Fachverband Physik der Hadronen und Kerne (HK)

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Übersicht der Hauptvorträge und Fachsitzungen

(Hörsäle Audimax, Audimax H1; HZO 50, 60, 70, 80, 90 und 100; Poster Audimax Foyer)

Plenarvorträge

PV I	Mo	11:15–12:00	Audimax	**Neutron-rich nuclei: recent in-beam gamma spectroscopy results from the RIBF** — •Alexandre Obertelli
PV II	Mo	12:00–12:45	Audimax	**Demystifying the Quark-Gluon Plasma** — •Ante Bilandzic
PV III	Di	9:00– 9:45	Audimax	**Accelerator Challenges of FAIR Phase 0** — •Mei Bai
PV IV	Di	9:45–10:30	Audimax	**Beta-detected NMR: radionuclides as probes in biophysics and biochemistry** — •Magdalena Kowalska
PV V	Mi	20:00–21:00	HZO 40	**Fusionsreaktionen – Die Energiequelle der Sonne und der Sterne auf der Erde nutzen** — •Sibylle Günter
PV VI	Do	9:00– 9:45	Audimax	**Neutron star mergers and the begin of multi-messenger astrophysics** — •Stephan Rosswog
PV VII	Do	9:45–10:30	Audimax	**An Improved Value of the Atomic Mass of the Proton** — •Florian Köhler-Langes
PV VIII	Fr	9:00– 9:45	Audimax	**Flow and fluctuations in high energy nuclear collisions** — •Stefan Floerchinger
PV IX	Fr	9:45–10:30	Audimax	**COMPASS: Unravelling light-flavour QCD** — •Jan Friedrich

Hauptvorträge

HK 15.1	Di	11:00–11:30	Audimax	**Lattice QCD calculations and the muon anomalous magnetic moment** — •Antoine Gerardin
HK 15.2	Di	11:30–12:00	Audimax	**Wie identifiziert man QCD-Exoten?** — •Malte Albrecht
HK 15.3	Di	12:00–12:30	Audimax	**Beta and double-beta decays within an effective theory** — •Eduardo Coello Pérez
HK 44.1	Do	11:00–11:30	Audimax	**Probing the quark-gluon plasma in ultrarelativistic heavy-ion collisions** — •Alice Ohlson
HK 44.2	Do	11:30–12:00	Audimax	**Transverse momentum dependent (TMD) factorization: status and progress** — •Alexey Vladimirov
HK 44.3	Do	12:00–12:30	Audimax	**Measuring the free neutron lifetime with ultracold neutrons at TRIGA Mainz** — •Dieter Ries
HK 54.1	Fr	11:00–11:30	Audimax	**The Origin of the Elements: Studying Stellar Reactions in the Laboratory** — •Claudia Lederer-Woods
HK 54.2	Fr	11:30–12:00	Audimax	**Accelerator mass spectrometry for a wide range of applications: from climate studies to geology and nuclear astrophysics** — •Markus Schiffer
HK 54.3	Fr	12:00–12:30	Audimax	**New Phenomena in Gamma-Ray Strength Functions** — •Ronald Schwengner

Hauptvorträge des fachübergreifenden Symposiums SYCC

Das vollständige Programm dieses Symposiums ist unter SYCC aufgeführt.

SYCC 1.1	Mi	9:00– 9:05	Audimax	**Introductory remarks** — •Evgeny Epelbaum, Stephan Paul
SYCC 1.2	Mi	9:05– 9:50	Audimax	**Understanding the structure of the proton through large-scale simulations** — •Constantia Alexandrou
SYCC 1.3	Mi	9:50–10:35	Audimax	**The quest for light exotic hadrons** — •Bernhard Ketzer
SYCC 2.1	Mi	11:00–11:45	Audimax	**Exotic hadrons with heavy quarks** — •Tomasz Skwarnicki
SYCC 2.2	Mi	11:45–12:30	Audimax	**Towards a new paradigm in hadron spectroscopy** — •Ulf-G. Meissner

Fachsitzungen

HK 1.1–1.7	Mo	14:00–16:00	HZO 50	**Hadron Structure and Spectroscopy I**
HK 2.1–2.7	Mo	14:00–16:00	HZO 60	**Heavy Ion Collisions and QCD Phases I**
HK 3.1–3.7	Mo	14:00–16:00	HZO 70	**Structure and Dynamics of Nuclei I**
HK 4.1–4.7	Mo	14:00–16:00	HZO 100	**Nuclear Astrophysics I**
HK 5.1–5.5	Mo	14:00–15:30	Audimax H1	**Instrumentation I**
HK 6.1–6.4	Mo	14:00–15:15	HZO 80	**Instrumentation II**
HK 7.1–7.5	Mo	14:00–15:30	HZO 90	**Instrumentation III**
HK 8.1–8.7	Mo	16:30–18:30	HZO 50	**Hadron Structure and Spectroscopy II**
HK 9.1–9.7	Mo	16:30–18:30	HZO 60	**Heavy Ion Collisions and QCD Phases II**
HK 10.1–10.6	Mo	16:30–18:15	HZO 70	**Structure and Dynamics of Nuclei II**
HK 11.1–11.6	Mo	16:30–18:15	HZO 100	**Fundamental Symmetries I**
HK 12.1–12.7	Mo	16:30–18:30	Audimax H1	**Instrumentation IV**
HK 13.1–13.7	Mo	16:30–18:30	HZO 80	**Instrumentation V**
HK 14.1–14.4	Mo	16:30–18:00	HZO 90	**Instrumentation VI**
HK 15.1–15.3	Di	11:00–12:30	Audimax	**Hauptvorträge I**
HK 16.1–16.7	Di	14:00–16:00	HZO 50	**Hadron Structure and Spectroscopy III**
HK 17.1–17.6	Di	14:00–15:45	HZO 60	**Heavy Ion Collisions and QCD Phases III**
HK 18.1–18.7	Di	14:00–16:00	HZO 70	**Structure and Dynamics of Nuclei III**
HK 19.1–19.5	Di	14:00–15:30	HZO 100	**Nuclear Astrophysics II**
HK 20.1–20.7	Di	14:00–16:00	HZO 80	**Instrumentation VII**
HK 21.1–21.5	Di	14:00–15:30	HZO 90	**Instrumentation VIII**
HK 22.1–22.7	Di	16:30–18:30	HZO 50	**Hadron Structure and Spectroscopy IV**
HK 23.1–23.7	Di	16:30–18:30	HZO 60	**Heavy Ion Collisions and QCD Phases IV**
HK 24.1–24.7	Di	16:30–18:30	HZO 70	**Structure and Dynamics of Nuclei IV**
HK 25.1–25.4	Di	16:30–17:45	HZO 80	**Structure and Dynamics of Nuclei V**
HK 26.1–26.5	Di	16:30–18:30	HZO 100	**Astroparticle Physics I**
HK 27.1–27.6	Di	16:30–18:30	Audimax H1	**Instrumentation IX**
HK 28.1–28.7	Di	16:30–18:15	HZO 90	**Instrumentation X**
HK 29	Di	19:00–20:00	HZO 50	**Jahrestreffen junger Wissenschaftler (yHEP, young High Energy Physicist association)**
HK 30.1–30.7	Mi	14:00–16:00	HZO 50	**Hadron Structure and Spectroscopy V**
HK 31.1–31.6	Mi	14:00–15:45	HZO 60	**Heavy Ion Collisions and QCD Phases V**
HK 32.1–32.8	Mi	14:00–16:00	HZO 70	**Structure and Dynamics of Nuclei VI**
HK 33.1–33.6	Mi	14:00–15:45	HZO 80	**Structure and Dynamics of Nuclei VII**
HK 34.1–34.6	Mi	14:00–15:45	HZO 100	**Nuclear Astrophysics III**
HK 35.1–35.8	Mi	14:00–16:00	Audimax H1	**Instrumentation XI**
HK 36.1–36.8	Mi	14:00–16:00	HZO 90	**Instrumentation XII**
HK 37.1–37.7	Mi	16:30–18:30	HZO 50	**Hadron Structure and Spectroscopy VI**
HK 38.1–38.5	Mi	16:30–18:00	HZO 80	**Hadron Structure and Spectroscopy VII**
HK 39.1–39.6	Mi	16:30–18:15	HZO 60	**Heavy Ion Collisions and QCD Phases VI**
HK 40.1–40.6	Mi	16:30–18:15	HZO 70	**Structure and Dynamics of Nuclei VIII**
HK 41.1–41.3	Mi	16:30–17:45	HZO 100	**Fundamental Symmetries II**
HK 42.1–42.6	Mi	16:30–18:00	Audimax H1	**Instrumentation XIII**
HK 43.1–43.3	Mi	16:30–17:15	HZO 90	**Instrumentation XIV**
HK 44.1–44.3	Do	11:00–12:30	Audimax	**Hauptvorträge II**
HK 45.1–45.7	Do	14:00–16:00	HZO 50	**Hadron Structure and Spectroscopy VIII**
HK 46.1–46.7	Do	14:00–16:00	HZO 60	**Heavy Ion Collisions and QCD Phases VII**

HK 47.1–47.6	Do	14:00–16:00	HZO 80	**Heavy Ion Collisions and QCD Phases VIII**
HK 48.1–48.8	Do	14:00–16:00	HZO 70	**Structure and Dynamics of Nuclei IX**
HK 49.1–49.4	Do	14:00–15:30	HZO 100	**Astroparticle Physics II and Applications**
HK 50.1–50.6	Do	14:00–15:45	Audimax H1	**Instrumentation XV**
HK 51.1–51.4	Do	14:00–15:15	HZO 90	**Instrumentation XVI**
HK 52.1–52.65	Do	16:30–18:45	Audimax Foyer	**Poster**
HK 53	Do	19:00–20:00	HZO 50	**Mitgliederversammlung**
HK 54.1–54.3	Fr	11:00–12:30	Audimax	**Hauptvorträge III**
HK 55.1–55.6	Fr	14:00–15:45	HZO 50	**Hadron Structure and Spectroscopy IX**
HK 56.1–56.5	Fr	14:00–15:30	HZO 60	**Heavy Ion Collisions and QCD Phases IX**
HK 57.1–57.5	Fr	14:00–15:30	HZO 80	**Heavy Ion Collisions and QCD Phases X**
HK 58.1–58.5	Fr	14:00–15:30	HZO 70	**Structure and Dynamics of Nuclei X**
HK 59.1–59.6	Fr	14:00–15:30	HZO 100	**Nuclear Astrophysics IV**
HK 60.1–60.6	Fr	14:00–15:45	Audimax H1	**Instrumentation XVII and Accelerators**
HK 61.1–61.6	Fr	14:00–15:45	HZO 90	**Instrumentation XVIII**

Hinweis auf Mittagsvortrag „Physiker in der Industrie“ der jDPG

Dienstag 13:00–14:00 Audimax H1

Jahrestreffen junger Wissenschaftler (yHEP, young High Energy Physicist association)

Dienstag 19:00–20:00 HZO 50

Mitgliederversammlung Fachverband Physik der Hadronen und Kerne

Donnerstag 19:00–20:00 HZO 50

HK 1: Hadron Structure and Spectroscopy I

Zeit: Montag 14:00–16:00 Raum: HZO 50

Gruppenbericht HK 1.1 Mo 14:00 HZO 50

Hadron Spectroscopy with COMPASS — •Boris Grube for the COMPASS-Collaboration — Physik-Department E18, Technische Universität München

COMPASS is a multi-purpose fixed-target experiment at the CERN Super Proton Synchrotron aimed at studying the structure and spectrum of hadrons. The two-stage spectrometer has a good acceptance for charged as well as neutral particles over a wide kinematic range and is thus able to measure a wide range of reactions. One of the main goals of the experiment is the study of the light-meson spectrum. In diffractive reactions, a rich spectrum of isovector mesons is produced using a 190 GeV/c negative pion beam. The resonances decay typically into multi-body final states and are extracted from the data using partial-wave analysis techniques. We have performed the so far most comprehensive analysis of this kind on the $\pi^-\pi^-\pi^+$ final state, for which COMPASS has acquired a large data set of 46 million event. In a novel approach, we take into account the dependence of the production process on the squared four-momentum transfer t from the beam to the target. As a consequence, we were able to better separate resonant and non-resonant contributions and to extract for the first time the dependence of the resonant and non-resonant amplitudes on t. We will discuss results from this analysis.

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 1.2 Mo 14:30 HZO 50

Inclusive charmonium production in energy region above 4 GeV at the BESIII experiment — •Simon Nakhoul, Klaus Goetzen, Ralf Kliemt, Frank Nerling, and Klaus Peters for the BESIII-Collaboration — GSI Helmholtz Center for heavy Ion research, Planckstrasse 1, Darmstadt, Germany

Since 2003, the XYZ charmonium-like states have become a hot topic in the hadron spectroscopy field. The Beijing Spectrometer III (BESIII) at the Beijing Electron-Positron Collider II (BEPC II) is one of the leading experiments in the XYZ-related physics. It has brought us numerous breakthrough discoveries like the observation of $Z_c(3900)$ and $Z_c(4020)$. In order to understand the nature of these intriguing states and their decay patterns, an inclusive analysis is performed using the recoil mass technique approach for different particles ($\pi^+\pi^-$, K^+K^-, $\pi^0\pi^0$, K_sK_s) at center of mass energies above 4 GeV. The aim of this analysis is to search for new unobserved XYZ decay channels and to provide accurate inclusive cross section measurements for $e^+e^- \to X_{c\bar{c}} + \pi^+\pi^-$ ($X_{c\bar{c}} = J/\psi, h_c, \psi(2S)$ ...) and compare them to the corresponding exclusive BESIII measurements.

* This work is supported by HGS-HIRe.

HK 1.3 Mo 14:45 HZO 50

Investigation of h_c decay patterns at BESIII — •Meike Kuessner — Ruhr-Universität Bochum, Institut für Experimentalphysik I, 44780 Bochum

The BESIII experiment at the BEPCII electron-positron collider in Beijing offers excellent opportunities to study rare charmonium decays, due to the high statistics data samples which were recorded at center of mass energies between $\sqrt{s} = 2 - 4.6$ GeV.
Although the existence of the pseudovector charmonium state h_c ($J^{PC} = 1^{+-}$) has already been confirmed experimentally in 1992, the decay pattern remained almost unknown. Only half of the expected decay channels, regarding the total resonance width, have been observed. The h_c state goes hand in hand with a special experimental challenge due to the circumstance that it can not be produced directly in e^+e^- annihilation or via radiative transitions from vector charmonium states. In the analysis presented here, the h_c state is studied in the production processes $\psi(2S) \to \pi^0 h_c$ and $Y \to \pi^+\pi^- h_c$ (where Y denotes the $\psi(4160)$, $Y(4230)$, $Y(4260)$, or $\psi(4415)$ state).
Preliminary results of the search for unknown h_c decay modes will be presented, based on $448 \cdot 10^6$ $\psi(2S)$ events and data sets recorded at $\sqrt{s} = 4.180$, 4.230, 4.260, and 4.420 GeV corresponding to 6180 pb^{-1}. Besides a discussion of the performed data selection, preliminary results for measured branching fractions of the h_c state will be presented.

Supported by DFG (FOR 2359)

HK 1.4 Mo 15:00 HZO 50

Study of Light Hadrons in radiative J/Ψ Decays at BESIII — •Jens Olaf Frech — Ruhr-Universität Bochum, Inst. für Experimentalphysik I, 44801 Bochum

The BESIII experiment, which is located at the symmetric electron-positron collider BEPCII in Beijing, has a center of mass energy between $\sqrt{s} = (2 - 4.6)$ GeV. It has recorded $1.3{\cdot}10^9$ J/Ψ events.
Lattice QCD predicts the lowest lying scalar glueball at a mass of 1.5 and 1.7 GeV/c^2. This leads to a mixing with the nearby mesons, which complicates the identification of glueballs. Radiative J/Ψ decays into two pseudoscalars provide an opportunity to study the states observed in the relevant region, as only intermediate states with even total angular momenta are allowed.
Using the large J/Ψ data sample mentioned above, the reaction $J/\Psi \to \gamma\eta\eta$ is studied, since it is a gluon rich process.
A status report for the study of the glueball candidates $f_0(1500)$ and $f_0(1710)$ will be presented.

Supported by DFG (FOR 2359)

HK 1.5 Mo 15:15 HZO 50

Measurement of η' and $f_1(1285)$ production in two-photon collisions at BESIII — •Dominik Schollmayer, Achim Denig, and Christoph Florian Redmer — Institut für Kernphysik, Universität Mainz, Deutschland

To further improve on the uncertainty of the Standard Model prediction of the anomalous magnetic moment of the muon, precise data on the production of mesons in two-photon collisions are of interest. The BESIII experiment at the e^+e^- collider BEPCII in Beijing has collected more than 10 fb^{-1} of data at center of mass energies between 3.773 GeV and 4.6 GeV. Based on these data the production of the η' and $f_1(1285)$ mesons in two-photon collisions is studied. The analysis aims at the determination of the radiative decay width and transition form factor in the region of momentum transfer below 3 GeV^2. In this presentation we will give an overview of the current status of the analysis.

Supported by DFG (SFB 1044).

HK 1.6 Mo 15:30 HZO 50

Measurement of the $e^+e^- \to p\bar{p}$ cross section via initial state radiation at BESIII — •Alaa Dbeyssi[1], Samer Ahmed[1], Paul Larin[1], Dexu Lin[1], Frank Maas[1,2,3], Cristina Morales[1], Christoph Rosner[1], Yadi Wang[1], and Bo Zheng[1] for the BESIII-Collaboration — [1]Helmholtz-Institut Mainz, Mainz, Germany — [2]Institute of Nuclear Physics, Mainz, Germany — [3]PRISMA Cluster of Excellence, Mainz, Germany

This contribution reports on the recent measurements of the $e^+e^- \to \bar{p}p$ cross section using the initial state radiation technique with an undetected photon at the BESIII experiment in Beijing. The analysis is based on data sets, corresponding to an integrated luminosity of 7.408 fb^{-1}, collected at center of mass energies between 3.773 and 4.600 GeV. Preliminary results on the measured proton form factors in the time-like region are presented. The proton magnetic form factor is determined in 30 intervals of the proton-antiproton invariant mass between 2.0 and 3.8 GeV/c^2 under the assumption that the electric and the magnetic form factors are equal ($|G_E| = |G_M|$). The proton form factor ratio is also measured in the region between 2.0 and 3.0 GeV/c^2.

HK 1.7 Mo 15:45 HZO 50

Hybrids as three-body states from a Faddeev-equation — •Christian Söhngen[1], Gernot Eichmann[2], Christian S. Fischer[1], and Richard Williams[1] — [1]Justus-Liebig-Universität, Gießen, Deutschland — [2]IST, Lisboa, Portugal

We report on recent progress in the description of hybrid states in the framework of Dyson-Schwinger/Faddeev equations [1]. Based on explicit solutions for the quark and gluon propagators and their interactions we formulate a three-body equation describing hybrids as bound states of non-perturbative quark, antiquark and gluon constituents. This setup builds on the analogous three-body framework for baryons [2] that has provided very satisfactory results for the octet and decu-

plet spectrum [3]. We discuss the hybrid's constituents and report on first results for the emergent bound state properties.

[1] G. Eichmann, H. Sanchis-Alepuz, R. Williams, R. Alkofer and C. S. Fischer, Prog. Part. Nucl. Phys. 91 (2016) 1

[2] G. Eichmann, R. Alkofer, A. Krassnigg and D. Nicmorus, Phys. Rev. Lett. 104 (2010) 201601

[3] H. Sanchis-Alepuz and C. S. Fischer, Phys. Rev. D 90 (2014) no.9, 096001

HK 2: Heavy Ion Collisions and QCD Phases I

Zeit: Montag 14:00–16:00 Raum: HZO 60

Gruppenbericht HK 2.1 Mo 14:00 HZO 60

Measurement of direct photons in Pb-Pb collisions at centre-of-mass energy per nucleon of 2.76 TeV with the Photon Conversion Method in the ALICE experiment at LHC — •Lucia Leardini for the ALICE-Collaboration — Physikalisches Institut — Heidelberg university

Photons are produced throughout the evolution of the Quark-Gluon Plasma (QGP), the hot and dense medium that is formed in heavy-ion collisions. The direct photons, originating from the early stages of the system evolution, are of particular interest to study the QGP characteristics and temperature at the photon emission time. The measurement presented here is extracted from the 2011 Pb-Pb run and relies on the Photon Conversion Method (PCM), based on the reconstruction of photon conversions by the Inner Tracking System (ITS) and the Time Projection Chamber (TPC).

HK 2.2 Mo 14:30 HZO 60

Benchmark of microscopic hadronic direct photon emission in thermal equilibrium — •Anna Schäfer[1,2], Jonas Rothermel[1,2], Juan M. Torres-Rincon[3], Niklas Ehlert[2], Charles Gale[4], and Hannah Petersen[1,2,5] — [1]Frankfurt Institute for Advanced Studies, D-60438 Frankfurt am Main, Germany — [2]Institut für Theoretische Physik, Goethe-Universität, D-60438 Frankfurt am Main, Germany — [3]Department of Physics and Astronomy, Stony Brook University, US-11794 Stony Brook, USA — [4]Department of Physics, McGill University, CA-H3A 2T8 Montreal, Canada — [5]GSI Helmholtzzentrum für Schwerionenforschung GmbH, D-64291 Darmstadt, Germany

Cross sections for direct photon production in hadronic scattering processes have been calculated according to an effective chiral field theory following Turbide et al. For $\pi + \rho \to \pi + \gamma$ and $\pi + \pi \to \rho + \gamma$ processes, these cross sections have been implemented into a novel hadronic transport approach (SMASH), which is suitable for collisions at low and intermediate energies. Comparisons of the obtained thermal rates in infinite matter calculations to theoretical predictions and to the ones used in hydrodynamic calculations are shown. This constitutes a benchmark for future non-equilibrium calculations. Employing SMASH for the final state rescattering in a hybrid approach will allow to assess the importance of the hadronic stage in the generation of direct photon flow.

