may indicate a quasi-bound $\eta\,{}^3$He state. In order to investigate the possibility of spin-dependent contributions to the total cross section, the deuteron tensor analysing power t_{20} has been measured in an excess energy range from $Q = 0$ MeV up to above $Q = 10$ MeV at the COSY-ANKE spectrometer. This allows one to compare the magnitudes of the contributions from the two spin configurations in the entrance channel with the strong variation seen in the average production amplitude. Furthermore, a weak angular dependence of t_{20} was also extracted and this provides insight into the structure of the production amplitude close to threshold.

Final results will be presented and discussed.

Supported by the COSY FFE programme.

HK 18.3 Di 14:45 HZ 3

Initial Research of np Scattering with Polarized Deuterium

Target at ANKE/COSY — •Boxing Gou for the ANKE-Collaboration — Institut für Kernphysik, Forschungszentrum Jülich, 52425 Jülich, Germany — Institute of Modern Physics, Chinese Academy of Sciences, 73000 Lanzhou, China

With the goal of understanding the nuclear forces, the ANKE collaboration has been working on a systematic NN spin program for many years. Due to the lack of free neutron sources experimental data of np scattering are very rare, especially at higher energies. It has been shown that using phase shift analysis (PSA) it is possible to reconstruct np scattering amplitudes from the spin observables of $pd \to \{pp\}_{^1S_0} n$ charge-exchange reaction. So far experiments were conducted using polarized deuteron beams and hydrogen target, which led to valuable results. To extend the research up to the highest nucleon energy available at COSY (2.8 GeV), proton beam and polarized deuterium target will be used. This talk will present the results of the commissioning experiment of a deuterium target at ANKE with emphasis on the initial research of charge-exchange reaction.

Supported by CSC program.

HK 18.4 Di 15:00 HZ 3

Investigation of the p + d → ^{3}He + η' reaction at WASA-at-COSY* — •Nils Hüsken, Florian Bergmann, Kay Demmich, Patrice Hüsemann, Alexander Täschner, and Alfons Khoukaz — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster

The $\eta'(958)$ meson is of special interest, because its higher mass compared to other pseudoscalar mesons is directly related to the $U_A(1)$ problem of QCD. Recent theoretical works discuss studies on the formation of $\eta'(958)$-mesic nuclei as a possibility to investigate an in-medium modification of the η' mass. Such a modification could shed light on the mechanism responsible for the generation of the η' mass. With the WASA-at-COSY setup two test beam times on proton-deuteron collisions were carried out at proton kinetic energies of $T_p = 1800\,\mathrm{MeV}$ and $T_p = 1850\,\mathrm{MeV}$ respectively to investigate the possibility to perform studies on the η' production in the proton-deuteron fusion at this installation. First results of the analysis of both beam-times will be presented, focusing on the production of both the $\omega(782)$ meson, used for normalization purposes, and the $\eta'(958)$ meson.

*Supported by COSY-FFE grants

HK 18.5 Di 15:15 HZ 3

Meson Masses are Integer Multiples of 70 MeV / c2** — •Karl Otto Greulich — Fritz Lipmann Institut, Jena, Germany

A contribution to the Mainz Conference presents the alpha / beta rule for exact calculation of masses of fundamental particles. Thereby alpha is the fine structure constant, beta is the proton / electron mass ratio. These masses are: m(particle) = a**-n * ß**m * Q * 27,2 eV/c**2. For n = 3, m = 0 and Q = 1, a mass of 70, 01 MeV / c**2 is predicted, for which no particle exists. In the present contribution it is shown, that this mass is the bases for calculation of meson masses, in the most cases with an accuracy in the 1 % range or better. The meson masses are m(meson) = N * 70,01 MeV/c**2, where N = 2**k + 3**l, with k = 1,2,3 and l = 0 or 1. For k=1, l=0 the pion mass results as 140,02 MeV/c**2 (experimental value 139,57), for k=2, l=1 the kaon mass results as 490,07 (experimental 493,68)MeV/c**2. The eta meson follows from k,l = 3,0. The rho and omega from k,l = 3,1.

Reference: KO. Greulich, What are Particles? A lesson from the photon. 2013 proceedings of SPIE 8832-43 (for download see http://www.fli-leibniz.de/kog, then click "here" and subsequently click "Physics")

HK 19: Schwerionenkollisionen und QCD Phasen

Zeit: Dienstag 14:00–16:00 Raum: HZ 6

Gruppenbericht HK 19.1 Di 14:00 HZ 6

Anisotropic flow measurements with ALICE — •Ilya Selyuzhenkov for the ALICE-Collaboration — Research Division and ExtreMe Matter Institute, GSI Helmholtzzentrum für Schwerionenforschung, Planckstr. 1, 64291 Darmstadt

Anisotropic transverse flow is sensitive to the QCD equation of state which governs the evolution of the medium produced in a heavy-ion collision, as well as, to the transport properties (e.g. viscocity) of matter in a deconfined phase.

Results from the anisotropic flow measurements since the first heavy-ion run at the LHC in 2010 will be reviewed. The anisotropic flow harmonics are measured for charged hadrons and for a wide spectrum of identified particles with the light, strange, and heavy quark content. The measurements are performed for particles produced over a wide range of (pseudo-)rapidity and transverse momentum for various collision centrality classes. The progress stimulated by these measurements in our understanding of the initial conditions and properties of the matter created in nucleus-nucleus and proton-nucleus collisions at relativistic energies will be discussed.

HK 19.2 Di 14:30 HZ 6

Initial state properties in heavy ion collisions at RHIC and LHC energies — •Rudy Marty[1,2], Elena Bratkovskaya[1,2], Wolfgang Cassing[3], and Jörg Aichelin[4] — [1]FIAS, Frankfurt, Germany — [2]ITP, Frankfurt, Germany — [3]ITP, Giessen, Germany — [4]Subatech, Nantes, France

The issue of initial conditions in relativistic heavy ion collisions is a subject of intensive debate. Especially the assumption of thermal equilibrium after ∼1 fm/c is currently not supported by microscopic transport approaches. In our study we compare the Parton-Hadron-String Dynamics (PHSD) with new transport approach RSP based on the Nambu-Jona-Lasinio (NJL) model, applying the same initial conditions from PHSD, which have a 'lumpy' energy density profile. The comparison of final hadronic observables shows that the initial parton distribution must be out of equilibrium in order to reproduce the multiplicity spectra dN/dp_T and $dN/d\eta$ and the elliptic flow v_2 for Au+Au at RHIC energies. We also discuss the applicability of an equation of state and the applicability of a hydrodynamics for relativistic high energy collisions.

HK 19.3 Di 14:45 HZ 6

Investigating the transition between hydrodynamics and transport in heavy ion collision simulations — •Dmytro Oliinychenko and Hannah Petersen — Frankfurt Institute of Advanced Studies

One of the established ways to describe the dynamical evolution of heavy ion collisions theoretically is hydrodynamics with subsequent switching to transport, i.e. so-called hybrid models [1]. The switching process itself is organized as follows: at some predefined hypersurface the hydrodynamic evolution is stopped and particle distributions are generated according to the Cooper-Frye formula. Unavoidably, some particles from these distributions fly back into the hydrodynamic region. Such particles, which are also refered to as "negative contributions", are usually neglected in current hybrid approaches [2].

In the present study we present a systematic investigation of the negative contributions in a coarse-grained transport approach. Many UrQMD (Ultra-relativistic Quantum Molecular Dynamics) events are generated and the negative contributions calculated in a Cooper-Frye prescription are compared to the negative contributions based on the actual underlying particles. The other crucial point in hybrid approaches is the assumption of local equilibrium in the early stages of the collision. Therefore, we also show how fast local thermal equilibrium is reached in the UrQMD transport approach. The goal of this study is to extract a criterion for local thermalization.

[1] P. Huovinen, H. Petersen; EPJ A48 (2012)171 [2] H. Petersen, et al.; Phys.Rev. C78 (2008) 04490

HK 19.4 Di 15:00 HZ 6

Studying the collision energy dependence of elliptic and triangular flow with a hybrid model — •Jussi Auvinen[1] and Hannah Petersen[1,2] — [1]Frankfurt Institute for Advanced Studies, Frankfurt am Main, Germany — [2]Institut für Theoretische Physik, Goethe Universität, Frankfurt am Main, Germany

Elliptic flow has been one of the key observables for establishing the finding of the quark-gluon plasma (QGP) at the highest energies of Relativistic Heavy Ion Collider (RHIC) and the Large Hadron Collider (LHC). As a sign of collectively behaving matter, the elliptic flow is expected to decrease at lower beam energies, where the QGP is not produced. However, in the recent RHIC beam energy scan, it has been

found that the inclusive charged hadron elliptic flow changes relatively little in magnitude within the energy range 7.7 - 39 GeV per nucleon-nucleon collision.

We study the collision energy dependence of the elliptic and triangular flow utilizing a Boltzmann+hydrodynamics hybrid model described in [1,2]. Such a hybrid model provides a natural framework for the transition from high collision energies, where the hydrodynamical description is essential, to smaller energies, where the hadron transport dominates. This approach is thus suitable for investigating the relative importance of these two mechanisms for the production of the collective flow at different beam energies.

References: [1] H. Petersen, J. Steinheimer, G. Burau, M. Bleicher and H. Stocker, Phys. Rev. C78, 044901 (2008). [2] J. Auvinen and H. Petersen, arXiv:1310.1764.

HK 19.5 Di 15:15 HZ 6

Charge-dependent azimuthal correlation measurements in Pb-Pb collisions with ALICE — •Jaap Onderwaater for the ALICE-Collaboration — Research Division and ExtreMe Matter Institute, GSI Helmholtzzentrum für Schwerionenforschung, Planckstr. 1, 64291 Darmstadt — Institut für Kernphysik, Technische Universität Darmstadt, Schlossgrabenstr. 9, 64289 Darmstadt

Parity violation in strong interactions is predicted to be observable in relativistic heavy-ion collisions. The occurrence of parity-odd domains may result in charge separation along a strong magnetic field created by moving ions – a phenomenon dubbed the chiral magnetic effect (CME). Sensitive experimental observables include two particle azimuthal correlations and correlation of particle pairs relative to the reaction plane. A challenge is to separate contributions to these correlations from background sources, which include local charge conservation and initial density fluctuations. Correlations for lead-lead collisions at $s_{NN} = \sqrt{2.76}$ TeV measured with the ALICE detector are presented as a function of centrality, average and relative transverse momentum, and separation in pseudorapidity, providing additional constraints for models.

HK 19.6 Di 15:30 HZ 6

Transport Coefficients of Relativistic Systems — •Moritz Greif — Goethe Universität Frankfurt

It becomes increasingly important to know the strength of dissipative effects in relativistic hydrodynamics. Recently, scientists have strongly focused on shear viscosity. Nevertheless, heat flow, being proportional to spatial gradients of e.g. chemical potential over temperature, can also be an important effect in studies of relativistic fluid dynamics. We investigated the heat conductivity coefficient for an ultrarelativistic Boltzmann-gas, using our partonic transport model BAMPS. BAMPS solves the relativistic Boltzmann-equation numerically for arbitrary different particle species. We use pQCD scattering cross-sections. Furthermore, the response of a charged, relativistic gas onto an external electric field determines the electric conductivity. We investigated the electric conductivity of different model systems using three different methods: analytic transport theory, linear response via Green-Kubo formulae in equilibrium BAMPS-setups, and applying the textbook-picture of linear response to BAMPS. We plan to investigate the electric conductivity with the recently improved 2 <-> 3 processes from BAMPS and compare the results with lattice QCD.

HK 19.7 Di 15:45 HZ 6

Investigation of Mach cones and the corresponding two-particle correlations in a microscopic transport model — •Ioannis Bouras[1], Barbara Betz[1], Zhe Xu[2], and Carsten Greiner[1] — [1]Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Straße 1, D-60438 Frankfurt, Germany — [2]Department of Physics, Tsinghua University, Beijing, China

Using a microscopic transport model we investigate the evolution of conical structures originating from the supersonic jet through the hot matter and dense matter of ultra-relativistic heavy-ion collisions. We found that the Mach cone angle is influenced by the source term properties, energy deposition and viscosity. While in a static medium a possible double-peak structure is overshadowed by the diffusion wake and head shock, it turns out that in central heavy-ion collisions due to the radial flow of the expanding medium a double-peak structure is visible. On the one hand this is mainly contributed from Mach cones propagating into the opposite direction of the radial flow, while on the other hand deflected jets may also contribute to a final double-peak structure. The corresponding double-peak structure is observed insofar the shear viscosity over entropy density ratio is sufficiently small, while a larger dissipation destroys any kind of Mach cone and/or double-peak structure.

HK 20: Schwerionenkollisionen und QCD Phasen

Zeit: Dienstag 14:00–16:00 Raum: HZ 7

HK 20.1 Di 14:00 HZ 7

Thermalization through Hagedorn-States — •Maxim Beitel — Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Straße 1, D-60438 Frankfurt, Germany

Our goal is to examine the evolution of a heavy ion collision starting from non-equilibrium to an equilibrium state by looking at the corresponding thermalization times. Therefore we use the hadronic transport model "UrQMD" as microscopic model for high-energetic heavy ion collisions. Unfortunately these times are too long at present because detailed balance is not realized for all collisions which may occur. In our approach to get rid of this drawback we deploy Hagedorn-States proposed by the "Statistical Bootstrap Model". Creation of these states in binary collisions and their decay into two particles only will lower the thermalization times in UrQMD. Supported by HGS-HIRe.

HK 20.2 Di 14:15 HZ 7

The role of fluctuations in the QCD phase diagram — •Naseemuddin Khan[1], Jan Martin Pawlowski[1], Kenji Fukushima[2], and Nils Strodthoff[1] — [1]Institute of Theoretical Physics Heidelberg — [2]Departement of Physics, Tokio University

We construct an effective quark meson diquark model to simulate QCD at low energies. We employ the framework of the functional renormalization group, within which fluctuations of fermions and bosons can be included. We study the behavior of the chiral condensate at various temperatures and chemical potentials as well as the diquark condensate, which arises at higher chemical potentials.

HK 20.3 Di 14:30 HZ 7

Dynamical simulation of a linear sigma model near the critical point — •Christian Wesp[1], Alex Meistrenko[1], Hendrik van Hees[2], and Carsten Greiner[1] — [1]Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Straße 1, D-60438 Frankfurt, Germany — [2]Frankfurt Institute for Advanced Studies, Ruth-Moufang-Straße 1, D-60438 Frankfurt, Germany

The intention of this study is the search for signatures of the chiral phase transition. To investigate the impact of flucutations, e.g. of the baryon number, on the transition or a critical point, the linear sigma model is treated in a dynamical 3+1D numerical simulation. Chiral fields are approximated as classical fields, quarks are described by quasi particles in a Vlasov equation. Additional dynamic is implemented by quark-quark and quark-sigma-field interaction. For a consistent description of field-particle interactions, a new Monte-Carlo-Langevin-like formalism has been developed and is discussed.
Supported by HGS-HIRe.

HK 20.4 Di 14:45 HZ 7

Inhomogeneous phases of isospin-asymmetric matter in the Nambu–Jona-Lasinio model — •Daniel Nowakowski[1,2], Michael Buballa[1], Stefano Carignano[3], and Jochen Wambach[1] — [1]Institut für Kernphysik, Technische Universität Darmstadt — [2]ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung — [3]Department of Physics, University of Texas at El Paso

We investigate the phase structure of strong-interaction matter within a two-flavor Nambu–Jona-Lasinio model. Earlier it has been shown for degenerate quark flavors that chiral symmetry-breaking phases with spatially modulated order-parameters can occur. We analyze the emergence of these inhomogeneous phases in isospin-asymmetric matter by

extending the model through an additional isospin chemical potential, however restricting the order-parameter to be spatially modulated in only one dimension. It is found that for a non-vanishing isospin chemical potential the formation of inhomogeneous chiral symmetry-breaking phases is disfavored, when enforcing equal periodicities for the up and down quarks and neglecting charged pion condensation. If the periodicities of the quarks are not limited to be of the same magnitude, inhomogeneous chiral symmetry-breaking phases are found to be less sensitive to the additional pairing stress and can occur in a larger domain of the phase diagram. As an outlook we discuss possible extensions, like the addition of inhomogeneous charged pion condensation or color superconductivity.

HK 20.5 Di 15:00 HZ 7

Effective SU(2) Polyakov Loop Models for the Deconfinement Transition — •Philipp Scior[1], Lukas Holicki[1], David Scheffer[1], Dominik Smith[1], Lorenz von Smekal[1,2], and Björn Wellegehausen[2] — [1]TU Darmstadt — [2]Justus-Liebig-Universität Gießen

We compare different SU(2) Polyakov loop actions with full two-color QCD simmulations around and above the critical Temperature. The actions are motivated by combined strong coupling and hopping expansion and respect Z_{2} center symmetry. We extract the effective couplings of our models by matching the Polyakov loop distributions and correlators in the effective models with those from full two-color QCD simmulations.

HK 20.6 Di 15:15 HZ 7

Dynamical quark mass generation in a strong external magnetic field — •Niklas Mueller[1,2], Christian S. Fischer[1], and Jacqueline A. Bonnet[1] — [1]Justus-Liebig-Universität Giessen — [2]Universität Heidelberg

We investigate the effect of a strong magnetic field on dynamical chiral symmetry breaking in quenched and unquenched QCD. To this end we apply the Ritus formalism to the coupled set of (truncated) Dyson-Schwinger equations for the quark and gluon propagator under the presence of an external constant Abelian magnetic field. We discuss the effect of the magnetic field onto the quark condensate and extract the chiral suszeptibility.

HK 20.7 Di 15:30 HZ 7

On three-point correlations in pure Landau gauge QCD — Adrian Blum[1], •Markus Huber[1], Mario Mitter[2,3], and Lorenz von Smekal[1,4] — [1]Theoriezentrum, Institut für Kernphysik, Technische Universität Darmstadt, Schlossgartenstrasse 2, 64289 Darmstadt — [2]Institut für Theoretische Physik, Universität Heidelberg, Philosophenweg 16, 69120 Heidelberg — [3]Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Straße 1, 60438 Frankfurt/Main — [4]Institut für Theoretische Physik, Justus-Liebig-Universität, 35392 Gießen

In the investigation of quantum chromodynamics Green functions are a useful means to bridge the gap between elementary fields and the emergent physics. Important for the progress in recent years was a good understanding of Green functions in the vacuum. Here we use functional methods for the calculation of correlation functions and investigate how large the errors induced by modern truncation schemes are. For this we calculate three-point functions and include them for the first time also dynamically into the system of truncated Dyson-Schwinger equations, thus reducing the dependence on models.

HK 20.8 Di 15:45 HZ 7

The Binder cumulant in O(N)-models — •Paul Springer and Bertram Klein — Physik Department, Technische Universität München, 85747 Garching

The phase structure of QCD is a much discussed topic in particle physics. In the context of this discussion we need precise knowledge about the nature of the chiral phase transition. A powerful tool to investigate it are lattice simulations. They are, however, still restricted to relatively large quark masses, far from the chiral limit, and to small volumes, which could affect the critical behavior. These two facts complicate the scaling analysis of lattice QCD results.

In the chiral limit, a continuous phase transition is expected in two-flavor QCD. Since continuous phase transitions are controlled by the long range fluctuations, only the dimensionality and symmetries dictate the universal behavior near the critical point. Therefore, more simple systems from the same universality class can be investigated in order to describe scaling behavior which is expected in lattice QCD.

Because the long range fluctuations play a prominent role at continuous phase transitions, it is self-evident that it is useful to investigate the behavior of higher-order critical fluctuations at the transition point. For this purpose the Binder cumulants seem to be very well suited.

We analyze the fourth-order Binder cumulant in 3-dimensional O(2)- and O(4)-models in finite volumes using non-perturbative Renormalization Group methods. This approach allows us to gain explicit insight into the behavior of the critical fluctuations and provides a tool which assists in analysis of lattice QCD data.

HK 21: Instrumentierung

Zeit: Dienstag 14:00–15:30 Raum: HZ 8

Gruppenbericht HK 21.1 Di 14:00 HZ 8

ALICE TRD On-line Tracking and Trigger Performance — •Felix Rettig[1], Jochen Klein[2], and Uwe Westerhoff[3] for the ALICE-Collaboration — [1]FIAS, Universität Frankfurt — [2]Physikalisches Institut, Universität Heidelberg — [3]IKP, Universität Münster

The Transition Radiation Detector (TRD) in A Large Ion Collider Experiment (ALICE) at the LHC consists of 6 layers of tracking chambers and covers a pseudo-rapidity range of ±0.9. Presently, 13 out of 18 azimuthal sectors are installed. The completion is planned during the first long LHC shutdown in 2013/14.

We will discuss how a hardware Level-1 trigger, about 8 us after an interaction, is derived by this detector. Chamber-wise track segments from fast on-detector reconstruction are read out with position, angle and PID information. In the Global Tracking Unit, these tracklets are merged to a track and used for the reconstruction of transverse momenta and electron identification of individual tracks. These tracks form the basis for versatile and flexible trigger conditions, s.a. single high-pt hadron, single high-pt electron, di-electron (J/Psi, Upsilon) and at least n close high-pt tracks (jet).

After a period of minimum bias data-taking, rare triggers are now used in ALICE. The TRD contributes a jet trigger and two electron triggers. We will discuss the tracking performance and report on our experience on the TRD-based triggers.

HK 21.2 Di 14:30 HZ 8

The RCU2: Readout Electronics Consolidation for the ALICE TPC in Run2 — •Attilio Tarantola for the ALICE-Collaboration — Institut für Kernphysik Frankfurt

The Time-Projection Chamber (TPC) is the main device for charged particle tracking and identification of the ALICE experiment at CERN. The Multi Wire Proportional Chambers on both endplates of the TPC contain segmented cathode planes with a total of 557 568 pads, which are read out by custom electronics. The sampling of the signals provides 3-D information of the trajectory of the particle tracks and their energy loss. The LHC is currently being upgraded, in order to increase energies and luminosities of the beams: in the next data taking period, Run2 (2015-2018), the data readout rate for the ALICE central barrel detectors is planned to increase to 400Hz for Pb-Pb collisions at low dead time, while a maximum event size of 70MB is foreseen for central collisions.

The present TPC readout control unit (RCU) is going to be replaced with a new readout system, RCU2, which will be able to achieve the new requirements in terms of data readout speed and radiation tolerance. The RCU2 board will interface the already existing ALICE data acquisition and trigger systems with the TPC Front End Cards. In this contribution we present the status of the RCU2 upgrade, the features of the new hardware components, the developed firmware as well as the selection of the radiation tolerant components and the employed fault tolerance techniques. (Work supported by BMBF and the Helmholtz Association).

HK 21.3 Di 14:45 HZ 8

The PASTA Chip - A Free-Running Readout ASIC for Silicon Strip Sensors in PANDA — •André Goerres[1], Tobias Stockmanns[1], James Ritman[1], and Angelo Rivetti[2] for the PANDA-Collaboration — [1]Institut für Kernphysik, Forschungszentrum Jülich, **Jülich**, Germany — [2]INFN Sezione di Torino, **Torino**, Italy

The PANDA experiment is a multi purpose detector, investigating hadron physics in the charm quark mass regime. It is one of the main experiments at the future FAIR accelerator facility, using $\bar{p}p$ annihilations from a 1.5-15 GeV/c anti-proton beam. Because of the broad physics spectrum and the similarity of event and background signals, PANDA does not rely on a hardware-level trigger decision.

The innermost of PANDA's sub-systems is the Micro Vertex Detector (MVD), consisting of silicon pixel and strip sensors. The latter will be read out by a specialized, free-running readout front-end called PANDA Strip ASIC (PASTA).

It has to face a high event rate of up to 40 kHz/ch in an radiation-intense environment. To fulfill the MVD's requirements, it has to give accurate timing information to incoming events ($<$ 10 ns) and determine the collected charge with an 8-bit precision. The design has to meet cooling and placing restrictions, leading to a very low power consumption ($<$ 4 mW/ch) and limited dimensions. Therefore, a simple, time-based readout approach is chosen.

In this talk, the conceptual design of the front-end will be presented.

HK 21.4 Di 15:00 HZ 8

The Next Generation CBM MVD Front-end Electronics — •Michael Wiebusch, Jan Michel, and Joachim Stroth — Goethe-Universität, Frankfurt

The Micro Vertex Detector (MVD) for the CBM experiment is a highly granular precision tracking device. Due to the ambitious requirements regarding spatial resolution, radiation hardness, read-out speed and material budget, monolithic active pixel sensors (MAPS) are the most suited detector technology for this purpose. A full read-out chain for these sensors was designed and successfully prototyped in a test experiment at CERN/SPS in November 2012. However, it also revealed some weaknesses of the scheme, motivating a new and advanced revision of read-out electronics. In this scope, the system moved to a more capable FPGA platform and a next generation front-end electronics was designed and produced. Among others, the new design features a set of additional configuration and monitoring capabilities which will be used to optimize the concept of biasing and routing critical analog signals to the sensor. The main challenge is the distance between active electronics and the sensor which is constrained by radiation levels and the in-vacuum operation of the MVD. This contribution will present and evaluate the new front-end electronics design compared to the old concept, including first performance results. *This work is supported by BMBF (05P12RFFC7), HIC for FAIR, EMMI, and GSI.

HK 21.5 Di 15:15 HZ 8

The next generation of frontend readout at COMPASS-II — •Tobias Grussenmeyer, Maximilian Büchele, Horst Fischer, Matthias Gorzellik, Florian Herrmann, Philipp Jörg, Kay Königsmann, Paul Kremser, and Sebastian Schopferer — Physikalisches Institut, Albert-Ludwigs-Universität Freiburg

The GANDALF framework, a high precision, high performance detector readout system, capable of highspeed pulse and logic signal digitization, has been extended by a new mezzanine card with optical connectors. Using the GTP transceivers of the Spartan-6 SLX45T on the mezzanine card in a special configuration allows high speed data transmission to frontend electronics with fixed latency. In the reverse direction, measured data is transmitted at the maximum speed of 3 GBit/s.

At the COMPASS-II experiment at CERN SPS this will be used for the TDC frontend readout of new driftchambers and RICH Thick-GEM detectors.

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

HK 22: Instrumentierung

Zeit: Dienstag 14:00–16:00 Raum: HZ 9

HK 22.1 Di 14:00 HZ 9

Response of a Prototype for the PANDA Barrel EMC to Tagged Photons in the Energy Range from 750 MeV up to 3.2 GeV — •Stefan Diehl[1], Christoph Rosenbaum[1], Daniel Bremer[1], Peter Drexler[1], Tobias Eissner[1], Till Kuske[1], Markus Moritz[1], Rainer W. Novotny[1], Christoph Schmidt[2], Ulrike Thoma[2], and Christoph Wendel[2] for the PANDA-Collaboration — [1]2nd Physics Institute, University Gießen — [2]HISKP, University Bonn

The PANDA detector at FAIR will be used to study the interaction of antiprotons in a fixed target experiment. The electromagnetic calorimeter (EMC) of the target spectrometer, consisting of >15,000 PWO crystals, with its expected excellent performance and efficiency for photons, will be one of the central components to achieve the physical goals. The required energy, position and time resolutions were confirmed and optimized with prototype detectors. This contribution will report on response measurements of a subsection of the barrel EMC, with a 6x10 matrix of tapered crystals (PROTO60), using tagged photons in an energy range from 0.75 up to 3.2 GeV at the ELSA facility in Bonn. The report will describe the analysis including the data extraction from the sampling ADCs, the calibration with cosmic muons and the achieved resolutions. In addition, the influence of dead material in front of the EMC was studied simulating inner detectors of PANDA. Another focus will be on the position dependence of the energy resolution within the crystal and the implementation of higher order energy correction algorithms. *Supported by BMBF, GSI, HIC for FAIR

HK 22.2 Di 14:15 HZ 9

Test von Avalanche-Photodioden für das PANDA-EMC — •Gerrit Kuhl für die PANDA-Kollaboration — Institut für Experimentalphysik I, Ruhr-Universität Bochum, Deutschland

In der Vorwärts-Endkappe des elektromagnetischen Kalorimeters (EMC) für das PANDA-Experiment, das am zukünftigen Beschleunigerzentrum FAIR an der GSI in Darmstadt stehen wird, werden zwei verschiedene Typen von Photodetektoren zur Detektion des Szintillationslichtes verwendet. Hierbei handelt es sich zum einen um Avalanche-Photodioden (APDs) und zum anderen um Vakuum-Phototetroden (VPTTs), die beide von der Firma Hamamatsu gefertigt werden.

Zum Test der 1 cm^2 großen APDs wurde ein Messaufbau entwickelt, der die Aufnahme von Spannungs-Verstärkungs-Kennlinien mit gepulster oder konstanter Lichtquelle erlaubt. Zur Erzeugung der Pulse wurde ein Lichtpulsersystem, welches die Szintillationspulse des im EMC ver- wendeten Szintillators Bleiwolframat (Pulslänge $\approx$ 10 ns) nachbildet, verwendet. Die Messungen wurden bei Temperaturen von +20°C und -25°C durchgeführt und decken Verstärkungsbereiche von M=1 bis M=200 ab. Auf diese Weise können die Herstellerangaben überprüft sowie eine Normierung der Verstärkungskennlinien vorgenommen werden.

Gefördert durch das BMBF mit Förderkennzeichen 05P12PCFP5 und das FZ Jülich.

HK 22.3 Di 14:30 HZ 9

Aufbau eines Messtandes zur Vorkalibration der Detektormodule für die Vorwärtsendkappe des elektromagnetischen Kalorimeters des $\bar{P}$ANDA - Experimentes — •Christoph Wendel, Christian Hammann, Matthias Kube, Claudia Lütz, Philipp Mahlberg, Merlin Rossbach, Christoph Schmidt, Ulrike Thoma und Georg Urff für die PANDA-Kollaboration — HISKP, Universität Bonn, Deutschland

Die Vorwärtsendkappe des im Aufbau befindlichen elektromagnetischen Kalorimeters des $\bar{P}$ANDA-Experimentes wird aus 3856 PWO-II bestehen. Jeweils 16 Kristalle bilden gemeinsam mit ihren Photosensoren, einer Kohlefaserhaltestruktur und der dazugehörigen Aluminiumhalterung ein Detektormodul. Vor dem endgültigen Einbau in das Experiment soll jedes dieser Module einem abschließenden Funktionstest und einer Vorkalibration mit Höhenstrahlung unterzogen werden.Hierfür wurden zwei Messstände aufgebaut, die es erlauben die Module unter Experimentbedingungen von -25°C zu betreiben und zu testen.

Im Vortrag wird der Aufbau der Messstände diskutiert. Dies schliesst insbesondere das Design der mit SiPMs ausgelesenen Triggerdetektoren ein, die für die Kalibrationsmessungen eingesetzt werden. Zusätzlich werden erste Kalibrationsdaten der Detektormodule aus den mit EPICS automatisierten und über One-Wire Sensoren überwachten Klimakammern gezeigt.

Gefördert durch das BMBF(FKZ: 05P12PDFP5).

HK 22.4 Di 14:45 HZ 9

Testmessungen an Vakuumphototetroden für das elektromagnetische Kalorimeter des $\bar{\text{P}}$ANDA Experimentes an FAIR — •Georg Urff, Christian Hammann, Matthias Kube, Claudia Lütz, Philipp Mahlberg, Merlin Rossbach, Christoph Schmidt, Ulrike Thoma und Christoph Wendel für die PANDA-Kollaboration — HISKP, Universität Bonn, Deutschland

Für die PWO-II Kristalle im elektromagnetischen Kalorimeter des derzeit im Aufbau befindlichen $\bar{\text{P}}$ANDA Experimentes an FAIR sind je nach Winkelbereich verschiedene Photosensoren vorgesehen. Neben den hauptsächlich verwendeten APDs werden in Vorwärtsrichtung Vakuumphototetroden (VPTTs) eingesetzt. Um die VPTTs vor dem Einbau in die Vorwärtsendkappe testen zu können, wurde ein Messtand realisiert, der die VPTTs über ein Lichtpulsersystem entweder homogen mit PWO-II äquivalenten Pulsen beleuchtet oder ein Abscannen der Oberfläche erlaubt. Da sich das Kalorimeter in einem bis zu 2 T starken Magnetfeld befinden wird, werden auch Testmessungen im Magnetfeld durchgeführt, um den Verstärkungsfaktor der VPTTs im Magnetfeld zu bestimmen. Der Testaufbau wird hierfür zwischen den Polschuhen eines drehbaren 2 T Elektromagneten eingebaut.

Im Vortrag werden neben dem Aufbau der Messapperatur Ergebnisse aus den Charakterisierungsmessungen der VPTTs aus der ersten Produktionscharge vorgestellt.

Gefördert durch das BMBF(FKZ: 05P12PDFP5).

HK 22.5 Di 15:00 HZ 9

A COME and KISS QDC read-out scheme for the HADES Electromagnetic Calorimeter — •Adrian Rost for the HADES-Collaboration — Technische Universität Darmstadt, Darmstadt

At the future FAIR Facility in Darmstadt the High Acceptance Di-Electron Spectrometer will continue its physics program. For beam energies between 2 and 40 GeV/u the database for pion and eta production is not complete. Therefore, interpretation of future di-electron data would have to depend on interpolations or on theoretical models. The addition of an electromagnetic calorimeter to HADES would allow such measurements and would additionally improve the electron-to-pion separation at large momentum p > 0.4 GeV/c. Furthermore, photon measurement would be of a large interest for the HADES strangeness program.

An 8 channel QDC Front-End-Electronics (FEE) was developed for the signals of photomultipliers (PMTs) from lead-glass calorimeter modules. The measurement principle is to convert the charge of the PMT signals into a pulse, where the charge is encoded in the width of the pulse. The width of the pulses is afterwards measured by the already well-established TRBv3 platform. For that simple electronics, hiding complex operations inside a commercial FPGA is used.

In this contribution the current status and future perspectives of this read-out concept will be shown.

Supported by VIP-QM/VH-NG-823, BMBF (05P12RFGHJ), Helmholtz Alliance EMMI, HIC for FAIR, HGS-HIRe.

HK 22.6 Di 15:15 HZ 9

Temperature-dependent gain compensation of CsI(Tl) detectors using pulse shape analysis* — •Joel Silva[1,2], Johann Isaak[1,2], Bastian Löher[1,2], Deniz Savran[1,2], Matjaz Vencelj[3], and Felix Wamers[1,2] — [1]ExtreMe Matter Institute EMMI and Research Division, GSI Helmholtzzentrum, Darmstadt, Germany — [2]Frankfurt Institute for Advanced Studies FIAS, Frankfurt, Germany — [3]Jožef Stefan Institute, Ljubljana, Slovenia

The scintillation properties of CsI(Tl) crystals and the gain of photosensors such as avalanche photodiodes (APDs) and photo-multipliers (PMs) are temperature dependent. Therefore, for accurate measurements in γ-ray spectroscopy using CsI(Tl) detectors temperature variations have to be precisely monitored. Since the decay time constants in the scintillation process of CsI(Tl) crystals also depend on the temperature, these changes can be compensated by analyzing the 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 results of the implementation of this method using CsI(Tl) crystals read out by PMs are presented. It shows to improve that the energy resolution of the detectors in a temperature changing environment ranging from -10 °C to 40 °C is improved. The suitability of the method using CsI(Tl) read out by APDs was investigated in the same temperature range. First results are also presented.

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

HK 22.7 Di 15:30 HZ 9

The backward end-cap for the PANDA electromagnetic calorimeter — •Luigi Capozza[1,2], Dexu Lin[1], Frank Maas[1,2], Oliver Noll[1], David Rodriguez Pineiro[1,2], and Roserio Valente[1,2] — [1]Helmholtz-Institut Mainz - Johannes Gutenberg-Universität Mainz — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH

The PANDA experiment at the new FAIR facility will cover a broad experimental programme in hadron structure and spectroscopy. As a multipurpose detector, the PANDA spectrometer needs to ensure almost 4π coverage of the scattering solid angle, full and accurate multiple-particle event reconstruction and very good particle identification capabilities. The electromagnetic calorimeter (EMC) will be a key item for many of these aspects. Particle energies ranging from some MeVs to several GeVs have to be measured with a relative resolution of $1\% \oplus 2\%/\sqrt{E/\text{GeV}}$. It will be a homogeneous calorimeter made of $PbWO_4$ crystals and will be operated at -25°C, in order to improve the scintillation light yield. With the exception of the very forward section, the light will be detected by large area avalanche photodiodes. The whole calorimeter has been designed in three sections: a forward end-cap, a central barrel and a backward end-cap (BWEC). In this contribution, a status report on the development of the BWEC will be given.

HK 22.8 Di 15:45 HZ 9

Kühlung und Temperaturbestimmung für die Rückwärtsentkappe des elektromagnetischen Kalorimeters des PANDA-Experiments — •Oliver Noll[1], Luigi Capozza[1,2], Frank Maas[1,2], David Rodriguez Pineiro[1,2], Roserio Valente[1,2] und Dexu Lin[1] — [1]Helmholtz-Institut Mainz - Johannes Gutenberg-Universität Mainz — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH

Das PANDA-Experiment wird am internationalen Beschleunigerzentrum FAIR in Darmstadt aufgebaut und wird ab 2018 Daten zu verschiedenen Themen der Hadronenphysik sammeln. Als Multifunktionsdetektor wird das PANDA-Spektrometer aus einer Vielzahl von Komponenten bestehen, die im Moment entwickelt, getestet und zusammengeführt werden. Das Helmholtz-Institut Mainz (HIM) entwickelt die Rückwärtsendkappe des elektromagnetischen Kalorimeters, die aus 524 Bleiwolframat-Kristallen ($PbWO_4$) besteht. Da die Ausbeute des Szintillationslichtes von $PbWO_4$ bei niedrigen Temperaturen steigt, wird der Detektor bei -25 °C betrieben. Um Linearität und Stabilität der Detektorantwort zu gewährleisten, muss die Temperatur auf 0.1 °C stabil und uniform gehalten werden. Zu diesem Zweck wird ein angemessenes Kühlsystem und eine individuelle Temperaturbestimmung der Kristalle gebraucht. Für die Temperaturmessung wurden aufgrund des beschränkten vorhandenen Platzes extrem flache PT100 Sensoren entwickelt. In diesem Beitrag werden Studien zum Verhalten des Kühlsystem und ein Verfahren zur Eichung der Temperatursensoren präsentiert.

HK 23: Hadronenstruktur und -spektroskopie

Zeit: Dienstag 16:30–18:45 Raum: HZ 1+2

Gruppenbericht HK 23.1 Di 16:30 HZ 1+2

Neuste Ergebnisse der Charm Physik bei BESIII — •Peter Weidenkaff und Wolfgang Gradl für die BESIII-Kollaboration — Universität Mainz

Das BESIII Experiment in Peking untersucht e+e- Kollisonen bei Schwerpunktsenergien zwischen 2.3 und 4.5 GeV. Bei 3.77 GeV liegt der angeregte $c\bar{c}$ Zustand $\Psi(3770)$, dessen Masse knapp über der Produktionsschwelle von $D\bar{D}$ liegt und der daher hauptsächlich in ein Paar Mesonen mit offenem Charm zerfällt. Mit einer Luminosität von 2.9fb^{-1} besitzt BESIII das zur Zeit größte Datensample bei dieser Energie. Wir berichten über die bisherigen Resultate im Bereich der Charm Physik bei BESIII. Die Ergebnisse umfassen Präzisionstests der Gitter-QCD, Vermessung interner Strukturen in Mehrkörperzerfällen und neue obere Schranken für seltene Zerfälle.

Gruppenbericht HK 23.2 Di 17:00 HZ 1+2

η und η' Physik mit dem Crystal Ball am MAMI — •Marc Unverzagt für die A2-Kollaboration — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz

Das Studium der Zerfälle der η und η' Mesonen bietet die Möglichkeit, vielfältige physikalische Askpekte wie das Verständnis der Niederenergie-QCD, C- und CP-Verletzung und elektromagnetiche Übergangsformfaktoren zu studieren. Das Crystal Ball Experiment am Beschleuniger MAMI in Mainz bietet ideale Voraussetzungen, viele Zerfälle der η und η' Mesonen zu untersuchen.

In diesem Vortrag wird zunächst das Crystal Ball at MAMI Experiment vorgestellt. Anschließend werden anhand der neuesten Ergebnisse vom Crystal Ball Experiment wichtige Fragestellungen auf diesem Gebiet diskutiert. Abschließend wird ein Ausblick auf das geplante Programm in Mainz im Bereich η/η' Physik gegeben.

HK 23.3 Di 17:30 HZ 1+2

Determination of the $p\Lambda$ Scattering Length from the Reaction $\vec{p}p \to pK^+\Lambda$ — •Florian Hauenstein for the COSY-TOF-Collaboration — Universität Erlangen-Nürnberg

The $\vec{p}p \to pK^+\Lambda$ reaction was measured with the COSY-TOF detector using a polarized proton beam of 2.70 GeV/c. Beside the studies of the production mechanism via Dalitz plot and polarization observables the measurement allows to extract the $p\Lambda$ scattering length from the final state interaction in the $p\Lambda$ invariant mass spectrum. Furthermore it is possible to get the spin triplet $p\Lambda$ scattering length using the dependence of the Kaon analyzing power on the invariant mass.

In this talk the extraction principle will be shown and preliminary results on the spin averaged and spin triplet $p\Lambda$ scattering length as well as the Kaon analyzing power and its dependence on the invariant mass will be given. In contrast to the published COSY-TOF results at 2.95 GeV/c the symmetric part of the analyzing power does not vanish for low $p\Lambda$ masses and so a determination of the spin triplet $p\Lambda$ scattering length is possible.

Supported by FZ-Jülich.

HK 23.4 Di 17:45 HZ 1+2

Study of chiral dynamics in $\pi^-\pi^0\pi^0$ production in Primakoff reactions at COMPASS — •Markus Krämer — TU-München Phisikdepartment E18, James-Franck-Str. 1, Garching

COMPASS is a fixed-target experiment at CERN, which uses muon and hadron beams produced at the SPS to address a wide variety of physics topics. In 2009 during a two-week long period data were recorded in order to study the Primakoff reaction by colliding a 190 GeV/c pion beam on a nickel target. A partial-wave analysis of this data allows to measure the absolute cross section of the reaction $\pi^-\gamma \to \pi^-\pi 0\pi 0$, which is predicted by chiral perturbation theory. The analysis of this reaction will be presented.

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

HK 23.5 Di 18:00 HZ 1+2

Energy Calibration for the Forward Detector at WASA-at-COSY — •Kay Demmich, Florian Bergmann, Patrice Hüsemann, Nils Hüsken, Alexander Täschner, and Alfons Khoukaz for the WASA-at-COSY-Collaboration — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster

Studies on rare and forbidden decays of light mesons are one main aspect of the WASA-at-COSY physics program. In this context a large data set of η mesons has been produced in proton proton scattering in order to investigate the decay properties of this meson. This high statistic measurement allows, e.g., for the search for the C parity violating reaction $\eta \to \pi^0 + e^+ + e^-$, for which only an upper limit for the relative branching ratio of 4×10^{-5} is quoted by the particle data group. The analysis of this forbidden decay channel relies on an effective separation of the physical background which is mainly caused by the direct pion production. To handle this background a missing mass analysis and kinematic fitting will be applied. Since both methods rely on a high energy resolution of the forward detector this detector, which measures the proton energies, has to be calibrated very carefully. In this contribution, a new calibration software is presented which has been developed especially for proton-proton measurements, and which allows for a precise determination of the calibration parameters by the mean of a graphical user interface and a dedicated fitting algorithm. Moreover, with this tool a run-by-run calibration can be realised. First results of the improved calibration will be presented.

*Supported by COSY-FFE grants

HK 23.6 Di 18:15 HZ 1+2

D^0-$\bar{D}^0$-Mischung im Zerfall $D^0 \to K_s\pi^+\pi^-$ bei $\overline{\text{P}}$ANDA * — •Andreas Pitka, Kai-Thomas Brinkmann, Hans-Georg Zaunick, Robert Schnell und Tommaso Quagli — II. Physikalisches Institut, Justus-Liebig-Universität Gießen, Heinrich-Buff-Ring 16, D 35392 Gießen

Im Rahmen des Standardmodells der Teilchenphysik gibt es lediglich vier Teilchen die quantenmechanisch mit ihren Antiteilchen mischen (K,D,B,B_s). Das $D^0/\bar{D}^0$-System kann am zukünftigen $\overline{\text{P}}$ANDA-Experiment anhand der Reaktion $\bar{p}p \to \psi(3770) \to D^0\bar{D}^0$ studiert werden. Die D-Mesonen befinden sich hierbei in einem quantenkorrelierten Zustand, eine zeitabhängige Dalitz-Plot-Analyse des sukzessiven Zerfalls $D^0 \to K_s\pi^+\pi^-$ erlaubt die Extraktion der Mischungsparameter sowie den Test auf CP-Verletzung. Anhand einer Monte-Carlo-Simulation im PandaRoot Framework wird gezeigt, inwieweit sich der untersuchte Kanal vom hadronischen Untergrund trennen lässt und mit welcher Genauigkeit die Mischungsparameter durch einen ungebinnten Likelihood Fit bestimmt werden können.

* gefördert durch BMBF und HIC for FAIR

HK 23.7 Di 18:30 HZ 1+2

IN SEARCH OF THE BOX ANOMALY BY STUDYING $\eta \to \pi^+\pi^-\gamma$ — •Lersch Daniel for the WASA-at-COSY-Collaboration — Jülich Center for Hadron Physics, Forschungszentrum Jülich, Germany

The decay $\eta \to \pi^+\pi^-\gamma$ is a suitable tool to study QCD anomalies. At the chiral limit, this decay is solely driven by the box anomaly term, which is part of the Wess-Zumino-Witten-(WZW) Lagrangian. However, at non zero meson masses, the triangle anomaly (also part of the WZW Lagrangian) dominates the box anomaly, because of the final state interactions between the two pions. Thus, a correct theoretical description of this decay can only be achieved by including final state interactions.

The experimental observables to test the interaction models are either the branching (done by CLEO and KLOE) or the distribution of the single photon energy, which has been recently measured in the reaction $pd \to {}^3He[\eta \to \pi^+\pi^-\gamma]$ 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: $pp \to pp[\eta \to \pi^+\pi^-\gamma]$. The data have been acquired during an 8 week experiment in spring 2010.

First results will show, how the channel $\eta \to \pi^+\pi^-\gamma$ is selected and how the experimental observables are determined afterwards.

HK 24: Struktur und Dynamik von Kernen

Zeit: Dienstag 16:30–18:45 Raum: HZ 4

Gruppenbericht HK 24.1 Di 16:30 HZ 4

Study of mixed-symmetric excitations via inelastic proton scattering — •Andreas Hennig[1], Vera Derya[1], Michael Elvers[1,2], Janis Endres[1], Andreas Heinz[2,3], Simon G. Pickstone[1], Desiree Radeck[1,2], Deniz Savran[5,6], Mark Spieker[1], Volker Werner[2,4], and Andreas Zilges[1] — [1]Institute for Nuclear Physics, University of Cologne — [2]Wright Nuclear Structure Laboratory, Yale University — [3]Department of Fundamental Physics, Chalmers University of Technology, Göteborg — [4]Institute for Nuclear Physics, TU Darmstadt — [5]Extreme Matter Institute EMMI and Research Division, GSI Darmstadt — [6]Frankfurt Institute for Advanced Studies FIAS, Frankfurt

Mixed-symmetric excitations are particularly sensitive to the proton-neutron interaction in atomic nuclei. The stable N=52 isotones have been studied extensively in the last decade. Nevertheless, experimental information on the heaviest stable isotone, ^{96}Ru, is still sparse. We have performed two experiments, one at the YRAST ball spectrometer at WNSL, Yale, the other at the SONIC&HORUS spectrometer in Cologne. Predominantly low-spin excitations were populated in ^{96}Ru by means of inelastic proton scattering via isobaric analog resonances in both cases. The proton-γ coincidence data of the Cologne experiment allows to extract nuclear level lifetimes using the Doppler-shift attenuation method (DSAM). Therewith, mixed-symmetry excitations can be identified based on absolute transition strengths.
Supported by the DFG (ZI-510/4-2) and US DOE Grant No. DE-FG02-01ER40609.

HK 24.2 Di 17:00 HZ 4

Probing the O(6) character of ^{196}Pt with inelastic electron scattering — •Simela Aslanidou, Andreas Krugmann, Peter von Neumann-Cosel, and Norbert Pietralla — Institut für Kernphysik, Technische Universität Darmstadt

The Interacting-Boson-Model [1] provides an elegant tool to classify low lying collective states in medium and heavy mass even-even nuclei. One of its dynamical symmetries is O(6) and a crucial test of this theory is to investigate the monopole transitions to the band head of the K=0 , σ=N-2 band.
A powerful tool to investigate monopole transitions is inelastic electron scattering. An experiment on ^{196}Pt -claimed to be a perfect O(6) nucleus [2]- has recently been performed at the superconducting electron linear accelerator S-DALINAC at Darmstadt using the high resolution LINTOTT spectrometer.
The experiment and preliminary results will be presented.
This work is supported by the DFG under contract SFB 634

[1] F. Iachello, Phys. Rev. Lett. 87, 052502 (2001)
[2] J. Cizewski et al., Phys. Rev. Lett. 40, 167 (1978)

HK 24.3 Di 17:15 HZ 4

Untersuchung des gemischt-symmetrischen Ein-Phononen-$2^+_{1,ms}$-Zustands in den schweren Isotopen ^{202,204}Hg — •Robert Stegmann[1], Thomas Möller[1], Norbert Pietralla[1], Georgi Rainovski[2], Christian Stahl[1], Marc Lettmann[1], Robert Janssens[3], Mike Carpenter[3] und Shaofei Zhu[3] — [1]Institut für Kernphysik, TU Darmstadt — [2]Faculty of Physics, St. Kliment Ohridski University Sofia, Bulgarien — [3]Argonne National Laboratory, Argonne, IL, USA

Im Rahmen des Interacting Boson Modells ergeben sich Proton-Neutron gemischt-symmetrische Zustände als Vertreter niedrigliegender Anregungen mit isovektoriellem Charakter. Der grundlegende gemischt-symmetrische Zustand in schwach kollektiven vibrationellen Kernen ist der stark mit dem 2^+_1-Zustand verwandte Ein-Quadrupol-Phonon-$2^+_{1,ms}$-Zustand. Bisher wurden solche Zustände in stabilen Kernen der Region um $A \approx 90$ und kürzlich auch um $A \approx 130$ untersucht. In der Umgebung des schwersten stabilen doppeltmagischen Kerns ^{208}Pb hingegen wurden bisher noch keine solchen Zustände identifiziert. Als einzig stabiler Kern in der unmittelbaren Nachbarschaft mit $2\pi - 2\nu$-Struktur erweist sich ^{204}Hg. Aus diesem Grund wurde am Argonne National Laboratory ein Experiment durchgeführt, bei dem ^{202,204}Hg-Projektile mit dem ATLAS-Beschleuniger auf je 890 MeV beschleunigt und beim Durchgang durch ein ^{nat}C-Target Coulomb-angeregt wurden. Gammastrahlung wurde mit dem Gammasphere-Spektrometer detektiert. Vorläufige Ergebnisse werden präsentiert.
Gefördert durch die DFG unter Pi 393/2-3.

HK 24.4 Di 17:30 HZ 4

Partielle $O(6)$ und quasi $SU(3)$ Symmetrie in rotorartigen Kernen — •Christoph Kremer[1], Norbert Pietralla[1], Jacob Beller[1], Ami Leviatan[2], Georgi Rainovski[3], Richard Trippel[1] und Piet Van Isacker[4] — [1]TU Darmstadt — [2]The Hebrew University of Jerusalem — [3]St. Kliment Ohridski University of Sofia — [4]Grand Accélérateur National d'Ions Lourds

Das Interacting Boson Model-1 (IBM-1) eignet sich zur Beschreibung kollektiver Anregungen von Kernen mit gerader Protonen und gerader Neutronenzahl [1]. Eine besondere Rolle innerhalb des IBM-1 nehmen die dynamischen Symmetrien $U(5)$, $O(6)$ und $SU(3)$ ein, die im geometrischen Modell vibratorartigen, gamma-weichen und rotorartigen Kernen entsprechen. Die Verbindung zwischen quasi-dynamischen (QDS) und partiellen, dynamischen Symmetrien (PDS) wird am Beispiel einer $O(6)$-PDS und einer $SU(3)$-QDS untersucht. Das kohärente Mischen der Basiszustände einer Symmetrie (QDS) kann zur Erhaltung von Teilen einer anderen, inkompatiblen Symmetrie bei einem Teil der Zustände (PDS) [2] führen. Unter Verwendung von [3] werden Kerne identifiziert, die gleichzeitig sowohl eine $O(6)$-PDS als auch eine $SU(3)$-QDS aufweisen.

[1] F. Iachello and A. Arima, *The Interacting Boson Model*, (Cambridge 1987)
[2] C. Kremer *et al.*, zur Veröffentlichung eingereicht
[3] E. A McCutchan *et al.*, Phys. Rev. **C 69** 064306 (2004)
Gefördert durch die DFG unter der Fördernummer SFB 634.

HK 24.5 Di 17:45 HZ 4

Kernstrukturuntersuchungen von ^{180}Os und ^{181}Os — •C. Fransen[1], T. Pissulla[1], T. Braunroth[1], G. de Angelis[2], A. Dewald[1], G. Friessner[1], J. Jolie[1], M. Hackstein[1], C. Michelagnoli[2], O. Möller[3], P. Petkov[5], C. Ur[4] und K.O. Zell[1] — [1]Institut für Kernphysik, Universität zu Köln — [2]INFN, Laboratori Nazionali di Legnaro, Italien — [3]Institut für Kernphysik, TU Darmstadt — [4]INFN Padua, Italien — [5]INRNE, Sofia, Bulgarien

Neutronenarme Kerne um A=180 sind von besonderem Interesse für Kernstrukturuntersuchungen, da verschiedenste Modelle wie das Interacting Boson Model, das General Collective Model und mikroskopische Rechnungen zu Energiedichte-Funktionalen eine oblat-prolate Formkoexistenz vorhersagen. Das Verhalten der Pt-Isotope um A=180 belegt dies. Andererseits zeigen Eigenschaften der tiefsten Banden von ^{176,178}Os, dass sich diese Kerne gut als X(5)-Kerne am kritischen Punkt des Formphasenübergangs von axialsymmetrischen Rotoren zu sphärischen Vibratoren beschreiben lassen. Dies motiviert die Untersuchung, inwieweit in dieser Region mit stark variierenden Eigenschaften weitere X(5)-Kerne identifiziert werden können, und inwieweit die genannten Modellrechnungen ein schlüssiges Bild liefern können. Hier werden die Ergebnisse eines Experiments zur Messung absoluter Übergangsstärken in ^{180}Os vorgestellt. Zusätzlich werden neue Daten des ungeraden Nachbarkerns ^{181}Os präsentiert, der durch ein freies Teilchen angekoppelt an ^{180}Os im Rahmen des Partikel-Triaxial-Rotor Modells zufriedenstellend beschrieben werden kann.
Gefördert durch das BMBF, Fördernr. 05P12PKFNE.

HK 24.6 Di 18:00 HZ 4

Präzise Untersuchung der Zerfallseigenschaften $J^\pi = 1^+$ Zustände der Scherenmode in ^{156}Gd* — •Tobias Beck[1], J. Beller[1], V. Derya[2], J. Isaak[3,4], B. Löher[3,4], N. Pietralla[1], C. Romig[1], M. Scheck[1,5,6], W. Tornow[7], H.R. Weller[7] und M. Zweidinger[1] — [1]IKP, TU Darmstadt — [2]IKP, Universität zu Köln — [3]EMMI, GSI, Darmstadt — [4]FIAS, Frankfurt — [5]School of Engineering, UWS Paisley, UK — [6]SUPA, Glasgow, UK — [7]Duke University, Durham, USA

Die Scherenmode, eine isovektorielle, niederenergetische $K = 1$ Anregung deformierter Kerne, wurde bisher hauptsächlich in (e,e') und (γ,γ') Experimenten untersucht, wobei letztere Experimente mit kontinuierlicher Bremsstrahlung nur auf starke Zerfallskanäle sensitiv sind. Daher wurde bisher angenommen, dass die 1^+_{sc} Scherenmodenzustände nur mit der Grundzustandsbande koppeln. Mittels zweier Kernreso-

nanzfluoreszenzexperimente mit quasi-monoenergetischen, linear polarisierten Photonen am γ^3-Messaufbau [1] an der High-Intensity $\vec{\gamma}$-Ray Source der Duke University, Durham, NC, wurde die Scherenmode in ^{156}Gd untersucht. Aus γ-Winkelverteilungen wurde – unter Zuhilfenahme der Alaga-Regel – für vier Zustände der Scherenmode das Multipolmischungsverhältnis des Übergangs $1^+_{sc} \to 2^+_1$ bestimmt. Für den 1^+_{sc} Zustand bei 3.07 MeV wurden Verzweigungsverhältnisse in neun tiefliegende Zustände untersucht, wobei drei neue Zerfälle beobachtet wurden.

[1] Löher *et al.*, Nucl. Intrum. Methods Phys. A 723 (2013) 136.

*Gefördert durch die DFG im Rahmen des SFB 634.

HK 24.7 Di 18:15 HZ 4

Octupole Correlations in Excited 0^+ States of the Actinides — •Mark Spieker[1], Dorel Bucurescu[2], Janis Endres[1], Thomas Faestermann[3], Ralf Hertenberger[4], Sorin Pascu[2], Hans-Friedrich Wirth[4], Nicolae-Victor Zamfir[2], and Andreas Zilges[1] — [1]Institute for Nuclear Physics, University of Cologne, Germany — [2]Horia Hulubei National Institute of Physics and Nuclear Engineering, Bucharest, Romania — [3]Physik Department, Technische Universität München, Munich, Germany — [4]Fakultät für Physik, Ludwig-Maximilians-Universität München, Munich, Germany

New experimental data has once again shown the importance of the octupole degree of freedom in the actindes. To further study possible admixtures of double-octupole structures to the wave function of positive-parity states, a high-resolution *(p,t)* experiment on ^{242}Pu has been recently performed at the Q3D magnetic spectrograph in Munich. Excited 0^+ states were populated in ^{240}Pu up to an excitation energy of 3 MeV. The new data allowed for a stringent test of the predictions of the *spdf* interacting boson model. In order to find possible double-octupole 0^+ candidates in the actinides, the signature of close-lying first and second excited 0^+ states has been proposed. It is found that the observation of this signature coincides with an *E1* γ-decay of the first excited 0^+ state, while this state is strongly populated in the *(p,t)* reaction [1].

Supported by the DFG (ZI-510/4-2).

[1] M. Spieker *et al.*, Phys. Rev. C **88** (2013) 041303(R)

HK 24.8 Di 18:30 HZ 4

Identifikation niederenergetischer isovektorieller Oktupol-Zustände in ^{144}Nd — •Michael Thürauf für die EXILL-Kollaboration — Institut für Kernphysik, TU Darmstadt

Kürzlich wurden erste Kandidaten für tiefliegende isovektorielle Anregungen, sog. „mixed-symmetry“ Zustände, im Oktupolsektor vorgeschlagen. Diese Klasse von Zuständen wurde im Rahmen des Interacting-Boson-Modell (IBM-2) vorhergesagt. Die sichere Identifikation liefert einen wesentlichen Beitrag zur Dekomposition der Oktupol-Oktupol-Restwechselwirkung in einen isoskalaren und isovektoriellen Anteil. Dies trägt wesentlich zum Verständnis des Oktupolfreiheitsgrades bei.

In ^{144}Nd ist der 3^--Zustand bei 2778 keV ein guter Kandidat für einen solchen „mixed-symmetry“ Oktupol-Zustand. Um die Natur dieses Zustandes zu klären, wurde 2012 im Verlauf der (n,γ)-Kampagne mit dem EX@ILL-Aufbau am ILL, Grenoble, ein Experiment ^{143}Nd$(n,\gamma)^{144}$Nd durchgeführt. Nach dem Einfang eines Neutrons werden 3^--Zustände vom Einfangszustand aus bevölkert. EX@ILL bietet die Möglichkeit, die Multipolmischungsverhältnisse der Übergänge $3^-_i \to 3^-_1$ zu bestimmen und damit die Natur der 3^-_i-Zustände festzulegen. Für den Übergang von einem „mixed-symmetry“ Oktupol-Zustand in den symmetrischen 3^-_1-Zustand erwartet man eine starke $M1$-Komponente. Erste vorläufige Spektren werden hierzu gezeigt.

Gefördert durch die DFG (KR 1796/2-1).

HK 25: Struktur und Dynamik von Kernen

Zeit: Dienstag 16:30–19:00 Raum: HZ 5

Gruppenbericht HK 25.1 Di 16:30 HZ 5

Untersuchung der Neutronenhautdicke bei mittleren und schweren Kernen mit mannigfaltigen experimentellen Techniken — •Michaela Thiel für die NeSS-Kollaboration — Institut für Kernphysik, JGU Mainz, Deutschland

Experimente zur Bestimmung der Neutronenhautdicke stellen heutzutage ein immer wichtigeres Bindeglied zwischen Kern- und Astrophysik dar. Dabei nutzt man den Zusammenhang zwischen Neutronenhautdicke und kernphysikalischer Zustandsgleichung zur Aufstellung maßgeblicher Randbedingungen für die Beschreibung von Neutronensternen. Die erste modellunabhängige Bestimmung der Neutronenhautdicke konnte 2010 anhand paritätsverletzender Elektronstreuung an einem Bleitarget im Rahmen des PREX Experiments am Jefferson Laboratory erzielt werden. Für eine Verifizierung dieses Ergebnisses sind zwei Messprogramme innerhalb des Instituts für Kernphysik (Mainz) geplant. Ebenfalls unter Ausnutzung von paritätsverletzender Elektronstreuung sind Experimente sowohl innerhalb der A1-Kollaboration mit dem existierenden Beschleuniger MAMI als auch mit dem zukünftigen Beschleuniger MESA im Rahmen der P2-Kollaboration geplant. Ziel ist die Bestimmung der paritätsverletzenden Asymmetrie mit einer Genauigkeit von 1%. Eine alternative Messmethode zur Bestimmung der Neutronenhautdicke stellt die kohärente Pion-Photoproduktion dar. Bei einem im Rahmen der A2-Kollaboration durchgeführten Experiment war die systematische Bestimmung der Neutronenhautdicke von drei Kernen aus der Zinn-Isotopenreihe von besonderem Interesse. Status und Perspektiven der drei Messprogramme werden vorgestellt.

Gruppenbericht HK 25.2 Di 17:00 HZ 5

Status of the R^{3}B Experiment — •Haik Simon for the R3B-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Planckstr. 1, D-64291 Darmstadt

The R^{3}B experiment aims at reaction studies using relativistic secondary beams, with a versatile setup, including a large target spectrometer (CALIFA), surounded by a silicon tracking system, a very efficient neutron time-of-flight spectrometer (NeuLAND) a superconducting dipole magnet (GLAD) and a high-rate capaple tracking system for heavy ions through the entire setup. The R^{3}B experiment, in it's precursor form, will be set up next year at Cave-C at the existing GSI facility and being used for tests of prototypes of the detectors around the newly to be installed GLAD magnet.

In this presentation I'd like to survey the progress and new developments being made for the different components of the setup.

Supported by LOEWE (HIC for FAIR), EMMI, and the BMBF

HK 25.3 Di 17:30 HZ 5

Microscopic calculations and energy expansions for neutron-rich matter — •Christian Drischler[1,2], Vittorio Somà[1,2], and Achim Schwenk[2,1] — [1]Institut für Kernphysik, Technische Universität Darmstadt — [2]ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung GmbH

We investigate the properties of asymmetric nuclear matter with two- and three-nucleon interactions based on chiral effective field theory. Focusing on neutron-rich matter, we calculate the energy for different proton fractions and include estimates of the theoretical uncertainty. We use our ab-initio results to test the quadratic expansion around symmetric matter with the symmetry energy term, and confirm its validity for highly asymmetric systems. Our calculated energy densities are in remarkable agreement with an empirical parameterization, developed to interpolate between pure neutron and symmetric nuclear matter. These findings are very useful for astrophysical applications and for developing new equations of state.

*This work was supported by the DFG through Grant SFB 634, the Helmholtz Alliance HA216/EMMI and the ERC Grant No. 307986 STRONGINT.

HK 25.4 Di 17:45 HZ 5

Four-Body Forces in Ab Initio Nuclear Structure — •Stefan Schulz, Angelo Calci, and Robert Roth — Institut für Kernphysik, Technische Universität Darmstadt

Nucleon-nucleon (NN) and three-nucleon (3N) interactions derived from chiral effective field theory, transformed using the similarity renormalization group (SRG), have been successful in the ab initio description of nuclear-structure. Previous investigations have shown strong indications for sizable effects originating by SRG-induced four-

nucleon (4N) contributions.

To obtain reliable results, the 4N contributions can either be suppressed or included in nuclear-structure calculations. We present an efficient scheme to take induced as well as initial 4N forces into account by performing the SRG transformation in four-body space and extending the importance-truncated no-core shell model (IT-NCSM) for their explicit inclusion. We investigate the effect of induced forces beyond the three-body level in ab intio nuclear-structure calculations and present results for p-shell nuclei up to ^{16}O.