HK 2.3 Mo 14:45 HZO 60

Measurement of Neutral Mesons and Direct Photons in pp Collisions with ALICE at the LHC — •Daniel Mühlheim for the ALICE-Collaboration — Institut für Kernphysik, WWU Münster

ALICE has published the invariant cross sections for the production of π^0 and η mesons in proton-proton collisions at $\sqrt{s} = 0.9$ TeV, 2.76 TeV, 7 TeV and most recently 8 TeV. Neutral mesons are reconstructed by means of three different detection systems; using the central barrel tracking detectors of ALICE in order to reconstruct photon conversions (PCM) and the two available calorimeters in the experiment, namely the PHOS and the EMCal. The reported measurements are carried out as well using a 'hybrid' system which reconstructs meson candidates by combining one EMCal photon with one PCM photon. Thus, this 'hybrid' system serves as an important cross-check and additionally measures an almost independent set of meson candidates. By using EMCal and PHOS triggers in addition, transverse momenta up to 40 GeV/c can be covered with the available statistics in the given datasets. In addition, the corresponding η/π^0-ratios will be shown to test scaling laws for particle production. All obtained results will be compared with different Monte Carlo generators as well as recent NLO pQCD predictions.

Based on the obtained results, inclusive direct photon measurements are being carried out, for which the most recent status will be presented. A novel method using the 'hybrid' PCM-EMCal system is followed in addition to tag π^0 candidates and extract the direct photon signal, which will be shortly illustrated.

HK 2.4 Mo 15:00 HZO 60

Reconstruction of neutral pions and direct photons at CBM-RICH detector via conversion* — •Ievgenii Kres, Karl-Heinz Kampert, and Christian Pauly for the CBM-Collaboration — University of Wuppertal

The Compressed Baryonic Matter (CBM) experiment at the future FAIR complex will investigate the phase diagram of strongly interacting matter at high baryon density and moderate temperatures in A+A collisions from 2-11 AGeV (SIS100). A central component of the proposed detector setup is a Ring Imaging Cherenkov Detector (RICH) using CO_2 as radiator gas, a focussing optics with a large spherical mirror, and, as a result of recent CBM RICH geometry optimizations, a cylindrically shaped photon detection surface. During the nucleus-nucleus collisions the created fireball passes several stages of evolution, where only specific types of particles can be produced. As leptons and photons are not affected by hadronic final state interactions, they offer the possibility to look into the fireball at different stages of evolution. The yields and transverse-momentum (p_T) spectra of identified particles are widely used to determine the conditions of the fireball at chemical and kinetic freeze-out. The presented analysis aims at reconstructing π^0 mesons via double conversion ($\pi^0 \to \gamma(e^+e^-) + \gamma(e^+e^-)$) and direct photons via single conversion ($\gamma \to (e^+e^-)$) inside the target or first detector layers in order to use their transverse-momentum (p_T) spectra to study fireball properties. Results of this conversion analysis are presented.

*gefördert durch BMBF 05P15PXFCA und GSI

HK 2.5 Mo 15:15 HZO 60

Measurement of neutral pions in pp collisions at $\sqrt{s}$ = 13 TeV with the ALICE EMCal — •Joshua Koenig for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

ALICE, as the dedicated heavy-ion experiment at the LHC, investigates the properties of the quark-gluon plasma (QGP), that is believed to be produced in Pb-Pb collisions at high center-of-mass energies. Reference measurements in pp collisions are essential to understand the characteristics of the QGP. The energy loss of partons traversing the QGP can be determined in hadron spectra at high transverse momentum. In ALICE the measurements of neutral meson (π^0, η) production with the calorimeters (EMCal, Dcal, Phos) complement the measurements of charged particles in the central barrel in these studies.
In this talk the reconstruction of π^0 via their two-photon decay channel is realized with the EMCal, which measures the energy and position of photons. The status of the measurement of π^0 in pp collisions at $\sqrt{s}$ = 13 TeV with the EMCal will be presented.
Supported by BMBF and the Helmholtz Association.

HK 2.6 Mo 15:30 HZO 60

Measurement of neutral mesons in p-Pb collisions at $\sqrt{s}$ = 5.02 TeV with the ALICE-PHOS — •Andrea Hornung for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

ALICE, the dedicated heavy-ion experiment at the LHC, investigates the properties of the quark-gluon plasma (QGP). In collisions of high energy nuclei, energy loss effects on the production of hadrons at high transverse momenta have been observed. To disentangle effects on particle production caused by the QGP and concurrent initial state effects, in addition to collisions of heavy nuclei, collisions of protons and nuclei are studied. In the experiment, measurements of neutral mesons (η, π^0) in the calorimeters complement measurements of charged particles in the central barrel.
The PHOS detector, one of the electromagnetic calorimeters of the experiment, measures the position and energy of photons and by such allows for the reconstruction of the π^0 and the η meson via their two-

photon decay channels. In this talk, the status of the measurement of π^0 and η mesons in p-Pb collisions at $\sqrt{s} = 5.02$ TeV will be presented. Supported by BMBF and the Helmholtz Association.

HK 2.7 Mo 15:45 HZO 60

Measurement of neutral mesons in Pb-Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 5.02$ TeV with the photon conversion method in the ALICE experiment — •Meike Danisch for the ALICE-Collaboration — Physikalisches Institut Heidelberg

Neutral mesons can provide important information on the energy loss of partons traversing the hot and dense matter, which is created in high energy heavy-ion collisions. Furthermore, they constitute the largest background contribution for direct photons, which are among the most important tools to study the properties of the Quark Gluon Plasma. In the ALICE experiment, neutral mesons can be measured via their decay to two photons. Apart from the two calorimeters EMCal and PHOS, photons can be reconstructed also via the Photon Conversion Method (PCM). The latter exploits the fact that a photon can convert to an electron-positron pair. These charged particles can be detected via their tracks in the Time Projection Chamber (TPC) and the Inner Tracking System (ITS). The PCM allows the measurement of both photons and neutral mesons, carrying low transverse momenta ($p_{\mathrm{T}} \gtrsim 1$ GeV), with very good energy resolution. Apart from presenting the performance of the photon conversion method, results from the π^0 and η meson production measurement in Pb-Pb collisions with a center-of-mass collision energy per nucleon of $\sqrt{s_{NN}} = 5.02$ TeV will be shown.

HK 3: Structure and Dynamics of Nuclei I

Zeit: Montag 14:00–16:00 Raum: HZO 70

Gruppenbericht HK 3.1 Mo 14:00 HZO 70

Status, Results and Perspectives of the FRS Ion Catcher — •Samuel Ayet San Andres for the FRS Ion Catcher-Collaboration — Justus-Liebig-Universität, Gießen — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt

In the Fragment Separator (FRS) at GSI, exotic nuclei are produced and separated in-flight at relativistic energies. The ions are stopped and thermalized in a cryogenic stopping cell (CSC) and extracted to a Multiple-Reflection Time-of-Flight Mass Spectrometer (MR-TOF-MS) for high precision mass measurements or for isobar and isomer separation.

The FRS Ion Catcher serves as the prototype for the future Ion Catcher at the Low-Energy-Branch (LEB) of the Super-FRS. The masses of more than 40 short-lived isotopes have been measured with accuracies down to the low 10^{-7} level. More than 15 isomers with excitation energies down to the few hundreds of keV were observed. A new analysis method suitable for overlapping peaks and low number of events was developed.

An overview of the latest results and proposed experiments to be carried out in the FRS Ion Catcher at GSI during the upcoming beam time period 2018 - 2019 covering mass measurements, beta-delayed neutron emission probabilities and reaction studies with multi-nucleon transfer will be presented.

HK 3.2 Mo 14:30 HZO 70

Collinear laser spectroscopy of nickel isotopes at CERN-ISOLDE — •Simon Kaufmann for the COLLAPS-ISCOOL-Collaboration — TU Darmstadt, Darmstadt, Deutschland

Nickel isotopes $^{58-68,70}$Ni were measured using collinear laser spectroscopy at the COLLAPS setup at CERN-ISOLDE. Nickel has the magic proton number 28, the first magic number that is caused by the spin-orbit interaction, and the isotope chain is state-of-the-art in nuclear structure research. Of particular interest are recent ab initio calculations entering into the medium mass region and demonstrating a clear correlation between the charge radius, the neutron radius and the electric dipole polarizability α_D in the case of ^{48}Ca [1] which could be confirmed in good agreement in a recent measurement [2]. Our measurements of the mean-square charge radii across up to N=42 shed light into the effect of the sub-shell closure around the N=40 sub-shell closure and help to understand its Z dependence in relation to neighboring elements. Ab initio calculations now become feasible in the nickel mass region as well. Recent α_D measurements in ^{68}Ni [3] are now backed up by our experimental value for the mean-square charge radius making this a rare case where both observables are experimentally known and will therefore provide an important new benchmark for ab initio theory.

[1] G. Hagen et al., Nature Physics12, 186-190 (2016)
[2] J. Birkhan et al., Phys. Rev. Lett. 118, 252501 (2017)
[3] D.M. Rossi et al., Phys. Rev. Lett. 111, 242503 (2013)

HK 3.3 Mo 14:45 HZO 70

Phase-imaging ion-cyclotron-resonance detection with ISOLTRAP at CERN — •Jonas Karthein for the ISOLTRAP-Collaboration — CERN, Geneva, Switzerland — Universität Heidelberg, Germany — MPI für Kernphysik, Heidelberg, Germany

The Penning-trap mass spectrometer ISOLTRAP, located at the radioactive ion beam facility ISOLDE at CERN, performs high-precision mass measurements of short-lived nuclides. This gives access to the study of nuclear-structure effects and provides precision β-decay Q-values to test nuclear models and fundamental interactions. Previously the measurement principle has been the time-of-flight ion-cyclotron-resonance detection technique, which limits accessible half-lives and relative uncertainties. With the new phase-imaging ion-cyclotron-resonance (PI-ICR) detection technique [S. Eliseev et al., Phys. Rev. Lett. 110 082501 (2013)], experiments can be performed with fewer ions and higher resolving power, providing access to new areas of the nuclear chart and to new physics. This talk will report on the ion-optical improvements required for the implementation of PI-ICR at ISOLTRAP, as well as results from first on-line measurements in both the high-precision and high-accuracy regimes. During a systematic on-line study the Q-value of the ^{88}Sr-^{88}Rb β-decay was determined with an uncertainty of < 130 eV. Furthermore, the separation of the low-lying isomeric states in ^{127}Cd and ^{129}Cd was achieved, from which their excitation energy was determined. A mass resolving power $\frac{m}{\Delta m} > 10^6$ was reached for only 100 ms measurement time compared to $\frac{m}{\Delta m} \sim 5 \cdot 10^4$ in ToF-ICR.

HK 3.4 Mo 15:00 HZO 70

Laser spectroscopy of the heaviest elements — •P. Chhetri[1,2], D. Ackerman[2,3], H. Backe[4], M. Block[2,4,5], B. Cheal[6], Ch. E. Düllmann[2,4,5], M. Eibach[2,7], J. Even[8], R. Ferrer[9], F. Giacoppo[2,5], S. Götz[2,4,5], F. P. Hessberger[2,5], O. Kaleja[2], J. Khuyagbaatar[2], P. Kunz[10], M. Laatiaoui[2,5,9], F. Lautenschläger[1,2], W. Lauth[4], L. Lens[2,4], N. Lecesne[3], A. K. Mistry[2,5], E. Minaya Ramirez[11], T. Murböck[2], S Raeder[2,5], Th. Walther[1], A. Yakushev[2,5], and Z. Zhang[12] — [1]TU Darmstadt — [2]GSI — [3]GANIL — [4]Universität Mainz — [5]Helmholtz-Institut Mainz — [6]University of Liverpool — [7]Universität Greifswald — [8]KVI-CART — [9]KU-Leuven — [10]TRIUMF — [11]IPN Orsay — [12]IMP Lanzhou

Laser spectroscopy of the heaviest elements with $Z > 100$ allows studying the influence of relativistic and QED effects on the atomic shell structure but is hampered by the low production rates available. Applying the sensitive Radiation Detected Resonance Ionization Spectroscopy technique at the SHIP velocity filter at GSI, we identified optical transitions in the element nobelium ($Z = 102$) for the first time [1]. Besides the identification of a strong optical ground state transition, its hyperfine structure splitting in the isotope ^{253}No was measured along with the isotope shifts in $^{252-254}$No. These results will be discussed and an outlook on first attempts in extending laser spectroscopy to the next heavier element, lawrencium ($Z = 103$), will be given.

[1] M. Laatiaoui *et al.*, Nature **538**, 495 (2016)

HK 3.5 Mo 15:15 HZO 70

Towards direct mass spectrometry of superheavy elements at SHIPTRAP — •Oliver Kaleja for the SHIPTRAP-Collaboration — MPIK Heidelberg — JGU Mainz — GSI Darmstadt

The Penning-trap mass spectrometer SHIPTRAP enables direct high-precision measurements of the heaviest elements produced at the velocity filter SHIP. The results allow us to probe and refine nuclear theories and contribute to the quest of finding the predicted island

of stability. In order to extend direct mass measurements to superheavy elements (Z $\geq$ 104) in the upcoming beamtime period in 2018 the setup was modified to accommodate the low production rates. In parallel, a second setup is being developed to adapt a non-destructive detection technique with single-ion sensitivity to this mass region. In this contribution an overview of the recent activities will be presented.

HK 3.6 Mo 15:30 HZO 70

Decay Spectroscopy at SHIP using the COMPASS set-up — •A. K. Mistry for the SHIP Decay Spectroscopy-Collaboration — Helmholtz Institut Mainz, Mainz, Germany — GSI Helmholtzzentrum, Darmstadt, Germany

A vital tool in the study of the structure of the nucleus is experimental decay spectroscopy in the focal plane after online separation of reaction products. In the heavy element region of the nuclear chart, a variety of theoretical models predict location of the enhanced shell stabilization region above the spherical closure at 208Pb (Z=82, N=126). Studies on the properties of nuclei at the edges of this enhanced superheavy region constrain these models by examining the evolution of shell closures in experimentally accessible regions of the nuclear landscape . Whilst current understanding of the spherical shell closures up to 208Pb is well established, towards the proton dripline, experimental knowledge on the evolution of the shell closures remains limited. To this end, recent efforts have focused on examining the N=126 shell closure at extreme proton numbers i.e. Z=92. The new focal plane detection system at SHIP COMPAct decay Spectroscopy Setup (COMPASS) was employed during a period of parasitic beam time at GSI, with the twofold purpose of performing an advanced commissioning of the setup, and to subsequently produce neutron deficient isotopes around the region of U, Np, and Pu. Results will be presented from the production of heavy, neutron deficient actinide isotopes with short lived decays in their corresponding chains.

HK 3.7 Mo 15:45 HZO 70

Accurate isotope shift measurement in the D1 and D2 line of Ba^+ — •Phillip Imgram, Kristian König, Jörg Krämer, Tim Ratajczyk, and Wilfried Nörtershäuser — Institut für Kernphysik, TU Darmstadt

The binding energy especially of *s*-electrons are affected by the finite nuclear size. Isotope shift measurements of electronic transitions provide therefore information about the nuclear charge radius. The sensitivity of the $S_{1/2} \rightarrow P_{1/2}$ (D1) and the $S_{1/2} \rightarrow P_{3/2}$ (D2) transitions in earth alkaline ions to this finite nuclear size effect should be identical apart from a small relativistic contribution, which can be explained with the relativistic admixture of the $S_{1/2}$ wave function to the $P_{1/2}$ configuration and has been measured for the first time by K. Wendt *et al.* [1] in Ba^+. Recent measurements of this effect in Ca^+ ions have revealed a considerable discrepancy to theoretical predictions [2]. To check whether such a discrepancy is also apparent in the Ba^+ system, measurements of higher accuracy as in [1] are required. Therefore, the absolute transition frequencies in several stable barium isotopes have been measured with a collinear/anti-collinear laser spectroscopy approach [3].

[1] K. Wendt *et al.*, Z. Phys. A 318, 125 - 129 (1984)
[2] C. Shi *et al.*, Appl. Phys. B (2017), 123:2
[3] A. Krieger *et al.*, Appl. Phys. B (2017) 123:15

HK 4: Nuclear Astrophysics I

Zeit: Montag 14:00–16:00 Raum: HZO 100

Gruppenbericht HK 4.1 Mo 14:00 HZO 100

Experimental Nuclear Astrophysics in Cologne — •Philipp Scholz, Felix Heim, Elena Hoemann, Marvin Körschgen, Jan Mayer, and Andreas Zilges — Institute for Nuclear Physics, University of Cologne

Nuclear reaction cross sections are one of the main ingredients for the understanding of nucleosynthesis processes in stellar environments. For isotopes heavier than those in the iron-peak region, reaction rates are often calculated using the Hauser-Feshbach statistical model (HF). The accuracy of these reaction rates crucially depend on the uncertainties of nuclear-physics input-parameters like γ-strength functions, optical-model potentials, and level densities.

The combination of the 10 MV FN-Tandem accelerator and the high-efficiency γ-ray spectrometer HORUS at the University of Cologne enables the investigation of γ-strength functions and level-densities via radiative proton-capture reactions.

This talk will introduce the in-beam technique with HPGe detectors as well as the method of two-step γ-ray cascades to the recently performed experiments on the ^{63}Cu(p,γ) and ^{65}Cu(p,γ) reactions. In addition, an overview about investigations of optical-model potentials and half-lives of long lived-isotopes via the activation technique will be given.

Supported by the DFG (ZI 510/8-1) and the ULDETIS project within the UoC Excellence Initiative institutional strategy. PS and JM are supported by the Bonn-Cologne Graduate School of Physics and Astronomy.

HK 4.2 Mo 14:30 HZO 100

Astrophysics with storage rings: ^{124}Xe beam at ESR — •Zuzana Slavkovská[1,2], Jan Glorius[1,2], Christoph Langer[1,2], René Reifarth[1,2], and Yuri Litvinov[2] for the E108B-Collaboration — [1]Goethe Universität Frankfurt — [2]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt

The astrophysically motivated reaction ^{124}Xe(p,γ) was investigated at the Experimentier-Speicherring (ESR) at the GSI in Darmstadt in June 2016.

For the first time it was possible to measure proton capture cross sections down to the Gamow window of the p-process using a storage ring. A ^{124}Xe beam reacted with a hydrogen gas jet target at five different energies between 5.5 AMeV and 8 AMeV. A newly designed double-sided silicon strip detector (DSSSD) placed directly into the ultrahigh vacuum of the ESR was used to detect the reaction products.

In this talk the experimental set-up and method as well as the challenges and results of the experiment will be presented.

This project is supported by HGS-HIRe, HIC for FAIR, BMBF (05P15RFFAA) and GSI-F&E.

HK 4.3 Mo 14:45 HZO 100

Felsenkeller 5 MV underground ion accelerator for nuclear astrophysics — •Daniel Bemmerer[1], Thomas E. Cowan[1,2], Marcel Grieger[1,2], Thomas Hensel[1,2], Arnd R. Junghans[1], Martina Koppitz[1,2], Felix Ludwig[1,2], Bernd Rimarzig[1], Stefan Reinicke[1,2], Ronald Schwengner[1], Klaus Stöckel[1,2], Tamás Szücs[1,3], Marcell P. Takács[1,2], Steffen Turkat[2,1], Andreas Wagner[1], Louis Wagner[1,2], and Kai Zuber[2] — [1]Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Dresden, Germany — [2]TU Dresden, Germany — [3]MTA ATOMKI, Hungary

A 5 MV Pelletron accelerator with both an internal and an external ion source providing for intensive $^1H^+$, $^4He^+$, and $^{12}C^+$ beams is being installed in the Felsenkeller underground site in Dresden, shielded from cosmic rays by 45 m rock overburden. Civil construction has recently been completed. The technical features of the new laboratory, test results, and the scientific program will be summarized. In addition to in-house research by HZDR and TU Dresden, the new accelerator will be open for outside users, both from Germany and worldwide.

HK 4.4 Mo 15:00 HZO 100

Big Bang Cosmology in the Lab: The ^{2}H$(p,\gamma)^3$He reaction studied at LUNA — Daniel Bemmerer[1], •Klaus Stöckel[1,2], and Tamás Szücs[1,3] for the LUNA-Collaboration — [1]Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Dresden, Germany — [2]TU Dresden, Germany — [3]MTA ATOMKI, Debrecen, Hungary

Recent high-precision measurements of the primordial ^{2}H abundance have opened the path to use Big Bang nucleosynthesis to constrain the primordial baryon to photon ratio with similar precision as the cosmic microwave background. This would provide an independent cross-check on current Big Bang models. However, the interpretation of the abundance is limited by the lack of precise nuclear data, in particular on the main ^{2}H destruction channel, the ^{2}H$(p,\gamma)^3$He reaction. A new experiment to study the ^{2}H$(p,\gamma)^3$He cross section directly in the Big Bang energy window is underway at the LUNA 400 kV accelerator, deep underground in the Gran Sasso laboratory, Italy. The progress of experiment and analysis will be summarized. – Supported by DFG

(BE 4100/4-1).

HK 4.5 Mo 15:15 HZO 100

Study of the Big Bang nuclear reactions ^{2}H$(p,\gamma)^3$He and ^{3}He$(\alpha,\gamma)^7$Be at high energy — •Steffen Turkat[1], Shavkat Akhmadaliev[2], Daniel Bemmerer[2], Felix Ludwig[1,2], Klaus Stöckel[1,2], Tamás Szücs[1,2], Louis Wagner[1,2], and Kai Zuber[1] — [1]Institut für Kern- und Teilchenphysik, TU Dresden, Germany — [2]Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Dresden, Germany

The improved precision of Big Bang nuclidic abundance determinations calls for more precise nuclear data to improve the models. Currently, the Big Bang abundance predictions for ^{2}H and ^{7}Li are limited in precision by the ^{2}H$(p,\gamma)^3$He and ^{3}He$(\alpha,\gamma)^7$Be reactions, respectively. In order to address this problem, a re-study of these cross sections is underway. Complementing low-energy data from LUNA, these cross sections are being measured in the 0.3-2 MeV center of mass energy range at the HZDR 3 MV Tandetron. The activated ^{7}Be samples from the latter reaction shall be counted at the new Felsenkeller underground facility. The status of the two experiments will be summarized. — Supported by DFG (ZU 123/21-1 and BE 4100/4-1).