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

HK 25.5 Di 18:00 HZ 5

Erstes EXL-Experiment mit radioaktiven Strahlen am ESR: Protonstreuung an ^{56}Ni — •Mirko von Schmid für die EXL E105-Kollaboration — Institut für Kernphysik, TU Darmstadt

EXL, „**EX**otic nuclei studied in **L**ight-ion induced reactions at the NESR storage-ring“, ist ein Projekt innerhalb von NUSTAR bei FAIR. Der Detektor für targetähnliche, leichte Rückstoßionen soll 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.

2012 wurde am existierenden ESR („**E**xperimental **S**torage **R**ing“, GSI) im Rahmen des laufenden EXL-Experimentierprogramms (E105) mit der Reaktion ^{56}Ni(p,p)^{56}Ni zum ersten Mal erfolgreich eine Kernreaktion mit gespeicherten, exotischen Schwerionen untersucht. Im Rahmen der Auswertung wurde der differentielle Wirkungsquerschnitt für die Reaktion ermittelt, um die radiale Dichteverteilung der Kernmaterie von ^{56}Ni zu bestimmen. Der Vortrag wird den aktuellen Stand der Analyse diskutieren und erste, vorläufige Ergebnisse präsentieren.

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

HK 25.6 Di 18:15 HZ 5

The neutron-rich oxygen isotopes ^{25,26}O — •Christoph Caesar for the R3B-Collaboration — TU Darmstadt, Institut für Kernphysik, Germany

The R3B-collaboration has studied the neutron-rich oxygen isotopes ^{25,26}O by utilizing a kinematically complete measurement at relativistic beam energies with the R3B-LAND-setup[1]. The isotopes of interest have been populated via proton removal from ^{26,27}F, respectively. The ground-state masses of both isotopes have been extracted: $E_r(^{25}\mathrm{O(gs)}) = 725^{+54}_{-29}$ keV; $E_r(^{26}\mathrm{O(gs)}) \leqslant 40/120$ (68%/95% c.l.) keV. Furthermore, limits on the lifetime of both ground-states have been extracted for the first time: $\tau(^{25}\mathrm{O(gs)}) \geq 8.2 \times 10^{-12}$ ns; $\tau(^{26}\mathrm{O(gs)}) \leqslant 5.7$ ns.

The determined ground-state energies have been compared to theoretical shell-model calculations based on chiral effective field theory potentials using chiral NN and 3N forces. In addition residual three-valence-neutron forces, which become more important with increasing neutron number along isotopic chains are included. This work is supported by ‘BMBF project 06 DA 7047 l’, ‘GSI TU Darmstadt Cooperation Contract’, ‘HIC for FAIR’ and ‘NAVI’.

[1] C.Caesar *et al.* Phys. Rev. C **88** (2013) 034313

HK 25.7 Di 18:30 HZ 5

***Ab Initio* Study of Neutron Drops with Chiral NN+3N Interactions** — •Sebastian Fischer, Robert Roth, Angelo Calci, and Joachim Langhammer — Institut für Kernphysik, Technische Universität Darmstadt

Neutron drops provide a simple test system of neutron-rich matter. Hence, *ab initio* calculations of these pure neutron systems may be used to constrain the large isospin properties of energy-density functionals and equations of state that are used for the description of very neutron-rich systems as they occur in astrophysical environments, e.g., neutron stars.

For the first time, we calculate properties of neutron drops interacting via realistic two- and three-nucleon forces derived from chiral effective field theory using the *ab initio* importance-truncated no-core shell model (IT-NCSM). In contrast to nuclei, systems consisting of only neutrons are not self-bound and, therefore, need to be confined in an external potential well. Variations of the external potential, typically a harmonic oscillator potential, can be used to explore different density regimes.

With this input, we compute a range of different properties of neutron drops, such as ground-state energies, radial densities and excitation energies, and compare our IT-NCSM results to previous calculations performed by using phenomenological interactions.

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

HK 25.8 Di 18:45 HZ 5

Ground-state deformation of Cs isotopes — •Dinko Atanasov for the ISOLTRAP-Collaboration — Max Planck Institute for Nuclear Physics, Heidelberg, Germany

We have performed precision mass measurements of several Cs ($Z = 55$) isotopes using a four-trap mass spectrometer ISOLTRAP, situated at ISOLDE/CERN. The experimental setup consists of an RFQ buncher and cooler, a multi-reflection time-of-flight mass separator and two Penning traps. This scheme allows routinely performing precision mass measurements on short-lived nuclides with a relative mass uncertainty of typically 1E-8. The mass of the neutron-rich ^{148}Cs nuclide was measured for the first time. In addition, the masses of ^{132,147}Cs isotopes were re-measured and found to deviate from the latest atomic-mass evaluation (AME2012). Nuclides found in transitional regions between spherical and deformed nuclear shapes are of particular importance for developing theoretical models. One such example of odd-Z mid-shell nuclei are neutron-rich Cs isotopes. The isotope ^{148}Cs is located in a region of the nuclear chart where the emergence of complex intrinsic shapes are expected such as a negative value for the hexadecapole deformation parameter of nuclear ground-state. For the interpretation of the data we investigated the systematics of ground-state properties such as charge radii or two-neutron separation energies and made an extensive comparison to theoretical predictions. Details of the measurements as well as the new results will be presented.

HK 26: Schwerionenkollisionen und QCD Phasen

Zeit: Dienstag 16:30–19:00 Raum: HZ 6

Gruppenbericht HK 26.1 Di 16:30 HZ 6

Shear viscosity from a large-Nc NJL model — •Robert Lang[1,3], Tetsuo Hatsuda[3], Norbert Kaiser[1], and Wolfram Weise[2,1] — [1]TUM Physik Department, Garching, Germany — [2]ECT* Villa Tambosi, Villazzano (TN), Italy — [3]RIKEN Nishina Center, Wakoshi, Japan

We investigate the shear viscosity to entropy ratio within the vicinity of the chiral phase transition/crossover using the NJL model in a large-Nc expansion. As heavy-ion collisions at RHIC and LHC in combination with hydrodynamic simulations suggest, this ratio is close to the AdS/CFT benchmark. This indicates a strongly correlated state of matter produced in such collisions. We study in detail the non-perturbative structure of the NJL model and the question if resummation techniques are required. In the large-Nc expansion next-to-leading-order contributions to the shear viscosity are derived.

HK 26.2 Di 17:00 HZ 6

Equation of State and Viscosities from a Gravity Dual of the Gluon Plasma — •Roman Yaresko[1,2] and Burkhard Kaempfer[1,2] — [1]Helmholtz-Zentrum Dresden-Rossendorf — [2]TU Dresden

Employing new precision data of the equation of state of the SU(3) Yang-Mills theory (gluon plasma) several dilaton potentials are adjusted in a holographic gravity-scalar set-up in the temperature range $(1-10)T_c$. The relation between the potentials is investigated. The results suggest that the shape of the potentials in the region corresponding to the above temperature interval (parameterized by the horizon position of a black brane embedded in an asymptotically AdS Riemann space) is the same in each case and, in particular, independent of any assumed UV or IR asymptotics. We further observe that the holographically calculated bulk viscosity, based on the AdS/CFT duality, is determined entirely by the equation of state, i.e. is the same for different potentials which fit the lattice data equally well. We find

the ratio of bulk viscosity to shear viscosity to be $\zeta/\eta \approx \pi\Delta v_s^2$ for $\Delta v_s^2 < 0.2$, where $\Delta v_s^2 \equiv 1/3 - v_s^2$ is the non-conformality measure and v_s^2 is the squared velocity of sound. The inclusion of quark degrees of freedom is discussed to arrive at a dual description (equation of state and transport coefficients) of the quark-gluon plasma in the strong-coupling regime, as relevant for heavy-ion collisions at LHC and RHIC.

HK 26.3 Di 17:15 HZ 6

On- and off-shell heavy quark transport properties in the quark gluon plasma (QGP) — •Hamza Berrehrah[1], Elena Bratkovskaya[1], Wolfgang Cassing[2], Pol-Bernard Gossiaux[3], and Jörg Aichelin[3] — [1]FIAS, Frankfurt, Germany — [2]ITP, Giessen, Germany — [3]Subatech, Nantes, France

Within the aim of a dynamical study of on- and off-shell heavy quarks Q in the quark gluon plasma (QGP) [1] - as produced in relativistic nucleus-nucleus collisions - we study the heavy quark collisional scattering on partons of the QGP and the underlying transport properties. The elastic cross sections are evaluated for perturbative partons (massless on-shell particles) and for dynamical quasi-particles (massive off-shell particles as described by the dynamical quasi-particles model DQPM) using the leading order Born diagrams [2]. Correspondingly, the on- and off-shell heavy quark dynamical collisional energy loss and transport coefficients are computed [3]. Within our study, we demonstrate the influence of the finite width of the quasi-particles on heavy quarks scattering. We, furthermore, provide a comprehensive comparison between perturbative and non-perturbative QCD based models on the determination of the heavy quark transport coefficients (drag and diffusion, longitudinal and transverse Q momentum fluctuations, etc.).

[1] W. Cassing, and E. L. Bratkovskaya, Nucl.Phys. A831 (2009) 215-242. [2] H. Berrehrah, E. Bratkovskaya, W. Cassing, P.B. Gossiaux, J. Aichelin, and M. Bleicher, arXiv:1308.5148. [3] H. Berrehrah, E. Bratkovskaya, W. Cassing, P.B. Gossiaux and J. Aichelin, to be submitted.

HK 26.4 Di 17:30 HZ 6

The second order hydrodynamic transport coefficient κ for the gluon plasma from the lattice — •Christian Schäfer and Owe Philipsen — Goethe-Universität, Frankfurt am Main, Germany

The quark gluon plasma produced in heavy ion collisions behaves like an almost ideal fluid described by viscous hydrodynamics with a number of transport coefficients. These are difficult to calculate in lattice QCD because of their real time nature. The second order coefficient κ is related to a Euclidean correlator of the energy-momentum tensor at vanishing frequency and low momentum. This allows for a lattice determination without maximum entropy methods or modelling, but the required lattice sizes represent a formidable challenge. We calculate κ in leading order lattice perturbation theory and simulations on $120^3 \times 6,8$ lattices with $a < 0.1$ fm. In the temperature range $2T_c - 10T_c$ we find $\kappa = 0.36(15)T^2$. Remarkably, this result is smaller than predicted by the AdS/CFT correspondence, but consistent with perturbation theory.

HK 26.5 Di 17:45 HZ 6

Event-by-Event Particle Multiplicity Fluctuations in Pb-Pb collisions with ALICE — •Mesut Arslandok for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

The study of event-by-event fluctuations of identified hadrons may reveal the degrees of freedom of the strongly interacting mater created in heavy-ion collisions. Particle identification that is based on the measurement of the specific ionization energy loss dE/dx works well on a statistical basis, however, suffers from ambiguities when applied on the event-by-event level. A novel experimental technique called the "Identity Method" was recently proposed to overcome such limitations. The method follows a probabilistic approach using the inclusive dE/dx distributions measured in the ALICE TPC, and determines the moments of the multiplicity distributions by an unfolding procedure. In this contribution, the status of an event-by-event fluctuation analysis that applies the Identity Method to Pb-Pb data from ALICE will be presented.

Supported by BMBF and the Helmholtz Association.

HK 26.6 Di 18:00 HZ 6

Probing the QCD matter close to the phase transition with net-particle fluctuations measured by ALICE at the LHC — •Jochen Thäder for the ALICE-Collaboration — Research Division and ExtreMe Matter Institute, GSI Helmholtzzentrum für Schwerionenforschung, Planckstr. 1, 64291 Darmstadt — Institut für Kernphysik, Technische Universität Darmstadt, Schlossgrabenstr. 9, 64289 Darmstadt

An event-by-event asymmetry in the number of particles and antiparticles produced at mid-rapidity in heavy-ion collisions can be related to fluctuations of the conserved quantities such as baryon number or charge in the strongly coupled quark-gluon plasma. Lattice calculations suggest that higher moments of the net-proton and the net-charge distributions are sensitive to the thermodynamic susceptibilities of the system.

The status of the event-by-event net-proton distribution and its higher moments measurement, taking the reconstruction efficiency into account, will be presented for Pb-Pb collisions at $\sqrt{s_{NN}} = 2.76$ TeV using the tracking and particle identification of the Time Projection Chamber of the ALICE apparatus at the LHC. Different methods will be compared and limits arising for the experimental data will be shown. Furthermore, results from net-charge fluctuations measured by the ALICE collaboration, their higher moments, and a comparison to the theoretical predictions will be presented.

HK 26.7 Di 18:15 HZ 6

Longitudinal thermalization via the Chromo-Weibel instability — •Maximilian Attems — Frankfurt Institute for Advanced Studies

Non-Abelian instabilities play a crucial role in the non-equilibrium dynamics of a weakly coupled Quark-Gluon Plasma. In particular, it has been proposed that this collective phenomenon may be the mechanism behind the fast thermalization of the plasma in ultra-relativistic heavy ion collisions. In this context, I will discuss recent advances in the understanding of the exponential growth and isotropization of soft unstable chromo-magnetic fields at short times which are produced by the Chromo-Weibel instabilities. The necessary momentum-space anisotropy that drives the instabilities is produced by the color-glass-condensate initial state. Using the discretized hard loop framework we simulate the 3D+3V realtime evolution of the soft gluonic fields in a longitudinally free streaming expanding background.

HK 26.8 Di 18:30 HZ 6

Spinodal amplification of density fluctuations in fluid-dynamical simulations of relativistic nuclear collisions — •Jan Steinheimer[1], Jorgen Randrup[2], and Volker Koch[2] — [1]Frankfurt Institute for Advanced Studies, Frankfurt am Main, Germany — [2]Lawrence Berkeley National Laboratory, Berkeley, USA

I will present work based on extending a previously developed two-phase equation of state, which for the first time allows simulating head-on relativistic lead-lead collisions, in the presence of a mechanically unstable phase region due to the first order deconfinement phase transition. For collision energies that bring the bulk of the system into the mechanically unstable spinodal region of the phase diagram, the density irregularities are being amplified significantly. The resulting density clumping may be exploited as a signal of the phase transition. I will discuss several observables, like nuclei production, radial correlations and di-lepton production, and their sensitivity on the observed density clumping.

HK 26.9 Di 18:45 HZ 6

Nonequilibrium dynamics and transport in a quark-meson model — •Alex Meistrenko[1], Christian Wesp[1], Hendrik van Hees[2], and Carsten Greiner[1] — [1]Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Straße 1, D-60438 Frankfurt, Germany — [2]Frankfurt Institute for Advanced Studies (FIAS), Ruth-Moufang-Straße 1, D-60438 Frankfurt, Germany

Based on the 2PI quantum effective action of the linear sigma model with constituent quarks, we develop a transport approach to study systems out of equilibrium. In particular, we focus on the chiral phase transition as well as the critical point, where nonequilibrium effects near the phase transition give rise to critical behavior such as the fluctuation of the baryon number density. Predictions for long-range correlations and fluctuations of observables in our model could be used to study fundamental properties of the QCD phase transition.

Supported by HGS-HIRe.

HK 27: Instrumentierung

Zeit: Dienstag 16:30–19:00 Raum: HZ 8

Gruppenbericht HK 27.1 Di 16:30 HZ 8

The BGO-OD experiment's commissioning — •Jürgen Hannappel for the BGO-OD-Collaboration — Physikalisches Institut, Nussallee 12, D-53115 Bonn

In the framework of an international collaboration a new detector is set up at the accelerator facility ELSA in Bonn, the BGO-OD experiment.

It aims at systematic investigation of non strange and strange meson photoproduction, in particular t-channel processes at low momentum transfer. The setups uniquely combines a central almost 4π acceptance BGO crystal calorimeter with a large aperture forward magnetic spectrometer providing good detection of both neutral and charged particles.

The status of the BGO-OD detector is presented. First results from the commissioning will be presented and discussed.

This work is supported by DFG (SFB/TR-16).

HK 27.2 Di 17:00 HZ 8

Energiekalibration mit der neuen HV-Versorgung des Crystal Ball Detektors — •Jennifer Wettig für die A2-Kollaboration — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz

Der Crystal Ball Detektor wird seit 2004 am Mainzer Mikrotron MAMI für Experimente genutzt. Zuvor war er am SLAC, am DESY und am BNL im Einsatz. Das dort verwendete, sehr stabile HV-System wurde auch in Mainz verwendet. Die Kalibration der individuellen Kanäle war allerdings nur manuell mit großem Zeitaufwand möglich. Zudem mussten Kabel und Stecker dringend erneuert werden. Deshalb wurde ein neues Verteilungssystem am Institut für Kernphysik an der Johannes Gutenberg-Universität Mainz entwickelt, welches eine präzise Ansteuerung der Hochspannungswerte einzelner Crystal Ball Kanäle erlaubt. Mithilfe dieses Systems wurde eine relative Energiekalibration des Crystal Ball Detektors mit der 4,4 MeV Photolinie einer AmBe-Quelle vorgenommen.

In diesem Vortrag wird zunächst der Crystal Ball und die alten und neuen HV-Verteilungssysteme vorgestellt. Dann wird die Kalibrationsmethode beschrieben und ein Vergleich zwischen beiden Methoden gezeigt.

HK 27.3 Di 17:15 HZ 8

Construction and First Characterisation of a Prototype for the PANDA Barrel EMC in a Close to Final Design — •Christoph Rosenbaum[1], Daniel Bremer[1], Stefan Diehl[1], Peter Drexler[1], Valery Dormenev[1], Tobias Eissner[1], Christine Le Galliard[2], Miktat Imre[2], Myroslav Kavatsyuk[5], Till Kuske[1], Dominique Marchand[2], Rainer W. Novotny[1], Phillippe Rosier[2], Andrej Ryantzev[3], Peter Wieczorek[4], Andrea Wilms[4], and Hans-Georg Zaunick[1] for the PANDA-Collaboration — [1]2. Physics Institute, University Gießen — [2]IPN Orsay, France — [3]IHEP Protvino, Russia — [4]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt — [5]KVI Groningen, The Netherlands

The EMC of the PANDA target spectrometer is one of the central detector components to achieve the physical goals. The barrel part will consist of lead thungstate (PWO) crystals operated at -25°C to achieve the required performance over a wide energy range. To achieve a good energy, position and time resolution, it is necessary to perform detailed tests of prototypes. The most recent one, PROTO120, represents a subsection of the barrel EMC. The design is close to the final concept of the EMC with respect to the detector assembly, cooling circuit and front-end electronics. The conversion of the scintillation light will be performed with two rectangular LAAPD, which are read-out separately via the APFEL-ASIC providing a large dynamic range, low power consumption and the optimized shaping. The talk will describe the details of the construction and a first test on the performance based on cosmic muons. *Supported by BMBF, GSI and HIC for FAIR

HK 27.4 Di 17:30 HZ 8

Aufbau und Test von Kalorimeter-Modulen für PANDA — •Claudius Schnier für die PANDA-Kollaboration — Institut für Experimentalphysik I, Ruhr-Universität Bochum

Für das PANDA-Experiment am HESR an FAIR in Darmstadt sind zur Auslese der Vorwärtsendkappe des elektromagnetischen Kalorimeters im Targetspektrometer Vakuumphototetroden und Avalanche-Photodioden vorgesehen. Die Photodetektoren sollen mit Szintillationskristallen in Modulbauweise zu 16er-Subeinheiten zusammengefasst werden. Allein für die Vorwärtsendkappe des PANDA-Detektors werden 3856 Szintillationskristalle (Bleiwolframat) benötigt. Bei einer angestrebten Betriebsdauer von 10 Jahren werden die Szintillationskristalle auf −25° C gekühlt. Um eine möglichst hohe Lichtausbeute zu erhalten, ist eine optimale optische Kopplung der Detektoren mit den Szintillationskristallen notwendig.

Es werden die Ergebnisse der Optimierung von Kalorimeter-Modulen, insbesondere der Klebung von Detektor-Kristalleinheiten und des Massenfertigungsprozesses diskutiert.

Gefördert durch das BMBF mit Förderkennzeichen 05P12PCFP5 und das FZ Jülich.

HK 27.5 Di 17:45 HZ 8

Charakterisierung von Vakuumphototetroden für das PANDA-Kalorimeter — •Tobias Holtmann für die PANDA-Kollaboration — Institut für Experimentalphysik I, Ruhr-Universität Bochum

Das PANDA-Experiment wird an der sich im Bau befindlichen Beschleunigeranlage FAIR am Antiprotonen-Speicherring HESR aufgebaut. Zur Auslese der Vorwärtsendkappe des elektromagnetischen Kalorimeters werden auch Vakuumphototetroden (VPTT) der Firma Hamamatsu verwendet. Da die VPTTs im Gegensatz zu herkömmlichen Photomultipliern nur zwei Dynodenstufen besitzen, können sie auch innerhalb des 2 T starken Magnetfeldes des Solenoidmagneten betrieben werden. Die im restlichen elektromagnetischen Kalorimeter verwendeten Avalanche-Photodioden können aufgrund der hohen Ereignisraten von bis zu $5 \cdot 10^5\,\mathrm{s}^{-1}$ pro Kristall im inneren Teil der Vorwärtsendkappe nicht verwendet werden.
Getestet wurden VPTTs, welche einen Durchmesser von 24 mm und eine Länge von 40 mm besitzen. Es werden Ergebnisse der Messungen zur Verstärkung der VPTTs mit und ohne Magnetfeld präsentiert. Die magnetfeldabhängigen Verstärkungen wurden innerhalb eines bis zu 1,15 T starken Magnetfeldes für verschiedene Winkeleinstellungen zwischen Magnetfeld und VPTT gemessen. Desweiteren werden Scans der Kathodenoberfläche vorgestellt.

Gefördert durch das BMBF mit Förderkennzeichen 05P12PCFP5 und das FZ Jülich.

HK 27.6 Di 18:00 HZ 8

The Temperature and Humidity Monitoring System for PANDA — •Miriam Kümmel for the PANDA-Collaboration — Institut für Experimentalphysik I, Ruhr-Universität Bochum

The electromagnetic calorimeter (EMC) of the PANDA detector to be constructed at FAIR consists of lead tungstate (PWO) crytals, which have a temperature dependent light yield. To achieve the design energy resolution, the EMC must be operated at -25°C, where temperature fluctuations of at most 0.1°C are acceptable. This results in high demands on the precision and resolution of the temperature monitoring. Ultra-thin platinum resistance temperature detectors (RTDs) are needed to measure the temperature in the densely packed EMC. The RTDs are read out by the temperature and humidity monitoring system for PANDA (THMP). Both have been developed at Ruhr-Universität Bochum. Not only the RTDs, but also the readout electronics has to be calibrated individually to suffice the high demands. Both, the calibration procedure and improvements in the electronic read out system will be presented.

This work is supported by the BMBF with support code 05P12PCFP5 and by FZ Jülich.

HK 27.7 Di 18:15 HZ 8

Die iPhos-Methode zur Energierekonstruktion hochenergetischer Protonen — •Michael Bendel[1], Roman Gernhäuser[1], Benjamin Heiss[1], Walter Henning[1], Philipp Klenze[1], Reiner Krücken[2], Tudi Le Bleis[1] und Max Winkel[1] für die R3B-Kollaboration — [1]Technische Universität München, Physik-Dept. E12, 85748 Garching — [2]TRIUMF, 4004 Wesbrook Mall, Vancouver, BC, V6T 2A3, 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.
Dieses Kalorimeter bestehend aus CsI(Tl)-Kristallen mit einer Auslese durch Avalanche-Photodioden, ist ein sehr 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 662keV γ-Strahlung und ein riesiger dynamischer Bereich, der es erlaubt gleichzeitig γ-Quanten mit wenigen 100keV, aber auch gestreute Teilchen mit mehreren 100MeV nachzuweisen. In Kernreaktionen bei relativistischen Strahlenergien erhalten leichte geladene Teilchen vorallem in Vorwärtsrichtung sehr hohe Energien im Bereich von 400MeV. Im Rahmen dieses Vortrags stellen wir eine vollkommen neue Rekonstruktionsmethode der Gesamtenergie von Teilchen vor, welche nicht im aktiven Detektormaterial absorbiert werden können.

HK 27.8 Di 18:30 HZ 8

CALIFA at R^{3}B: Recent developments at TU Darmstadt — •Alexander Ignatov, Ilja Homm, Guillermo Fernández Martinez, Stoyanka Ilieva, Thorsten Kröll, Han-Bum Rhee, Mirko von Schmid, and Christian Sürder for the R3B-Collaboration — Technische Universität Darmstadt, Darmstadt, Germany

CALIFA is a calorimeter and spectrometer that aims to detect gamma-rays and light charged particles. It is a part of the R^{3}B experiment at the future FAIR facility. CALIFA is a highly segmented detector surrounding the target to allow the measurement of the emission angle and energy of reaction products. The CALIFA barrel consists of CsI(Tl) scintillating crystals, which are individually read out with Avalanche Photodiodes. Therefore, a gain monitoring system is needed. In this work we propose to use light signals from a pulsed LED, distributed to the detector elements via optical fibres, to monitor gain variations. The CALIFA Forward EndCap is the part of the detector, which covers forward emission angles, where Lorentz boosted gamma-rays have maximum energy. Moreover, protons of the same energy may be detected in this forward region. Therefore, the CALIFA EndCap should posess high detection efficiency and the ability to discriminate detected particles by type. We present here our research on using $LaBr_3$(Ce) and $CeBr_3$ scintillators read out with Avalanche Photodiods and Silicon Photomultipliers.

This work is supported by BMBF (06DA9040I, 05P12RDFN8) and HIC for FAIR.

HK 27.9 Di 18:45 HZ 8

Commissioning and performance studies of a proton recoil detector at the COMPASS-II experiment — •Philipp Jörg, Maximilian Büchele, Horst Fischer, Matthias Gorzellik, Tobias Grussenmeyer, Florian Herrmann, Kay Königsmann, Paul Kremser, and Sebastian Schopferer — for the COMPASS collaboration, Physikalisches Institut, Albert-Ludwigs-Universität Freiburg

The COMPASS-II experiment is a fixed target experiment situated at CERN. A tertiary myon beam from the SPS scattered of protons from a liquid hydrogen target is used to measure Deeply Virtual Compton Scattering (DVCS) and Hard Exclusive Meson Production (HEMP). These processes offer a unique way to determine Generalized Parton Distributions, which are related to the total angular momentum of quarks, antiquarks and gluons in the nucleon by Ji's Sume Rule.

One of the major parts of the COMPASS-II upgrade is the CAMERA detector. CAMERA is a proton recoil detector surrounding the COMPASS-II liquid hydrogen target. Its purpose is to measure the recoiled target proton in DVCS and HEMP reactions and viz to act as a veto to ensure the exclusivity of the measurement.

The talk will give an outline of the detector and its readout electronics. It is focused on the commissioning and performance of the CAMERA detector and will give a brief insight into the ongoing DVCS analysis. Supported by BMBF and EU FP7 (Grant Agreement 283286).

HK 28: Astroteilchenphysik

Zeit: Dienstag 16:30–19:00 Raum: HZ 9

Gruppenbericht HK 28.1 Di 16:30 HZ 9

Status und erste Resultate der Dark Matter Suche mit EDELWEISS-III — •Klaus Eitel für die EDELWEISS-Kollaboration — Karlsruher Institut für Technologie, Institut für Kernphysik, Postfach 3640, 76021 Karlsruhe

Das EDELWEISS Experiment verwendet massive kryogene Ge-Bolometer, um im Untergrundlabor von Modane Rückstöße schwach wechselwirkender massiver Teilchen (WIMPs) nachzuweisen. Zur Unterdrückung der natürlichen Radioaktivität wird der Energieeintrag eines stoßenden Teilchens als Wärmesignal über einen NTD-Thermistor und als Ionisationssignal über Al-Ringelektroden ausgelesen.

Mit dem erweiterten Setup von EDELWEISS-III wurden mit 15 Detektoren aus 12 kg reinsten Ge-Monokristallen in 2013 Kalibrationsdaten und erste Daten zur Suche nach dunkler Materie aufgenommen. In 2014 wird EDELWEISS um weitere 25 Detektoren des Typs FID800 ergänzt und damit das DM-Experiment mit der größten Targetmasse an kryogenen Detektoren. Ziel ist eine untergrundfreie WIMP-Suche mit einer Exposition von bis zu 12.000 kg-Tagen. Die Verbesserungen der Ausleseelektronik, der Abschirmung und des Detektordesigns sowie erste Resultate der Datenaufnahme mit EDELWEISS-III werden vorgestellt. Ein Ausblick auf die Nutzung der hier verwendeten Ge-Detektoren mit ihrer exzellenten Untergrundunterdrückung im geplanten EURECA-Experiment wird gegeben.

Die vorgestellten Arbeiten werden in Teilen gefördert durch die Helmholtz-Allianz für Astroteilchenphysik, HAP, ein Instrument des Impuls- und Vernetzungsfonds der Helmholtz-Gemeinschaft.

Gruppenbericht HK 28.2 Di 17:00 HZ 9

Das Double Chooz Reaktorneutrino-Experiment — •Marianne Göger-Neff für die Double Chooz-Kollaboration — Technische Universität München

Das Double Chooz Reaktorneutrino-Experiment hat eine präzise Messung des dritten Neutrino-Mischungswinkels θ_{13} zum Ziel. Diese Messung eröffnet die Möglichkeit, mit zukünftigen Experimenten die Neutrino-Massenhierarchie zu bestimmen und nach leptonischer CP-Verletzung zu suchen.

Im Double Chooz Experiment werden Antineutrinos aus dem französischen Chooz-Kernkraftwerk über den inversen Betazerfall in 10 m^3 Gd-geladenem Szintillator nachgewiesen. Mit dem fernen Detektor im Abstand von 1.05 km vom Reaktor konnte 2011 erstmals ein Defizit gegenüber dem erwarteten Neutrinofluss beobachtet werden. Der nahe Detektor im Abstand von ca. 400 m vom Reaktor befindet sich im Aufbau und soll im Frühjahr 2014 mit der Datennahme beginnen. Im letzten Jahr konnte die Genauigkeit der Messung durch Ausnützen eines neuen Detektionskanals, dem Neutroneneinfang am Wasserstoff, sowie durch eine Untergrundmessung bei ausgeschalteten Reaktoren, weiter verbessert werden.

Gruppenbericht HK 28.3 Di 17:30 HZ 9

Future Direct Dark Matter Search with EURECA — •Jean-Côme Lanfranchi for the EURECA-Collaboration — TU München, James-Franck-Strasse, 85748 Garching

EURECA (European Underground Rare Event Calorimeter Array) is a future ton-scale experiment aimed at the direct detection of Dark Matter (DM). It is based on detector technology as used in the running low-temperature experiments CRESST and EDELWEISS. EURECA strives for a final sensitivity in the spin-independent WIMP-nucleon cross-section of $\sim 2\text{x}10^{-11}$pb. Unlike other direct DM searches EURECA offers the unique possibility to probe the WIMP parameter space using multiple target materials such as Ge and $CaWO_4$. The present status as well as future plans and technological challenges of the experiment will be discussed. This research was supported by the DFG cluster of excellence: Origin and Structure of the Universe, the Helmholtz Alliance for Astroparticle Phyiscs, the Maier-Leibnitz-Laboratorium (Garching) and by the BMBF: Project 05A11WOC EURECA-XENON.

HK 28.4 Di 18:00 HZ 9

Preparing a Proton Asymmetry Measurement with PERKEO III — •Lukas Raffelt[1], Peter Lennert[1], Hartmut Abele[2], Torsten Soldner[3], Ulrich Schmidt[1], Heiko Saul[4], Christoph Roick[1], and Bastian Märkisch[1] — [1]Physikalisches Institut, Heidelberg, Deutschland — [2]Atominstitut, Wien, Österreich

— [3]Institut Laue-Langevin, Grenoble, Frankreich — [4]Forschungs-Neutronenquelle Heinz Maier-Leibnitz (FRM-II), Garching, Deutschland

Precision measurements of angular correlation coefficients in neutron beta decay allow tests of the Standard Model and a determination of the ratio of coupling constants $\lambda = g_A/g_V$ of the weak interaction.

We plan to measure the proton asymmetry C with the instrument PERKEO III at the ILL (Grenoble) in 2014. This will provide a cross-check of other measurements of several neutron decay correlation coefficients and might be sensitive to contributions of scalar and tensor interactions. Currently the only precision measurement of the proton asymmetry has been performed in 2008 with PERKEO II. Using the new spectrometer in pulsed mode and utilizing the improved detector concept, we expect to increase the precision to approximately 0.25%.

Electrons and protons from the decay will be measured in a combined detector. The protons are converted to secondary electrons using a new high voltage system with thin foils. A scintillator with new light-guides and all-side readout will provide a homogeneous detection of the electrons.

HK 28.5 Di 18:15 HZ 9

An active electron dump for PERC — •Carmen Ziener, Christoph Roick, Lukas Raffelt, Ulrich Schmidt, and Bastian Märkisch — Physikalisches Institut, Universität Heidelberg, Germany

The instrument PERC (Proton Electron Radiation Channel) is currently under construction at the FRM-II and will be used for precision spectroscopy on electrons and protons from neutron beta decay and to measure asymmetries like the beta asymmetry on the 10^{-4} level. A key feature of PERC is a magnetic barrier field which lets only pass about 1/16 of all electrons or protons from neutron decay. Only these particles will afterwards be guided to the detectors. All other particles will be absorbed in a dump at the other end of the instrument. In electron spectroscopy, backscattering off of this beam dump or the detectors can in principle be a significant source of systematic error. We present the concept of an active electron beam dump, which is used to suppress and control this effect.

HK 28.6 Di 18:30 HZ 9

Measurement of the beta asymmetry in neutron beta decay — •H. Saul[1], H. Abele[2], D. Dubbers[3], B. Märkisch[3], H. Mest[3], A. Pethoukov[4], N. Rebrova[3], C. Roick[3], T. Soldner[4], X. Wang[2], and D. Werder[3] — [1]FRM II, Technische Universität München, Garching, Germany — [2]Atominstitut, Technische Universität Wien, Wien, Austria — [3]Physikalisches Institut, Universität Heidelberg, Heidelberg, Germany — [4]Institut Laue-Langevin, Grenoble, France

Neutron beta decay is the simplest semi-leptonic weak decay and described accurately by the standard model using the first CKM-matrix element and the ratio of vector and axial vector couplings, λ. With more than a dozen observables it is a sensitive probe for investigating the nature of weak interaction and to search for physics beyond the standard model. In the past, measuring the beta asymmetry A in polarized neutron decay has been the most precise way of determining λ and nowadays it allows - together with other observables - to derive limits on non-standard model interactions, such as scalar and tensor couplings. The neutron decay spectrometer Perkeo III was installed at the PF1B cold neutron beam site at the Institut Laue-Langevin to measure the beta asymmetry. By using a pulsed beam combined with an improved detector design a significant reduction of several systematic uncertainties has been achieved compared to the predecessor, Perkeo II.

In this talk recent results of the measurements with Perkeo III will be presented. In particular, we show the energy distribution of the electrons together with the calibration tools for the detectors.

HK 28.7 Di 18:45 HZ 9

Elektronendetektion mit Plastikszintillatoren — •Christoph Roick, Jascha Grabowski, Lukas Raffelt, Carmen Ziener, Ulrich Schmidt und Bastian Märkisch — Physikalisches Institut, Universität Heidelberg

Mit dem Instrument Perkeo III wurde die Energieabhängigkeit der β-Asymmetrie im Zerfall freier Neutronen gemessen. Diese Messung ermöglicht auch die erstmalige Bestimmung des schwachen Magnetismus aus dem Neutronenzerfall. Voraussetzung hierfür ist eine genaue Charakterisierung der verwendeten Detektoren. Die für die Messung eingesetzten Plastikszintillatoren erlauben eine hohe Ereignisrate, haben aber eine nichtlineare Lichtausbeute und eine nicht zu vernachlässigende Wahrscheinlichkeit der Elektronenrückstreuung. Im Vortrag wird auf Experimente zur Detektoreichung und Ermittlung der Rückstreueigenschaften eingegangen, sowie ein Vergleich mit Monte-Carlo-Simulationen gezogen.

HK 29: Hauptvorträge II

Zeit: Mittwoch 11:00–13:00 Raum: HZ 1+2

Hauptvortrag HK 29.1 Mi 11:00 HZ 1+2

Physics of Heavy Quarks in Nuclear Collisions at the LHC — •Raphaelle Bailhache for the ALICE-Collaboration — Goethe-Universitaet, Frankfurt, Germany

After three years of successful operation with lead and proton beams at the Large Hadron Collider (LHC), many exciting results could be obtained from the measured data. The characterization of the Quark-Gluon Plasma (QGP), the deconfined state of strongly-interacting matter produced in high-energy collisions of heavy ions, is the main purpose of the ALICE experiment. In this presentation, emphasis will be put on the measurement of heavy quarks, including both hadrons with open heavy flavours and quarkonia. These probes play a key role for the study of thermalization and deconfinement in heavy-ion collisions, and the determination of the QGP properties. The measurements discussed in this talk include heavy-quark energy loss as well as quarkonia suppression and regeneration in the medium. Qualitatively new features are observed in Pb-Pb collisions at the LHC as compared to previous measurements at lower collision energies. The production of heavy quarks is also affected by the presence of cold nuclear matter in the initial state. The study of p-Pb collisions is instrumental to quantify these effects, and supports the conjecture of significant final-state effects in Pb-Pb. Finally, we conclude with a brief look into the future, where an increase of the LHC collision rate and energy will open new opportunities for heavy-quark physics with ALICE.

Hauptvortrag HK 29.2 Mi 11:40 HZ 1+2

Electric Dipole Moment Measurements at Storage Rings — •Jörg Pretz for the JEDI-Collaboration — Physikalisches Institut 3B, RWTH Aachen University — IKP2, Forschungszentrum Jülich

Electric Dipole Moments (EDMs) of elementary particles are considered as one of the most powerful tools to discover CP violation beyond the Standard Model and to find an explanation for the dominance of matter over anti-matter in our universe.

Up to now experiments concentrated on neutral systems (neutron, atoms, molecules). Storage rings offer the possibility to measure EDMs of charged particles by observing the influence of the EDM on the spin motion. The Cooler Synchrotron COSY at the Forschungszentrum Jülich provides polarized protons and deuterons up to a momentum of 3.7 GeV/c and is thus an ideal starting point for such an experimental programme. Plans for measurements of charged hadron EDMs and results of first test measurements will be presented.

Hauptvortrag HK 29.3 Mi 12:20 HZ 1+2

Faster and further, masses and more: Latest developments and results from ISOLTRAP — •Robert Wolf — Institut für Physik, Universität Greifswald, Felix-Hausdorff-Str. 6, 17489 Greifswald — Max-Planck-Institut für Kernphysik, Saupfercheckweg 1, 69117 Heidelberg

Precision mass measurements of radioactive nuclides give direct insight to one of the most fundamental properties of atomic nuclei, their binding energy. Investigating this property as a function of proton and neutron numbers is crucial for advancing theory in describing and predicting the structure of nuclei. Furthermore, knowledge of masses far from stability is necessary for the understanding of nucleosynthesis in supernovae and neutron stars. Laboratory experiments are often extremely challenging due to the short half-lives and low production rates of the nuclides of interest. At the same time, longer-lived or stable contaminations are produced by orders of magnitude more, demand-

ing a high selectivity and resolving power of the mass spectrometer. ISOLTRAP at ISOLDE/CERN has already investigated over 500 isotopes on an uncertainty level down to $\delta m/m = 1 \times 10^{-8}$ by use of Penning-trap techniques. To extend the range of accessible nuclides even further, the setup has been upgraded with a multi-reflection time-of-flight mass analyzer. This device can be operated as a mass purifier or a mass spectrometer, which allowed mass measurements for nuclear astrophysics applications and tests of valence-shell calculations based on 3N forces. The talk will give an overview of these recent developments and further applications of the new MR-ToF device.

HK 30: Hadronenstruktur und -spektroskopie

Zeit: Mittwoch 16:30–18:45 Raum: HZ 1+2

Gruppenbericht HK 30.1 Mi 16:30 HZ 1+2

Aktuelle Entwicklungen beim COBRA-Experiment — •Silke Rajek für die COBRA-Kollaboration — Exp. Physik IV, TU Dortmund, Dortmund

Das COBRA-Experiment untersucht im Gran Sasso Untergrundlabor mit Hilfe von Raumtemperatur-Halbleiterdetektoren aus CdZnTe mit insgesamt 9 Doppel-Beta zerfallenden Isotopen den neutrinolosen Doppelbetazerfall, dessen Nachweis grundlegende Fragen der Neutrinophysik klären könnte.

Im Vortrag werden das im November letzten Jahres mit 64 Detektoren vollständig in Betrieb genommene Demonstrator-Setup im Gran Sasso Labor gezeigt sowie das Potential der angewandten Analysemethoden und neue Limits vorgestellt. Resultierend aus den Erkentnissen wurde der Entwurf für ein Large-Scale-Experiment mit über 11000 Detektoren und 400kg Quellenmasse erstellt, sowie bereits Untersuchungen zu größeren Detektoren und ASIC-FPGA basierter Ausleseelektronik durchgeführt. Dieses future concept wird ebenfalls im Vortrag vorgestellt.

HK 30.2 Mi 17:00 HZ 1+2

Searching a Dark Photon with HADES — •Malgorzata Gumberidze for the HADES-Collaboration — TU Darmstadt

The existence of a photon-like massive particle, the gamma' or dark photon, is postulated in several extensions of the Standard Model. These models are often advocated to explain some recent puzzling astrophysical observations, as well as to solve the sofar unexplained deviation between the measured and calculated values of the muon anomaly. The dark photon, unlike conventional photon, would have mass and would be detectable via its mixing with the latter. We present a search for the e^+e^- decay of such a hypothetical dark photon, also named U vector boson, in inclusive dielectron spectra measured by HADES in the p (3.5 GeV) + p, Nb reactions, as well as the Ar (1.756 GeV/u) + KCl reaction. An upper limit on the kinetic mixing parameter squared ϵ^2 at 90% CL has been obtained for the mass range M(U) = 0.02 - 0.55 GeV/c^2 and is compared with the present world data set. For masses 0.03 - 0.1GeV/c^2, the limit has been lowered with respect to previous results, allowing to exclude a large part of the parameter region favored by the muon g-2 anomaly. Furthermore, an improved upper limit of 2.3 * 10^{-6} at 90% CL on the branching ratio has been set on the branching ratio of the helicity-suppressed direct decay of the eta meson, $\eta \rightarrow e^+e^-$.

Supported by: ViP-QM/VH-NG-823, BMBF (05P12RFGHJ), Helmholtz Alliance EMMI, HIC for FAIR, HGS-HIRe

HK 30.3 Mi 17:15 HZ 1+2

Entwurf eines Spektrometers für Niederenergieexperimente an MESA — •Julian Müller — Institut für Kernphysik - Johannes Gutenberg-Universität Mainz

Eine mögliche Erweiterung des Standardmodells durch ein neues Vektorboson - dunkles Photon genannt - hat in den letzten Jahren große Aufmerksamkeit erlangt. Ein neues U(1) Eichboson könnte unter anderem die beobachtete Abweichung des anomalen magnetischen Moment des Myons von der Vorhersage des Standardmodells erklären.

Der neue energierückgewinnende Beschleuniger MESA eröffnet neue Möglichkeiten für die Suche nach dem dunklen Photon, da er einen Elektronstrahl mit extrem hoher Luminosität bei niedrigen Energien liefern wird. Unser Ziel ist der Aufbau eines Doppelarmspektrometers für Präzisionsmessungen an einem internen Gastarget. In diesem Vortrag werden die notwendigen Schritte zu einem vorläufigen Entwurf eines hochauflösenden Spektrometers dargelegt. Diese beinhalten das Desing der Magnete, die Optimierung der Strahlenoptik, sowie die Konstruktion von dreidimensionalen Modellen und die Simulation der Magnetfelder.

HK 30.4 Mi 17:30 HZ 1+2

P2 - Die schwache Ladung des Protons — •Dominik Becker — Institut für Kernphysik Johannes Gutenberg-Universität Mainz Johann-Joachim-Becher-Weg 45 D 55128 Mainz

Das Ziel der P2-Kollaboration ist es, den elektroschwachen Mischungswinkel $\sin^2(\theta_W)$ bei niedrigem Impulsübertrag mit einer relativen Unsicherheit von 0,15 % zu bestimmen. Dies kann durch eine Messung der schwachen Ladung des Protons mit einer Genauigkeit von 1,9 % erreicht werden. Die paritätsverletzende Asymmetrie der elastischen Elektron-Proton-Streuung gewährt dabei den experimentellen Zugang zur schwachen Ladung des Protons. Das Projekt befindet sich gegenwärtig in der Planungsphase, die Messung wird am neuen Elektronenbeschleuniger MESA in Mainz durchgeführt werden. Im Rahmen des Vortrags vorgestellt und diskutiert werden das experimentelle Konzept, Berechnungen zur erreichbaren Präzision, sowie Simulationen mit Geant4, welche durchgeführt werden, um mögliche Detektorkonfigurationen zu erforschen.

HK 30.5 Mi 17:45 HZ 1+2

Towards a Q-value measurement of tritium — •Marc Schuh[1], Tommi Eronen[1], Martin Höcker[1], Jochen Ketter[1], Sebastian Streubel[1], Robert S. Van Dyck Jr.[2], and Klaus Blaum[1] — [1]Max-Planck-Institut für Kernphysik, Heidelberg — [2]Department of Physics, University of Washington, Seattle, WA 98195-1560, USA

THe-Trap is a precision Penning-trap mass spectrometer [1] at the Max-Planck-Institut für Kernphysik in Heidelberg. The main goal of the experiment is to measure the tritium/helium-3 mass ratio in order to deduce the Q-value of the tritium β-decay. The aimed accuracy of 10 parts per trillion (ppt) in the mass ratio would allow determining the Q-value with a precision of 30 meV, which would be a 40-fold improvement over the currently adopted value. An improved tritium Q-value is of relevance for the Karlsruhe Tritium Neutrino (KATRIN) collaboration, which is using a β-endpoint spectrometer to measure the antielectron neutrino mass. So far, our most precise measurement is the carbon-12/oxygen-16 mass ratio [2] with a modest relative precision of 120 ppt in early 2013. Further improvements will allow us to reach the desired 10 ppt precision in order to help solving one of the of the most exciting questions in physics — determining the neutrino mass.

[1] Ch. Diehl et al., Hyperfine Interact 199, 291-300 (2011)
[2] S. Streubel *et al.*, Applied Physics B, DOI:10.1007/s00340-013-5669-x

HK 30.6 Mi 18:00 HZ 1+2

The Low Energy Photon Tagger NEPTUN: Toward a Detailed Study of the Pygmy Dipole Resonance with Real Photons — •Diego Semmler[1], T. Aumann[1], C. Bauer[1], M. Baumann[1], M. Beckstein[1], J. Beller[1], A. Blecher[1], N. Cvejin[1], M. Duchêne[1], F. Hug[1], J. Kahlbow[1], M. Knörzer[1], K. Kreis[1], C. Kremer[1], R. Lefol[4], B. Löher[2,3], P. Ries[1], C. Romig[1], H. Scheit[1], L. Schnorrenberger[1], D. Symochko[1], and C. Walz[1] — [1]Institut für Kernphysik, Darmstadt, Germany — [2]ExtreMe Matter Institute EMMI and Research Division, Frankfurt, Germany — [3]Institute for Advanced Studies FIAS, Frankfurt, Germany — [4]University of Saskatchewan, Saskatoon, Canada

The low energy photon tagger NEPTUN at the S-DALINAC delivers a quasi-monoenergetic photon beam between about 4 MeV and 20 MeV with a resolution of approximately 25 keV. Tagged photons provide the possibility to measure the dipole strength of nuclei in the energy range below and above the neutron threshold. The highly efficient $LaBr_3$ based spectrometer GALATEA will be used to detect not only the direct decays to the ground state, but also cascading decays can be measured with suitable efficiency. We will measure (γ,n)- and (γ,nγ)-reactions with neutron detectors based on plastic scintillators.

This talk provides an overview about setup and goals of the NEP-

TUN experiment as well as the current state of the commissioning phase. Planned optimizations of the setup, based on the results of a test beam time in June 2013, are also presented.

Supported by DFG (SFB 634)

HK 30.7 Mi 18:15 HZ 1+2

Identifizierung von Lateral Surface Events bei CdZnTe Coplanar Grid Detektoren für das COBRA-Experiment — •Robert Theinert für die COBRA-Kollaboration — TU Dortmund, Lehrstuhl für Experimentelle Physik IV, 44221 Dortmund, D

Das COBRA-Experiment sucht mit Hilfe von CdZnTe Halbleiterdetektoren nach dem neutrinolosen Doppelbetazerfall ($0\nu\beta\beta$). Der Nachweis dieses Zerfalls würde es ermöglichen die Frage zu klären, ob Neutrinos Dirac- oder Majorana-Teilchen sind und zudem die Bestimmung der effektiven Majorana-Masse der Neutrinos ermöglichen.

Im aktuellen Demonstrator Aufbau im Gran Sasso Untergrundlabor sind 64 Coplanar Grid Detektoren in Betrieb. Die eigens für dieses Detektordesign von der COBRA Collaboration entwickelten Analysetechniken ermöglichen sowohl eine Bestimmung der Interaktionstiefe zwischen Kathode und Anode, als auch die Identifizierung von Ereignissen an den anderen Seitenflächen (Lateral Surface Events) des Detektors. Eine Hauptursache von Untergrundereignissen in der Region of Interest ist die an den Seitenflächen auftreffende Alphastrahlung. Solche Ereignisse können nun mit den entwickelten Analysemethoden erkannt werden wodurch eine signifikante Reduzierung des Untergrundes möglich ist.

Im Vortrag werden aktuelle Erkenntnisse und Messergebnisse zur Lateral Surface Events Bestimmung vorgestellt.

HK 30.8 Mi 18:30 HZ 1+2

Die Low-Background-Beta-Spektrumspräzisionversmessung des vierfach verbotenen Übergangs von Indium-115 — •Andree Welker — Institut für Kern- und Teilchenphysik, TU-Dresden

In der Menge der derzeit bekannten Nuklide existieren lediglich drei, welche eine Umwandlung über einen vierfach verbotenen Übergang vornehmen. Diese sind Vanadium-50 mit einer Halbwertszeit (T1/2) von $1{,}5 \cdot 10^{17}$ Jahren und einem Q-Wert von 1037 keV, Cadmium-113 mit $T1/2 = 7{,}7 \cdot 10^{15}$ Jahren und Q = 316 keV sowie das Nuklid Indium-115 mit $T1/2 = 4{,}41 \cdot 10^{14}$ und Q = 495 keV. Die Vermessung des Beta-Spektrums des zuletzt genannten Nuklids wird in diesem Vortrag näher beschrieben. Die hieraus gewonnenen Daten ermöglichen eine detaillierte Analyse dieses Spektrums zur Validierung einer in den 1970er Jahren entwickelten Theorie. Der Fokus der Datengewinnung liegt hierbei auf dem niederenergetischen Bereich. Zur Realisierung wurde eine Kupferkammer entwickelt, welche mit Hilfe von Passivated Implanted Planar Silicon (PIPS)-Detektoren den Verlauf präzise vermessen soll. Das Konzept der Datenerfassung sowie erste Messungen sind Gegenstand dieses Vortags.

HK 31: Struktur und Dynamik von Kernen

Zeit: Mittwoch 16:30–19:00 Raum: HZ 4

Gruppenbericht HK 31.1 Mi 16:30 HZ 4

Multi-Strangeness dynamics at $\overline{\mathrm{P}}$ANDA — •Theodoros Gaitanos, Horst Lenske und Ulrich Mosel — Institut für Theoretische Physik, Universität Gießen

Multi-strange bound hadron systems are excellent candidates for studying in-medium hyperon-hyperon (YY) interactions. A better understanding of the strangeness sector of the hadronic equation of state is crucial for our understanding of astrophysical objects like neutron stars. Furthermore, these studies are being motivated by actual and planed experimental activities on hypernuclear physics (HypHI and $\overline{\mathrm{P}}$ANDA Collaborations). In fact, HypHI has already studied single-strange hypernuclei in heavy-ion collisions, whereas studies on double- and multi-strange nuclear systems are being planed by $\overline{\mathrm{P}}$ANDA. We have reported in the past first studies on single- and double-Λ hypernuclei production in reactions induced by heavy-ions and antiprotons, respectively. The YY-interaction is still little known and many controversial theoretical predictions exist in the literature. We therefore extend our previous works by investigating the influence of various hyperon-hyperon interactions on the production dynamics of multi-Λ hypernuclei in reactions relevant for FAIR. Particular attention is paid to the heavy Ω-baryon ($S = -3$) and its role to the formation of multi-Λ hypernuclei in reactions induced by antiprotons.

Work supported by DFG LE439/9-1 and BMBF 05P12RGFTE.

Gruppenbericht HK 31.2 Mi 17:00 HZ 4

Isospin properties of low-lying electric dipole excitations — •Vera Derya[1], Janis Endres[1], Muhsin N. Harakeh[2,3], Deniz Savran[4,5], Mark Spieker[1], Heinrich J. Wörtche[2], and Andreas Zilges[1] — [1]Institute for Nuclear Physics, University of Cologne — [2]KVI, University of Groningen, The Netherlands — [3]GANIL, CEA/DSM-CNRS/IN2P3, Caen, France — [4]ExtreMe Matter Institute EMMI and Research Division, GSI, Darmstadt — [5]Frankfurt Institute for Advanced Studies FIAS, Frankfurt

An accumulation of low-lying electric dipole excitations, the electric Pygmy Dipole Resonance (PDR), was observed below and around the neutron threshold in neutron-rich atomic nuclei [1]. In a systematic study, complementary to real-photon scattering experiments, the isoscalar probe of α particles at 136 MeV was used in α-γ coincidence experiments at the Big-Bite Spectrometer at KVI to study the isospin character of low-lying $E1$ excitations. The combined results permit a separation of the isovector from the isoscalar dipole response. Whereas a splitting into a lower-energy isospin-mixed part and a higher-energy isovector part was observed in heavier nuclei, a state-to-state change in isospin character was found in ^{48}Ca. Recently, protons at 80 MeV were used as an additional probe in a p-γ coincidence experiment. The most recent results and an overview of the systematics will be presented.

Supported by the DFG (ZI 510/4-2), EURONS, and the Alliance Program of the Helmholtz Association (HA216/EMMI).

[1] D. Savran, T. Aumann, and A. Zilges, Prog. Part. Nucl. Phys. 70 (2013) 210.

HK 31.3 Mi 17:30 HZ 4

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

Tremendous progress is being made on the experimental study of hypernuclei, especially on the spectroscopy of p-shell hypernuclei. Their theoretical description, however, is limited to phenomenological models or to very light (i.e. s-shell) systems. We present *ab initio* calculations of p-shell hypernuclei using chiral Hamiltonians including leading-order (LO) hyperon–nucleon as well as two- and three-nucleon interactions at N^{3}LO and N^{2}LO, respectively. To improve convergence with respect to model space size, the Hamiltonians are evolved using a Similarity Renormalization Group (SRG) transformation. The many-body calculations are carried out in the framework of the importance-truncated no-core shell model.

We present the first *ab initio* results for the spectroscopy of ${}^{7}_{\Lambda}$Li, ${}^{9}_{\Lambda}$Be and ${}^{13}_{\Lambda}$C obtained using chiral and phenomenological hyperon–nucleon interactions. We also discuss the role of SRG-induced hyperon–nucleon–nucleon (YNN) terms which hint at the impact of chiral YNN interactions.

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

HK 31.4 Mi 17:45 HZ 4

Constraining the electric dipole photon strength function in ^{130}Te — •J. Isaak[1,2], M.W. Ahmed[3], J. Beller[4], J. Glorius[5], J.H. Kelley[3], M. Krtička[6], B. Löher[1,2], N. Pietralla[4], C. Romig[4], G. Rusev[7], D. Savran[1,2], M. Scheck[8], J. Silva[1,2], K. Sonnabend[5], A.P. Tonchev[9], W. Tornow[3], H.R. Weller[3], and M. Zweidinger[4] — [1]ExtreMe Matter Institute EMMI and Research Division, Darmstadt — [2]FIAS, Frankfurt — [3]Department of Physics, Duke University, TUNL, USA — [4]Institut für Kernphysik, TU Darmstadt — [5]Institut für Angewandte Physik, Goethe-Universität Frankfurt — [6]Faculty of Mathematics and Physics, Charles University, Prague — [7]Chemistry Division, LANL, USA — [8]School of Engineering, University of the West of Scotland, UK — [9]Physics Division, LLNL, USA

The decay properties of photo-excited states in ^{130}Te have been investigated by means of Nuclear Resonance Fluorescence experiments at

the Darmstadt High Intensity Photon Setup (DHIPS) and the High Intensity γ-ray Source (HIγS). The combination of continuous-energy bremsstrahlung on the one hand and the quasi-monoenergetic and linearly polarized photon beam on the other enables a detailed insight into the photoabsorption cross section and the decay behavior of spin-1 states. Comparing these results to simulations within the statistical model allow for constraining the electric dipole photon strength function (E1-PSF) [1]. Results are presented and discussed.

*Supported by the Alliance Program of the Helmholtz Association (HA216/EMMI) and by the DFG (SFB 634 and SO907/2-1).

[1] J. Isaak *et al.*, PLB 727 (2013) 361-365.

HK 31.5 Mi 18:00 HZ 4

Studying the potential of antihyperons in nuclei with antiprotons — •Alicia Sanchez Lorente[1], Sebastian Bleser[1], Josef Pochodzalla[2], and Marcell Steinen[1] for the PANDA-Collaboration — [1]Helmholtz-Institut Mainz — [2]Institute for nuclear physics, JGU Mainz

The interaction between an antibaryon and a nucleus may shed light on the short range antibaryon-baryon force in a unique way. However, because of the deep imaginary part of the nuclear potential of antibaryons, the physics of antihyperons in nuclei is hitherto an uncharted territory. Recently it was proposed to use transverse momentum correlations of exclusively produced antihyperon-hyperon pairs in antiproton-nucleus collisions to obtain information on the antihyperon potentials relative to that of the corresponding hyperon[1]. In the present study we use the Giessen Boltzmann-Uehling- Uhlenbeck Transportmodell (GiBUU) to explore the production of exclusive hyperon-antihyperon pairs close to threshold. Unlike the schematic calculation of ref.[1], these GiBBU simulations take e.g. important rescattering effects into account. In case of $\bar{p}$+^{20}Ne→ $\bar{\Lambda}\Lambda$+X we confirm a significant sensitivity of transverse momentum correlations to the nuclear potential of Λ's. We also explore the feasibility of such measurements at the $\bar{P}$ANDA experiment of the international facility FAIR.

[1] J. Pochodzalla, Phys. Lett. B **669**, 306-310 (2008)

HK 31.6 Mi 18:15 HZ 4

Gamma Strength Function of ^{96}Mo: A Test of the Axel-Brink Hypothesis ⋆ — •Dirk Martin[1], Andreas Krugmann[1], Anna Maria Krumbholz[1], Peter von Neumann-Cosel[1], Norbert Pietralla[1], Iryna Poltoratska[1], Vladimir Ponomarev[1], and Atsushi Tamii[2] for the E376-Collaboration — [1]Institut für Kernphysik, TU Darmstadt — [2]Research Center for Nuclear Physics, Osaka, Japan

The gamma strength function of ^{96}Mo, derived from a variety of experiments, shows quite severe disagreement, in particular near the neutron threshold. A new experimental method is discussed, viz. relativistic proton scattering under extreme forward angles at RCNP Osaka, Japan [1], which allows a consistent analysis of data below and above the particle threshold. Here, intermediate-energy proton beams are used in combination with a high energy resolution of the order $\Delta E/E \approx 8 \cdot 10^{-5}$. E1 and M1 cross sections can be determined by a multipole decomposition of angular distributions utilizing DWBA calculations [2, 3]. The additional measurement of polarization transfer observables provides an independent check of the method. Results for the gamma strength function of ^{96}Mo derived from the E1 cross sections are presented and compared to findings with other experimental techniques.

[1] A. Tamii et al., Nucl. Inst. Meth. A 605 (2009) 326.
[2] A. Tamii et al., Phys. Rev. Lett. 107 (2011) 062502.
[3] I. Poltoratska et al., Phys. Rev. C 85 (2012) 041304(R).
⋆ Supported by DFG through SFB 634 and NE 679/3-1.

HK 31.7 Mi 18:30 HZ 4

To which densities is spin-polarized neutron matter a weakly interacting Fermi gas?⋆ — •Thomas Krüger[1,2], Kai Hebeler[1,2], and Achim Schwenk[2,1] — [1]Institut für Kernphysik, Technische Universität Darmstadt — [2]ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung

We study spin-polarized neutron matter based on chiral NN, 3N and 4N interactions to next-to-next-to-next-to-leading order (N^{3}LO) and provide theoretical uncertainties. Our results show that spin-polarized neutron matter at nuclear and subnuclear densities is remarkably close to a noninteracting Fermi gas. Implications of our findings for energy-density functionals and other applications are discussed.

⋆This work was supported by the DFG through Grant SFB 634, by the ERC Grant No. 307986 STRONGINT, and by the Helmholtz Alliance HA216/EMMI.

HK 31.8 Mi 18:45 HZ 4

First results of a ^{92}Mo(p,p'γ) experiment performed with SONIC&HORUS — •Simon G. Pickstone, Vera Derya, Andreas Hennig, Mark Spieker, Julius Wilhelmy, and Andreas Zilges — Institute for Nuclear Physics, University of Cologne

To gain additional information on nuclear structure from particle-induced reactions, the new silicon-detector array SONIC with 8 ΔE-E-telescopes was installed inside the existing γ array HORUS consisting of 14 HPGe detectors. The main purpose of the combined setup will be the study of inelastic scattering experiments using p, d and α beams delivered by the Cologne 10 MV Tandem accelerator.

Since the excitation of the target nucleus is uniquely determined by the energy loss of the projectile, gates on the excitation of specific levels or on a certain final level can be set. Due to the angular granularity of SONIC&HORUS, angular correlations between the ejectile and the emitted γ ray can be measured, which gives access to the spin of the level. Using the particle identification capabilities, light ejectiles (p to α) can be easily distinguished, allowing the study of weaker reaction channels, e.g. inelastic scattering, even if the cross section is dominated by others, e.g. transfer reactions.

As a first physics test case, the reaction ^{92}Mo(p,p'γ) was measured. Preliminary results of this experiment will be shown, concentrating on states and decay properties of the Pygmy Dipole Resonance.

Supported by the DFG (ZI 510/4-2).

HK 32: Struktur und Dynamik von Kernen

Zeit: Mittwoch 16:30–19:00 Raum: HZ 5

Gruppenbericht HK 32.1 Mi 16:30 HZ 5

Photoneninduzierte γ-γ Koinzidenzmessungen mit dem γ^3-Setup an HIγS⋆ — •B. Löher[1,2], T. Aumann[4,7], J. Beller[4], C. Bernards[5], N. Cooper[5], V. Derya[3], M. Duchêne[4], J. Endres[3], A. Hennig[3], J. Isaak[1,2], J. Kelley[6,8], M. Knörzer[4], N. Pietralla[4], C. Romig[4], D. Savran[1,2], M. Scheck[4], H. Scheit[4], J. Silva[1,2], W. Tornow[8], H. Weller[8], V. Werner[5] und A. Zilges[3] — [1]ExtreMe Matter Institute EMMI and Research Division, Darmstadt — [2]FIAS, Frankfurt — [3]Institut für Kernphysik, Universität zu Köln — [4]Institut für Kernphysik, TU Darmstadt — [5]WNSL, Yale University, New Haven, USA — [6]Department of Physics, NCSU, USA — [7]GSI Helmholtzzentrum für Schwerionenforschung — [8]Department of Physics, Duke University, TUNL, USA

Ein neuer experimenteller Aufbau bestehend aus HPGe- und $LaBr_3$-Detektoren wurde an der High Intensity γ-ray Source (HIγS) installiert [1]. Die Kombination des mono-energetischen Photonenstrahls von HIγS mit der Methode der γ-γ-Koinzidenzen ermöglicht erstmals die direkte Beobachtung von Zerfallskaskaden in Kernresonanzfluoreszenz-Experimenten. Die besonders hohe Sensitivität erlaubt die Untersuchung des Zerfallsverhaltens von Spin = 1, 2 Zuständen mit geringer Intensität unterhalb der Teilchenschwellen. Ein Überblick über den neuen Aufbau, sowie die Ergebnisse des Experiments am Kern ^{140}Ce werden präsentiert und mit QPM Rechnungen verglichen.

⋆ Supported by the Alliance Program of the Helmholtz Association (HA216/EMMI), the DFG (SFB 634 and ZI 510/4-2).