HK 4.6 Mo 15:30 HZO 100

Investigating total and partial cross sections of the ^{107}Ag(p,γ)^{108}Cd reaction — •Felix Heim[1], Elena Hoemann[1], Jan Mayer[1], Philipp Scholz[1], Mark Spieker[1,2], and Andreas Zilges[1] — [1]Institute for Nuclear Physics, University of Cologne — [2]NSCL, Michigan State University, MI 48824, USA

The γ process plays an important role in the nucleosynthesis of the majority of the p nuclei. Since the network of the γ process includes so many different reactions and - mainly unstable - nuclei, cross-section values are predominantly calculated in the scope of the Hauser-Feshbach statistical model. The values depend heavily on the nuclear physics input-parameters like the nuclear level density (NLD), the γ-ray strength function (γ-ray SF) and nucleon+nucleus optical model potentials (OMPs). Total and partial cross-section measurements can improve the accuracy of the theoretical calculations. To extend the experimental database the ^{107}Ag(p,γ)^{108}Cd reaction was studied via the in-beam method at the high-efficiency HPGe γ-ray spectrometer HORUS at the University of Cologne. Proton beams with energies between 3.5 and 5.0 MeV were provided by the 10 MV FN-Tandem accelerator. The comparison of the experimental results to Hauser-Feshbach calculations allowed to find adjusted microscopic models for the NLD and γ-ray SF, which very nicely reproduce the results of total and partial cross sections.

Supported by the DFG (ZI 510/8-1) and the ULDETIS project within the UoC Excellence Initiative institutional strategy.

HK 4.7 Mo 15:45 HZO 100

Characterization of the cesium sputter ion source for the new Felsenkeller 5 MV underground accelerator — •Felix Ludwig[1,2], Martina Koppitz[1,2], Daniel Bemmerer[1], and Kai Zuber[2] — [1]Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Dresden — [2]Technische Universität Dresden

In order to determine the cross section of the ^{12}C$(\alpha,\gamma)^{16}$O reaction at astrophysically relevant energies, an accelerator with a stable and intensive ^{12}C ion beam in an ultra low background environment is needed. For this purpose a 134-MC-SNICS cesium sputter ion source is going to be part of the Felsenkeller shallow underground accelerator facility. To determine the characteristics of this ion source overground tests were undertaken at HZDR. The contribution will report on long time measurements of the ion current and the beam emittance.

HK 5: Instrumentation I

Zeit: Montag 14:00–15:30 Raum: Audimax H1

Gruppenbericht HK 5.1 Mo 14:00 Audimax H1

Construction and Assembly of the Electromagnetic Calorimeter for the PANDA Target Spectrometer — •Markus Moritz for the PANDA-Collaboration — II. Physikalisches Institut, Justu-Liebig-Universität, Gießen

The electromagnetic target calorimeter (EMC) of the future $\overline{P}ANDA$ detector has the challenging aim to detect high energy photons with excellent energy resolution from 15 GeV down to a few tens of MeV. To reach this goal, improved $PbW0_4$ scintillator crystals, cooled down to $-25°C$ have been chosen. They provide a fast decay time for highest count rates, short radiation length for compactness, improved light yield for lowest thresholds and excellent radiation hardness. The target calorimeter itself is divided into into a barrel and two endcaps. The individual crystal will be read out with two precisely matched large area avalanche photo diodes (APD). In the very inner part of the forward encap vacuum phototetrodes will be used instead.

In this talk the construction and assembly status will be presented. This includes for example the assembly of detector subunits, mechanical support structure, the cooling system, optical monitoring system and front end electronics.

This project is supported by the BMBF.

HK 5.2 Mo 14:30 Audimax H1

Temperaturregelug für das $\overline{P}$ANDA-EMC — •Daniel Gockel für die PANDA-Kollaboration — Ruhr-Universität Bochum, Institut für Experimentalphysik I

Das $\overline{P}$ANDA-Experiment (Antiproton Annihilation at Darmstadt) ist eines der Großexperimente an der zur Zeit im Bau befindlichen Beschleunigeranlage FAIR (Facility for Antiproton and Ion Research) in Darmstadt. $\overline{P}$ANDA soll dabei auf dem Gebiet der Hadronenspektroskopie, der exotischen Materie sowie über die Struktur der Nukleonen neue Erkenntnisse liefern. Innerhalb des Detektors werden die vom HESR-Speicherring gelieferten Antiprotonen mit Impulsen zwischen $1,5\,\mathrm{GeV}/c$ und $15\,\mathrm{GeV}/c$ auf quasi ruhende Protonen treffen (Fixed Target Experiment).

Das homogene Elektromagnetische Kalorimeter wird aus 15644 Bleiwolframat-Kristallen (PWO-II) bestehen, deren Lichtausbeute stark temperaturabhängig ist. Bei Temperaturen von $T = -25\,°\mathrm{C}$ wird eine bis zu vier mal höhere Lichtausbeute erreicht als bei $T = +25\,°\mathrm{C}$ ($\mathrm{d}LY/\mathrm{d}T = -3\,\%/°\mathrm{C}$ bei Raumtemperatur). Um eine zeitlich konstante und räumlich homogene Temperatur der Kristalle zu gewährleisten, werden die Temperaturen des Kühlmittels der verschiedenen Kühlkreisläufe durch Zuheizen geregelt.

Die einzelnen Hardwarekomponenten, deren Ansteuerung und die Temperaturregelung werden vorgestellt.

Gefördert durch das BMBF.

HK 5.3 Mo 14:45 Audimax H1

The HADES electromagnetic calorimeter upgrade: status and perspectives* — •Adrian Rost — TU Darmstadt

The HADES spectrometer is located at the SIS18 accelerator at the GSI Helmholtzzentrum für Schwerionenforschung GmbH in Darmstadt. The new electromagnetic calorimeter (ECAL) detector, which is based on lead-glass modules, is currently under commissioning. The calorimeter enables photon measurements. Thus neutral mesons (π^0, η, ω), which are essential for interpretation of dilepton data, will be measured. Furthermore, photon measurement is of a large interest for the HADES strangeness program. The read-out system is based on the PaDiWa-AMPS2 Q2ToT (Charge-to-Time-over-Threshold) front-end board for the well established TRB3 (Trigger and Read-out Board - version 3) platform. The needed discriminators, the high precision TDCs (Time-to-Digital-Converters) and the data acquisition functionality are implemented with the help of FPGAs (Field Programmable Gate Arrays). In this contribution the status of the detector installation will be shown. Special emphasis will be put on the read-out system and its performance.

This work has been supported by the DFG through GRK 2128 and VH-NG-823.

HK 5.4 Mo 15:00 Audimax H1

Ergebnisse der Strahlenhärteuntersuchung der Hochspannungsuntereinheit des $\overline{P}$ANDA EMC* — •Christopher Hahn für die PANDA-Kollaboration — II. Physikalisches Institut, Gießen, Deutschland

Um sicherzustellen, dass die Hochspannungsjustiereinheit der im Elektromagnetischen Kalorimeter des $\overline{P}$ANDA Experimentes am zukünfti-

gen FAIR Komplex in Darmstadt verwendeten Avalanche Photodioden (APD) während der Betriebsdauer funktionsfähig bleibt, wurden Untersuchungen zur Strahlenhärte durchgeführt. Die Veränderungen der Justierelektronik wurde anhand der Kennlinienveränderungen (Dunkelstrom bei anliegender Spannung) ausgewählter APDs bestimmt, welche als Referenz dienten. Unterschiedliche bestückte Platinen des Prototyps der Justiereinheit wurden am Strahlenzentrum in Gießen sowohl Neutronen als auch Gammastrahlung ausgesetzt. Zusätzlich wurde eine Platine am AGOR am KVI-CART/Groningen (Niederlande) mit Protonen bestrahlt. Die verwendete Gammastrahlendosis übersteigt die erwartete Strahlendosis hinter den im Kalorimeter verwendeten Bleiwolframat-Kristallen um ein Vielfaches. Die Anzahl der Hadronen ($\int \phi \, dt$) lag bei den Tests unterhalb der im Experiment erwarteten. Zusätzlich wurde untersucht, ob Veränderungen der Elektronik anhand einer aufgenommenen Kennlinie vor der Bestrahlung und einer entsprechenden Kennlinie nach der Bestrahlung zurückgerechnet werden können. Die Ergebnisse dieser Untersuchungen des Prototyps der Hochspannungsunterversorgung des $\overline{\text{P}}$ANDA EMCs sollen vorgestellt werden. *gefördert durch das BMBF und HIC for FAIR

HK 5.5 Mo 15:15 Audimax H1

Feature extraction of the electromagnetic calorimeter preamplifier (APFEL - ASIC) for the PANDA experiment at FAIR — Samer Ahmed[1,2], Luigi Capozza[1], Alaa Dbeyssi[1], Phillip Grasemann[1,2], Frank Maas[1,2,3], •Oliver Noll[1,2], David Rodriguez Pineiro[1], Sahra Wolff[1,2], Manuel Zambrana[1,2] und Iris Zimmermann[1,2] für die PANDA-Kollaboration — [1]Helmholtz-Institut Mainz, Mainz, Germany — [2]Institute of Nuclear Physics, Mainz, Germany — [3]PRISMA Cluster of Excellence, Mainz, Germany

The PANDA experiment at the upcoming FAIR accelerator facility will study antiproton annihilation reactions at antiproton beam momenta from 1.5 GeV/c up to 15 GeV/c. With its modular multi purpose detector system it will be able to observe a variety of physics channels. The electromagnetic process group (EMP) at HI-Mainz is developing the backward end-cap of the electromagnetic calorimeter. Within this activity a method for the real time extraction of specific signal features using the APFEL ASIC preamplifier will be developed for the whole PANDA calorimeter. It has to recognise the signal pulse shape whilst ensuring at the same time a single channel threshold for deposited energy of lower than 3 MeV for meet the PANDA requirements. The extraction procedure need to be optimised in terms of resource usage in view of the many read out channels. The talk will discuss the feature extraction with emphasis for its efficient implementation on a FPGA via distributed arithmetics.

HK 6: Instrumentation II

Zeit: Montag 14:00–15:15 Raum: HZO 80

Gruppenbericht HK 6.1 Mo 14:00 HZO 80

The CBM Time-of-Flight wall — •Ingo Deppner and Norbert Herrmann for the CBM-Collaboration — Physikalisches Institut der Universität Heidelberg

The Compressed Baryonic Matter (CBM) experiment aims at exploring the QCD phase diagram at large baryon densities in the beam energy range from 2 A GeV to 11 (35) A GeV at the SIS100 (SIS300) accelerator of FAIR/GSI. For charged particle identification that is required by many observables that are sensitive to the phase structure like collective flow, phase space population of rare hyperons, fluctuations of conserved quantities, - a high performance Time-of-Flight (TOF) wall with a granularity of about 120.000 channels and a system timing resolution of better than 80 ps is being built. The most demanding challenge, however, is the enormous incident particle fluxes between 100 Hz/cm^2 and 25 kHz/cm^2 generated at the highest interaction rates (10 MHz) that CBM is designed for. Part of the wall ($\sim$10.000 channels) will be installed in the forward hemisphere ($1.0 < \eta < 1.5$) of the STAR experiment at RHIC/ BNL during the beam energy scan (BES II) campaign planned for 2019/2020. This project, called eTOF, is in the scope of the FAIR phase 0 program.
The status and the performance regarding time resolution, efficiency, cluster size and rate capability of the TOF system and in particular of the eTOF system as well as the physics reach will be discussed.
Work was supported partially by BMBF 05P12VHFC7 and by EU/FP7-HadronPhysics3/WP19.

HK 6.2 Mo 14:30 HZO 80

Untersuchung von RPC-Auflösungen mit kosmischer Strahlung — •Philipp Weidenkaff für die CBM-Kollaboration — Universität Heidelberg

Die Cbm-ToF Gruppe entwickelt und produziert RPC-Flugzeit-Detektoren für CBM und das eToF-Update des STAR-Experiments. Detektor-Tests mit kosmischer Strahlung sind ein wichtiger Schritt in der Qualitätskontrolle der Module für die 2018-2019 anstehenden System-Integrationstests in MiniCBM@SIS18 und STAR@RHIC. Mit Messungen kosmischer Strahlung wird das Verhalten der RPC-Detektoren in Bezug auf Zeitauflösung, Ortsauflösung und Effizienz bei minimalem Teilchenfluss bestimmt. In einer solchen sauberen Umgebung kann dass Detektor-Verhalten unabhängig von störendenden Einflüssen komplexer Reaktionen untersucht werden und bietet die Möglichkeit die Analyse-Software anhand von einfachen Ereignissen im Vergleich zu Monte-Carlo-Simulationen zu verifizieren.

HK 6.3 Mo 14:45 HZO 80

Barrel Time-of-Flight Detector for the PANDA Experiment - Hardware Performance Validation - Update — •Sebastian Zimmermann[1,2], Ken Suzuki[1], Kai-Thomas Brinkmann[2], Marius Chirita[1], Nicolaus Kratochwil[1], William Nalti[1], Lukas Gruber[1], Dominik Steinschaden[1], Albert Lehmann[3], Merlin Böhm[3], Carsten Schwarz[4], Herberth Orth[5], Kamal Dutta[6], and Kushal Kalita[6] for the PANDA-Collaboration — [1]Stefan-Meyer-Institut, Wien, Österreich — [2]JLU, Gießen — [3]FAU, Erlangen-Nürnberg — [4]GSI, Darmstadt — [5]HIM, Mainz — [6]Gauhati University, Assam, India

We describe the technical layout and the expected performance of the Barrel Time-of-Flight detector (*Barrel TOF*) for the PANDA target spectrometer, giving updates on recent developments. The Barrel TOF detector has been designed to precisely measure the time at which a charged particle transits the detector with a resolution superior to the other sub-detectors. It will signal the topology of physics events, hence setting cornerstones for event classification. The implementation of the Barrel TOF is based on very fast organic scintillator tiles coupled to Silicon Photomultipliers. In total 2000 scintillators and 16k SiPMs will be used, covering 5 m^2. The detector R&D is now in advanced stage and the technical design report is being reviewed by FAIR council.

The emphasis of this talk will be put on the updated design and performance of the PCB stripline transmission and fine scans of the time resolution of the detector elements, continuing the updates for the B-TOF detector.

HK 6.4 Mo 15:00 HZO 80

Barrel Time-of-Flight Detector for the PANDA Experiment - Hardware Performance Validation - Update — •Sebastian Zimmermann[1,2], Ken Suzuki[1], Kai-Thomas Brinkmann[2], Marius Chirita[1], Nicolaus Kratochwil[1], William Nalti[1], Lukas Gruber[1], Dominik Steinschaden[1], Albert Lehmann[3], Merlin Böhm[3], Carsten Schwarz[4], Herberth Orth[5], Kamal Dutta[6], and Kushal Kalita[6] for the PANDA-Collaboration — [1]Stefan-Meyer-Institut, Wien, Austria — [2]JLU, Gießen — [3]FAU, Erlangen-Nürnberg — [4]GSI, Darmstadt — [5]HIM, Mainz — [6]Gauhati University, Assam, India

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HK 7: Instrumentation III

Zeit: Montag 14:00–15:30 Raum: HZO 90

Gruppenbericht HK 7.1 Mo 14:00 HZO 90

Status of the open charm physics program of NA61/SHINE* — •Michael Deveaux for the NA61/SHINE-Collaboration — Goethe Universität Frankfurt am Main

NA61/SHINE aims to study the production of open charm in A+A collision systems at high CERN SPS energies. To do so, the experiment was upgraded with the so-called Small Acceptance Vertex Detector (SAVD). The SAVD consists of four layers of 50 μm thin MIMOSA-26 CMOS sensors and incorporates the electronics of the prototype of the CBM Micro Vertex Detector and the thin carbon fibre ladders developed for the ALICE ITS. The detector was operated successfully during the regular Xe+La data taking of NA61/SHINE in 2017.

We discuss the detector performance and show preliminary results on D^0 relying on data from a 150A GeV/c Pb+Pb commissioning run carried out in December 2016. Moreover, we give an outlook toward the construction of a full, Large Acceptance Vertex Detector (LAVD).

* Supported by the Polish NCN (2014/15/B/ST2/02537), St-Petersburg Univ. (11.38.242.2015) and HIC for FAIR.

HK 7.2 Mo 14:30 HZO 90

Optimierung der Betriebseinstellungen des MuPix7-Sensorprototyps — •René Hagdorn für die Mu3e-Kollaboration — Universität Heidelberg, Physikalisches Institut, jetzt an der Ruhr-Universität Bochum, Institut für Experimentalphysik I

Das Mu3e-Experiment wird mit einer Sensitivität von einem in 10^{16} Myonzerfällen nach dem im Standardmodell untersagten leptonfamilienzahlverletzenden Prozess $\mu^+ \to e^+e^-e^+$ suchen. Ein beobachtetes Signal wäre ein klarer Hinweis auf Neue Physik. Um Streueffekte im Detektor gering zu halten, soll der Spurdetektor aus 50 μm dünnen Siliziumpixelsensoren basierend auf dem Konzept der hochspannungsbetriebenen monolithischen aktiven Pixelsensoren (HV-MAPS) bestehen. Die vorgesehene Heliumgaskühlung des Detektors ist auf eine maximale Kühlleistung von 400 mW/cm^2 ausgelegt, was den erlaubten Energieverbrauch der Sensoren limitiert.

Die Betriebseinstellungen des MuPix7-Sensorprototyps wurden in Labormessungen systematisch optimiert und während einer Teststrahlkampagne validiert. Es wurde eine optimale Einstellung mit einem Energieverbrauch von ca. 275 mW/cm^2 gefunden, die gleichzeitig einen breiten Arbeitsbereich mit Effizienzen von mehr als 99 % und ein verbessertes Signal-zu-Rausch-Verhältnis gegnüber vorherigen Betriebseinstellungen bietet. Zudem wurde mit dem MuPix7 ein Verfahren entwickelt, mit dem effizienzähnliche Werte in einer Labormessung bestimmt werden können, was die Planung und den Ablauf künftiger Effizienzmessungen während der Strahlzeiten vereinfacht.

HK 7.3 Mo 14:45 HZO 90

Status of the read-out system of the Belle II pixel detector — •Andrei Rabusov, Igor Konorov, Dmytro Levit, Stefan Huber, and Stephan Paul — Technische Universität München

The new experiment Belle II at the SuperKEKB e^+e^- collider at KEK, Tsukuba, Japan will start by late 2018 to continue searches of the New Physics in heavy flavor sector. In comparison to the previous detector Belle the new one is equipped with the pixel detector, which consist of 40 detector modules. The functionality of the pixel detector is studied during Phase II (period from November 2017 to May 2018) using only 4 modules installed inside the detector volume. In this report I present the current status of the Belle II pixel detector read-out system. The report will include the latest read-out scheme and results of Phase II commissioning with the corresponding laboratory tests. I will show in the first time the final version of the system architecture which achieves 20 Gb/s read-out speed test. Additionally, I will present the clustering algorithm based on moving window method, subevent building and the study of the effect on the average event size in case of overlapping triggers of two different data formats used in the read-out system: clustered and zero-suppressed data formats.

HK 7.4 Mo 15:00 HZO 90

Towards an EPICS based Detector Control System for the CBM Micro Vertex Detector — •Philipp Klaus for the CBM-MVD-Collaboration — Goethe-Universität, Frankfurt

The Compressed Baryonic Matter experiment at FAIR (CBM) is a dedicated fix-target experiment designed to explore the QCD phase diagram in the region of high net-baryon density. Operating the CBM Micro Vertex Detector requires a well integrated dedicated Detector Control System (DCS) to guarantee maximum detector performance. The main aspects that require control and monitoring comprise powering, vacuum conditions, the cooling system, the detector positioning, and diagnostic information from the readout/DAQ. The Experimental Physics and Industrial Control System (EPICS) was chosen to implement the DCS. A full-fledged control user interface will be provided in a Control System Studio (CSS) environment, complemented by a monitoring-only real-time web interface.

This constribution will present the status of the MVD DCS excercised with an actual prototype called PRESTO.
This work has been supported by BMBF (05P15RFFC1), GSI, HIC for FAIR and HGS-HIRe.

HK 7.5 Mo 15:15 HZO 90

Evaluation of Innovative Cooling Concepts with High-Performance Carbon Materials for Vertex Detectors operated in Vacuum — •Daniela Mijatovic for the CBM-MVD-Collaboration — Goethe-Universität

Operating high-precision vertex detectors in vacuum, like the Micro Vertex Detector (MVD) in the CBM experiment at FAIR, calls for trading off the cooling performance against the material budget to guarantee high-quality tracking performance. Vertex detectors operating in vacuum have to fulfill additional requirements, among them an excellent cooling performance as convective cooling is absent. As a consequence, high-performance, carbon-based materials are used for sensor carriers following the concept of heat conduction to guide the heat dissipated by the sensors to dedicated heat sinks located outside the geometrical detector acceptance. Sensor carrier materials based on pyrolytic graphite (e.g. Thermal Pyrolythic Graphite (TPG)) were systematically characterized. To do so, a standardized vacuum test stands with IR thermography was set up to quantitatively examine the thermal performance of the MVD modules in vacuum.

This contribution presents our work in designing and testing innovative carrier material assemblies to efficiently cool ultra-thin vertex detectors in the context of constructing the Micro-Vertex-Detector of CBM at the future FAIR facility.

"This work has been supported by BMBF (05P15RFFC1), GSI and HIC for FAIR."

HK 8: Hadron Structure and Spectroscopy II

Zeit: Montag 16:30–18:30 Raum: HZO 50

Gruppenbericht HK 8.1 Mo 16:30 HZO 50

Spin Density Matrix Elements in Exclusive Omega Meson Production at COMPASS — Horst Fischer, Matthias Gorzellik, and •Philipp Jörg — Albert-Ludwigs-Universität Freiburg, on behalf of the COMPASS collaboration

A major part of the COMPASS-II program is dedicated to the investigation of generalized parton distributions (GPDs) and transverse momentum dependent parton distributions (TMDs), which aim for the most complete description of the partonic structure of the nucleon.

GPDs are experimentally accessible via lepton-induced exclusive reactions, in particular the Deeply Virtual Compton Scattering (DVCS) and Deeply Virtual Meson Production (DVMP). At COMPASS, those processes are investigated using a high intensity muon beam with a momentum of 160 GeV/c impinging on a 2.5 m-long liquid hydrogen target. To ensure the exclusivity and precision of the measurement, wide angle electromagnetic calorimetry together with a two-stage magnetic spectrometer is used.

Exploiting the flavour filtering character of DVMP measurements,

the COMPASS experiment is able to access different combinations of quark and gluon GPDs by studying the exclusive production of various mesons. We report on the extraction of spin density matrix elements in exclusive ω production.
*Supported by BMBF and the DFG Research Training Group Programme 2044.

HK 8.2 Mo 17:00 HZO 50

Nucleon resonance spectroscopy via meson-pair decay* — •Mariana Nanova for the CBELSA/TAPS-Collaboration — II. Physikalisches Institut, Justus-Liebig-Universität Gießen

Photoproduction of mesons provides important information about the excitation spectrum of the nucleon that is still not sufficiently understood despite various long-lasting experimental and theoretical efforts [1]. Reactions with multiple-meson final states are important, in particular $\pi^0\eta$ since the η acts as an isospin filter and provides information on the nature of the intermediate resonances. We studied the two-meson photoproduction with the CB/TAPS detector system at the ELSA accelerator in Bonn in the reaction γp$\rightarrow p\pi^0\eta$. High statistics have been obtained in irradiating a liquid hydrogen target with photon beams in the incident energy range from 0.9 to 3.0 GeV. A kinematic fit has been used in the reconstruction and identification of the exit channels. Dalitz plots show a clear evidence for various baryon resonances populated in the decay of higher lying nucleon resonances. Preliminary results on studying a narrow resonance-like structure, claimed by other experiments, will be presented.

[1] E. Klempt and J.-M. Richard, *Rev. Mod. Phys.* **82** (2010) 1095
*Supported by DFG through SFB/TR16.

HK 8.3 Mo 17:15 HZO 50

Analysis of the reaction $\gamma p \rightarrow K^0\Sigma^+$ in the $K^0 \rightarrow (\pi^0\pi^0)$ decay channel at the BGO-OD experiment — •Stefan Alef for the BGO-OD-Collaboration — Physikalisches Institut Universität Bonn

The BGO-OD experiment at the ELSA facility in Bonn investigates nucleon excitations via meson photoproduction. One research objective is associated strangeness production, which includes the reaction channel $\gamma p \rightarrow K^0\Sigma^+$.

The K^0 is reconstructed via its neutral decay. Kinematic fitting and template fits are used to discriminate signal against background.
Supported by DFG (PN 50165297).

HK 8.4 Mo 17:30 HZO 50

The η'-nucleus potential at low meson momenta* — •Mariana Nanova and Volker Metag for the CBELSA/TAPS-Collaboration — II. Physikalisches Institut, Justus-Liebig-Universität Gießen

The production of η'-mesons in coincidence with forward-going protons has been studied in photon induced reactions on ^{12}C and on a LH_2 target for incoming photon energies of 1.3-2.6 GeV at the electron accelerator ELSA. Under these kinematic constraints the η' mesons are produced with relatively low kinetic energy ($\approx$ 150 MeV) since the coincident protons take over most of the momentum of the incident photon beam. For the C-target this allows the determination of the real part of the η'-carbon potential at low meson momenta by comparing with collision model calculations of the η' kinetic energy distribution and excitation function. The present measurement extends earlier determinations of the η'-nucleus potential at higher average momenta towards the production threshold. A comparison of the data with calculations by E. Paryev [1] indicates that also at low momenta deep η'-nucleus potentials of $\geq$ 100 MeV can be excluded. The LH_2 data, taken as a reference to check the data analysis and the model calculations, provide differential and integral cross sections in good agreement with previous results for η' and η photoproduction off the free proton.

[1] E. Ya. Paryev, *J. Phys. G* **43** (2016) 015106
*Supported by DFG through SFB/TR16.

HK 8.5 Mo 17:45 HZO 50

Analysis of the reaction $\gamma p \rightarrow K^0\Sigma^+$ by the identification of the charged K^0 decay channel at the BGO-OD experiment* — •Björn-Eric Reitz for the BGO-OD-Collaboration — Physikalisches Institut, Universität Bonn

The BGO-OD experiment at the ELSA facility in Bonn investigates nucleon excitations via meson photoproduction. A program of measurements of associated strangeness final states has begun, one of which is $\gamma p \rightarrow K^0\Sigma^+$.

This talk shows preliminary results of the analysis for the charged decay channel $K^0\Sigma^+ \rightarrow (\pi^-\pi^+)\,(\pi^0 p)$ obtained from new data.
*Supported by DFG (PN 50165297).

HK 8.6 Mo 18:00 HZO 50

Low-energy limit of the O(4) quark-meson model from the functional renormalization group approach — •Jürgen Eser[1], Florian Divotgey[1], Mario Mitter[2], and Dirk Rischke[1] — [1]Institut für Theoretische Physik, Johann Wolfgang Goethe-Universität, Max-von-Laue-Str. 1, 60438 Frankfurt am Main — [2]Department of Physics, Brookhaven National Laboratory, Upton, NY 11973

We compute the low-energy limit of the O(4)-symmetric quark-meson model as an effective field theory for Quantum Chromodynamics within the Functional Renormalization Group (FRG) approach. In particular, we analyze the renormalization group flow of momentum-dependent pion self-interactions beyond the local potential approximation. The numerical results for these couplings obtained from the FRG are confronted with a recent tree-level study. Additionally, their effect on the wave-function renormalization and the curvature masses is investigated.

HK 8.7 Mo 18:15 HZO 50

$\eta \rightarrow \pi^0 e^+ e^-$ – Search for C-violation with WASA-at-COSY* — •Kay Demmich, Florian Bergmann, Nils Hüsken, and Alfons Khoukaz for the WASA-at-COSY-Collaboration — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, Germany

By the means of the experimental setup WASA-at-COSY a huge $pp \rightarrow pp\eta$ data set of $\approx 5\times10^8$ η-mesons has been collected, aiming for analyses of rare and forbidden η-decays. This data set allows for studies on C-parity violating reactions like the electromagnetic decay $\eta \rightarrow \pi^0 e^+ e^-$ via a virtual photon, which is forbidden within the standard model. The branching ratio can be determined with a significantly higher sensitivity than the current upper limit of 4×10^{-5} as quoted by the PDG. Since C-parity conserving higher order processes are highly suppressed, this decay poses a perfect probe to test the conservation laws of the standard model.
Preliminary results of the analysis will be presented and discussed.

*Supported by FFE program of the Forschungszentrum Jülich.

HK 9: Heavy Ion Collisions and QCD Phases II

Zeit: Montag 16:30–18:30 Raum: HZO 60

Gruppenbericht HK 9.1 Mo 16:30 HZO 60

Final state hadron chemistry and kinematic distributions in Au+Au collisions at $\sqrt{s_{NN}}$ = 2.42 GeV with HADES — •Malgorzata Gumberidze for the HADES-Collaboration — TU Darmstadt

The matter formed in central heavy-ion collisions at a few GeV per nucleon is commonly understood as resonance matter, a gas of nucleons and excited baryon states with a substantial contribution from mesonic, mostly pionic excitations. Yet, in the initial phase of the reaction the system is compressed to densities several times larger than the normal nuclear matter density density and temperatures of about 80 MeV. At such extreme conditions the fundamental properties of the hadrons are expected to be modified.

The High Acceptance DiElecton Spectrometer (HADES), installed at heavy-ion synchrotron SIS18 at the GSI Helmholtzzentrum für Schwerionenforschung (Germany), is currently the only experiment studying properties of strongly interacting matter in a few A GeV energy regime. It studies dielectron and hadron production in heavy-ion collisions, as well as in proton- and pion-induced reactions in the energy range of 1 - 4 GeV.

In this contribution the yields and spectra of a comprehensive set of hadrons (p, $\pi^{\pm}$, $K^{\pm}$, ϕ, Λ) produced in Au+Au collisions at $\sqrt{s}$ = 2.42 GeV will be presented. The high statistics data allows for studying multi-differential distributions. Experimental spectra will be confronted with results obtained by other experiments as well as with

available model calculations.

HK 9.2 Mo 17:00 HZO 60

Strangeness production via resonances in nucleus-nucleus collisions — •Vinzent Steinberg[1,2], Jan Staudenmaier[1,2], Feng Li[2], and Hannah Petersen[1,2,3] — [1]Institute for Theoretical Physics, Goethe University, Franfurt am Main, Germany — [2]Frankfurt Institute for Advanced Studies, Frankfurt am Main, Germany — [3]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany

The production of strange particles in heavy-ion collisions is enhanced compared to elementary reactions with particularly interesting results on the ϕ meson production close to the threshold by the HADES collaboration at GSI-SIS energies. In this talk, SMASH (Simulating Many Accelerated Strongly-interacting Hadrons), a new hadronic transport approach designed to describe the non-equilibrium evolution of heavy-ion collisions, is applied to investigate the production of strange particles. The production mechanism via resonances is constrained by experimental data from elementary collisions and can describe strangeness production in small systems. To describe large systems, in-medium effects may be important.

HK 9.3 Mo 17:15 HZO 60

The effect of finite particle number sampling on baryon number fluctuations — •Jan Steinheimer[1] and Volker Koch[2] — [1]Frankfurt Institute for Advanced Studies, Ruth-Moufang-Str. 1, 60438 Frankfurt am Main, Germany — [2]Nuclear Science Division, Lawrence Berkeley National Laboratory, Berkeley, California 94720, USA

In this talk we discuss the effects of finite particle number sampling on the net baryon number cumulants, extracted from fluid dynamical simulations of nuclear collisions. The commonly used finite particle number sampling procedure introduces an additional Poissonian (or multinomial if global baryon number conservation is enforced) contribution which increases the extracted moments of the baryon number multiplicity distribution. If this procedure is applied to a fluctuating fluid dynamics framework one severely overestimates the actual cumulants. It will be shown that the sampling of so called test-particles suppresses the additional contribution to the moments by at least one power of the number of test-particles. The method will be demonstrated for a numerical fluid dynamics simulation that includes the effects of spinodal decomposition due to a first order QCD phase transition in heavy ion collisions. Furthermore, in the limit where anti-baryons can be ignored, we derive analytic formulas which capture exactly the effect of particle sampling on the baryon number cumulants. These formulas may be used to test the various numerical particle sampling algorithms.

This talk is based on: J.Steinheimer and V.Koch, Phys. Rev. C 96, no. 3, 034907 (2017).

HK 9.4 Mo 17:30 HZO 60

Integration of cosmic muons in the Bethe-Bloch parametrization with the ALICE TPC — •Matthias Kleiner for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

The Time Projection Chamber (TPC) is the main tracking and particle identification detector of the ALICE experiment at the CERN LHC. The specific energy loss ($\mathrm{d}E/\mathrm{d}x$) of particles traversing the TPC is parametrized in the ALICE analysis framework AliROOT by a Bethe-Bloch function. At present, the function is fitted using clean samples of electrons, protons and pions. However, none of these particles have a velocity in the region of the relativistic rise up to the Fermi plateau. In this talk, a new method is presented which includes the cosmic muons $\mathrm{d}E/\mathrm{d}x$ to the parametrization. The quality of the new parametrization is studied and compared to the parametrization obtained without muons. Supported by BMBF and Helmholtz Association.

HK 9.5 Mo 17:45 HZO 60

Recent event-by-event net-particle fluctuation results from ALICE — •Mesut Arslandok for the ALICE-Collaboration — Physikalisches Institut Heidelberg

The fluctuations of conserved charges - such as electric charge, strangeness, or baryon number - in ultrarelativistic heavy-ion collisions provide insights into the properties of hot and dense matter produced as well as the QCD phase diagram. They can be related to the moments of the multiplicity distributions of identified particles. In this context, experimental results will be presented on event-by-event analysis of net baryon fluctuation measurements in Pb–Pb collisions recorded by the ALICE Collaboration at the CERN LHC. In addition to net-protons, used as a proxy for net-baryons, similar results for net-pions and net-kaons will be presented. Contributions from participant fluctuations and resonances as well as baryon number conservation will be discussed. Particular emphasis will be placed on the quantitative understanding of the centrality and rapidity width dependence of the obtained results. The data will be compared with recent predictions from the Hadron Resonance Gas model (HRG) and Lattice QCD (LQCD).

Supported by BMBF and SFB 1225 ISOQUANT.

HK 9.6 Mo 18:00 HZO 60

Perspectives on strangeness physics with the CBM experiment at FAIR — •Iouri Vassiliev[1], Maksym Zyzak[1], and Ivan Kisel[2,3] for the CBM-Collaboration — [1]GSI Helmholtzzentrum für Schwerionenforschung GmbH — [2]Frankfurt Institute for Advanced Studies — [3]Goethe-Universität Frankfurt

The main goal of the CBM experiment at FAIR is to study the behavior 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 promising signatures of this new states are the enhanced production of multi-strange particles. The CBM detector is designed to measure such rare diagnostic probes with unprecedented precision and statistics. Important key observables are the production of hypernuclei and dibaryons. Theoretical models predict that single and double hypernuclei, and heavy multi-strange short-lived objects are produced via coalescence in heavy-ion collisions with the maximum yield in the region of SIS100 energies. The discovery and investigation of new hypernuclei and of hyper-matter will shed light on the hyperon-nucleon and hyperon-hyperon interactions. Feasibility studies of these key observables in the CBM experiment are presented.

HK 9.7 Mo 18:15 HZO 60

Application of Cellular Automaton track finder in TPC detectors — •Grigory Kozlov[1,2], Yuri Fisyak[3], Ivan Kisel[1,4], and Maksim Zyzak[4] for the CBM-Collaboration — [1]FIAS, Frankfurt am Main, Germany — [2]JINR, Dubna, Russia — [3]BNL, Upton, USA — [4]GSI, Darmstadt, Germany

Track finding procedure is one of the key step of events reconstruction in high energy physics experiments. Track finding algorithms combine hits into tracks and reconstruct trajectories of particles flying through the detector. The problem of combining hits into particle trajectories is considered as an extremely time consuming task because of large combinatorics. Thus, calculation speed is crucial in heavy ion experiments. The Cellular Automaton (CA) algorithm provides a perfect solution for this task. Being intrinsically parallel, it can be massively parallelised on the modern many core computing platforms keeping high track reconstruction efficiencies even in case of high particle multiplicity. The CA track finder algorithm was investigated in application to the TPC CA track finder in the STAR experiment within the FAIR Phase 0 as a part of preparation to the Beam Energy Scan II (BES II) program. The track finder is being prepared to operate in the online mode, thus, requires maximum possible speedup. To achieve these goal the data structures were improved for better SIMDisation and parallelisation, the implementation was optimised utilising the locality of the CA algorithm. As a result, higher speed is achieved with the reconstruction efficiency being the same.

HK 10: Structure and Dynamics of Nuclei II

Zeit: Montag 16:30–18:15 Raum: HZO 70

Gruppenbericht HK 10.1 Mo 16:30 HZO 70

Fast timing results from EXILL&FATIMA for fission fragments in the neutron-rich region around Z=40, N=60. — •Jan Jolie[1], Jean-Marc Régis[1], Saba Ansari[1,2], Nima Saed-Samii[1], and Nigel Warr[1] — [1]Institut für Kernphysik, Universität zu Köln, Zülpicher Str. 77, 50937 Köln — [2]CEA de Saclay, IRFU, 91191 Gif-sur-Yvette, France

Several lifetimes or lifetime limits were measured in the even-even Strontium isotopes 94-Sr, 96-Sr and 98-Sr [1] and Zirconium isotopes 98-Zr, 100-Zr, and 102-Zr [2] using the EXILL&FATIMA array [3] to perform fast electronic timing on fission products produced after cold neutron capture in 235U. Absolute values and limits for the lifetimes of the lowest yrast states could be determined. The results are compared to state-of-the-art Monte Carlo Shell Model calculations and to several predictions based on Energy Density Functionals. Supported by the BMBF, Grant No. 05P15PKFNA.

[1] J.M. Régis et al. Phys. Rev. C95 (2017) 054319 [2] S. Ansari et al. Phys. Rev. C96 (2017) 054323 [3] J.M. Régis et al. Nucl. Instr. Meth. Phys. Res. A763 (2014) 210

HK 10.2 Mo 17:00 HZO 70

Lifetime measurements in neutron-rich Ce isotopes — •Guillermo Fernández Martínez, Stoyanka Ilieva, and Thorsten Kröll for the FATIMA-GS-Collaboration — Institut für Kernphysik, Technische Universität Darmstadt, Schlossgartenstr. 9, 64289 Darmstadt

The structural evolution of neutron-rich Ce isotopes (Z=58) can be better understood through the knowledge of their low-lying states' lifetimes. The data presented here originate from an experimental campaign carried out at the Argonne National Laboratory (ANL) at the turn of the year 2015/2016, that aimed for the direct measurement of lifetimes of excited states in the ^{252}Cf spontaneous fission products. The combined usage of one hemisphere of the Gammasphere, consisting of 51 high-resolution HPGe detectors, and an array of 25 ultra-fast $LaBr_3$(Ce) scintillators from the NuSTAR-FATIMA collaboration, allowed the collection of coincident γ-rays for a period of 30 days. The selection of the Ce isotopes of interest was ensured by posing the necessary amount of energy gates in the HPGe detectors on their characteristic transitions, while the lifetimes in the region from some nanoseconds down to few tens of picoseconds were obtained from the time response of the $LaBr_3$(Ce) detectors, applying the Generalized Centroid Difference method. In the present work, first results for the lifetimes of the low-lying excited states of $^{146-150}$Ce will be shown. This work is supported by the German BMBF under grant no. 05P12RDNUP (NuPNET), the FATIMA collaboration, the TU-GSI cooperation contract and HIC for FAIR.

HK 10.3 Mo 17:15 HZO 70

Lifetimes in ^{128,130}Te extracted via the Doppler-shift attenuation method using pγ coincidences — •Sarah Prill[1], Anna Bohn[1], Michelle Färber[1], Pavel Petkov[1,2,3], Simon G. Pickstone[1], Mark Spieker[1,4], Vera Vielmetter[1], Michael Weinert[1], and Andreas Zilges[1] — [1]Institute for Nuclear Physics, University of Cologne, Cologne — [2]INRNE, Bulgarian Academy of Sciences, Sofia, Bulgaria — [3]National Institute for Physics and Nuclear Engineering, Bucharest, Romania — [4]NSCL, Michigan State University, MI 48824, USA

To study the E2 strength around the semi-magic Sn isotopes, existing data for the Te isotopes were compiled. Since the information on level lifetimes in ^{128}Te and ^{130}Te is scarce, two pγ-coincidence experiments were performed using the Doppler-shift attenuation method (DSAM) [1] at the SONIC@HORUS setup in Cologne [2]. Nuclear-level lifetimes were extracted and feeding contributions could be excluded by particle energy gates in the spectra from the new version of the silicon detector array SONIC. By determining γ-decay branching ratios and B(E2) transition strengths, systematics in the Te isotopes were examined. This contribution will present the experimental setup as well as preliminary results and discuss the systematics in the Te isotopes.

Supported by the DFG (ZI-510/7-1).

[1] A. Hennig *et al.*, Nucl. Instr. and Meth. A 794 (2015) 171-176
[2] S.G. Pickstone *et al.*, Nucl. Instr. and Meth. A 875 (2017) 104-110

HK 10.4 Mo 17:30 HZO 70

Lifetime Measurement of the 4_1^+ state in ^{212}Po — •Christian Sürder[1], Guillermo Fernández Martínez[1], Stoyanka Ilieva[1], Jan Jolie[2], Vasil Karayon[2], James Keatings[4], Thorsten Kröll[1], Georgi Rainovski[3], Jean-Marc Régis[2], Nima Saed-Samii[2], Marcus Scheck[4], Mirko von Schmid[1], and Pietro Spagnoletti[4] — [1]Institut für Kernphysik, Technische Universität Darmstadt, 64289 Darmstadt, Germany — [2]Institut für Kernphysik, Universität zu Köln, 50937 Köln, Germany — [3]Faculty of Physics, St. Kliment Ohridski University of Sofia, 1164 Sofia, Bulgaria — [4]University of the West of Scotland, Paisley, United Kingdom

^{212}Po lies just two protons and two neutrons above the doubly magic nucleus ^{208}Pb. However, its structure exhibits interesting features of shell model and cluster model configurations [Ref: A. Astier, Phys. Rev. Lett. 104, 042701 (2010)]. In April 2016 an experiment was performed at the IKP at the University of Cologne with the goal to determine the lifetime of the $4_1^+ \rightarrow 2_1^+$ transition in ^{212}Po. The HORUS setup, equiped with 8 HPGe and 8 $LaBr_3$(Ce) detectors, was used. The nucleus was populated via the ^{208}Pb(^{12}C,^{8}Be) reaction at 62 MeV. The data were analysed applying the Generalized Centroid Difference Method (GCD) [Ref: J.-M. Régis et al., Nuclear Instruments and Methods in Physics Research A 726 (2013) 191-202]. The status of the analysis will be presented.

HK 10.5 Mo 17:45 HZO 70

Lifetime determination in 192,194,196 Hg via γ-γ fast-timing spectroscopy — •Arwin Esmaylzadeh, Jean-Marc Régis, Vasil Karayonchev, Lukas Knafla, Lisa Gerhard, and Jan Jolie — Insitut für Kernphysik, Universität zu Köln

Lifetimes of excited states in ^{192,194,196}Hg were measured using the Generalized Centroid Difference (GCD) method [1]. Three fusion evaporation reactions were used at the Cologne 10 MV Tandem accelerator: ^{184}W(^{12}C,4n)^{192}Hg, ^{186}W(^{12}C,4n)^{194}Hg and ^{197}Au(p,2n)^{196}Hg to populate the states of interest. To observe the γ-rays the HORUS spectrometer was equipped with eight HPGe- and nine $LaBr_3$(Ce) detectors. Lifetimes of 2_1^+, 4_1^+ and negative parity band member states were measured in all three nuclei. The experimental results were compared and discussed in the framework of the Interacting Boson Model (IBM). Two model calculations, i.e. IBM-Configuration Mixing (IBM-CM)[2] and IBM-2 [3] were used to describe the nuclei of interest. The two models calculations describe the properties of the nuclei within the experimental uncertainties.