[1] B. Löher *et al.*, Nucl. Instr. Meth. A 723 (2013) 136–142

HK 32.2 Mi 17:00 HZ 5

Probing the shell closure at $N = 32$ by mass measurements of neutron-rich potassium isotopes — •M. Rosenbusch for the ISOLTRAP-Collaboration — Ernst-Moritz-Arndt-Universität Greifswald

The Penning-trap mass spectrometer ISOLTRAP at ISOLDE/CERN has been set up for precision mass measurements of short-lived nuclides and has been continuously improved for accessing more exotic nuclides. A crucial step forward has been made with the installation of a multi-reflection time-of-flight mass separator (MR-ToF MS), which enables

high-resolution mass separation of contaminated ions, resulting, e.g., in the measurement of ^{82}Zn [1]. More recently, mass measurements have been performed directly in the MR-ToF MS instead of using a Penning trap. This paved the way for the mass determination of ^{53,54}Ca [2], which would not have succeeded in ISOLTRAP's Penning traps. The obtained two-neutron separation energies (S_{2n}) unambiguously confirm a shell closure at $N = 32$, indicated earlier by measurements of the excitation energies of the first 2^+ state in ^{52}Ca [3]. In addition, with the MR-ToF MS at ISOLTRAP the masses of ^{52}K and ^{53}K have been determined for the first time. With a half-life of only 30 ms, ^{53}K is the shortest-lived nuclide ever investigated at ISOLTRAP. The data are currently under evaluation. In this contribution, the new S_{2n} values will be presented and the crossing of the neutron shell closure at $N = 32$ for potassium will be discussed. [1] R. N. Wolf *et al.*, Phys. Rev. Lett. 110, 041101 (2013);[2] F. Wienholtz *et al.*, Nature 498, 346-349 (2013);[3] A. Huck *et al.*, Phys. Rev. C 31, 2226 (1985)

HK 32.3 Mi 17:15 HZ 5

Medium-Mass and Heavy Nuclei from Chiral NN+3N Hamiltonians — •Sven Binder, Joachim Langhammer, Angelo Calci, and Robert Roth — TU Darmstadt

We present ab initio calculations of nuclear binding energies using chiral two- plus three-nucleon Hamiltonians evolved consistently with the similarity renormalization group. We use coupled-cluster theory at the singles and doubles excitations level in combination with a non-iterative treatment of triples excitations in order to obtain accurate solutions of the many-body problem. We explore different chiral two- and three-nucleon interactions and the systematics of ground-state energies up to 132-Sn. These calculations open the door to ab initio calculations in the regime of heavy nuclei and demonstrate the predictive power of chiral Hamiltonians.

HK 32.4 Mi 17:30 HZ 5

Lebensdauermessung tiefliegender, langlebiger Isomere und γ-Spektroskopie in ^{100}Rh — •Matthias Dewald, Andrey Blazhev und Jan Jolie — IKP, Universität zu Köln

Im vergangenen Jahr wurde ein Experiment zur Untersuchung von ^{100}Rh am HORUS Spektrometer des Kölner Tandembeschleunigers durchgeführt. Erzeugt wurde der Kern über die Reaktion ^{100}Ru(p,nγ)^{100}Rh mit gepulstem Protonenstrahl mit einer Energie von 8 MeV. Im Fokus der Messung stand die Überprüfung von Lebensdauern tiefliegnder isomerer Zustände im Nanosekundenbereich. Die Messung dieser Lebensdauern erfolgte mit Hilfe der Pulsung, deren Zeitauflösung 4 ns betrug, sowie dem Zeitsignal der Germaniumdetektoren des Spektrometers. Um γ-Übergänge unterhalb 100 keV gut auflösen zu können, wurde zusätzlich ein Germaniumdetektor in das Spektrometer integriert, der für Röntgen- und niederenergetische γ-Strahlung ausgelegt ist. Desweiteren sollte aufgrund der guten Statistik über γ-γ-Koinzidenzmatrizen das Anregungsspektrum von ^{100}Rh unterhalb 2 MeV systematisch überprüft und gegebenenfalls ergänzt werden. Das Experiment, sowie Ergebnisse der laufenden Auswertung werden präsentiert.

HK 32.5 Mi 17:45 HZ 5

Fission properties of the BCPM energy–density functional — •Samuel Andrea Giuliani[1,2] and Luis Miguel Robledo[2] — [1]Institut für Kernphysik, Technische Universität Darmstadt, Schlossgartenstr. 2, D–64289 Darmstadt — [2]Departamento de Física Teórica (Módulo 15), Universidad Autónoma de Madrid, E–28049 Madrid, Spain

Fission dynamics properties of the Barcelona–Catania–Paris–Madrid energy density functional are explored with mean–field techniques. Potential energy surfaces as well as collective inertias relevant in the fission process are computed for several nuclei where experimental data exist. Inner and outer barrier heights as well as fission isomer excitation energies are reproduced quite well in all the cases. The spontaneous fission half–lives t_{sf} are also computed using the standard semiclassical approach and the results are compared with the experimental data. The experimental trend with mass number is reasonably well reproduced over a range of 27 orders of magnitude. However, the theoretical predictions suffer from large uncertainties when the quantities that enter the spontaneous fission half–life formula are varied. Modifications of only a few per cent in the pairing correlation strengths strongly modify the collective inertias with a large impact on the spontaneous fission lifetimes in all the nuclei considered. Encouraged by the quite satisfactory description of the trend of fission properties with mass number, we explore the fission properties of the even-even uranium isotope chain from ^{226}U to ^{282}U. Very large lifetimes are found beyond A = 256 with a peak at neutron number N = 184.

HK 32.6 Mi 18:00 HZ 5

Preparations for an optical access to the lowest nuclear excitation in ^{229}Th * — •Lars v.d.Wense[1], Benedict Seiferle[1], Peter Thirolf[1], and Mustapha Laatiaoui[2] — [1]Ludwig-Maximilians-Universität München — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH

The isomeric lowest excited nuclear level of ^{229}Th has been indirectly measured to be 7.6 ± 0.5 eV (163 ± 11 nm)[1]. In order to improve the accuracy as prerequisite of an all-optical control, ^{229m}Th is populated via a 2% decay branch in the α decay of ^{233}U. The Thorium ions are extracted and cooled with the help of a buffer gas stopping cell and an RFQ-cooler. In order to suppress accompanying α decay chain products other than ^{229}Th, a quadrupole mass spectrometer (QMS) is used, performance and extraction efficiency measurements were performed. Following the QMS, the Thorium isomers will be collected on a 50 μm micro electrode. The decay of these isomers can then be detected using deep UV optics [2], presently in the phase of preparation and adjustment. Newest results will be presented.

[1] B.R. Beck et al., PRL 98, 142501 (2007).
[2] L. v.d.Wense et al., JINST 8 P03005 (2013).

* Supported by DFG Grant number TH956/3-1.

HK 32.7 Mi 18:15 HZ 5

Relative μs-Isomerpopulation nach Spaltung in leichten Fragmenten mit $79 \leq A \leq 100$ — •Matthias Rudigier[1], Andrey Blazhev[1], Jan Jolie[1], Jean-Marc Regis[1], Nigel Warr[1], Christoph Fransen[1], Ulli Köster[2], Thomas Materna[2] und Gary Simpson[3] — [1]Institut für Kernphysik, Universität zu Köln, Zülpicher Straße 77, 50937 Köln, Deutschland — [2]Institut Laue-Langevin, BP 156, 6, rue Jules Horowitz, F-38402 Grenoble CEDEX 9, France — [3]Laboratoire de Physique Subatomic et de Cosmologie, IN2P3-Centre National de la Reserche Scientifique / Universite Joseph Fourier, F-38026 Grenoble, France

In Messungen am Lohengrin Massenseparator des Institute Laue-Langevin, Grenoble, wurden μs-Isomere in leichten Spaltfragmenten der Massengegend $79 \leq A \leq 100$ untersucht. Gemessene Isomerlebensdauern werden vorgestellt. Desweiteren wurde die relative Isomerpopulation nach Spaltung von ^{233}U, ^{235}U und ^{241}Pu, induziert durch thermische Neutronen, gemessen. Diese Daten können Aufschluss über die mittlere Spinverteilung der Fragmente nach der Spalung geben. Die Ergebnisse werden mit Vorhersagen eines statistischen Modells verglichen.

HK 32.8 Mi 18:30 HZ 5

Quadrupole Collectivity in neutron-rich Cd istotopes — •Sabine Bönig[1], Thorsten Kröll[1], Marcus Scheck[1,2], Stoyanka Ilieva[1], and Anna-Lena Hartig[1] for the IS477/IS524-Collaboration — [1]Institut für Kernphysik, TU Darmstadt — [2]University of West Scotland, United Kingdom

The neutron-rich cadmium nuclei with a proton number of Z=48 are some of the most interesting isotopes in nuclear structure physics due to the proximity to the proton and neutron shell closures at Z=50 and N=82 respectively. The transition strength B(E2, $0^+_{gs} \rightarrow 2^+_1$) and quadrupole moment $Q_s(2^+_1)$ in the even neutron-rich isotopes $^{122-128}$Cd was measured in Coulomb excitation experiments with MINIBALL at REX-ISOLDE (CERN). Results of these experiments will pursue the picture of the behaviour of the transition strength towards the neutron shell closure at N=82. A closer insight into the onset of collectivity and the roles played by different orbits can be obtained by the investigation of the odd isotopes. We started this program with the examination of ^{123}Cd where already discrepancies in the level scheme to the literature were evidenced. In this contribution the results of these investigations will be presented. This project is supported by BMBF (No. 06 DA 9036I and No. 05 P12 RDCIA), HIC for FAIR, EU through EURONS (No. 506065) and ENSAR (No. 262010).

HK 32.9 Mi 18:45 HZ 5

Nuclear structure effects in high-energy bremsstrahlung from spin-0 and spin-1/2 nuclei — •Doris Jakubassa-Amundsen — University of Munich, Germany

Bremsstrahlung from relativistic spin-polarized electrons colliding with

inert nuclei is calculated by taking into account the nuclear form factors and the kinematical recoil. For the spin-1/2 nuclei additional contributions from the anomalous magnetic moment and the dynamical recoil are considered. Electron bremsstrahlung is described with the help of semirelativistic wavefunctions while nuclear bremsstrahlung, when present, is treated within the Born approximation. The triply differential bremsstrahlung cross section is integrated over the electron scattering angle to study the polarization correlations between the beam electron and the emitted photon. Results are shown for 20-120 MeV electrons colliding with protons, 19F, 64Zn and 89Y. It is also attempted to explain the background in electron spectra from nuclear excitation in terms of bremsstrahlung. As an example the 180 degree spectrum from exciting the giant M2 resonance in 90Zr by 42.7 MeV electrons is analyzed.

HK 33: Schwerionenkollisionen und QCD Phasen

Zeit: Mittwoch 16:30–19:00 Raum: HZ 6

Gruppenbericht HK 33.1 Mi 16:30 HZ 6

Photon and dilepton production across collision energies and centralities — •Olena Linnyk[1], Elena Bratkovskaya[2,3], and Wolfgang Cassing[1] — [1]Justus Liebig Universität Gießen, Gießen, Deutchland — [2]Johann Wolfgang Goethe Universität, Frankfurt am Main, Deutchland — [3]Frankfurt Institute for Advanced Studies, Frankfurt am Main, Deutchland

Real and virtual photons are established messengers of chiral symmetry restoration and deconfinement phase transition in heavy-ion collisions. We calculate the emission of photons and dileptons throughout the evolution of the heavy-ion collisions using the parton-hadron-string dynamics (PHSD) transport approach and interpret the recent observations of the strong photon elliptic flow at RHIC and LHC simultaneously with the precisely measured photon and dilepton spectra. This allows us to disentangle the individual hadronic and partonic emission sources and to conclude on the characteristics of the produced QCD matter – the temperatures, densities and the degree of thermalisation reached, the lifetime of the QGP and the modification of vector mesons. Comparing the known sources to the data, we examine the possibility to accommodate new effects, such as the photon production in the initial pre-equilibrium phase and the dilepton production in the mixed phase. Additionally, we provide predictions for the dilepton spectra at LHC, the collision centrality dependence of the photon yield at RHIC, and the excitation function of the low-mass dilepton yield, thus investigating the potential of the dilepton measurements within the RHIC beam energy scan program, FAIR and NICA facilities.

HK 33.2 Mi 17:00 HZ 6

Dielectron production in pp collisions at $\sqrt{s} = 7$ TeV with ALICE at the LHC — •Markus K. Köhler for the ALICE-Collaboration — Research Division and ExtreMe Matter Institute, GSI Helmholtzzentrum für Schwerionenforschung, Planckstr. 1, 64291 Darmstadt — Institut für Kernphysik, Technische Universität Darmstadt, Schlossgrabenstr. 9, 64289 Darmstadt

Dileptons provide an important probe for the medium, which can be created in heavy-ion collisons. Thereby, proton-proton collisions are crucial as a reference measurement.
We will present the latest results on the dielectron analysis in minimum-bias proton-proton collisons at $\sqrt{s} = 7$ TeV with the ALICE detector system at the LHC, CERN. The results will be compared to the expected hadronic sources. This measurement provides also the possibility to extract the total charm cross section and the yield of direct photons.
Moreover, first results for a high-p_t dielectron analysis with events triggered using the electromagnetic calorimeter will be shown.

HK 33.3 Mi 17:15 HZ 6

Measurement of Low-Mass Dielectron Production in Pb–Pb Collisions with ALICE — •Patrick Reichelt for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

The measurement of electron-positron pairs (dielectrons) in the low invariant mass region allows to study the vacuum and in-medium properties of light vector mesons. Additionally, dielectrons from thermal photons are an important probe for the study of the evolution of the hot and dense medium created in heavy-ion collisions. In particular, the extraction of virtual photons in the low-mass region provides a complimentary measurement of the real photon yield. In the ALICE apparatus at the LHC, electrons at mid-rapidity are identified by their specific energy loss in the Inner Tracking System (ITS) and the Time Projection Chamber (TPC), combined with time-of-flight information from TOF. We will present the status of the low-mass dielectron analysis in Pb–Pb collisions at $\sqrt{s_{NN}} = 2.76$ TeV, involving these detector systems. Special emphasis will be laid on the extraction of the virtual photon yield. The invariant mass distribution will be compared to the expected hadronic sources.

Supported by BMBF and the Helmholtz Association.

HK 33.4 Mi 17:30 HZ 6

Prospects of Low-Mass Dielectron Measurements in ALICE with an upgraded Central Barrel Detector — •Carsten Klein for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

The measurement of electron-positron pairs in the low invariant mass region allows to study vacuum and in-medium properties of light vector mesons. Dielectrons also probe the production of thermal photons in heavy-ion collisions. ALICE is well-suited to perform this measurement due to its tracking and particle identification capabilities at very low momenta. However, Dalitz decays and photon conversions lead to a high combinatorial background. Additionally, coincident semi-leptonic decays of charm and anti-charm hadrons produce a continuum signal, which dominates over the thermal dielectron signal. Both contributions can be reduced by an upgraded Inner Tracking System (ITS), to be installed during LHC's long shutdown 2 (2018). It will further improve the tracking efficiency at low p_{T} and provide detection capabilities for electrons from secondary vertices like conversions and heavy-quark decays. A simulation with the final design for an upgraded ITS was carried out. Our prediction of the impact on the low-mass dielectron measurement in Pb-Pb collisions at full LHC energy will be presented.
Supported by BMBF and the Helmholtz Association.

HK 33.5 Mi 17:45 HZ 6

How robust is a thermal photon interpretation of the ALICE low-p_T data? — Michael Klasen[1], Christian Klein-Bösing[2,3], •Florian König[1], and Johannes Wessels[2] — [1]Institut für Theoretische Physik, Westfälische Wilhelms-Universität Münster — [2]Institut für Kernphysik, Westfälische Wilhelms-Universität Münster — [3]ExtreMe Matter Institute, GSI, Darmstadt

We present a rigorous theoretical analysis of the ALICE measurement of low-p_T direct-photon production in central lead-lead collisions at the LHC with a centre-of-mass energy of $\sqrt{s_{NN}} = 2.76$ TeV. Using NLO QCD, we compute the relative contributions to prompt-photon production from different initial and final states and the theoretical uncertainties coming from independent variations of the renormalisation and factorisation scales, the nuclear parton densities and the fragmentation functions. Based on different fits to the unsubtracted and prompt-photon subtracted ALICE data, we consistently find $T = 304 \pm 58$ MeV and 309 ± 64 MeV for the effective temperature of the quark-gluon plasma (or hot medium) at $p_T \in [0.8; 2.2]$ GeV and $p_T \in [1.5; 3.5]$ GeV as well as a power-law (p_T^{-4}) behavior for $p_T > 4$ GeV as predicted by QCD hard scattering.

HK 33.6 Mi 18:00 HZ 6

Real and virtuell photon emission within effective quark-meson models — •Falk Wunderlich[1,2] and Burkhard Kämpfer[1,2] — [1]Helmholtz-Zentrum Dresden-Rossendorf, Bautzner Landstr. 400, 01328 Dresden, Germany — [2]Institut für Theoretische Physik, TU Dresden, Zellescher Weg 17, 01062 Dresden

Certain aspects of the behaviour of strongly interacting matter can be understood in terms of effective models. Among such models are the quark-meson models. With a suitable choice of parameters and field content their phase diagram exhibits a 1st order phase transition that terminates in a critical point at nonzero chemical potential. Including the electromagnetic sector we investigate the dependence of the real and virtual photon rates on temperature and chemical potential with

emphasis on peculiarities near the critical point.

HK 33.7 Mi 18:15 HZ 6

Low-mass di-electron reconstruction at the CBM experiment at FAIR — •Elena Lebedeva[1], Claudia Höhne[1], and Tetyana Galatyuk[2] for the CBM-Collaboration — [1]Justus-Liebig-Universität Gießen, Gießen, Germany — [2]Technische Universität Darmstadt, Darmstadt, Germany

The Compressed Baryonic Matter (CBM) experiment at the future FAIR facility will investigate high baryon density matter at moderate temperatures in A+A collisions from 4-35 AGeV. One of the key observables of the CBM physics program is electromagnetic radiation from the early fireball carrying undistorted information on its conditions to the detector. This includes detailed investigations of low-mass vector mesons in their di-electron channel. In the presented simulation studies we investigate the feasibility to effectively reduce the combinatorial background with the currently foreseen experimental setup, which does not provide electron identification in front of the magnetic field. The strategy of electron identification and background suppression will be discussed. Simulation results with most-up-to date realistic detector description as well as detailed background studies will be presented.

HK 33.8 Mi 18:30 HZ 6

Electric and magnetic response of hot QCD matter — •Thorsten Steinert and Wolfgang Cassing — Institut für Theoretische Physik, Universität Giessen, 35392 Giessen, Germany

We study the electric conductivity as well as the magnetic response of hot QCD matter at various temperatures T and chemical potentials μ_q within the off-shell Parton-Hadron-String Dynamics (PHSD) transport approach for interacting partonic systems in a finite box with periodic boundary conditions. The response of the strongly-interacting system in equilibrium to an external electric field defines the electric conductivity σ_0 whereas the response to a moderate external magnetic field defines the induced diamagnetic moment $\mu_L\ (T, \mu_q)$ as well as the spin susceptibility $\chi_S(T, \mu_q)$. We find a sizeable temperature dependence of the dimensionless ratio σ_0/T well in line with calculations in a relaxation time approach for $T_c < T < 2.5T_c$ as well as an increase of σ_0 with μ_q^2/T^2. Furthermore, the frequency dependence of the electric conductivity $\sigma(\Omega)$ shows a simple functional form well in line with results from the Dynamical QuasiParticle Model (DQPM). The spin susceptibility $\chi_S(T, \mu_q)$ is found to increase with temperature T and to rise $\sim \mu_q^2/T^2$, too. The actual values for the magnetic response of the QGP in the temperature range below 250 MeV show that the QGP should respond diamagnetically in actual ultra-relativistic heavy-ion collisions since the maximal magnetic fields created in these collisions are smaller than $B_c(T)$ which defines a boundary between diamagnetism and paramagnetism.

HK 33.9 Mi 18:45 HZ 6

Inhomogeneous phases in effective quark models — •Achim Heinz, Francesco Giacosa, Marc Wagner, and Dirk H. Rischke — Institut of Theoretical Physics, Frankfurt am Main, Germany

Chiral symmetry is a symmetry of the QCD Lagrangian, which is spontaneously broken due to nonperturbative phenomena. As a consequence, a chiral condensate, which corresponds to a vacuum's condensate of quark-antiquark pairs, emerges. Usually, this condensate is treated as constant over space, but analytic as well as numerical studies show that an inhomogenous condensation is favored at high density. However, in most cases it is not possible to calculate analytically the emergence of inhomogeneous condensation. Therefore it is important to improve numerical methods: in the talk, we present a new numerical approach which is capable to reproduce well-known analytic results in 1+1 as well as in 1+3 dimensions. We also outline which studies can be performed with this method in the near future.

HK 34: Instrumentierung

Zeit: Mittwoch 16:30–19:00 Raum: HZ 8

Gruppenbericht HK 34.1 Mi 16:30 HZ 8

The Silicon Tracking System of the CBM experiment — •Tomas Balog for the CBM-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

The Compressed Baryonic Matter (CBM) experiment at FAIR will explore the phase diagram of strongly interacting matter at the highest net-baryon densities in nucleus-nucleus collisions with interaction rates up to 10 MHz. As the core tracking detector of CBM the Silicon Tracking System (STS) will be installed in the gap of the 1 T super conducting dipole magnet for reconstruction of charged particle trajectories and its momenta. The requirement on momentum resolution, $\Delta p/p = 1\%$, can only be achieved with an ultra-low material budget, imposing particular restrictions on the location of 2.5 million channel front-end electronics dissipating 40 KW in the fiducial volume of about 2 m^3. The concept of the STS is based on a modular structure containing 300 μm thick double-sided silicon microstrip sensors read out through ultra-thin multi-line micro-cables with fast self-triggering electronics. As central building blocks the modules consisting of each a sensor, micro-cable and front-end electronics will be mounted with lightweight carbon fiber support structures onto 8 detector stations. At the station periphery infrastructure such as power and cooling lines will be placed. The status of the STS development is summarized in the presentation, including an overview on sensors, read-out electronics, prototypes, and system integration.

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

Gruppenbericht HK 34.2 Mi 17:00 HZ 8

Der Mikrovertex-Detektor des PANDA-Experiments — •Hans-Georg Zaunick für die PANDA-Kollaboration — II. Physikalisches Institut, Justus-Liebig-Universität Gießen, 35392 Gießen

Das PANDA-Detektorsystem am derzeit im Aufbau befindlichen Beschleunigerkomplex FAIR in Darmstadt ist konzipiert für die Untersuchung der starken Wechselwirkung in Proton-Antiproton-Annihilationen. Der experimentelle Aufbau besteht aus einem das stationäre Target umgebenden Targetspektrometer und dem Vorwärtsspektrometer, das den stark in Vorwärtsrichtung geboosteten Event-Topologien Rechnung trägt. Um Charm-haltige Kanäle mit hoher Effizienz registrieren zu können, umgibt den Interaktionspunkt ein Mikrovertex-Detektor (MVD), welcher durch hohe Spur- und Vertexauflösung u.a. kurzlebige Charmonium-Zustände vom Untergrund zu unterscheiden vermag.

Der MVD wird aus vier Lagen dünner Silizium-Detektoren bestehen, davon zwei Lagen Pixelsensoren und zwei Lagen doppelseitige Streifensensoren (DSSD), sowie mehreren Pixel/Streifen Vorwärts-Disks. Dieser Beitrag konzentriert sich auf die technologischen Aspekte von Design und Konstruktion des Detektors in Hinblick auf die herausfordernden experimentellen Bedingungen, wie z.B. die Abwesenheit eines Hardware-Triggers, hohe Ortsauflösung, begrenztes Verlustleistungs-Budget oder die Strahlenhärte aller Komponenten. Es werden aktuelle Prototypen und bisher mit ihnen durchgeführte Strahltests vorgestellt und deren Ergebnisse diskutiert.

Gefördert durch BMBF und HIC4FAIR

HK 34.3 Mi 17:30 HZ 8

Characterization of silicon microstrip sensors with a pulsed infrared laser system for the CBM experiment at FAIR — •Pradeep Ghosh[1,2] and Juergen Eschke[2,3] for the CBM-Collaboration — [1]Goethe Univ., Frankfurt — [2]GSI — [3]FAIR

The Silicon Tracking System (STS) for the Compressed Baryonic Matter (CBM) experiment at FAIR will comprise more than 1200 double-sided silicon microstrip sensors. For the quality assurance of the prototype sensors a laser test system has been built up. The aim of the sensor scans with the pulsed infrared laser system is to determine the charge sharing between strips and to measure the uniformity of the sensor response over the whole active area. The laser system measures the sensor response in an automatized procedure at several thousand positions across the sensor with focused infrared laser light ($\sigma \approx 15\ \mu$m, $\lambda = 1060$ nm). The duration (5 ns) and power (few mW) of the laser pulses are selected such, that the absorption of the laser light in the 300 μm thick silicon sensors produces a number of about 24k electrons, which is similar to the charge created by minimum ionizing particles in these sensors. Results from the characterization of monolithic active

pixel sensors, to understand the spot-size of the laser, and laser scans for different sensors will be presented.

Supported by Helmholtz International Center for FAIR, HGS-HIRe and H-QM.

HK 34.4 Mi 17:45 HZ 8

Implementation of the FPGA-based cluster finder for the CBM-MVD — •Qiyan Li for the CBM-MVD-Collaboration — Goethe-University, Frankfurt

The Micro Vertex Detector (MVD) of the CBM experiment at FAIR is optimized to identify rare open-charm particles by their decay topology, which requires a high demands on its spatial resolution, radiation hardness and rate capability. The MVD will be equipped with CMOS Monolithic Active Pixel Sensors. Those sensors feature an on-chip zero suppression and 1-dimensional cluster finding.
To further reduce the load on the event builders and future mass storage systems, we have developed a 2-dimensional cluster finding and characterization algorithm suited for preprocessing and reducing the data streams generated by the free-running pixel sensors. The algorithms are implemented in the FPGA of the readout controller system (ROC) for the MVD. After the sensors' data are cross-checked for possible errors and synchronization problems, they will be stored in a frame buffer, which serves as the input for the cluster finder. Then, the output of cluster finder will be transferred to a readout buffer and shipped forward via TRB-net.
This contribution will present the implementation of the algorithms on the remaining free resources of the FPGAs in the MVD ROCs, followed by presenting test result on compression capability, performance and error-handling. * supported by BMBF (05P12RFFC7), HIC for FAIR, and GSI.

HK 34.5 Mi 18:00 HZ 8

Development of prototype CO_2 cooling system for the CBM Silicon Tracking System — •Evgeny Lavrik for the CBM-Collaboration — Physikalisches Institut der Universität Tübingen, Tübingen, Deutschland

The CBM experiment aims to study the properties of nuclear matter at high net-baryon densities. The STS is the key detector to reconstruct charged particle tracks created in heavy-ion interactions. The foreseen interaction rate of up to 10 MHz requires radiation hard detectors as well as efficient cooling of front-end electronic boards (FEBs). To avoid thermal runaway the system must be kept at -5°C or below all the time. This is rather challenging because the overall thermal load in the 2 m^3 STS enclosure is up to 40 kW.

Because of these requirements liquid CO_2 is used as a cooling agent as it is superior in terms of volumetric heat transfer coefficient compared to other agents.

In our study we built an open cooling system to determine the two-phase CO_2 cooling parameters. Furthermore we designed and built custom heat exchangers adapted to the STS geometry and measured their cooling efficiency. We will present preliminary results of our ongoing work.

Supported by: BMBF and grant 05P12VTFCE

HK 34.6 Mi 18:15 HZ 8

Integration of the strip barrel staves of the PANDA Micro Vertex Detector — •Tommaso Quagli, Kai-Thomas Brinkmann, Robert Schnell, and Hans-Georg Zaunick for the PANDA-Collaboration — II. Physikalisches Institut, Justus-Liebig-Universität Gießen, Gießen, Germany

PANDA is a key experiment of the future FAIR facility, under construction in Darmstadt, Germany. It will study the collisions between an antiproton beam and a fixed proton or nuclear target. The Micro Vertex Detector (MVD) is the innermost detector of the apparatus and is composed of four concentric barrels and six forward disks, instrumented with silicon hybrid pixel detectors and double-sided silicon microstrip detectors; its main task is the identification of primary and secondary vertices. The central requirements include high spatial and time resolution, trigger-less readout with high rate capability, good radiation tolerance and low material budget.

Square and rectangular microstrip sensors will be used in the two outer barrels of the detector. The sensors and the front-end electronics will be arranged on linear staves, composed of a carbon support structure with an embedded active cooling system. A flexible multilayer bus will be used to route the signals on the stave towards the DAQ system. The design of the stave, its integration concept and some relevant hardware developments will be presented.

Supported by BMBF, HGS-HIRe and JCHP.

HK 34.7 Mi 18:30 HZ 8

A low-power front-end amplifier for the microstrip sensors of the PANDA Microvertex Detector — •Valentino Di Pietro[1], Kai-Thomas Brinkmann[1], Angelo Rivetti[2], Alberto Riccardi[1], Manuel Rolo[2], and Sara Garbolino[2] for the PANDA-Collaboration — [1]II. Physikalisches Institut, JLU Gießen, Gießen, Germany — [2]INFN Sezione di Torino, Torino, Italy

The most common readout systems designed for nuclear physics detectors are based on amplitude measurements. The information that needs to be preserved is the charge delivered by a particle hitting the sensor. The electronic chain employed in these cases is made of two main building blocks: front-end amplifier and ADC. An issue in the implementation of such an architecture in scaled CMOS technologies is the dynamic range, because the charge information is extrapolated through the sampling of the peak of the front-end output signal. It is therefore interesting to explore the use of time-based architectures that offer better performances. In fact, in these topologies the linearity between the charge and the signal duration can be maintained even if some building blocks in the chain saturate. The main drawback is the loss in resolution since a duration measurement involves the difference between two time measurements. This work will present the design of a front-end optimized for fast Time-over-Threshold applications. The circuit has been developed for the microstrip detectors of the PANDA experiment. The architecture of the front-end amplifier will be presented and simulations in a 110 nm CMOS technology will be discussed. Supported by BMBF, HGS-HIRe and JCHP.

HK 34.8 Mi 18:45 HZ 8

Detector module development for the CBM Silicon Tracking System — •Olga Bertini for the CBM-Collaboration — GSI Helmholtzzentrum, Darmstadt

The central detector of the CBM experiment at FAIR, the Silicon Tracking System (STS), is designed to reconstruct hundreds of charged particle tracks produced at rates up to 10 MHz in interactions of ion beams of up to 45 AGeV projectile energies with nuclear targets. The building block of the tracking system is a module suitable for a low-mass detector construction. In a module, the basic functional unit of the STS, radiation tolerant microstrip sensors are read out through low-mass multi-line cables with self-triggering front-end electronics located at the periphery of the system. Light-weight carbon fibre support structures will carry 10 of such modules and build up the STS stations. The performance of module prototypes has been evaluated, resembling the structure of the intended STS module. The shown prototypes comprise a full-size CBM05 sensor and two 128-channel read-out cables attached to the read-out pads on either side of the sensor. The cables end in connector boards interfacing to two front-end boards each hosting one n-XYTER chip.
Supported by EU-FP7 HadronPhysics3.

HK 35: Astroteilchenphysik

Zeit: Mittwoch 16:30–18:45 Raum: HZ 9

HK 35.1 Mi 16:30 HZ 9

Experimental Determination of the Antineutrino Spectrum of the Fission Products of U238 — •Nils Haag, Achim Gütlein, Martin Hofmann, Walter Potzel, and Lothar Oberauer — Technische Universität München, 85748 Garching

Accurate predictions of the antineutrino spectrum emitted by a nuclear reactor are of paramount importance for current and future reactor neutrino experiments. The antineutrinos are produced in the β-decays of the fission daughters of the four main fuel isotopes ^{235}U, ^{238}U, ^{239}Pu, and ^{241}Pu. One way to calculate the total $\bar{\nu}_e$-spectrum emitted by a fuel assembly is to experimentally determine the cumula-

tive β - spectra emitted after fission of these four main fuel isotopes and to convert these into the corresponding $\bar{\nu}_e$ - spectra. Three of the four spectra could already be determined in the 1980's, but only recently an experiment at the scientific neutron source FRM II in Garching could be performed to measure the $\bar{\nu}_e$ - spectrum of ^{238}U which contributes 10 % to the total antineutrino output of a standard PWR. With this spectrum, it is now possible to predict the antineutrino output of a reactor without the use of theoretical calculations for the contribuing spectra.
This talk describes the results of the experiment and discusses the impact on the current analysis of reactor neutrino experiments and the reactor antineutrino anomaly, which may give a hint on the possible existence of light sterile neutrinos.

HK 35.2 Mi 16:45 HZ 9

Measurements of Proton- and Electron-Quenching in Organic Liquid Scintillators — •Vincenz Zimmer, Paul Hackspacher, Dominikus Hellgartner, Lothar Oberauer, Ludwig Prade, and Jürgen Winter — Technische Universität München

Understanding quenching effects in organic liquid scintillators is vital for various present and future neutrino experiments, like Double Chooz, Borexino, LENA and JUNO.

Electron-quenching plays a crucial role for low energy electron events below about 500 keV, like electron recoil events from Compton-scattering and from ν-e-scattering - especially for solar pp-neutrino events. To measure this effect a coincidence experiment using a scintillation detector and a HPGe-detector has been set up and the analysis of first data shows promising results.

The understanding of proton-quenching is important for both signal and background detection in neutrino experiments. This effect defines the energy scale of ν-p-scattering, which is a major detection channel for supernova-νs. Furthermore, recoil protons from cosmogenic neutrons pose a severe background for the detection of the diffuse supernova neutrino background (DSNB) and reactor neutrinos. A time-of-flight based experiment has been established at the MLL (Garching). Using a pulsed ^{11}B-beam and a fixed H_2-target neutrons with $6 - 11$ MeV are produced to investigate the quenching effect by the resulting proton recoils in different liquid scintillator samples.

This research was supported by the DFG cluster of excellence 'Origin and structure of the Universe' and the Maier-Leibnitz-Laboratorium.

HK 35.3 Mi 17:00 HZ 9

Performance des Fokalebenendetektors während der Inbetriebnahme des KATRIN Hauptspektrometers — •Fabian Harms für die KATRIN-Kollaboration — Karlsruher Institut für Technologie, Institut für Experimentelle Kernphysik

Das Ziel des **Ka**rlsruher **Tri**tium **N**eutrino Experiments ist die modellunabhängige Bestimmung der effektiven Ruhemasse des Elektron-Antineutrinos mit einer bis dato unerreichten Sensitivität von 200 meV/c^2 (90% C.L.). Dies geschieht mittels der kinematischen Untersuchung der Elektronen aus dem Tritium β-Zerfall durch ein auf dem MAC-E Filter Prinzip basierendes Spektrometer. Der KATRIN Fokalebenendetektor (FPD) - bestehend aus einer Si-PIN Diode mit 148 Segmenten - ist Teil des MAC-E Filters und weist die vom Spektrometer transmittierten Elektronen mit hoher Effizienz und nahezu untergrundfrei nach.
Im Laufe des Sommers 2013 wurde das KATRIN Hauptspektrometer für eine dreimonatige Messphase erstmals in Betrieb genommen. Dabei war insbesondere die Langzeit-Performance des Fokalebenendetektors entscheidend für den Erfolg dieser Messphase.
Neben einer Übersicht über den Aufbau des Fokalebenendetektor-Systems wird in diesem Beitrag die Performance des Detektors während der Spektrometer Inbetriebnahme zusammengefasst.
Gefördert durch das BMBF unter dem Kennzeichen 05A11VK3 und von der Helmholtz-Gemeinschaft.

HK 35.4 Mi 17:15 HZ 9

Main Spectrometer and Detector Commissioning Measurements by Time-of-Flight at the KATRIN experiment — •Nicholas Steinbrink, Volker Hannen, Jan Behrens und Christian Weinheimer für die KATRIN-Kollaboration — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, Wilhelm-Klemm-Str. 9, 48149 Münster

The KATRIN experiment aims to measure the electron neutrino mass with a sensitivity of < 0.2 eV at 90% confidence level. The measurement is accomplished by scanning the endpoint of the tritium beta decay spectrum with an electrostatic high pass filter, based on the MAC-E-Filter (magnetic adiabatic collimation with an electrostatic filter) principle. The filtering takes place in the main spectrometer of KATRIN while the count-rate as a function of the filter energy is measured with the focal plane detector (FPD).

The whole spectrometer and detector system (SDS) has undergone successful commissioning measurements in 2013. For that purpose, a mono-energetic angular selective electron gun has been used as calibration source. As the electron gun is driven in a pulsed mode, the time-of-flight (TOF) of electrons through the main spectrometer can be measured as well. That allows to obtain further information about the performance and functionality of the setup. In this talk results from the TOF measurements are presented. Particular emphasis will be put on the integrity of the wire electrode, which can be probed by TOF data.

This work is supported by BMBF under 05A11PM2.

HK 35.5 Mi 17:30 HZ 9

Messungen der Transmissionseigenschaften des KATRIN Hauptspektrometers — •Moritz Erhard für die KATRIN-Kollaboration — Karlsruher Institut für Technologie (KIT), Institut für experimentelle Kernphysik (IEKP)

Ziel des Karlsruher Tritium Neutrino Experiments ist es, durch eine Endpunktsuntersuchung des β-Zerfallsspektrums von Tritium die effektive Masse des Elektronantineutrinos direkt und modellunabhängig mit einer Sensitivität von 200 meV/c^2 (90% CL) zu bestimmen. Um diese hohe Sensitivität zu erreichen wird das KATRIN Hauptspektrometer mit dem MAC-E-Filter (Magnetic Adiabatic Collimation followed by Electrostatic Filter) Prinzip betrieben.

Die Kenntnis der genauen Transmissionseigenschaften des Hauptspektrometers ist für die spätere Interpretation der Tritiumdaten und Extraktion der Neutrinomasse von großer Wichtigkeit.

Bei der Inbetriebnahme des Spektrometers im Sommer 2013 wurden mithilfe einer Elektronenkanone Messungen der Transmissionseigenschaften des Hauptspektrometers durchgeführt. Die gewonnenen Daten werden in diesen Vortrag präsentiert.

Gefördert durch das BMBF unter Kennzeichen 05A11VK3, 05A11PM2 und die Helmholtz-Gemeinschaft.

HK 35.6 Mi 17:45 HZ 9

Background due to secondary electron emission in the KATRIN experiment — •Benjamin Leiber and Ferenc Glück — Karlsruhe Institute of Technology, IKP and IEKP

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. A significant part of the background is due to cosmic muon and/or environmental gamma induced secondary electron emission from the vessel inner wall and electrode surfaces of the KATRIN main spectrometer. The secondary emission rates in the KATRIN pre-, monitor and main spectrometers have been determined by a combination of measurements and simulations. In the case of the main spectrometer this rate is about 50 kHz. Due to the magnetic shielding effect, the background rate is several orders of magnitude smaller than the above secondary emission rate. The background reduction of the magnetic shielding can be improved by improving the axial symmetry of the magnetic and electric fields inside the main spectrometer. In addition, the background rate due to the secondary electron emission can be further reduced with the help of electric shielding realized by the wire electrode system inside the main spectrometer.

We acknowledge support by the BMBF of Nr. 05A11VK3 and by the Helmholtz Association.

HK 35.7 Mi 18:00 HZ 9

Radon backgrounds in the KATRIN experiment — •Richard Rink, Stefan Görhardt, and Jan Oertlin for the KATRIN-Collaboration — Karlsruhe Institute of Technology (KIT), Institut für Kernphysik (IKP)

The KATRIN experiment aims to determine the effective mass of the electron anti-neutrino with a sensitivity of 200 meV by investigating the kinematics of tritium β-decay. In order to achieve this sensitivity, the overall background of the experiment needs to be on the order of 0.01 counts per second.

The decay of radon atoms, which emanate from different sources inside the spectrometer, produces high energy (order of 10 keV) electrons. These electrons can be stored inside the spectrometer because of the magnetic mirror effect and create a large number of secondary

electrons via ionization of the residual gas. The secondaries are accelerated by the electric potential and therefore will have the same energy as the signal electrons from β-decays by the time they arrive at the detector.

This talk will present investigations of radon-induced backgrounds during the recent commissioning measurement phase of the KATRIN main spectrometer and discuss the efficiency of counter measures.

This work was supported by the BMBF under grant no. 05A11VK3 and by the Helmholtz Association.

HK 35.8 Mi 18:15 HZ 9

Messung der Langzeitstablilität verschiedener Rb/Kr-Quellen am KATRIN Monitorspektrometer — •Ingo Reuter für die KATRIN-Kollaboration — Karlsruher Institut für Technologie (KIT), Insititut für experimentelle Kernphysik (IEKP)

Das Ziel des KArlsruher TRItium Neutrino Experiments KATRIN ist die Bestimmung der effektiven Masse des Elektron-Antineutrinos, mit einer bisher unerreichten Sensitivität von 200 meV/c^2. Für das Experiment ist ein Spektrometer nach dem MAC-E-Filter Prinzip aufgebaut worden, um das Energiespektrum der Tritium-Zerfallselektronen nahe ihres Endpunkts zu vermessen. Damit diese Sensitivität über die gesamte Messzeit gewährleistet werden kann, ist eine langzeitstabile Spannungsüberwachung und Kalibration erforderlich mit einer Unsicherheit von 60 meV über zwei Monate bei -18,6 kV. Hierzu werden am Monitorspektrometer, auch einem MAC-E-Filter, monoenergetische Konversionselektronen einer Rb/Kr Quelle gemessen. Das Rb wird durch Ionenimplantation in ein Substrat eingebracht. Dieser Vortrag gibt einen Überblick über die Eignung verschiedener Substrate für eine solche Kalibrationsquelle. Gefördert durch das BMBF unter der Kennzeichnung 05A11VK3 und der Helmholtz-Gemeinschaft.

HK 35.9 Mi 18:30 HZ 9

Status report on the tritium source-related components of the KATRIN experiment — •Martin Babutzka, Markus Steidl, and Michael Sturm for the KATRIN-Collaboration — Karlsruher Institut für Technologie (KIT)

The KArlsruhe Tritium Neutrino Experiment (KATRIN) aims for the direct model-independent neutrino mass measurement with a sensitivity of $m_{\bar{\nu}_e} < 200\,\mathrm{meV}$ (90% C.L.). While the commissioning of the high resolution MAC-E filter has already started, some of the tritium related components are still in the finishing stage at the manufacturers. We give a status report on all source and transport components of KATRIN as well as all related tritium processing and analytic intruments at the Tritium Laboratory Karlsruhe. Additionally we describe the improvements in simulations and our program to characterize the components in advance of tritium data taking. This is of special importance as the statistical and systematic uncertainties of the $m_{\bar{\nu}_e}$ measurement are closely related to the performance and stability of the windowless gaseous tritium source - as well to the functionality of the transport section, which has to reduce the tritium flow by 14 orders of magnitude in order to avoid backgrounds and to the performance of monitoring systems which are able to detect changes in the source parameters down to a precision of 0.1 %.

HK 36: Hauptvorträge III

Zeit: Donnerstag 11:00–13:00 Raum: HZ 1+2

Hauptvortrag HK 36.1 Do 11:00 HZ 1+2

Testing the Standard Model at the precision frontier: The anomalous magnetic moment of the muon — •Andreas Hafner — Johannes Gutenberg Universität Mainz, Institut für Kernphysik

The anomalous magnetic moment of the muon $(g-2)_\mu$ is one of the most precisely measured quantities in particle physics (0.54 ppm). There is a long-standing discrepancy of 3-4 standard deviations between the direct measurement of $(g-2)_\mu$ and its theoretical evaluation.

This theoretical prediction is subdivided into three contributions: QED, weak and hadronic. The QED and weak parts can be determined in perturbative approaches with very high precision. Thus, the hadronic uncertainty dominates the total theoretical uncertainty. Within the hadronic uncertainty, the largest contribution stems from the vacuum polarization term, which can be evaluated with the measurement of the inclusive hadronic cross section in e^+e^- annihilation. The second largest contribution to the hadronic uncertainty stems from the so-called light-by-light amplitudes. They have to be evaluated via theoretical models. These models can be tested, optimized and the corresponding uncertainties can be estimated by transition form factor measurements.

Existing and future measurements of the relevant hadronic cross sections and form factors are presented.

Hauptvortrag HK 36.2 Do 11:30 HZ 1+2

The muon g-2 and the Adler function from lattice QCD — •Gregorio Herdoiza — Institute of Nuclear Physics Johannes Gutenberg-Universität Mainz Johann-Joachim-Becher-Weg 45 D-55099 Mainz, Germany

The anomalous magnetic moment of the muon, $g-2$, is one of the most promising observables to identify the signs for physics beyond the Standard Model. QCD contributions are currently responsible for a large fraction of the overall theoretical uncertainty in the determination of the muon $g-2$, and in the running of the QED coupling constant. The recent progress in determining these hadronic contributions from first principles by means of lattice QCD calculations will be reviewed. Studies of the vacuum polarisation function and of the Adler function in the low-energy regime which is essential for current phenomenological studies, as well as in a region of large momentum transfer will be considered. The latter energy regime can be used to match lattice QCD calculations to perturbation theory, thereby providing a way to determine the strong coupling constant.

Hauptvortrag HK 36.3 Do 12:00 HZ 1+2

Reviewing hadron production in the SIS energy regime using new HADES Au+Au data — •Manuel Lorenz for the HADES-Collaboration — Goethe-Universität, Frankfurt am Main — ExtreMe Matter Institute EMMI, Darmstadt

Data on particle production in heavy ion collisions in the energy regime of 1-2 A GeV have been collected over almost three decades now. As most of the newly created hadrons are produced below or slightly above their free NN-thresholds, data are usually interpreted with the help of phenomenological models, rather than comparing to elementary reference measurements. Driven by advance in detector technology, more and more rare and penetrating probes have become accessible, and still keep challenging our knowledge about the properties of the created system and its dynamical evolution.

The recently collected HADES data from Au+Au collisions at 1.23 A GeV represents in this energy regime the most advanced sample of heavy ion collisions in terms of precision and statistics (7*10^9 collected events). Using the yields and spectra of reconstructed hadrons ($\pi^{+-}, K^{+-}, K^0_s, \Lambda$) provides therefore the optimal bases to test state of the art models and to question the extent of our present understanding of hadron production. This work has been supported by BMBF (05P12RFGHJ), Helmholtz Alliance EMMI, HIC for FAIR, HGS-HIRe.

Hauptvortrag HK 36.4 Do 12:30 HZ 1+2

Encounters with Di-Baryons – from the ABC Effect to a Resonance in the Neutron-Proton System*. — •Mikhail Bashkanov for the WASA-at-COSY-Collaboration — Physikalisches Institut der Universität Tübingen

Despite their long painful history dibaryon searches have recently received new interest, in particular by the recognition that there are more complex quark configurations than just the familiar $q\bar{q}$ and qqq systems. The "hidden color" aspect makes dibaryons a particularly interesting object in QCD.

Within our two-pion production program we recently started to investigate the intriguing ABC effect, which denotes a low-mass enhancement in the $\pi\pi$-invariant mass spectrum produced in double-pionic fusion. We observe that this phenomenon is correlated with a resonance structure at $\sqrt{s} = 2.37$ GeV with $\Gamma \approx 70$ MeV and $I(J^P) = 0(3^+)$. In order to reveal the nature of this structure we measured its possible decay channels $d\pi^0\pi^0, d\pi^+\pi^-, pp\pi^0\pi^-, np\pi^0\pi^0, NN\pi$ and pn by pd collisions in the quasi-free reaction mode utilizing WASA at COSY.

The *pn* decay channel of the resonance, the *experimentum crucis*, was measured by use of polarized deuterons in inverse kinematics. First preliminary results for the *np* analyzing power exhibit a pronounced resonance effect in the ${}^3G_3$ partial wave.

The observed ρ channel $\pi^+\pi^-$ production is capable to explain the missing strength in *pn* induced e^+e^- production providing thus a possible explanation of the DLS puzzle.

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

HK 37: Hadronenstruktur und -spektroskopie

Zeit: Donnerstag 14:00–15:45 Raum: HZ 1+2

HK 37.1 Do 14:00 HZ 1+2

Hard exclusive meson production to constrain GPDs — •Johannes ter Wolbeek, Horst Fischer, Matthias Gorzellik, Arne Gross, Philipp Jörg, Kay Königsmann, Pasquale Malm, Christopher Regali, Katharina Schmidt, Stefan Sirtl, and Tobias Szameitat — for the COMPASS collaboration, Physikalisches Institut, Albert-Ludwigs-Universität Freiburg

The concept of Generalized Parton Distributions (GPDs) combines the two-dimensional spatial information, given by form factors, with the longitudinal momentum information from the PDFs. Thus, GPDs provide a three-dimensional 'tomography' of the nucleon. Furthermore, according to Ji's sum rule, the GPDs H and E enable access to the total angular momenta of quarks, antiquarks and gluons. While H can be approached using electroproduction cross section, hard exclusive meson production off a transversely polarized target can help to constrain the GPD E.
At the COMPASS experiment at CERN, two periods of data taking were performed in 2007 and 2010, using a longitudinally polarized 160 GeV/c muon beam and a transversely polarized NH_3 target. This talk will introduce the data analysis of the process $\mu + p \to \mu' + p' + V$ and recent results will be presented. Supported by BMBF, DFG and EU FP7 (Grant Agreement 283286).

HK 37.2 Do 14:15 HZ 1+2

COMPASS results on the transverse spin asymmetry in identified dihadron production in SIDIS — •Christopher Braun — Univ. Erlangen

The parton distribution function $h_1^q(x)$ of a transversely polarized quark q inside a transversely polarized nucleon, is chiral-odd and therefore not accessible in inclusive deep-inelastic scattering. It can only be observed in semi-inclusive deep-inelastic scattering (SIDIS) in combination with another chiral-odd function like the dihadron interference fragmentation function (IFF) $H_{1,q}^{\sphericalangle}$. The 160 GeV/$c$ polarized muon beam of CERNs M2 beamline allows COMPASS to investigate transverse spin effects using polarized solid state targets.
In this contribution an overview of COMPASS results for the azimuthal asymmetry in identified dihadron production is given. Taking advantage of the very precise particle identification of the apparatus using the RICH detector an identification of the hadrons which form the pairs in terms of pions and kaons was performed. Recently, the full set of this asymmetry from the COMPASS data on the deuteron and the proton target is available. The latter has been taken in the years 2007 and 2010, while the deuteron date dates back to the years 2003 and 2004. Data sets from same targets have been combined and analyzed using homogeneous cuts and methods. This allows for a detailed comparison of the obtained results to each other, to the corresponding results of the HERMES experiment and to model predictions. Furthermore an extraction of the so-called "Transversity" distribution $h_1(x)$ for u and d quarks was carried out. − Supported by German BMBF

HK 37.3 Do 14:30 HZ 1+2

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

The COMPASS experiment at the M2 beamline of the CERN SPS has taken data with a polarised muon beam scattering of a polarised NH_3 target in 2011. The beam energy has been increased to 200 GeV compared to 160 GeV in 2007. With the increased beam energy it is possible to reach higher values of Q^2 and lower values of x_{Bj}, compared to our first measurement in 2007. We will present our results on the longitudinal double spin asymmetry A_1^p and the spin-dependent structure function g_1^p from the 2011 data taking. This results will be used in a NLO QCD fit to the worlds data to obtain the polarised parton distributions and also to update our results on the validation of the Bjorken sum rule, connecting the integral of the non-singulet structure function with the ratio of the weak coupling constants.

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

HK 37.4 Do 14:45 HZ 1+2

Lambda-Polarisation in der Reaktion p (3.5 GeV) + Nb. — •Christian Wendisch für die HADES-Kollaboration — Helmholtz-Zentrum Dresden-Rossendorf

Die bereits 1976 erstmals beobachtete starke Polarisation von Hyperonen aus Kernreaktionen mit unpolarisierten Projektilen stellt ein bislang nur unzureichend erforschtes Phönomen dar. Entgegen den Erwartungen übt der Spin einen bedeutenden Einfluss bei der Teilchen-Erzeugung in inklusiven Prozessen, unabhängig von der kinetischen Energie der Reaktion, aus. Die Messung der Hyperon-Polarisation liefert somit Informationen über die Spin-Abhängigkeit der Quark-Verteilungen im Nukleon sowie der Fragmentationsprozesse und erlaubt den Test von Modellen zur Baryon-Struktur. Insbesondere in der Reaktion unpolarisierter Nukleonen stellen Λ-Hyperonen ein ideales Instrument zur Untersuchung der Polarisations-Effekte dar, weil sie über ihren schwachen Zerfall als natürliches Polarimeter wirken.

Aufgrund der großen Raumwinkelabdeckung und der hohen Nachweiseffizienz für Hadronen ermöglicht das High Acceptance Di-Electron Spectrometer (HADES) Λ-Hyperonen in einem weiten Phasenraumbereich zu rekonstruieren und somit deren Polarisation in der Reaktion p (3.5 GeV) + Nb in Abhängigkeit von Transversalimpuls und Rapidität zu bestimmen. Unsere Analyse zeigt eine signifikant negative Polarisation, welche im Mittel -11 % beträgt und mit steigendem Transversalimpuls zunimmt. Diese Arbeit wurde unterstützt durch das BMBF.

HK 37.5 Do 15:00 HZ 1+2

Measurement of Identified Jet Fragmentation Functions in Proton-Proton Collisions with ALICE at the LHC — •Benjamin A. Hess for the ALICE-Collaboration — Physikalisches Institut, Universität Tübingen, Germany

The ALICE experiment has excellent tracking and particle identification capabilities for tracks with transverse momenta ranging from 150 MeV/c up to several 10 GeV/c. This renders the measurement of identified jet fragmentation functions possible.

Partons from hard interactions at large momentum transfers fragment into jets. The non-perturbative aspect of the fragmentation process is encoded in so-called fragmentation functions that need to be determined from experiment. Comparing the measured functions with theoretical models can help to better understand the fragmentation process.

The anti-kT algorithm is used to reconstruct charged jets. Charged particles in these jets are then identified via their specific energy loss dE/dx in the ALICE TPC. First results for identified fragmentation functions in proton-proton collisions at $\sqrt{s} = 7$ TeV will be presented and compared to MC models.

HK 37.6 Do 15:15 HZ 1+2

Feasibility Study of a Transversely Polarized Target in Panda — •Bertold Fröhlich — Helmholtz Institut Mainz

PANDA (Antiproton Annihilation at Darmstadt) is a key project at the Facility for Antiproton and Ion Research (FAIR), currently under construction at the GSI Darmstadt. PANDA is a state of the art detector for antiproton-proton fixed target experiments. A transversely polarized target in PANDA would allow the determination of the proton electromagnetic form factors in the time-like region with unprecedented accuracy and the first-time extraction of their imaginary part, opening a new window for investigating the nucleon structure.

As a first step for achieving a transverse target polarization, the target region has to be shielded against the 2 T longitudinal magnetic

flux from the solenoid of the PANDA spectrometer. We present numerical simulations and experimental results on intense magnetic flux shielding using a high temperature superconducting hollow cylinder.

HK 37.7 Do 15:30 HZ 1+2

Accessing Transition Distribution Amplitudes with the PANDA experiment at FAIR — •Manuel Zambrana, Maria del Carmen Mora, and Frank Maas — Institut für Kernphysik, Johannes Gutenberg Universität, Mainz, Germany

The possibility of accessing the proton to pion Transition Distribution Amplitudes with the future PANDA detector at the FAIR facility is investigated. At high center of mass energy and four-momentum transfer, the amplitude of signal channel $\bar{p}p \to e^+e^-\pi^0$ admits a QCD factorized description in terms of Distribution Amplitudes and Transition Distribution Amplitudes in the forward and backward regions. Feasibility studies of measuring $\bar{p}p \to e^+e^-\pi^0$ with the PANDA detector have been performed at the center of mass energy squared $s = 5\ \mathrm{GeV}^2$ and $s = 10\ \mathrm{GeV}^2$, in the kinematic region of four-momentum transfer $3.8 < q^2 < 4.2\ \mathrm{GeV}^2$ and $7 < q^2 < 8\ \mathrm{GeV}^2$, respectively. These include detailed simulations on signal reconstruction efficiency as well as on rejection of the most severe background channel, i.e. $\bar{p}p \to \pi^+\pi^-\pi^0$. Simulations show that the particle identification capabilities of the PANDA detector will allow to achieve a background rejection factor larger than 10^8 while keeping the signal reconstruction efficiency at the level of 40%, and that a clean lepton signal can be reconstructed with a data sample corresponding to 2 fb^{-1} of integrated luminosity. The future measurement of the signal channel cross section with PANDA will provide a test of QCD factorization and opens the possibility of accessing the proton to pion Transition Distribution Amplitudes.

HK 38: Hadronenstruktur und -spektroskopie

Zeit: Donnerstag 14:00–16:00 Raum: HZ 3

Gruppenbericht HK 38.1 Do 14:00 HZ 3

selected charmonium and charmonium-like states at BESIII — •yu-ping guo for the BESIII-Collaboration — Institut für Kernphysik Johannes Gutenberg-Universität Mainz, Mainz, Germany

Using large data samples collected at $\psi(3686)$ peak and around the peaks of the vector charmonium resonances above 4.0 GeV, study of the charmonium (charmonium-like) states are performed at BESIII experiment.

Comparing to the charmonium states above the charm threshold, the states below the charm threshold are well understood, except the three spin-singlet states, η_c, h_c and $\eta_c(2S)$. With the data accumulated at the $\psi(3686)$ peak, the properties of these states are measured with high precision or at the first time. Based on the data samples taken above 4.0 GeV, the process of $\pi^+\pi^- h_c$ has been studied, the cross section line-shape will help us to understand the Y-states above the charm threshold. In addition, in the Dalitz study of the $\pi^+\pi^- h_c$ system, a charged charmonium-like state $Z_c(4020)$ has been observed, whose property is similar to the previous observed $Z_c(3900)$ in $\pi^+\pi^- J/\psi$ system.

HK 38.2 Do 14:30 HZ 3

Search for hybrids at BABAR: study of the rare decays B to J/psi K K K, and search for B0 to J/psi phi. — •Elisabetta Prencipe — FZJ Juelich, Leo Brandt Strasse - 52428 Juelich

We study the rare B meson decays B to J/psi K K K, B to J/psi phi K, and search for B0 to J/psi phi, using 468 millions of BBbar events collected at the Y(4S) resonance with the BABAR detector at the PEP-II e+e- asymmetric-energy storage ring. We perform a study of the decays B to J/psi K K K and B to J/psi phi K, obtaining new BR measurements. We also search for B0 to J/psi phi and derive an UL on the BR for this decay mode, according to predictions. We search for resonance production in the J/psi phi mass spectrum and obtain limits on the BR of the resonances claimed by the CDF Collaboration. We find that the distribution of events on the Dalitz plot is inconsistent with being uniform, although, in order to assess the presence of a resonant behavior, higher statistics and a full Dalitz plot analysis are needed.

HK 38.3 Do 14:45 HZ 3

Analyse des Reaktion $\bar{p}p \to \omega\pi^0\eta$ bei Crystal Barrel im Fluge — •Marvin Richter für die PANDA-Kollaboration — Institut für Experimentalphysik I, Ruhr-Universität Bochum, Deutschland

An der internationalen Teilchenbeschleunigeranlage FAIR am $\bar{\mathrm{P}}$ANDA-Experiment, welche sich derzeit im Aufbau befindet, werden $\bar{p}p$-Annihilationsprozesse mit Schwerpunktsenergien von bis zu 5,5 GeV untersucht. Die Spektroskopie der dabei entstehenden Hadronen setzt meist eine Partialwellenanalyse voraus.
Um ein besseres Verständnis über die $\bar{p}p$-Annihilation in Bezug auf das $\bar{\mathrm{P}}$ANDA-Experiment zu erlangen, werden Messdaten vom Crystal Barrel-Experiment, welche am Antiprotonspeicherring LEAR am CERN im Jahre 1995 aufgenommen worden sind, analysiert.
In diesem Vortrag werden die Selektion der Reaktion $\bar{p}p \to \omega\pi^0\eta$ im Fluge vorgestellt und vorläufige Ergebnisse präsentiert.

Gefördert durch das BMBF mit Förderkennzeichen 05P12PCFP5 und das Forschungszentrum Jülich.

HK 38.4 Do 15:00 HZ 3

Spectroscopy of final states with neutral particles in COMPASS — •Sebastian Uhl — Technische Universität München, Physik Department E18, 85748 Garching

To study the spectrum of light hadrons the COMPASS experiment at CERN has collected a huge data set with a negative pion beam impinging on a liquid hydrogen target. Resonances are diffractively produced at squared four-momentum transfers to the target between $0.1\,(\mathrm{GeV}/c)^2$ and $1\,(\mathrm{GeV}/c)^2$. The two-stage magnetic spectrometer with two electromagnetic calorimeters allows to study charged as well as semi-neutral final states, thus allowing an immediate consistency check between the flagship channel $\pi^-\pi^-\pi^+$ and its isospin partner $\pi^-\pi^0\pi^0$.

The decomposition of the three-pion mass spectra is done with the help of a partial-wave analysis. Partial waves up to spin six are included in the first step of the analysis, where the spin-parity decomposition of the data is performed in bins of the three-pion mass and the squared four-momentum transfer t'. The binning in t' provides a handle to better separate the resonant and non-resonant parts of the intensity in the second stage of the analysis, the modeling of the mass dependence of the spin-density matrix in order to extract resonance parameters.

This work was supported by the BMBF, the DFG Cluster of Excellence "Origin and Structure of the Universe" (Exc 153), and the Maier-Leibnitz-Laboratorium der Universität und der Technischen Universität München.

HK 38.5 Do 15:15 HZ 3

Study of the $\pi^+\pi^-$ System in $\pi^-\pi^+\pi^-$ Final States at COMPASS — •Fabian Krinner — Physik-Department, Technische Universität München, Bayern.

COMPASS, located at CERN's Super Proton Synchrotron, is a multi-purpose fixed-target experiment for studying the structure and spectrum of light hadrons using muon and hadron beams on various targets. With its high acceptance and resolution, it has e.g. collected the world's biggest data set of diffractively produced $\pi^-\pi^+\pi^-$ final states. This large amount of data allows not only for a very detailed partial-wave analysis of this particular final state, but also for a novel type of analysis which extracts the $\pi^+\pi^-$-subsystem with the quantum numbers $I^G J^{PC} = 0^+0^{++}$ from the three-pion final state without any model input on its shape. This new study reveals correlations of the $f_0(980)$ with decays of the $\pi(1800)$, the $\pi_2(1880)$ as well as a new state, the $a_1(1420)$, which will be presented.

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

HK 38.6 Do 15:30 HZ 3

Resonance extraction from diffractively produced $\pi^-\pi^+\pi^-$ final states at COMPASS — •Stephan Schmeing[1] and COMPASS Kollaboration[2] — [1]TU München E18 — [2]CERN

The COMPASS experiment studies the spectrum of hadrons and has acquired a large data sample of diffractively produced $\pi^-\pi^+\pi^-$ final

states using a 190 GeV pion beam on a hydrogen target. The large amount of data allow to perform the partial-wave analysis in bins of the squared four-momentum transfer t' from the beam to the target. Surprisingly, the data exhibit a pronounced dependence of the partial-wave contents on t'.

Using a novel analysis method this effect is exploited in order to better separate resonant from non-resonant contributions in the partial waves. This makes it possible to extract resonance parameters with higher precision, for example for the long-debated $a_1(1260)$. In addition the t'-dependence contains important information about the different contributing production processes. We will present the first results of this new method in the $\pi^- p \to \pi^-\pi^+\pi^- p$ channel.

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

HK 38.7 Do 15:45 HZ 3

Scattering lengths of Nambu-Goldstone bosons off D mesons and dynamically generated heavy-light mesons — •Michael Altenbuchinger[1], Lisheng Geng[2], and Wolfram Weise[1,3] — [1]Physik Department, TU München, D-85747 Garching — [2]School of Physics and Nuclear Energy Engineering, Beihang Univ., Beijing 100191, China — [3]ECT*, Villazzano (Trento), Italy

Recent lattice QCD simulations of the scattering lengths of Nambu-Goldstone bosons off the D mesons are studied using unitary chiral perturbation theory. We show that the lattice QCD data are better described in the covariant formulation than in the heavy-meson formulation. The $D^*_{s0}(2317)$ can be dynamically generated from the coupled-channels DK interaction without a priori assumption of its existence. A new renormalization scheme is proposed which manifestly satisfies chiral power counting rules and has well-defined behavior in the infinite heavy quark mass limit. Using this scheme we predict the heavy-quark spin and flavor symmetry counterparts of the $D^*_{s0}(2317)$.

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

HK 39: Struktur und Dynamik von Kernen

Zeit: Donnerstag 14:00–16:00 Raum: HZ 4

Gruppenbericht HK 39.1 Do 14:00 HZ 4

Microscopic description of α-cluster states in ^{12}C — •Thomas Neff and Hans Feldmeier — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

The structure of ^{12}C is investigated, using both a microscopic α-cluster model and fermionic molecular dynamics (FMD) where individual nucleons are considered as degrees freedom. In the FMD calculation an effective realistic interaction derived in the unitary correlation operator method (UCOM) is employed. By explicitly including ^{8}Be+α channels resonances and scattering states above the three-α threshold can be investigated. Of particular interest are the second 0^+ state, the famous Hoyle state, and the second 2^+ state. Monopole and quadrupole transition strengths are analyzed and compared to experiment.