Supported by DFG grant JO391/16-1

[1] J-M Régis et al., Nucl. Instrum. Methods Phys. Res. 726C (2013)
[2] J. E. García-Ramos and K. Heyde, Phys. Rev. C, 89 (2014)
[3] K. Nomura, R. Rodriguez-Guzman, and L. Robledo, Phys. Rev. C 87 (2012)

HK 10.6 Mo 18:00 HZO 70

Lifetime determination in ^{211}At via γ-γ fast-timing spectroscopy — •Vasil Karayonchev[1], Piet Van Isacker[2], Andrey Blazhev[1], Christoph Fransen[1], Jan Jolie[1], and Jean-Marc Régis[1] — [1]Institute for Nuclear Physics, University of Cologne — [2]Grand Accélérateur National d'Ions Lourds, BP 55027, F-14076 Caen Cedex 5, France

Lifetimes of excited states in ^{211}At were measured using the electronic γ-γ fast timing technique [1]. The nucleus of interested was populated in a ^{208}Pb(^{6}Li,3n)^{211}At fusion-evaporation reaction at the the 10 MV Tandem accelerator at the Institute for Nuclear Physics, University of Cologne. The lifetimes of the $17/2_1^-$, $23/2_1^-$ states were determined for the first time. The experimental results are compared to two shell model calculations, one using the modified Kuo-Herling interaction [2] and the other using an empirical interaction for 3 particles in a single j=9/2 shell.

Supported by DFG grant JO391/16-1

[1] J-M Régis et al., Nucl. Instrum. Methods Phys. A Res. 726 (2013).
[2] E.K. Warburtion, and B.A. Brown, Phys. Rev. C 43 (1991) 602.

HK 11: Fundamental Symmetries I

Zeit: Montag 16:30–18:15 Raum: HZO 100

Gruppenbericht HK 11.1 Mo 16:30 HZO 100

Laser spectroscopy of highly charged bismuth ions: The hyperfine-puzzle of strong-field QED — •Johannes Ullmann — Institut für Kernphysik, Universität Münster

Laser spectroscopy of the ground state hyperfi ne splittings in hydrogen-like and lithium-like bismuth ions ($^{209}Bi^{82+}$ and $(^{209}Bi^{80+}$) tests the theory of bound-state quantum electrodynamics (QED) in the strong field of the nucleus. Precise theoretical predictions use a specifi c difference of both splitting energies to cancel the large uncertainty of nuclear contributions. The transition in Li-like Bismuth was observed for the first time in 2011, yet the accuracy of the result was limited by the calibration of the electron cooler voltage, determining the ion velocity. Here, we report on improved laser spectroscopic measurements of both hyperfine splittings. The accuracy was improved by about an order of magnitude compared to the first observation in 2011. The most important new feature was an in-situ high voltage measurement system with an accuracy at the 10-ppm level provided by German metrology institute Physikalisch-Technische Bundesanstalt. The experimentally determined specific difference deviates more than 7σ from theory. This so-called hyperfine puzzle might be explained either by unknown effects in the specific difference or by a incorrect value of the nuclear magnetic moment of ^{209}Bi. Recent and future investigations to resolve this puzzle are presented.

HK 11.2 Mo 17:00 HZO 100

Limits on the Fierz Interference Term in Neutron Beta Decay with PERKEO III — •Heiko Saul[1,2], Hartmut Abele[2], Dirk Dubbers[3], Bastian Märkisch[1], Alexandr Pethukov[4], Christoph Roick[1], Torsten Soldner[4], and Xiangzun Wang[2] — [1]Physik Department ENE, TU München — [2]Atominstitut, TU Wien — [3]Physikalisches Institut, Universität Heidelberg — [4]Institut Laue-Langevin, Grenoble

Neutron beta decay provides an excellent toolkit for the investigation of the structure of the weak interaction and potential deviations from the predictions of the standard model of particle physics.

Measuring the beta asymmetry provides the most precise way to determine the ratio of axialvector- and vector-coupling, λ, and is also sensitive to non-zero scalar and tensor couplings via the Fierz interference term, b.

The neutron decay spectrometer Perkeo III was used to measure several correlation coefficients in neutron beta decay and performed the most precise measurement of the beta asymmetry at the PF1B beam at the Institut Laue-Langevin, Grenoble. In this talk we present the result of an energy-dependent analysis of the experimental beta asymmetry which yields limits on the Fierz interference term.

HK 11.3 Mo 17:15 HZO 100

Current Status of the Proton Asymmetry Measurement with Perkeo III — •Christoph Roick[1], Michael Klopf[2], Lukas Raffelt[1,3], Heiko Saul[1,2], Wilfried Mach[1], Daniel Moser[5], Gertrud Konrad[5], Torsten Soldner[4], Hartmut Abele[2], Ulrich Schmidt[3], and Bastian Märkisch[1] — [1]Physik-Department der TU München — [2]TU Wien, Atominstitut — [3]Physikalisches Institut der Universität Heidelberg — [4]Institut Laue-Langevin, Grenoble, Frankreich — [5]Stefan-Meyer-Institut, Wien

We present the status of the data analysis of the recent measurement of the proton asymmetry in neutron beta decay with Perkeo III. This first direct measurement using a pulsed neutron beam and a proton retardation system will improve the first indirect measurement of the proton asymmetry, which has been performed with Perkeo II. Measuring the proton asymmetry allows searches for physics beyond axialvector and vector couplings of the Standard Model when combined with measurements of other correlation coefficients of neutron beta decay.

HK 11.4 Mo 17:30 HZO 100

Normalization of stopped muons for the COMET muon to electron conversion experiment — •Andreas Jansen, Kai Zuber, and Dominik Stöckinger — TU Dresden, Institut für Kern- und Teilchenphysik, Germany

The COMET experiment at J-PARC in Japan will search for charged-lepton flavor violation by measuring the rate of neutrinoless transition of muons to electrons in the surrounding of atomic nuclei. Because this process is highly suppressed in the Standard Model it represents an excellent candidate to search for new physics and to confirm or constrain many new theories.

Negative muons will be shot at a muon stopping target where they are stopped in the coulomb field of aluminum atoms. As muons are mostly captured in excited energy levels they promptly cascade down to the 1s ground state, emitting characteristic X-rays in the process. To obtain the total number of muons stopped these X-rays are beeing measured using a high-purity germanium detector.

The key role in the following calculation plays the full energy peak efficiency of the used detector. Because of a complex structure of the muon stopping target as well as the far away position of the detector 3.5 m downstream, it is not trivial to determine this quantity. The talk will present the methods which were developed to study the efficiency and determine its value for the upcoming COMET measurements.

HK 11.5 Mo 17:45 HZO 100

Probing charged lepton flavor violation with the Mu2e experiment — •Stefan E. Müller and Anna Ferrari for the Mu2e-Collaboration — Helmholtz-Zentrum Dresden-Rossendorf, Dresden, Germany

The Mu2e experiment, currently under construction at the Fermi National Accelerator Laboratory near Chicago, will search for the neutrinoless conversion of muons to electrons in the field of an aluminum nucleus. This charged lepton flavor-changing process is highly suppressed in the Standard Model and therefore undetectable. There exist however scenarios for physics beyond the Standard Model that predict small but observable rates.The Mu2e experiment aims at a sensitivity four orders of magnitude better than existing experiments. This is achieved by a rigorous control of all backgrounds that could mimic the monoenergetic signal electron.

The design and status of the Mu2e experiment will be presented. In addition, I will highlight the results from several test runs carried out at HZDR's ELBE facility to study the radiation hardness and performance of components for the Mu2e calorimeter and for the detector that monitors the rate of stopped muons in the aluminum target.

HK 11.6 Mo 18:00 HZO 100

Investigation of non-depolarizing neutron guide coatings for neutron beta decay studies with PERC — •Alexander Hollering[1], Thorsten Lauer[2], Bastian Märkisch[3], and Ulrich Schmidt[4] — [1]FRM-II TU München, 85748 Garching — [2]Movatec GmbH, 85386 Eching — [3]TU München, 85748 Garching — [4]Universität Heidelberg, 69120 Heidelberg

Neutron beta decay is a sensitive tool to search for non-V-A couplings beyond the Standard model in the charged weak interaction. The PERC instrument is currently under construction at the MLZ, Garching and aims to measure correlation parameters in neutron beta decay with an accuracy improved by one order of magnitude to a level of 10^{-4}. This requires control of the neutron polarization on the same level. Inside PERC instrument, an 8 m long neutron guide is used as decay volume in a magnetic field of 1.5 Tesla and is fed by a highly polarized cold neutron beam. Supermirror neutron guides are usually made of hundreds of layers from nickel and titanium on a glass substrate. Nickel is magnetized by the magnetic field which leads to depolarization of the neutron beam even for layers made of nickel alloy with vanadium added. In order to ensure a depolarization of the neutron beam on the level of 10^{-4} per bounce, completely non-magnetic coatings preferably made of diamagnetic materials are required. We present measurements of our supermirrors made from copper and titanium layers with excellent reflectivity. Also despite the high mobility of copper, which leads to interdiffusion, our supermirrors are highly resistant to baking-out needed to reach low residual gas pressure.

HK 12: Instrumentation IV

Zeit: Montag 16:30–18:30 Raum: Audimax H1

Gruppenbericht HK 12.1 Mo 16:30 Audimax H1

Status of the Transition Radiation Detector for the CBM Experiment — •Philipp Kähler for the CBM-Collaboration — Institut für Kernphysik, WWU Münster, Germany

The Transition Radiation Detector (TRD) will be part of the Compressed Baryonic Matter (CBM) experiment at FAIR. Multi-Wire Proportional Chambers (MWPCs) for this detector are challenged to record interaction rates up to 10 MHz in heavy-ion collisions, which will result in particle rates at the TRD plane of up to 120 kHz cm^{-2}: the MWPCs will therefore be built in a fast design with signal collection times below 300 ns.

The physics case, the finalised technical detector design and the latest evolution of the self-triggered read-out chain will be summarised. In 2017, testbeam measurements have been performed in DESY II electron beam and in the high-rate environment of the Gamma Irradiation Facility (GIF^{++}) at CERN. Results from these tests will be presented and their implications discussed. This work is supported by BMBF.

HK 12.2 Mo 17:00 Audimax H1

Track reconstruction on CBM-TRD testbeam data — •Felix Fidorra for the CBM-Collaboration — Institut für Kernphysik, WWU Münster, Germany

The Compressed Baryonic Matter (CBM) experiment is a fixed-target heavy-ion experiment at the SIS100 accelerator at FAIR. The CBM Transition Radiation Detector (TRD) is one of the key detectors to provide electron as well as charged fragment identification and tracking. Some Detector prototypes were tested on several testbeam campaigns at the SPS accelerator at CERN and other accelerator facilities. In the testbeam campaigns at the SPS in 2016, Multi-Wire Proportional Chambers (MWPC) with outer dimensions of 95 cm x 95 cm have been used to record the generated particles in a Pb–Pb fixed-target setup. This type of chamber was developed for usage in the outer region of the detector at the final experiment. The testbeam data will be discussed with respect to track reconstruction, incident angles and detector efficiency. This work is supported by BMBF.

HK 12.3 Mo 17:15 Audimax H1

Automated gaintable measurements for the CBM-TRD — •Johannes Beckhoff for the CBM-Collaboration — Institut für Kernphysik, WWU Münster, Germany

The Transition Radiation Detector (TRD) is a part of the Compressed Baryonic Matter (CBM) experiment at FAIR. Multi-Wire Proportional Chambers (MWPCs) with a PE foam foil radiator are contributing to particle identification and overall tracking performance. The chambers will be operated for PID with Xenon, while for calibration measurements also Argon is of interest. Measurements with Argon and Xenon will be compared and discussed regarding gas gain and the choice of the amplification voltage.
In this talk an automated chamber calibration stand for gaintable determination is presented. First results and comparisons from the gas measurements will be presented. This work is supported by BMBF.

HK 12.4 Mo 17:30 Audimax H1

Test beam results of prototypes for the CBM-TRD at DESY and GIF++ — •Florian Roether for the CBM-Collaboration — Institut für Kernphysik, Frankfurt, Deutschland

The Compressed Baryonic Matter (CBM) experiment at the 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 as well as the identification of light nuclei.

The TRD will be constructed from modules of two sizes. Each TRD module consists of a radiator, a thin Multiwire Proportional Chamber (MWPC) and the coresponding Front-End Electronics (FEE).

The evaluation of the performance of these detectors at suitable facilities is a crucial part of the research and development process. The latest large prototypes which were build in a joint effort in Frankfurt and Münster, have been tested in 2017 at DESY and GIF++ (CERN). In this talk we will present results from these testbeam campaigns.

This work is supported by BMBF-grant 05P15RFFC1

HK 12.5 Mo 17:45 Audimax H1

Status of the Readout Chain for the CBM-TRD Experiment — •Cruz de Jesus Garcia Chavez for the CBM-Collaboration — Institut für Kernphysik, WWU Münster, Germany

The Transition Radiation Detector (TRD) is part of the Compressed Baryonic Matter (CBM) experiment at FAIR. During 2017, the TRD readout chain featured important upgrades such as the introduction of the new Self-triggered Pulse Amplification and Digitization asIC (SPADIC) version 2.0, which implements the STS-HCTSP protocol for data transmission to the Data Processing Board (DPB), developed on the AMC FMC Carrier Kintex (AFCK) FPGA. This later implements a FLIM data transmission protocol to the FLES Interface Board (FLIB). The slow control and configuration for the DPB as well as for the front-ends is based on the (IPbus) protocol.

Results and evaluation of the readout chain during testbeam measurements performed in 2017 using Multi-Wire Proportional Chambers (MWPCs) at DESY II electron beam and on the Gamma Irradiation Facility (GIF^{++}) at CERN will be presented together with an overview of the new SPADIC 2.1 protocol and the commissioning status. This work is supported by BMBF.

HK 12.6 Mo 18:00 Audimax H1

Implementation of the ALICE TRD triggers — •Guido Willems for the ALICE-Collaboration — Westfälische Wilhelms-Universität Münster and CERN

The Transition Radiation Detector (TRD) of ALICE is operated at high event inspection rates around 10 kHz and allows for processing the data of all particles detected in a collision event within a time window shorter than 6 μs. The processing involves the reconstruction of all particle tracks as well as the generation of trigger signals which are used to trigger the readout of other detectors in ALICE. A large number of Xilinx Virtex-4 FX100 FPGAs are combined and process the incoming data in parallel in order to achieve this performance.

This talk outlines how the detector with its online data processing infrastructure works and focuses on the trigger decision unit. Recently, it has been extended by a new trigger on light nuclei which is now already being used in production data taking. It significantly enhances the sample of events containing deuterons, tritons, $Z = 2$ particles like helium and alpha as well as their corresponding antiparticles. The trigger is operated in pPb and pp collisions where these events are generally very rare.

HK 12.7 Mo 18:15 Audimax H1

Feasibility Studies on a Nuclei Trigger using the ALICE-TRD — •Benjamin Brudnyj — Institut für Kernphysik, Goethe-Universität Frankfurt, Frankfurt am Main

At the Large Hadron Collider (LHC) at CERN significant production rates of light (anti-)(hyper-)nuclei have been measured in Pb–Pb collisions. The production of such nuclei has recently become a topic of high interest. For instance the measured lifetime of the lightest hypernucleus, the hypertriton (a bound state of a proton, a neutron and a Λ hyperon), is significantly below the expectation of state-of-the-art theory calculations which expect the lifetime to be very close to the Λ lifetime. Therefore, it is important to also measure these rare nuclei in p–p collisions.

Due to their short lifetime, only its decay products can be measured, e.g. the charged two body decay channel ${}^{3}_{\Lambda}\mathrm{H} \rightarrow {}^{3}\mathrm{He} + \pi^{-}$. In order to be able to measure these rare (anti-)fragments also in p–p and p–Pb collisions, it is essential to increase the statistics by employing a trigger on nuclei. Using the data on Pb–Pb collisions at $\sqrt{s_{NN}} = 2.76$ TeV it turned out that particles with $Z > 1$ in the TRD show a behavior that can be used to implement such a nuclei trigger.

In this talk the physics case of a nuclei trigger will be elaborated as well as the exctracted efficiencies and purities for the different light nuclei. In addition, first results of triggered data on p–Pb collisions at $\sqrt{s_{NN}} = 8.16$ TeV and on pp collisions at $\sqrt{s} = 13$ TeV will be presented.

HK 13: Instrumentation V

Zeit: Montag 16:30–18:30 Raum: HZO 80

Gruppenbericht HK 13.1 Mo 16:30 HZO 80

Data preprocessing of the DAQ system for TOF detector in CBM experiment — •Wenxiong Zhou[1,2], Pierre Ioizeau[1], Jochen Fruehauf[1], Junfeng Yang[1], David Emschermann[1], and Walter Muller[1] for the CBM-Collaboration — [1]GSI Helmholtz Center for Heavy Ion Research, Darmstadt, Germany — [2]Chongqing University, Chongqing, China

In order to acquire the larger volume of data in the Compressed Baryonic Matter (CBM) experiment, a new free-trigger data acquisition (TLDAQ) system will be used. TOF detector is one of the detectors will be used in the CBM experiment. To ensure the correct data transfer and easy data reconstruction in the TOF DAQ system, the data should be processed before it is sent to back-end computer cluster. Therefore, a data preprocessing board is needed. In additional to the time data of the TOF detector, there is also epoch data from every front end electronics (FEE). The epoch data is very important for the TLDAQ system, it is the foundation of the event reconstruction in back-end computer. To reduce data volume and simplify the event reconstruction, the same epoch events from different FEEs should be merged into one event. A data preprocessing method is proposed to solve this problem. The process is divided into two parts. The first part is used to separate epoch event from data event. Every input FEE has a such module. The second part is used to merge data and epoch from different FEEs into one frame. This architecture can avoid the decreasing of data transfer speed when there are many input FEEs.

HK 13.2 Mo 17:00 HZO 80

Hit reconstruction for the CBM-TRD — •Philipp Munkes for the CBM-Collaboration — Institut für Kernphysik, WWU Münster, Germany

The Compressed Baryonic Matter (CBM) experiment is a fixed target heavy-ion experiment at the SIS100 accelerator at FAIR. The CBM Transition Radiation Detector (TRD) is one of the key detectors to provide electron as well as charged fragment identification and tracking. The experiment is planned to be run with data taking in a free-streaming configuration with a software trigger. After the software trigger performs a fast evaluation of a timeslice, a self-contained portion of the data stream from the experiment, all data matching the trigger conditions is analyzed online and written to disk after the full reconstruction. Corresponding algorithms are currently being developed and tested in Frankfurt and Münster and tested on data recorded during various test beam campaigns of the CBM-TRD. This talk will present the current status of the CBM-TRD offline analysis framework and an evaluation of the various reconstruction algorithms employed therein. This work is supported by BMBF.

HK 13.3 Mo 17:15 HZO 80

The Endcap Disc DIRC for PANDA at FAIR — •Mustafa Schmidt, Simon Bodenschatz, Michael Düren, Erik Etzelmüller, Klaus Föhl, Avetik Hayrapetyan, Kristof Kreutzfeldt, Julian Rieke, and Marc Strickert — II. Physikalisches Institut, JLU Gießen, Deutschland

The Endcap Disc DIRC is a Cherenkov detector that has been developed to provide an excellent particle identification for the future PANDA experiment by separating $\pi^{\pm}$ and $K^{\pm}$ up to a momentum of 4 GeV/c with a separation power of 3σ in the polar angle region from 5° to 22°. This goal will be achieved by using a highly polished Cherenkov radiator made of synthetic fused silica that is read out at the rim by using focusing elements and fast photo sensors. Different MCP-PMT photocathode materials and setup options have been studied with the help of Monte-Carlo simulations and validated by testing several prototype detectors in particle beams at CERN and DESY. This talk covers mainly the dedicated reconstruction algorithms that are used for obtaining likelihood values for different particle hypotheses. A full simulation of one detector quadrant has been performed to study the detector performance for different particle momenta under the influence of the magnetic field of the PANDA solenoid magnet. Furthermore, the glueball decay $\bar{p}p \to f_0(1500)\pi^0 \to K^+K^-\pi^0$ was chosen as a benchmark channel to evaluate PID ith the Endcap Disc DIRC in PANDA. For a fast event-filtering, an online reconstruction framework has been prepared. Preliminary tests, which have been carried out with a Virtex-4 FPGA card, show promising results.

HK 13.4 Mo 17:30 HZO 80

Track reconstruction within the Cellular Automaton approach for the PANDA Forward Tracking System — •Pugach Mykhailo[1,2,3], Ivan Kisel[1,2], Maksym Zyzak[4], and Irina Zivko[5] — [1]Goethe-Universität, Frankfurt — [2]Frankfurt Institute for Advanced Studies, Frankfurt — [3]KINR, Kyiv, Ukraine — [4]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt — [5]ITEP, Moscow, Russia

Aiming to reconstruct particles emitted at small angles and flying through a non-uniform magnetic field in the Forward Tracking System (FTS) of the PANDA experiment, a software package has been developed within the Cellular Automaton approach taking advantages of modern processor architectures by using the Vector Classes libraries for parallel data processing as well as providing a user-friendly experience through interfaces which enable the usage of any of the algorithm's functionality from the PandaRoot framework.
The implemented algorithm intends to group hits into tracks estimating the momentum as well as other kinematical propeties of the track (coordinates and slopes to the coordinate axes).
In this talk the developed algorithm is described extensively taking into account the specifics of the FTS, quality assurance plots are presented as well verifying high efficiency rates.
Supported by HIC for FAIR and HGS-HIRe.

HK 13.5 Mo 17:45 HZO 80

Fuzzy Bayes Tracking – Experimental performance — •Philipp Napiralla[1], Herbert Egger[2], Philipp R. John[1], Norbert Pietralla[1], Michael Reese[1], and Christian Stahl[1] — [1]Institut für Kernphysik, TU Darmstadt — [2]AG Numerik und wissenschaftliches Rechnen, TU Darmstadt

The Advanced GAmma Tracking Array (AGATA) is a new type of γ-spectrometer using position resolution via Pulse Shape Analysis to allow for a high energy resolution in addition to high efficiency. Due to its Germanium shell without any Compton shielding, γ-ray tracking algorithms are needed. In contrast to existing tracking algorithms that are based on a "Figure of Merit" approach, the so-called *Bayes-Tracking algorithm* uses conditional probability densities and Bayes' Theorem. As an improvement of the *Bayes-Tracking algorithm*, the presented *Fuzzy Bayes Tracking* (FBT) introduces fuzzy logic and machine learning into the framework. FBT's performance on experimental source data is shown and compared to existing tracking algorithms. An outlook on possible experimental applications of the Fuzzy Bayes Tracking is given.

Supported by BMBF 05P15RDFN1 and 05P15RDFN9.

HK 13.6 Mo 18:00 HZO 80

XRootD-Plugin-basierte Lösungen für Site-spezifische Anforderungen — •Jan Knedlik, Paul Kramp und Schwarz Kilian — GSI Helmholtzzentrum für Schwerionenforschung, Planckstr. 1, 62491 Darmstadt

XRootD hat sich als ein Standard für WAN-Zugriff auf Daten in HEP und HENP etabliert. Dabei sind Site-spezifische Anforderungen wie sie bei GSI existieren, bisher technisch schwierig umzusetzen gewesen. XRootD erlaubt die Anpassung von grundlegenden Funktionen der XRootD Server durch Plugins, seit Version 4.0 auch für die Anpassung der XRootD Clients. In diesem Beitrag zeigen wir unsere XRootD-basierten Entwicklungen am Beispiel des ALICE Tier 2 Zentrums und der zukünftigen ALICE Analysis Facility. Unter anderem wird ein XRootD-Redirector-Plugin vorgestellt, welches lokale Clients direkt auf ein lokal gemountetes Shared-Filesystem weiterleitet, sowie die dafür notwendigen Änderungen an XRootD, welche ab Version 4.8.0 verfügbar sind. Zudem wurde einen Prototyp für einen XRootD-Shared-Filesystem-Caching-Proxy erstellt.

HK 13.7 Mo 18:15 HZO 80

Ongoing development of the ALICE Tier 2 Center at GSI — •Sören Fleischer, Raffaele Grosso, Jan Knedlik, Thorsten Kollegger, Paul Kramp, and Kilian Schwarz for the ALICE-Collaboration — GSI, Planckstr. 1, 64291 Darmstadt

GSI has been operating a Tier 2 Center for the ALICE experiment since 2004. It runs on the shared computing cluster in the Green IT

Cube at GSI. In 2017 it has been the largest and one of the most efficient ALICE Tier 2 Centers. In this contribution we describe the current status of the center and important changes within the past year. Those include the development of an XRootD plugin which allows local grid clients direct access to a shared file system avoiding XRootD data servers, as well as a plugin that creates symbolic links in order to simplify local data access without grid methods. Mediumterm the ALICE Tier 2 Center at GSI will be transformed into one of presumably 3 ALICE Analysis Facilties. The anticipated changes thereby arising are presented.

HK 14: Instrumentation VI

Zeit: Montag 16:30–18:00 Raum: HZO 90

Gruppenbericht HK 14.1 Mo 16:30 HZO 90

Der PANDA Luminositätsdetektor — •Florian Feldbauer für die PANDA-Kollaboration — Ruhr-Universität Bochum, Deutschland

Das PANDA-Experiment, welches im Antiproton-Speicherring HESR an der im Bau befindlichen Beschleunigeranlage FAIR in Darmstadt stehen wird, ist für Fragen der Hadronenphysik optimiert. 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 bestimmt. Um eine absolute Messgenauigkeit von 5% zu erreichen werden die Spuren der gestreuten Antiprotonen gemessen. Dazu werden 4 Detektorebenen mit gedünnten Siliziumsensoren verwendet (HV-MAPS). HV-MAPS sind Pixelsensoren mit integrierter Ausleseelektronik. Sie werden mit einer Sperrspannung von 60 V betrieben, um die Strahlenhärte zu erhöhen. Die 4 Ebenen, die verfahrbar montiert sind, bestehen aus CVD-Diamanten auf denen die Sensoren aufgeklebt sind. Zur Reduktion der Vielfachstreuung wird der Aufbau im Vakuum betrieben.
Das Konzept des Luminositätsdetektors wird vorgestellt und dabei technische Aspekte wie Vakuumsystem, Kühlung und Elektronik diskutiert, sowie Einblicke in die Datenanlyse gegeben.

Gruppenbericht HK 14.2 Mo 17:00 HZO 90

Towards the CBM-MVD: The Group Report — •Michal Koziel — Goethe-Universität, Frankfurt

The Compressed Baryonic Matter Experiment (CBM) is one of the core experiments of the future FAIR facility. It will explore the phase diagram of strongly interacting matter in the regime of high net baryon densities with numerous probes, among them open charm. The Micro Vertex Detector (MVD) will contribute to the secondary vertex determination on a 10 μm scale, background rejection in dielectron spectroscopy and reconstruction of weak decays of multi-strange baryons. The detector comprises up to four stations placed next to the target in vacuum. The stations are populated with 50 μm thin, highly-granular customized Monolithic Active Pixel Sensors (called "MIMOSIS"), featuring a spatial resolution of <5 μm, a readout speed of less than 10 μs/frame, a radiation tolerance of $>10^{13} n_{eq}/cm^2$ and 3 Mrad. This contribution will summarize all recent activities towards constructing the MVD, that involve in particular CMOS sensor development, characterization and read-out, integration and cooling aspects as well as MVD performance simulations.
This work has been supported by BMBF (05P15RFFC1), GSI and HIC for FAIR.

HK 14.3 Mo 17:30 HZO 90

Updates on the Micro Vertex Detector Geometry for the CBM - Experiment — •Philipp Sitzmann for the CBM-MVD-Collaboration — Goethe-Universität Frankfurt

The Compressed Baryonic Matter experiment at FAIR (CBM) is a dedicated fix-target experiment design to explore the QCD phase diagram in the region of high net-baryon density. The CBM Micro Vertex Detector employs CMOS Monolithic Active Pixel Sensors. A new sensor generation called MIMOSIS is under development at IPHC Strasbourg. The stations of the MVD had to be adapted to the needs of the now larger sensors. In the ongoing development, two dedicated geometry setups of the MVD have been implemented: one optimized for secondary vertex reconstruction for open charm measurements and another one suited for multi-strange hyperon tracking. The neccessary updates in the geometry and the results in vertexing and track reconstruction will be discussed. Furthermore, a short overview on the MVD software as part of the CBM-ROOT framework will be given, highlighting the flexibility to include new geometries in the software.
This work has been supported by BMBF (05P15RFFC1), GSI, HIC for FAIR and HGS-HIRe.

HK 14.4 Mo 17:45 HZO 90

News on Rad Hardness studies for the CBM MVD — •Tobias Bus for the CBM-MVD-Collaboration — Goethe Universität

The Micro Vertex Detector of the future CBM-experiment will rely on CMOS Monolithic Active Pixel Sensors (MAPS) provided by IPHC Strasbourg (MIMOSA-series).

To adapt the radiation tolerance of the sensors to the demanding requirements of this experiment, prototypes featuring AC-coupled sensors have been produced. This feature allows to apply a depletion voltage of up to 40 V to the collection diodes of the sensor. A prototype named PIPPER-2 was exposed to radiation doses of up to $5 \cdot 10^{14} \frac{n_{eq}}{cm^2}$ and tested hereafter. The results will be shown and the advantages and limits of the approach will be discussed.

This work has been supported by BMBF (05P15RFFC1), GSI and HIC for FAIR.

HK 15: Hauptvorträge I

Zeit: Dienstag 11:00–12:30 Raum: Audimax

Hauptvortrag HK 15.1 Di 11:00 Audimax

Lattice QCD calculations and the muon anomalous magnetic moment — •Antoine Gerardin — Institute for Nuclear Physics, Mainz

The anomalous magnetic moment of the muon is one of the most promising observables to identify hints for physics beyond the Standard Model of particle physics. This quantity exhibits a persistent discrepancy of 3.5 standard deviations between the direct measurement by the Brookhaven E821 Collaboration and its theoretical prediction based on the Standard Model. Two new experiments (E989 at Fermilab and E34 at J-PARC) should reduce the experimental error by a factor four in the next few years. A similar reduction of the theory error is therefore highly desirable. The later is now dominated by effects of the strong interaction between quarks and gluons (QCD): the contribution from the hadronic vacuum polarization (HVP) and from hadronic light-by-light scattering (HLbL). I will discuss recent progress on determination of hadronic contributions from lattice QCD calculations.

Hauptvortrag HK 15.2 Di 11:30 Audimax

Wie identifiziert man QCD-Exoten? — •Malte Albrecht — Ruhr-Universität Bochum, Germany

Das Spektrum der bekannten QCD-Zustände ist ausgesprochen umfangreich. Neben den im Quarkmodell etablierten Zuständen (Mesonen, Baryonen) sollte es nicht nur weitere Multiquarkzustände, sondern auch Gluebälle und Hybride geben. Trotz zahlreicher Kandidaten war eine eindeutige Identifikation und Klassifikation solcher Zustände bisher jedoch nicht zweifelsfrei möglich. In diesem Vortrag wird aufgezeigt, wie durch gezielte Untersuchungen der Produktions- und Zerfallseigenschaften in verschiedenen physikalischen Prozessen und Energiebereichen ein konsistentes Bild entstehen kann.

Hauptvortrag HK 15.3 Di 12:00 Audimax

Beta and double-beta decays within an effective theory — •Eduardo Coello Pérez — Institut für Kernphysik, Technische Universität Darmstadt, 64289 Darmstadt, Germany — ExtreMe Matter Institute EMMI, Helmholtzzentrum für Schwerionenforschung GmbH, 64291 Darmstadt, Germany

We have developed an effective theory in terms of collective degrees of freedom to calculate the matrix elements for beta decays from odd-mass nuclei to excited states in spherical even-even nuclei. For the systems in which the effective theory consistently describes the data, we then also calculated the matrix element for the two-neutrino double-beta decay between the corresponding even-even nuclei. The systematic construction of the effective operators within the effective theory allows one to estimate theoretical uncertainties. The calculated two-neutrino double-beta decay matrix elements with associated theoretical uncertainties consistently describe experimental data where available, without the need for additional adjustments.

HK 16: Hadron Structure and Spectroscopy III

Zeit: Dienstag 14:00–16:00 Raum: HZO 50

Gruppenbericht HK 16.1 Di 14:00 HZO 50

The NA64 experiment for searches of rare events at CERN — •Michael Hösgen and Bernhard Ketzer for the NA64-Collaboration — Universität Bonn, Helmholtz-Institut für Strahlen- und Kernphysik, Bonn, Germany

We report on the recent activity of the NA64 experiment at the SPS of CERN. The NA64 experiment uses a beam dump setup to conduct missing energy searches with a high intensity electron beam.

In 2016 and 2017 separate dedicated searches for two mediators between standard model and dark sector, a new light vector boson A' and a new short-lived neutral boson X, were performed. The A' was proposed as a possible explanation for magnetic moment anomalies of muons. It could be created in electron on target reactions $e^-Z \to e^-ZA'$ and supposedly decay invisible into lighter dark sector particles ($A' \to \chi\bar{\chi}$). The X is motivated by an excess of e^+e^--pairs in $^8Be^*$ excited state nuclear transitions. It could be produced in bremsstrahlung interactions $e^-Z \to e^-ZX$ and decay into standard model leptons ($X \to e^+e^-$).

We show the experimental setup and the analysis strategies of the searches for both bosons. We present the data from 2016 and take a first glance at the data recorded in 2017.

HK 16.2 Di 14:30 HZO 50

Search for the Y(2175) in Photo-Production at GlueX — •Abdennacer Hamdi[1,2], Klaus Götzen[1,2], Frank Nerling[1,2], and Klaus Peters[1] for the GlueX-Collaboration — [1]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany. — [2]Goethe University Frankfurt

A long-standing goal of hadron physics has been to understand how the quark and the gluonic degrees of freedom that are present in the fundamental Quantum Chromodynamics Lagrangian manifest themselves in the spectrum of hadrons. Of particular interest is how the gluonic excitations give rise to exotic states. One class of such states are hybrid meson, theses states are predicted by phenomenological models and Lattice Quantum Chromodynamics calculations. A candidate for hybrid mesons is the Y(2175), as observed in electron-positron experiments.

We present the status and plans to search for this hybrid state in photo-production at the GlueX experiment in Jefferson Lab's Hall D, which had its first full production run in spring of 2017.

This work is supported by HGS-HIREe.

HK 16.3 Di 14:45 HZO 50

Nucleon quasi-parton distribution functions within the chiral quark soliton model — •Hyeon-Dong Son, Asli Tandogan-Kunkel, and Maxim V. Polyakov — Institut für Theoretische Physik II Fakultät für Physik und Astronomie Ruhr-Universität Bochum 44780 Bochum Deutschland

Quasi-Parton Distribution Functions(qPDFs), recently suggested by X. Ji, are of great importance as they open access to usual parton distribution functions in the lattice simulation of the QCD. It is meaningful to achieve a reliable calculation of them from a QCD-effective approach at low energy regime to provide a better insight. In this context, we present our recent studies on the nucleon qPDFs within the framework of the chiral quark-soliton model. We describe the evolution of the qPDFs as the nucleon velocity approaches to the light-like limit $v \to 1$ and discuss the relevant sum rules as well.

HK 16.4 Di 15:00 HZO 50

π^0 transition form factor measurement with A2 — •Lena Heijkenskjöld for the A2-Collaboration — Institute for Nuclear Physics, JGU Mainz

Meson transition form factors (TFFs) describe the dynamics of the transition between photons and hadrons and hence provide a probe of the intrinsic structure of hadrons. Within the singly-virtual time-like region, the TFF of the π^0 meson can be accessed via the Dalitz decay process $\pi^0 \to \gamma e^+e^-$. Due to the low branching ratio of the π^0 Dalitz decay (∼1.2%), a high statistics experiment is needed. The A2 experiment at MAMI, where π^0 mesons are produced by photo-induced reactions on protons, provides a high yield of π^0 Dalitz decays, and thus allows for a precision measurement of the π^0 TFF. Both completed and upcoming contributions of the A2 collaboration to the precision measurements of the π^0 TFF will be presented.

HK 16.5 Di 15:15 HZO 50

Measurement of the proton scalar polarizabilities at MAMI — •Edoardo Mornacchi for the A2-Collaboration — Institut für Kernphysik, Universität Mainz

The electric (α_{E1}) and magnetic (β_{M1}) scalar polarizabilities are fundamental properties related to the internal structure of the nucleon. They play a crucial role not only in our understanding of the nucleon, but also in other areas such as atomic physics. In the past, the values of α_{E1} and β_{M1} were determined from the unpolarized differential cross-section of the Compton scattering $\gamma p \to \gamma p$. The measurement of the beam asymmetry Σ_3, provides an alternative approach to the extraction of the scalar polarizabilities, with different sensitivity and systematics compared to the unpolarized cross-section.
This asymmetry was measured for the first time below the pion photoproduction threshold by the A2 Collaboration with the Crystal Ball/TAPS experiment at MAMI (Mainz, Germany). A linearly polarized photon beam impinged on a liquid hydrogen target and the scattered photons were detected with the Crystal Ball/TAPS setup, providing almost 4π coverage. A new high precision measurement of both unpolarized cross-section and beam asymmetry Σ_3 is ongoing at MAMI and polarizabilities α_{E1} and β_{M1} will be extracted with unprecedented precision. The impact of the recently obtained and expected results on the extraction of the scalar polarizabilities will be discussed in this talk.
Supported by DFG under contract SFB1044.

HK 16.6 Di 15:30 HZO 50

Radiative pion-photoproduction in covariant chiral perturbation theory — •Jan Rijneveen — Ruhr-Universität, Bochum, Deutschland

Radiative pion-photoproduction is studied in the framework of covariant chiral perturbation theory with and without explicit Delta degrees of freedom. This reaction is of special interest as it allows one to extract the value of the magnetic moment of the Delta isobar using the recent experimental data at MAMI.

HK 16.7 Di 15:45 HZO 50

Femtoscopy studies using the "Correlation Analysis Tool using the Schrödinger equation" (CATS) — •Dimitar Mihaylov and Laura Fabbietti — James-Franck-Straße 1, 85748 Garching, Germany

The femtoscopy method can be used to investigate both the emission source and the interaction potential between particle pairs by measuring their correlation function. Recent studies have demonstrated that femtoscopy can be deployed to study the hyperon-nucleon interaction at low relative distances and momenta. The deeper understanding of

those interactions is relevant not only in nuclear physics, but is strongly linked to the equation of state which in turn relates to the structure of neutron stars.

Femtoscopy analyses performed in high energy pp collisions at ALICE demonstrated bigger sensitivity to the interaction potentials due to the small emission source. However the currently available analysis tool in the field tend to be approximate and only applicable to larger source radii. This motivated us to develop the "Correlation Analysis Tool using the Schrödinger equation" (CATS) which entirely relies on numerical methods to evaluate the correlation function.

In this talk we will explain the basic working principles of the new tool, we will test it against established benchmark methods in the field and finally we will present the results from the first physics studies performed with CATS.

This work is supported by SFB1258.

HK 17: Heavy Ion Collisions and QCD Phases III

Zeit: Dienstag 14:00–15:45 Raum: HZO 60

Gruppenbericht HK 17.1 Di 14:00 HZO 60

Study of electromagnetic radiation from hot and dense medium formed in Au+Au collisions at $\sqrt{s_{NN}}$ = 2.42 GeV* — •Szymon Harabasz for the HADES-Collaboration — TU Darmstadt

In heavy-ion collisions at energies 1-2 GeV per nucleon the medium is formed with baryon density a few times higher than normal nuclear matter density. The unique tool to study properties of such medium is electromagnetic radiation.

HADES has investigated virtual photons produced in N+N, N+A, A+A and π+A reactions in this energy regime. The results from the largest system – Au+Au at $\sqrt{s_{NN}}$ = 2.42 GeV – reveal nearly exponential low invariant mass spectra after subtracting properly contributions of first-chance NN collisions, and hadron decays at freeze-out. These findings suggest strong modification of vector meson spectral function, due to coupling to abundant baryon resonances, in accordance with significant drop of chiral condensate at such high densities.

In this contribution, first results of differential data analysis will be presented and compared to the available theory model calculations.

**This work has been supported by VH-NG-823, Helmholtz Alliance HA216/EMMI and GSI.*

HK 17.2 Di 14:30 HZO 60

Dilepton production and resonance properties within a new hadronic transport approach — •Jan Staudenmaier[1,2] and Hannah Petersen[1,2,3] — [1]Frankfurt Institute for Advanced Studies (FIAS), Ruth-Moufang-Straße 1, 60438 Frankfurt am Main — [2]Institut für Theoretische Physik, Johann Wolfgang Goethe-Universität, Max-von-Laue-Str. 1, 60438 Frankfurt am Main — [3]GSI Helmholtzzentrum für Schwerionenforschung, Planckstr. 1, 64291 Darmstadt

The dilepton emission in heavy-ion reactions at low beam energies is examined within a hadronic transport approach. In this talk the production of electron-positron pairs from a new approach named SMASH (Simulating Many Accelerated Strongly-interacting Hadrons) is introduced. The dilepton emission is consistently taken into account below the hadronic threshold. The calculations are systematically confronted with HADES data. The present approach employing a resonance treatment based on vacuum properties is validated by an excellent agreement with experimental data up to system sizes of carbon-carbon collisions. After establishing this well-understood baseline in elementary and small systems, the significance of medium effects is investigated with a coarse-graining approach based on the same hadronic evolution. The effect of explicit in-medium modifications to the vector meson spectral functions is important for dilepton invariant mass spectra in ArKCl and larger systems, even though the transport approach with vacuum properties reveals similar features due the coupling to baryonic resonance and the intrinsically included collisional broadening.

HK 17.3 Di 14:45 HZO 60

Electromagnetic Spectral Functions from the FRG — •Christopher Jung[1], Naoto Tanji[2], Ralf-Arno Tripolt[2], Lorenz von Smekal[1], and Jochen Wambach[2] — [1]JLU, Giessen — [2]ECT*, Trento

We present first results on electromagnetic spectral functions as obtained by applying the non-perturbative functional renormalization group approach to an effective low-energy theory motivated by the gauged linear sigma model. We study the in-medium behavior of these spectral functions in different regimes of the phase diagram and aim in calculating temperature and chemical potential dependent dilepton rates. In particular, we focus on possible signatures in these data for a critical endpoint (CEP) and the restoration of chiral symmetry.

HK 17.4 Di 15:00 HZO 60

Thermal dilepton emission at low and intermediate energies — •Florian Seck[1], Tetyana Galatyuk[1,2], Ralf Rapp[3], and Joachim Stroth[4,2] — [1]TU Darmstadt — [2]GSI, Darmstadt — [3]Texas A&M Univ., College Station, USA — [4]Goethe-Universiät Frankfurt

The systematic study of dilepton production in heavy-ion collisions across a large range of collision energies makes it possible to link experimental observables like yields and slopes of the spectra to features in the QCD phase diagram. As dileptons are emitted during the whole space-time evolution of the collision, the resulting spectra comprise several contributions from first-chance NN collisions, the hadronic freeze-out cocktail, but also thermal radiation which serves as messenger of the QCD matter properties inside the hot and dense medium.