HK 39.2 Do 14:30 HZ 4

Phase-space representation for nuclear potentials — •Dennis Weber[1,2], Hans Feldmeier[2,3], and Thomas Neff[2] — [1]ExtreMe Matter Institute EMMI and Research Division — [2]GSI Helmholtzzentrum für Schwerionenforschung, Planckstraße 1, 64291 Darmstadt, Germany — [3]Frankfurt Institute for Advanced Studies, Max-von-Laue-Straße 1, 60438 Frankfurt, Germany

Many modern realistic nucleon-nucleon (NN) potentials are given in a momentum space matrix element representation. Although this momentum space representation can be used in most nuclear many-body calculations, it is desirable to study and visualize NN potentials in a more intuitive way as a function of the relative distance between two nucleons. We introduce a phase-space representation which depends on both, relative distance and relative momentum of the nucleons. This representation is employed to investigate realistic NN potentials and the effect of renormalization methods like the "Unitary Correlation Operator Method" (UCOM) and the "Similarity Renormalization Group" (SRG) with respect to momentum and angular momentum dependence.

HK 39.3 Do 14:45 HZ 4

Proton-proton elastic scattering measurements at COSY — •Zara Bagdasarian for the ANKE-Collaboration — Forschungszentrum Juelich, Juelich, Germany — Tbilisi State University, Tbilisi, Georgia

To construct the reliable phase shift analysis (PSA) that can successfully describe the nucleon-nucleon (NN) interaction it is necessary to measure variety of experimental observables for both proton-proton (pp) and neutron-proton (np) elastic scattering. The polarized beams and targets at COSY-ANKE facility allow a substantial contribution to the existing database. The experiment was carried out in April 2013 at ANKE using a transversely polarized proton beam incident on an unpolarized hydrogen cluster target. Six beam energies of T_p = 0.8, 1.6, 1.8, 2.0, 2.2, 2.4 GeV were used. The aim of this talk is to present the preliminary results for the analyzing power (A_y) for the pp elastic scattering in the so-far unexplored $5< \theta_{cm} <30$ angular range. Our measurements are also compared to the world data and current partial wave solutions.

HK 39.4 Do 15:00 HZ 4

Normal spin asymmetries in the A4 experiment — •David Balaguer Rios — Institut fuer Kernphysik, Mainz, Deutschland

At the MAMI facilities the A4 Collaboration has measured the normal spin asymmetries in the elastic and quasielastic scattering of electrons on proton and deuteron, respectively, to have access to the imaginary part of the two-photon exchange amplitude. Here we present the measurements for the energies of 210, 315 and 420 MeV at backward angles and compare them with the model calculations.

HK 39.5 Do 15:15 HZ 4

Quasi-Free Scattering of Neutron-Deficient Carbon Isotopes in Inverse Kinematics — •Matthias Holl for the R3B-Collaboration — Institut für Kernphysik, Technische Universität Darmstadt, Germany

Quasi-free scattering reactions are a valuable tool to study single-particle properties of nuclei[1]. Particularly, they can be used to study absolute spectroscopic factors which appear to be quenched for deeply bound nucleons[2].

Quasi-free scattering of relativistic neutron-deficient isotopes has been studied in inverse kinematics during experiment S393 at the R3B-LAND setup. In this experiment, a radioactive beam coming from the fragment separator FRS was used to induce secondary reactions with a CH_2 target. The incoming beam as well as the reaction products were detected in kinematically complete measurements.

Results for the (p,2p) and (p,pn) reactions on ^{10,11}C will be shown and compared to results obtained for knockout reactions from these isotopes.

[1] G. Jacob and Th. A. J. Maris, Rev. Mod. Phys. 38 (1966) 121
[2] A. Gade et al., Phys. Rev. C 77 (2008) 044306

Supported by the State of Hesse (LOEWE Centre HIC for FAIR), and through the GSI-TU Darmstadt cooperation agreement.

HK 39.6 Do 15:30 HZ 4

Energy-variance extrapolation for importance-truncated no-core and valence-space shell model — •Christina Stumpf, Jonas Braun, Roland Wirth, and Robert Roth — Institut für Kernphysik, Technische Universität Darmstadt

The no-core shell model (NCSM) and valence-space shell model (SM) are successful tools for the description of the nuclear spectroscopy. Both methods are computationally demanding and are limited by the model-space dimensions. To extend the NCSM and SM to larger model spaces, we apply an importance-truncation (IT) scheme based on a perturbative importance measure reducing the model spaces to the relevant basis states for the description of one or a few target eigenstates. This IT scheme necessitates an extrapolation to vanishing importance measure. Since the dependence of the energies on the importance measure can be highly non-linear, the extrapolation can give rise to large un-

certainties. We present a more sophisticated extrapolation technique based on the energy variance, which vanishes in the limit of the full model space. We demonstrate the efficiency of the IT-NCSM and IT-SM with energy-variance extrapolation for ground-state and excitation energies of p-shell nuclei (IT-NCSM) and pf-shell nuclei (IT-SM) by comparing the results to both, full and importance-truncated NCSM and SM calculations with the conventional threshold extrapolation.

∗ Supported by DFG (SFB 634), HIC for FAIR and BMBF (06DA70471)

HK 39.7 Do 15:45 HZ 4

Three-nucleon forces and the spectroscopy of neutron-rich calcium isotopes⋆ — •Johannes Simonis[1,2], Jason D. Holt[1,2], Javier Menéndez[1,2], and Achim Schwenk[2,1] — [1]Institut für Kernphysik, Technische Universität Darmstadt — [2]ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung GmbH

We study excited-state properties of neutron-rich calcium isotopes based on chiral two- and three-nucleon interactions. Our results are based on a many-body perturbation theory approach combined with large-scale diagonalizations. In particular, we will focus on the impact of 3N forces on electromagnetic transitions including the investigation of theoretical uncertainties by means of cutoff variation and different sets of low-energy constants.

⋆This work was supported by ERC Grant No. 307986 STRONGINT, by the DFG through Grant SFB 634, by the BMBF under Contract No. 06DA70471, and by the Helmholtz Alliance HA216/EMMI.

HK 40: Nukleare Astrophysik

Zeit: Donnerstag 14:00–16:00 Raum: HZ 5

Gruppenbericht HK 40.1 Do 14:00 HZ 5

Nuclear reactions studies for p-process nucleosynthesis* — •Jan Glorius[1,2], Kerstin Sonnabend[1], and René Reifarth[1] — [1]Goethe-Universität Frankfurt am Main, 60438 Frankfurt am Main, Germany — [2]GSI Helmholtzzentrum für Schwerionenforschung, 64291 Darmstadt, Germany

The stellar nucleosynthesis of the so-called p-nuclei involves a large number and variety of nuclear reactions, which have to be studied and understood in order to reliably model these processes. A wide spectrum of experimental approaches can be persued for these investigations. An overview of the activities of the experimental astrophysics group at the Goethe University Frankfurt in the field will be given. This includes the measurement of proton-, α- and γ-induced reactions using in-beam and activation methods as well as storage ring experiments in inverse kinematics at the ESR.

*supported by the DFG (SO907/2-1), DAAD (50141757) and HIC for FAIR

Gruppenbericht HK 40.2 Do 14:30 HZ 5

The impact of neutrino oscillations on supernova explosion, nucleosynthesis, and the neutrino signals. — •Meng-Ru Wu[1], Tobias Fischer[2], Lutz Huther[1], Gabriel Martinez-Pinedo[1,3], and Yong-Zhong Qian[4] — [1]Institut für Kernphysik, Technische Universität Darmstadt, Darmstadt, Germany — [2]Institute for Theoretical Physics, University of Wrocław, Wrocław, Poland — [3]GSI Helmholtzzentrum für Schwerioneneforschung, Darmstadt, Germany — [4]School of Physics and Astronomy, University of Minnesota, Minneapolis, USA

Core-collapse supernovae are among the major astrophysical sites that produce elements heavier than iron. They are also the most intense sources for MeV neutrinos. These neutrinos play essential roles in various physical processes in supernovae, such as the revival of the supernova shock by neutrino heating and any neutrino-associated nucleosynthesis. Consequently, neutrino oscillations among active flavors or between active and sterile flavors might affect the above mentioned processes significantly. In this talk, we will present our recent calculation of neutrino oscillations in supernovae and their impact on supernova explosion and nucleosynthesis. In addition, we will discuss the expected galactic supernova neutrino signals in current and planned neutrino detectors and their possible implication for both physics of supernovae and the fundamental property of neutrinos.

HK 40.3 Do 15:00 HZ 5

Charged current interactions of ν_μ neutrinos in supernova — •Andreas Lohs[1,2], Gabriel Martinez-Pinedo[1,2], and Tobias Fischer[3] — [1]Technische Universität Darmstadt — [2]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt — [3]University of Wroclaw, Poland

We calculate opacities and production rates for charged current interaction reactions for muon neutrinos and muons in core collapse supernova. We find that these reactions contribute significantly to the opacity of muon neutrinos at densities of 10^{13} g/cm^3 and higher. Consequently the neutrinosphere position becomes different for ν_μ and $\bar{\nu}_\mu$, probably resulting in spectral differences between ν_μ, $\bar{\nu}_\mu$ and ν_τ, $\bar{\nu}_\tau$. For the above densities, we find that the rate of muon production is faster than the dynamical evolution timescale. Muons will reach equilibrium abundances in the supernova core allready before bounce. The change in composition due to equilibration of muons is investigated in a post-processing way. It leads to a temporary net antineutrino abundance in the core, possibly affecting the deleptonization of the proto neutron star and resulting in a net muon flavour abundance in the stellar core. We therefore recommend implementation of these reactions in future simulations. Andreas Lohs is a member of H-QM Helmholtz graduate school and supported by GSI and HIC for FAIR. This work is partly supported by Deutsche Forschungsgemeinschaft through contract SFB 634.

HK 40.4 Do 15:15 HZ 5

^{13,14}B(n,γ) via Coulomb Dissociation to Constrain the Astrophysical r Process — •Sebastian Altstadt for the R3B-Collaboration — Goethe-Universität Frankfurt — GSI Helmholtzzentrum für Schwerionenforschung GmbH

^{13,14}B(n,γ) was experimentally studied via Coulomb dissociation at the LAND/R^{3}B setup in order to understand the impact of (n,γ) reactions on neutron-rich boron isotopes on the r process. A primary beam of ^{40}Ar was fragmented and the isotopes in question were separated from the primary beam using a fragment separator. A secondary beam of ^{14,15}B was then directed onto a Pb-target to investigate the neutron breakup within the equivalent photon field. The results from the Coulomb dissociation measurement and first experimental constraints on the radiative capture cross sections will be presented. Furthermore, new evidence for a 1n halo-structure in ^{14}B will be discussed.

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

HK 40.5 Do 15:30 HZ 5

Search for Supernova-produced ^{60}Fe in the Earth's Fossil Record — •Shawn Bishop[1], Peter Ludwig[1], Ramon Egli[2], Valentyna Chernenko[1], Thomas Faestermann[1], Nicolai Famulok[1], Leticia Fimiani[1], Thomas Frederichs[3], Jose Gomez[1], Karin Hain[1], Marianne Hazlik[4], Gunther Korschinek[1], Silke Merchel[5], and Georg Rugel[5] — [1]TU München, Physik Department — [2]ZAMG, Wien — [3]Universität Bremen, Geowissenschaften — [4]TU München, Fakultät für Chemie — [5]HZDR, Dresden

Approximately 1.8 to 2.8 Myr before the present our planet was subjected to the debris of a supernova explosion. The terrestrial proxy for this event was the discovery of live atoms of ^{60}Fe in a deep-sea ferromanganese crust [Knie et al., Phys. Rev. Lett. (2004)]. The signature for this supernova event should also reside in magnetite (Fe_3O_4) magnetofossils produced by magnetotactic bacteria extant at the time of the Earth-supernova interaction; these bacteria were and are ubiquitous in all ocean sediments. We have conducted accelerator mass spectrometry (AMS) measurements, searching for *live* ^{60}Fe in the magnetofossil component of a Pacific Ocean sediment core (ODP Core 848); additional AMS measurements are now ongoing with a second sediment core (ODP Core 851) in which we expect to find a higher ^{60}Fe signal. This talk will present the current preliminary status of our ^{60}Fe search results for both sediment cores.

HK 40.6 Do 15:45 HZ 5

First results of the ^{92}Mo$(p,\gamma)^{93}$Tc reaction performed at

the HORUS spectrometer in Cologne — •Jan Mayer[1], Martin Baldenhofer[1], Lars Netterdon[1], Anne Sauerwein[2], Philipp Scholz[1], and Andreas Zilges[1] — [1]Institute for Nuclear Physics, University of Cologne — [2]Institute for Applied Physics, Goethe University Frankfurt

The γ process is an important nucleosynthesis mechanism to explain the abundances of the majority of p nuclei, which are bypassed by neutron capture processes. To improve the accuracy of reaction rates predicted by theoretical models, precise experimental data is required. In-beam experiments with HPGe detectors aim at measuring total and partial reaction cross sections for stable as well as unstable products and thus either allow the direct calculation of stellar rates or constrain nuclear physics input parameters. Located at the 10 MV tandem accelerator of the University of Cologne, the high-efficiency HPGe γ-ray spectrometer HORUS was used to measure the ^{92}Mo(p,γ)^{93}Tc reaction at proton energies between 3.7 and 5 MeV. In this talk, first results on total and partial cross sections will be presented.

Partly supported by the DFG (Zi 510/5-1).

HK 41: Schwerionenkollisionen und QCD Phasen

Zeit: Donnerstag 14:00–16:00 Raum: HZ 6

Gruppenbericht HK 41.1 Do 14:00 HZ 6

p-Pb collisions at the LHC: an overview of ALICE measurements — •Anton Andronic for the ALICE-Collaboration — Research Division and ExtreMe Matter Institute, GSI Helmholtzzentrum f\"ur Schwerionenforschung, Planckstr. 1, 64291 Darmstadt

A crucial control experiment for the interpretation of deconfined matter studies in high-energy nucleus-nucleus collisions, proton-lead collisions at the LHC led to interesting observations of their own. Currently a hot debate is ongoing whether the measurements are described by initial-state effects related to gluon saturation or if data suggest final state, flow-like, effects akin to those studied in Pb–Pb collisions.

A summary is given of measurements in p–Pb of: i) the nuclear modification factor for inclusive charged particle production, ii) the average transverse momentum correlation with charged-particle multiplicity and iii) two-particle correlations in azimuth and pseudorapidity. The implication of these data for the understanding of the role of initial and final state effects in proton-lead collisions is discussed.

HK 41.2 Do 14:30 HZ 6

Transverse momentum distributions of charged particles in p-Pb collisions with ALICE at the LHC — •Julius Gronefeld for the ALICE-Collaboration — Research Division and ExtreMe Matter Institute, GSI Helmholtzzentrum für Schwerionenforschung, Planckstr. 1, 64291 Darmstadt — Institut für Kernphysik, Technische Universität Darmstadt, Schlossgrabenstr. 9, 64289 Darmstadt

ALICE is dedicated to heavy ion collisions, with the aim of understanding the physics of the hot and dense medium produced in collisions of lead ions.

The LHC is not only capable of symmetric lead lead or proton proton collisions, but can also deliver collisions between protons and lead ions. Those events are investigated in order to disentangle cold nuclear matter effects from the influence of the hot and dense medium produced in Pb-Pb collisions.

A common way to investigate the mediums or cold nuclear matter effects is the determination of the nuclear modification factorgiven by the ratio between a given transverse momentum (p_T) spectrum and a pp reference spectrum scaled by the number of binary collisons.

In the talk transverse momentum distributions measured with ALICE at a collision energy of $\sqrt{s_{NN}} = 5.02$ TeV in proton lead collisions will be presented. Spectra and R_{pPb} will be shown in dependence on multiplicity and rapidity range. In addition the findings will be compared to current models.

HK 41.3 Do 14:45 HZ 6

Hints for collective effects in identified particle spectra from p–Pb collisions at 5.02 TeV — •Michael Schork — Physikalisches Institut, University of Heidelberg, Im Neuenheimer Feld 226

First hints for collective dynamics in high-multiplicity p-Pb collisions at LHC were observed in two-particle correlations of unidentified particles [1,2]. We present results of a systematic fit using a simple blast wave parameterization [3] to identified particle spectra from p-Pb and Pb-Pb collisions as measured by ALICE at LHC. While in Pb-Pb collisions, a large number of particles can be commonly described by a single set of parameters including mass A=2 and A=3 nuclei, also spectra from high-multiplicity p-Pb collisions allow for a description within this rather simple model. Finally, we give predictions for spectra and the nuclear modification factor of mesons carrying a charm or bottom quark.

[1] S. Chatrchyan, CMS Collaboration et al., Phys. Lett. B, 718 (2013), 795.

[2] B. Abelev, ALICE Collaboration et al., Phys. Lett. B, 719 (2013), 29.

[3] E. Schnedermann, J. Sollfrank and U. Heinz, Phys. Rev. C48 (1993) 2462.

HK 41.4 Do 15:00 HZ 6

Neutral meson measurement via photon conversions in p-Pb collisions at $\sqrt{s_{NN}}$ = 5.02 TeV with ALICE at the LHC — •Annika Passfeld for the ALICE-Collaboration — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, Germany

The measurement of particle production in p-Pb collisions at high LHC energies allows the study of fundamental properties of quantum chromodynamics (QCD) at low parton momentum fraction x and high gluon densities. Moreover it is important as reference for heavy ion collisions. It can show whether the initial state of the colliding nuclei plays a role in the observed suppression of hadron production at high p_T in Pb-Pb collisions. The measurement of neutral pions has the advantage of large statistics of identified particles over a relatively large transverse momentum range. In addition, the neutral pion measurement is crucial for the background determination for other analyses like the direct photon measurement.

In this talk the current status of the $\pi^0 \rightarrow \gamma\gamma$ and $\eta \rightarrow \gamma\gamma$ analysis using photon conversions will be presented. Differential invariant cross sections for minimum bias collisions and for different charged particle multiplicities will be shown for both mesons as well as R_{p-Pb} for the neutral pions.

HK 41.5 Do 15:15 HZ 6

Dielectron cocktail in pp, p–Pb and Pb–Pb collisions at the LHC — •Irem Erdemir for the ALICE-Collaboration — Institut für Kernphysik, Goethe Universität Frankfurt

The measurement of dielectrons allows to investigate the properties of strongly interacting matter, in particular the quark-gluon plasma (QGP), which is created in heavy-ion collisions at the LHC. The evolution of the collision can be probed via dielectrons since electrons do not interact strongly and are created during all stages of the collision. One of the interests in dielectron measurements is motivated by possible modifications of the electromagnetic emission spectrum in the QGP, where pp collisions are used as a medium-free reference.
The dielectron spectrum consists of contributions from various processes. In order to estimate contributions of known hadronic sources to the dielectron spectrum, calculated simulations of the so-called hadronic cocktail are performed. We present the status of the dielectron cocktail simulation in the low-mass region for pp, p–Pb and Pb–Pb collisions at LHC energies.
Supported by BMBF and the Helmholtz Association.

HK 41.6 Do 15:30 HZ 6

Measurement of low-mass dielectrons in p–Pb collisions with ALICE — •Theo Bröker for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

Low-mass dielectrons are an important probe for the hot and dense medium which is created in ultrarelativistic heavy-ion collisions. Since leptons do not interact strongly, they carry information from all collision stages with negligible final state interaction. While pp collisions provide a reference measurement for a medium-free environment, the impact of cold nuclear matter effects on the dielectron characteristics can be estimated from p–Pb collisions. We will present the latest results of the dielectron measurements in p–Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 5.02$ TeV with the ALICE detector. The measured dielectron mass spectra

will be compared to expectations from hadronic sources.
Supported by BMBF and the Helmholtz Association.

HK 41.7 Do 15:45 HZ 6

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

The description of J/ψ production in proton-proton and its nuclear modification in proton-nucleus collisions remains challenging for theory based on perturbative QCD and factorization. Furthermore, the investigation of J/ψ in pp and p-A collisions represents an important reference for heavy-ion collisions, where charmonium production is seen as a key observable for deconfinement.

First results of the nuclear modification factor of inclusive J/ψ in proton-lead collisions with the central barrel of ALICE, both integral as well as differential in transverse momentum, will be presented. Model comparisons will be discussed.

HK 42: Schwerionenkollisionen und QCD Phasen

Zeit: Donnerstag 14:00–16:00 Raum: HZ 7

Gruppenbericht HK 42.1 Do 14:00 HZ 7

Modification of hadron properties in compressed nuclear matter: Recent results from the FOPI collaboration. — •Victoria Zinyuk for the FOPI-Collaboration — Universität Heidelberg, Heidelberg, Germany

In compressed baryonic matter the properties of hadrons are believed to alter as a result of various non-trivial in -medium effects such as the partial restoration of the spontaneously broken chiral symmetry, the modified baryon-meson couplings and the nuclear potential. Possible modification of properties like mass, width and dispersion relation can be experimentally observed for strange particles produced sub- or close-to-production threshold energies. The FOPI detector at SIS18 provides a possibility to investigate the production and propagation of charged and neutral strange particles in a wide range of phase space. This presentation gives an overview of FOPI's recent results on collective behavior and modification of phase space distribution for strange mesons at densities up to 2-3 ρ_0, investigated in heavy-ion collisions, and at normal nuclear matter density as observed in pion-induced reactions.

HK 42.2 Do 14:30 HZ 7

Strange meson spectral functions and cross sections at GSI-FAIR conditions — •Daniel Cabrera[1], Laura Tolós[2], Jörg Aichelin[3], and Elena Bratkovskaya[1] — [1]Institute for Theoretical Physics and Frankfurt Institute for Advanced Studies, Frankfurt University, 60438 Frankfurt am Main, Germany — [2]Institut de Ciències de l'Espai (IEEE/CSIC), Campus Universitat Autònoma de Barcelona, Facultat de Ciències, Torre C-5, E-08193 Bellaterra, Spain — [3]Subatech, UMR 6457, IN2P3/CNRS, Université de Nantes, École des Mines de Nantes, Nantes, France

We discuss recent progress on the properties of strange mesons in nuclear matter at finite temperature from a chiral unitary approach in coupled channels, which incorporates the s- and p-waves of the kaon nucleon interaction. As a novelty, the in-medium scattering amplitudes and cross sections in several channels (such as $\bar{K}N \to \pi\Sigma$) are obtained in addition to the (off-shell) K and $\bar{K}$ spectral functions and quasi-particle properties, which is of particular interest for microscopic transport evaluations of strangeness production and propagation in heavy-ion collisions. We overview previous results from the Parton-Hadron-String Dynamics transport approach (PHSD), relying on a G-matrix calculation of strange meson spectral functions within a meson-exchange model. Our understanding of strange meson interactions in nuclear matter within transport simulations is discussed in view of the in-medium cross sections obtained within the chiral unitary approach.

HK 42.3 Do 14:45 HZ 7

In-medium properties of strange vector mesons in dense and hot nuclear matter — •Andrej Ilner[1], Daniel Cabrera[1,2], Pornrad Srisawad[3], and Elena Bratkovskaya[1,2] — [1]Institut für theoretische Physik, Johann Wolfgang-Goethe Universität, Frankfurt am Main, Deutschland — [2]FIAS, Frankfurt am Main, Deutschland — [3]Faculty of Science, Naresuan University, Phitsanulok, Thailand

We investigate the in-medium properties of strange vector mesons (K^* and $\bar{K}^*$) in dense and hot nuclear matter based on chirally motivated models of the meson self-energies. We parameterise medium effects as density or temperature dependent effective masses and widths, obtain the vector meson spectral functions within a Breit-Wigner prescription (which is often used in transport simulations), and study whether such an approach can retain the essential features of full microscopic calculations. For $\mu_B \neq 0$ the medium corrections arise from $\bar{K}^*(K^*)N$ scattering and the $\bar{K}^*(K^*) \to \bar{K}(K)\pi$ decay mode (accounting for in-medium $\bar{K}(K)$ dynamics). We calculate the scattering contribution to the K^* self-energy based on the hidden local symmetry formalism for vector meson nucleon interactions, whereas for the $\bar{K}^*$ self-energy we implement recent results from a self-consistent coupled-channel determination within the same approach. For $\mu_B \simeq 0$ and finite temperature we rely on a phenomenological approach for the kaon self-energy in a hot pionic medium consistent with chiral symmetry, and evaluate the $\bar{K}^*(K^*) \to \bar{K}(K)\pi$ decay width. The emergence of a mass shift at finite temperature is studied with a dispersion relation over the imaginary part of the vector meson self-energy.

HK 42.4 Do 15:00 HZ 7

Charged Kaon Production in Au+Au-Collisions at 1.23 AGeV with HADES — •Heidi Schuldes for the HADES-Collaboration — Goethe-Universität Frankfurt

In the energy regime of 1-2 AGeV, strangeness is produced below its elementary production threshold, this results in a steep excitation function. Due to their quark content, positive and negative kaons have different elementary production thresholds. Furthermore, K^+ are supposed to feel a repulsive kaon nucleon potential, while K^- can be resonantly absorbed by nucleons.

HADES, installed at the Helmholtzzentrum für Schwerionenforschung (GSI) in Darmstadt, Germany, provides excellent capability to measure rare kaon signals. In April and May 2012, 7.3 billion Au(1.23 GeV per nucleon)+Au collisions have been recorded by the HADES detector. In this contribution preliminary particle spectra of charged kaons measured in Au+Au reactions will be presented. The results will be discussed with respect to the production mechanism.

Supported by BMBF (05P12RFGHJ), Helmholtz Alliance EMMI, HIC for FAIR, HGS-HIRe and H-QM.

HK 42.5 Do 15:15 HZ 7

Spectral Functions for the Quark-Meson Model Phase Diagram from the Functional Renormalization Group — •Ralf-Arno Tripolt[1], Nils Strodthoff[2], Lorenz von Smekal[1,3], and Jochen Wambach[1,4] — [1]Theoriezentrum, Institut für Kernphysik, Technische Universität Darmstadt, 64289 Darmstadt, Germany — [2]Institut für Theoretische Physik, Ruprecht-Karls-Universität Heidelberg, 69120 Heidelberg, Germany — [3]Institut für Theoretische Physik, Justus-Liebig-Universität Giessen, 35392 Giessen, Germany — [4]GSI Helmholtzzentrum für Schwerionenforschung GmbH, 64291 Darmstadt, Germany

We present a method to obtain spectral functions at finite temperature and density from the Functional Renormalization Group. Our method is based on a thermodynamically consistent truncation of the flow equations for 2-point functions with analytically continued frequency components in the originally Euclidean external momenta. For the uniqueness of this continuation at finite temperature we furthermore implement the physical Baym-Mermin boundary conditions. We demonstrate the feasibility of the method by calculating the mesonic spectral functions in the quark-meson model along the temperature axis of the phase diagram, and at finite quark chemical potential along the fixed-temperature line that crosses the critical endpoint of the model.

HK 42.6 Do 15:30 HZ 7

Chiral restoration and deconfinement in two-color QCD with two flavors of staggered quarks — •David Scheffler[1], Christian Schmidt[2], Philipp Scior[1], Dominik Smith[1], and Lorenz von Smekal[1,3] — [1]Institut für Kernphysik, Technische Universität Darm-

stadt, Darmstadt, Germany — [2]Fakultät für Physik, Universität Bielefeld, Bielefeld, Germany — [3]Institut für Theoretische Physik, Justus-Liebig-Universität, Gießen, Germany

In preparation of lattice studies of the two-color QCD phase diagram we study chiral restoration and deconfinement at finite temperature with two flavors of staggered quarks using an RHMC algorithm on GPUs. We first study unquenching effects in local Polyakov loop distributions, and the Polyakov loop potential obtained via Legendre transformation, in a fixed-scale approach for heavier quarks. We also present the chiral condensate and the corresponding susceptibility over the lattice coupling across the chiral transition for lighter quarks. Using Ferrenberg-Swendsen reweighting we extract the maxima of the chiral susceptibility in order to determine pseudo-critical couplings on various lattices suitable for chiral extrapolations. These are then used to fix the relation between coupling and temperature in the chiral limit.

HK 42.7 Do 15:45 HZ 7

Lattice simulations of the interacting tight-binding model of graphene — •Dominik Smith[1] and Lorenz von Smekal[1,2] — [1]Technische Universität Darmstadt — [2]Justus-Liebig-Universität Giessen

We present results of lattice simulations of the tight-binding model of graphene (carbon atoms arranged on a two-dimensional hexagonal lattice) using a realistic two-body interaction potential for the electronic quasi-particles in which screening of electromagnetic interactions is taken into account. We discuss the spontaneous breaking of the symmetry under exchange of the two triangular sub-lattices, which corresponds to a transition from a conducting to an insulating phase and which occurs when the effective fine structure constant of the theory crosses above a certain threshold. This transition posesses strong similarities to chiral symmetry breaking in relativistic field theory, due to the structure of the low-energy effective theory of graphene, which is a theory of strongly coupled massless Dirac particles. We present a prediction for the exact location of the transition and discuss the possibility of studying other phase transitions of the sytem, such as the topological Lifshitz transition which occurs at finite density in the pure tight-binding theory.

HK 43: Instrumentierung

Zeit: Donnerstag 14:00–16:00 Raum: HZ 8

Gruppenbericht HK 43.1 Do 14:00 HZ 8

CASCADE-Neutronendetektor: Ein GEM-basierter Festkörperdetektor — •Michael Liebig, Markus Köhli, Gerd Modzel und Ulrich Schmidt — Physikalisches Institut, Universität Heidelberg

Der CASCADE-Detektor ist ein orts- und flugzeitaufgelöster Detektor für thermische Neutronen. Er detektiert die Konversionsprodukte in dünnen Schichten absorbierter Neutronen mit Hilfe von borbedampfter Gas Elektron Multiplier (GEM)-Folien. Die Technologie stellt eine Alternative zu klassischen He-3-Zählrohren dar und eröffnet neue Anwendungfelder, wie etwa der Spin-Echo-Technik (MIEZE).

Aufgebaut ist der CASCADE-Detektor bisher aus einem Stapel von bis zu acht mit Bor-10 beschichteter ladungstransparenter GEM-Folien. Parallel zu einer mikrostrukturierten Streifenauslese wird das Ladungssignal an den GEMs verwendet die Konversionsschicht zu identifizieren.

Das hier vorgestellte neue Design verbessert durch Materialienwahl und eine neue Geometrie vor allem seine Effizienz bei MIEZE-Messungen, da überkoppelnde Signale reduziert werden und selbstspannende Rahmen eine optimale Positionierung ermöglichen. Die Ausleseelektronik besteht aus einem FPGA-Board und dem ladungsempfindlichen Verstärker nXYter, einem selbsttriggernden 128-Kanal-ASIC, der für statistisch verteilte Neutronen entwickelt wurde.

HK 43.2 Do 14:30 HZ 8

First Measurement of dE/dx with a GEM-based TPC — •Felix Valentin Böhmer for the GEM-TPC-Collaboration — Technische Universität München

Realizing gas amplification for TPCs with GEM foils – instead of the traditional setup using MWPCs and a gating grid – promises to allow continuous operation of such a detector: exploiting the intrinsic suppression of ion backflow that is characteristic for GEMs lifts the constraint to low-rate environments entailed by the presence of a gating system. While the spatial resolution achievable with GEM foils is comparable to or better than that of MWPCs, fluctuations of the gain in a multi-GEM system could compromise the energy resolution of the detector.

We have studied the specific energy loss ("dE/dx") performance of a TPC based on a triple-GEM readout – the largest of its kind to date – on data from a 3-weeks physics campaign inside the FOPI spectrometer at GSI, Germany. Particle identification capabilities for particles originating from π-induced reactions are studied as a function of the momentum. Resolutions are extracted using an exponentially modified Gaussian as a fit function, and are found to be in good agreement with expectations. A dedicated Monte Carlo study has been performed to investigate the impact of the track length on the peak asymmetries in a truncated mean analysis.

Supported by the BMBF, the DFG Cluster of Excellence "Universe" and the EU 7^{th} framework program

HK 43.3 Do 14:45 HZ 8

Ion back flow and energy resolution in GEM detectors for the ALICE TPC — •Esther Bartsch, David Just, Rainer Renfordt, and Harald Appelshäuser for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

For the upgrade of the Time Projection Chamber (TPC) of the ALICE experiment at the CERN LHC it is planned to replace the multiwire proportional readout chambers by Gas Electron Multiplier (GEM) stacks. The high interaction rate of 50 kHz foreseen for the Run 3 period of the LHC makes a readout scheme desirable that can accommodate the 100 times higher rates. GEM-based readout chambers that can be operated in continuous mode are the prime candidate. However, the backflow of positive ions into the detector volume turns out to be too high in commonly used triple-GEM stacks, producing unacceptable levels of space charge and thus distortions of the drift field. Several measures to reduce the ion back flow (IBF) can be taken: addition of a fourth GEM foil, optimization of the GEM voltages and transfer fields between the foils.

A dedicated test detector for the characterization of triple and quadruple GEM stacks was set up at the IKF in Frankfurt. The results of systematic studies of the IBF and the energy resolution in different arrangements of standard and large-pitch GEM foils will be presented.

Supported by BMBF and the Helmholtz Association.

HK 43.4 Do 15:00 HZ 8

Discharge probability studies in GEM structures for the ALICE TPC upgrade — •Piotr Gasik for the ALICE-Collaboration — TU München, Boltzmannstr. 2, 85748 Garching, Germany

A large Time Projection Chamber (TPC) is the main device for tracking and charged particle identification in the ALICE experiment at the CERN LHC. After the second long shutdown in 2018, the LHC will deliver Pb beams colliding at an interaction rate of about 50 kHz, which is about a factor of 100 above the present readout rate of the TPC. In order to make full use of this luminosity, a major upgrade of the TPC is required. It is foreseen to replace the existing MWPC-based readout with Gas Electron Multiplier (GEM) foils.

The GEM foils are commonly known structures used as proportional counters, which permits to obtain high gains at very high radiation rates. However, highly ionizing particles, which may be produced during heavy ion collisions, may trigger an electrical breakdown which may result in damage of the foils or readout electronics.

The key parameter for a long-term operation of the GEM-based TPC is the stability against electrical discharges. We performed discharge probability studies in triple and quadruple GEM structures in Ne- and Ar-based gas mixtures to find operational conditions for the upgraded ALICE TPC. Preliminary results from these measurements will be discussed in this contribution.

This work is supported by BMBF and DFG Cluster of Excellence "Universe" (Exc 153).

HK 43.5 Do 15:15 HZ 8

Secondary vertex reconstruction with a GEM-TPC at FOPI

— •Sverre Dørheim for the GEM-TPC-Collaboration — Technische Universität München

A Time Projection Chamber (TPC) with GEM amplification was built and installed in the FOPI experiment at GSI, Darmstadt, in the end of 2010, in order to improve vertex and track reconstruction and provide additional information on specific energy loss for particle identification.

After several test runs with cosmic rays and particle beams, it was successfully operated for a three-week physics campaign with a 1.7-GeV π^- beam impinging on nuclear targets. The goal of this physics campaign is to investigate strangeness production in nuclear matter. Two important probes in this investigation are Λ and K^0_S. The reconstruction of such neutral particles relies heavily on the ability to distinguish the decay vertex from the main interaction vertex. Here, the excellent position resolution of the GEM-TPC plays an important role.

I will discuss the reconstruction of secondary decay vertices, including the alignment of the TPC, reconstruction of tracks, particle identification, and vertexing algorithms. First results on yields of Λ and K^0_S will be presented.

Supported by the BMBF, the DFG Cluster of Excellence "Universe" and the EU 7th framework program.

HK 43.6 Do 15:30 HZ 8

THick Gas Electron Multiplier (THGEM) detector readout based on TDC-FPGAs — •Maximilian Büchele, Horst Fischer, Matthias Gorzellik, Tobias Grussenmeyer, Florian Herrmann, Phillip Jörg, Paul Kremser, and Sebastian Schopferer — for the THGEM group of the COMPASS collaboration, Physikalisches Institut, Albert-Ludwigs-Universität Freiburg

The RD51 program has been investigating a novel photon detector technology called THGEM, aimed to be operated in future Ring Imaging Cherenkov (RICH) Counters. The THGEM design is adopted from the Gas Electron Multiplier (GEM) using Printed Circuit Board (PCB) material. The manufacturing process uses standard PCB drilling and etching techniques which allows to cover large detector areas at gains up to 10^6 in a mechanically robust and very cost-efficient manner. Promising results have also been obtained with a hybrid approach, which combines the THGEM with a Micromega layer to further suppress the ion back flow to the photocathode.

In the course of the RICH-1 detector upgrade of the COMPASS experiment at CERN, the existing Multi Wire Proportional Chambers will partly be replaced by a set of THGEMs. For the digital readout, we are designing a front-end board processing 384 detector channels by TDC-FPGAs. The boards reading a single THGEM chamber are connected in a star topology in order to exploit the data rate capability of the optical transceivers interfacing with the downstream data acquisition system.

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

HK 43.7 Do 15:45 HZ 8

Ionenrückfluss in Dreifach- und Vierfach-GEM-Detekoren — Markus Ball, •Julia Bloemer, Andreas Hönle, Korbinian Eckstein und Bernhard Ketzer — Technische Universität München

Nach dem zweiten langen Shutdown des LHC in 2018 wird der ALICE-Detektor Pb-Pb-Kollisionen mit einer deutlich höheren Kollisionsrate von mindestens 50 kHz aufnehmen. Der herkömmliche Betrieb der ALICE-TPC (Zeitprojektionskammer) mit Vieldrahtkammern und einem Sperrgitter zur Ionenunterdrückung erlaubt jedoch nur eine Kollisionsrate von mehreren kHz. Die verwendete TPC muss in diesem Zuge für eine kontinuierliche Auslese weiterentwickelt werden.

Eine alternative Technik der Gasverstärkung stellen hier Gas Electron Multiplier (GEMs) dar, die eine intrinsische Unterdrückung von zurückdriftenden Ionen ermöglichen. Um die Feldverzerrungen durch Ionen in einem beherrschbaren Rahmen zu halten muss ein Rückfluss von Ionen bis unter Werte von 1% minimiert werden. Eine Vielzahl von Parametern steht dabei zur Optimierung zur Verfügung, dazu gehören Gasmischung, Spannungs- und Feldkonfigurationen, die Anzahl der Folien sowie ihre mikroskopische Struktur.

Dieser Vortrag gibt eine Übersicht der systematischen Studien zu Detektoren mit drei und vier GEM-Folien an der TUM.

Unterstützt durch BMBF und DFG Exzellenzcluster Universe (Exc. 153).

HK 44: Instrumentierung

Zeit: Donnerstag 14:00–15:45 Raum: HZ 9

HK 44.1 Do 14:00 HZ 9

A high resolution germanium detector array for hypernuclear studies at $\overline{\text{P}}$ANDA — Sebastian Bleser[1], Jürgen Gerl[2], Felicce Iazzi[3], Jasmina Kojouharova[2], Ivan Kojouharov[2], Josef Pochodzalla[4], Kai Rittgen[4], Cihan Sahin[4], Alicia Sanchez Lorente[1], and •Marcell Steinen[1] — [1]Helmholtz-Institut Mainz — [2]GSI Darmstadt — [3]Politecnico and INFN, Torino — [4]Institute for nuclear physics, JGU Mainz

The $\overline{\text{P}}$ANDA experiment, planned at the FAIR facility in Darmstadt, aims at the high resolution γ-spectroscopy of double Λ hypernuclei. For this purpose a devoted detector setup is required, consisting of a primary nuclear target, an active secondary target and a germanium detector array for the γ-spectroscopy. Due to the limited space within the $\overline{\text{P}}$ANDA detector a compact design is required. In particular the conventional LN_2 cooling system must be replaced by an electro mechanical device and a new arrangement of the crystals is needed.

This presentation shows the progress in the development of the germanium detectors. First results of in-beam measurements at COSY with a new electro mechanically cooled single crystal prototype are presented. Digital pulse shape analysis is used to disentangle pile up events due to the high event rate. This analysis technique also allows to recover the high original energy resolution in case of neutron damage. Finally the status of the new triple crystal detector prototype is given.

HK 44.2 Do 14:15 HZ 9

Pulse Shape Analysis Optimization with segmented HPGe-Detectors — •Lars Lewandowski[1], Benedikt Birkenbach[1], Bart Bruyneel[2], and Peter Reiter[1] for the AGATA-Collaboration — [1]Institute for Nuclear Physics, University of Cologne — [2]CEA, Saclay

Measurements with the position sensitive, highly segmented AGATA HPGe detectors rely on the gamma-ray-tracking GRT technique which allows to determine the interaction point of the individual gamma-rays hitting the detector. GRT is based on a pulse shape analysis PSA of the preamplifier signals from the 36 segments and the central electrode of the detector. The achieved performance and position resolution of the AGATA detector is well within the specifications. However, an unexpected inhomogeneous distribution of interaction points inside the detector volume is observed as a result of the PSA even when the measurement is performed with an isotropically radiating gamma ray source. The clustering of interaction points motivated a study in order to optimize the PSA algorithm or its ingredients. Position resolution results were investigated by including contributions from differential crosstalk of the detector electronics, an improved preamplifier response function and a new time alignment. Moreover the spatial distribution is quantified by employing different χ^2-minimization procedures. Supported by the German BMBF (05P12PKFNE TP4)

HK 44.3 Do 14:30 HZ 9

Characterisation of pixel sensor prototypes for the ALICE ITS Upgrade — •Felix Reidt for the ALICE-Collaboration — CERN — Physikalisches Institut, Universität Heidelberg

ALICE is preparing a major upgrade of its experimental apparatus to be installed in the second long LHC shutdown (LS2) in the years 2018-2019. A key element of the upgrade is the replacement of the Inner Tracking System (ITS) deploying Monolithic Active Pixel Sensors (MAPS). The upgraded ITS will have a reduced material budget while increasing the pixel density and readout rate capabilities. The novel design leads to higher pointing and momentum resolution as well as a p_T acceptance extended to lower values. The corresponding sensor prototypes were qualified in laboratory measurements and beam tests with respect to their radiation tolerance and detection efficiency. This talk will summarise recent results on the characterisation of prototypes belonging to the ALPIDE family.

HK 44.4 Do 14:45 HZ 9

Ortssensitiver Nachweis von kosmischer Höhenstrahlung in

einem segmentierten HPGe-Detektor — •David Schneiders, Benedikt Birkenbach, Jürgen Eberth, Herbert Hess, Gheorghe Pascovici, Peter Reiter und Andreas Vogt — IKP, Universität zu Köln

Der neu entwickelte Dual-Gain-Vorverstärker der AGATA-HPGe-Detektoren ermöglicht mit Hilfe eines Time-over-Threshold-Verfahrens den Nachweis von hochenergetischen γ-Quanten und geladenen Teilchen bis zu einer Energie von 160 MeV. Die Messmethode reduziert zusätzlich die Totzeit des Detektors signifikant. Durch die Segmentierung des Detektors ist es möglich, partielle Energiedepositionen ortssensitiv aufzulösen. In einer Langzeitmessung wurden Energien bis 200 MeV von hochenergetischen Teilchen aus der kosmischen Höhenstrahlung nachgewiesen. Energieverlustrechnungen sind konsistent mit dem Myonenanteil der einfallenden Höhenstrahlung. Die gemessenen Ergebnisse wurden ebenfalls mit den Ergebnissen einer Monte-Carlo-Simulation des Detektorsystems verglichen. Wichtige zukünftige Anwendung ist die Unterdrückung von unerwünschten hochenergetischen Sekundärteilchen bei der in-beam γ-Spektroskopie bei NUSTAR/FAIR.
Gefördert durch das BMBF (05P12PKFNE TP4).

HK 44.5 Do 15:00 HZ 9

Radiation damage in single crystal CVD diamond material investigated with a high current Au beam. — •Jerzy Pietraszko and Wolfgang Koenig for the HADES-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Planckstraße 1, 64291 Darmstadt, Germany

Single-crystal Chemical Vapor Deposition (ScCVD) diamond based prototype detectors have been constructed for the high current heavy ion experiments HADES and CBM at the future FAIR facility at GSI Darmstadt. Their properties have been studied with a high current density beam (about 2-3$\times 10^6$/s/mm^2) of 1.25 A GeV Au ions. Details of the design, the intrinsic properties of the detectors and their performance after irradiation with such beam will be reported.

HK 44.6 Do 15:15 HZ 9

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

Eine Compton-Kamera für hochenergetische γ-Quanten, bestehend aus einem 36-fach segmentierten ortsempfindlichen HPGe-Detektor und einem Double-Sided-Silicon-Strip-Detector (DSSSD), wurde im Rahmen des TRAKULA-Projekts in Betrieb genommen. Das Nachweisverfahren beruht auf Comptonstreuung im DSSSD und der Detektion des gestreuten γ-Quants im HPGe-Detektor. Koinzidenzmessungen mit den beiden Detektoren ermöglichen die Bestimmung des Emissionsorts der γ-Strahlung. Die Wechselwirkungsorte im HPGe-Detektor und ihre zeitliche Sequenz werden mittels Impulsformanalyse der 37 HPGe-Detektorsignale und der γ-ray tracking Methode bestimmt. Die Emissionsorte von punktförmigen γ-Quellen wurden bei verschiedenen Energien und für unterschiedliche Versuchsaufbauten, bei denen auch mehrere Strahlungsquellen gleichzeitig verwendet wurden, bestimmt. Mit der neuen Compton-Kamera wurde eine Winkelauflösung von unter 5° erzielt, die nahe an der berechneten Ortsauflösung liegt. Gefördert durch BMBF Projekt 02MUK013D und 02NUK013F.

HK 44.7 Do 15:30 HZ 9

Proton detection in the neutron lifetime experiment PENeLOPE — •Christian Tietze for the PENeLOPE-Collaboration — Technische Universität München, Physik Department E18

Although neutron lifetime plays an important role in the Standard Model of particle physics, τ_{n} is not very precisely know and often discussed. The official PDG mean value has been lowered during the last three years by more than 6σ to the new value of 880.0 ± 0.9s. The new precision experiment PENeLOPE, which is currently developed at TU München, will help to clear this up. Ultra-cold neutrons are lossless stored in a magneto-gravitational trap, formed by superconducting coils. The combined determination of τ_{n} by counting the surviving neutrons after each storage cycles on one side and in-situ detection of the decay protons on the other side together with a very good handle on systematic errors leads to an unprecedented precision of the neutron lifetime value of 0.1s. This contribution will give an overview of the challenges concerning proton detection under the exceptional requirements of this experiment. The developed concept of using avalanche photodiodes for direct proton detection will be presented as well as results from first measurements with a prototype detector read out by particular developed electronics. This project is supported by the cluster of excellence "Origin and structure of the universe", the Deutsche Forschungsgemeinschaft and the Maier-Leibnitz Laboratorium, Garching.

HK 45: Instrumentierung

Zeit: Donnerstag 14:00–15:45 Raum: HZ 10

Gruppenbericht HK 45.1 Do 14:00 HZ 10

Status and Perspective of the FRS Ion Catcher Experiment — •Jens Ebert — Justus-Liebig-Universität Gießen

Exotic nuclei are produced in stellar processes like the p- and r-process and are essential for our understanding of nucleosynthesis beyond iron. They have in common that they are on the chart of nuclides far away from the valley of stability, which corresponds to an unusual ratio of neutrons to protons and short half-lives. Possible ways of producing exotic nuclei in the laboratory are for example projectile fragmentation and fission. Nuclei produced this way have high energies and must be slowed down for high-accuracy low-energy experiments like MATS and LaSpec. At the FRS Ion Catcher experiment this has been done in July and August 2012 for an Uranium beam with 1GeV/u fragmented on a Beryllium target. The projectile fragments have been separated in-flight, range-bunched, slowed-down in the Fragment Separator (FRS) at GSI and subsequently thermalized in a cryogenic stopping cell (CSC). With the ions extracted from the CSC and transported to a multiple-reflection time-of-flight mass spectrometer (MR-TOF-MS), mass measurements were performed for isotopes with A=211 and A=213. Essential for the measurements were a fast and efficient extraction from the CSC and a quick mass measurement, because of the low detection rate and short half-lives for the nuclides of interest. In this presentation the results of our experiment in July and August 2012 and goals for the next beam time in 2014 will be presented.

HK 45.2 Do 14:30 HZ 10

Cluster-jet targets for laser induced ion acceleration — •S. Grieser[1], D. Bonaventura[1], M. Büscher[2], I. Engin[3], A.-K. Hergemöller[1], E. Köhler[1], F. Schlüter[2], A. Täschner[1], and A. Khoukaz[1] — [1]Institut für Kernphysik, Westfälische Wilhelms-Universität Münster — [2]Peter Grünberg Institut (PGI), FZ Jülich — [3]Institut für Kernphysik, (IKP), FZ Jülich

The directed ion acceleration induced by high-energy laser pulses is a strongly increasing research field. In such experiments ultra-short laser pulses focussed on a target create a plasma, in which strong secondary electric fields can accelerate protons and ions to multi-MeV energies. A major drawback of the commonly used targets, like gas-jets or foils, is their low density or the need to be replaced after each laser pulse. An innovative perspective for high-flux and high-repetition-rate experiments is the application of a cluster-jet source, which continuously produces a flux of cryogenic solid clusters by the expansion of precooled gases within fine Laval nozzles. Therefore, a cluster-jet target was built up and set successfully into operation at the University of Münster and will be used for experiments on laser and plasma physics at the University of Düsseldorf. Systematic measurements were done to determine the target beam thickness, possible beam structures, the stability, and the position within the scattering chamber to ensure the ideal requirements for the experiments. For this purpose, the cluster beam was illuminated by a diode laser 33 cm behind the Laval nozzle and observed by a CCD camera. The results on the cluster beam properties will be presented and discussed.

HK 45.3 Do 14:45 HZ 10

Laval Nozzles for Cluster-Jet Targets — •Ann-Katrin

Hergemöller, Daniel Bonaventura, Silke Grieser, Esperanza Köhler, Alexander Täschner, and Alfons Khoukaz — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, 48149 Münster, Germany

Cluster-jet targets are highly suited as internal targets for storage ring experiments. Here the target beam itself is produced by the expansion of pre-cooled gases within fine Laval nozzles. With such targets high and constant target beam thicknesses can be achieved and adjusted continuously during operation. At the prototype cluster-jet target for the PANDA experiment, which was built up and set successfully into operation at the University of Münster, density structures within the cluster beam directly behind the nozzle have been observed. Therefore, a tilting system was installed, allowing for an adjustment of the nozzle system relative to the experimental setup. With this installation target densities of more than 2×10^{15} atoms/cm^2 at a distance of 2.1 m behind the nozzle were achieved. To study the impact of the Laval nozzle geometry on the beam structures and the achievable densitiy, an improved nozzle production method was established. With this technique it is possible to produce with high efficiency fine micrometer-sized nozzles with variable geometries, e.g. different opening angles, opening diameters or lengths of the exit trumpet. The method for the production of Laval nozzles will be presented and new perspectives will be discussed. Supported by EU (FP7), BMBF, and GSI F+E.

HK 45.4 Do 15:00 HZ 10

Optimization of the target system for the hypernuclear experiment at $\overline{\text{P}}$ANDA — •Sebastian Bleser[1], Felice Iazzi[2], Josef Pochodzalla[3], Kai Rittgen[3], Cihan Sahin[3], Alicia Sanchez Lorente[1], and Marcell Steinen[1] — [1]Helmholtz-Institut Mainz — [2]Politecnico di Torino and INFN, Sez. di Torino, Italy — [3]Institut für Kernphysik, Johannes Gutenberg-Universität, Mainz

Gamma spectroscopy of double Λ hypernuclei will be one of the main topics addressed by the $\bar{\text{P}}$ANDA experiment at the planned FAIR-facility at Darmstadt, Germany. For this project a dedicated hypernuclear detector setup will be installed. In addition to the general purpose of the $\bar{\text{P}}$ANDA detector it consists of a primary nuclear target for the production of $\Xi^- + \bar{\Xi}$ pairs, a secondary active target for the formation of hypernuclei and the identification of associated decay products as well as a germanium detector array to perform γ spectroscopy.
Results of the current hardware development will be presented in the talk: For the positioning of the primary filament target in the beam halo the functionality of piezo motors is investigated in vacuum. Stability tests of the primary target chamber are performed with various thin materials. For the secondary target the readout of silicon microstrip detectors with ultra-thin flexible cables is checked to fan out the readout electronics. Furthermore, design studies of support structures for the whole detector setup are considered.
On the simulation side a compromise between the stopping probability of Ξ^- hyperons and the reconstruction accuracy of weak decay pions will be discussed.

HK 45.5 Do 15:15 HZ 10

Performance of the Cryogenic Stopping Cell for the LEB at the FRS Ion Catcher — •Moritz Pascal Reiter for the FRS Ion Catcher-Collaboration — II.Physikalsiche Institut JLU Giessen

At the FRS Ion Catcher, projectile and fission fragments are produced at relativistic energies, separated in-flight, range-focused, slowed-down and thermalized in a cryogenic stopping cell (CSC) to kinetic energies to a few eV. A multiple-reflection time-of-flight mass spectrometer (MR-TOF-MS) is used to perform direct mass measurements and to remove isobaric contaminants. The isobarically clean beam may be delivered to further experiments, for example mass-selected decay spectroscopy. The FRS Ion Catcher serves as a test bench for the Low-Energy-Branch of the Super-FRS at FAIR, where the CSC and the MR-TOF-MS will be key devices for experiments with stopped projectile and fission fragments. The CSC has been commissioned with ^{238}U projectile fragments produced at 1000 MeV/u. The spatial isotopic separation in-flight was performed with the FRS applying a monoenergetic degrader. For the first time, a stopping cell was operated with exotic nuclei at cryogenic temperatures (70 to 100 K). An overall efficiency of up to 15 %, a combined ion survival and extraction efficiency of about 50 %, and short extraction times of 24 ms were achieved for heavy α-decaying uranium fragments. Mass spectrometry with a multiple-refection time-of-fight mass spectrometer has demonstrated the excellent cleanliness of the CSC. In this presentation advantages of the cryogenic operation for the cleanliness as well as the behavior of the CSC during the online experiments will be discussed.

HK 45.6 Do 15:30 HZ 10

A laser ablation carbon cluster ion source for MR-TOF-MS — •Christine Hornung[1], Timo Dickel[1,2], Jens Ebert[1], Hans Geissel[1,2], Wolfgang R. Plass[1,2], Ann-Kathrin Rink[1], and Christoph Scheidenberger[1,2] — [1]II. Physikalisches Institut, Justus-Liebig-Universität Giessen, Giessen, Germany — [2]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany

The FRS Ion Catcher at GSI is the test facility for the future Low-Energy Branch (LEB) of the Super-FRS at FAIR. It consists of the FRS, a cryogenic stopping cell and a multiple-reflection time-of-flight mass spectrometer (MR-TOF-MS). At the LEB high precision mass measurements of exotic nuclei will be possible at the MATS experiment. The MR-TOF-MS is an indispensable diagnostic device for operation of the cryogenic stopping cell.

For calibration and systematic studies of the MR-TOF-MS at the FRS Ion Catcher calibrants over a broad mass range are essential. For this purpose a laser ablation carbon cluster ion source has been designed, commissioned and tested. The system can be operated at order of magnitude higher repetition rates (100Hz) than existing system and is thus ideally suited for the needs of the MR-TOF-MS (repetition rates ∼100Hz). Several measures (small laser spot size, special ion optics, x-y-movable targettable) have been taken to ensure long term stable operation (∼weeks) at highest repetition rate. Results of the commissioning and first tests with different targets will be presented.

HK 46: Poster

Zeit: Donnerstag 16:00–18:00 Raum: HZ Poster

HK 46.1 Do 16:00 HZ Poster

Simulations of the Measurement of the Form Factor for the Ds Semileptonic Decay with the PANDA Detector — •Lu Cao and James Ritman — Institut für Kernphysik, Forschungszentrum Jülich, D-52425 Jülich, Germany

The PANDA experiment is one of the major projects of the FAIR facility in Darmstadt and will study a wide range of physics topics in the high energy region. One of the interesting topics is the semileptonic D_s decays governed by both the weak and strong forces, where the strong interaction effects can be parameterized by the transition form factor. Techniques such as lattice QCD offer increasingly precise calculations, but as the uncertainties shrink, experimental validation of the results becomes increasingly important. The achievable performance of the PANDA detector for these types of reactions has not yet been studied in detail; however, this is expected to work very well based upon the design performance and experience with other detector systems.

This report summarizes the simulation and reconstruction status of the D_s decay chain at PANDA. In the reconstruction procedure, we focus on developing the software and evaluating the expected precision of these measurements with the Monte Carlo simulation studies of the physics performance of the PANDA detector. The related decay models in this chain are checked via Dalitz plot analysis; the present version of EvtGen in PANDAROOT has been enhanced by a new model describing the $D_s \to K^+K^-\pi^-$ decay. With the help of theoretical predictions of the cross section, the production rate is estimated.

HK 46.2 Do 16:00 HZ Poster

Simulations of the Measurement of the Form Factor for the Ds Semileptonic Decay with the PANDA Detector — •Lu Cao and James Ritman — Institut für Kernphysik, Forschungszentrum Jülich, D-52425 Jülich, Germany

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HK 46.3 Do 16:00 HZ Poster

A Geant4 based MC simulation for the COMPASS-II experiment at CERN — •Tobias Szameitat, Horst Fischer, Matthias Gorzellik, Arne Gross, Philipp Jörg, Kay Königsmann, Christopher Regali, Katharina Schmidt, Stefan Sirtl, and Johannes ter Wolbeek — for the COMPASS collaboration, Physikalisches Institut, Albert-Ludwigs-Universität Freiburg

The COMPASS-II experiment at CERN is a fixed-target experiment for the investigation of the spin structure of the nucleon and for hadron spectroscopy. The theoretical framework of Generalized Parton Distributions (GPDs) provides a dynamical and geometrical picture of the nucleon. Experimentally the GPDs can be accessed in exclusive measurements such as Hard Exclusive Meson Production and Deeply Virtual Compton Scattering. Built as a multi-purpose two stage spectrometer, the COMPASS-II experiment allows for measurements of such exclusive reactions. For a detailed understanding of the spectrometer acceptance a new Geant4 based simulation tool has been developed. We report on the key features of the software including its different detector geometries and its event simulation. Supported by BMBF, DFG and EU FP7 (Grant Agreement 283286).

HK 46.4 Do 16:00 HZ Poster

ΣN cusp effect and angular distributions in the the CMS frame in the $\vec{p}p \to pK^+\Lambda$ reaction — •Sedigheh Jowzaee for the COSY-TOF-Collaboration — IKP-1, Forschungszentrum Jülich, Germany — Jagiellonian University, Krakow, Poland

The $\vec{p}p \to pK^+\Lambda \to pK^+p\pi^-$ reaction has been measured with the COSY-TOF spectrometer with a polarized beam at a momentum of 2.95 GeV/c. Due to the full phase space covered by the COSY-TOF experiment, the Dalitz plot can be analyzed to study the details of the reaction mechanism. The Dalitz plot distribution reveals an influence of pΛ final state interaction (FSI), N^* resonances and cusp effects at the $\Sigma^0 p$ threshold as an enhancement in the $p\Lambda$ subsystem. The cusp effects is more pronounced than measured at a beam momentum of 2.7 GeV/c. Moreover, the cusp shape due to the interference with N^* resonances is studied in different regions of the $K\Lambda$ subsystem. The angular distribution of products in the CMS are also studied to determine the coefficients of Legendre polynomials by fitting to angular distribution of the reaction. The preliminary results of this analysis will be shown in this presentation.

HK 46.5 Do 16:00 HZ Poster

Absolute Photon Flux and $\gamma p \to p\pi^0$ Cross Section Determination at the BGO-OD Experiment* — Marvin Bleckwenn, Daniel Geffers, and •Thomas Zimmermann for the BGO-OD-Collaboration — Physikalisches Institut, Universität Bonn

The BGO-OD experiment, presently under construction at the electron accelerator ELSA at Bonn university, is intended for the systematic investigation of the photo-production of mesons.

It 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 combines a magnetic field with a series of tracking detectors, drift chambers and time of flight walls, allowing precise momentum reconstruction of forward travelling particles.

As proof for correct functionality of the BGO-OD experiment and the analysis, the π^0 cross section was determined. This required measurement of the absolute photon flux and simulation of the experimental acceptance.

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

HK 46.6 Do 16:00 HZ Poster

Simulation and Analysis of the channel $\bar{p}p \to e^+e^-\pi^0$ using the TDA production mechanism for its measurement with PANDA. — •María Carmen Mora Espí, Manuel Zambrana, and Frank Maas for the PANDA-Collaboration — Helmholtz-Institut Mainz, Mainz, Deutschland

The Transition Distribution Amplitudes (TDA) are universal non-perturbative objects describing the transition between two different particles. The TDA production mechanism can be used in the factorised description of hard processes which can be produced in PANDA at FAIR. One of these processes is the proton-antiproton annihilation into a lepton pair with high invariant mass q2 in association with a neutral pion of low transverse momentum, $\bar{p}p \to e^+e^-\pi^0$. Detailed simulation studies for the measurement of this channel have been performed including the separation of the signal channel from its main background channel ($\bar{p}p \to \pi^+\pi^-\pi^0$) as well as the study of the reconstruction efficiency of the signal. The preliminary results and the first conclusions are presented here together with a short discussion over the possible access of the TDA with PANDA.

HK 46.7 Do 16:00 HZ Poster

Measurement of electromagnetic time-like form factors of protons in BESIII — •Cristina Morales[1], Frank E. Maas[1], Paul Larin[1,2], and Dexu Lin[1] — [1]Helmholtz-Institut Mainz, SB1, Johann-Joachim-Becher-Weg 36, 55128 Mainz — [2]Institut für Kernphysik, Universität Mainz, Germany

The electromagnetic form factors of protons in the time-like region are re-viewed. We present the current status of the field and emphasize the relevant role of initial state radiation processes studied in high luminosity storage rings, such as the tau-charm factory BEPCII, i.e. BES-III experiment. We also present expectations from BES-III energy-scan measurements around the proton production threshold and above.

HK 46.8 Do 16:00 HZ Poster

P2 - High precision determination of the Weak Mixing Angle - Detector Design — •Kathrin Gerz — Institut für Kernphysik, Mainz, Deutschland

P2 is going to extract a highly precise value of the Weak Mixing Angle from a measurement of the parity violating asymmetry in the electron proton scattering. The determination of this key parameter of the electroweak interaction is an essential test of the Standard Model's validity.

Preparations for this experiment have started in early 2012. The poster is going to address design concepts and feasibility studies.

HK 46.9 Do 16:00 HZ Poster

Technical Development of the Backward End-Cap (BWEC) for the PANDA Electromagnetic Calorimeter (EMC) — •Roserio Valente[1,2], Luigi Capozza[1], Frank Maas[1,2], Oliver Noll[1], David Piñeiro[1,2], and Dexu Lin[1] for the PANDA-Collaboration — [1]Helmholtz-Institut Mainz - Johannes Gutenberg-Universität-Mainz 55099 Mainz — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH/Planckstraße 164291 Darmstadt

The EMC will play a very important role in the PANDA multipurpose target spectrometer at FAIR. It will be made of a total of 15484 PbWO4 crystals and subdivided into three parts: a central barrel, a forward and a backward end-cap. The EMC backward region is a strategic location for the assembling of the whole detector. Through this point all services needed by the inner detectors, such as cooling, power supply and signal readout are routed into the spectrometer. These constraints, together with the need of maximising hermeticity and the other functional requirements of the whole EMC, impose to the BWEC particularly high dimensional accuracy, structural and temperature stability. Different designs were studied to meet the geometrical requirements. To maximise the scintillation light output, the crystals need to be cooled to about -25°C with a temperature stability of +/- 0.1°C. A cooling network is being developed and will be manufactured by selective laser sintering. Pressure drop calculations, finite element simulations and heat insulation optimisation were performed to show that the temperature requirements can be fulfilled using the leakless (low pressure) cooling system available for all PANDA subdetectors.

HK 46.10 Do 16:00 HZ Poster

The APD High Voltage Board Characterization Station for

the Crystal Barrel Calorimeter — •Dimitri Schaab for the CBELSA/TAPS-Collaboration — Helmholtz-Institut für Strahlen- und Kernphysik, Nussallee 14-16, 53115 Bonn, Germany

The Crystal Barrel experiment investigates the inner dynamics of nucleons by baryon spectroscopy in photoproduction processes.
In order to enhance the acceptance for the photoproduction off the neutron a major hardware upgrade has been initialized in the past. It is about the upgrade from the currently used PIN-photodiode readout to a readout with avalanche-photodiodes (APD). The new concept provides a faster timing signal and allows the main calorimeter, which consists of 1230 scintillator crystals, to be part of the first level trigger stage.
The complete front-end electronics has been re-designed where the high voltage supply board is adapted to the temperature sensitive gain of the APDs. Before the electronics can be built into the calorimeter all supply boards have to be tested and characterized. The main tasks of the characterization station is to calibrate the on-board voltage measurement circuits and the voltage control as well as to test the functionality of the temperature compensation.
The performance and results of the APD High Voltage Board Characterization Station will be presented.
Supported by the Deutsche Forschungsgemeischaft (SFB/TR16) and Schweizerischer Nationalfonds.