We couple in-medium thermal dilepton rates with a coarse-graining method of hadronic transport simulations to compute dilepton spectra at energies $\sqrt{s_{NN}} \leq 10$ GeV, where hydrodynamic simulations may be less reliable. After checking the degree of thermalization of the system, local temperature, baryon and pion densities can be extracted in the nearly equilibrated parts of the fireball. This allows for the convolution of thermal rates with the space-time evolution of the medium.

The results will be discussed in the context of the excitation function of yields and slopes of the invariant-mass spectrum at different energies and compared to available experimental data.

This work has been supported by: VH-NG-823, Helmholtz Alliance HA216/EMMI, GSI, and the DFG through the grant CRC-TR 211.

HK 17.5 Di 15:15 HZO 60

Dielectron production in pp collisions at $\sqrt{s}$= 7 TeV with ALICE — •Sebastian Scheid for the ALICE-Collaboration — Institut für Kernphysik, Goethe University, Frankfurt

Dileptons are a prime probe of the deconfined state of strongly-interacting matter, the Quark-Gluon Plasma (QGP), produced in high-energy heavy-ion collisions, as they are not affected by final-state interactions and produced at all stages of the collision. A measurement of the thermal radiation from the QGP in the dielectron intermediate-mass region gives information on the medium temperature. In this region the main component of the dielectron continuum is coming from correlated semi-leptonic decays of D- and B-mesons, which may be affected by the interaction of the heavy quarks with the QGP. Therefore, it is crucial to understand the primordial heavy-flavour production in vacuum and find a way to separate this contribution from the thermal signal of the QGP. This can be studied in proton-proton collisions.

In this talk, the measurement of correlated e^+e^- pairs in pp collisions at $\sqrt{s}$ = 7 TeV with ALICE will be presented. In particular, we will show how the measured distance of closest approach (DCA) of the electrons to the primary vertex of the collision gives the possibility to separate prompt and non-prompt dielectron pairs. The results will be compared with the expectations from known hadronic sources as a function of m_{ee}, $p_{T,ee}$ and DCA_{ee}. The extraction of the charm and beauty cross sections from a fit of the data with different Monte-Carlo generators will be discussed, as well as the measured fraction of direct photons to inclusive photons. Supported by BMBF.

HK 17.6 Di 15:30 HZO 60

Dielectron production in Pb–Pb collisions at $\sqrt{s_{NN}}$ = 5.02 TeV with ALICE — •Carsten Klein for the ALICE-Collaboration — Institut für Kernphysik, Goethe Universität Frankfurt

Electron-positron pairs are an excellent probe to investigate the prop-

erties of the Quark-Gluon Plasma (QGP) created in ultra-relativistic heavy-ion collisions. Because they are produced at all stages of the collision and do not interact strongly with the medium, their spectra reflect the entire space-time evolution of the system. At low invariant mass, the dielectron production is sensitive to the properties of vector mesons in the dense medium which is related to the predicted restoration of the chiral symmetry. In the intermediate-mass region, the dielectron continuum gives further insight into the heavy-quark energy loss in the QGP via the measurement of correlated electron-positron pairs from charm- and beauty- hadron decays.

In this talk, the status of the dielectron measurements in Pb-Pb collisions at $\sqrt{s_{\rm NN}} = 5.02$ TeV with ALICE will be presented. In order to interpret the data, the findings will be compared to the expected yield of known hadronic sources, i.e. the hadronic cocktail, as a function of the invariant mass and pair transverse momentum. Finally, the status of the measurement of virtual direct photons and modifications of the dielectron yield in Pb-Pb collisions will be discussed.
Supported by BMBF

HK 18: Structure and Dynamics of Nuclei III

Zeit: Dienstag 14:00–16:00 Raum: HZO 70

Gruppenbericht HK 18.1 Di 14:00 HZO 70

Nuclear structure studies with SONIC@HORUS - Using p-γ coincidences to selectively measure the γ-decay behaviour of nuclear excited states — •Michael Weinert[1], Anna Bohn[1], Michelle Färber[1], Miriam Müscher[1], Simon G. Pickstone[1], Sarah Prill[1], Philipp Scholz[1], Mark Spieker[1,2], Vera Vielmetter[1], Julius Wilhelmy[1], and Andreas Zilges[1] — [1]Institute for Nuclear Physics, University of Cologne — [2]NSCL, Michigan State University, MI 48824, USA

The SONIC@HORUS setup has been developed and improved over the last years in Cologne, optimizing it for the investigation of level lifetimes and the γ-decay behaviour of low-spin states [1]. Housing 14 HPGe and twelve silicon detectors (single or telescope), it is well suited for scattering and transfer reactions over a wide mass region. By measuring the ejectile energy and requiring the coincident detection of γ-rays, the excitation of single states and their subsequent γ-decay can be observed. Level lifetimes can be extracted using the Doppler-shift attenuation method and avoiding feeding problems. γ-decay branchings to excited states are observed with high sensitivity and particle-γ angular correlations reveal spins and parities of excited states. This contribution will introduce the setup, present results of several experiments performed with it, and discuss further developments.

Supported by DFG (ZI 510/7-1). JW is supported by the Bonn-Cologne Graduate School of Physics and Astronomy.
[1] S. G. Pickstone *et al.*, NIM A 875 (2017) 104

HK 18.2 Di 14:30 HZO 70

Studying p-γ angular distributions in inelastic proton scattering on ^{60}Ni with SONIC@HORUS — •Michelle Färber[1], Anna Bohn[1], Miriam Müscher[1], Simon G. Pickstone[1], Sarah Prill[1], Philipp Scholz[1], Mark Spieker[1,2], Vera Vielmetter[1], Michael Weinert[1], Julius Wilhelmy[1], and Andreas Zilges[1] — [1]Institute for Nuclear Physics, University of Cologne — [2]NSCL, Michigan State University, MI 48824, USA

The combined setup SONIC@HORUS [1] at the Cologne tandem accelerator, consisting of 12 Silicon and 14 HPGe detectors, is the central setup for nuclear structure experiments using inelastic scattering of light ions. The coincident measurement of the excitation energy and the decaying γ-rays enables a very selective study of properties of nuclear states.

In a previous experiment it could be shown that the measured p-γ angular distribution of transitions in ^{94}Mo can be reproduced by the distorted wave born approximation (DWBA), enabling a spin and parity assignment for low-spin states. A second (p,p'γ) experiment was performed at the 10 MV FN tandem accelerator in Cologne with the aim to verify the spin and parity determination using the DWBA, and to assign multipolarities of the transitions in the low-energy region in ^{60}Ni by studying intensity ratios for different p-γ angle groups. This contribution will present the current status of the analysis of the ^{60}Ni(p,p'γ) experiment.

Supported by DFG(ZI 510/7-1). JW is supported by the BCGS.
[1] S. G. Pickstone *et al.*, NIM A 875 (2017) 104

HK 18.3 Di 14:45 HZO 70

Nuclear structure of ^{82}Se and ^{82}Kr relevant for $0\nu\beta\beta$ decay — •Udo Gayer[1], Tobias Beck[1], Jörn Kleemann[1], FNU Krishichayan[2], Bastian Löher[1], Oliver Papst[1], Norbert Pietralla[1], Philipp Christian Ries[1], Deniz Savran[3], Michael Weinert[4], Werner Tornow[2], and Volker Werner[1] — [1]IKP, TU Darmstadt — [2]Duke University, Durham NC, USA — [3]GSI, Darmstadt — [4]IKP, Universität zu Köln

The nuclei ^{82}Se and ^{82}Kr are candidates for the hypothetical neutrinoless double-beta ($0\nu\beta\beta$) decay process, and a precise knowledge of their nuclear structure is necessary to estimate decay rates and extract neutrino properties from a possible observation. Therefore, we have studied the decay properties of low-lying dipole excitations up to 4.2 MeV in both isotopes in a nuclear resonance fluorescence experiment with quasi-monoenergetic, polarized photons at the High-Intensity Gamma-Ray Source (HIγS). The experiment used the γ^3 setup [1] and a second setup with four HPGe detectors for a simultaneous measurement of ^{82}Se and ^{82}Kr. In this energy range, several dipole excitations were newly identified, and their relative excitation strengths were estimated from nonresonant scattering off the targets. Transitions of 1^+ scissors mode states to lower-lying excited states with branching ratios as low as 1 % were observed, which can give an insight into shape coexistence effects [2]. Results of the experiment will be presented and interpreted.

*Supported by DFG research grant SFB 1245
[1] B. Löher et al., NIMA **723** (2013) 136-142
[2] J. Beller et al., Phys. Rev. Lett. **111** (2013) 172501

HK 18.4 Di 15:00 HZO 70

Decay Characteristics of the Scissors Mode in the $0\nu\beta\beta$-Decay Mother ^{150}Nd* — •Jörn Kleemann[1], T. Beck[1], U. Gayer[1], N. Pietralla[1], V. Werner[1], S. Finch[2], FNU Krishichayan[2], B. Löher[1], O. Papst[1], P. C. Ries[1], M. Schilling[1], W. Tornow[2], M. Weinert[3], and M. Zweidinger[1] — [1]IKP, TU Darmstadt — [2]Duke University, Durham NC, USA — [3]IKP, Universität zu Köln

^{150}Nd is a candidate for a potential neutrinoless double beta ($0\nu\beta\beta$) decay to ^{150}Sm. If such a decay were to be measured the neutrino mass could be extracted from the decay rate. To do so, however, precise knowledge of the nuclear structure of both nuclei is necessary. Therefore, nuclear resonance fluorescence experiments were conducted on both isobars using the γ^3 setup [1] at the High Intensity γ-ray Source (HIγS) of the Triangle Universities Nuclear Laboratory in Durham, NC, USA. The experiments focused on the decay characteristics of the scissors mode, namely the ratio of its transition strengths to the 0_2^+ and ground state, as it induces constraints on nuclear matrix elements involved in the extraction of the neutrino mass [2]. By using HIγS' intense, nearly monochromatic, linearly polarized γ-ray beam, dipole states were selectively excited. Their parities were determined through the angular distribution of their ground-state transition and a decay to the 0_2^+ state was observed. Preliminary results of the experiment on ^{150}Nd will be presented and compared to analogous results on ^{150}Sm.

*Supported by the DFG through the research grant SFB 1245.
[1] B. Löher *et al.* Nucl. Instr. Meth. Phys. Res. A **723**, 136 (2013)
[2] J. Beller *et al.* Phys. Rev. Lett. **111**, 172501 (2013)

HK 18.5 Di 15:15 HZO 70

Probing the $E2$ properties of the scissors mode with real photons* — •Tobias Beck[1], Norbert Pietralla[1], Udo Gayer[1], Volker Werner[1], Bastian Löher[1], Deniz Savran[2], Andreas Zilges[3], Vera Derya[3], and Werner Tornow[4] — [1]IKP, TU Darmstadt — [2]GSI, Darmstadt — [3]IKP, Universität zu Köln — [4]Duke University, Durham, NC, USA

The study of the properties of the nuclear scissors mode provides an essential insight into the nature of the restoring forces between the proton and neutron subsystems. Recently, first information on the $E2$ decay transition strength of the scissors mode was extracted [1] from a high-statistics photon-scattering experiment on ^{156}Gd using quasi-monochromatic photon beams provided by the High Intensity γ-ray Source (HIγS). The data allowed for measuring a finite value of the $E2/M1$ multipole mixing ratio and, thus, the first measurement of

an F-vector $E2$ transition in axially deformed nuclei. A similar continuative experiment has been performed on the well-deformed nuclei ^{162,164}Dy at HIγS. The obtained results indicate that highest-precision photon-scattering experiments with linearly polarized photons are highly sensitive to the electric quadrupole-decay properties of the scissors mode. The obtained results will be presented in detail and discussed in terms of the underlying nuclear physics. An outlook for future research will be given.

[1] T. Beck *et al.*, Phys. Rev. Lett. **118**, 212502 (2017).

⋆This work was supported by the DFG under Grant Nos. SFB 634 and SFB 1245.

HK 18.6 Di 15:30 HZO 70

γ-Zerfallsverhalten von Scherenmoden-Zuständen von ^{76}Ge* — •Marcel Schilling[1], Tobias Beck[1], Malte Cordts[1], Vera Derya[2], Udo Gayer[1], Bastian Löher[3], Norbert Pietralla[1], Philipp C. Ries[1], Christopher Romig[1], Deniz Savran[3], Volker Werner[1], Werner Tornow[4], Henry R. Weller[4], Volker Werner[1] und Markus Zweidinger[1] — [1]IKP, TU Darmstadt — [2]IKP, Universität zu Köln — [3]GSI, Darmstadt — [4]Duke University, Durham, USA

Die Erforschung des neutrinolosen doppelten Betazerfalls ($0\nu\beta\beta$) ist eine der wichtigsten offenen Fragen der Teilchenphysik, da dieser über die Grenzen des Standardmodells hinaus geht. Die Beobachtung eines solchen Zerfalls würde zeigen, dass Neutrinos Majoranateilchen sind. Hierfür ist ^{76}Ge ein potentieller Mutterkern. Mittels eines Kernresonanzfluoreszenzexperiments wurde an der High Intensity γ-Ray Source in Durham, NC, USA, das Zerfallsverhalten der Scherenmode von ^{76}Ge untersucht. Die Zerfälle konnten mittels $\gamma\gamma$-Koinzidenzen nachgewiesen und analysiert werden. Das Verzweigungsverhältnis der Scherenmode in den 0_2^+-Zustand und deren Stärke ist hierbei von Interesse, da sich hieraus Parameter festlegen lassen, die sensitiv auf die nuklearen Matrixelemente und die Zerfallsrate des $0\nu\beta\beta$-Zerfalls von ^{76}Ge nach ^{76}Se sind[2]. Es werden die bisherigen Schritte der Analyse und erste Ergebnisse präsentiert.

[1] B. Löher et al., Nucl. Instr. Meth. Phys. Res. A 723, 136 (2013).
[2] J. Beller et al. Phys. Rev. Lett. 111, 172501 (2013).

* gefördert durch SFB 1245 und ZI 510/7-1, sowie HA216/EMMI

HK 18.7 Di 15:45 HZO 70

Investigation of isovector valence-shell excitations in nuclei around the N = 82 shell closure — •Ralph Kern[1], Robert Stegmann[1], Georgi Rainovski[2], Norbert Pietralla[1], Liam Gaffney[3], Kalin Gladnishki[2], Vasil Karayonchev[4], Pär-Anders Söderström[1], Pietro Spagnoletti[5], Andreas Vogt[4], Nigel Warr[4], Andree Welker[3], Volker Werner[1], Johannes Wiederhold[1], and Radostina Zidarova[2] — [1]Technische Universität Darmstadt — [2]University of Sofia — [3]CERN — [4]Universität zu Köln — [5]University of the West of Scotland

In near-spherical nuclei, the two most fundamental quadrupole-collective excitations can be understood as a mixture of the collective 2^+ proton and 2^+ neutron excitations: the fully symmetric 2_1^+ state and the so-called mixed-symmetric $2_{1,\mathrm{ms}}^+$ state. Based on the evolution of these states in the N = 80 isotonic chain, it has been suggested that the properties of the mixed-symmetry states are sensitive to the underlying subshell structure. In particular, the observed fragmentation of the $2_{1,\mathrm{ms}}^+$ of ^{138}Ce has been explained as due to the absence of a mechanism dubbed shell stabilization. In order to examine further the effect of shell stabilization of the MSSs, it is necessary to identify and study the properties of these states in the next heavy N = 80 isotones beyond Z = 58: ^{140}Nd and ^{142}Sm. This Coulomb excitation experiment was performend at the RIB facility ISOLDE at CERN using the MINIBALL HPGe-array. Preliminary results from the experiment will be shown.

Supported by the BMBF under Grant No. 05P15RDCIA.

HK 19: Nuclear Astrophysics II

Zeit: Dienstag 14:00–15:30 Raum: HZO 100

Gruppenbericht HK 19.1 Di 14:00 HZO 100

Constraining the nuclear equation of state through the tidal deformability of neutron stars — •Svenja Kim Greif[1,2], Kai Hebeler[1,2], and Achim Schwenk[1,2,3] — [1]Institut für Kernphysik, Technische Universität Darmstadt — [2]ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung GmbH — [3]Max-Planck-Institut für Kernphysik, Heidelberg

The pioneering gravitational wave observation from a binary neutron star merger opens up new possibilities to constrain the equation of state of dense matter. In particular, the observed signal allows to extract an upper bound for the dimensionless tidal deformability of neutron stars. In this work, we study to what extent simultaneous measurements of neutron star masses and tidal deformabilities can constrain radii of neutron stars and the equation of state. To this end, we consider equations of state up to nuclear densities based on chiral effective field theory interactions and extend them in a general way to higher densities. Based on a large set of equations of state, we systematically incorporate the constraints from observations and causality to derive model-independent limits for the equation of state over a wide range of densities and for the properties of neutron stars.

*This work is supported by the DFG through Grant SFB 1245 and ERC Grant No. 307986 STRONGINT.

HK 19.2 Di 14:30 HZO 100

Classification of Twin Star Solutions — •Jan-Erik Christian, Andreas Zacchi, and Jürgen Schaffner-Bielich — Goethe Universtität Frankfurt

With the recent measurement of the gravitational wave GW170817 by LIGO the investigation into the inner workings of neutron stars becomes increasingly active. In that light we explore the possible mass radius relation of compact stars for the equation of states with a first order phase transition. Low density matter is described by a nuclear matter equation of state resulting from fits to nuclear properties. A constant speed of sound parametrization is used to describe the high density matter phase with the speed of sound $c_s^2 = 1$. A classification scheme of four distinct categories including twin star solutions, i. e. solutions with the same mass but differing radii, is found which are compatible with the $M \geq 2M_\odot$ pulsar mass constraint. We show the dependence of the mass and radius differences on the transition parameters and delineate that higher twin star masses are more likely to be accompanied by large radius differences. These massive twin stars are generated by high values of the discontinuity in the energy density and the lowest possible values of the transition pressure that still result in masses of $M \geq 2M_\odot$ at the maximum of the hadronic branch.

HK 19.3 Di 14:45 HZO 100

Structure of slowly rotating magnetized neutron stars in a perturbative approach — •Martin Jakob Steil[1], Micaela Oertel[2], and Michael Buballa[1] — [1]Theoriezentrum, Institut für Kernphysik, Technische Universität Darmstadt, Germany — [2]LUTH, Observatoire de Paris, PSL Research University, CNRS, Université Paris Diderot, France

With their extreme densities, fast rotation and strong electromagnetic fields, neutron stars (NS) provide a unique laboratory for probing strongly interacting matter under extreme conditions. Understanding the fundamental interactions that govern matter under those extreme conditions is one of the major challenges of modern physics. Extracting information about the underling micro physics and equation of state (EoS) of NS matter from NS bulk requires a detailed theoretical understanding of NS structure.

In this work we explore the possibility and viability of describing the effects of strong magnetic fields and rotation on NS structure as perturbations around a spherical symmetric background star. We solve the Einstein-Maxwell equations up to first order in rotation frequency f and second order in the central magnetic field B_c for simple field configurations and compare our perturbative results to numerical results obtained within the framework of numerical relativity. We report a good quantitative agreement for slow rotation frequencies $f \lesssim 10\,\mathrm{Hz}$ and moderate central magnetic fields $B_c \lesssim 10^{13}\,\mathrm{T}$. Further we explore the possibility of modeling the structure of NS based on realistic microscopic EoS with analytic models for compact fluid spheres.

HK 19.4 Di 15:00 HZO 100

Core-collapse supernovae and the impact of the equation of state* — •Hannah Yasin[1] and Almudena Arcones[1,2] — [1]Institut für Kernphysik, TU Darmstadt, Germany — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

Core-collapse supernovae represent one of the most energetic events in the universe and are the production site of many elements. The evolution during and after the supernova explosion is key for nucleosynthesis. In both phases, the equation of state (EOS) plays an important role determining the contraction and cooling of the neutron star and thus affecting the ejecta conditions. However, the EOS is still not fully understood and topic of current research in nuclear physics as well as in astrophysics. We investigate the impact of the equation of state in the context of the long-time evolution of core-collapse supernovae.

* Supported through grant SFB 1245.

HK 19.5 Di 15:15 HZO 100

Investigation of thermal effects on the equation of state and radii of neutron stars — •Sabrina Schäfer[1,2], Hannah Yasin[1], Almudena Arcones[1,3], and Achim Schwenk[1,2,4] — [1]Institut für Kernphysik, Technische Universität Darmstadt — [2]ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung GmbH — [3]GSI Helmholtzzentrum für Schwerionenforschung GmbH — [4]Max-Planck-Institut für Kernphysik, Heidelberg

Recently, a set of cold representative equations of state have been derived from calculations based on chiral effective field theory, combined with constraints from neutron star observations. This made it possible to derive an uncertainty band for the equation of state and the radius of cold neutron stars. In this work, we study finite temperature effects on realistic equations of state of hot and dense matter and the resulting behavior in a core-collapse supernova. Using a method for including thermal effects in the equation of state, we investigate the impact of finite-temperature microphysics on the radii of neutron stars.

*This work is supported by the DFG through Grant SFB 1245.

HK 20: Instrumentation VII

Zeit: Dienstag 14:00–16:00 Raum: HZO 80

Gruppenbericht HK 20.1 Di 14:00 HZO 80

Towards new analog read-out electronics for the HADES drift chamber system — •Michael Wiebusch for the HADES-Collaboration — Goethe-Universität, Frankfurt

Track reconstruction in HADES is realized with 24 planar, low-mass drift chambers (MDC). About 27000 drift cells provide both, precise spatial information of track hit points and energy loss information. In order to handle high rates and track densities expected at the future SIS100 accellerator at FAIR, an upgrade of the MDC system is mandatory. Besides employing an advanced FPGA based TDC concept, this involves new analog front-end electronics, as the original analog read-out ASIC (ASD8) is no longer procurable. A promising replacement read-out chip candidate is the PASTTREC ASIC (developed at Jagiellonian University, Krakow), which is currently at the focus of our investigations. To assess its compatibility with MDC, PASTTREC was challanged in three different test environments (alongside with the ASD8 ASIC for reference): A cosmic muon tracking set-up at GSI detector lab, a 2.7 MeV/c proton beam test at COSY (FZ Jülich) and a UV LASER set-up at Helmholtz-Zentrum Dresden-Rossendorf. Emphasis is placed on assessing the timing precision of the joint system comprising detector and front-end electronics. The latter set-up, in addition, allows to study drift cell properties due to its unique ability to map the drift-time w.r.t. position over the entire cell. This contribution will present and compare the results of the abovementioned measurements. This work has been supported by BMBF (05P15RFFCA), GSI and HIC for FAIR.