HK 46.11 Do 16:00 HZ Poster

Is the four-phonon G.D.R. implicated in fission? — Genevieve Mouze and •Christian Ythier — Faculté des Sciences,Université de Nice, 06108 Nice cedex 2,France

The non-fissility with thermal neutrons of the 238 uranium system results from the too small clusterization energy E(cl) created when the system changes into 208 lead + 31 neon or 209 lead + 30 neon [1]. Indeed, it becomes fissile only when E(cl), at the most equal to 49.97 MeV at E(n) = 0, reaches 51.47 MeV at E(n) = 1.5 MeV. We suggest that this fissility does not simply result from a core-cluster collision destroying the lead core, since E(cl) is too small for overcoming the corresponding Coulomb barrier of 88.33 MeV, but rather from a combined shifting of the 82 protons of the lead core against the whole neutron phase, i.e. from a four-phonon giant dipole resonance, since E(cl) reaches about four times the G.D.R. energy of 238 uranium. We suggest that this 4-phonon G.D.R. triggers the nucleon phase of the fission reaction, a phase characterized by an uncertainty in the energy as great as 3.87 GeV, the ephemeral disappearance of any proton charge, and a lifetime of 0.17 ys. [1] G. Mouze, Nuovo Cimento A 106 (1993) 835 , A 103(1990) 617.

HK 46.12 Do 16:00 HZ Poster

From the law of Flynn to the Pyatkov effect — •Christian Ythier and Genevieve Mouze — Faculté des Sciences,Université de Nice, 06108 Nice cedex 2,France

The linear variation of the mean mass A(L) of the light fission products of an asymmetrically fissioning system as a function of its mass A(F) [1] results from the transfer of an almost constant number x(L) of nucleons from the primordial 208 lead core to the corresponding cluster of mass A(cl) = A(F) - 208. We show that A(L) = 82 + 1/2 A(cl) and that, without correction for prompt- neutron emission, x(L) equals 68 for the n-induced fission of 235 uranium and 60 for the spontaneous fission of 252 californium. The variation law can now be written A(L) = 1/2 A (F) - 22, i.e. x(L) = 186 - 1/2 A (F) . We suggest that the x(L) nucleons can condense into a cluster if they are hindered from reaching the primordial cluster by the accidental interposition of the nascent heavy fragment, a core of 126 nucleons formed in the destruction of the lead core :This situation can be realized in the conditions chosen by Pyatkov et al.[2] for observing the colinear ternary fission mode, i.e. the formation of clusters of mass 28(44), 126 and 68(60), with which 14(22) extra nucleons still can combine. [1] K.F. Flynn et al.,PRC, 5 (1972)1725 . [2] Yu.V. Pyatkov et al., EPJA, 45 (2010)20.

HK 46.13 Do 16:00 HZ Poster

Backtracking algorithm for lepton recontruction with HADES — •Patrick Sellheim for the HADES-Collaboration — Goethe-Universität Frankfurt

The HADES (High Acceptance Di-Electron Spectrometer) at the GSI Helmholtzzentrum für Schwerionenforschung investigates dilepton and strangeness production in elementary and heavy-ion collisions. In April - May 2012 HADES recorded 7 billion Au+Au events at a beam energy of 1.23 GeV/u with the highest multiplicities measured so far. The track reconstruction and particle identification in the high track density environment are challenging.
Most important detector component for lepton identification is a Ring Imaging Cherenkov detector. Its main purpose is the separation of electrons and positrons from large background of charged pions produced in heavy-ion collisions. In order to improve lepton identification a new backtracking algorithm was developed.
In this contribution we will show the results of a new backtracking algorithm compared to the currently applied method for $e^{-/+}$ identification. Efficiency and purity of a reconstructed $e^{-/+}$ sample will be discussed as well.
Supported by BMBF (05P12RFGHJ), Helmholtz Alliance EMMI, HIC for FAIR, HGS-HIRe and H-QM.

HK 46.14 Do 16:00 HZ Poster

study of the η meson in Pb-Pb collisions at $\sqrt{s_{NN}}$=2.76 TeV using the photon conversion method with ALICE — •Lucia Leardini — Physikalisches Institut, Heidelberg, Germany

The π^0 and η mesons are probes for studying the energy loss of the particles traveling through the hot and dense medium that forms after heavy-ions collisions, the Quark Gluon Plasma. Moreover, the study of the π^0 and η mesons in Pb-Pb collisions gives us an important reference with which to approach the direct photon measurement since they constitute its most important background.

The analysis is carried out using the Photon Conversion Method which exploits the ALICE Inner Tracking System (ITS) and the Time Projection Chamber (TPC) and makes possible measurements at low p_T with large significance. The data analyzed have been gathered during the 2011 and have a statistics eight times larger than the 2010 data. With the large statistics of the 2011 data it will be possible to measure the differential invariant cross section of the η meson as function of the transverse momentum up to a p_T of about 10 GeV/c in different centrality classes.

The results of the π^0 and η mesons from the 2011 data with the Photon Conversion Method with the ALICE detector will be presented.

HK 46.15 Do 16:00 HZ Poster

Centrality determination in Au-Au collisions at 1.23 AGeV with HADES — •Behruz Kardan and Christoph Blume for the HADES-Collaboration — Goethe-Universiät, Frankfurt am Main

The determination of the reaction centrality is essential in the study of the properties of extreme QCD matter, because it is directly related to the initial geometrical properties of the collision and allows the comparison of observables with other experiments and with theoretical calculations.

In HADES the charged particle multiplicity measured with different detectors is used as a centrality estimator for Au+Au collisions at 1.23 AGeV. Based on Glauber model simulation we deduce the geometrical properties, such as the number of participating nucleons and the number of binary nucleon-nucleon collisions, by fitting the simulated charged particle distributions to the measured data.

By comparing these results to simulations based on the UrQMD event generator the resolutions and possible biases of different centrality estimators are determined.

Supported by Helmholtz Alliance EMMI, HIC for FAIR, GSI and HGS-HIRe

HK 46.16 Do 16:00 HZ Poster

Two-phonon $E1$ excitations in ^{40}Ca and ^{140}Ce — •Martin Baldenhofer[1], Vera Derya[1], Janis Endres[1], Andreas Hennig[1], Bastian Löher[2,3], Deniz Savran[2,3], Werner Tornow[4], and Andreas Zilges[1] — [1]Institute for Nuclear Physics, University of Cologne — [2]ExtreMe Matter Institute EMMI and Research Division, GSI, Darmstadt — [3]Frankfurt Institute for Advanced Studies FIAS, Frankfurt — [4]Department of Physics, Duke University, USA

The coupling of a quadrupole- and an octupole-vibrational excitation results in a quintuplet of $J^\pi = 1^-$ to 5^- vibrational states with two-phonon structure. Candidates for harmonic two-phonon excitations are found energetically in the vicinity of the sum of the constituent excitation energies. Their structure can be tested by studying their γ-decay behavior in detail. We studied candidates for two-phonon $E1$ excitations in two nuclei of different mass, namely ^{40}Ca and ^{140}Ce, with the high-efficiency γ^3 setup [1] at the High Intensity γ-ray Source facility at the Triangle Universities Nuclear Laboratory in Durham, USA. The mono-energetic γ-ray beam allows for a selective excitation of the states of interest. In combination with the γ^3 setup, on the one hand, a high efficiency for γ-ray detection is achieved by an array of HPGe

and LaBr detectors, and, on the other hand, the analysis of γ-γ coincidences is possible.

Supported by the DFG (ZI 510/4-2) and the Alliance Program of the Helmholtz Association (HA216/EMMI).

[1] B. Löher *et al.*, Nucl. Instr. and Meth. A **723** (2013) 136

HK 46.17 Do 16:00 HZ Poster

Angular distribution measurements in particle-γ coincidences using SONIC&HORUS — •Julius Wilhelmy, Vera Derya, Andreas Hennig, Simon G. Pickstone, Mark Spieker, and Andreas Zilges — Institute for Nuclear Physics, University of Cologne

The combined setup SONIC&HORUS consists of the γ-ray spectrometer HORUS with 14 HPGe detectors and the recently commissioned particle spectrometer SONIC with up to 8 ΔE-E silicon detectors. This setup is used to measure the ejectile of a nuclear reaction (p, d, t, or α) in coincidence with the deexciting γ rays emitted by the recoil nucleus. By requiring a certain ejectile energy (*e.g.* the excitation of a level), a very clean γ spectrum is obtained, in which only physically related events remain. Measuring the angular correlations between the coincident ejectiles and γ-rays allows spin assignments to excited nuclear levels by comparison to theoretical particle-γ angular correlations.

An overview of the experimental setup will be given and preliminary p-γ angular correlations measured in a recent ^{92}Mo(p,p'γ) experiment will be shown.

Supported by the DFG (ZI 510/4-2).

HK 46.18 Do 16:00 HZ Poster

Relative Selbstabsorptionsmessung dipolangeregter Zustände in ^{27}Al * — •Laura Mertes, Jacob Beller, Nadia Benouaret, Haridas Pai, Norbert Pietralla, Christopher Romig, Marcus Scheck und Markus Zweidinger — Institut für Kernphysik, Technische Universität Darmstadt

Der Kern ^{27}Al wird häufig als Standard für die Kalibrierung des Photonenflusses bei Kernresonanzfluoreszenzexperimenten mit kontinuierlichen Bremsstrahlungsphotonen verwendet, weshalb eine genaue Kenntnis der Lebensdauern dipolangeregter Zustände in ^{27}Al von großer Bedeutung ist. Daher wurden mittels einer Selbstabsorptionsmessung mit Bremsstrahlungsphotonen am Darmstädter S-DALINAC die Grundzustandsübergangsbreiten und damit die Lebensdauern von angeregten Zuständen in ^{27}Al bis zu einer Energie von E_γ=7.1 MeV bestimmt. Die Selbstabsorptionsmessung wurde relativ zu dem Kalibrationsstandard ^{11}B durchgeführt. Die Messmethode und Ergebnisse werden vorgestellt und diskutiert.

* Gefördert durch die DFG im Rahmen des SFB 634

HK 46.19 Do 16:00 HZ Poster

Preparation of an experiment to directly detect the deexcitation of the ^{229m}Th nuclear isomer* — •Benedict Seiferle[1], Lars v.d. Wense[1], Peter Thirolf[1], and Mustapha Laatiaoui[2] — [1]LMU München — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH

Indirect measurements show that ^{229}Th has a transition energy of 7.6±0.5 eV to its first excited state, which corresponds to an UV transition wavelength of 163±11 nm [1]. The experiment under developement aims to detect and measure this wavelength [2]. For this purpose a ^{233}U source is placed in a buffer gas cell, where a continuous beam is produced out of the recoil ions. By using a quadrupole mass spectrometer the ^{229}Th ions are separated from other short-lived decay products of the ^{233}U decay chain and are then collected on a micro electrode (50μm in diameter). The deexcitation of these ^{229m}Th ions will then be detected by a VUV-optical setup, containing two customized annular parabolic VUV mirrors and a phosphorus screen behind an MCP detector, watched by a CCD camera. The mirrors, as well as the collection surface, are placed in vacuum and have to be motorized, to allow for an external position control. The main focus of the poster lies on the UV system with its motorization and alignment.

[1] B.R. Beck et al., (2007), PRL 98, 142501.
[2] L.v.d. Wense et al., (2013), JINST 8 P03005.

* Supported by the DFG Grant number TH956/3-1

HK 46.20 Do 16:00 HZ Poster

Study of Dipole Responses in ^{120}Sn by (p,p') Measurement at zero-degrees — •Anna Maria Krumbholz[1], Peter von Neumann-Cosel[1], Atsushi Tamii[2], and Vladimir Yu. Ponomarev[1] for the E316-Collaboration — [1]TU Darmstadt — [2]RCNP, Osaka

A consistent and powerful method to measure electric and magnetic dipole modes over a broad excitation energy range including energies below and above the neutron separation energy is polarized proton scattering at small scattering angles including 0° [1]. A topic of high current interest is the question whether (γ,γ') data provide the correct strength of the pygmy dipole resonance (PDR) since the extraction of B(E1) strength depends on the unobserved branching ratios to excited states. Furthermore, parts of the strength may be missed because of the limits of energy resolution and detection sensitivity. Spectroscopy of the PDR provides important insight into a possible interpretation of the mode as a neutron skin oscillation. Measurements of ^{120}Sn(p,p') reaction have been performed at RCNP with a beam energy of 295 MeV and an energy resolution of about 25 keV. For the separation of electric and magnetic contributions two different independent methods are applied, viz. a multipole decomposition of the angular distributions of the cross sections based on DWBA calculations and a model-independent analysis based on polarization transfer coefficients. Results of the analysis will be presented and compared to a ^{120}Sn(γ, γ') experiment [2].

[1] A. Tamii et al., Phys. Rev. Lett. 107, 062502 (2011).
[2] B. Özel, Ph.D. thesis, Çukurova University, Adana, Turkey (2008).
*Supported by DFG under contracts SFB 634 and NE 679/3-1.

HK 46.21 Do 16:00 HZ Poster

Effizienzkalibrierung am hochauflösenden Energieverlustspektrometer am S-DALINAC mit Hilfe einer ^{90}Sr-Quelle * — •Michaela Hilcker, Norbert Pietralla, Peter von Neumann-Cosel, Andreas Krugmann, Simela Aslanidou und Gerhart Steinhilber — Institut für Kernphysik, TU Darmstadt

Die relative Effizienz der Siliziumstreifenzähler des Detektorsystems des Lintott-Spektrometers [1] am Institut für Kernphysik der TU Darmstadt wurde überprüft. Dazu wurden bei verschiedenen Magnetfeldeinstellungen Beta-Spektren einer ^{90}Sr-Quelle aufgenommen, die sich in der Streukammer befand, um das Verhalten der einzelnen Kanäle zu vergleichen. Abweichungen zu theoretischen Vorhersagen basierend auf Fermis goldener Regel werden diskutiert. Mittels elastischer Elektronenstreuung bei einer Einschussenergie von 75 MeV an ^{150}Nd wurde während einer Elektronenstreu-Messkampagne im Herbst 2013 auch eine Messung zur absoluten Effizienz der Siliziumstreifen gemacht.

[1] A. Lenhardt, Dissertation D17, TU Darmstadt (2005).
* Gefördert von der DFG durch den SFB 634.

HK 46.22 Do 16:00 HZ Poster

Vergleich von Photoabsorptionsquerschnitten in relativistischer Protonenstreuung mit elektromagntischen Proben* — •Sergej Bassauer, Dirk Martin und Peter von Neumann-Cosel — Institutut für Kernphysik, TU Darmstadt

Durch den Vergleich aus der Coulombanregung extrahierter Photoabsorptionsquerschnitte in relativistischer Protonenstreuung mit elektromagnetischen Proben können Rückschlüsse auf den Untergrund durch nukleare Prozesse gezogen werden. Hierfür stehen Protonenstreudaten für die Kerne ^{28}Si, ^{40}Ca, ^{48}Ca, ^{96}Mo, ^{120}Sn, ^{144}Sm und ^{208}Pb sowie die entsprechenden Photoabsorptionsquerschnitte zur Verfügung. Ziel ist es durch das Anwenden verschiedener Methoden (virtuelle Photonenmethode, Waveletanalyse) die nuklearen Untergrundanteile der Protonenstreuspektren zu bestimmen und nach möglichen Parametrisierungen dieser als Funktion der Anregungsenergie, des Streuwinkels und der Massenzahl des Targetkerns zu suchen. Erste Resultate für ^{40}Ca werden diskutiert.

*Gefördert durch die DFG im Rahmen des SFB 634 und NE 679/3-1

HK 46.23 Do 16:00 HZ Poster

Lifetime of the first excited 2^+ state in ^{172}Hf and ^{174}Hf — •Rosa-Belle Gerst, Simon Stegemann, Jan Jolie, Jean-Marc Régis, Matthias Rudigier, Nima Saed-Samii, and Karl Oskar Zell — Institut für Kernphysik, Universität zu Köln, Zülpicher Str. 77, 50937 Köln

Using the ^{170}Yb(α,2n) and ^{172}Yb(α,2n) reactions the lifetimes of the first excited 2^+ state in ^{172}Hf and ^{174}Hf have been measured in fast-timing experiments using the Cologne Orange-Spectrometer and 6 $LaBr_3$(Ce)-Detectors. The lifetimes were obtained analyzing e^--γ-coincidence time-spectra with the slope method. The new and more precise lifetimes correct existing, outdated lifetimes in nuclear databases. Additionally, the systematics of the B(E2,$2_1^+ \rightarrow 0_1^+$) is studied.

This work was supported by the Deutsche Forschungsgemeinschaft (JO 391/16-1).

HK 46.24 Do 16:00 HZ Poster

Neutronenhautstudien mit schweren Kernen anhand kohärenter π^0-Photoproduktion — •Maria Isabel Ferretti Bondy für die A2-Kollaboration — Kernphysik Institut - Uni Mainz

Während die Ladungsverteilung von Kernen, u.a. in Elektronstreuexperimenten, mit sehr hoher Genauigkeit bestimmt wurde, sind Informationen über die Massenverteilung experimentell schwerer zugänglich und somit weniger exakt bekannt.

Von besonderem Interesse ist eine genaue Bestimmung der Neutronen Dichteverteilung. Speziell in Kernen mit N>>Z erwartet man die Bildung einer ausgeprägten Neutronenhaut, da die überschüssigen Neutronen nach außen gedrückt werden. Die genaue experimentelle Bestimmung der Neutronenhautdicke liefert wesentliche Vorgaben für die kernphysikalische Zustandsgleichung (EOS) und erlaubt somit Schlussfolgerungen auf die Größe von Neutronensternen.

Unter Ausnutzung der Reaktion $A(\gamma,\pi^0)A$ wurde 2012 im Rahmen der A2-Kollaboration am Mainzer Mikrotron (MAMI) ein Experiment zur Bestimmung der Massenverteilung von verschiedenen Kernen (^{58}Ni,$^{116,120,124}Sn$,^{208}Pb) durchgeführt. In diesem Poster werden neben dem Detektorsystem sowohl die Analysemethode zur Extraktion der Neutronenhautdicke, als auch erste Ergebnisse für ^{208}Pb präsentiert.

HK 46.25 Do 16:00 HZ Poster

Ion bunch stacking in a Penning trap after purification in an electrostatic ion-beam trap — •M. Rosenbusch for the ISOLTRAP-Collaboration — Ernst-Moritz-Arndt-Universität Greifswald

Measurements in analytical mass spectrometry as well as in precision mass determinations for atomic and nuclear physics are often handicapped when the ion sources deliver contaminations, i.e., unwanted ions of masses similar to those of the ions of interest. In particular, in ion-trapping devices, large amounts of contaminant ions result in significant systematic errors. At the Penning-trap mass spectrometer ISOLTRAP (ISOLDE/CERN), ions are purified in a multi-reflection time-of-flight mass separator (MR-ToF MS), which reaches a mass resolving power in excess of 10^5 in only tens of milliseconds [1,2]. However, the subsequent Penning-trap mass measurements require durations in order of a second. If only a certain maximum amount of ions can be processed simultaneously and the major parts are contaminants, the number of purified ions per mass-measurement cycle is limited. An improvement for such situations has been developed and realized recently [3]. The fast separation procedure of the MR-ToF MS is repeated several times while the purified ions are accumulated in a preparation Penning trap. In this contribution the method is described and proof-of-principle measurements are presented. [1] R. N. Wolf *et al.*, Nucl. Instrum. Meth. A 686, 82 (2012); [2] R. N. Wolf *et al.*, Int. J. Mass Spectrom. 349-350, 123 (2013); [3] M. Rosenbusch *et al.*, Appl. Phys. B, accepted (2013), http://dx.doi.org/10.1007/s00340-013-5702-0

HK 46.26 Do 16:00 HZ Poster

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 46.27 Do 16:00 HZ Poster

Velocity distribution in Recoil-Distance Doppler-Shift experiments — •Thomas Braunroth, Matthias Hackstein, Alfred Dewald, Claus Müller-Gatermann, Christoph Fransen, and Dorothea Wölk — Institut für Kernphysik, Universität zu Köln, Germany

The Recoil-Distance Doppler-Shift (RDDS) technique is a well established method to measure lifetimes of excited nuclear states in the picosecond range. In standard RDDS experiments at non-relativistc beam-energies, the velocities of the emerging recoils are usually distributed narrowly around a mean velocity $\overline{v} = \langle v \rangle_v$. Under these circumstances, the effect of the velocity distribution is neglectable and the assumption that all nuclei move with the average velocity is justified. In this poster we investigate the influence of broader velocity distributions on lifetimes determined using the standard lifetime analysis-method DDCM. This can be observed, e.g., in experiments with thick targets. In particular, it is shown that the effect of the velocity distribution on the deduced lifetime is minimised at the maximum amplitude of the derivative of the decay function.
This work was partly supported by the BMBF (Germany) under Contract no. 05P12PKFNE.

HK 46.28 Do 16:00 HZ Poster

Messung der Resonanzen der Kernreaktion $^{19}F(p,\alpha\gamma)^{16}O$ bei Protonenenergien von 0,3 bis 1 MeV — •Daniel Brenner[1], Hans-Eberhard Zschau[2], Sven Neve[1] und Lothar Schmidt[1] — [1]Institut für Kernphysik, Frankfurt a.M., Deutschland — [2]Dechema-Forschungsinstitut, Frankfurt a.M., Deutschland

Obwohl die Resonanzen der Kernreaktion $^{19}F(p,\alpha\gamma)^{16}O$ vielseitig für quantitative Analysen und zur Fluor-Tiefenprofilierung genutzt wird, gibt es wenige Messungen zu Wirkungsquerschnitten und Halbwertsbreiten der einzelnen Resonanzen. Gemessene Anregungskurven sind selten und haben meist eine hohe Schrittweite der Protonenenergie.

In dieser Arbeit wurde die Anregungskurve für Protonenenergien von 0,3 bis 1 MeV mit einer Schrittweite von 500 eV gemessen. Als Target diente ein Titan-Aluminium-Träger mit einer dünnen Fluorschicht an der Oberfläche. Die Anregungskurve wurde in einen Anteil des Trägermaterials und einen resonanten und einen nicht resonanten Anteil der Fluor-Kernreaktion getrennt. Die Wirkungsquerschnitte, Halbwertsbreiten und Anteile der drei γ-Emissionen wurden für die jeweiligen Resonanzen bestimmt.

HK 46.29 Do 16:00 HZ Poster

Datenaufnahme mit einer Trapezfilter-basierten Datenaufnahme bei Ereignisraten bis hin zu 100 kHz — •Stefan Schmidt[1], Jan Glorius[1], Gabriele Hampel[2], Tanja Heftrich[1], René Reifarth[1], Zuzana Slavkovská[1], Kerstin Sonnabend[1], Christian Stieghorst[2], Norbert Wiehl[2] und Stephan Zauner[2] — [1]Goethe Universität, Frankfurt am Main — [2]Johannes Gutenberg Universität, Mainz

In klassischen analogen Datenaufnahmesystemen müssen zum Teil mehrere elektronische Module hintereinandergeschaltet werden, um eine einzelne Informationen zu messen. Moderne digitale Datenaufnahmesysteme hingegen ermöglichen neben der eigentlichen Digitalisierung des Messsignals auch eine Signalverarbeitung in einem einzelnen Modul. Die Signalhöhe, die häufig eine Energieinformation enthält, kann dabei durch einen Trapezfilter bestimmt werden.

Da sich nicht jeder der Parameter eines solchen Trapezfilters mit Größen einer analogen Datenaufnahme identifizieren lässt, sind Erfahrungswerte mit analogen Systemen nicht direkt auf digitale Systeme übertragbar. Vor diesem Hintergrund wurden im Mai 2012 Untersuchungen zum Verhalten einer Trapezfilter-basierten digitalen Datenaufnahme bei Ereignisraten von bis zu 100 kHz durchgeführt. Dabei wurde ein CAEN V1724 mit einem HPGe-Detektor verbunden, mit dem ^{24}Na-Proben unterschiedlicher Aktivität vermessen wurden.

Dieses Projekt wird gefördert durch den GIF Research Grant No. G -1051-103.7/2009, der Helmholtz Nachwuchsgruppe VH-NG-327 und dem Nuclear Astrophysics Virtual Institute (NAVI).

HK 46.30 Do 16:00 HZ Poster

Production of ^{85}Kr — Stefan Fiebiger[1], •Zuzana Slavkovská[1], Ulrich Giesen[2], Michael Heil[3], Ralf Plag[1,3], René Reifarth[1], Kerstin Sonnabend[1], and Benedikt Thomas[1] — [1]Goethe Universität Frankfurt — [2]Physikalisch-Technische Bundesanstalt, Braunschweig — [3]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt

Neutron capture and β^--decay are competing branches of the s-process nucleosynthesis path at ^{85}Kr, which makes it an important branching point. The knowledge of its neutron capture cross section is therefore an essential tool to constrain stellar models of nucleosynthesis.
A ^{85}Kr sample can be produced via the irradiation of a stable, metallic

^{82}Se sample with α-beam. The gas stays trapped inside selenium as long as the temperature remains below 50°C. Fulfilling this temperature limit during the irradiation is one of the main technical difficulties during the production of ^{85}Kr.
Since the corresponding production cross sections are not known well enough, an experiment was performed at the PTB in Braunschweig, Germany. Various α-induced reactions on natural selenium were studied via the activation technique and the preliminary results are presented.
This project is supported by the ERC-consolidator project NAUTILUS.

HK 46.31 Do 16:00 HZ Poster

Charakterisierung einer LaBr3(Ce) Anordnung — •Matthias Fix[1], Jan Glorius[1], Kathrin Göbel[1], Arnd Junghans[2], René Reifarth[1], Stefan Schmidt[1] und Kerstin Sonnabend[1] — [1]Goethe Universität Frankfurt — [2]Helmholtz Zentrum Dresden Rossendorf

Differentielle Neutroneneinfangquerschnitte werden oft bestimmt, indem die prompte gamma-Emission zum Nachweis der stattgefundenen Reaktion genutzt wird. Für eine kalorimetrische Messung sind Detektorsysteme geeignet, die die Probe in einer 4pi Anordnung umgeben und hohe Effizienz aufweisen. Im Bereich der neutroneninduzierten Reaktionen wurde dafür bisher meist BaF2 als Szintillatormaterial benutzt. Die seit einigen Jahren verfügbaren Szintillatoren auf der Basis von Lanthanverbindungen zeichnen sich durch eine wesentlich verbesserte Energieauflösung aus. Um die Eignung von LaBr3(Ce) für solch einen Aufbau zu testen, wurde eine Anordnung von 2 Detektoren untersucht und die experimentellen Daten mit Simulationen verglichen. Dabei wurde besonderes Augenmerk auf Energie- und Zeitauflösung sowie die Effizienz gelegt. Zum Einsatz kamen verschiedene gamma-Emitter 22Na, 137Cs, 54Mn, 60Co sowie eine AmBe-Quelle.

HK 46.32 Do 16:00 HZ Poster

Auswahl von Backing-Materialien für hochleistungsbeständige Proben an FRANZ* — Markus Reich, Philipp Erbacher, Jan Glorius, Alexander Koloczek, René Reifarth, Stefan Schmidt, Kerstin Sonnabend und •Benedikt Thomas — Goethe Universität Frankfurt

An der Frankfurt Neutronenquelle FRANZ werden Experimente mit hochintensiven Protonenstrahlen geplant. Dabei werden Leistungsdepositionen von 4 kW, hauptsächlich im Backing-Material des Targets, erwartet. Die entstehende Wärme soll durch eine effiziente Wasserkühlung abgeführt werden. Für die Messungen der Wirkungsquerschnitte der Reaktionen ^{90}Zr(p,γ) und ^{91}Nb(p,γ) wurden verschiedene Backing-Materialien ausgewählt und die Temperaturentwicklung innerhalb der Targets mithilfe von Simulationen untersucht. Zur Optimierung der Kühlung wurden verschiedene Kühlgeometrien entwickelt und die Temperaturentwicklung für verschiedene Strahldurchmesser bei gleichen Randbedingungen simuliert. Mit Sicht auf den durch Reaktionen im Backing-Material produzierten Untergrund wird Wolfram als Backing-Material für die ^{91}Nb-Probe vorgeschlagen. Für die ^{90}Zr-Probe eignet sich Gold als Backing-Material. Beide Backing-Materialien wurden in den Temperatursimulationen für alle Geometrien untersucht.
* gefördert durch DFG(SO907/2-1)

HK 46.33 Do 16:00 HZ Poster

Friedmann-Kosmologie mit Dunkler Materie und Dunkler Energie — •Robin Lautenbacher und Horst Lenske — Institut für Theoretische Physik, Justus-Liebig-Universität Giessen, Heinrich-Buff-Ring 16, D-35392 Giessen

Die Zustandsgleichungen von Friedmann-Universen werden für verschiedene Szenarien untersucht. Im Mittelpunkt stehen erweiterte Modelle, die neben der üblichen zeitunabhängigen auch zeitabhängige Dichte-Druck Relation zulassen. Ergebnisse für materie- und strahlungsdominierte Universen werden präsentiert und der Bezug zum Hubble-Parameter herausgearbeitet. In einem erweiterten Modell werden Beiträge von Dunkler Materie und Dunkler Energie betrachtet. Beiträge zur Energiedichte werden zunächst wechselwirkungsfrei untersucht mithilfe einer inhomogenen Zustandsgleichung für Dunkle Energie, die als Vakuumenergie angesetzt wird. Abschließend werden Wechselwirkungen zwischen Dunkler Materie und Vakuumenergie mit homogenen Zustandsgleichungen betrachtet.

HK 46.34 Do 16:00 HZ Poster

Field mapping of the KATRIN Pinch Magnet — •Axel Müller for the KATRIN-Collaboration — Karlsruhe Institute of Technology, IEKP

The **Ka**rlsruhe **Tri**tium **N**eutrino experiment aims to probe the effective mass of the electron antineutrino in a model-independent way with an unsurpassed sensitivity of 200 meV/c^2 (90% C.L.). The energy spectrum of the electrons from Tritium β-decay is analyzed by an electrostatic spectrometer which is based on the MAC-E filter principle. The so-called PINCH magnet - a superconducting solenoid located at the end of the spectrometer - is a crucial part of the MAC-E filter and its field strength of 6 T is directly related to the sensitivity of the experiment. Thus, a clear understanding of its field stability and field map is indispensable for the success of KATRIN.
Along with an overview of the KATRIN experiment and the MAC-E filter principle this poster will present the results of a detailed study of the PINCH magnet's field map obtained with a 3-axis hall probe.
This work is supported by the BMBF (05A11VK3) and the Helmholtz association.

HK 46.35 Do 16:00 HZ Poster

The Focal-Plane Detector System of the KATRIN Experiment — •Frank Bandenburg for the KATRIN-Collaboration — Karlsruhe Institute of Technology, IEKP

The **Ka**rlsruhe **Tri**tium **N**eutrino experiment aims to probe the effective mass of the electron antineutrino in a model-independent way with an unsurpassed sensitivity of 200 meV/c^2 (90% C.L.). The task of the Focal-Plane Detector System is to detect the electrons from the Tritium β-decay which were transmitted through an electrostatic spectrometer based on the MAC-E filter principle. Thereby, a high detection efficiency has to be maintained while keeping the detector nearly background free. The detector system consists of two superconducting solenoids, a post-acceleration electrode, as well as several calibration sources. The detector itself is a Si-PIN diode wafer of 90 mm diameter with 148 segments and low-noise amplification electronics.
Besides an overview of the Focal-Plane Detector system this poster will focus on its performance parameters. This includes its intrinsic background level as well as its energy resolution and detection efficiency.
This work is supported by the BMBF (05A11VK3) and the Helmholtz association.

HK 46.36 Do 16:00 HZ Poster

Life time of the HFS transition in Li-like ^{209}Bi^{80+} — Ch. Geppert[2,3], V. Hannen[1], R. Jöhren[1], Th. Kühl[2,3,4], W. Nörtershäuser[2,3], H.-W. Ortjohann[1], R. S'anchez[3], Th. Stöhlker[2,3,4,5], •J. Vollbrecht[1], Ch. Weinheimer[1], and D. Winters[3] — [1]Institut für Kernphysik, Uni Münster — [2]Institut für Kernchemie, Uni Mainz — [3]GSI, Darmstadt — [4]Helmholtz Institut Jena — [5]Uni Jena

Measuring the hyperfine splitting of heavy, highly charged ions enables tests of QED in strong fields. HFS calculations have a relative uncertainty of more than 10^{-3} due to the distribution of the magnetic moment (Bohr-Weisskopf-Effekt). With an appropriate comparison of H- and Li-like ions this nuclear structure contribution can be suppressed. Bismuth is a suitable element for these studies, as the HFS splitting for both configurations are in a wavelength range suitable for laser spectroscopy. For this purpose the two ion species were stored in the Experimental Storage Ring at GSI at a velocity of $\beta = 0.71$. To efficiently collect the forward emitted photons a specially developed movable detector system was used. Thereby the HFS of Li-like ^{209}Bi^{80+} was successfully measured for the first time. Besides the determination of the transition energy it was possible to extract the life time of the transition out of the collected data. The corresponding analysis and the results are presented on this poster.
This work is supported by BMBF under contract number 05P12PMFAE.

HK 46.37 Do 16:00 HZ Poster

Study of magnetic field design for the neutron lifetime project: tau-SPECT — Marcus Beck[1], •Simo Dragisic[1], Klaus Eberhardt[2], Werner Heil[1], Jan Karch[1], Fabian Kories[1], Yury Sobolev[1,2], Dietmar Stepanow[1], and Norbert Trautmann[2] — [1]Institut für Physik Universität Mainz , Mainz, Deutschland — [2]Institut für Kernchemie Universität Mainz, Mainz, Deutschland

Magnetic storage of ultracold neutrons (UCN) is a new approach to measure the lifetime of the free neutron. At Mainz we plan to upgrade the existing superconducting aSPECT spectrometer [1] by implementing a magnetic multipole made out of permanent magnets . This measure will provide the radial storage of UCN whereas the aSPECT mag-

net itself confines the UCN ("low field seakers") along its longitudinal axis. In the meantime, extensive magnetic field calculations have been done using Comsol multiphysics which gave us the optimum arrangement of multipole magnets. The poster informs about the requirements on the design of the Halbach multipole magnet, the resulting magnetic field strength and the geometric constraints within the cold bore tube of the aSPECT magnet.

HK 46.38 Do 16:00 HZ Poster

Towards reaction cross section measurements of β^+ emitters produced in hadron therapy — •Björn Tegetmeyer[1], Saad Aldawood[1,2], Hugh van der Kolff[1,3], Christian Lang[1], Katia Parodi[1], and Peter Thirolf[1] — [1]LMU, Munich, Germany — [2]TU Delft, Netherlands — [3]King Saud University, Riyadh, Saudi Arabia

Therapeutic proton (or carbon) beams hitting human tissue induce nuclear reactions, eventually producing β^+-emitting reaction products ($^{10,11}C$,$^{14,15}O$,^{13}N). Those can be used for an ion-beam range verification via positron emission tomography (PET). In order to allow for a precise treatment planning in hadron therapy, the most relevant nuclear cross sections need to be included with sufficient precision into the phenomenological hadron interaction modes of the Monte-Carlo simulation. However, many of these cross sections are not known to the desired accuracy. Thus, we started to develop the methodology to measure proton-induced reaction cross sections of medically relevant β^+-emitters, starting with $^{16}O(p,\alpha)^{13}N$ at the Garching Tandem accelerator ($E_p = 7 - 20$ MeV). The experimental setup, procedure and status of the project will be displayed.

HK 46.39 Do 16:00 HZ Poster

Bestimmung der Nachweisgrenze bei der Tiefenprofilierung von Fluor in TiAl mittels PIGE — •Daniel Brenner[1], Hans-Eberhard Zschau[2], Sven Neve[1] und Lothar Schmidt[1] — [1]Institut für Kernphysik, Frankfurt a.M., Deutschland — [2]Dechema-Forschungsinstitut, Frankfurt a.M., Deutschland

Die Modifizierung der Oberflächen von Titan-Aluminium-Legierungen mit Fluor verbessert die Oxidationsbeständigkeit bei hohen Temperaturen. Bei einem neuen Verfahren des Recyclings des Werkstoffs werden geringe Mengen CaF_2 zugesetzt. Auch dies könnte zu einem erfolgreichen Oxidationsschutz führen.

Um einen erfolgreichen Halogeneffekt für geringe Konzentrationen von Fluor nachweisen oder widerlegen zu können, muss Fluor auch im ppm-Bereich zerstörungsfrei nachgewiesen werden können. Dazu wurden $TiAl$-Proben mit geringen Mengen Fluor oberflächennah implantiert. Durch Mehrfachimplantationen kann ein Bereich annähernd konstanter Fluor-Konzentration realisiert werden. Die Technik der Proton Induced Gamma Emission (PIGE) diente zum Nachweis der implantierten Profile. Die Nachweisgrenze unter den Bedingungen der zerstörungsfreien Tiefenprofilierung des bisher üblichen Messsystems mit NaI-Detektor und VKA wurde auf 400 ppm bestimmt und nach Umstieg auf digitale Datenaufnahme weiter verbessert. Es wurden sowohl mit Fluor implantierte $TiAl$-Proben, als auch Proben aus recyceltem $TiAl$ untersucht.

HK 46.40 Do 16:00 HZ Poster

Bunching High Intensity Proton Beams with a CH-DTL — •Malte Schwarz, Christine Claessens, Manuel Heilmann, Ole Hinrichs, Daniel Koser, Oliver Meusel, Daniel Noll, Holger Podlech, Ulrich Ratzinger, and Anja Seibel — Institut für Angewandte Physik, Goethe-Universität Frankfurt am Main, Germany

The Frankfurt Neutron Source at the Stern-Gerlach-Zentrum (FRANZ) will provide ultra short neutron pulses at high intensities and repetition rates. The facility is under construction with an expected first beam by the end of 2014. A 5-Gap CH rebuncher is installed behind a coupled RFQ/IH-DTL combination at the end of the LINAC section between two magnetic quadrupole triplets. It will be used for varying the final energy between 1.8 and 2.2 MeV, as well as for focusing the proton beam bunch longitudinally, to compensate RF defocusing effects and huge space charge forces at currents up to 200 mA at the final stage of extension.

Therefore high current beam dynamic simulations are in progress. They include benchmarking of different beam dynamic codes like LORASR, TraceWin and Bender (a new PIC tracking code developed at IAP), as well as validating the results by measurements. Detailed error tolerance studies, thermal simulations and examination of multipole field impact, due to the cavity geometry, are also done.

Furthermore, this CH rebuncher serves as prototype for CH cavity operation at MYRRHA (Belgium), an Accelerator Driven System (ADS) for transmutation of high level nuclear waste. After copperplating the cavity, RF conditioning will start in spring 2014.

HK 46.41 Do 16:00 HZ Poster

The Fast Piezo-Based Frequency Tuner for sc CH-Cavities — •Michael Amberg[1,2], Kurt Aulenbacher[1], Winfried Barth[1], Marco Busch[2], Florian Dziuba[2], Holger Podlech[2], and Ulrich Ratzinger[2] — [1]Helmholtz-Institute Mainz (HIM), Mainz, Germany — [2]IAP University of Frankfurt, Frankfurt am Main, Germany

Superconducting (sc) structures have to fulfill strict mechanical requirements to assure a stable operation of a cavity. Even small mechanical disturbances caused by effects like microphonic noise, pressure fluctuations of the liquid helium bath or Lorentz force detuning can change the resonance frequency of the cavity in the range of several hundred kHz. To control the slow and fast frequency variations during operation a compact frequency tuner prototype equipped with a stepper motor and a piezo actuator has been developed at the Institute for Applied Physics (IAP) of Frankfurt University. The tuner design and the results of first mechanical tests at room temperature of the first prototype are presented.

HK 46.42 Do 16:00 HZ Poster

Cold Tests of a sc 325 MHz CH-Cavity — •Marco Busch[1], Florian Dziuba[1], Holger Podlech[1], Ulrich Ratzinger[1], and Michael Amberg[2,1] — [1]IAP University of Frankfurt, Frankfurt am Main, Germany — [2]Helmholtz-Institute Mainz (HIM), Mainz, Germany

At the Institute for Applied Physics (IAP), University of Frankfurt, a superconducting 325 MHz CH-Cavity has been designed, built and first tests at 4 K have been performed. The cavity is determined for beam tests with a 11.4 AMeV, 10 mA ion beam at the GSI UNILAC. It consists of 7 gaps and is a candidate to deliver a gradient of at least 5 MV/m yielding voltages of 2.5 MV and above. New properties of this compact structure comprise low electric peak fields, improved surface processing capabilities and power coupling. Furthermore dynamic bellow tuners are welded into the resonator controlling the frequency after cool-down and during operation. In this contribution first measurement results accomplished at 4 K at the cryo lab in Frankfurt will be presented.

HK 46.43 Do 16:00 HZ Poster

Systematische Vermessung der Pumpeigenschaften kryogener Oberflächen — •Frederic Chill[1,2], Oliver Kester[1,2], Peter Spiller[2] und Lars Bozyk[2] — [1]Institut für Angewandte Physik, Frankfurt — [2]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt

Die Qualität des Strahlvakuums ist entscheidend für den stabilen Betrieb von Schwerionen-Synchrotrons mit höchster Intensität. Kryogene Oberflächen sind in der Lage, Restgas bis zu einem von den Dampfdruckkurven vorgegebenen Druck durch *Kryokondensation* zu binden. Bei geringer Oberflächenbedeckung kann Restgas auch durch *Kryosorption* gebunden werden. Dies erlaubt es, Wasserstoff ab dem Unterschreiten von 18K zu einem deutlich tieferen Endruck zu pumpen, als die Dampfdruckkurve angibt.

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

Zur Bestimmung dieser Größen wird derzeit ein Experiment mit einer kaltkopfgekühlten Kammer aufgebaut. Es erlaubt die Messung des Saugvermögens und des Gleichgewichtsdrucks der kalten Oberflächen. Daraus lassen sich dann die gesuchten Parameter ermitteln. Mit den Ergebnissen kann die Voraussagegenauigkeit des bei GSI entwickelten Simulationsprogramms für das dynamische Vakuum in kalten Beschleunigerabschnitten weiter verbessert werden.

HK 46.44 Do 16:00 HZ Poster

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

At the heavy ion LINAC at GSI, a novel scheme of non-invasive Bunch Shape Monitor has been tested with several ion beams at 11.4 MeV/u.

Caused by the beam impact on the residual gas, secondary electrons are liberated. These electrons are accelerated by an electrostatic field, transported through a sophisticated electrostatic energy analyzer and an rf-deflector, acting as a time-to-space converter. Finally a MCP detects the electron distribution. For the applied beam settings this Bunch Shape Monitor is able to obtain longitudinal profiles down to 400 ps with a resolution of 50 ps, corresponding to 2 degree of the 36 MHz acceleration frequency. During a long shutdown period for the GSI accelerators in 2013, the monitor underwent a general technical retrofit: Influence of the beam has been significantly reduced, due enhanced electrodes, new apertures have been installed to decrease electron scattering, sophisticated stepping motors will allow better image properties, a MCP shielding plate will prevent high background.

Together with these improvements the achievements of the monitor are discussed.

HK 46.45 Do 16:00 HZ Poster

Buncher-Cavities for the MYRRHA Injector LINAC — •Daniel Koser, Markus Basten, Dominik Mäder, Daniel Noll, Holger Podlech, Ulrich Ratzinger, Malte Schwarz, Anja Seibel, and Markus Vossberg — Institute for Applied Physics IAP, Frankfurt am Main, Germany

MYRRHA (Multi-purpose hYbrid Research Reactor for High-tech Applications) is currently being designed as an Accelerator Driven System (ADS) for demonstrating the feasibility of transmutation of high level nuclear waste. The MAX project (MYRRHA Accelerator eXperiment and development) is the corresponding R&D programme for the designated proton driver, which should provide the spallation target with a continuous wave proton beam of 600 MeV and 4 mA.

The current layout of the injector design includes a 2-gap as well as a 5-gap room temperature rebunching structure operating at 176,1 MHz with total effective voltages of 116 kV and 270 kV, respectively, which both are being designed at IAP. For maximum power efficiency the 2-gap structure is going to be implemented as a quarter-wave coaxial resonator whereas the 5-gap structure will be a CH cavity, for which a prototype was already built within the scope of FRANZ.

In order to optimize the performance and to provide a reliable cooling system and mechanical stability, RF, thermal and structural mechanics simulations are done mainly using CST Studio. Also the beam dynamics is going to be investigated using a new particle in cell tracking code called BENDER, which was developed at IAP.

HK 46.46 Do 16:00 HZ Poster

Design of a 325 MHz Ladder - Type RFQ for FAIR — •Maximilian Schütt, Robert Brodhage, Ali Almomani, and Ulrich Ratzinger — Institut für Angewandte Physik, Goethe-Universität Frankfurt, Max-von-Laue-Str. 1, 60438 Frankfurt am Main

For the research program with cooled antiprotons at FAIR a dedicated 70 MeV, 70 mA proton injector is required. The first rf accelerator element is a 325 MHz RFQ accelerating from 95 keV to 3.0 MeV. RFQ's beyond 300 MHz were realized in 4-Vane-type geometry so far. At IAP there is a tradition in 4-Rod-type RFQ development. This RFQ-type is dominating at lower frequencies. Very promising results have been reached with a ladder type-RFQ, which has been investigated during 2013. We will show most recent 3D simulations of the general layout and of a whole cavity demonstrating the power of a ladder type RFQ. An RFQ layout for the new FAIR proton injector will be presented. In comparison with a traditional 4-Rod RFQ approach the geometry is more convenient at high frequencies.

HK 46.47 Do 16:00 HZ Poster

High Gradient Room Temperature Cavity Development for 10-100 AMeV Beams — •Ali Almomani and Ulrich Ratzinger — Institut für Angewandte Physik - Frankfurt Universität, Frankfurt am Main, Germany

The linac activities are aimed on compact designs and to increase the voltage gain per meter. At IAP - Frankfurt, a CH design was developed for these studies, where the mean effective accelerating field is expected to reach well above 10 MV/m at 325 MHz, β=0.164. Within a funded project (BMBF No. 05P12RFRB9), this cavity is systematically developed. The results should give an impact on the rebuilt of the UNILAC - Alvarez section, optimized for achieving the beam intensities specified for the GSI - FAIR project. The availability of the GSI 3 MW klystron test stand will be very important for these investigations. The status of the cavity design will be presented.

HK 46.48 Do 16:00 HZ Poster

Experimental Results of an ExB Chopper System — •Christoph Wiesner, Hannes Dinter, Martin Droba, Oliver Meusel, Daniel Noll, Tobias Nowottnick, Onur Payir, Ulrich Ratzinger, and Philipp Schneider — IAP, Goethe-Universität Frankfurt, Max-von-Laue-Str. 1, 60438 Frankfurt am Main

A new chopper system for low-energy high-perveance beams and high repetition rates was developed for the Low Energy Beam Transport (LEBT) section of the accelerator-driven neutron source FRANZ [1]. The chopper combines a static magnetic deflection field with a pulsed electric compensation field in a Wien filter-type ExB configuration [2]. The total system length is 80 cm.

Successful beam operation of the chopper has started. Helium beams with 14 keV energy were chopped with the required repetition rate of 257 kHz. The beam pulses have rise times of 120 ns and Full Width at Half Maximum (FWHM) of 240 ns to 370 ns. When the future high-current proton source of the FRANZ facility is available, the chopper will operate with a 50 mA, 120 keV beam. The design of the chopper and results of beam experiments are presented.

[1] U. Ratzinger et al., Proc. of IPAC2011, San Sebastian, Spain, WEPS040.

[2] C. Wiesner et al., Proc. of IPAC2012, New Orleans, LA., USA, THPPP074.

HK 46.49 Do 16:00 HZ Poster

Strahlseparationssystem für intensive Protonenstrahlen — •Onur Payir, Hannes Dinter, Oliver Meusel, Daniel Noll, Tobias Nowottnick, Ulrich Ratzinger, Philipp Schneider und Christoph Wiesner — IAP, Goethe-Universität Frankfurt, Max-von-Laue-Str. 1, 60438 Frankfurt am Main

Die beschleunigergetriebene Neutronenquelle FRANZ soll hochintensive Neutronenpulse mit einer Wiederholrate von 250 kHz erzeugen. In der niederenergetischen Strahltransportsektion prägt ein ExB Chopper dem primären 120 keV, 50 mA Protonenstrahl die 250 kHz Zeitstruktur auf. Um dabei die durch Strahlverluste hervorgerufene thermische Belastung und die unkontrollierte Produktion von Sekundärteilchen zu minimieren, ist für die anschließende Strahlseparation ein sogenanntes masseloses Septumsystem in Planung.

Das Septumsystem besteht aus einem statischen C-Magneten und einer magnetischen Abschirmröhre mit einem Schlitz an der Seite. Der C-Magnet soll den am Chopper abgelenkten Strahl in einen Beam Dump führen. Gleichzeitig wird mit der Abschirmröhre das magnetische Feld auf der ca. 60 mm entfernten Strahlachse des transmittierten Strahls abgeschirmt. Mithilfe numerischer Simulationen wurde das Funktionsprinzip und die Strahltransporteigenschaften des Septumsystems untersucht und das Design des C-Magneten entworfen. Bei einem Hauptfeld von ca. 260 mT konnte auf der Strahlachse ein Maximalfeld von <1 mT erreicht werden, während der abgelenkte Strahl durch Modifikationen an den Polschuhplatten des C-Magneten mit minimalen Verlusten in einen Beam Dump geführt werden konnte.

HK 46.50 Do 16:00 HZ Poster

Untersuchungen des Transports niederenergetischer Strahlen durch einen Solenoidkanal — •Tobias Nowottnick, Hannes Dinter, Philipp Schneider, Christopher Wagner, Oliver Meusel, Onur Payir, Ulrich Ratzinger und Christoph Wiesner — IAP, Goethe-Universität Frankfurt, Max-von-Laue-Str. 1, 60438 Frankfurt am Main

In der Low Energy Beam Transport Section (LEBT) der Frankfurter Neutronenquelle FRANZ [1] werden vier Solenoide als magnetische Linsen für die transversale Fokussierung des 50 mA Protonenstrahls eingesetzt. Dabei werden die ersten beiden Solenoide für die Einpassung in den ExB-Chopper [2] verwendet, welcher dem 120 keV Strahl eine Zeitstruktur aufprägt. Die beiden anderen Solenoide werden für die Einpassung in die gekoppelte RFQ/IH-DTL Beschleunigerstruktur verwendet.

Der niederenergetische Transportkanal wurde erfolgreich in Betrieb genommen. Es werden experimentelle Untersuchungen und Strahltransportsimulationen für einen Helium-Teststrahl dargestellt. Dabei liegt der Fokus der Untersuchung auf einer maximalen Transmission und einer verlustfreien Einpassung in die Akzeptanz des Choppers.

[1] U. Ratzinger et al., Proc. of IPAC2011, San Sebastián, Spain, WEPS040.

[2] C. Wiesner et al., Proc. of IPAC2012, New Orleans, LA., USA, THPPP074.

HK 46.51 Do 16:00 HZ Poster

Entwicklung einer Gabor-Plasmalinse mit geregelter Fokus-

sierstärke — •Stephan Klaproth, Kathrin Schulte, Oliver Meusel, Martin Droba und Ulrich Ratzinger — Institut für Angewandte Physik, Frankfurt, Deutschland

Durch das elektrische Raumladungsfeld der in der Gabor-Plasmalinse eingeschlossenen Elektronenwolke können, unter Voraussetzung einer homogenen Elektronendichteverteilung, Ionenstrahlen aberrationsfrei abgebildet werden.

Dabei sind Kenntnisse über die Eigenschaften und die Parameter, wie z.B. die Plasmadichte, die Raumladungsverteilung und die zeitliche Stabilität des Nicht-Neutralen-Plasmas wichtig. Über das angelegte Potential, das magnetische Feld und den Restgasdruck lassen sich diese Eigenschaften variieren. Um diesen 3D-Parameterraum ausmessen zu können soll ein automatisiertes Kontrollsystem entworfen werden.

Das Kontrollsystem soll dabei nicht nur in der Lage sein den 3D-Parameterraum auszumessen, sondern auch die Brechkraft der Gabor-Plasmalinse im Einsatz als Fokussierelement automatisch zu regeln.

In diesem Beitrag werden die Funktionsweise der Diagnose und das Konzept des Kontrollsystems präsentiert.

HK 46.52 Do 16:00 HZ Poster

First coupled CH Power Cavity for the FAIR Proton Injector — •Robert Brodhage[1], Wolfgang Vinzenz[1], Ali Almomani[2], and Ulrich Ratzinger[2] — [1]GSI Helmholtzzentrum für Schwerionenforschung — [2]Institut für Angewandte Physik, Uni Frankfurt

For the research program with cooled antiprotons at FAIR a dedicated 70 MeV, 70 mA proton injector is required. The main acceleration of this room temperature linac will be provided by six CH cavities operated at 325 MHz. Each cavity will be powered by a 2.5 MW Klystron. For the second acceleration unit from 11.5 MeV to 24.2 MeV a 1:2 scaled model has been built. Low level RF measurements have been performed to determine the main parameters and to prove the concept of coupled CH cavities. In 2012, the assembly and tuning of the first power prototype was finished. Until then, the cavity was tested with a preliminary aluminum drift tube structure, which was used for precise frequency and field tuning. In 2013 the final drift tube structure has been welded inside the main tanks and the preparation for copper plating has taken place. This paper will report on the main tuning and commissioning steps towards that novel type of DTL and it will show the latest results measured on a fully operational and copper plated CH proton cavity.

HK 46.53 Do 16:00 HZ Poster

Inbetriebnahme der gekoppelten RFQ-IH-Struktur für FRANZ — •Manuel Heilmann, Christine Claessens, Dominik Mäder, Oliver Meusel, Ulrich Ratzinger, Alwin Schempp und Malte Schwarz — Institut für Angewandte Physik, Goethe-Universität Frankfurt am Main, Germany

Die Frankfurter Neutronenquelle am Stern-Gerlach-Zentrum (FRANZ) liefert sehr kurze Neutronenpulse bei hohen Intensitäten und Wiederholraten. Die Neutronen werden mit 2 MeV Protonen über eine ^{7}Li(p,n)^{7}Be Reaktion erzeugt. Die gekoppelte RFQ-IH-Kombination mit einer Betriebsfrequenz von 175 MHz hat eine Gesamtlänge von 2,3 m und beschleunigt Protonen von 120 keV auf 2,03 MeV. Die Verlustleistung der gekoppelten Strukturen summiert sich auf über 200 kW. Die RFQ-IH-Kombination wird nur von einem HF-Sender betrieben und die Leistung wird induktiv in den RFQ eingekoppelt. Die IH-Struktur wird über eine induktive interne Kopplung mit angeregt. Der erste Strahlbetrieb der Beschleuniger ist ausgelegt für 50 mA. Die IH-Komponenten sind gebaut und erste HF-Messungen werden vorbereitet. Beide Beschleuniger werden separat konditioniert und danach gekoppelt. Der erste Strahlbetrieb der beiden Beschleuniger und der MEBT-Sektion wird Ende 2014 statt finden.

HK 46.54 Do 16:00 HZ Poster

Strahldynamik in der LEBT-Sektion für FRANZ — •Philipp P. Schneider, Hannes Dinter, Martin Droba, Oliver Meusel, Daniel Noll, Tobias Nowottnick, Onur Payir, Holger Podlech, Alwin Schempp und Christoph Wiesner — Institut für Angewandte Physik (IAP), Goethe-Universität, Max-von-Laue-Str. 1, 60438 Frankfurt am Main

Die Sektion für Niederenergie-Strahltransport (Low Energy Beam Transport, LEBT) der beschleunigergetriebenen Neutronenquelle FRANZ besteht aus insgesamt vier Solenoiden. Die erste Sektion, die aus zwei Solenoiden besteht, wird einen 120 keV Protonen-Strahl in ein Chopper-System einpassen. Dem Chopper-System folgt eine Sektion mit zwei weiteren Solenoiden, die den Strahl in die Akzeptanz des anschließenden RFQs einpassen. Der Beschleuniger wird entweder mit einem kontinuierlichen 2-mA-Strahl oder einem gepulsten Strahl mit Strahlströmen von 50 mA bis 200 mA bei 250 kHz Wiederholrate betrieben. Die hohe Intensität dieser Ionenstrahlen erfordert die Berücksichtigung von Raumladungseffekten. Es wurden Teilchensimulationen mit verschiedenen Parameter-Sets durchgeführt, um die Einstellungen bester Transmission und Strahlqualität zu finden. Zudem wurden Verlustprofile entlang des Transportkanals berechnet, um Hotspots zu identifizieren. Die Simulationsergebnisse für die beste Transmission bei niedrigstem Emittanzwachstum werden präsentiert.

HK 46.55 Do 16:00 HZ Poster

The electronic readout of the $\overline{\text{P}}$ANDA Straw Tube Tracker — •Stephan Leiber, James Ritman, and Peter Wintz for the PANDA-Collaboration — Forschungszentrum Jülich GmbH

The $\overline{\text{P}}$ANDA experiment at FAIR will use antiproton beams with momenta between 1.5 and 15 GeV/c and proton, deuteron or nucleon targets to study $\bar{\text{p}}$p-annihilations in the charm quark mass regime with $\sqrt{s} = 2.3$ - 5.5 GeV.
The central Straw Tube Tracker (STT) in the $\overline{\text{P}}$ANDA-spectrometer is a gas detector consisting of 4636 closed-packed, self supporting straw tubes which are arranged in six hexagonal sectors and 23 - 27 radial layers to precisely measure the particle tracks and their specific energy loss dE/dx for particle identification. The single hit resolution is about $\sigma_{xy} = 150\,\mu$m and $\sigma_z = 2$ - 3 mm and the information of the particle identification ($\sigma_{(dE/dx)} < 10\,\%$) is needed to separate protons, pions and kaons with momenta below 1 GeV/c.
In 2013 the construction phase of the STT started. The design including the readout system will be described and results from in-beam and cosmic ray tests will be shown.

HK 46.56 Do 16:00 HZ Poster

Implementation of Pattern Recognition for the $\bar{\text{P}}$ANDA Forward Tracking System* — •Martin J. Galuska, Jifeng Hu, Wolfgang Kühn, J. Sören Lange, Yutie Liang, David Münchow, Björn Spruck, and Milan Wagner for the PANDA-Collaboration — II. Physik. Inst., JLU Gießen

The planned $\bar{\text{P}}$ANDA fixed-target experiment will operate with up to $2 \cdot 10^7$ antiproton-proton or antiproton-nucleus collisions per second. Up to 8 primary charged particles per event are expected to reach the acceptance of the $\bar{\text{P}}$ANDA Forward Tracking System (FTS) detector which is comprised of 6 stations with 4 straw tube double layers with drift times ≤ 150 ns. With $\geq 99.6\%$ probability the signals of ≤ 8 events will have to be processed simultaneously at the peak interaction rate of 20 MHz.

A Hough transform based charged particle tracking algorithm for the $\bar{\text{P}}$ANDA FTS detector was developed. In the region of the $\bar{\text{P}}$ANDA Forward Spectrometer it uses a 3-stages track model of line+parabola+line for the projection of the track into the bending x-z-plane. The projection into the non-bending y-z-plane is approximated by a straight line. Results on efficiency and momentum resolution will be presented.

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

HK 46.57 Do 16:00 HZ Poster

Cluster beam investigation with MCPs — •Esperanza Köhler, Daniel Bonaventura, Silke Grieser, Ann-Katrin Hergemöller, Alexander Täschner, and Alfons Khoukaz — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, 48149 Münster, Germany

High intensity cluster-jet beams produced in Laval nozzles represent a very attractive and extremely interesting tool for studies at storage ring experiments, such as $\overline{\text{P}}$ANDA, or for laser-induced particle acceleration. Since the cluster properties vary with increasing number of constituents, it is essential to perform systematic measurements on the target thickness and especially on the cluster masses. For this purpose a monitoring system based on Micro Channel Plates (MCPs) combined with a phosphor screen has been developed and installed at the beam dump of the $\overline{\text{P}}$ANDA prototype cluster-jet target in Münster. It could be shown that this MCP system allows for a direct observation of an ionised cluster beam. In addition, with this setup the possibility to visualise the vertex zone at the ANKE cluster-jet target at COSY was succesfully demonstrated, where a proton beam with a momentum of 2.09 GeV/c interacted with a hydrogen cluster-jet beam. Furthermore, cluster mass investigations can be performed in conjunction with a retardation field. In this presentation an overview of the MCP detection

system, images of the cluster-jet beam and the vertex zone as well as the results of the current cluster mass measurements will be presented and discussed.
Supported by EU (FP7), BMBF, and GSI F+E.

HK 46.58 Do 16:00 HZ Poster

Cherenkov-Licht Nachweis und e^+e^--Identifikation im HADES RICH* — •Tobias Kunz[1], Jürgen Friese[1], Korbinian Schmidt-Sommerfeld[1] und Laura Fabietti[2] — [1]Physik Dept. E12, Technische Universität München, 85748 Garching, Deutschland — [2]Excellence Cluster "Universe", 85748 Garching

Für die e^+e^--Paarspektroskopie in Schwerionenreaktionen ist die Nachweiswahrscheinlichkeit für relativistische e^+/e^--Teilchen von zentraler Bedeutung. Im HADES Experiment an der GSI, Darmstadt, werden diese mit einem hadronblinden RICH-Detektor identifiziert, der das Cherenkovlicht mit einem photosensitiven Gasdetektor nachweist. Für ein quantitatives Verständnis der e^+e^--Nachweiswahrscheinlichkeit wird eine genaue Kenntnis des Ansprechverhaltens des Photonendetektors benötigt. Nach dem Neubau der Ausleseelektronik wurden dazu verschiedene Messungen durchgeführt. Einerseits wurden in voll rekonstruierten π^0-Dalitz-Zerfällen ($\pi^0 \to \gamma e^+e^-$) aus Au + Au Reaktionen bei E = 1.25 AGeV die gemessenen Cherenkovringe im Hinblick auf das Photonensignal untersucht. Desweiteren wurde der Detektor mit einer speziellen Lichtquelle bestrahlt, die bei einer Rate von ca. 1 kHz einzelne Photonen im VUV-Bereich emittiert. Die erhaltenen Amplituden- und Padmultiplizitätsverteilungen für einzelne Photonen dienen als Grundlage für die vollständige Simulation des Detektors. Die Ergebnisse beider Messungen werden vorgestellt.
* supp. by BMBF(06MT7180)

HK 46.59 Do 16:00 HZ Poster

A novel mass calibration mode for the MR-TOF-MS at the FRS Ion Catcher — •Jens Ebert for the FRS Ion Catcher-Collaboration — Justus-Liebig-Universität Gießen

Fission and projectile fragments, produced in an accelerator facility at relativistic energies, must be slowed down for high-precision experiments at low energies. At the FRS Ion Catcher experiment, a test bench for the low energy branch of the Super-FRS at FAIR, this has been done in July and August 2012 for an Uranium beam with 1GeV/u fragmented on a Beryllium target. The projectile fragments were separated in-flight, range-bunched, slowed-down in the Fragment Separator (FRS) at GSI and subsequently thermalized in a cryogenic stopping cell (CSC). With the ions extracted from the CSC and transported to a multiple-reflection time-of-flight mass spectrometer (MR-TOF-MS) mass measurements were performed for different isobars with A=211 and A=213 like the short lived ^{213}Rn with a half-live of only 20 ms.

The data analysis of this mass measurements including a novel calibration mode for ions with different turn numbers in the analyzer of the MR-TOF-MS will be presented. This calibration mode allows high resoluted mass measurements for ions of interest without isobaric calibration ions.

HK 46.60 Do 16:00 HZ Poster

Simulation eines 4π BaF_2-Kalorimeters mit GEANT4 * — •Emilio Mevius[1], Max Gilbert[1], Jan Glorius[1], Ralf Plag[2], Rene Reifarth[1], Stefan Schmidt[1], Kerstin Sonnabend[1], Mario Weigand[1] und Clemens Wolf[1] — [1]Institut für Angewandte Physik, Goethe Universität Frankfurt — [2]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt

Zur Untersuchung neutronen- und protoneninduzierter Reaktionen kommt an der Frankfurter Neutronenquelle FRANZ ein 4π BaF_2-Kalorimeter zum Einsatz. Es besteht aus bis zu 42 Kristallen mit fünf- oder sechseckiger Grundfläche, um eine möglichst vollständige Abdeckung des gesamten Raumwinkels zu gewährleisten. Die Geometrie des gesamten Detektorarrays wurde erstmals in GEANT4 implementiert und die Detektorantwort zu diskreten Photonenenergien, wie sie bei Verwendung von Eichquellen auftreten, simuliert.
Die Ergebnisse der Simulation werden vorgestellt und mit Messungen verglichen.

* gefördert durch die DFG (SO907/2-1) und HIC for FAIR

HK 46.61 Do 16:00 HZ Poster

Investigation of work functions for precision experiments to investigate the standard electroweak model — •Marcus Beck[1,2], Werner Heil[1], Ernst W. Otten[1], Christian Schmidt[1], and Alexander Wunderle[1] — [1]Institut für Physik, Johannes Gutenberg-Universität Mainz, Germany — [2]Helmholtz-Insitut Mainz, Germany

The standard model of the electroweak interaction is tested with ever increasing precision by non-accelerator experiments, e.g. using beta decay. The precision of these experiments has reached a point where the variation of the work function of the materials used for electrodes starts to limit the sensitivity. We investigate these variations of the work function for the *a*SPECT and the KATRIN experiments using a scanning Kelvin probe and the photoelectric effect. In 2013 *a*SPECT had a successfull beam time at the cold neutron beam line PF1b at the Institut Laue Langevin to determine the ratio of the weak coupling constants g_A/g_V. KATRIN is being set-up at the Karlsruhe Institute for Technology to measure the absolute mass of the electron-antineutrino. In order to achieve the sensitivity goals of these experiments the variation of the work function of their electrodes in time and space have to be known at the level of 10 meV. Systematic studies of the work function of various surfaces covered with a thin gold layer will be presented.

HK 46.62 Do 16:00 HZ Poster

Study of the PANDA barrel DIRC prototype timing resolution — •Marvin Krebs[1,2], Klaus Peters[1,2], Carsten Schwarz[1], and Jochen Schwiening[1] for the PANDA-Collaboration — [1]GSI Helmholtzzentrum fuer Schwerionenforschung GmbH, Darmstadt — [2]Goethe- Universitaet, Frankfurt am Main

The PANDA experiment at the new Facility for Antiproton and Ion Research in Europe (FAIR) at GSI, Darmstadt, will study fundamental questions of hadron physics and QCD. A DIRC (Detection of Internally Reflected Cherenkov light) counter will provide hadronic particle identification (PID) in the barrel region of the PANDA detector. In order to meet the PID requirements the DIRC has to provide precise measurements of the Cherenkov angle and the propagation time of single photons. A barrel DIRC prototype was successfully tested with particle beams at CERN in 2012. A detailed study was performed after the beam time to understand the observed timing resolution and the contributions from the photon detectors, trigger system, and the electronics. The prototype readout system, including the TRBs (Trigger and Readout Boards) and the current generation of MCP-PMTs (Micro Channel Plate - Photo Multiplier Tubes) was studied using electronic pulsers and picosecond laser pulsers. We present measurements of the single photon timing resolution as a function of critical parameters like signal amplitudes, signal slopes, and sensor occupancy. 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

HK 46.63 Do 16:00 HZ Poster

First test results of TRD prototypes for CBM with alternating wires — •Pascal Dillenseger, Susanne Glässel, and Florian Roether — Institut für Kernphysik Frankfurt

The CBM (Compressed Baryonic Matter) at FAIR will be dedicated to the exploration of the QCD phase diagram in the region of high net-baryon densities using heavy-ion collisions. The CBM Transition-Radiation Detector (TRD) has to deliver a good tracking and electron identification performance in an unprecedented high particle-density environment. A thin Multi-Wire Proportional Chamber (MWPC) without drift region delivers the required fast detector response for the expected high signal rates.
One key challenge is to achieve stability of the gas gain. To reduce its sensitivity to cathode deformations, an alternating wire structure, as proposed for the ALICE VHMPID (Nucl. Instrum. Meth. A698 (2013) 11-18), is exploited. Field wires are introduced between the sense wires to improve the field line distribution and its stability. An asymmetric structure, i.e. one cathode is closer to the wire plane than the other, provides fast removal of positive ions. Prototypes with standard and alternating field wires, symmetric and asymmetric structure, and different pad planes have been build and tested with an ^{55}Fe source to measure position and pressure dependent gain variations.
Supported by BMBF and the Helmholtz Association.

HK 46.64 Do 16:00 HZ Poster

Automatisierung von Messprozeduren zur systematischen Charakterisierung von Pixelsensoren* — •Benjamin Linnik für die CBM-MVD-Kollaboration — Goethe-Universität, Frankfurt

Die Strahlenhärte von monolithischen CMOS-Pixelsensoren (MAPS),

wie sie im ILC, im Heavy-Flavour-Tracker von STAR, ITS-Upgrade von ALICE und Mikro-Vertex-Detektor von CBM verwendet werden sollen, ist Thema eines Forschungs- und Entwicklungsprojekt zwischen IKF Frankfurt und IPHC Straßburg. Sie konnte im vergangenem Jahrzehnt durch Strahlenhärtestudien stark verbessert werden.

Die dafür notwendigen systematischen Strahlenhärtestudien erfordern die Analyse einer großen Zahl von Prototypsensoren nach einem standardisierten Messprotokoll unter kontrollierten Laborbedingungen. Wir stellen in diesem Beitrag ein automatisches Überwachungs- und Automatisierungssystems vor namens **M**APS **A**utomatic **B**ot **S**ystem (MABS), welches zur Vereinfachung und Beschleunigung der Messserien entwickelt wurde. Dieses überwacht und koordiniert als primäre Aufgabe die Datenaufnahme und Chipprogrammierung jeder einzelnen Messung. Weiterhin wurden Schnittstellen entwickelt für z.B. eine Temperaturüberwachung oder die Einbindung externer Laborgeräte. Zusätzlich erstellt das System eine umfangreiche Dokumentation aller Parameter und verfügt über Schnittstellen zum Onlinemonitoring über Webbrowser und mobiler Endgeräte.

*gefördert durch HGS-HIRe, BMBF (05P12RFFC7), HIC for FAIR, EU-FP7 and GSI.

HK 46.65 Do 16:00 HZ Poster

Status of the TRIGA User Facility in Mainz — •Fabian Kories[1], Klaus Eberhardt[2], Gabriele Hampel[2], Werner Heil[1], Jan Peter Karch[1], Tobias Reich[2], Yury Sobolev[1], and Norbert Trautmann[2] — [1]Institut für Physik, Johannes Gutenberg Universität Mainz — [2]Institut für Kernchemie, Johannes Gutenberg Universität Mainz

Ultra-cold neutrons (UCN) offer unique opportunities for investigating the properties of the free neutron with exceptionally high precision such as the measurement of its lifetime.

At the pulsed TRIGA reactor in Mainz, a superthermal UCN source using solid deuterium as converter is operational and delivers up to 10 UCN/cm^3 in typical storage volumes of 10 l.

Within PRISMA Cluster of excellence, this source will be upgraded to a targeted strength of 100 UCN/cm^3 in order to transform TRIGA Mainz into a world-leading user facility for UCN research. Besides the installation of a He liquefier to sustain long-term experiments, the existing neutron guides have to be replaced by high-quality guides with low surface roughness which are internally coated with Ni-58 to increase the phase space for UCN transport.

The poster gives a status report on the activities at the UCN source at TRIGA Mainz.

HK 46.66 Do 16:00 HZ Poster

Kalibrierung und Effizienz eines Neutronendetektor-Arrays für (e,e'n) Experimente — •Maxim Singer, Anna Maria Krumbholz und Peter von Neumann-Cosel — Institut für Kernphysik, TU Darmstadt

Am supraleitenden Elektronenbeschleuniger S-DALINAC wurde ein Neutronendetektorball aufgebaut[1], welcher zur systematischen Untersuchung von Riesenresonanzen in koinzidenten Elektronenstreuexperimenten eingesetzt werden soll. Der Detektorball setzt sich aus 13 Flüssigszintillatordetektoren des Typs 5“× 2“ BC-501A zusammen und deckt einen Raumwinkel von ungefähr 1.3 π ab.

Für den experimentellen Einsatz des Detektorballs muss zunächst die Effizienz der Neutronendetektoren und die Nachweiswahrscheinlichkeit für Mehrneutronenereignisse sowie die Crosstalk-Eigenschaften des Gesamtaufbaus vermessen werden. Präsentiert werden die Ergebnisse der Effizienzbestimmung des Detektorballs anhand der Vermessung des Energiespektrums einer Cf-252-Quelle mit bekannter Neutronenmultiplizität, welche mit der Flugzeitmethode in einer Koinzidenzschaltung mit den Spaltfragmenten durchgeführt wird. Die Crosstalk-Eigenschaften, bestimmt aus einem Vergleich des gemessenen Cf-252-Energiespektrums mit dem in GEANT4 simulierten, werden gezeigt.

[1] M. Chernykh, Dissertation, D17, Technische Universität Darmstadt, (2008).

HK 46.67 Do 16:00 HZ Poster

Magnetic field mapping at the BGO-OD experiment — •Philipp Bielefeldt for the BGO-OD-Collaboration — Physikalisches Institut, Universität Bonn, Nussallee 12, D-53115 Bonn

The new BGO-OD experiment at the ELSA accelerator, Bonn, is built to systematically investigate meson photoproduction, with measures planned for associated strangeness, vector and pseudoscalar meson final states. A nearly 4π acceptance central BGO calorimeter is complemented by a tracking magnetic spectrometer in forward direction.

In order to optimise the spectrometer's resolution, a thorough understanding of the magnet's fringe fields is needed, obtained from both simulation and precision measurements. A short overview of simulation and measurement techniques as well as a comparison of their recent results will be given and the effect on BGO-OD's momentum reconstruction will be discussed.

HK 46.68 Do 16:00 HZ Poster

Study of the PANDA Barrel DIRC prototype timing resolution — •Marvin Krebs[1,2], Klaus Peters[1,2], Carsten Schwarz[1], and Jochen Schwiening[1] — [1]GSI Helmholtzzentrum fuer Schwerionenforschung GmbH, Darmstadt — [2]Goethe-Universität Frankfurt am Main

The PANDA experiment at the new Facility for Antiproton and Ion Research in Europe (FAIR) at GSI, Darmstadt, will study fundamental questions of hadron physics and QCD. A DIRC (Detection of Internally Reflected Cherenkov light) counter will provide hadronic particle identification (PID) in the barrel region of the PANDA detector. In order to meet the PID requirements the DIRC has to provide precise measurements of the Cherenkov angle and the propagation time of single photons. A barrel DIRC prototype was successfully tested with particle beams at CERN in 2012. A detailed study was performed after the beam time to understand the observed timing resolution and the contributions from the photon detectors, trigger system, and electronics. The prototype readout system, including the TRBs and the current generation of MCP-PMTs was studied using electronic pulsers and picosecond laser pulsers. We present measurements of the single photon timing resolution as a function of critical parameters like signal amplitudes, signal slopes and sensor occupancy. Work supported by EU FP7 grant, contract number 227431, HadronPhysics2, and the Helmholtz Graduate School for Hadron and Ion research HGS-HIRe

HK 46.69 Do 16:00 HZ Poster

Fluent Simulations for the Cryogenic Stopping Cell for the low energy branch at FAIR — •Frank Morherr for the FRS Ion Catcher-Collaboration — JLU Giessen

A cryogenic stopping cell (CSC) has been developed for the low-energy branch of the Super-FRS at FAIR, GSI, Germany. The stopping cell technique is based on the stopping of in-flight separated high energetic ions in a noble gas, Helium in our case. The system design is based on the Super-FRS beam properties. By SIMION simulations the flow of the Ions in the DC-field along the stopping cell length and the ion trajectories along the DC-field of the CSC and the behavior of the RF carpet have been simulated using SIMION code in our group. Until now simulations of the gas flow are missed. Especially the design of the nozzle, where the Ions leave the stopping cell has not been investigated in detail. In the current design a straight extraction nozzle is used. With a laval-nozzle there exists a convergent solution. The goal is, to design an extraction nozzle such, that the gas flow through the nozzle becomes stable for high densities to lead the Ions. So they can be catch by the extraction RFQs. For low densities far away the gas must escape sideward so it is possible to pump it away. The gas dynamics at the extraction nozzle have been simulated using ASNYS Fluent Calculations, they will be combined with ion optics simulations, first results will be presented and allow understanding the behavior of the ions.

HK 46.70 Do 16:00 HZ Poster

Layout of the Micro Vertex Detector for CBM* — •Tobias Tischler, Samir Amar-Youcef, Michael Deveaux, Michal Koziel, Christian Müntz, and Joachim Stroth for the CBM-MVD-Collaboration — Goethe Universität, Frankfurt

For the reconstruction of open charm hadrons with the CBM experiment, a Micro Vertex Detector (MVD) with an excellent resolution of the secondary decay vertex (< 70 μm along the beam axis) is required. To achieve this vertex resolution a material budget of a few 0.1% X_0 is mandatory for the individual detector stations positioned downstream in close vicinity to the target. To further reduce the multiple scattering the MVD operates in moderate vacuum.

In this contribution, we will present the planned layout of the MVD, guided by constraints regarding the acceptance of CBM, space limitations as well as technical aspects of module production. The layout employs the actual geometry of the Monolithic Active Pixel Sensors to be used in the MVD, as well as advanced sensor support materi-

als , heat sinks and further supporting structures. The resulting CAD layout was then converted to the corresponding Geant geometry and implemented into the CBM simulation package (CbmRoot). A dedicated software code was used to estimate a material budget in the case of a SIS−100 setup. The results will be presented and discussed.

*supported by HIC for FAIR, GSI , BMBF (05P12RFFC7), EU-FP7 HadronPhysics3

HK 46.71 Do 16:00 HZ Poster

Nicht-ionisierende Strahlenhärte eines hochohmigen CMOS Monolithic Active Pixel Sensors mit bis zu $80\mu m$ Pixelgröße* — •Stefan Strohauer für die CBM-MVD-Kollaboration — Goethe-Universität, Frankfurt

Zur Verbesserung der Strahlenhärte von monolithischen CMOS-Pixelsensoren (MAPS) arbeiten das IKF Frankfurts und das IPHC Straßburgs an einem Forschungs- und Entwicklungsprojekt, um diese Sensoren im Mikrovertex-Detektor des zukünftigen CBM-Experimentes einzusetzen. Weiterhin sollen sie im Heay-Flavour-Tracker von STAR, im ITS-Upgrade von ALICE, wie auch im ILC eingesetzt werden. Durch die Verwendung eines hochohmigen aktiven Volumens von $1k\Omega cm$ konnte die Strahlenhärte für nicht-ionisierende Strahlung vergrößert werden.

Die Pixelgröße wurde bisher zum Erreichen der nicht-ionisierenden Strahlenhärte minimiert. Allerdings wird die geforderte sekundäre Vertexauflösung von $50\mu m$ auch mit größeren Pixeln erreicht. Auf Grund der verbesserten Strahlenhärte hochohmiger Sensoren kann es sinnvoll sein, die Pixelgröße nun wieder anzuheben, denn dadurch kann die Integrationszeit und die Leistungsaufnahme von MAPS verringert werden.

Hierdurch motiviert wurde die Strahlenhärte des hochohmigen Sensors MIMOSA-29 mit einer Pixelgröße von bis zu $80\mu m$ studiert. Neben der Pixelgröße wurden verschiedene Pixelgeometrien mit unterschiedlicher Diodenzahl pro Pixel untersucht.

*gefördert durch das BMBF (05P12RFFC7), HIC for FAIR und GSI.

HK 46.72 Do 16:00 HZ Poster

Hardware upgrade for A2 data acquisition — Michael Ostrick, Wolfgang Gradl, Peter-Bernd Otte, Andreas Neiser, Oliver Steffen, •Martin Wolfes, and Tito Körner for the A2-Collaboration — Institut für Kernphysik, Mainz, Deutschland

The A2 Collaboration uses an energy tagged photon beam which is produced via bremsstrahlung off the MAMI electron beam. The detector system consists of Crystal Ball and TAPS and covers almost the whole solid angle. A frozen-spin polarized target allows to perform high precision measurements of polarization observables in meson photo-production.

During the last summer, a major upgrade of the data acquisition system was performed, both on the hardware and the software side. The goal of this upgrade was increased reliability of the system and an improvement in the data rate to disk. By doubling the number of readout CPUs and employing special VME crates with a split backplane, the number of bus accesses per readout cycle and crate was cut by a factor of two, giving almost a factor of two gain in the readout rate.

In the course of the upgrade, we also switched most of the detector control system to using the distributed control system EPICS. For the upgraded control system, some new tools were developed to make full use of the capabilities of this decentralised slow control and monitoring system.

The poster will present some of the major contributions to this project.

HK 46.73 Do 16:00 HZ Poster

Development of a time projection chamber for Crystal Ball at MAMI — •Oliver Steffen, Martin Wolfes, and Wolfgang Gradl for the A2-Collaboration — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz

The Crystal Ball Collaboration uses energy tagged bremstrahlung photons produced from the MAMI electron beam to study photo-induced reactions on nucleons and nuclei. The Crystal Ball/TAPS 4π calorimeter setup is optimized for the detection of neutral final states. Charged particles are identified and measured by the inner detector system including a two layer MWPC. The increased rate of charged particles in current and future experiments exceeds the rate capability of these MWPCs.

We are developing a small Time Projection Chamber with triple GEM readout meeting the stringent space requirements of the Crystal Ball experiment. This new tracking detector will feature higher rate capabilities and allows better track reconstruction. We are investigating the use of Carbon Fiber Reinforced Plastics (CFRP) to build light but strong chamber walls. First tests with carbon fiber prepregs show promising results. In addition we are using the PLUTO event generator to study the detector acceptance under our experiment conditions. Similar simulations are done to optimize the number and the shape of the readout pads.

This poster will give an overview of the current status of the project and present the latest results.

HK 46.74 Do 16:00 HZ Poster

Development of a cooling system and vacuum chamber for the pion tracker for HADES — •Tobias Schmitt for the HADES-Collaboration — TU München, James-Franck-Straße, D-85748 Garching

One of the future experiments planned at SIS18 with the HADES spectrometer in GSI Darmstadt envisages the employment of a pion beam colliding on a LH2 or a nuclear target. Due to the fact that the secondary pion beam has a high momentum spread, the momentum for each induvidual pion has to be measured for the planned exclusive measurements.

For this purpose our group develops a pion tracking system, consisting of two double sided striped silicon detectors. Both will be located at different positions in the beamline in front of the HADES experiment, therefore they have to deal with high particle rates. Considering the detection of pions (MIPs), the noise of the detectors has to have a very small level. This can be achieved by cooling.

For now the final version of the detector chamber and cooling system has been built and is currently tested. The proposed poster will show the current status and performance of the cooling system for the silicon detector, focusing on the reduction of the leakage current and the noise.

This work is supported by the Excellence Cluster Universe.

HK 46.75 Do 16:00 HZ Poster

Design of a Beam Position Sensitive Cavity as a Schottky Noise Detector for Mass Measurements in CR@FAIR — •Xiangcheng Chen[1], Shahab Sanjari[2,1], Peter Hülsmann[1], Yuri Litvinov[1,3], Fritz Nolden[1], Jeremi Piotrowski[4], and Markus Steck[1] — [1]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany — [2]ExtreMe Matter Institute, Darmstadt, Germany — [3]Max-Planck-Institut für Kernphysik, Heidelberg, Germany — [4]AGH University of Science and Technology, Krakow, Poland

Mass is one of fundamental characteristics of a nucleus. It plays an important role in many areas of physics, as well as other science branches. Especially in nuclear astrophysics, the masses of unstable nuclei close to nucleon drip lines are of great interests, since they are indispensable quantities for modelling nucleosynthesis processes in stellar objects. The Facility for Antiproton and Ion Research (FAIR), by providing high-intensity high-energy secondary beams, will enable unprecedented opportunities to investigate such nuclei. In particular, the collector ring (CR) is designed to be operated in the isochronous ion-optical mode as a high precision mass spectrometer. In order to satisfy the stringent requirements on accuracy and sensitivity for the future mass measurements, a non-destructive detector that is sensitive to single ions is being developed. Owing to the position sensitivity, it will be possible to correct for errors originating from different orbit lengths. In this work, we present simulation results of several possible designs of a cavity-based detector and discuss their potential applications as Schottky-noise detectors.

HK 46.76 Do 16:00 HZ Poster

Data quality assessment for the ALICE Photon Spectrometer PHOS — •Dominik Herzig for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

The ALICE experiment is designed to study the properties of strongly interacting matter at high energy densities with high precision.

The ALICE PHOS detector is a high resolution electromagnetic calorimeter to measure the position and energy of photons produced in heavy ion collisions. The PHOS consists of 17920 lead-tungstate crystal towers organized in 5 modules.

A vital part of the analysis of the PHOS data is the evaluation of bad towers. Miscalibrated or malfunctioning towers need to be excluded before further data analysis can start.

We present a data driven approach to bad tower identification. Observables such as the average hit energy or the average hit number per

cell are used in this approach. The results are compared to alternative methods of bad channel QA already used for the PHOS analysis.
Supported by BMBF and the Helmholtz Association.

HK 46.77 Do 16:00 HZ Poster

CoTEx - Coil tests for the neutron lifetime experiment PENeLOPE — •Dominic Gaisbauer for the PENeLOPE-Collaboration — Technische Universität München, Physikdepartment E18

PENeLOPE is an experiment with ultra-cold neutrons (UCN) for determining their lifetime in a magneto-gravitational trap with special designed superconducting coils developed at Technische Universität München. It is designed to have a precision of up to 'pm 0.1s. Due to their unique characteristics all coils for the trap have to be trained and tested in a preliminary experiment called CoTEx before they can be inserted into PENeLOPE. The poster will highlight the results of the first welded coil stack delivered in December 2013. A short overview of CoTEx in general and the slow control and quench detection of CoTEx will also be presented.

This project is supported by the Deutsche Forschungsgemeinschaft, the Maier-Leibnitz-Laboratorium Garching and the Cluster of Excellence "Origin and Structure of the Universe".

HK 46.78 Do 16:00 HZ Poster

Simplified Object Oriented Data Analysis at the BGO-OD Experiment — •Oliver Freyermuth for the BGO-OD-Collaboration — Physikalisches Institut, Nussallee 12, D-53115 Bonn

The ROOT-based analysis framework ExPlORA is used at the BGO-OD Experiment at the electron accelerator ELSA at Bonn university. Its modular structure allows to simplify the application of cuts to experimental data and the visualization of results. A set of generic plugins and tools to allow for both quick and thorough analyses and postprocessing of the output has been developed. It integrates with the XML-based configuration of ExPlORA and can be used without knowledge of the internals of the framework. Care has been taken to achieve the execution speed of compiled code without the requirement of extensive programming knowledge.
This work is supported by the DFG (SFB/TR-16).

HK 46.79 Do 16:00 HZ Poster

A Web 2.0 Approach to DAQ Monitoring and Controlling — •Manuel Penschuck for the TRB3-Collaboration — Goethe-Universität, Frankfurt

In the scope of experimental set-ups for the upcoming FAIR experiments, a FPGA-based general purpose trigger and read-out board (TRB3) has been developed which is already in use in several detector set-ups (e.g. HADES, CBM-MVD, PANDA). For on- and off-board communication between the DAQ's subsystems, TrbNet, a specialised high-speed, low-latency network protocol developed for the DAQ system of the HADES detector, is used. Communication with any computer infrastructure is provided by Gigabit Ethernet.

Monitoring and configuration of all DAQ systems and front-end electronics is consistently managed by the powerful slow-control features of TrbNet and supported by a flexible and mature software tool-chain, designed to meet the diverse requirements during development, setup phase and experiment. Most building blocks offer a graphical-user-interface (GUI) implemented using omnipresent web 2.0 technologies, which enable rapid prototyping, network transparent access and impose minimal software dependencies on the client's machine.

This contribution will present the GUI-related features and infrastructure highlighting the multiple interfaces from the DAQ's slow-control to the client's web-browser.

* supported by BMBF (05P12RFFC7), BMBF (05P12RFGHJ), HIC for FAIR, and GSI.

HK 46.80 Do 16:00 HZ Poster

Commissioning of a pulsed UV photoelectron source at the KATRIN main spectrometer — Jan Behrens[1], Stefan Groh[2], •Volker Hannen[1], Raphael Jöhren[1], Lorenz Josten[1], Nicholas Steinbrink[1], Christian Weinheimer[1], Daniel Winzen[1], Michael Zacher[1], and Miroslav Zbořil[1] for the KATRIN-Collaboration — [1]Westfälische Wilhelms-Universität, Institut für Kernphysik, Münster, Germany — [2]Karlsruher Institut für Technologie, KIT Zentrum für Elementarteilchen- und Astrophysik, Karlsruhe, Germany

The KATRIN experiment aims to measure the electron neutrino mass with a sensitivity of < 0.2 eV at 90% confidence level. The measurement is accomplished by scanning the endpoint of the tritium β-spectrum with an electrostatic spectrometer, based on the MAC-E-Filter (magnetic adiabatic collimation with an electrostatic filter). For the calibration of the spectrometer a mono-energetic, angular selective UV photoelectron source had been developed and constructed in Münster (see K. Hugenberg, Prog. Part. Nucl. Phys. **64** (2010) 288). This electron source has been used in the successful commissioning of the main spectrometer and detector system in summer 2013. The poster will present the characteristics of the electron source determined during the spectrometer measurements.
This work is supported by BMBF under 05A11PM2.

HK 46.81 Do 16:00 HZ Poster

CALIFA at R3B: Development of Quality Assurance system for APD — •Han-Bum Rhee, Alexander Ignatov, Stoyanka Ilieva, Thorsten Kröll, and Mirko von Schmid for the R3B-Collaboration — Technische Universität, Darmstadt, Germany

CALIFA is a calorimeter and spectrometer that aims to detect gamma-rays and light charged particles. It is a part of the R^3B experiment at the future FAIR facility. The CALIFA barrel consists of CsI(Tl) scintillating crystals, which are individually read out with Avalanche Photodiodes. While APDs are insensitive to magnet fields, its gain depends with temperature and voltage. Therefore, we have developed and built the quality assurance testing system for double APDs. In order to control the temperature, we made a water circulation system. We use a light signal from a pulsed LED,which is distributed to the active area of the APDs, to measure the gain variation of APD. In this presentation, we explain the concept of the QA testing system and report the results of the QA test.

This work is supported by BMBF(06DA9040I,05P12RDFN8) and HIC for FAIR.

HK 46.82 Do 16:00 HZ Poster

Radiation hardness studies of epitaxial diodes for the PANDA Micro-Vertex-Detector — •Tommaso Quagli[1], Kai-Thomas Brinkmann[1], Daniela Calvo[2], and Robert Schnell[1] for the PANDA-Collaboration — [1]II. Physikalisches Institut, Justus-Liebig-Universität Gießen, Gießen, Germany — [2]INFN, Sezione di Torino, Torino, Italy

PANDA is a key experiment of the future FAIR facility, under construction in Darmstadt, Germany. It will study the collisions between an antiproton beam and a fixed proton or nuclear target. The Micro Vertex Detector (MVD) is its innermost detector and is composed of four concentric barrels and six forward disks, instrumented with silicon hybrid pixel and double-sided microstrip detectors. It serves the identification of primary and secondary vertices. The main requirements include high spatial and time resolution, trigger-less readout with high rate capability, good radiation tolerance and low material budget.

In order to investigate the radiation hardness of the silicon pixel sensors, irradiation studies were performed on diodes using a proton beam at the Bonn Isochronous Cyclotron. The diodes featured an epitaxial layer grown on a Czochralski substrate; the thicknesses of the epitaxial layers were 100 μm and 150 μm, respectively. Additionally, some of the samples were treated with an oxygenation process.

The study was performed with two different fluences, comparing the I-V and C-V curves of the non-irradiated diodes with the ones obtained immediately after the irradiation and after an annealing phase.

Supported by BMBF, HGS-HIRe, INFN and JCHP.

HK 46.83 Do 16:00 HZ Poster

Performance Tests of novel Scintillator Materials and Readout devices for the CALIFA@R^{3}B — •Christian Sürder, Guillermo Fernández Martinez, Ilja Homm, Alexander Ignatov, Tania Ilieva, Thorsten Kröll, Han-Bum Rhee, and Mirko von Schmid — Institut für Kernphysik, Technische Universität Darmstadt, Germany

CALIFA (**CAL**orimeter for the **I**n **F**light detection of γ-rays and light charged p**A**rticles) is part of the R^3B project. It will be realized at FAIR (**F**acility for **A**ntiproton and **I**on **R**esearch), which is built at the GSI Helmholtzzentrum für Schwerionenforschung GmbH. The CALIFA consists of the Barrel part, covering central angles and the End-Cap part for the forward angles. The requirement to detect high energy gamma rays with good efficiency and the presence of a magnetic field lead to numerous implications on the detector technology. In this work we investigate the possibility to use novel scintillating materials, namely $LaBr_3$:(Ce) and $CeBr_3$ with APDs (**A**valanche **P**hoto **D**iode) and SiPM (**Si**licon **P**hoto**M**ultiplier) readout.
This work is supported by BMBT (06DA9040I, 05P12RDFN8) and

HIC for FAIR.

HK 46.84 Do 16:00 HZ Poster

High-Voltage Picoamperemeter — •Andrea Bugl[1], Markus Ball[1], Michael Böhmer[1], Sverre Dörheim[1], Andreas Hönle[1], Igor Konorov[1], and Bernhard Ketzer[1,2] — [1]Technische Universität München, Garching — [2]Helmholtz-Institut für Strahlen- und Kernphysik, Bonn

Current measurements in the nano- and picoampere region on high voltage are an important tool to understand charge transfer processes in micropattern gas detectors like the Gas Electron Multiplier (GEM). They are currently used to e.g. optimize the field configuration in a multi-GEM stack to be used in the ALICE TPC after the upgrade of the experiment during the 2nd long shutdown of the LHC.

Devices which allow measurements down to 1pA at high voltage up to 6kV have been developed at TU München. They are based on analog current measurements via the voltage drop over a switchable shunt. A microcontroller collects 128 digital ADC values and calculates their mean and standard deviation. This information is sent with a wireless transmitting unit to a computer and stored in a root file. A nearly unlimited number of devices can be operated simultaneously and read out by a single receiver. The results can also be displayed on a LCD directly at the device. Battery operation and the wireless readout are important to protect the user from any contact to high voltage.

The principle of the device will be explained and systematic studies of their properties will be shown.

Supported by the DFG Cluster of Excellence "Universe" and the EU 7th framework program.

HK 46.85 Do 16:00 HZ Poster

Construction of the XENON1T purification system and slow control — •Sergej Schneider, Ethan Brown, Christian Huhmann, Stephan Rosendahl, and Christian Weinheimer — Institut für Kernphysik, Universität Münster

A fundamental and still unanswered question in astrophysics is the nature of dark matter. A promising approach for a direct detection of a Weakly Interacting Massive Particle (WIMP) is the search for a recoil signal in a dual phase xenon time projection chamber. The XENON Dark Matter Project is currently upscaling from 62 kg detector to the ton scale detector XENON1T to reach sensitivity for a 100 GeV/c^2 particle with a cross section of $\sigma = 2 \cdot 10^{47}\mathrm{cm}^2$. When aiming at such a high sensitivity it is crucial to provide extremely pure xenon as detector material in order to allow for a high light and charge collection. These signals are attenuated by trace electronegative impurities.

Electronegative impurities are being removed in the purification system of XENON1T by constantly circulating the xenon gas through a high temperature getter. This system is monitored and controlled by a slow control system in order to acquire data, send out alarms in case of dysfunctions and allow to operate relevant devices from a control panel. The construction of the XENON1T purification system and implementation of the slow control will be presented. This work is funded by BMBF.

HK 46.86 Do 16:00 HZ Poster

Characterization of a transverse electron target for storage rings — •Sabrina Geyer[1], Oliver Meusel[1], and Oliver Kester[1,2] — [1]Goethe Universität, Frankfurt, Germany — [2]GSI, Darmstadt, Germany

For the investigation of electron-ion interaction processes at storage rings a transverse electron target has been developed. A sheet beam of free electrons is focused by electrostatic fields through a defined interaction region. Its open geometry is suited to electron and photon spectroscopy. The adjustable electron energy ranges between several tens eV and a few keV. The target is dedicated to the storage rings of the Facility for Antiproton and Ion Research (FAIR).

Simulations regarding the energy resolution and the optical behaviour have been performed. The target is currently under characterization at a test bench. First experimental results will be presented.

HK 46.87 Do 16:00 HZ Poster

Quality assessment of ultra-thin CMOS sensors for the micro vertex detector of the CBM experiment at FAIR. — •Michal Koziel, Norbert Bialas, and Borislaw Milanovic for the CBM-MVD-Collaboration — University of Frankfurt, Germany.

The Compressed Baryonic Matter experiment installed at the future FAIR facility will be equipped with a high-precision micro-vertex detector aiming at an outstanding primary and secondary vertex resolution. Highly granular, ultra-low material budget sensors, so-called Monolithic Active Pixel Sensors,, manufactured at standard CMOS process, will be employed. Imperfections in CMOS process as well as further dicing and thinning procedures affect the yield of sensors to be mounted in the detector stations. To select sensors with the best characteristics, probe testing prior to integration is mandatory. However, handling and testing of 50-um thin CMOS pixel sensors is non-standard . This contribution will present the dedicated tools and procedures, focusing on the question whether such thin devices can be efficiently and reliably probe-tested.

*supported by HIC for FAIR, GSI , BMBF (05P12RFFC7), EU-FP7 HadronPhysics3

HK 46.88 Do 16:00 HZ Poster

A New Avalanche Photo Diode Readout for the Crystal Barrel Calorimeter — •Peter Klassen for the CBELSA/TAPS-Collaboration — Helmholtz-Institut für Strahlen- und Kernphysik, Nussallee 14-16, 53115 Bonn, Germany

The CBELSA/TAPS experiment at ELSA measures double polarisation observables in meson photoproduction off protons and neutrons. To be able to measure purely neutral reactions on a polarized neutron target with high efficiency, the main calorimeter has to be integrated into the first level trigger. This requires to exchange the existing PIN photo diode by a new avalanche photo diode (APD) readout.

The newly developed readout electronics will provide an energy resolution compatible to the previous set-up and a fast trigger signal down to 10 MeV energy deposit per crystal. After the successful final tests with a 3x3 CsI crystal matrix in Bonn at ELSA and in Mainz at MAMI all front-end electronics were produced in fall 2013. Automated test routines for the front-end electronics were developed and the characterisation measurement of all APDs was successfully accomplished in Bonn. At the end of January 2014 the first half of the Crystal Barrel will be disassembled and the installation of the new APD readout will start. This poster presents the performance of the final front-end set-up, the progress of the ongoing APD installation and the current state of the back-end electronics development.

Supported by the Deutsche Forschungsgemeischaft (SFB/TR16) and Schweizerischer Nationalfonds.

HK 46.89 Do 16:00 HZ Poster

Die $\bar{\mathrm{P}}$ANDA-Vorwärtsendkappe: Simulationen und deren Vergleich mit Prototyptestmessungen — •Christian Hammann, Matthias Kube, Claudia Lütz, Philipp Mahlberg, Merlin Rossbach, Christoph Schmidt, Ulrike Thoma, Georg Urff und Christoph Wendel für die PANDA-Kollaboration — HISKP, Universität Bonn, Deutschland

Eine wichtige Detektorkomponente des $\bar{\mathrm{P}}$ANDA Experimentes an FAIR ist das elektromagnetische Kalorimeter (EMC). Das EMC des Targetspektrometers wird aus ca. 15500 Bleiwolframat-Kristallen bestehen, die bei -25°C betrieben werden. Die Kristalle sollen größtenteils mit jeweils zwei APDs ausgelesen werden. Im inneren Bereich der Vorwärtsendkappe sollen die Kristalle hingegen, aufgrund dort zu erwartenden hohen Raten, mit VPTTs bestückt werden.

Zum besseren Verständnis dieses Detektors existiert eine Geant4 basierte Simulation. Mit deren Hilfe können charakteristische Eigenschaften der Vorwärtsendkappe, wie deren Energie- und Ortsauflösung, untersucht werden. Um die Simulation der Vorwärtsendkappe zu überprüfen, wurden am SPS-Beschleuniger am CERN Testmessungen an einem Prototypen mit Elektronen in einem Energiebereich von 5 bis 15 GeV durchgeführt. Die Bedingungen der Teststrahlzeit wurden in der Simulation nachgebildet. Dies gilt insbesondere für das Strahlprofil und die Ausrichtung des Detektors relativ zum Elektronenstrahl.

In diesem Beitrag wird der Vergleich der Simulation mit den Testmessungen diskutiert.

Gefördert durch das BMBF(FKZ: 05P12PDFP5).

HK 46.90 Do 16:00 HZ Poster

Ein digitales Echtzeit-Trigger-System für den CALIFA Detektor — •Philipp Klenze, Michael Bendel, Roman Gernhäuser, Benjamin Heiss, Walter Henning, Reiner Krücken, Tudi Le Bleis, Patrick Remmels und Max Winkel für die R3B-Kollaboration — Physik Department E12, Technische Universität München

Das CALIFA Kalorimeter mit seinen etwa 3000 Szintillationskristallen ist eine der wesentlichen Komponenten des R^3B- Spektrometers. Eine besondere Herausforderung ist hier die schnelle Generierung von komplexen Trigger-Entscheidungen für das gesamte Detektorsystem

in Echtzeit. Detektorweite Energiesummen oder Multiplizitäten stellen ebenso wie die besondere Behandlung bestimmter Triggermuster ein wesentliches Werkzeug zur präzisen Vorauswahl von relevanten Ereignissen dar.

Um die dazu notwendigen Informationen innerhalb von $1-2\mu$s sammeln und verarbeiten zu können, wird ein neuartiger, asynchroner, digitaler Summierer-Baum auf Basis von verzögerungsarmen CPLDs und FPGAs entwickelt. Um die bereits vorhandene Infrastruktur zur Steuerung und Auslese nutzen zu können, wird dies mit kompakten Addon-Boards in die bestehende Ausleseelektronik integriert.

HK 46.91 Do 16:00 HZ Poster

Characterization of the PANDA MVD Trapezoidal Silicon Strip Sensors and the Development of their Readout System — •Dariusch Deermann, Tobias Stockmanns, and James Ritman for the PANDA-Collaboration — Forschungszentrum Jülich GmbH

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

In order to operate and test the first trapezoidal strip sensor prototypes of the MVD, they are chracterized with a probestation as well as with a dedicated testboard. Furthermore, the existing Juelich Digital Readout System has to be modified for the trapezoidal sesors.

In this poster the adaption of the Juelich Digital Readout System for the trapezoidal silicon strip sensors as well as their characterization will be presented.

HK 47: Hadronenstruktur und -spektroskopie

Zeit: Donnerstag 16:30–19:00 Raum: HZ 1+2

Gruppenbericht HK 47.1 Do 16:30 HZ 1+2

XYZ physics at BESIII experiment — •Zhiqing Liu — Johannes Gutenberg University of Mainz, Johann-Joachim-Becher-Weg 45, D-55099 Mainz, Germany

Searching for exotic particles (XYZ particles) with quark content different from conventional baryons and mesons are of high interest in particle physics. Using the large data samples collected above 4 GeV, the BESIII experiment was able to study the XYZ particles in an improve precision. Recently, BESIII has discovered the charged charmoniumlike states $Z_c(3900)$, $Z_c(4020)/Z_c(4025)$, which is obviously good candidates for four quark state. In addition, BESIII also observed the X(3872) particle in Y(4260) radiative transition and $Z_c(3900)$ in DD^* decay channel, which would help us understand their nature in a more deeper way. In this talk, I'll review all the recent results at the BESIII experiment, together with our future plan toward the study of XYZ physics.

Gruppenbericht HK 47.2 Do 17:00 HZ 1+2

Hadron Spectroscopy with COMPASS — •Florian Haas[1] and COMPASS Collaboration[2] — [1]Physik Department E18 TU München — [2]CERN

COMPASS is a multi-purpose fixed-target experiment at the CERN Super Proton Synchrotron aimed at studying the structure and spectrum of hadrons. One goal is the search for new hadronic states, in particular hybrid mesons and glueballs. Its large acceptance, high resolution, and high-rate capability make the COMPASS experiment an excellent device to study the spectrum of light-quark mesons in diffractive and central production up to masses of about $2.5\,\mathrm{GeV}/c^2$. COMPASS is able to measure final states with charged and neutral particles, so that resonances can be studied in different reactions and decay channels. During 2008 and 2009, COMPASS took a large data sample using 190 GeV negative and positive hadron beams on various targets. We present new results from the analyses of this data set. One focus lies on the search for new mesons in diffractively produced multi-particle final states. Novel analysis methods are applied to study the dependence of partial waves on the squared four-momentum transfer t' from the beam to the target. This leads to a better separation of resonant and non-resonant contributions. In addition a new analysis scheme was developed that permits to extract information about the $\pi^+\pi^-$ subsystem in the $\pi^-\pi^+\pi^-$ final state with only minimal model bias. Finally central-production reactions are studied in order to search for glueball candidates in the scalar sector. Supported by BMBF, MLL and the Cluster of Excellence Exc153 "Origin and Structure of the Universe"

HK 47.3 Do 17:30 HZ 1+2

Electronic width of X(3872) — Achim Denig, Zhiqing Liu, and •Martin Ripka — KPH Uni Mainz

The structure and origin of the exotic X(3872) resonance, is still a subject of investigations. Recently it was also observed at BESIII. The X(3872) is a candidate for a Tetraquark, a Meson molecule or various other models. A precise measurement of its electronic width can help to support or disfavor some of the theoretical models. Although it is not a vector resonance, we found methods to study the structure of X(3872) with ISR methods at the BESIII experiment in Beijing/China. In this talk we present preliminary results of a new measurement of the upper limit of the electronic width of X(3872).

HK 47.4 Do 17:45 HZ 1+2

Lattice investigation of tetraquark candidates — •Joshua Berlin[1], Abdou Abdel-Rehim[2], Constantia Alexandrou[2], Mattia Dalla Brida[3], Mario Gravina[2], Giannis Koutsou[2], and Marc Wagner[1] — [1]Goethe-Universität Frankfurt am Main, Institut für Theoretische Physik, Max-von-Laue-Straße 1, D-60438 Frankfurt am Main, Germany — [2]Department of Physics, University of Cyprus, P.O. Box 20537, 1678 Nicosia, Cyprus Computation-based Science and Technology Research Center, Cyprus Institute, 20 Kavafi Street, Nicosia 2121, Cyprus — [3]School of Mathematics, Trinity College Dublin, Dublin 2, Ireland

We present the status of an ongoing long-term lattice QCD project concerned with the study of light and heavy tetraquark candidates, using a variety of different creation operators. The computation of disconnected diagrams, which is technically challenging, is discussed in detail.

HK 47.5 Do 18:00 HZ 1+2

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

COMPASS is a fixed-target experiment at the CERN SPS which focused on light-quark hadron spectroscopy during the data taking periods in 2008 and 2009. A world-leading data set was collected with a $190\,\mathrm{GeV}/c$ hadron beam impinging on a liquid hydrogen target in order to study, inter alia, the central exclusive production of glueball candidates in the light-meson sector. Especially the double-Pomeron exchange mechanism ought to be well suited for the production of mesons without valence quark content. We select centrally produced systems with two pseudo-scalar mesons in the final state from the COMPASS data set recorded with an incoming proton. The decay of this system is decomposed in terms of partial waves, where particular attention is paid to the inherent mathematical ambiguities of the amplitude analysis. Furthermore, we discuss possible parametrisations that are able to describe the mass dependence of the partial-wave analysis results of $\pi\pi$ and $K\bar{K}$ final states.

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

HK 47.6 Do 18:15 HZ 1+2

Hunting for $\mathbf{K^{*+}(892)}$ in 3.5 GeV pp and pNb reactions — •Dimitar Mihaylov for the HADES-Collaboration — Excellence Cluster "Universe", Boltzmannstr. 2, 85748, Garching, Germany

The production of the kaon excitation $K^{*+}(892)$ has never been investigated for pp collisions at energies near to the production threshold. The HADES spectrometer provides the unique opportunity to investigate the production of the $K^{*+}(892)$ particle at kinetic beam energy of 3.5 GeV for both pp and pNb reactions. The analysis of the pp data

will provide information about the production cross section for pp collisions as well as a reference for the study of the pNb data and consequently, it will improve our knowledge about pn reactions, scattering reactions inside the nucleus, production of the $K^{*+}(892)$ excitation through secondary processes (e.g. $\pi N \to K^{*+}\Lambda$) etc.

In this analysis the $K^{*+}(892)$ particles are reconstructed by using the decay channel $K^{*+}(892) \to K^0_S\pi^+ \to \pi^+\pi^-\pi^+$. The statistics of the data is enough for a differential analysis. In order to apply acceptance and efficiency corrections to the pp data we have performed simulations of the two dominant production channels.

HK 47.7 Do 18:30 HZ 1+2

Phenomenology of a pseudoscalar glueball and charmed mesons in the extended linear sigma model — •Walaa I. Eshraim, Francesco Giacosa, and Dirk Rischke — J. W. Goethe University, Frankfurt am Main, Germany

In the framework of the so-called extended linear sigma model (eLSM), we include a pseudoscalar glueball with a mass of 2.6 GeV (as predicted by Lattice QCD simulations) and we compute the two- and three-body decays into scalar and pseudoscalar mesons. This study is relevant for the future PANDA experiment at the FAIR facility. As a second step, we extend the eLSM by including the charm quark according to the global $U(4)_r \times U(4)_l$ chiral symmetry. We compute the masses, weak decay constants and strong decay widths of open and hidden charmed mesons. The results are in good agreement with the experimental data.

HK 47.8 Do 18:45 HZ 1+2

Radiative corrections to charged pion-pair production — •Stefan Petschauer and Norbert Kaiser — Physik-Department, Technische Universität München, James-Franck-Straße 1, D-85747 Garching

We calculate the one-photon loop radiative corrections to the charged pion-pair production process $\pi^-\gamma \to \pi^+\pi^-\pi^-$. In the low-energy region this reaction is governed by the chiral pion-pion interaction. Electromagnetic counterterms are included in order to remove the ultraviolet divergences generated by the photon-loops. Infrared finiteness of the virtual radiative corrections is achieved by including soft photon radiation below an energy cut-off. The purely electromagnetic interaction of the charged pions mediated by one-photon exchange is also taken into account. We present radiative corrections to the total cross sections as well as to the mass spectra. One finds that the effects are of the order of a few percent.

This work has been supported in part by DFG and NSFC (CRC110).

HK 48: Struktur und Dynamik von Kernen

Zeit: Donnerstag 16:30–19:00 Raum: HZ 4

Gruppenbericht HK 48.1 Do 16:30 HZ 4

Hochauflösende Elektronenstreuung am S-DALINAC und Experimente zu Monopolmatrixelementen und gemischtsymmetrischen Zuständen * — •Andreas Krugmann, Simela Aslanidou, Sergej Bassauer, Jonny Birkhan, Michaela Hilcker, Alexander Hufnagel, Florian Hug, Frederic Kornas, Christoph Kremer, Peter von Neumann-Cosel, Norbert Pietralla und Gerhart Steinhilber — Institut für Kernphysik, TU Darmstadt

Im Herbst 2013 wurden hochauflösende Elektronenstreuexperimente am 169° Spektrometer des supraleitenden Elektronenlinearbeschleunigers S-DALINAC durchgeführt. Durch die erstmalige Nutzung von nichtisochroner Rezirkulierung des e^--Strahls und einer Dispersionsanpassung zwischen Strahl und Spektrometer, sowie der erfolgreichen Inbetriebnahme einer digitalen HF-Regelung konnten extrem stabile Strahlbedingungen für Hochenergieelektronenstreuexperimente geschaffen und Energieauflösungen von bis zu 22 keV (FWHM) bei 75 MeV erreicht werden. In diesem Gruppenvortrag werden sowohl die Modernisierungen des Detektorsystems erläutert als auch auf die vorläufigen Ergebnisse zur Bestimmung von Monopolmatrixelementen in den Kernen ^{150}Nd und ^{196}Pt eingegangen, die einen empfindlichen Test einer möglichen Realisierung der X(5) und O(6) Symmetrien des Modells wechselwirkender Bosonen in realen Kernen erlauben. Des weiteren werden experimentelle Formfaktoren zu symmetrischen und gemischtsymmetrischen 2^+ Zuständen in den Kernen ^{94}Zr und ^{96}Zr diskutiert.

* Gefördert von der DFG durch den SFB 634.

Gruppenbericht HK 48.2 Do 17:00 HZ 4

Measurements of (p,2p) and (p,pn) quasi-free knockout reactions in inverse kinematics — •Alina Movsesyan[1,2] and Valerii Panin[1,2] for the R3B-Collaboration — [1]IKP, TU Darmstadt, Deutschland — [2]GSI, Darmstadt, Deutschland

We will present results from benchmark experiments dedicated to investigations of nuclear structure with proton-induced quasi-free scattering (QFS) reactions in inverse kinematics at relativistic energies. Kinematically complete measurements were undertaken, making use of the ALADIN/LAND-R^{3}B setup at GSI Darmstadt, which allow for analysis of (p,2p) and (p,pn) reactions. Similar technique with an upgraded setup will be used for the future R^{3}B program at FAIR/GSI, for studies of the single-particle (SP) structure and the role of N-N correlations in very exotic nuclei. One-neutron and one-proton quasi-free knockout reactions on ^{12}C will be presented, followed by heavier, unstable ^{57}Ni nucleus. The QFS signature has been observed by angular correlations of the knocked out nucleon and recoiled target proton. Cross sections for knocking out a proton/neutron from corresponding SP states have been measured. In combination with a reaction theory, they provide information on the reduction of spectroscopic strength for these states. The deduced spectroscopic/reduction factors and the branching between proton knockout from p- and deeper lying s-shells from ^{12}C will be compared to results of (e,e'p), (p,2p) and (d,^{3}He) reactions. The results of ^{57}Ni will be compared to previous findings from knockout reactions on Be target. The work is supported by BMBF, GSI TU Darmstadt Cooperation Contract, HIC for FAIR and NAVI.

HK 48.3 Do 17:30 HZ 4

The Two-Proton Halo Nucleus ^{17}Ne Studied in High-Energy Nuclear Breakup Reactions — •Felix Wamers[1,2,3,4], Justyna Marganiec[3,1,4], Thomas Aumann[3,4], Carlos Bertulani[5], Leonid Chulkov[4,6], Michael Heil[4], Ralf Plag[4,7], Deniz Savran[1,2], and Haik Simon[4] for the R3B-Collaboration — [1]EMMI, GSI, Darmstadt, Germany — [2]FIAS, Frankfurt, Germany — [3]IKP, TU Darmstadt, Darmstadt, Germany — [4]GSI, Darmstadt, Germany — [5]Texas A&M University-Commerce, Commerce, USA — [6]NRC Kurchatov Institute, Moscow, Russian Federation — [7]Goethe Universität, Frankfurt, Germany

We report on exclusive measurements of nuclear breakup reactions of highly-energetic (500 MeV) unstable ^{17}Ne beams impinging on light targets in an experiment at the R^{3}B-LAND complete-kinematics reaction setup at GSI. Focusing on the properties of beam-like ^{15}O-p (= ^{16}F) systems produced in one-proton-removal reactions, we are presenting a comprehensive analysis of the s-/d-wave configuration mixing of the ^{17}Ne valence-proton pair that is used to quantify its halo-nature. The results include the ^{15}O-p relative-energy spectrum, ^{16}F momentum distributions, and their corresponding momentum profile.

This work was supported by the Alliance Program of the Helmholtz Association (HA216/EMMI), by NAVI, by the German Federal Ministry for Education and Research (BMBF) (project 05P12RDFN8), by HIC for FAIR, by Eurons (European Commission contract no. 506065), and by the GSI-TU Darmstadt cooperation.

HK 48.4 Do 17:45 HZ 4

Status of the MLLTRAP system [*] — •Christine Weber, Robert Meissner, Peter Müller, and Peter Thirolf — Fakultät für Physik, LMU - München, 85748 Garching

The MLLTRAP Penning trap system serves as a development environment, both for mass spectrometry as well as for decay spectroscopy experiments [1] at Europe's upcoming facilities for low-energy experiments with exotic isotopes. High-precision mass spectrometry in a Penning trap is carried out via a determination of a stored ion's cyclotron frequency. These experiments are planned at the future DESIR facility of SPIRAL2 in France [2].

A novel detector-trap system is presently being built for the realization of direct in-situ decay spectroscopy experiments of stored ions at MATS [3] at FAIR. This setup combines the high-resolution purification capabilities of a Penning trap with a customized detector-trap. It

serves for the ion storage as well as for the detection of the emitted decay products. In this way, novel types of nuclear decay spectroscopy experiments are becoming feasible, which are free from any background or scattering effects from a source material. This contribution gives an outline on the future perspectives of MLLTRAP and the present status of the development work.

[1] C.Weber et al., Int. J. of Mass Spectrometry 349-350, 270 (2013).
[2] B. Blank et al., Int. J. of Mass Spectrometry 349-350, 264 (2013).
[3] D. Rodriguez et al., Eur. Phys. J. Special Topics 183, 1 (2010).
[*] Supported by BMBF (06ML9148, 05P12WMFNE), DFG (HA 1101/14-1), and MLL.

HK 48.5 Do 18:00 HZ 4

Ab Initio Nuclear Structure and Reactions with Chiral Three-Body Forces — •Joachim Langhammer[1], Petr Navratil[2], Robert Roth[1], and Angelo Calci[1] — [1]Institut für Kernphysik - Theoriezentrum, TU Darmstadt — [2]TRIUMF, Vancouver, Canada

One major ambition of ab initio nuclear theory is the description of nuclear-structure and reaction observables on equal footing. This is accomplished by combining the no-core shell model (NCSM) with the resonating-group method (RGM) to a unified ab initio approach to bound and continuum states, which is developed further to the no-core shell model with continuum (NCSMC). We present the formal developments to include three-nucleon interactions in both the NCSM/RGM and NCSMC formalism. This provides the possibility to assess the predictive power of chiral two- and three-nucleon forces in the variety of scattering observables. We study three-nucleon force effects on phase-shifts, cross sections and analyzing powers in first ab-initio studies of nucleon-^{4}He scattering with chiral two- and three-nucleon forces. Finally, we focus on heavier target nuclei using the NCSMC, e.g., in neutron-^{8}Be scattering and study the impact of the continuum on the spectrum of ^{9}Be.

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

HK 48.6 Do 18:15 HZ 4

Perturbation Theory for Ab Initio Nuclear Structure? — •Alexander Tichai, Joachim Langhammer, and Robert Roth — Institut für Kernphysik, Technische Universität Darmstadt

Many-body perturbation theory provides a standard tool for the calculation of energies and observables. It turns out that convergence properties of perturbation series are very sensitive to the partitioning of the Hamiltonian in use. We choose Hartree-Fock (HF) basis functions as a starting point for a perturbative expansion. A recursive treatment enables us to investigate energy corrections up to order 30 for light nuclei. Furthermore we present third-order energy corrections to the correlation energy for closed-shell nuclei over the whole mass range up to ^{208}Pb. The HF basis leads to a perturbation series with better convergence properties compared to Harmonic Oscillator (HO) basis sets and obviates the use of resummation techniques.

We use a two- and three-body interaction constructed from chiral effective field theory transformed through similarity renormalization group techniques (SRG). We show consistency of our results to coupled-cluster calculations and give an outline of degenerate Hartree-Fock perturbation theory for open-shell nuclei and excited states.

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

HK 48.7 Do 18:30 HZ 4

Proton-induced knockout reactions with netron-rich Oxygen Isotopes at R^{3}B — •Leyla Atar for the R3B-Collaboration — IKP, TU Darmstadt — GSI

Proton-induced knockout reactions are one of the main goal of the experimental program at the future R^{3}B (Reactions with Relativistic Radioactive Bemas) Experiment at FAIR. It allows us to obtain spectroscopic information about valence and deeply bound single-nucleon states and to study their evolution over a large variation in isospin. Recent studies have shown that the occupancies of loosely bound valence nucleons in neutron- or proton-rich nuclei have a spectroscopic factor close to unity, whereas single-particle strength for deeply bound nucleons is suppressed in isospin asymmetric systems compared to the predictions of the many-body shell model. Further experimental and theoretical studies are needed for a qualitative and quantitative understanding. For this aim a series of measurements have been performed on the complete oxygen isotopic chain using the existing experimental setup LAND/R^{3}B at GSI. We will present the main scientific goals, the concepts of the experiment and the preliminary results.
This work is supported by BMBF project 06 DA 7047 I.

HK 48.8 Do 18:45 HZ 4

Search for beta-delayed protons from ^{11}Be — •Oliver Forstner for the IS541-Collaboration — VERA Laboratory, University of Vienna, Austria — Stefan-Meyer-Institut, Austrian Academy of Sciences, Vienna, Austria — CERN, Geneva, Switzerland

The one-neutron halo nucleus ^{11}Be can emit a proton in a beta decay of the halo neutron. However, due to the Q-value of this decay channel (280.7±0.3 keV) the expected branching ratio will be very low – most estimates are a few times 10^{-8} – and the detection of the outgoing proton with a kinetic energy of a few hundred keV is challenging. Therefore our attempt was to detect the remaining nucleus ^{10}Be with the help of accelerator mass spectrometry (AMS). AMS is a highly sensitive tool to detect radioisotopes at the ultra-trace level. A beam of ^{11}Be ions was produced at the ISOLDE facility at CERN and implanted in a collection sample. The sample was transferred to the VERA AMS facility at the University of Vienna where the ^{10}Be content was determined. In my talk I will present details of the experiment and results of the successful detection of this rare decay channel.

HK 49: Nukleare Astrophysik

Zeit: Donnerstag 16:30–18:30 Raum: HZ 5

Gruppenbericht HK 49.1 Do 16:30 HZ 5

Underground nuclear astrophysics in Europe: a status update — •Daniel Bemmerer — Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Dresden

The cross sections of nuclear reactions taking place in stars and in the Big Bang are generally so low that they can only be measured in the low-background environment of an underground accelerator. The talk will report about progress achieved in the past year at the world's only such machine, the LUNA 0.4 MV accelerator in Gran Sasso/Italy. The ^{2}H(α,γ)^{6}Li cross section has been measured for the first time directly in the Big Bang energy region, pinning down the amount of primordial ^{6}Li. Measurements of the ^{17}O(p,α)^{14}N and ^{22}Ne(p,γ)^{23}Na cross sections important for nucleosynthesis in an astrophysical nova are underway at LUNA, and preliminary data at unprecedented low energies are already available. An activation study of the ^{40}Ca(α,γ)^{44}Ti reaction using offline counting in the Felsenkeller underground laboratory in Dresden has yielded new and more precise resonance strengths. In order to apply the method of underground nuclear astrophysics to topics such as helium and carbon burning and the neutron sources for the astrophysical s-process, it is necessary to install a higher-energy accelerator underground. The status of the relevant new accelerator projects at Gran Sasso and at Felsenkeller will be reported. – Supported by DFG (BE 4100/2-1) and NAVI (HGF VH-VI-417).

HK 49.2 Do 17:00 HZ 5

(n,γ)-Wirkungsquerschnitte von ^{69,71}Ga und ^{63,65}Cu bei 25 und 90 keV — •Clemens Beinrucker[1], Michael Berger[1], Stefan Fiebiger[1], Micaela Fonseca[5], Tanja Heftrich[1], Franz Kaeppeler[4], Antonin Krasa[2], Claudia Lederer[1], Ralf Plag[1], Arjan Plompen[3], Rene Reifarth[1], Stefan Schmidt[1] und Kerstin Sonnabend[1] — [1]Goethe Universität, Frankfurt — [2]SCK-CEN, Mol — [3]Institute for Reference Materials and Measurements, Geel — [4]Karlsruhe Institute of Technology, Karlsruhe — [5]Centro de Fisica Nuclear da Universidade de Lisboa, Portugal

Etwa die Hälfte der beobachteten Isotopenhäufigkeit mit $A > 56$ wird im s-Prozess produziert. Die wichtigsten Reaktionen sind Neutroneneinfänge und β-Zerfälle. Zum besseren Verständnis des s-Prozesses sind die (n,γ)-Querschnitte bei stellaren Energien von Bedeutung.

Neutroneneinfangquerschnitte können u.a. in einem Aktivierungsexperiment bestimmt werden. Dabei werden die Photonen aus dem radioaktiven Zerfall einer durch Neutronenbestrahlung aktivierten Probe

mit Hilfe von hochreinen Germanium-Detektoren nachgewiesen. Der Neutronenfluss wird dabei relativ zu ^{197}Au(n,γ) gemessen.

Dieser Beitrag stellt Ergebnisse eines solchen Experiments mit Proben aus natürlichem Gallium und Kupfer vor. Dabei wurden Protonen von einem Van-de-Graaff-Generator beschleunigt, um mittels der ^{7}Li(p,n)-Reaktion ein der Boltzmannverteilung bei $kT = 25$ keV ähnliches Spektrum und eine breite Verteilung um 90 keV zu erhalten.

Dieses Projekt wurde durch EFNUDAT, ERINDA und das EuroGENESIS Projekt MASCHE unterstützt.

HK 49.3 Do 17:15 HZ 5

Gamma-ray width measurements in ^{15}N at the ELBE nuclear resonance fluorescence setup — •Tamás Szücs[1,2], Daniel Bemmerer[1], Ralph Massarczyk[1,3], Ronald Schwengner[1], Marcell Takács[1,3], and Louis Wagner[1,3] — [1]Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Dresden — [2]MTA ATOMKI, Debrecen/Hungary — [3]TU Dresden

The stable nucleus ^{15}N is the mirror of the astrophysically important ^{15}O, compound nucleus of the leading reaction of the Bethe-Weizsäcker cycle of hydrogen burning. Most of the ^{15}N level widths below the neutron and proton emission thresholds are known from just one nuclear resonance fluorescence (NRF) measurement published more than 30 years ago, with unsatisfactory precision on some cases [1]. A recent experiment with the AGATA demonstrator array aimed to determine level widths with the Doppler Shift Attenuation Method (DSAM) in ^{15}O and ^{15}N populated in ^{14}N + ^{2}H reaction. In order to set a benchmark value for the upcoming AGATA demonstrator data, the widths of several ^{15}N levels are being studied using the bremsstrahlung facility γELBE at the electron accelerator of Helmholtz-Zentrum Dresden-Rossendorf (HZDR). The γELBE experiment and its preliminary results will be presented. – Supported by the Helmholtz Association (HGF) through the Nuclear Astrophysics Virtual Institute (HGF VH-VI-417).

[1] R. Moreh et al., Physical Review C 23, 988 (1981)

HK 49.4 Do 17:30 HZ 5

Sensitivity studies for the p process — •Kathrin Göbel[1], Jan Glorius[1], Alexander Koloczek[1,2], Marco Pignatari[3], René Reifarth[1], René Schach[1], and Kerstin Sonnabend[1] for the NuGrid-Collaboration — [1]Goethe-Universität Frankfurt am Main — [2]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt — [3]Universität Basel

Sequences of photo dissociations and β-decays during explosive conditions produce most of the p nuclei between ^{74}Se and ^{196}Hg (γ process). Some of the light p nuclei, e.g. the neutron magic isotope ^{92}Mo, may also be synthesized by proton capture reactions, especially in thermonuclear supernovae.
Nucleosynthesis simulations require stellar models and a complete reaction network. The NuGrid collaboration has developed routines to post-process the nucleosynthesis depending on temperature and density profiles derived from stellar models. Seed distributions serve as input parameters to the simulations.
We show the influence of rate variations on the abundances of the light p nuclei in a 25 solar mass Supernova model and the effect of different seed distributions. Furthermore, we present the current status of our nucleosynthesis studies of the p process in thermonuclear supernovae.

This project was supported by the Helmholtz International Center for FAIR, DFG (SO907/2-1) and HGS-HIRe.
NuGrid acknowledges significant support from NSF grants PHY 02-16783 and PHY 09-22648 (JINA) and EU MIRG-CT-2006-046520.

HK 49.5 Do 17:45 HZ 5

Nuclear Structure input for Nuclear Astrophysics — •Andrea Idini and Gabriel Martinez-Pinedo — Institut für Kernphysik, Schlossgartenstraße 2, 64289 Darmstadt

Nuclear Structure calculations can provide important input to Nuclear Astrophysics and detector physics.

Shell-Model calculations are a good tool to constrain high-energy neutrino cross sections that will play an important role in the next generation supernova neutrino detectors.

Moreover high-precision nuclear structure calculations can help to shed light on exotic nuclei that occur in some astrophysical scenarios like the accreting matter onto a Neutron Star.

HK 49.6 Do 18:00 HZ 5

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

Neutrino pair bremsstrahlung and absorption ($NN \leftrightarrow NN\nu\bar{\nu}$) and inelastic scattering of neutrinos ($NN\nu \leftrightarrow \nu NN$) are of great relevance for the generation of and energy transport by neutrinos in core-collapse supernovae. In this talk, we will show that in mixtures of protons and neutrons the interaction rates are enhanced at subnuclear densities due to the large scattering lengths. As a result, the rate for neutrino pair bremsstrahlung and absorption is significantly larger below $10^{13}\,\mathrm{g\,cm^{-3}}$ compared to rates currently used in supernova simulations, which are based on the one-pion-exchange approximation. We will also show further results for neutrino interaction rates up to nuclear densities obtained in the framework of chiral effective field theory.

*This work was supported by the Studienstiftung des Deutschen Volkes, ARCHES, the Helmholtz Alliance HA216/EMMI and the ERC Grant No. 307986 STRONGINT.

HK 49.7 Do 18:15 HZ 5

New time-of-flight data for the neutron capture cross-section of ^{63}Cu — •M. Weigand[1], T.A. Bredeweg[2], A. Couture[2], M. Jandel[2], J.M. O'Donnell[2], R. Reifarth[1] und J.L. Ullmann[2] — [1]Goethe Universität, Frankfurt, Germany — [2]LANL, Los Alamos, USA

One of the important questions in nuclear astrophysics is how the observed abundances of elements came to be. Nearly all of the elements beyond the iron peak are either formed by the s- or the r-process in almost equal shares. The precise s-process path depends on stellar parameters like temperature and neutron density, and on nuclear parameters like half-lifes and neutron capture cross-sections (NCS). Thus, there is a big need for experimental data on the involved reactions to calculate their stellar rates to understand s-process nucleosynthesis.

The NCS of the copper isotopes influences the isotopic ratios of Zn. Former experiments concerning the NCS of ^{63}Cu showed large discrepancies. In order to determine the ^{63}Cu(n,γ) cross-section in the astrophysical energy region, an experiment has been performed using the calorimetric 4π-BaF_2 array DANCE at the Los Alamos National Lab (LANL). The results of the experiment will be presented.

This work is supported by the Helmholtz Nachwuchsgruppe VH-NG-327 and the Nuclear Astrophysics Virtual Institute NAVI.

HK 50: Instrumentierung

Zeit: Donnerstag 16:30–19:00 Raum: HZ 8

Gruppenbericht HK 50.1 Do 16:30 HZ 8

Der PANDA-Luminositätsdetektor — A. Denig[1,2], •F. Feldbauer[1,2], M. Fritsch[1,2], F. Heidelberg[1,2], P. Jasinski[1,2], A. Karavdina[2], R. Kieser[1,2], R. Klasen[1,2], M. Michel[1,2], C. Motzko[1,2], H. Leithoff[1,2], S. Pflüger[1,2], C. Stoll[1,2] und T. Weber[1,2] für die PANDA-Kollaboration — [1]Helmholtz-Institut Mainz — [2]Johannes-Gutenberg Universität Mainz

Mit PANDA wird am Antiprotonen-Speicherring HESR der Beschleunigeranlage FAIR in Darmstadt ein Experiment zur Verfügung stehen, das für Fragen der Hadronphysik optimiert ist. Mit dieser Anlage wird es möglich sein, neue Zustände zu entdecken und die Linienform dieser wie auch bereits bekannter Zustände sehr präzise zu vermessen. Zur Normierung der dafür verwendeten Energie-Scan-Messungen wird die exakte Kenntnis der Luminosität benötigt.
Die Luminosität wird bei PANDA anhand der Winkelverteilung der elastischen Antiproton-Proton-Streuung gemessen. Zur Reduktion der Unsicherheit in der Bestimmung der Luminosität durch Kleinwin-

kelstreuung und Modellannahmen wird der Luminositätsdetektor 11 m hinter dem Wechselwirkungspunkt nahe der Strahlachse (3.5-8 mrad) im Vakuum platziert. Die Teilchenspuren werden mit 4 Detektorebenen rekonstruiert. Diese sind mit HV-MAPS bestückt, die auf wärmeleitenden CVD-Diamantscheiben aufgebracht werden. Angestrebt ist eine Messgenauigkeit von 3%.
Das Konzept des Luminositätsdetektors wird vorgestellt und dabei technische Aspekte wie Vakuumsystem, Kühlung und Elektronik diskutiert.

Gruppenbericht HK 50.2 Do 17:00 HZ 8

Status des Mikro-Vertex-Detektors des CBM-Experimentes* — •Dennis Doering für die CBM-MVD-Kollaboration — Goethe-Universität, Frankfurt

Der Mikro-Vertex-Detektor des CBM-Experimentes an FAIR soll mit 50 μm dünnen, hochgranularen monolithischen CMOS-Pixelsensoren (MAPS) ausgestattet werden. Die Detektorentwicklung wird in einem Forschungs- und Entwicklungsprojekt zwischen IKF Frankfurt und IPHC Straßburg vorangetrieben. Am IPHC Straßburg werden die Sensoren designt, während das IKF Frankfurt die Integration des Detektors sowie ergänzende Strahlenhärtestudien durchführt.
Das Ziel ist es, einen Mikro-Vertex-Detektor mit einer Ortsauflösung von 5 μm, einer Zeitauflösung von 30μs, einem Materialbudget der ersten Detektorstation von $0,3\% X_0$ und einer Strahlenhärte von $10^{13} n_{eq}/cm^2$ (nicht-ionisierend) sowie 1 $Mrad$ (ionisierend) zu entwickeln.
Während MAPS die Ortsauflösung und das Materialbudget intrinsisch erfüllen, war die Zeitauflösung und Strahlenhärte für die Anwendung im Vertexdetektor von CBM ungenügend. In diesem Gruppenbeitrag wird der Status der Detektorintegration des letzten Jahres vorgestellt und anschließend die Fortschritte in der Strahlenhärte der letzten Jahre zusammengefasst, die zu einer um eine Größenordnung verbesserten ionisierenden und nicht-ionisierenden Strahlenhärte der Sensoren führen.
*gefördert durch das BMBF (05P12RFFC7), HIC for FAIR, EU-FP7 HadronPhysics3 und GSI.

HK 50.3 Do 17:30 HZ 8

High Voltage Monolithic Active Pixel Sensors for the PANDA Luminosity Detector* — •Tobias Weber, Florian Feldbauer, Prometeusz Jasinski, Heinrich Leithoff, Christof Motzko, and Miriam Fritsch for the PANDA-Collaboration — Helmholtz-Institut Mainz and Institut für Kernphysik, Universität Mainz

The PANDA-Experiment will be part of the new FAIR accelerator center at Darmstadt, Germany. It is a fixed target experiment using a antiproton beam with very high resolution for precision measurements. For a variety of measurements like energy-scans the precise determination of the luminosity is needed.

The luminosity detector will determine the luminosity by measuring the angular distribution of elastically scattered antiprotons very close to the beam axis (3-8 mrad). To reconstruct antiproton tracks four layers of thinned silicon sensors with smart pixel readout on chip (HV-MAPS) will be used. Those sensors are currently under development by the Mu3e-collaboration.

In the talk the concept of the luminosity measurement is shortly introduced before a summary of the status of HV-MAP prototypes and recent test beam results are presented.

*promoted by BMBF, DFG and HGF

HK 50.4 Do 17:45 HZ 8

Ein Kühlsystem für den PANDA-Luminositätsdetektor — •Heinrich Leithoff[1,2], Florian Feldbauer[1,2], Prometeusz Jasinski[1,2], Christof Motzko[1,2], Tobias Weber[1,2] und Miriam Fritsch[1,2] für die PANDA-Kollaboration — [1]Helmholtz-Institut Mainz — [2]Institut für Kernphysik, Universität Mainz

Zur Messung der Luminosität soll beim PANDA-Experiment ein Spurdetektor verwendet werden, der aus 4 Ebenen HV-MAPS (High Voltage Monolithic Active Pixel Sensors) besteht. Dieser wird 11 m hinter dem Wechselwirkungspunkt ins Strahlrohr integriert, um die elastisch extrem vorwärts gestreuten Antiprotonen zu vermessen. Die Apparatur wird unter Vakuum betrieben, um die Vielfachstreuung zu minimieren und damit die Genauigkeit der Luminositätsmessung zu erhöhen. Dies hat allerdings den Nachteil, dass die Halbleiterdetektoren, elektronischen Bauteile und Kabel aktiv gekühlt werden müssen.

Um zusätzlich die Materialbelegung gering zu halten, werden die Sensoren auf 200μm dünne Diamantscheiben aufgeklebt, die an einer gekühlten Aluminiumstruktur befestigt werden. Ein möglichst guter thermischer Übergang wird durch Einschmelzen eines Kühlrohres aus Edelstahl in die Aluminiumhalterung gewährleistet.

Diskutiert werden die erwartete Leistungsfähigkeit des Kühlsystems sowie die Produktion und Validierung der Kühlstrukturen.

HK 50.5 Do 18:00 HZ 8

A simulation model of MAPS for the FairRoot framework* — •Samir Amar-Youcef, Benjamin Linnik, and Philipp Sitzmann for the CBM-MVD-Collaboration — Goethe-Universität Frankfurt

CMOS MAPS are the sensors of choice for the MVD of the CBM experiment at the FAIR facility. They offer a unique combination of features required for the CBM detector like low material budget, spatial resolution, radiation tolerance and yet sufficient read-out speed.

The physics performance of various designs of the MVD integrated to the CBM detector system is evaluated in the CBM-/FairRoot simulation framework. In this context, algorithm are developed to simulate the realistic detector response and to optimize feature extraction from the sensor information. The objective of the sensor response model is to provide fast and realistic pixel response for a given track energy loss and position. In addition, we discuss aspects of simulating event pile-up and dataflow in the context of the CBM FLES event extraction and selection concept. This is of particular importance for the MVD since the sensors feature a comparably long integration time and a frame-wise read-out. All other detector systems operate with untriggered front-end electronics and are freely streaming time-stamped data to the FLES. Because of the large data rates, event extraction is performed via distributed networking on a large HPC compute farm.

We present an overview and status of the MVD software developments focusing on the integration of the system in a free-flowing readout system and on the concurrent application for simulated and real data. *supported by BMBF (05P12RFFC7), HIC for FAIR and GSI

HK 50.6 Do 18:15 HZ 8

Timing tests of Silicon-Photomultipliers for readout of large plastic scintillators — •Stefan Gohl[1,2], Daniel Bemmerer[1], Thomas E. Cowan[1,2], Klaus Heidel[1], Tobias Reinhardt[2,1], Marko Röder[1,2], Daniel Stach[1], Andreas Wagner[1], and David Weinberger[1] for the R3B-Collaboration — [1]Helmholtz-Zentrum Dresden-Rossendorf (HZDR) — [2]TU Dresden

Silicon Photomultipliers (SiPMs) are under study as a possible replacement for timing photomultiplier tubes (PMTs) in the NeuLAND (New Large Area Neutron Detector) detector at FAIR. SiPMs have several advantages over PMTs. They are insensitive to magnetic fields, small and they can be manufactured economically. Therefore, studies have been made with different SiPMs, preamplifiers and scintillators aiming to find a suitable setup with a good timing resolution for NeuLAND. Some parameters, e.g. bias voltage and light input, were tuned as well. The SiPMs were irradiated with an electron beam at ELBE and a picosecond laser system while the signals were recorded with a digital oscilloscope and evaluated by using a software Constant Fraction Discriminator (CFD). Preliminary results will be presented.

Supported by NupNET NEDENSAA (05 P09 CRFN5) and Helmholtz Portfolio Initiative "Detector Technology and Systems".

HK 50.7 Do 18:30 HZ 8

MIMOSA-26 Calibration and Noise Measurement Based on the Digital Sensor Output — •Borislav Milanovic for the CBM-MVD-Collaboration — Goethe Uni Frankfurt

CMOS Monolithic Active Pixel Sensors (MAPS) are used for high-precision tracking in particle detectors. They are applied for the STAR detector and also considered for the future CBM and ALICE experiments. MAPS combine high detection efficiency (> 99 %), with ultra-low material budget (thinned to 50 μm) and low power consumption (ca. 250 mW/cm^2). Their main feature is an integrated digital readout circuit situated directly on-chip. MIMOSA-26, developed at the IPHC Strasbourg, represents the basis of a modern MAPS. The sensor allows programming and slow control via JTAG. Sensitivity to impinging particles can be easily modified by changing the internal JTAG registers. However, the sensors require a careful tuning of run-time parameters, e.g. thresholds for the on-chip discriminators to guarantee a high detection efficiency and a low fake hit occupancy, i,e, electronic noise. This contribution presents a systematic study of the sensor/pixel response to noise allowing for a sensor characterization, calibration and selection prior to integration. This work is supported by BMBF (05P12RFFC7), HIC for FAIR, and GSI.

HK 50.8 Do 18:45 HZ 8

An automated testing procedure for microstrip sensors for the CBM Silicon Tracking System — •Pavel Larionov for the CBM-Collaboration — Goethe Universität Frankfurt

The goal of the CBM experiment at FAIR is to explore the QCD phase diagram in the region of high net-baryon densities and moderate temperatures. The Silicon Tracking System (STS), the core tracking detector of the CBM experiment, is located close to the target and is used to reconstruct charged particle trajectories and its momenta in nucleus-nucleus collisions. The tracking stations will be mounted with ∼1200 double-sided silicon microstrip sensors which have to be tested before installation. For mass testing, automated quality assurance procedures are required to save both time and manpower. The performance of the developed program and the measurement results for different prototype sensors will be presented.

Supported by EU-FP7 HadronPhysics3, HIC for FAIR, HGS-HIRe and H-QM.

HK 51: Instrumentierung

Zeit: Donnerstag 16:30–18:45 Raum: HZ 9

Gruppenbericht HK 51.1 Do 16:30 HZ 9

Upgrade of the ALICE TPC for high-rate operation — •Jens Wiechula for the ALICE-Collaboration — Physikalisches Institut, Eberhard Karls Universität Tübingen

After the second long shutdown the LHC will provide substantially higher collision rates of up to 50 kHz in Pb–Pb. The dedicated heavy-ion experiment, ALICE, at the LHC will record every interaction, leading to an inspected integrated luminosity of $\mathcal{L}_{\mathrm{int}} = 10\,\mathrm{nb}^{-1}$ during the RUN 3 data taking phase. This will result in a significant improvement on the sensitivity of rare probes that are considered key observables to characterise the hot and dense QCD matter created in such collisions.

In order to cope with these collision rates, ALICE plans an upgrade of the detectors and the online computing systems. The main detector for track reconstruction and particle identification is a large volume Time Projection Chamber (TPC). Currently, the usage of conventional multi-wire proportional chambers (MWPCs) limits the readout rate to 3.5 kHz, due to the need of a triggered ion gate. To overcome this limitation, the MWPCs will be exchanged by innovative Gas Electron Multipliers (GEMs), allowing for a continuous readout. The ALICE TPC will be the first continuously operated detector of its kind running in a high luminosity, high track-density environment.

Challenges and implications of the detector upgrade as well as the current status of the R&D will be reported.

HK 51.2 Do 17:00 HZ 9

Integrating a gas chromatograph for measuring gas compositions in ALICE — •Martin Fleck — Physikalisches Institut, University of Heidelberg, Im Neuenheimer Feld 226

The ALICE Time Projection Chamber and Transition Radiation Detector operate with gases whose exact composition affect substantially their performance. In particular, the gas composition determines drift velocity and gas gain of these detectors and therefore its precise knowledge is crucial, both for detector calibration and for online monitoring and trigger generation.

The analysis of the gas components and contaminants from air is a challenging task. Most of the sensors available on the market are insufficient or require frequent and tedious calibration.

A solution is the use of a gas chromatograph customary configured for the detection of the concerned gases, mainly noble gases, CO_2, and the rest of the natural air components.

We present an approach of how such an instrument, after proper calibration, can be reliably operated to provide frequent samples of the gas composition. The results are subsequently transported and integrated into the detector's control system for monitoring and archiving and for immediate use in calibration procedures.

HK 51.3 Do 17:15 HZ 9

The CBM time of flight wall - System aspects — •Ingo Deppner and Norbert Herrmann for the CBM-Collaboration — Physikalisches Institut der Universität Heidelberg

The Compressed Baryonic Matter spectrometer (CBM) is a future heavy ion experiment located at the Facility for Anti-proton and Ion Research (FAIR) in Darmstadt, Germany. The main goal of CBM is the investigation of the phase diagram of strongly interacting matter in the region of the highest baryon densities. In order to measure the necessary observables with unprecedented precision an excellent particle identification is required. The key element providing hadron identification at incident energies between 2 and 35 AGeV is a 120 m^2 large Time-of-Flight (ToF) wall composed of Multi-gap Resistive Plate Chambers (MRPC). In this contribution we will illustrate the current conceptual design of the ToF-wall which is based on a modular structure composed of super modules (SM). The various proposed RPC configurations in particular a prototype developed in Heidelberg as well as the resulting system aspects will be discussed.

Work was supported partially by BMBF 05PRVHC7 and by EU/FP7-HadronPhysics3/WP19

HK 51.4 Do 17:30 HZ 9

The HADES RPC Time of Flight Wall performance in Au+Au Collisions at 1.23 AGeV — •Georgy Kornakov — TU Darmstadt

The HADES Resistive Plate Chamber (RPC) detector measures the time-of-flight of charged particles in the innermost part of the High Acceptance Di-Electron Spectrometer located at GSI, Darmstadt, Germany. Its main goal is to provide lepton identification at low momenta (p<400MeV/c) as well as identification of pi, K, p, He3, d/He4, t, studied by the experiment.

For the Au+Au beam time, a major improvement of the spectrometer in terms of granularity and particle identification capability was achieved by replacing the old TOFino detector by the new shielded timing RPC time-of-flight detectors. The gold beam provided by the SIS 18 accelerator with energy of 1.23 AGeV was colliding with a segmented gold target, creating in the RPC region mean multiplicities of 72 charged particles per event and in the most central ones of 150 charged particles.

Results show a RPC efficiency above 95 % and a mean time accuracy below 70 ps. In here we will describe the design and performance characteristics required to achieve the goal as well as the methods and algorithms used for calibration and correction of the data.

HK 51.5 Do 17:45 HZ 9

Der Myonen-Detektor des CBM Experiments bei FAIR — •Anna Senger[1], Partha Pratim Bhaduri[2] und Shabir Bhat[3] für die CBM-Kollaboration — [1]GSI, Darmstatd, Deutschland — [2]VECC, Kolkata, Indien — [3]Kashmir University, Srinagar, Indien

Eine der Herausforderungen des CBM Experiments ist die Messung von Myonenpaaren aus Zerfällen von Vektormesonen (ρ, ω, ϕ, J/ψ, ψ'), die in Schwerionenstößen erzeugt werden. Die Multiplizität der Myonenpaare variiert zwischen 10-3 und 10-9 pro zentralem Au+Au Stoß, wobei in jeder Reaktion bis zu 1000 geladene Hadronen emittiert werden. Die Unterdrückung der Hadronen und der Nachweis der Myonen werden durch ein aktives Absorbersystem erreicht, das aus mehreren Lagen Eisen und Detektorebenen besteht und die Spuren aller geladenen Teilchen rekonstruiert. Die Nachweis-Effizienzen und die Signal-zu-Untergrund Verhältnisse werden in Simulationsrechnungen untersucht, basierend auf realistischen Annahmen bezüglich der Teilchenmultiplizitäten und der Detektoreigenschaften. Die Ergebnisse der Simulationen für FAIR Energien von 8 bis 25 AGeV für realistische Experimentbedingungen werden vorgestellt.

HK 51.6 Do 18:00 HZ 9

RPC test with heavy-ion beams — •Christian Simon and Norbert Herrmann for the CBM-Collaboration — Physikalisches Institut und Fakultät für Physik und Astronomie, Ruprecht-Karls-Universität Heidelberg, D-69120 Heidelberg, Deutschland

The Time-of-Flight (ToF) wall of the Compressed Baryonic Matter (CBM) experiment, conceptualized on the basis of high-resolution timing Multi-gap Resistive Plate Chambers (MRPCs), is intended to account for concise hadron identification at an unprecedented event rate of 10 MHz in Au+Au collisions. Comprehensive performance tests of

several purpose-built multi-strip MRPC prototypes forseen for different rate regions of the planned 120 m^2 ToF wall are an essential instrument to study the response and the limitations of the current design. Such evaluation studies were carried out both under SIS-18 heavy-ion beam load at GSI in the fall of 2012 and under cosmic irradiation in the lab throughout the year 2013. Particle flux conditions of up to a few tens of kHz/cm^2 as expected to impinge on the ToF wall in future CBM runs can be provided at the SIS-18 accelerator. A generic calibration scheme for MRPCs with strip read-out has been developed and will be described. Preliminary results concerning key characteristics like efficiency and timing resolution of a multi-strip MRPC demonstrator will be presented, as well as an outlook to the specifications and requirements of a planned high-rate in-beam test at GSI in 2014. The project is partially funded by BMBF 05PRVHFC7 and by EU/FP7-HadronPhysics3/WP19.

HK 51.7 Do 18:15 HZ 9

Detection efficiency of the neutron detector BELEN-48 measured at the PTB Braunschweig — •Michele Marta[1,2], Jorge Agramunt[3], Roger Caballero-Folch[4], Guillem Cortés[4], Iris Dillmann[1,2,5], Martin Erhard[6], Luis M. Fraile[7], Ulrich Giesen[6], Ralf Nolte[6], Albert Riego[4], Stefan Röttger[6], and Jose Luis Taín[3] — [1]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany — [2]II. Physikalisches Institut, Justus-Liebig Universität Giessen, Germany — [3]IFIC-CSIC University of Valencia, Valencia, Spain — [4]INTE-DFEN, Universitat Politecnica de Catalunya, Barcelona, Spain — [5]TRIUMF, Vancouver, Canada — [6]Physikalisch-Technische Bundesanstalt (PTB), Braunschweig, Germany — [7]Universidad Complutense de Madrid, Spain

The BEta-deLayEd Neutron detector BELEN-48 is a highly efficient detector of β-delayed neutrons, for nuclear structure, nuclear astrophysics and reactor studies. It consists of 48 ^{3}He proportional counters arranged in a polyethylene matrix in a way that the detection efficiency remains constant for neutron energies from thermal up to a few MeV. In order to validate MCNPX simulations, the detection efficiency has been calibrated with well-known (p,n) and (α,n) reactions on ^{7}Li, ^{13}C and ^{51}V producing neutrons with energies between 0.1 and 5 MeV. The experiment has been performed at the neutron metrology facility of PTB, which allowed the measurement of yields and angular distributions with a calibrated monitor. The new results indicate anisotropies, which are not reported in literature and have been taken into account to obtain the experimental efficiencies for BELEN.

HK 51.8 Do 18:30 HZ 9

Comissioning of a 1-m distillation plant to remove krypton out of xenon — •Stephan Rosendahl[1], Ethan Brown[1], Ion Cristescu[2], Alexander Fieguth[1], Christian Huhmann[1], Michael Murra[1], and Christian Weinheimer[1] — [1]Institut für Kernphysik, Wilhelm-Klemm Strasse 9, 48149 Münster, Germany — [2]Karlsruher Institut für Technologie, Tritium Laboratory, Hermann-von-Helmholtz-Platz 1, 76344 Eggenstein-Leopoldshafen, Germany

The XENON1T experiment aims for the direct detection of dark matter in the form of Weakly Interacting Massive Particles (WIMPS) and is now under construction. For this purpose a dual-phase TPC, filled with xenon is used, aiming for a fiducial volume of 1 ton to increase the sensitivity to WIMP-nucleon cross section by 1.5 orders of magnitude compared to current experiments. One dominant radioactive contamination, which one needs to reduce to reach the sensitivity, is ^{85}Kr, which has a beta-becay with an endpoint energy of 687keV. Therefore, the xenon has to be purified to a concentration of <0.1ppt (parts per trillion) natural krypton in xenon. This talk reports about the commissioning of a cryogenic distillation plant to remove krypton out of xenon, using 1m of package material, as a milestone on the way to a distillation column using 3m package material. Different diagnostics tools, like a ^{83m}Kr tracer method and cold trap-enhanced mass spectrometry, allow to characterize the efficiency of the system.

Different aspects of the project have been funded by DFG-Großgeräte, BMBF and Helmholtz-Alliance for Astroparticle Physics HAP.

HK 52: Hadronenstruktur und -spektroskopie

Zeit: Freitag 11:00–13:00 Raum: HZ 1+2

Gruppenbericht HK 52.1 Fr 11:00 HZ 1+2

Measurement of the Proton Polarizabilities at MAMI — •Vahe Sokhoyan for the A2-Collaboration — The George Washington University, Washington D.C., USA — Institut für Kernphysik, Universität Mainz, Germany

Polarizabilities are fundamental properties related to the internal dynamics of the nucleon. They play a crucial role not only in our understanding of the nucleon, but also in other areas such as precision atomic physics and astrophysics. Recent analyses of unpolarized Compton scattering data have indicated significant model dependence in the extraction of the scalar polarizabilities of the proton, resulting in a gross underestimation of the errors. The four spin polarizabilities of the proton have never been separated and only two linear combinations of those are known.

A program performed by the A2 Collaboration at the MAMI accelerator facility in Mainz aims for the first individual extraction of the nucleon scalar and spin polarizabilities using Compton scattering on the nucleons. The Crystal Ball and TAPS 4π spectrometer setup is used for the corresponding measurements. To extract the proton scalar polarizabilities independently, the beam asymmetry Σ_3 has been measured below pion production threshold. For the determination of the spin polarizabilities the beam asymmetry Σ_3 and the beam-target asymmetry Σ_{2x} were measured at higher energies, where the sensitivity to the spin polarizabilities increases.

In this talk the current results and the plans for the upcoming measurements will be presented.

HK 52.2 Fr 11:30 HZ 1+2

Measurement of the Pion Polarizability with COMPASS — •Stefan Huber for the COMPASS collaboration — Physikdepartment E18, Technische Universitaet Muenchen

Chiral Perturbation Theory predicts a precise value for the charged-pion polarisability. Experiments performed within the last decades are in tension with this value and also do not agree with each other.

At the COMPASS experiment at CERN the pion polarisability is accessible through the Primakoff effect, where the quasi-real photons surrounding the nickel nuclei are used to measure pion-photon scattering. Studying the energy distribution of the outgoing photons, the polarisability value can be extracted.

During the 2009 data taking COMPASS performed a first measurement based on about 60 000 exclusive events. In addition to the measurement with a pion beam a control measurement with a muon beam has been performed in order to control the systematics. The details of the measurement as well as the results will be discussed.

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

HK 52.3 Fr 11:45 HZ 1+2

Proton polarizabilities from polarized Compton scattering — •Nadiia Krupina and Vladimir Pascalutsa — Johannes Gutenberg-Universitaet Mainz, Germany

We study the low-energy expansion of polarized Compton scattering off the proton. We show that the leading non-Born contribution to the beam asymmetry of low-energy Compton scattering is given by the magnetic polarizability alone, the electric polarizability cancels out. Based on this fact we propose to determine the magnetic dipole polarizability of the proton from the beam asymmetry. Computing the higher-order (recoil) effects of polarizabilities on beam asymmetry, we show that they are suppressed in forward kinematics. We also present the low-energy expansion of doubly-polarized observables, from which the spin polarizabilities can be extracted.

HK 52.4 Fr 12:00 HZ 1+2

Feasibility studies of $\bar{p}p \to e^+e^-$ for the measurement of proton form factors at PANDA — •Alaa Dbeyssi[1,2], Frank E. Maas[1,3], Luigi Capozza[1], Bertalan Feher[1], Dmitry Khaneft[1], Paul Larin[1], Dexu Lin[1], Cristina Morales[1], Maria Carmen Mora Espi[1], Oliver Noll[1], Roberto Perez[1], David Rodriguez[1], Roserio Valente[1], Manuel Zambrana[1], Iris Zimmermann[1], Egle

Tomasi-Gustafsson[2], and Dominique Marchand[2] for the PANDA-Collaboration — [1]Helmholtz-Institut Mainz, Germany — [2]Institut de Physique Nucleaire, Orsay, France — [3]GSI, 64291 Darmstadt, Germany

Electromagnetic form factors of hadrons are fundamental quantities which describe the structure and the internal dynamics of these system. The electromagnetic structure of the proton is parametrized in terms of electric G_E and magnetic G_M form factors. The channels $\bar{p}p \leftrightarrow e^+e^-$ allow to access the Time-Like region. At the future accelerator complex FAIR, in Darmstadt, the PANDA (antiProton ANnihilation at DArmstadt) collaboration plans to measure proton Time-Like form factors using an antiproton beam of momentum up to 15 GeV/c. Feasibility studies of the reaction $\bar{p}p \to e^+e^-$ for the Time-Like proton form factor measurements at PANDA are presented here. The background reactions are also studied, in particular the $\bar{p}p \to \pi^+\pi^-$ channel. The results obtained from a realistic Monte Carlo simulation using the simulation framework of the experiment (PANDARoot) show that the proton form factors can be measured at PANDA with unprecedented accuracy.

HK 52.5 Fr 12:15 HZ 1+2

Machbarkeitsstudien zur Messung der zeitartigen, elektromagnetischen Formfaktoren des Protons in Reaktionen von $\bar{p}p \to \mu^+\mu^-$ am PANDA-Experiment. — •Iris Zimmermann für die PANDA-Kollaboration — Helmholtz-Institut Mainz

Die Messung der zeitartigen, elektromagnetischen Formfaktoren G_E und G_M in Prozessen von $\bar{p}p \to \mu^+\mu^-$ ermöglicht einen Zugang zur inneren Struktur des Protons. Die Machbarkeit solcher Studien bei PANDA kann in Simulationsstudien unter Verwendung des Softwarepakets PANDARoot untersucht werden. Eine besondere Herausforderung stellt dabei die Unterdrückung des dominierenden, hadronischen Untergrundkanals dar, welcher in Form von Paaren aus gegensätzlich geladenen Pionen auftritt. Ein Ziel ist es daher, eine gute Signal-Untergrund-Trennung zu ermöglichen. Der aktuelle Status der laufenden Studien für das Signal sowie des wichtigsten Untergrundkanals wird vorgestellt.

HK 52.6 Fr 12:30 HZ 1+2

Measurement of the $e^+e^- \to \pi^+\pi^-$ Cross Section Using Initial State Radiation at BESIII — •Benedikt Kloss and Achim Denig — Institut für Kernphysik Mainz

The magnetic moment of the muon is one of the most precisely measured quantities in modern particle physics. The theoretical prediction and the experimental measurement differ by more than 3.6 standard deviations. The hadronic cross section of $e^+e^- \to \pi^+\pi^-$ is an important impact for the theoretical prediction of the hadronic contribution to the magnetic moment of the muon. The experimental measurement of this cross section was performed by the KLOE and the BABAR experiment with high precision. These experiments dominate the world average but they differ below 1 GeV by 2.0 standard deviations. Another comparable experiment is needed. This measurement can be done at the BESIII experiment in Beijing, China. Using the technique of initial state radiation it might be possible to measure this hadronic cross section below 3.0 GeV with a comparable precision to BABAR and KLOE. This talk will give an overview of the current status of this analysis.

HK 52.7 Fr 12:45 HZ 1+2

Tau Spectral Functions in a Linear Sigma Model with Weak Interactions. — •Anja Habersetzer — Goethe-Universität, Frankfurt, Deutschland

The decay of the Tau lepton is governed by weak interactions. After implementing weak interaction into a Linear Sigma Model with global U(2)_L x U(2)_R symmetry including scalar, pseudoscalar, vector and axial-vector mesons we determined the vacuum coupling constant of the weak bosons to hadrons and calculated the vector and axial-vector spectral functions. The results are in good agreement with the ALEPH data and confirm that rho and a1 meson are chiral partners.

HK 53: Hadronenstruktur und -spektroskopie

Zeit: Freitag 11:00–12:45 Raum: HZ 3

Gruppenbericht HK 53.1 Fr 11:00 HZ 3

Study of $\vec{p}\vec{N} \to \{pp\}_s\pi$ reactions in the near-threshold region at ANKE-COSY — •Sergey Dymov for the ANKE-Collaboration — FZ-Juelich, Wilhelm-Johnen-Straße 52428 Jülich

For decription of pion reactions within the χPT framework it is important to establish that the same short-range $NN \to NN\pi$ vertex contributes to both p-wave pion production, where both initial and final NN pairs are in S waves, and to other low energy phenomena.

The COSY-ANKE collaboration has embarked on an ambitious program of performing a complete set of measurements of the $NN \to \{pp\}_s\,\pi$ reactions so that a full amplitude analysis can be carried out. By selecting events with excitation energy in the proton-proton system $E_{pp} < 3$ MeV, the resulting diproton $\{pp\}_s$ is overwhelmingly in the $^1S_0$ state. As parts of this program, measurements at $T_p = 353$ MeV of the cross sections $d\sigma/d\Omega$ and proton analyzing powers A_y^p in the $\vec{p}p \to \{pp\}_s\,\pi^0$ and the quasi-free $\vec{p}n \to \{pp\}_s\pi^-$ reactions were done at ANKE, as well as of the transverse spin correlations $A_{x,x}$ and $A_{y,y}$ in the $\vec{n}\,\vec{p} \to \{pp\}_s\pi^-$ reaction.

The partial wave analysis results in three distinct solutions that can all describe reasonably well the measured values. However, the predictions for $A_{x,z}$ are radically different. Hence even a low statistics measurement of this parameter would be sufficient to resolve the ambiguities. For a proton beam this can be achieved through the use of a Siberian snake. It is planned that such an experiment will be carried out at ANKE using the polarized deuterium target.

HK 53.2 Fr 11:30 HZ 3

Hyperon Interactions in Nuclear Matter — •Madhumita Dhar and Horst Lenske — Institut für Theoretische Physik, Universität Gießen

Baryon-baryon interactions within the $SU(3)$-octet are investigated in free space and nuclear matter. A meson exchange model is used for determining the interaction. The Bethe-Salpeter equations are solved in a $3-D$ reduction scheme. In-medium effects have been incorporated by including a two particle Pauli projection operator in the scattering equation. The coupling of the various channels of total strangeness $S = -1, -2$ and conserved total charge is studied in detail. Calculations and the corresponding results are compared for using the isospin and the particle basis. Matrix elements are compared in detail, in particular discussing mixing effects of different hyperon channels. Special attention is paid to the physical thresholds. The density dependence of interaction is clearly seen in the variation of the in-medium low-energy parameters. The approach is compared to descriptions derived from chiral-EFT and other meson-exchange models e.g. the Nijmegen and the Juelich model.

This work is supported by HIC for FAIR and HGS-HIRe.

HK 53.3 Fr 11:45 HZ 3

Λ_c^+ production in antiproton-proton annihilation within an effectiveLagrangian model — •Radhey Shyam[1] und Horst Lenske[2] — [1]Institut für Theoretische Physik,Justus-Liebig-Universität Giessen, Heinrich-Buff-Ring 16, D-35392 Giessen and Saha Institute of Nuclear Physics,Kolkata, India — [2]Institut für Theoretische Physik,Justus-Liebig-Universität Giessen, Heinrich-Buff-Ring 16, D-35392 Giessen

Using effective hadronic Lagangians with physical hadron masses and coupling constants determined from SU(4) flavor symmetry, we study the production cross sections of charmed baryon Λ_c^+ in the $\bar{p}p \to \bar{\Lambda}_c\Lambda_c^+$ reaction. The production mechanism is described by the t-channel meson exchange diagrams involving the excahnge of D^0 and D^* mesons. At the $ND^0\Lambda_c$ and $ND^*\Lambda_c$ vertices several types of form factors have been used and sensitivity of the production cross sections to their form and the cut-off parameters appearing therein have been investigated. With a monopole form factor and a cut-off parameter of 2.5 GeV, our cross sections are of the same order of magnitude as those obtained in Ref. [1].

This work has been supported by DFG Le439/8-2 and HIC for FAIR.

[1] J. Haidenbauer and G. Krein, Phys. Lett. B **687**, 314 (2010).

HK 53.4 Fr 12:00 HZ 3

Light meson production in nucleon-nucleon reactions — •Khaled Teilab, Susanna Gallas, Francesco Giacosa, and Dirk H. Rischke — Goethe-Universität, Frankfurt

We study the production of mesons in nucleon-nucleon reactions at center-of-mass momenta of a few GeV using an $N_f = 2$ linear sigma model, extended by including the $N_f = 2$ multiplets of (pseudo-) scalar and (axial-) vector mesons and a doublet of the nucleon together with its chiral partner (the $N^*(1535)$ or $N^*(1650)$ resonance).

Cross sections for the production of $\pi-$, $\eta-$, $\rho-$ and $\omega-$mesons will be presented. The results are compared to experimental data.

HK 53.5 Fr 12:15 HZ 3

Investigation of the quasi-free reaction $\mathrm{p + d \to d + \eta + p_{sp}}$ close to threshold at ANKE — •Daniel Schroeer, Christopher Fritzsch, Alfons Khoukaz, Malte Mielke, Michael Papenbrock, and Alexander Taeschner for the ANKE-Collaboration — Institut für Kernphysik, Westfälische Wilhelms-Universität, 48149 Münster, Germany

Recent precision measurements on the interaction of η mesons with He nuclei have shown evidence for an unexpectedly strong final state interaction which could possibly lead to the formation of η-mesic nuclei. To further investigate this behaviour for different nuclei a measurement on the reaction $\mathrm{p + d \to d + \eta + p_{sp}}$ has been performed at the ANKE experiment located at the COSY accelerator of the Forschungszentrum Jülich. Here the deuteron serves as an effective neutron target while the remaining proton acts in good approximation as a spectator particle.The chosen beam momenta ($p_1 = 2.09$ GeV/c and $p_2 = 2.25$ GeV/c) in combination with the Fermi motion of the nucleons inside of the deuteron allow to measure cross sections in an excess energy range from 0 MeV up to 100 MeV. Based on these information the dη scattering length $a_{\mathrm{d}\eta}$ will be measured which will shed new light on the interaction between η meson and nucleons. In addition the data obtained at higher excess energies will allow for further information about the role of nucleonic resonances on the η meson production. Recent results will be presented and discussed.

Supported by the COSY-FFE program.

HK 53.6 Fr 12:30 HZ 3

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

Die empirische Zweikörperwechselwirkung USD wurde durch zusätzliche experimentelle Daten verbessert. Die daraus resultierenden Wechselwirkungen USDA/USDB beschreiben ^{26}Na in Hinblick auf Anregungsenergien und Spinzuweisungen in besserer Übereinstimmung mit experimentellen Ergebnissen. Dies motivierte die Bestimmung von Übergangswahrscheinlichkeiten zwischen angeregten Zuständen als sensitive Probe der zugrunde liegenden Schalenstruktur. Hierzu wurde ein Coulombanregungsexperiment mit einem radioaktiven ^{26}Na-Strahl bei einer Energie von 2,82 MeV/u an einem ^{104}Pd-Target mit dem MINIBALL-Spektrometer am REX-ISOLDE Beschleuniger durchgeführt. Mit Hilfe von GOSIA2-Berechnungen wurden Übergangswahrscheinlichkeiten der ersten angeregten Zustände in ^{26}Na aus den experimentellen Daten bestimmt. Der Vergleich mit theoretischen Werten zeigt auch bei den neuen Wechselwirkungen USDA/B eine bessere Übereinstimmung.

Unterstützt durch BMBF (05P12PKFNE TP6) und ENSAR (Projektnummer 262010).

HK 54: Nukleare Astrophysik

Zeit: Freitag 11:00–12:45 Raum: HZ 4

Gruppenbericht HK 54.1 Fr 11:00 HZ 4

Quantum Monte Carlo Calculations with Chiral Effective Field Theory Interactions⋆ — •Ingo Tews[1,2], Kai Hebeler[1,2], Achim Schwenk[2,1], Alexandros Gezerlis[3], and Evgeny Epelbaum[4] — [1]Institut für Kernphysik, Technische Universität Darmstadt — [2]ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung GmbH — [3]Department of Physics, University of Guelph — [4]Institut für Theoretische Physik II, Ruhr-Universität Bochum

We present first quantum Monte Carlo (QMC) calculations with chiral effective field theory (EFT) interactions. To achieve this, we remove all sources of nonlocality, which hamper the inclusion in QMC calculations, in nuclear forces to next-to-next-to-leading order. We perform auxiliary-field diffusion Monte Carlo (AFDMC) calculations for the neutron matter energy up to saturation density based on these local nucleon-nucleon interactions. Our results provide nonperturbative benchmarks with theoretical uncertainties. For the softer interactions, perturbative calculations are in excellent agreement with the AFDMC results. This work paves the way for QMC calculations with systematic chiral EFT interactions for nuclei and nuclear matter, for testing the perturbativeness of different orders, and allows for matching to lattice QCD results by varying the pion mass.

⋆ This work was carried out within the ERC Grant No. 307986 STRONGINT, and also supported by the Helmholtz Alliance Program of the Helmholtz Association contract HA216/EMMI. Computations were performed at the Jülich Supercomputing Center.

HK 54.2 Fr 11:30 HZ 4

Study of the 17Ne Coulomb Dissociation process and its role for the rp process of nucleosynthesis. — •Justyna Marganiec[1,2], Felix Wamers[2,1,3,5], Thomas Aumann[1,3], Irina Egorova[6], Leonid Grigorenko[7,8], Michael Heil[3], Yuliya Perfenova[7,9], and Ralf Plag[3,4] for the R3B-Collaboration — [1]TU Darmstadt, Germany — [2]EMMI, GSI Darmstadt, Germany — [3]GSI Darmstadt, Germany — [4]Goethe-Universitaet, Frankfurt am Main, Germany — [5]FIAS, Frankfurt am Main, Germany — [6]BLTP JINR Dubna, Russia — [7]FLNR JINR Dubna, Russia — [8]RRC KI, Moscow, Russia — [9]INP, Moscow, Russia

The study of 17Ne Coulomb dissociation process gives us a possibility to study the time-reversed reaction 15O(2p,gamma)17Ne, with the detailed balance theorem. This reaction could serve as a bypass of 15O waiting point during the rp process, and move the initial CNO material towards heavier nuclei.

The two-proton capture can proceed sequentially or directly from the three-body continuum. And the reaction rate can be enhanced by a few orders of magnitude by taking the three-body continuum into account. The Coulomb dissociation method is the one way to experimentally determine the three-body radiative capture cross section, which is needed to verify theoretical calculations, and which was not experimentally determined yet. The experiment has been performed at the LAND/R3B setup at GSI.

This project is supported by NAVI, GSI-TU Darmstadt cooperation, HIC for FAIR, EMMI and BMBF.

HK 54.3 Fr 11:45 HZ 4

Background intercomparison with escape-suppressed germanium detectors in underground mines — •Tamás Szücs and Daniel Bemmerer — Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Dresden

A key requirement for underground nuclear astrophysics experiments is the very low background level in germanium detectors underground. The reference for these purposes is the world's so far only underground accelerator laboratory for nuclear astrophysics, LUNA. LUNA is located deep underground in the Gran Sasso laboratory in Italy, shielded from cosmic rays by 1400 m of rock. The background at LUNA was studied in detail using an escape-suppressed Clover-type HPGe detector [1]. Exactly the same detector was subsequently transported to the Felsenkeller underground laboratory in Dresden, shielded by 45 m of rock, and the background was shown to be only a factor of three higher than at LUNA when comparing the escape-suppressed spectra, with interesting consequences for underground nuclear astrophysics [2]. As the next step of a systematic study of the effects of a combination of active and passive shielding on the cosmic ray induced background, this detector is now being brought to the "Reiche Zeche"

mine in Freiberg/Sachsen, shielded by 150 m of rock. The data from the Freiberg measurement will be shown and discussed. – Supported by the Helmholtz Association (HGF) through the Nuclear Astrophysics Virtual Institute (HGF VH-VI-417).

[1] T. Szücs et al., Eur. Phys. J. A 44, 513 (2010)
[2] T. Szücs et al., Eur. Phys. J. A 48, 8 (2012)

HK 54.4 Fr 12:00 HZ 4

Erzeugung von ^{91}Nb zur Untersuchung der Reaktion ^{91}Nb(p,γ) an FRANZ — •Benedikt Thomas, Jan Glorius, Rene Reifarth, Anne Sauerwein, Stefan Schmidt und Kerstin Sonnabend — Goethe Universität, Frankfurt, Germany

Die hohen Protonenströme, die FRANZ liefern wird, werden es möglich machen (p,γ) und (n,γ)-Messungen an Targets mit geringer Targetkernzahl durchzuführen, wie es bei der Untersuchung von Reaktionen an radioaktiven Kernen, die nicht natürlich auf der Erde vorkommen, der Fall ist. Ein Beispiel ist das Isotop ^{91}Nb, für das der Wirkungsquerschnitt der Reaktion ^{91}Nb(p,γ)^{92}Mo bei 2 MeV Protonenenergie und damit im astrophysikalisch relevanten Bereich für den p-Prozess bestimmt werden soll. Dafür muss ^{91}Nb in ausreichender Zahl hergestellt werden. Eine mögliche Methode zur Erzeugung von ^{91}Nb ist die Aktivierung von ^{92}Mo mit Protonen bei Energien zwischen 15 MeV bis 30 MeV. Die dominanten Reaktionskanäle (p, 2n), (p, pn) und (p, 2p) mit den anschließenden β-Zerfällen können eine ausreichende Anzahl ^{91}Nb bereit stellen, um nach einer chemischen Aufbereitung ein Target für Experimente an FRANZ zu erhalten.

Dieses Projekt wird durch die DFG (SO907/2-1) und HIC for FAIR unterstützt.

HK 54.5 Fr 12:15 HZ 4

Determining cross sections of the ^{187}Re(α,n) reaction at astrophysically relevant energies — •Philipp Scholz[1], Janis Endres[1], Jan Mayer[1], Lars Netterdon[1], Anne Sauerwein[2], and Andreas Zilges[1] — [1]Institute for Nuclear Physics, University of Cologne — [2]Institute for Applied Physics, Goethe University Frankfurt

Network calculations of the γ process rely almost completely on theoretically predicted reaction rates in the scope of the Hauser-Feshbach statistical model. But especially the prediction of cross sections for (γ,α)-reactions at energies within or close to the astrophysically relevant energy window remains a problem due to the uncertainties in the basic α+nucleus optical-model potentials. Although experimental values far above the Coulomb-barrier are well reproduced, commonly used α-optical potentials often fail to describe the trend at center-of-mass energies comparable to those in astrophysical sites of the γ process. Improvements of the adopted optical-model potentials are hampered by the lack of experimental values at low energies. For the improvement of the experimental situation an α-induced reaction on the very heavy nucleus ^{187}Re was investigated via the activation technique using the Cologne Clover Counting Setup. Cross sections at five energies close to the astrophysically relevant energy region could be measured amongst others applying the $\gamma\gamma$-coincidence method. The experimental setup as well as recent results will be presented.

Partly supported by the DFG (ZI 510/5-1 and INST 216/544-1).

HK 54.6 Fr 12:30 HZ 4

Prompt fission γ-ray emission from thermal- and fast-neutron induced fission — •Stephan Oberstedt[1], Robert Billnert[1,2], Matthieu Lebois[3], Andreas Oberstedt[2], and Jon Wilson[3] — [1]European Commission, Joint Research Centre IRMM — [2]Fundamental Fysik, CTH, S-41296 Göteborg — [3]Institut de Physique Nucléaire Orsay, F- 91406 Orsay

In recent years we conducted a systematic investigation of fission-fragment de-excitation through prompt neutron and γ-ray emission. For the latter we were able to obtain spectral data for thermal-neutron induced fission on ^{235}U [1] and ^{241}Pu [2] with unprecedented accuracy. The recently installed neutron source LICORNE [3], where neutrons are produced in inverse kinematics, enables us to explore prompt de-excitation also for fast-neutron induced fission. A first experiment campaign on ^{235,238}U and ^{232}Th was performed at LICORNE. From our experimental data we established a systematic trend up to incident neutron energies of 20 MeV that compares well with modern theoretical calculations.

[1] A. Oberstedt et al., Phys. Rev C87, 051602(R), 2013
[2] R. Billnert et al., to be published in Phys. Rev C
[3] M. Lebois et al., Nucl. Instr. Meth. A735 (2014) 145-151

HK 55: Beschleuniger und Anwendungen kernphysikalischer Methoden

Zeit: Freitag 11:00–13:00 Raum: HZ 5

HK 55.1 Fr 11:00 HZ 5

Measurements of neutron-induced reactions in inverse kinematics — •Rene Reifarth[1] and Yuri A. Litvinov[2,3] — [1]Goethe-Universität Frankfurt am Main, Max-von-Laue-Str.1, 60438 Frankfurt am Main, Germany — [2]GSI Helmholtzzentrum für Schwerionenforschung, 64291 Darmstadt, Germany — [3]Max-Planck-Institut für Kernphysik, 69117 Heidelberg, Germany

Neutron capture cross sections of unstable isotopes are important for neutron-induced nucleosynthesis as well as for technological applications. A combination of a radioactive beam facility, an ion storage ring and a high flux reactor would allow a direct measurement of neutron induced reactions over a wide energy range on isotopes with half lives down to minutes.

HK 55.2 Fr 11:15 HZ 5

Vermessung von Strahlparametern mittels elastischer Proton-Deuteron-Streuung — •Nils Hempelmann für die JEDI-Kollaboration — RWTH Aachen, III. Physikalisches Institut B

Die Messung des elektrischen Dipolmoments (EDM) von Hadronen bietet eine Möglichkeit zur Suche nach neuer Physik jenseits des Standardmodells. EDMs geladener Hadronen können an Speicherringen bestimmt werden. Um systematische Fehler zu minimieren, ist eine genaue Vermessung des Strahlprofils notwendig. Ziel dieser Arbeit ist die Entwicklung einer Methode zur Rekonstruktion der Position und des Transversalimpulses eines einfallenden Teilchens im Strahl. Die Teilchen werden elastisch gestreut und die Spuren beider auslaufenden Teilchen vermessen. Über die bekannte Kinematik kann auf das Strahlprofil geschlossen werden. Das Verfahren wurde anhand eines Datensatzes erprobt, der 2010 mit einem Siliziumspurdetektor am Cooler Synchrotron (COSY) in Jülich aufgenommen wurde. Im Vortrag wird die Limitierung dieser Methode aufgrund von Vielfachstreuung diskutiert.

HK 55.3 Fr 11:30 HZ 5

Studies of systematic limitations in the EDM searches at storage rings — •Artem Saleev for the JEDI-Collaboration — Institut für Kernphysik, Forschungszentrum Jülich, Germany

Future experiments on search for the EDM of protons and deuterons at COSY will make use of the E/B- fields to drive the EDM-induced spin precession. One of the options is the so-called radiofrequency Wien-filter. It excerts zero Lorentz force on the beam, is EDM-transparent, but rotates the magnetic moment (MDM) of the beam particles by which it generates the frequency modulation of the spin tune. This modulation causes a coupling to the EDM precession in the constant motional electric field in the ring and the buildup of the EDM signal under the resonance condition.

The troubling issue is that, alongside with the radial motional E-field, the so-called imperfection, radial and longitudinal B-fileds from the magnet misalignments abound in the ring. The Wien-filter frequency modulation of the spin tune couples the MDM to the imperfection magnetic fields in precisely the same manner as the EDM couples to the motional electric field in the ring and the imperfection magnetic fields emerge as one of the principal sources of the systematic background to the EDM signal. Upon half a century of experimentation with neutrons, the upper bound of the neutron EDM is at the level of almost 10^{-12} of the neutron MDM. This indicates a challenge one faces in disentangling the true EDM signal from the MDM induced signal and the compensation for imperfection fields.

HK 55.4 Fr 11:45 HZ 5

A Development of BPM for P-LINAC at FAIR — •Mohammed Almalki[1], Oliver Kester[1], Peter Forck[1], Wolfgang Kaufmann[1], Thomas Sieber[1], Piotr Kowina[1], Wolfgang

Vinzenz[1], Claire Simon[2], Dejan Tinta[3], Rok Hrovatin[3], Promoz Lemut[3], and Christoph Krueger[1] — [1]GSI, Darmstadt — [2]CEA/DSM/IRFU — [3]Instrumentation Technologies, Solkan, Slovenia

Four-fold button Beam Position Monitor (BPM) has been developed for the planned Proton LINAC at the FAIR facility. These monitors will be installed at 14 locations along the LINAC and four of them will be mounted only about 40 mm upstream of the CH cavities. A BPM prototype will be fabricated to evaluate the rf power at the BPM location as generated by cavity excitation as well as to test different options in the mechanical design. For the read-out electronics, the I/Q digital signal processing will be implemented to derive the transverse beam position and the beam phase. This contribution presents the status of the BPM development and focuses on the mechanical design and the optimization of the button pick-ups. The development progress of digital signal processing system will be discussed as well.

HK 55.5 Fr 12:00 HZ 5

Simulations of the high energy beam transport section (HEBT) at FRANZ — •Ole Hinrichs, Christine Claessens, Manuel Heilmann, Oliver Meusel, Daniel Noll, Rene Reifarth, Stefan Schmidt, Malte Schwarz, and Kerstin Sonnabend — Goethe-Universität Frankfurt

The Frankfurt Neutron Source at the Stern-Gerlach-Zentrum (FRANZ) currently under construction will deliver a proton beam of up to 20 mA constant current with energies between 1.8 MeV and 2.2 MeV. This facility aims at exploring proton- and neutron-induced reactions of astrophysical interest. The high proton flux is well suited for studying nuclear reactions related to the nucleosynthesis of the p-nuclei, which might yield hints on the physics of type Ia supernovae. Furthermore, FRANZ will offer the opportunity to measure radiative neutron capture reactions for unstable branch point nuclei of the s-process.
We will present the current status of the beam line up to the BaF_2 calorimeter. This contribution will focus on simulations to optimise beam transport and phase space distribution with respect to an optimised beam spot size.
This project is supported by the DFG (SO907/2-1) and the Helmholtz-nachwuchsgruppe VH-NG-327.

HK 55.6 Fr 12:15 HZ 5

Alpha Spectroscopy — Felix Krueger, •Heinrich Wilsenach, and Kai Zuber — IKTP TU-Dresden, Dresden, Germany

Alpha decays from long living isotopes are one of the limiting backgrounds for experiments searching for rare decays with stringent background constrains, such as neutrinoless double beta decay experiments. It is thus very important to accurately measure the half-lifes of these decays, in order to properly model their background contribution. Therefore, it is important to be able to measure half-lifes from alpha decays of the order of 1×10^{15} yr. A measurement of such a long lived decay imposes, however, a series of challenges, where the correct discrimination between background and true signal is critical. There is also a more general interest in such long living half-life measurements, as their value depends crucially on the underlying nuclear model.

This work proposes a setup to measure long lived alpha decays, based on the design of the Frisch-Grid ionisation chamber. It will be shown that the proposed design provides a good separation of signal and background events. It will also be demonstrated that, with pulse shape analysis, it is possible to constrain the source position of the decay, further improving the quality of the data. A discussion of the characterisation of the detector will also be presented as well as some results obtained with calibration sources.

HK 55.7 Fr 12:30 HZ 5

CHANDA and ERINDA: Joint European programs for research on safety of nuclear facilities and waste reduction — •Roland Beyer[1,2], Eckart Grosse[2], Roland Hannaske[1,2], Arnd R. Junghans[1], and Toni Kögler[1,2] — [1]Institut für Strahlenphysik, Helmholtz Zentrum DD-Rossendorf, 01328 Dresden — [2]Institut für Kern- und Teilchenphysik, TU Dresden, 01069 Dresden

In spite of the planned termination of the German nuclear power program neutron beam facilities in Germany can contribute considerably to research studies on the reduction of hazards due to nuclear waste. Transnational research programs support EU groups who want to carry out projects at the new tof set-up nELBE at HZDR, the calibrated n-flux at PTB and the FRANZ accelerator under construction at Frankfurt. Vice versa various facilities in the EU offer beams for transmutation and safety related studies with neutrons to German scientists under support by ERINDA (2011-2013) and CHANDA (2014-2017; solving challenges in nuclear data for the safety of European nuclear facilities). For work in that field scientific visits are also fostered to improve the exchange of experience between the partners (13 and in future about 35 from 18 countries). Plans for new projects as well as results obtained so far will be discussed, and special emphasis will be given to the present research performed at nELBE on neutron scattering and absorption.

HK 55.8 Fr 12:45 HZ 5

Sensitivity of future liquid xenon experiments to the detection of double-beta decays of xenon — •Jan Thurn — IKTP TU Dresden

Dark searches are one of the most active fields of physics in the recent years. A new generation of experiments using liquid xenon as active medium are currently under investigation to further increase the sensitivity. These will exceed the present limit of 1 t active mass. This development will allow to reach unprecedented sensitivities not only for dark matter searches, but also for half-life measurements of long living isotopes of xenon.

Xenon itself has three candidates for double-beta decay, but only the 2nbb decay of ^{136}Xe has been measured with a half-life of $T_{1/2} = (2.38 \pm 0.11 \pm 0.05) \times 10^{21}$ yr. In this talk studies of sensitivities for the detection of the yet unobserved remaining double beta decay modes of xenon by this new generation of experiments will be presented. A particular emphasis on the sensitivity for a measurement of the half-life of ^{134}Xe will be performed, assuming different background models.

HK 56: Instrumentierung

Zeit: Freitag 11:00–12:45 Raum: HZ 8

Gruppenbericht HK 56.1 Fr 11:00 HZ 8

Low noise and low power preamplifiers for large area avalanche photodiodes - results from the testing of a mass prodcution series with an automatized test system — •Irakli Keshelashvili — University of Basel

Modern, high precision EM calorimeters need to run at very high count-rates, require good time and energy resolution, and large dynamic ranges. In addition, newly developed FPGA systems allow the construction of very dedicated experimental triggers in order to select efficiently reactions with low cross sections among high overall reaction rates. Avalanche Photo Diodes (APD's) are used in many of such systems, in particular when magnetic fields are involved. A disadvantage is their relatively low gain which together with other requirements is a challenge for the preamplifier design. Our group has developed special Low Noise / Low Power (LNP) preamplifiers for this purpose. The LNP preamplifier will be used for the upgrade of the Crystal Barrel detector (planned at begining of 2014) at the Bonn ELSA accelerator, mainly aiming at a good time resolution capability (existing readout is with photodiodes without timing information), while conserving the good energy resolution. The ˜1400 CsI scintillator modules will be equipped with double large area APDs for which special temperature compensation of the gain is necessary. Similar preamplifiers have been also developed by our group for the readout of the PANDA EMC forward end-cap. We report the results from the testing of the first 1500 channels of the preamplifiers for the Crystal Barrel experiment using a specially developed automatized test system.

HK 56.2 Fr 11:30 HZ 8

Commissioning of the Tagger Electronics for the BGO-OD experiment — •Francesco Messi for the BGO-OD-Collaboration — Physikalisches Institut, Uni-Bonn

The BGO-OD experiment, presently at a commissioning phase at the

electron accelerator ELSA at Bonn University, is intended for the systematic investigation of the photo-production of mesons. The experiment is using bremsstrahlung photons from an electron beam incident upon a radiator. The photon energy is measured via the momentum analysis of the electrons in a magnetic "tagging" spectrometer. The electrons are detected in a 120 channel plastic scintillator hodoscope with a rate up to 10MHz per single channel and 50MHz for the total detector. A coincidence between two neighboring channels is required to suppress background. In addition to the measurement of the photon energy, the hodoscope provides time information for coincidence measurements. New tagger electronics were developed and are now installed. The characteristics and the performance of the new Read-Out Electronics will be presented.

HK 56.3 Fr 11:45 HZ 8

Correction of differential nonlinearities in Analog-to-digital converters used for digital γ-ray spectroscopy — •Michael Weinert[1], Andreas Hennig[1], Wolfgang Hennig[2], Nigel Warr[1], Gheorghe Pascovici[1], and Andreas Zilges[1] — [1]Institute for Nuclear Physics, University of Cologne — [2]XIA LLC, Hayward CA 94544

Many experiments in nuclear structure and nuclear astrophysics demand for a spectroscopy setup with a high dynamic energy range while maintaining decent count rates. In such experiments conducted at the Cologne HORUS γ-ray spectrometer which is equipped with a fully digitized data acquisition system severe peak broadening and double peak structures in the energy spectra have been observed. These spectral distortions originate from the differential nonlinearity (DNL) of the Analog-to-digital converters used for digitizing the preamplifier signals. A correction method for this DNL using standard calibration sources and artificial pulser signals will be presented as well as an offline correction algorithm. The algorithm is capable of removing double peak structures and increasing the energy resolution for broadened peaks while achieving a better linearity in energy calibration compared to the uncorrected data.

Supported by the DFG (ZI 510/4-2).

HK 56.4 Fr 12:00 HZ 8

Entwicklung eines Triggerdetektors für vorwärtsgerichtete Protonen — •Marc Hillenbrand für die A2-Kollaboration — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz, Deutschland

Die A2 Kollaboration am Mainzer Mikrotron MAMI untersucht photoinduzierte Reaktionen an Nukleonen und Kernen sowie Zerfälle von Mesonen (η, η', ω), die mit hoher Rate an MAMI erzeugt werden können. Die wichtigsten Komponenten des Detektorsystems der A2 Kollaboration sind ein Spektrometer zur Energiemarkierung von Bremsstrahlsungsphotonen ("Tagger"), sowie die beiden Kalorimeter Crystal Ball und TAPS.

In diesem Vortrag wird ein Szintillationsdetektor zur schnellen Unterscheidung langsamer Protonen von minimal ionisierenden Teilchen vorgestellt. Dieser soll zur Definition eines Triggersignals für die Photoproduktion von η' Mesonen in Schwellennähe dienen. Der Aufbau und Test des Detektors sowie der geplante Einsatz im Trigger werden diskutiert.

HK 56.5 Fr 12:15 HZ 8

Development of a Feature Extraction Pre-Procesing Stage for the CBM-TRD — •Cruz de Jesus Garcia Chavez and Udo Kebschull for the CBM-Collaboration — Infrastructure and Computer Systems in Data Processing (IRI), Frankfurt University, 60325 Frankfurt am Main, Germany

The feature extraction is a data pre-processing stage of the proposed data acquisition chain (DAQ) for the CBM-TRD experiment at FAIR, aiming to deliver event-filtered and bandwidth-reduced data to the First Level Event Selection (FLES).

The TRD detector of the CBM experiment will be conformed of about 24,000 SPADIC 1.0 front-end chips. The SPADIC 1.0 can deliver full time-bin signals plus useful metadata. In order to efficiently pre-process the data coming from multiple TRD detectors and to deliver only useful and event-filtered information to the FLES, a feature extraction firmware has been developed in order to process multiple SPADIC 1.0 chips. The feature extraction firmware implements multiple algorithms in order to find regions of interest within time-bin signals. Algorithms such as peak-finding, charge integration, center of gravity and time-over threshold were implemented for online analysis. On the other hand, a local clustering algorithm allows to find cluster members and to implement even further data reduction algorithms. This contribution presents an overview of the development and implementation of the feature extraction firmware based in a SysCore3 FPGA development board for the CBM-TRD experiment, as well as its performance in a laboratory setup.

HK 56.6 Fr 12:30 HZ 8

Concepts for Pre-Assemply Data Acquisition for the PANDA Experiment* — •Milan Wagner, Thomas Gessler, Wolfgang Kühn, Sören Lange, and Björn Spruck for the PANDA-Collaboration — JLU Gießen

The $\overline{\mathrm{P}}$ANDA detector will be a located at the high energy storage ring (HESR), at the facility for anti protons and ion research (FAIR) in Darmstadt, Germany. It will operate with a very high interaction rate of up to 20 MHz, in a free streaming mode without hardware trigger. Data filtering will be performed by complete online event recontruction with a highly parallelized farm of FPGAs as first level and on a farm fo GPUs or PCs as a second level. The requirement is a background reduction by a factor of ¿1000. Parts of the $\overline{\mathrm{P}}$ANDA detector will be pre-assembled and tested at the Forschungszentrum Jülich, before being transported to GSI at a later stage. The data acquisition (DAQ) system for the pre-assembly comprises of a Synchronization Of Data Acquisition (SODA) source, up to 9 Trigger and Readout Boards (TRB) based on a Lattice ECP3 FPGAs, for data concentration, and up to 4 Compute Nodes (CN), for event building and filtering. A CN is a xTCA-compliant board based on a Virtex-5 FX70T FPGA, with a μTCA-formcator. It is equipped with 2x2 GB DDR2 RAM, one GB/Ethernet and 4x6.25 Gb/s optical links. In this contribution, we present the DAQ system for the pre-assembly for $\overline{\mathrm{P}}$ANDA, which will have up to 207 optical links as inputs and Gb/Ethernet as output.

*This work is suported by BMBF(05P12RGFPF), HGS-HIRe for FAIR and the LOEWE-Zentrum HIGforFAIR.

HK 57: Instrumentierung

Zeit: Freitag 11:00–13:00 Raum: HZ 9

Gruppenbericht HK 57.1 Fr 11:00 HZ 9

PANDA Luminosity Detector software: preparation for expected challenges — •A. Karavdina[1], A. Denig[1,2], P. Jasinski[1,2], M. Michel[1,2], S. Pflüger[1,2], and M. Fritsch[1,2] for the PANDA-Collaboration — [1]Johannes Gutenberg-Universität Mainz — [2]Helmholtz-Institut Mainz

Precise determination of the luminosity is crucial for planned PANDA experiment (FAIR, Germany). For the luminosity measurement we will exploit the differential cross section of the elastic $\bar{p}p$ scattering in dependence of the scattering angle. The Luminosity Detector (LMD) should have full azimuthal angle acceptance and good spatial resolution to achieve the needed precision for the measurement. These requirement can be succeeded by four planes of thin silicon pixel sensors. In parallel to the prototype construction, the reconstruction software is under development. Monte Carlo based simulation is used to proof the design concept, test the reconstruction under different conditions and study expected distortions of the simulated ideal world by real life effects. Those effects include possible technical problems (e.g. sensor misalignment or broken sensors) as well as challenges not related directly to the LMD set-up (e.g. physical background or radiation damage). Moreover the extraction of the luminosity relies on a sophisticated fit to the data with a combination of the theory model, non-uniform detector resolution and reconstruction efficiency. A special framework was developed to simplify fitting procedure.

In this talk an overview of the reconstruction software concept and studies related to the effects discussed above will be presented.

HK 57.2 Fr 11:30 HZ 9

GPU Implementations of Online Track Finding Algorithms at PANDA — •Andreas Herten[1], Tobias Stockmanns[1], James Ritman[1], Andrew Adinetz[2], Dirk Pleiter[2], and Jiri

Kraus[3] for the PANDA-Collaboration — [1]Institut für Kernphysik, Forschungszentrum Jülich GmbH — [2]Jülich Supercomputing Centre, Forschungszentrum Jülich GmbH — [3]NVIDIA GmbH

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

At an event rate of $2 \cdot 10^7$/s a data rate of 200 GB/s is expected. A reduction of three orders of magnitude is required in order to save the data for further offline analysis. Since signal and background processes at PANDA have similar signatures, no hardware-level trigger is foreseen for the experiment. Instead, a fast online event filter is substituting this element. We investigate the possibility of using graphics processing units (GPUs) for the online tracking part of this task. Researched algorithms are a Hough Transform, a track finder involving Riemann surfaces, and the novel, PANDA-specific Triplet Finder.

This talk shows selected advances in the implementations as well as performance evaluations of the GPU tracking algorithms to be used at the PANDA experiment.

HK 57.3 Fr 11:45 HZ 9

Digital timing algorithms applied to fast scintillators response — •Guillermo Fernández Martínez for the R3B-Collaboration — Institut für Kernphysik, TU Darmstadt

The future Facility for Antiproton and Ion Research (FAIR) will house the calorimeter and spectrometer CALIFA, whose design, construction and testing are currently being carried out by the R3B collaboration. The mentioned calorimeter is an array of scintillation detectors displayed in a barrel configuration, which covers the total solid angle. These new fast scintillation materials have been developed in last few years and their main interest lies on their versatility, which allows their use both for applications and fundamental research. In the same way, fast digitizers let the collection of signals at increasingly higher sampling frequencies. Our research takes advantage of these fair properties and is therefore focused on the analysis of digitized pulses for several aims: understanding the behaviour of radiation inside new fast scintillators and the development or improvement of digital algorithms which yield accurate resolution for fast timing and may be also applied to particle identification.

This work is supported by BMBF(06DA9040I, 05P12RDFN8) and HIC for FAIR.

HK 57.4 Fr 12:00 HZ 9

GENFIT - a Generic Track-Fitting Toolkit — •Johannes Rauch[1] and Tobias Schlüter[2] — [1]Technische Universität München — [2]Ludwig-Maximilians-Universität München

GENFIT is an experiment-independent track-fitting toolkit, which combines fitting algorithms, track representations, and measurement geometries into a modular framework. We report on a significantly improved version of GENFIT, based on experience gained in the Belle II, PANDA, and FOPI experiments. Improvements concern the implementation of additional track-fitting algorithms, enhanced implementations of Kalman fitters, enhanced visualization capabilities, and additional implementations of measurement types suited for various kinds of tracking detectors. The data model has been revised, allowing for efficient track merging, smoothing, residual calculation and alignment.

HK 57.5 Fr 12:15 HZ 9

An improved detector response simulation for the CBM Silicon Tracking System — •Hanna Malygina for the CBM-Collaboration — Goethe Universität Frankfurt

The Compressed Baryonic Matter experiment(CBM) at FAIR is designed to explore the QCD phase diagram in the region of high net-baryon densities. As the central detector component the Silicon Tracking System (STS) is based on double-sided micro-strip sensors. To achieve realistic simulations the response of the silicon strip sensors should be precisely included in the digitizer which simulates a complete chain of physical processes caused by charged particles traversing the detector, from charge creation in silicon to a digital output signal. The new version of the STS digitizer comprises in addition non-uniform energy loss distributions (according to the Urban theory), thermal diffusion and charge redistribution over the read-out channels due to interstrip capacitances. To verify the performance of the new digitizer we chose 1 GeV-pions as incident particles, tracks with random impact and inclination from -45^0 to 45^0. We used the center-of-gravity algorithm to reconstruct the clusters. As the most significant effect we identified the non-uniform energy loss along the incident particle track. A comparison between experimental data from LHCb and our simulation is shown.

Supported by EU-FP7 HadronPhysics3, HIC for FAIR, HGS-HIRe and H-QM.

HK 57.6 Fr 12:30 HZ 9

FPGA helix tracking algorithm for PANDA — •Yutie Liang[1], Martin Galuska[1], Thomas Gessler[1], Jifeng Hu[1], Wolfgang Kühn[1], Jens Sören Lange[1], David Münchow[1], Björn Spruck[1], and Hua Ye[1,2] for the PANDA-Collaboration — [1]II. Physikalisches, Giessen University, 35392, Germany — [2]Institute of High Energy Physics, Beijing 10049, P. R. China

The PANDA detector is a general-purpose detector for physics with high luminosity cooled antiproton beams, planed to operate at the FAIR facility in Darmstadt, Germany. The central detector includes a silicon Micro Vertex Detector (MVD) and a Straw Tube Tracker (STT). Without any hardware trigger, large amounts of raw data are streaming into 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) as first level and on a farm of GPUs or PCs as a second level. 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 is shown. A performance study using C++ and the status of the VHDL implementation will be presented.

*This work was supported in part by BMBF (05P12RGFPF), the LOEWE-Zentrum HICforFAIR and the JCHP FFE(COSY-099).

HK 57.7 Fr 12:45 HZ 9

Fission experiments *n*ELBE — •Toni Kögler[1,2], Roland Beyer[2], Roland Hannaske[1,2], Arnd Junghans[2], Ralph Massarczyk[1,2], Ronald Schwengner[2], and Andreas Wagner[2] — [1]Helmholtz-Zentrum Dresden-Rossendorf, 01328 Dresden, Germany — [2]Technische Universität Dresden, 01062 Dresden, Germany

At the Center for High-Power Radiation Sources at Helmholtz-Zentrum Dresden-Rossendorf fast neutron-induced fission cross section experiments on ^{235}U and ^{242}Pu are investigated by a parallel plate fission ionization chamber. To optimize the chamber parameters extensive Geant4 simulations with GEF code generated fission observable inputs have been used. Pile-up effects had to be included due to the high α-activity of the plutonium targets. Experimental data from a comparative measurement with PTB's H19 transfer device is presented. Using the HZDR nanosecond pre-amplifier with total signal times of 500 ns reduces the α pile-up and enables a QDC based data processing.

HK 58: Instrumentierung

Zeit: Freitag 11:00–13:00 Raum: HZ 10

HK 58.1 Fr 11:00 HZ 10

Polarimeterkonzepte für das EDM precursor experiment — •Paul Maanen — III. Physikalisches Institut B, RWTH Aachen

Die im Standardmodell vorhergesagte CP-Verletzung reicht nicht aus, um die offensichtlich existierende Materie-Antimaterie-Asymmetrie unseres Universums zu erklären. Es muss deshalb neue Physik mit zusätzlichen CP-verletzenden Effekten geben. Diese könnten sich in permanenten elektrischen Dipolmomenten von Elementarteilchen manifestieren. Die JEDI (Jülich Electric Dipole Moment Investigations) Kollaboration wurde gegründet, um auf dem $10^{-29}e \cdot$ cm-Level nach permanenten elektrischen Dipolmomenten von Hadronen (p,d,3He) zu suchen. Bei der angestrebten Methode der Messung äußert sich das elektrische Dipolmoment als Aufbau der vertikalen Polarisation des

Strahls. In diesem Vortrag soll ein Konzept für ein Polarimeter zur Messung vorgestellt werden sowie die Ergebnisse erster Simulations- und Hardwarestudien gezeigt werden.

HK 58.2 Fr 11:15 HZ 10

A radiofrequency quadrupole cooler and buncher for the TRIGA-SPEC experiment — •Thomas Beyer for the TRIGA-SPEC-Collaboration — Max-Planck-Institut für Kernphysik, Heidelberg

The mass spectrometer TRIGA-TRAP and the laser spectroscopy setup TRIGA-LASER, forming the TRIGA-SPEC experiment, are installed at the research reactor TRIGA Mainz in order to perform high-precision measurements of ground state properties of short-lived neutron-rich radionuclides. Such measurements allow testing the predictive power of nuclear mass models and support astrophysical nucleosynthesis calculations. The extraction and preparation of these nuclides for both experimental branches is achieved by using an aerosol-based gas-jet system to transport them from an actinide target located inside the reactor to an external surface ionization ion source. The ion source is followed by a mass separator and a linear Paul trap, which was the cooler for emittance elimination COLETTE at MISTRAL/ISOLDE. It has been installed in Mainz and the capability of accumulating and bunching ion beams has been implemented to provide low-emittance ion pulses of 250 ns width containing up to 10^6 ions. A brief description of the upgraded linear Paul trap as well as its performance in bunching stable ions is presented.

HK 58.3 Fr 11:30 HZ 10

Aktive Methoden zur Untergrundreduktion im KATRIN-Experiment — •Jan David Behrens für die KATRIN-Kollaboration — Westfälische Wilhelms-Universität, Münster

Durch das **KA**rlsruhe **TRI**tium **N**eutrino-Experiment soll die Masse des Elektron-Antineutrinos mit einer Sensitivität von 200 meV/c^2 (90% C.L.) vermessen werden. Die Vermessung der Form des Tritium-β-Spektrums im Endpunktbereich ermöglicht eine modellunabhängige Bestimmung dieses wichtigen Parameters.

Die Energieanalyse der Zerfallselektronen erfolgt beim KATRIN-Experiment in einem elektrostatischen Spektrometer, das nach dem Prinzip des MAC-E-Filters arbeitet. Durch die Kombination von elektrischen und magnetischen Feldern können im Spektrometer unerwünschte Penningfallen zu einem erhöhten Untergrund führen.

Eine Möglichkeit zur Untergrundreduktion ist das aktive Entfernen von gespeicherten Elektronen durch die Erzeugung eines elektrischen Dipolfeldes und/oder magnetischen Pulses, um die Speicherbedingungen aufzuheben. Der Vortrag stellt beide Methoden sowie erste Resultate der erfolgreichen Messungen zur Kommissionierung des KATRIN-Haupspektrometers im Sommer 2013 vor.

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

HK 58.4 Fr 11:45 HZ 10

A Low-Energy Antiproton Detector Prototype for AFIS — •Lingxin Meng, Daniel Greenwald, Alexander Hahn, Philipp Hauptmann, Igor Konorov, Martin Losekamm, Stephan Paul, Thomas Pöschl, and Dieter Renker — Technische Universität München

Antiprotons are produced in interactions of primary cosmic rays with earth's exosphere, where a fraction of them will be confined in the geomagnetic field in the inner van Allen Belt. The antiproton-to-proton flux ratio predicted by theory is in good agreement with recent results from the South Atlantic Anomaly (SAA) published by the PAMELA collaboration. We have designed the AFIS (Antiproton Flux in Space) project in order to extend the measurable range of antiprotons towards the low-energy region. In scope of this project a small antiproton detector consisting of scintillating fibers and silicon photomultipliers is being developed as payload for a CubeSat traversing the SAA in Low Earth Orbit.

For the proof of concept we have built a prototype called "CubeZero" which completed its first test using pion and proton beams at PSI, Switzerland. Our primary goal was to investigate on the performance of tracking and Bragg peak identification in hardware and software. Analysis of detector performance based on data taken during this beam test will be presented in this talk.

This project is supported by the DFG Excellence Cluster Universe (Exc 153).

HK 58.5 Fr 12:00 HZ 10

The neutron lifetime experiment PENeLOPE — •Wolfgang Schreyer for the PENeLOPE-Collaboration — Technische Universität München, Physik Department E18

The neutron lifetime $\tau_n = 880.0 \pm 0.9$ s is an important parameter in the Standard Model of particle physics and in Big Bang cosmology. Several systematic corrections of previously published results reduced the PDG world average by several σ in the last years and call for a new experiment with complementary systematics.

The experiment PENeLOPE, currently under construction at the Physik-Department of Technische Universität München, aims to determine the neutron lifetime with a precision of 0.1 s. It will trap ultra-cold neutrons in a magneto-gravitational trap using a large superconducting magnet and will measure their lifetime by both neutron counting and online proton detection.

This presentation will give an overview over the latest developments of the experiment.

The project is supported by the Maier-Leibnitz-Laboratorium (Garching), the Deutsche Forschungsgemeinschaft and the Excellence Cluster "Origin and Structure of the Universe".

HK 58.6 Fr 12:15 HZ 10

PIPERADE: A Penning trap based isobar separator for the future low-energy facility DESIR of SPIRAL2 — •A. de Roubin[1,2], P. Ascher[1], B. Blank[2], K. Blaum[1], P. Dupré[3], M. Gerbaux[2], S. Grévy[2], H. Guérin[2], D. Lunney[3], and S. Naimi[1] — [1]MPIK, Heidelberg, Germany — [2]CENBG, Gradignan, France — [3]CSNSM, Orsay, France

Exotic nuclei currently not accessible will be delivered to the future DESIR facility for nuclear structure and astrophysics studies as well as for testing the Standard Model, using beta decay spectroscopy, laser spectroscopy and trap-based experiments. For most of the experiments, a high precision is needed and can be reached only if highly pure samples of exotic nuclei are delivered. Some particular physics cases will be presented.

PIPERADE will be a system placed upstream the DESIR hall to purify the radioactive ion beam from undesired contaminants. It will consist of a radio-frequency quadrupole to bunch and cool the beam and of a double Penning-trap system to separate the isobaric species and accumulate the ions of interest. The purified beam will then be sent to the various experiments of the low-energy DESIR facility.

The challenge for the present double Penning-trap system consists of being able to accumulate very large amounts of short-lived nuclei ($10^5 - 10^6$) while maintaining the resolving power necessary for isobar selection of at least 10^5. For this purpose, studies of space charge effects and new excitation schemes are under investigation and will be presented.

HK 58.7 Fr 12:30 HZ 10

Experimenteller Test verschiedener Phoswich-Detektor Konzepte — •B. Heiss, M. Bendel, R. Gernhäuser, W. Henning, T. Le Bleis und M. Winkel — Technische Universität München, Physik-Dept. E12, 85748 Garching

Das CALIFA-Kalorimeter wird ein wesentlicher Bestandteil des R^3B-Experiments sein, welches an der neu entstehenden Beschleunigeranlage FAIR (Darmstadt) aufgebaut wird. Das großvolumige Kalorimeter bestehend aus CsI(Tl)-Kristallen, welche durch Avalanche-Photodioden ausgelesen werden, soll die gesamte Targetregion einschließen.
Bei relativistischen Strahlenergien von 700AMeV erhalten gestreute Teilchen vor allem in Vorwärtsrichtung Energien von vielen 100MeV. Diese Teilchen zu stoppen erfordert einen hohen Materialaufwand, wodurch der Wirkungsquerschnitt für unerwünschte Kernreaktionen in den Szintillatorkristallen erhöht wird. Das Phoswich-Konzept bietet die Möglichkeit auch die Energie für nicht gestoppte Teilchen zu rekonstruieren. In diesem Vortrag werden verschiedene Phoswich-Konfigurationen vorgestellt und Ergebnisse mit verschiedenen Prototyp-Detektoren aus einem Experiment am CCB - IFJ PAN in Krakau mit hochenergetischen Protonen diskutiert.

HK 58.8 Fr 12:45 HZ 10

Gamma ray tracking with the AGATA demonstrator — •Benedikt Birkenbach, Herbert Hess, Lars Lewandowski, Peter Reiter, Tim Steinbach, David Schneiders, and Andreas Vogt for the AGATA-Collaboration — IKP, Universität zu Köln

The performance of the AGATA demonstrator will be discussed based on data taken from a multi-nucleon transfer experiment at the AGATA

PRISMA setup at LNL (INFN, Italy). A primary ^{136}Xe beam of 1 GeV hitting a ^{238}U target was used to produce a multitude of nuclei in the vicinity of ^{136}Xe and corresponding reaction partners in the actinide region. The obtained results for in-beam gamma-ray spectroscopy allow for a critical assessment of the novel gamma ray tracking technique and comparison with standard procedure. High resolution spectroscopy of both reaction products after multi-nucleon transfer reaction in the presence of a high background from excited fission fragments is based on pulse-shape analysis (PSA) and gamma-ray tracking (GRT). The quality of the position information is crucial for the final energy resolution after Doppler correction. The impact of the calculated PSA libraries and the initial detector characterization for the PSA and GRT are summarized. Details of the achieved position and energy resolution, peak-to-background optimization are presented and illustrated with results from the neutron-transfer products in Xe and U-isotopes. Supported by the German BMBF (05P12PKFNE TP4), ENSAR-TNA03.

HK 59: Hadronenstruktur und -spektroskopie

Zeit: Freitag 14:00–16:00 Raum: HZ 1+2

Gruppenbericht HK 59.1 Fr 14:00 HZ 1+2

Online software trigger at PANDA/FAIR — •Donghee Kang[1], Achim Denig[2], Klaus Götzen[3], Ralf Kliemt[1], Frank Nerling[1], and Klaus Peters[3] for the PANDA-Collaboration — [1]Helmholtz-Institut Mainz, Germany — [2]Institut für Kernphysik, Universität Mainz, Germany — [3]GSI Helmholtzzentrum für Schwerionenforschung GmbH

The PANDA experiment at FAIR will employ a novel trigger-less readout system. Since a conventional hardware trigger concept is not suitable for PANDA, a high level online event filter will be applied to perform fast event selection based on physics properties of the reconstructed events. A trigger-less data stream implies an event selection with track reconstruction and pattern recognition to be performed online, and thus analysing data under real time conditions at event rates of up to 40 MHz.The projected data rate reduction of about three orders of magnitude requires an effective background rejection, while retaining interesting signal events. Real time event selection in the environment of hadronic reactions is rather challenging and relies on sophisticated algorithms for the software trigger. The implementation and the performance of physics trigger algorithms presently studied with realistic Monte Carlo simulations will be discussed. The impact of parameters such as momentum or mass resolution, PID probability, vertex reconstruction and a multivariate analysis using the TMVA package for event filtering is presented.

HK 59.2 Fr 14:30 HZ 1+2

Perspectives on Open Charm Physics with PANDA — •Elisabetta Prencipe and James Ritman for the PANDA-Collaboration — FZJ Juelich, Leo Brandt Strasse - 52428 Juelich

The experiment PANDA at FAIR (Facility for Antiproton and Ion Research) in Darmstadt (Germany) will investigate fundamental questions of hadron and nuclear physics in interactions of antiprotons with nucleons and nuclei. Gluonic excitations and the physics of hadrons with strange and charm quarks will be accessible with unprecedented accuracy, thereby allowing high precision tests of the strong interaction. In particular, the D{sJ}(2317)+ and D{sJ}(2460)+ are still of high interest 10 years after their discovery, because they can not be simply understood in term of potential models. In fact, the low statistics and lack of precision of the past experiments did not allow to clarify their nature. Recently LHCb at CERN have made progresses in this respect, but still not at the level of precision required in order to clarify the puzzle of the cs-bar spectrum. PANDA will be able to achieve a factor 20 higher mass resolution than attained at the B-factories, which is expected to be decisive on these and second-order open questions. The technique to evaluate the width from the excitation function of the cross section of the D{sJ} mesons will be presented, and full simulations performed with PandaRoot will be shown.

HK 59.3 Fr 14:45 HZ 1+2

Strange and charm meson masses from twisted mass lattice QCD — •Martin Kalinowski and Marc Wagner — Goethe University Frankfurt am Main

We present results of a twisted mass lattice QCD computation of the strange and charm meson spectrum with $2+1+1$ dynamical quark flavors. Particular focus is put on excited D and D_s mesons and on a connection to the "$1/2, 3/2$ limit" for the $D^{**}_{(s)}$.

HK 59.4 Fr 15:00 HZ 1+2

The resonances f0(1370), f0(1500) and f0(1710) in the extended Linera Sigma Model — •Stanislaus Janowski, Francesco Giacosa, and Dirk H. Rischke — Goethe-University, Frankfurt am Main, Germany

In order to study the vacuum properties of the scalar-isoscalar states f0(1370), f0(1500) and f0(1710) we use the extended Linear Sigma Model (eLSM) with globel chiral symmetry and dilatation invariance. Our effective Lagrangian contains (pseudo)scalar and (axial)vector quark-antiquark states and a scalar glueball. We investigate mixing, masses, and decays. We find that a scenario in which f0(1710) is predominantely a scalar glueball is in agreement with the vacuum's phenomenology.

HK 59.5 Fr 15:15 HZ 1+2

$a_0(980)$ **as a dynamically generated resonance in the extended linear sigma model** — •Thomas Wolkanowski-Gans and Francesco Giacosa — Goethe-Universität Frankfurt am Main

We study basic properties of scalar hadronic resonances within the so-called extended linear sigma model (eLSM), which is an effective model of QCD based on chiral symmetry and dilatation invariance. In particular, we focus on the mass and decay width of the isovector state $a_0(1450)$ and perform a numerical study of the propagator pole(s) on the unphysical Riemann sheets. Here, the $a_0(1450)$ is understood as a seed state explicitly included in the eLSM – this is in fact not true for the corresponding resonance below 1 GeV, the $a_0(980)$, which is sometimes interpreted as a kaonic (i.e., dynamically generated) bound state. In our work we want to clarify if the yet not included $a_0(980)$ can be found as a propagator pole generated by hadronic loop contributions. From such an investigation one could learn more about the general dependence of the eLSM – and effective field models in general – on strongly coupled hadronic intermediate states, possibly giving new insight into the low-energy regime, scalar resonances and both its theoretical description and physical interpretation.

HK 59.6 Fr 15:30 HZ 1+2

Analyse der Reaktion $\bar{p}p \to \pi^+\pi^-\pi^0\pi^0$ bei Crystal Barrel im Fluge — •Arber Mustafa — Institut für Experimentalphysik I, Ruhr-Universität Bochum

Am PANDA-Experiment, welches an der künftigen Beschleunigeranlage FAIR aufgebaut wird, werden $\bar{p}p$-Annihilationen bis zu einer Schwerpunktsenergie von etwa 5,5 GeV untersucht. Eines der Hauptziele des Experiments ist die Spektroskopie von Hadronen, insbesondere von Charmonium-Zuständen. Die Identifizierung zu einer Reaktion beitragender Resonanzen erfordert dabei meist eine Partialwellenanalyse der Reaktion. Um im Hinblick auf das PANDA-Experiment die $\bar{p}p$-Annihilationen näher zu untersuchen, wird die Reaktion $\bar{p}p \to \pi^+\pi^-\pi^0\pi^0$ im Fluge bei Strahlenimpulsen von 900 MeV/c und 1940 MeV/c rekonstruiert. Die analysierten Daten wurden durch das Crystal Barrel-Experiment am Antiprotonspeicherring LEAR am CERN in den Jahren zwischen 1989 und 1996 aufgezeichnet. In diesem Beitrag werden die Selektion der Reaktion und vorläufige Resultate vorgestellt.

Gefördert durch das BMBF mit Förderkennzeichen 05P12PCFP5 und das FZ Jülich.

HK 59.7 Fr 15:45 HZ 1+2

ComPWA: Ein allgemeines Partialwellenanalyse Framework — Florian Feldbauer[1,2], Miriam Fritsch[1,2], Klaus Götzen[1,3], Prometeusz Jasinski[1,2], Anastasia Karavdina[2], •Mathias Michel[1], Frank Nerling[1] und Klaus Peters[1,3] — [1]HI Mainz — [2]Universität Mainz — [3]GSI Darmstadt

Viele neue Experimente verschreiben sich der Suche nach neuen konventionellen sowie exotischen hadronischen Zuständen wie z.B. Hybri-

den oder Gluebällen. Zur Identifizierung möglicher Kandidaten und zur eindeutigen Einordnung bereits bekannter Zustände wird in einem Großteil der Analysen eine Partialwellenanalyse (PWA) benötigt. Zu diesem Zweck wird das neue, flexible und effiziente PWA-Framework ComPWA entwickelt. Es ist modular gestaltet, was es erlaubt, problemlos weitere Modelle und Formalismen hinzuzufügen, wie auch gleichzeitig mehrere Datensätze (auch verschiedener Experimente) anzupassen. Außerdem werden verschiedene Minimierungs- und Bewertungsroutinen zur Verfügung gestellt. Um Einschränkungen bisheriger PWA-Programme zu vermeiden, werden neue, allgemeine Methoden der Optimierung implementiert. Ziel ist es, die Software mit Daten laufender Experimente wie z.B. BaBar oder BESIII zu entwickeln und zu testen. In diesem Vortrag werden der Status der Entwicklung sowie erste Testergebnisse vorgestellt.

HK 60: Hadronenstruktur und -spektroskopie

Zeit: Freitag 14:00–15:45 Raum: HZ 3

Gruppenbericht HK 60.1 Fr 14:00 HZ 3

Behaviour of kaons in cold nuclear matter — •Kirill Lapidus for the HADES-Collaboration — Excellence Cluster 'Universe', Boltzmannstr. 2, 85748, Garching, Germany

A number of experimental and theoretical efforts were made to understand the behaviour of hadrons immersed in a strongly interacting environment. This contribution addresses the case of K^0-mesons produced in proton-niobium collisions. The high-statistics ($\sim 10^4$ kaons) data were delivered by the HADES experiment (GSI Helmholtzzentrum), employing a proton beam with a kinetic energy of 3.5 GeV. The GiBUU transport model was used for the interpretation of the data. The model allows to simulate the production and propagation of kaons inside the nucleus, including their interaction with the collective of nucleons in terms of a mean field potential. The data favour the presence of the repulsive kaon potential that follows from the Chiral Perturbation Theory.

Supported by BMBF and the Excellence Cluster "Universe".

HK 60.2 Fr 14:30 HZ 3

Investigation of isospin effects in $dp \to {}^3\mathrm{He}\,\pi^+\pi^-$ at ANKE* — •Malte Mielke[1], Christopher Fritzsch[1], Paul Goslawski[1], Alfons Khoukaz[1], Michael Papenbrock[1], Daniel Schröer[1], Alexander Täschner[1], and Colin Wilkin[2] for the ANKE-Collaboration — [1]Westfälische Wilhelms-Universität, Münster,Germany — [2]University College London, U.K.

Two-pion production in nuclear collisions has been the subject of intensive research for more than 50 years, ever since the discovery of the so-called ABC-effect in proton-deuteron collisions. The effect appears as an enhancement at low two-pion invariant masses and is found to be dominantly in the $\pi\pi$ isospin $I_{\pi\pi} = 0$ channel. In the $dp \to {}^3\mathrm{He}\,\pi^+\pi^-$ reaction, interferences of $I_{\pi\pi} = 0$ and $I_{\pi\pi} = 1$ are allowed, which permits studies on possible contributions of the Roper resonance, especially in the isovector part. These cause the ${}^3\mathrm{He}\,\pi^+$ and ${}^3\mathrm{He}\,\pi^-$ invariant-mass distributions to differ in shape and are therefore experimentally accessible.

The high momentum resolution that is needed to quantify these differences can be achieved with the ANKE spectrometer at the COoler SYnchrotron (COSY), where data of the reaction $dp \to {}^3\mathrm{He}\,\pi^+\pi^-$ were recorded in an excess energy range of 265 to 285 MeV. The use of kinematically complete events allows a detailed analysis of the invariant mass distributions to be made and reveals that there must be some isospin-one $\pi\pi$ production even for relatively low values of $M_{\pi\pi}$. Final results will be presented and discussed.

*Supported by the COSY-FFE programme.

HK 60.3 Fr 14:45 HZ 3

Antiproton Annihilation and Meson Production on Nuclei — •Stefanie Lourenço[1], Horst Lenske[1] und Slawomir Wycech[1,2] — [1]Institut für Theoretische Physik, Universität Gießen — [2]National Centre for Nuclear Studies, Hoza 69, 00-681, Warsaw, Poland

With the study of hadron and meson production in antinucleon-nucleus reactions a broad spectrum of final particle configurations and physics phenomena become accessible. Our approach is directed towards investigations of non-strangeness meson production and strangeness channels, ranging from elementary processes in antiproton-proton interactions and antiproton-nucleus collisions to the production of hypernuclei. We are investigating coherent meson production in antiproton-nucleus reactions, intended as exploratory studies for the PANDA experiment and, if realized at a later stage of FAIR, also for the nuclear structure-oriented AIC proposal. The underlying fundamental antinucleon-nucleon and meson-nucleon interactions enter into the optical potentials, which are folded with Hartree-Fock-Bogoliubov nuclear densities. Existing approaches to pion nucleus interactions have been extended to higher energies beyond the Δ-resonance. A phenomenological ansatz for the antinucleon-nucleon interaction, describing the whole energy range up to $p_{\mathrm{lab}} = 15$ GeV/c is presented. Cross sections are shown for the elementary processes and future experiments at FAIR.

Supported by DFG (Le439/8-2, Le439/7-1) and HIC for FAIR

HK 60.4 Fr 15:00 HZ 3

Correlation studies in the low energetic p(T=3.5 GeV) + Nb system — •Oliver Arnold for the HADES-Collaboration — Technische Universität München, Garching, Germany

In astrophysics, a technique was developed to determine the source size of stellar objects with a measurement of the correlation between photons which were emitted from this object. This HBT formalism named after their inventors Hanbury-Brown and Twiss was independently discovered in nuclear physics by Goldhaber et al. who measured an angular correlation for like-sign pion pairs. This discovery was the starting point to use the HBT technique in nuclear physics e.g. in the field of heavy ion physics to gain information about the excited matter state of large temperature and density created during the collision of the ions by measuring final state interactions of the produced particles.

We use the HBT technique to measure the correlation between protons which were produced in proton-niobium collisions and detected with HADES at a proton beam kinetic energy of 3.5 GeV. We compare the experimental correlation function with theoretical predictions from the Koonin model to extract the region of homogeneity. It also allows us to confront transport model simulations (UrQMD) with the HADES data to learn more about the emission dynamics of protons.

This work was supported by the Helmholtz fonds VH-NG-330 and the Excellence Cluster "Universe".

HK 60.5 Fr 15:15 HZ 3

Search for the kaonic bound state ppK^- in pp$\to pK^+\Lambda$* — •Robert Muenzer — Excellence Cluster Universe, TU-München, Boltzmannstrasse 2, D-85748 Garching

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). Such results are heavily discussed among the community since the description of the background needs a good knowledge of the underling production reaction in the reaction pp$\to pK^+\Lambda$.

We have measured the proton-proton reaction with a beam energy of 3.1 GeV at the FOPI Spectrometer at GSI-Darmstadt. At this experiment a set of around 1000 events of these exclusive reaction $pp \to pK^+\Lambda$ could be extracted.

This exclusive events were analysis with the Bonn Gatchina Partial Wave Analysis framework (3), which provides a solution including several resonant and non-resonant production mechanism and their interference. This description delivers a sufficient description of experimental data and a determination of possible contribution of ppK^-.

In this talk method of the background description via the PWA and the determination of an upper limit for the ppK^- will be presented.

(1) L. Fabbietti, J. Siebenson / arXiv:1208.0205
(2) T. Yamazaki, M. Maggiora, P. Kienle / PRL 104 / 132502 (2010)
(3) Sarantsev, A., Chin.Phys.,C33,1085-1092

*supported by Helmholz fonds VH-NG-330

HK 60.6 Fr 15:30 HZ 3

Exclusive Measurement of Resonance Productions associated with Strangeness in pp@3.5 GeV* — •Jia-Chii Berger-Chen for the HADES-Collaboration — TU München, Boltzmannstr. 2, 85748

Garching, Germany

A detailed understanding of p+p reactions has a great importance for the study of p+A and also heavy ion collisions, where with increased nuclear density in-medium modifications of hadrons are expected. For that reason exclusive cross sections and studies of exclusive kinematics in p+p reactions are necessary. Especially, the ability to distinguish resonant from non-resonant productions will help in the understanding of underlying kinematics. A dedicated analysis has been performed on the p+p data measured at 3.5 GeV with the HADES experiment (GSI, Darmstadt, Germany). We concentrate on the study of the reactions $p + p \rightarrow Y + p + \pi^+ + K^0$ (Y = Λ or Σ^0), in which an intermediate Δ^{++} resonance decaying into proton and π^+ might be produced. The strength of this analysis is the capability to decompose not only resonant and non-resonant reactions, but also reactions with a Λ from a Σ^0 in the final state. Especially because the reaction $p + p \rightarrow \Sigma^0 + \Delta^{++} + K^0$ has never been measured before. In this contribution the analysis procedure will be presented as well as the resulting cross sections and obtained kinematic distribtions.

* supported by BMBF, TUM Graduate School, Excellence Cluster "Universe" and Helmholtz VH-NG-330

HK 61: Nukleare Astrophysik

Zeit: Freitag 14:00–15:45 Raum: HZ 4

Gruppenbericht HK 61.1 Fr 14:00 HZ 4

Triaxiality as essential feature for electromagnetic strength, level density and neutron capture cross sections in heavy nuclei — •Eckart Grosse[2], Arnd R. Junghans[1], and Ralph Massarczyk[1,2] — [1]Institut für Strahlenphysik, Helmholtz Zentrum DD-Rossendorf, 01328 Dresden — [2]Institut für Kern- und Teilchenphysik, TU Dresden, 01069 Dresden

Reliable predictions for compound nuclear processes leading to nuclides outside the valley of stability are of importance for nuclear astrophysics as well as for the transmutation of nuclear waste. Assuming triaxiality in nearly all nuclei with A>70 a combined parameterization is presented for level density and photon strength. For the strength functions a fit to IVGDR shapes by the sum of three Lorentzians adding up to the TRK sum rule is used. Only two global fit-parameters are needed and a third one suffices to also describe level densities sufficiently well, if the significant collective enhancement due to the loss of axial symmetry is accounted for. Predicted level distances for the small spins reached by capture at the neutron threshold agree well to observations for more than 100 spin-0 target nuclei. Simultaneously derived neutron capture cross sections in the range of unresolved resonances are in accord to experimental findings as well as to Maxwellian averages (kT=30 keV) of neutron capture cross sections compiled recently for simulations of nuclear reactions in AGB-stars.

HK 61.2 Fr 14:30 HZ 4

Measurement of the ^{20}N(γ,n)^{19}N cross section by Coulomb dissociation — •Marko Röder[1,2], Daniel Bemmerer[1], Thomas E. Cowan[1,2], Zoltán Elekes[1,3], Tobias Reinhardt[2,1], Andreas Wagner[1], and Kai Zuber[2] for the R3B-Collaboration — [1]Helmholtz-Zentrum Dresden-Rossendorf (HZDR) — [2]Institut für Kern- und Teilchenphysik, Technische Universität Dresden — [3]MTA Atomki, Debrecen, Hungary

In the astrophysical r-process, many neutron-rich nuclei are involved. The reactions on these exotic nuclei can only be studied with radioactive ion beams. One example is the ^{19}N(n,γ)^{20}N reaction that is included in a neutrino-driven wind scenario. Using ^{20}N as a beam, this reaction was studied at the GSI Fragment Separator (FRS) in inverse kinematics via Coulomb dissociation in the S393-experiment. The relativistic neutrons were observed by the LAND-detector. I will give final results of the analysis, including the cross section of the ^{20}N(γ,n)^{19}N reaction, the γ-ray spectrum of excited ^{19}N from this reaction, and also some data on the ^{21}N(γ,n)^{20}N reaction.

— Supported by GSI F&E (DR-ZUBE), NupNET NEDENSAA (05 P09 CRFN5) and Plattform für Detektortechnologie und -systeme.

HK 61.3 Fr 14:45 HZ 4

Untersuchung der Reaktion ^{90}Zr(p,γ) mit In-beam Gammaspektroskopie — •Philipp Erbacher[1], Jan Glorius[1], Lars Netterdon[2], Anne Sauerwein[1], Kerstin Sonnabend[1], Benedikt Thomas[1] und Andreas Zilges[2] — [1]Institut für Angewandte Physik, Goethe Universität Frankfurt am Main — [2]Institut für Kernphysik - Universität zu Köln

Nach dem aktuellen Stand der Forschung wird der p-Kern ^{92}Mo zum größten Teil durch Photodesintegrationsreaktionen in Typ II Supernovae produziert. Netzwerkrechnungen zeigen jedoch, dass dieses Produktionszenario alleine nicht ausreicht, um die solare Häufigkeit von ^{92}Mo zu erklären. Als zusätzliches Produktionsszenario wurden daher Protoneneinfangreaktionen während Typ Ia Supernovae vorgeschlagen. Um diese Annahme zu überprüfen, ist eine genaue Kenntnis der relevanten Wirkungsquerschnitte notwendig. Aus diesem Grund wurde ein zu 97.65 % angereichertes ^{90}Zr-Target mit Protonen mit Energien von 2.5 MeV bis 5.1 MeV bestrahlt, um die Wirkungsquerschnitte der Reaktion in den Grundzustand und das Isomer von ^{91}Nb zu bestimmen. Die Messungen wurden am Horus-Spektrometer an der Universität zu Köln durchgeführt. In diesem Vortrag werden die vorläufigen Ergebnisse des Experiments vorgestellt.

gefördert durch DFG (SO907/2-1) und HIC for FAIR.

HK 61.4 Fr 15:00 HZ 4

Response functions of cold neutron matter: density, spin and current fluctuations — •Jochen Keller and Armen Sedrakian — Institut für Theoretische Physik, Goethe-Universität, Frankfurt am Main

We study the response of a single-component pair-correlated baryonic Fermi-liquid to density, spin, and their current perturbations. A complete set of response functions is calculated in the low-temperature regime. We derive the spectral functions of collective excitations associated with the density, density-current, spin, and spin-current perturbations. The dispersion relations of density and spin fluctuations are determined and it is shown that the density fluctuations lead to exciton-like undamped bound states, whereas the spin excitations correspond to diffusive modes above the pair-breaking threshold. The contribution of the collective pair-breaking modes to the specific heat of neutron matter at subnuclear densities is computed and is shown to be comparable to that of the degenerate electron gas at not too low temperatures.

HK 61.5 Fr 15:15 HZ 4

Nucleosynthesis of Molybdenum in neutrino-driven winds — •Julia Bliss[1] and Almudena Arcones[1,2] — [1]Institut für Kernphysik, TU Darmstadt — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH

Neutrino-driven winds that follow core-collapse supernovae are an exciting astrophysical site for the production of heavy elements. For a long time it has been thought that the neutrino-driven winds could be the host for the r-process, but recent hydrodynamical simulations show that the conditions are not sufficient neutron rich. Nonetheless, lighter heavy elements between Sr and Ag can be produced in neutrino-driven winds. Among these elements, Mo has raised attention since various astrophysical scenarios failed to reproduce the solar abundance ratio of $Y(^{92}\mathrm{Mo})/Y(^{94}\mathrm{Mo})$. Moreover, available data of SiC X-grains present different isotopic ratios than in the solar system. We have done a systematic nucleosynthesis study to identify the necessary conditions to reproduce the observed Mo isotopic ratios based on neutrino-driven winds.

HK 61.6 Fr 15:30 HZ 4

Proton-induced reactions on naturally composed zirconium — •Anne Sauerwein[1], Philipp Erbacher[1], Jan Glorius[1], Joachim Görres[1], Kerstin Sonnabend[1], Edward Stech[2], and Michael Wiescher[2] — [1]Institut für Angewandte Physik, Goethe Universität Frankfurt am Main, Germany — [2]Institute for Structure and Nuclear Astrophysics (ISNAP), University of Notre Dame, Indiana, USA and Joint Institute of Nuclear Astrophysics

Most reaction rates for the so-called p process, which produces the p nuclei, are adopted from Hauser-Feshbach-model (HFM) calculations. In order to improve the accuracy of theoretically predicted reaction rates, an improvement of its nuclear physics input is required. For this

reason naturally composed zirconium was bombarded with protons at energies between 2 MeV and 10 MeV in order to determine cross sections of seven (p,γ) and (p,n) reactions using the activation technique. The irradiations and the γ-ray spectroscopy took place at the ISNAP of the University of Notre Dame, USA. These measurements allow systematic investigations of the proton-optical model potentials, an important input of the HFM, from the neutron closed-shell isotope ^{90}Zr to the double subshell-closed isotope ^{96}Zr. In this contribution we present our preliminary results.

Supported by DFG (SO907/2-1) and HIC for FAIR.

HK 62: Nukleare Astrophysik

Zeit: Freitag 14:00–15:45 Raum: HZ 5

Gruppenbericht HK 62.1 Fr 14:00 HZ 5

Charged-particle induced reaction studies for the astrophysical γ process — •Lars Netterdon[1], Martin Baldenhofer[1], Jan Mayer[1], Anne Sauerwein[2], Philipp Scholz[1], and Andreas Zilges[1] — [1]Institute for Nuclear Physics, University of Cologne — [2]Institute for Applied Physics, Goethe University Frankfurt am Main

About 35 neutron-deficient nuclei, referred to as *p* nuclei, are bypassed by the *s* and *r* process. The majority of these nuclei is believed to be produced by photodisintegration reactions and subsequent β decays during the γ process. Reaction rates for the γ-process reaction network are mainly predicted by statistical model calculations as experimental data are scarce. In order to reduce the uncertainties in these calculations from the nuclear physics side, the input parameters entering the calculations, such as optical-model potentials and the γ-strength function, must be constrained experimentally. In this talk, an overview of experiments aiming at these input parameters performed at the Institute for Nuclear Physics in Cologne will be given. This includes α-induced reactions on ^{168}Yb [1] and the ^{130}Ba(p,γ) reaction using the activation technique. Moreover, a dedicated setup for in-beam nuclear astrophysics experiments utilizing the high-efficiency HPGe-detector array HORUS will be presented in detail. Total and partial cross-section results of the ^{89}Y(p,γ) reaction and first results of experiments on the ^{85}Rb(p,γ) and ^{112}Sn(α,γ) reactions are shown.
Partly supported by the DFG (ZI 510/5-1 and INST 216/544-1).
[1] L. Netterdon *et al.*, Nucl. Phys. A **916** (2013) 149

HK 62.2 Fr 14:30 HZ 5

Effects of the nuclear symmetry energy in core-collapse supernovae — •Matthias Hempel[1], Tobias Fischer[2], Matthias Liebendörfer[1], Jürgen Schaffner-Bielich[3], and Friedrich-Karl Thielemann[1] — [1]Universität Basel, Schweiz — [2]University of Wroclaw, Poland — [3]Universität Frankfurt

The nuclear symmetry energy is known to be an important quantity of the equation of state (EOS) of dense matter. In this presentation we analyze its effect in core-collapse supernovae by means of hydrodynamical simulations with detailed neutrino transport. We consider a representative selection of supernova EOS which we have developed recently, and compare their characteristic properties with experimental constraints. Besides effects on the supernova dynamics, we study implications on nucleosynthesis conditions in the so-called wind phase. Regarding the latter, we can conclude that the current constraints seem to allow only slightly neutron-rich conditions which would not result in a full r-process.

HK 62.3 Fr 14:45 HZ 5

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

Recent research has shown that the (n,γ) transition-rates on light nuclei can have an influence on the neutron-balance during the r-process. Especially neutron rich carbon isotopes play an important role in r-process nucleo synthesis network calculations which include light nuclei, since these nuclei are aligned along major flow-paths. In particular ^{18}C is of interest, because it can be interpreted as a waiting point. The ^{17}C(n,γ)^{18}C rate could so far only be estimated theoretically and has an uncertainty of a factor of ten [1]. At the R^{3}B-CaveC setup at GSI we have measured the (n,γ) time reversed reaction, i.e. ^{18}C(γ,n)^{17}C for the above mentioned nucleus, via the Coulomb-breakup of ^{18}C beam. The kinematically complete measurement allows extracting energy dependent neutron-capture cross section with respect to the excitation energy by using the invariant-mass method. Experimental results will be presented in comparison to theoretical calculations. This work is supported by BMBF, HIC for FAIR and NAVI
[1] T. Sasaqui et al., APJ 634 (2005) 1173

HK 62.4 Fr 15:00 HZ 5

Broken Superfluid in Dense Quark Matter — •Denis Parganlija[1], Andreas Schmitt[1], and Mark Alford[2] — [1]Institut für Theoretische Physik, Technische Universität Wien, 1040 Vienna, Austria — [2]Department of Physics, Washington University St Louis, MO, 63130, USA

Quark matter at high densities is a superfluid. Properties of the superfluid become highly non-trivial if the effects of strange-quark mass and the weak interactions are considered. These properties are relevant for a microspic description of compact stars.
We discuss the effect of a (small) explicitly symmetry-breaking term on the properties of a zero-temperature superfluid in a relativistic ϕ^4 theory. If the U(1) symmetry is exact, chemical potential and superflow can be equivalently introduced either via (1) a background gauge field or (2) a topologically nontrivial mode. However, in the case of the explicitly broken symmetry, we demonstrate that the scenarios (1) and (2) lead to quantitatively different results for the mass of the pseudo-Goldstone mode and the critical velocity for superfluidity.

HK 62.5 Fr 15:15 HZ 5

Important measurements using reactor technique in order to constrain the s-Process path — •Tanja Heftrich[1], Sebastian Altstadt[1], Jan Glorius[1], Kathrin Göbel[1], Michael Heftrich[1], Franz Käppeler[2], Claudia Lederer[1], Marcus Mikorski[1], Ralf Plag[1], Rene Reifarth[1], Stefan Schmidt[1], Zuzana Slavkovska[1], Kerstin Sonnabend[1], Christian Stieghorst[3], Mario Weigand[1], Norbert Wiehl[3], and Stephan Zauner[3] — [1]Goethe University Frankfurt, Germany — [2]KIT, Germany — [3]University of Mainz, Germany

About half of the heavy elements from iron to bismuth are synthesized during s process (slow neutron capture process) by a sequence of neutron captures and β-decays. The involved β-decay times are usually shorter than the competitive neutron capture times. The resulting s process path runs along the neutron-rich side of the valley of stability in the nuclear chart. An experimental determination of the involved neutron capture cross sections and half-lives is highly desired to reproduce the elemental abundances. Long-lived radioactive isotopes can be produced in reactor activation experiments to determine the β-decay half-lives. As shown at the example of ^{60}Fe, the half-lives times of such isotopes might be more uncertain than currently estimated. An independent investigation is therefore highly desirable. We will present first measurements, and future opportunities for half-live measurements in reactor activation experiments. This project was supported by the HGS-HIRe, the HIC for FAIR, the HGF Young Investigator Project VH-NG-327 and the DFG SO907/2-1.

HK 62.6 Fr 15:30 HZ 5

Simulations of Electron Capture Supernovae with Approximate Neutrino Transport — •Heiko Möller[1], Tobias Fischer[2], Sam Jones[3], and Gabriel Martínez-Pinedo[1,4] — [1]TU Darmstadt — [2]University of Wrocław — [3]Keele University — [4]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt

We have performed simulations of electron capture supernovae in a spherically symmetric general relativistic radiation hydrodynamics model with approximate neutrino treatment. We base our study on an $8.8 M_\odot$ O-Ne-Mg core progenitor (Nomoto, 1984, 1987). We successfully obtain an explosion and compare our results with a reference run performed with an state-of-the-art three-flavor Boltzmann neutrino transport scheme implemented into the same hydrodynamic code. In general, we find good agreement in the the electron-flavor neutrino spectra. However, we find shorter explosion timescales and also significantly lower explosion energies of only $1.4 \cdot 10^{48}$ erg. This result is in agreement with the explosion energy of SN 2008S as derived by Tominaga et al. (2013) based on light curve studies.

Currently we are extending our simulations to the recently published

super-AGB star progenitor models by Jones et al. (2013) with regard to their evolution towards an electron capture supernova.

Our study also explores the role of weak interaction rates in determining the evolution and shaping the spectra of the emitted neutrinos.

Heiko Möller is member of the HGS-HIRe Graduate School. This work is supported by the Deutsche Forschungsgemeinschaft through contract SFB 634.

HK 63: Schwerionenkollisionen und QCD Phasen

Zeit: Freitag 14:00–16:00 Raum: HZ 6

HK 63.1 Fr 14:00 HZ 6

Production of hypernuclei from excited nuclear residues in relativistic ion collisions — •Alexander Botvina[1], Marcus Bleicher[1], and Josef Pochodzalla[2] — [1]FIAS, J.W.Goethe University, Frankfurt/Main — [2]IKP, J.Gutenberg University, Mainz

Within dynamical and statistical theories we study the main regularities in the production of hypernuclei emerging from the projectile and target residues in relativistic ion collisions. We demonstrate that the yields of hypernuclei increase considerably at beam energies above the energy threshold for Lambda hyperons, followed by a saturation for yields of hypernuclei with increasing the beam energy up to few TeV [1]. These hypernuclei have a broad distribution in masses and isospin. They can even reach beyond the neutron and proton drip-lines since they are stable with respect to nucleon emission [2]. Weak decay of such hypernuclei may lead to formation of normal nuclei beyond the drip-lines also, thus providing a unique chance for reaching island of stability on the nuclear chart. The production of specific hypernuclei depend strongly on the isotopic composition of the projectile, therefore, there is an opportunity to obtain exotic hypernuclei that may be difficult to reach in traditional hypernuclear experiments [1]. The perspectives of hypernuclear studies involving these novel processes at the future FAIR facility are discussed.

[1] A.S. Botvina, K.K. Gudima, and J. Pochodzalla, Phys. Rev. C88, 054605 (2013).

[2] N. Buyukcizmeci, A.S. Botvina, J. Pochodzalla, and M. Bleicher, Phys. Rev. C88, 014611 (2013).

HK 63.2 Fr 14:15 HZ 6

Search for the Ξ^0-p bound state in $\sqrt{s_{\rm NN}}$ = 2.76 TeV Pb–Pb collisions with ALICE at the LHC — •Joachim Tscheuschner for the ALICE-Collaboration — Research Division and ExtreMe Matter Institute, GSI Helmholtzzentrum für Schwerionenforschung, Planckstr. 1, 64291 Darmstadt — Institut für Kernphysik, Technische Universität Darmstadt, Schlossgrabenstr. 9, 64289 Darmstadt

Dibaryons, bound states of two baryons, have been predicted for a long time. However, despite the effort on the experimental side, none has been found yet, the deuteron being the only one known. Confirming their existence would give an insight into the interaction among baryons. At LHC energies they should have higher production probability since baryons are abundantly produced and the ALICE apparatus, with its excellent particle identification and vertexing capabilities, is particularly suited to the search of these unstable states. In this contribution the ongoing investigation of the Ξ^0-p dibaryon in Pb–Pb collisions at $\sqrt{s_{\rm NN}}$ = 2.76 TeV is presented. It is predicted to weakly decay mainly in Λ+p. This decay, with $\Lambda \rightarrow \pi^- + \mathrm{p}$, has a topology similar to the one of the multi-strange baryons already measured by the ALICE Collaboration.

HK 63.3 Fr 14:30 HZ 6

Search for the Λn bound state and the H-dibayron in $\sqrt{s_{\rm NN}}$ = 2.76 TeV Pb–Pb collisions with ALICE at the LHC — •Nicole Martin for the ALICE-Collaboration — Research Division and ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung, Planckstr. 1, 64291 Darmstadt — Institut für Kernphysik, Technische Universität Darmstadt, Schlossgrabenstr. 9, 64289 Darmstadt

ALICE is the experiment at the CERN LHC dedicated to the investigation of nucleus–nucleus collisions at the highest energies ever reached in the laboratory. The excellent particle identification capabilities and the ultralow momentum reach of ALICE allow for the reconstruction of a significant number of rare states or even exotic ones. In this talk we present results from a sample of Pb–Pb collisions at $\sqrt{s_{\rm NN}}$ = 2.76 TeV. Particles as well as the corresponding anti-particles have been identified based on their specific energy loss in the Time Projection Chamber and velocity information from the Time-Of-Flight detector. The Inner Tracking System allows a precise determination of the collision vertex. Therefore primary and secondary particles can be well separated. This helps for example in the search for lighter exotic hyper-matter states, i.e. Λ-Λ (also known as H-dibaryon) and Λn bound states. We present here the search for a possible Λn bound state decaying into a deuteron and a pion and for the H-dibaryon decaying into Λ, proton and pion. The results are compared with model calculations.

HK 63.4 Fr 14:45 HZ 6

Proton-Lambda Correlations in Pb-Pb Collisions at $\sqrt{s_{\rm NN}}$ = 2.76 TeV with ALICE — •Hans Beck for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

Femtoscopic two-particle correlations carry important information about the particle emitting source. Of particular interest is the $m_{\rm T}$ dependence of the extracted source radii, which is introduced by the dynamics of the system created in heavy-ion collisions. The reach in $m_{\rm T}$ of the traditional pion-pion correlation measurements is limited by the small rest mass of the examined particles. Thus, it can be extended with the analysis of pairs of heavier particles, e.g. proton-lambda pairs, being the heaviest system for which source sizes can so far be extracted.

The excellent PID capabilities of ALICE allow to obtain lambda and proton samples with very high purities. The measured proton-lambda correlation functions are affected by feed-down due to weak decays of higher mass baryons. Using data-driven methods, a corresponding correction is applied to the data. This allows to extract radius parameters in several centrality classes and $m_{\rm T}$ intervals at larger $m_{\rm T}$ with high precision.

Supported by BMBF and the Helmholtz Association.

HK 63.5 Fr 15:00 HZ 6

Short-lived particles reconstruction with KF Particle Finder for the CBM experiment — Ivan Kisel[1,2,3], Iouri Vassiliev[3], and •Maksym Zyzak[1,2,3] for the CBM-Collaboration — [1]Goethe-Universität Frankfurt am Main — [2]Frankfurt Institute for Advanced Studies — [3]GSI Helmholtzzentrum fur Schwerionenforschung GmbH

The CBM experiment is being designed to operate at extreme interaction rate up to 10^7 Hz. Due to the complicated triggering the full online event reconstruction is required.

The KF Particle Finder package is being developed for the online reconstruction and selection of short-lived particles. The package reconstructs about 50 particles including strange mesons, hyperons, charmed particles, low mass vector mesons, strange and charmed resonances. The Au+Au collisions with energies from 4 to 35 AGeV were investigated with realistic detector simulation. The package shows high reconstruction efficiency. For example, for K^0_s and Λ particles it is about 20%.

Since the speed is of particular importance for online reconstruction, the package was vectorized and parallelized. KF Particle Finder shows linear scalability with respect to the number of cores. The processing time for one mbias Au+Au event at 25 AGeV is about 1.5 ms per core.

Supported by EU-FP7 HadronPhysics3, HIC for FAIR, HGS-HIRe for FAIR and Hessischen Ministerium fuer Wissenschaft und Kunst

HK 63.6 Fr 15:15 HZ 6

Fast reconstruction of multi-strange hyperons in the CBM experiment — •Iouri Vassiliev[1], Ivan Kisel[1,2], and Maxim Zyzak[1,2,3] for the CBM-Collaboration — [1]GSI, Helmholtzzentrum für Schwerionenforschung Darmstadt, Germany — [2]Institute for Advanced Studies, Frankfurt am Main, Germany — [3]Goethe University Frankfurt am Main, 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, charmonium and low mass vector mesons in the environment of a heavy-ion collision. This task requires fast and efficient track reconstruction algorithms, primary vertex finder and particles finder. Results of feasibility studies of the multi-strange hyperons in the CBM experiment will be presented.

HK 63.7 Fr 15:30 HZ 6

Untersuchung der Multiplizität charakteristischer Röntgenstrahlung nach Fusionsprozessen schwerer Kerne mit dem MINIBALL Spektrometer — •Sebastian Reichert, Dennis Muecher und Walter Henning — TU Muenchen, Physik Department E12, Deutschland

Die Identifikation schwerer und super schwerer Kerne nach Fusion mittels Recoil Spektroskopie ist ein probates Mittel, das bei zunehmend geringeren Wirkungsquerschnitten der Fusionsprodukte und der sehr geringen Statistik an ihre Grenzen stoesst. Eine bisher wenig genutzte Art einer zusaetzlichen Identifikationsmoeglichkeit bietet die Messung der charakteristischen Roentgenstrahlung waehrend der Abregung des Evaporation Residues, die nach einer internen Konversion auftritt. Im Gegensatz zu den Uebergangslinien ist diese sehr gut berechenbar. Dieser Vortrag stellt eine Masterarbeit vor, in der eine (grobe) theoretische Vorhersage ueber die Haeufigkeit des Auftretens der internen Konversion getroffen wird. Am MINIBALL-Setup am Maier Leibnitz Laboratorium wurden Multiplizitaeten mittelschwerer Kerne auf Basis verschiedener Analysemethoden bestimmt. Die Unterdrueckung des Untergrunds fuer schwere Kerne war ein weiterer Teil und wurde als Vorarbeit fuer anstehende Experimente am RIKEN gesehen.

HK 63.8 Fr 15:45 HZ 6

What happens actually in multinucleon transfer reactions ? — Geneviève Mouze and •Christian Ythier — Faculté des Sciences,Université de Nice, 06108 Nice cedex 2,France

In the 90Zr + 208Pb reaction at 560 MeV identical Gaussian isotopic distributions having a width of 2.5 u are observed for products of Z comprised between 40 and 32 [1]: Are they really due to a multineutron pick-up process accompanying any proton stripping, as believed today [2] ? In fact they are distributions of the neutron number N of the product around its most probable value: This uncertainty in N results from the lifetime of only 0.17 yoctosecond of a new state of nuclear matter, which has been also found in the fission reaction[3]. Interestingly, the new state is characterized by the disappearance of any proton charge and might be triggered, in fission, by a combined shifting of the proton phase against the neutron phase of ordinary matter: It may be asked whether this state is triggered, in transfer reactions, by the crossing of the Coulomb barrier, at which any proton charge should logically disappear. [1] C.A. Ur et al., Fusion 06,A.I.P., vol.853 (2006) p.43. [2] G. Pollarolo, Fusion 06,A.I.P., vol.853 (2006) p.29. [3] G. Mouze et al., http://arxiv.org/abs/1004.1337

HK 64: Instrumentierung

Zeit: Freitag 14:00–16:00 Raum: HZ 9

HK 64.1 Fr 14:00 HZ 9

The Influence of Additional Semiconductor Discs on the Reconstruction of $\overline{\Lambda}\Lambda$ in the $\overline{\mathrm{P}}$ANDA Experiment — •Simone Esch, Tobias Stockmanns, and James Ritman for the PANDA-Collaboration — IKP, Forschungszentrum Jülich

The $\overline{\mathrm{P}}$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 $\overline{\mathrm{p}}$p annihilation with intense, phase space cooled beams with momenta between 1.5 and 15 GeV/c. $\overline{\mathrm{P}}$ANDA is able to measure a wide range of charmed and strange hyperons to study the dynamic of quark pair creation and hadronization. Plans exist to enlarge the acceptance of the $\overline{\mathrm{P}}$ANDA Micro Vertex Detector in beam direction by adding two additional semiconductor discs to improve the detection of long living particles like hyperons. As a first test of these disks a simulation has been done of the physics process $\overline{\mathrm{p}}\mathrm{p} \rightarrow \overline{\Lambda}\Lambda \rightarrow \overline{\mathrm{p}}\pi^{+}\mathrm{p}\pi^{-}$

A comparison of the reconstruction of this channel with and without the additional disks will be presented.

HK 64.2 Fr 14:15 HZ 9

Employing the CBM Micro Vertex Detector for background rejection in dilepton analyses — •Erik Krebs for the CBM-Collaboration — Goethe-Universität Frankfurt

The light vector mesons ρ, ω and ϕ are known to be excellent probes of the processes taking place in violent heavy-ion collisions. The leptonic decay channels of these mesons are of special interest as the leptons leave the hot and dense fireball without further interaction and may reveal information on the characteristics of the matter created in the collisions. However, electrons and positrons from γ-conversions and Dalitz decays of π^0 are the main contributors to a large combinatorial background obscuring the information carried by the dileptons.

The Micro-Vertex Detector (MVD) of the Compressed Baryonic Matter (CBM) experiment may contribute to reduce this background by employing two methods. The excellent position resolution of the MVD and its proximity to the target gives a chance to reject close pairs by measuring the distance between nearest hits. A specific field configuration will be required for this approach. A second approach is to reconstruct the low momentum partner of a conversion electron in the MVD.

*This work has been supported by BMBF (05P12RFFC7), HIC for FAIR, H-QM and GSI.

HK 64.3 Fr 14:30 HZ 9

Development of a CO_2 Cooling System for the CBM Silicon Tracking System — •Jorge Sanchez Rosado for the CBM-Collaboration — GSI Helmholtzzentrum, Darmstadt

The Silicon Tracking System (STS) is the central detector system of the Compressed Baryonic Matter experiment (CBM) at FAIR. Its 2,5 million channel read-out electronics will dissipate ∼40 kW in a confined volume of 2 m^3.

A two phase (evaporative) CO_2 cooling system is taken as the first choice to extract the dissipated heat fulfilling the requirements such as reduction of mass budget and the use of smaller diameter for cooling pipes. The 2-Phase Accumulator Controlled Loop (2PACL) concept conceived at NIKHEF is the ideal method due to its stability and the only need of passive components inside the detector volume.

A 1 kW prototype plant is shown which is being assembled presently at GSI and will go into operation in summer 2014.

Supported by EU-FP7 HadronPhysics3 and CRISP.

HK 64.4 Fr 14:45 HZ 9

Development of radiation tolerant microstrip sensors for the CBM Silicon Tracking System — •Minni Singla for the CBM-Collaboration — Goethe Universität Frankfurt

The Silicon Tracking System (STS) is the central detector system of the Compressed Baryonic Matter experiment (CBM) at FAIR investigating the phase diagram of strongly interacting matter in nucleus-nucleus collisions with collision rates up to 10 MHz. The extreme interaction rates require radiation tolerant detector components. An overview of the development of radiation tolerant STS microstrip prototype sensors will be presented including test results for irradiated sensors. For this purpose the prototype sensors had been irradiated at the TRIGA nuclear reactor of the University of Ljubljana. Besides the static measurements, the charge collection efficiency of these irradiated sensors was measured. Additionally a controlled thermal annealing of the sensors has been performed to extract the beneficial and reverse annealing time constants which will help to develop an operational scenario for the STS.

Supported by EU-FP7 HadronPhysics3, HIC for FAIR, HGS-HIRe and H-QM.

HK 64.5 Fr 15:00 HZ 9

Commissioning of the recoil detector for the day-one experiment at HESR with pp elastic scattering at COSY — •Huagen Xu — Forschungszentrum Juelich

The conceptual design of the luminosity monitor for the PANDA experiment is based on measuring the differential elastic antiproton-proton scattering rate by 4 planes of HV-MAPS tracking detector. The ab-

solute precision is limited by the lack of existing data in the relevant momentum region. Therefore, the so-called Day-One experiment at HESR will measure antiproton-proton elastic scattering. 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. In order to test the method proposed for the Day-One experiment one of the recoil arms has been designed and built. The commissioning of the recoil arm by measuring proton-proton elastic scattering has been performed at COSY in July and September of 2013. The preliminary results of the commissioning will be presented.

HK 64.6 Fr 15:15 HZ 9

Performance Test and Commissioning of Recoil Detectors of HESR Day-One Experiment — •QIANG HU[1,2], HUAGEN XU[2], and JAMES RITMAN[2] — [1]Institute of Modern Physics, CAS, 730000 Lanzhou, China — [2]Forschungszentrum Juelich, 52425 Juelich, Germany

The proposed Day-One experiment at HESR is to measure antiproton-proton elastic scattering in a large range of four momentum transfer squared t (0.0008 - 0.1 GeV^2). One goal of the experiment is to determine the elastic differential parameters, i.e. σ_T, ρ and b. The elastic scattered antiproton and recoil proton will be measured by tracking detectors in the forward angle region and by recoil detectors near θ=90°, respectively. The recoil detectors consist of two silicon detectors and two germanium detectors which cover a polar angle from 71° to 91.5°. All detectors are single-sided structure with 1.2 mm pitch on the front side. The two silicon detectors have the same dimensions, 76.8 mm × 50.0 mm × 1.0 mm. The two germanium detectors have the same sensitive area but different thickness, 80.4 mm × 50.0 mm × 5.0 (11.0) mm.

After assembling and system tests in the laboratory with radioactive source ^{244}Cm, the detector system has been installed into COSY ring. The commissioning experiments by using proton beam has been performed in 2013. Data of proton-proton elastic scattering has been taken at several momenta. Preliminary data analysis indicate that the recoil detectors are working as good as expected. The latest results will be presented.

HK 64.7 Fr 15:30 HZ 9

Development of a Compton camera for online ion beam range verification via prompt γ detection * — •SAAD ALDAWOOD[1,2], CHRISTIAN LANG[1], HUGH VAN DER KOLFF[1,3], LUDWIG MAIER[4], RUDOLF LUTTER[1], JONATHAN BORTFELDT[1], KATIA PARODI[1], and PETER G. THIROLF[1] — [1]Ludwig-Maximilians-Universität München, Germany — [2]King Saud University, Riyadh, Saudi Arabia — [3]Delft University of Technology, The Netherlands — [4]Technische Universität München, Germany

Precise and preferablly online ion beam range verification is a mandatory prerequisite to fully exploit the advantages of hadron-therapy in cancer treatment. Our aim is to develop an imaging system based on a Compton camera designed to detect prompt γ rays induced by nuclear reactions between ion beam and biological tissue. The Compton camera prototype consists of a stack of double-sided Si-strip detectors (DSSSD) acting as scatterers, while the absorber is formed by a $LaBr_3$ scintillator crystal read out by a position-sensitive multi-anode photomultiplier. The $LaBr_3$ detector was characterized with both absorptive and reflective side-face wrapping materials. Comparative studies of energy and time resolution, photopeak detection efficiency and spatial resolution will be presented together with first tests of the complete camera system.

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

HK 64.8 Fr 15:45 HZ 9

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

The beam detector for experiments with pion beams at the HADES spectrometer in GSI Darmstadt has been developed. The main goal of this development is to provide efficient event by event reconstruction of secondary pion momenta. Pions are created impacting nitrogen or proton beams on a secondary beryllium target and are then delivered through a chicane to the experimental areas. The expected momentum spread of the secondary pion beam is about 8% whereas simulated resolution of reconstructed momenta is below 0.5%.

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

The tracking system is based on double-sided silicon strips sensors build in radiation hardness technology, and a n-XYTER ASIC front-end readout. The trigger logic is implemented in the TRB3 boards. The whole system is designed as a standalone, easy scalable and portable.

In this talk we are showing status and performance of the system, and recent results obtained in the laboratory and with proton beams at COSY with 2 GeV protons.

This work is supported by Helmholtz VH-NG-330.