HK 20.2 Di 14:30 HZO 80

The COMPASS trigger for Drell-Yan Measurement 2018 — •Benjamin Veit — for the COMPASS Collaboration, Institut für Kernphysik, Mainz, Germany

In 2018 the COMPASS experiment measures double-muon-production in the reaction of negative pions of 190 GeV/c with a polarized ammonia target. This process is called Drell-Yan process. The final state consists of two oppositely charged muons and a hadronic state. The hadrons and remaining beam pions are removed by an absorber directly behind the target, the remaining muon pairs are detected in the double stage COMPASS spectrometer. For a symmetric acceptance for positive and negative muons, the muon trigger system has to be modified. The setup and monitoring of the COMPASS muon trigger system for the 2018 run will be presented.

HK 20.3 Di 14:45 HZO 80

Tests of the Hit-Detection ASIC V2.0 for the PANDA EMC at FAIR — S. Ahmed[1,2], L. Capozza[1], A. Dbeyssi[1], H. Deppe[4], H. Flemming[4], •P. Grasemann[1,2], F. Maas[1,2,3,4], O. Noll[1,2], D. Rodriguez Pinerio[1], P. Wieczorek[4], S. Wolff[1,2], M. Zambrana[1,2], and I. Zimmermann[1,2] — [1]Helmholtz-Institut Mainz, Mainz, Germany — [2]Institute of Nuclear Physics, Mainz, Germany — [3]PRISMA Cluster of Excellence, Mainz, Germany — [4]GSI Helmholtz Centre for Heavy Ion Research, Darmstadt, Germany

The PANDA experiment at the upcoming FAIR accelerator facility will study antiproton annihilation reactions at antiproton beam momenta from 1.5 GeV/c up to 15 GeV/c. With its modular multi purpose detector system it will be able to observe a variety of physics channels. The electromagnetic process group at HI-Mainz is developing the backward end-cap of the electromagnetic calorimeter.

For this prototype, the original design foresees that analogue signals are guided over several meters to the analog-digital converters.

The so-called Hit-Detection ASIC is a multichannel sampling digitizer with additional internal digital signal processing based on an analogue transient recorder with subsequent pipeline ADC.

This setup will eliminate the need for line driver electronics and reduce the amount of signal cables not only for the backward end-cap but especially for the barrel part of the EMC.

In the talk the promising results of the characterization of the Hit-Detection ASIC in its current version will be shown.

HK 20.4 Di 15:00 HZO 80

Recent projects based on the TRB DAQ framework — •Jan Michel — Goethe-Universität, Frankfurt

The TRB data acquisition system was originally developed for the last upgrade of the HADES detector at GSI. Its development started more than 10 years ago, but in the meantime this project has evolved into a full eco system of hard- and software projects. We want to highlight some of the recent developments:

The FPGA-based TDC implementation with a precision down to 10 ps (achieved with offline calibration) can now be equipped with in-FPGA online calibration simplifying the overall data taking effort while still achieving a very good precision of 30 ps.

To name a few of the current projects, a team at TU Munich prepares to employ TRB3sc boards for PMT read-out in the deep-sea STRAW experiment in a depth of 2.6 km. Groups from Wuppertal, Gießen and GSI finalized their system of electronics for RICH detectors which will be installed at FAIR phase-0 experiments in the next months.

In Frankfurt, the TRB3sc/TrbNet framework is being used for characterizing the performance of the first prototype sensor (Mimosis-0) for the future CBM Micro-Vertex-Detector.

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

HK 20.5 Di 15:15 HZO 80

Toward a demonstrator of the free-streaming data acquisition system for the CBM experiment at FAIR — •Pierre-Alain Loizeau and David Emschermann for the CBM-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung GmbH

The Compressed Baryonic Matter experiment (CBM) will be based at the new Facility for Antiproton and Ion Research (FAIR), which will deliver heavy-ion beams up to energies of 14 A GeV. In nucleus-nucleus collisions at these beam energies strongly interacting matter with densities up to 10 times normal nuclear matter is expected to be produced. The key objective of CBM is to investigate the QCD phase diagram in the region of high baryon-densities. CBM is designed to cope with

very high interaction rates up to 10 MHz. This will allow to perform high precision measurements of extremely rare probes which have not been accessible by previous nucleus-nucleus experiments in this energy regime. To achieve the high rate capability CBM will be equipped with fast and radiation hard detectors employing free-streaming readout electronics. A prototype high-speed Data Acquisition (DAQ) system was used for some of CBM subsystems in 2016 and 2017, based on a combination of microTCA (uTCA) and PCIe FPGA boards. A full prototype of the DAQ system using in addition the CERN radiation hard ASIC GBTX will be used for the phase 1 of the *mCBM@SIS18* ("mini-CBM") setup in 2018. For *mCBM* phase 2 in 2019, it will be upgraded to a close to final demonstrator system with a single PCIe board replacing the uTCA and PCIe ones. We will report on the progress in the preparation of these DAQ setups.

HK 20.6 Di 15:30 HZO 80

Beam test results for new DIRICH readout chain for MAPMTs and MCPs — •Vivek Patel, Joerg Foertsch, Karl - Heinz Kampert, and Christian Pauly for the CBM-Collaboration — Bergische Universitaet Wuppertal, Gauss Strasse 20,Wuppertal

The CBM RICH detector and the upgraded HADES RICH detector, will use Hamamatsu H12700 MAPMTs for photon detection. In a common effort of the HADES-, CBM-, and PANDA- collaborations, a new FPGA-based readout scheme for these MAPMTs (and for MCPs) is being developed, focussing on excellent timing precision limited only by the Transit Time spread of the sensors (MAPMTs: 300ps, MCPs: 60 ps). The core element of this development is the 32ch DiRICH module. Signal discrimininationation, time-over-threshold measurement, as well as digital data handling are all implemented on a single Lattice ECP5 FPGA, providing a cost-effective and highly compact solution. It also has a low power consumption (12mW/amplifier, 50mW per channel). First prototypes of the DIRICH module were obtained last year and were throughly tested and are now ready for mass production. In November 2017 this DiRICH concept was tested at COSY under real beam conditions along with H12700 MAPMTs in a small prototype setup. In this talk we will present first results from the analysis of beam test data, focussing in particular on efficiency and ToT usage for crosstalk suppression. In addition we will also discuss the effect of a Wavelength Shifting coating (WLS) of the MAPMTs Supported by : BMBF grant 05P15PXFCA, and GSI.

HK 20.7 Di 15:45 HZO 80

Structure of the $\overline{\text{P}}$ANDA Detector Control System — •Tobias Triffterer for the PANDA-Collaboration — Institut für Experimentalphysik I, Ruhr-Universität Bochum, Bochum, Germany

The $\overline{\text{P}}$ANDA experiment is a pillar of the Facility for Antiproton and Ion Research (FAIR) which is currently under construction in Darmstadt, Germany. $\overline{\text{P}}$ANDA will investigate open questions in hadron physics by studying the collision of antiprotons in the momentum range from 1.5 GeV/c to 15 GeV/c with a fixed target.

The $\overline{\text{P}}$ANDA detector consists of 30 subsystems which all depend on several kinds of services (like high voltage, low voltage, cooling, gas etc.) to operate properly. The purpose of a detector control system (DCS) is to monitor and control all these devices, report to the crew on shift and provide insight to subsystem experts to solve any occuring problem. In addition, it programs the front-end devices with the necessary calibration parameters to operate properly.

The control software for an individual subsystem gets created by the $\overline{\text{P}}$ANDA members responsible for said subsystem, but in addition components like the operator interfaces, the alarm system and the archiving system are managed by a dedicated Controls Group within the $\overline{\text{P}}$ANDA Collaboration.

This talk explores the challenges in bringing together heterogenic software components for a variety of different tasks and illustrates the way the $\overline{\text{P}}$ANDA Collaboration is solving these challenges, e. g. by dividing the DCS into layers and independent subnetworks.

This project is supported by the BMBF.

HK 21: Instrumentation VIII

Zeit: Dienstag 14:00–15:30 Raum: HZO 90

Gruppenbericht HK 21.1 Di 14:00 HZO 90

Status of the Barrel and Disc DIRC detectors at PANDA — •Markus Pfaffinger for the PANDA-Collaboration — Physikalisches Institut , Universität Erlangen-Nürnberg

The PANDA experiment at the new FAIR facility at GSI in Darmstadt will investigate open questions of hadron physics in the momentum region of $1.5 - 15\,\text{GeV/c}$ with $\bar{\text{p}}$p annihilations. The excellent particle identification (PID) needed will be achieved by two DIRC detectors. The Barrel DIRC will surround the interaction point and perform a π/K separation for momenta of $0.5 - 3.5\,\text{GeV/c}$ at polar angles from 22° to 140°. Its design is based on the successful BaBar DIRC with several improvements to make it more compact and to achieve a separation power larger than $3\,\sigma$ for the expected momentum region of the π/K. In the forward region of the detector the Endcap Disc DIRC will be located to cover an angular region from 5° to 22° and clearly separate π/K up to 4 GeV/c with a separation power of about $3\,\sigma$. For the detection of the Cherenkov photons lifetime-enhanced MCP-PMTs will be used in combination with fast readout electronics. The radiators will be made of precisely polished fused silica to guarantee a low photon loss ratio and conserve the Cherenkov angle during their propagation through the optical components using internal total reflection. To evaluate the designs Geant4 simulations and tests of different prototypes have been performed at various beam facilities. This talk will present both detector concepts and the achieved results.

HK 21.2 Di 14:30 HZO 90

Setup and first results of quality assurance measurements with MCP-PMTs — •Merlin Böhm, Rafael Frytz, Albert Lehmann, Daniel Miehling, Markus Pfaffinger, and Samuel Stelter for the PANDA-Collaboration — Physikalisches Institut, Universität Erlangen-Nürnberg

For the planned DIRC detectors (detection of internally reflected Cherenkov light) of the PANDA experiment several hundred microchannel-plate photomultipliers (MCP-PMTs) are required. The PMTs must have a good time resolution and a homogeneous gain and quantum efficiency across the active surface. To measure, among others, the position dependent time resolution, gain and dark count rate (DCR), we have built a semi-automatic quality control measurement setup in a light tight box consisting of a 3D-stepper and a picosecond laser pulser. Number of hits, timing and pulse height data for each anode channel are parallelly read out with the PADIWA-AMP2/TRB3 DAQ system from GSI. In first test measurements the laser was scanned across the surface of different MCP-PMTs. With these measurements, besides the mentioned properties, we could also easily study background sources like DCR, afterpulsing probability and recoil ion TOF distributions, crosstalk among the anode channels like charge sharing and electronics effects, and the distributions of electrons recoiling at the first MCP layer.

- Gefördert durch BMBF und GSI -

HK 21.3 Di 14:45 HZO 90

Lifetime performance of recently developed Microchannel-Plate Photomultipliers — •Daniel Miehling, Merlin Böhm, Steffen Krauss, Albert Lehmann, Markus Pfaffinger, Nico Schwarm, and Samuel Stelter for the PANDA-Collaboration — Physikalisches Institut , Universität Erlangen-Nürnberg

The PANDA experiment at the new FAIR facility will use two DIRC detectors for hadron identification. The focal plane of both DIRC detectors will be located inside a magnetic field of ∼1 T. In the PANDA environment the only sensor option for the detection of the Cherenkov photons are Microchannel-Plate Photomultipliers (MCP-PMTs). The most limiting parameter until a few years ago was the lifetime of the MCP-PMTs. The quantum efficiency (QE) correlated to the integrated anode charge (IAC) being measured in the sensor is an indicator for the lifetime. The QE will decrease with increasing IAC because of aging processes taking place at the photo cathode (PC) until the sensor is "blind". One of these processes is the interaction of feedback ions from the residual gas which may damage the PC on impact. The Erlangen lifetime setup is capable of illuminating various MCP-PMTs simultaneously and monitoring their IAC. The spectral QE of the sensors is measured every few weeks and full surface scans are made every

few months. This talk will present the current setup and the latest obtained results. The focus will be on recent 2-inch MCP-PMTs from Photonis and Hamamatsu. IACs of $\gg 5\,\mathrm{C/cm^2}$ were obtained with no or only minor QE loss which is sufficient for both PANDA DIRCs.

- Funded by BMBF and GSI -

HK 21.4 Di 15:00 HZO 90

Time resolution of the DiRICH MAPMT readout with and without WLS coverage * — •Adrian Amatus Weber for the CBM-Collaboration — Justus-Liebig-Universität Gießen

The HADES experiment during FAIR phase 0 and later the CBM experiment will employ RICH detectors for high quality electron identification. Photon detection is performed by H12700 Hamamatsu MAPMTs. A new FPGA-TDC based readout scheme has been developed with the 32 channel DiRICH readout module as its core component. Signal discrimination, time- and time-over-thershold measurement, as well as digital data handling, are all implemented on a central Lattice ECP5 FPGA. Good timing resolution requires a careful timing calibration taking into account nonlinearities in the TDC-FPGA design itself, temperature and voltage variations, as well as channel-to-channel delays has to be performed. We developed an FPGA based linear calibration of the TDCs that could successfully be tested on a TrbSc board. Timing precision in the range of 20-30 ps is achieved. A proximity focusing CBM RICH prototype has been tested at COSY using the full FPGA-TDC readout for 12 MAPMTs, partially covered with WLS coatings in order to enhance the UV sensitivity. Timing precision of the MAPMTs and readout electronics in-beam with and without WLS coating has been measured. The timing precision is on the order of 500 ps. Adding the WLS layer one measures an additional fast (2.4 ns) fluorescence decay component.

* supported by BMBF(05P15RGFCA) and HGS-HiRe; for the CBM, HADES and TRB collaboration

HK 21.5 Di 15:15 HZO 90

Optimierung einer Diskriminatorschwelle der DIRICH MAPMT Auslesekette* — •Jörg Förtsch für die CBM-Kollaboration — Bergische Universität Wuppertal

In diesem Vortrag stellen wir die DIRICH-Auslesekette des CBM- und HADES-Experiments am FAIR Beschleunigerzentrum vor. Die Frontend Elektronik verzichtet auf ADCs und verwendet lediglich TDCs, die in einem Lattice ECP5 FPGA integriert sind. Die Optimierung der Diskriminatorschwelle ist hierbei entscheidend für eine hohe Nachweiswahrscheinlichkeit sowie präzise Messung der Ankunftszeit der Photonen bei gutem Signal- zu Rausch-Verhältnis. Da jegliche Amplitudeninformation fehlt, ist das Bestimmen der Diskriminatorschwelle aus einem Amplitudenspektrum nicht möglich. In diesem Vortrag soll eine Methode beschrieben werden, die über die Signalrate als Funktion der eingestellten Schwelle (Ratenscan) und deren Differenzierung ein sogenanntes statistisches Pulshöhenspektrum generiert und damit die Schwellenfindung ermöglicht. Das Verfahren wurde mit einzelnen Photonen und einem H12700 MAPMT (Hamamatsu) getestet.

*gefördert durch BMBF 05P15PXFCA, GSI und Beiträge der TRB Kollaboration

HK 22: Hadron Structure and Spectroscopy IV

Zeit: Dienstag 16:30–18:30 Raum: HZO 50

Gruppenbericht HK 22.1 Di 16:30 HZO 50

Measurement of hadronic cross sections at BESIII using Initial State Radiation — •Christoph Florian Redmer and Achim Denig for the BESIII-Collaboration — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz, Deutschland

The anomalous magnetic moment of the muon $a_\mu = (g_\mu - 2)/2$ is one of the most precisely determined observables in the Standard Model. Despite the achieved precision of 0.54 ppm, there remains a discrepancy of more than three standard deviations between the Standard Model prediction and the direct measurement. The uncertainties of the Standard Model prediction are currently completely dominated by hadronic contributions, where the largest comes from the hadronic vacuum polarization. Hadronic cross sections measured at e^+e^- colliders can be used as experimental input to improve the calculations, making use of the optical theorem. At the BESIII experiment in Beijing these cross sections are determined using the method of Initial State Radiation. This presentation will give an overview of the recent results and the current status of the analyses.

Supported by DFG (SFB 1044).

HK 22.2 Di 17:00 HZO 50

Feasibility Studies for Ξ Baryon Spectroscopy in Antiproton-Proton Reactions with the PANDA Detector — •Jennifer Pütz, Albrecht Gillitzer, and James Ritman for the PANDA-Collaboration — Forschungszentrum Jülich, Jülich, Deutschland

For a deep insight into the mechanisms of non-perturbative QCD it is essential to understand the excitation pattern of baryons.Up to now only the nucleon excitation spectrum has been subject to systematic experimental studies while very little is known on excited states of double or triple strange baryons.

In studies of antiproton-proton collisions the $\overline{\mathrm{P}}$ANDA experiment is well-suited for a comprehensive baryon spectroscopy program in the multi-strange sector. A large fraction of the inelastic $\bar{\mathrm{p}}\mathrm{p}$ cross section is associated to final states with a baryon-antibaryon pair together with additional mesons, giving access to excited states both in the baryon and the antibaryon channel.

In this study we focus on the $\Lambda\overline{\mathrm{K}}$ decay of excited Ξ states. For final states containing a $\Xi\overline{\Xi}$ pair cross sections up to the order of μb are expected, corresponding to production rates of $\sim 10^6$/d at a Luminosity $L = 10^{31}\,\mathrm{cm^{-2}\,s^{-1}}$ (5% of the design value). The strategy to study the excitation spectrum of Ξ baryons in antiproton-proton collisions will be discussed. The reconstruction of reactions of the type $\bar{\mathrm{p}}\mathrm{p} \to \Xi^{-*}\bar{\Xi}^{+}$ with $\Xi^{-*} \to \Lambda\,\mathrm{K}^-$ (and their charge conjugate) with the $\overline{\mathrm{P}}$ANDA detector will be presented.

HK 22.3 Di 17:15 HZO 50

Radiative corrections to the magnetic moments of proton and neutron — •Norbert Kaiser — Physik Department, Technische Universität München, 85748 Garching

The radiative corrections of order α/π to the magnetic moments of the proton and the neutron are estimated. The photon-loop diagram of the vertex-correction type is evaluated with phenomenological nucleon vector form factors. Infrared-finiteness and gauge-invariance require the inclusion of the wave-function renormalization factor from the self-energy diagram. Using recent empirical form factor parametrizations the corrections amount to $\delta\kappa_p = -3.42 \cdot 10^{-3}$ and $\delta\kappa_n = 1.34 \cdot 10^{-3}$. The effects from photon-loops with internal $\Delta(1232)$-isobars are also studied. For two customary versions of the $\Delta N\gamma$-vertex and spin-3/2 propagator, these radiative corrections have values of $\delta\kappa_p^{(\Delta)} = (-0.9,\, 0.0)\cdot 10^{-3}$ and $\delta\kappa_n^{(\Delta)} = (1.2,\, -0.8)\cdot 10^{-3}$, respectively. Taking these ranges as a systematic error, our estimates read $\delta\kappa_p = (-3.9 \pm 0.4)\cdot 10^{-3}$ and $\delta\kappa_n = (1.5 \pm 1.0)\cdot 10^{-3}$.

This work has been supported in part by DFG and NSFC (CRC110).

HK 22.4 Di 17:30 HZO 50

Precise nucleon-nucleon potentials from chiral EFT — •Patrick Reinert, Evgeny Epelbaum, and Hermann Krebs — Institut für Theoretische Physik II, Ruhr-Universität Bochum, Germany

Ab initio calculations in few- and many-body systems require precise two-nucleon forces as input. We present new nucleon-nucleon (NN) potentials up to fifth order in chiral effective field theory, whose adjustable parameters have been fitted to the 2013 Granada database of experimental NN scattering data. We employ a new local regularization scheme for long-range forces in momentum space which does not distort the long-range behavior of the interaction and allows for a systematic extension to three-nucleon forces and currents. Furthermore, the contact interaction part of the potentials is studied and we discuss both the removal of redundant contact interaction terms at fourth order as well as the inclusion of sixth order contact interactions in F-Waves and their effects on the two-nucleon system.

HK 22.5 Di 17:45 HZO 50

Search for Light Exotic Baryons at the A2 Experiment

— •Dominik Werthmüller for the A2-Collaboration — School of Physics and Astronomy, University of Glasgow, United Kingdom

The recent claim of a heavy hidden-charm pentaquark by the LHCb collaboration reignites the question of whether exotic baryons can also be built only from light quarks. The existence of a strange pentaquark, initially alleged by the LEPS collaboration in 2003, was never convincingly substantiated. On the other hand, the unusual properties of certain nucleon and hyperon states, such as the $N(1440)$, the $N(1535)$, and the $\Lambda(1405)$, could be attributed to an exotic pentaquark nature. Moreover, there are new hints of a potentially exotic signature in the ηN system.

Light exotic baryons can be produced in photoproduction reactions at the tagged-photon beam experiment A2 located at the MAMI electron accelerator facility in Mainz. This contribution will give an overview of recent results and current activities on the search for light exotic baryons at A2.

HK 22.6 Di 18:00 HZO 50

Searches for exotic resonances in baryonic decays of charmonia — •Jan Reher — Insitut für Experimantalphysik I, Ruhr-Universität Bochum

The BESIII experiment, located at the BEPCII electron-positron-collider at the Institute for High Energy Physics in Beijing, offers high-statistics datasets at center of mass energies corresponding to J/Ψ and $\Psi(2S)$ masses. These large samples allow studies of rare and exotic particles.

The final state $\Lambda\bar{\Lambda}\pi^+\pi^-$ is studied based on $448 \cdot 10^6$ $\Psi(2S)$- and $1.3 \cdot 10^9$ J/Ψ events, because exotic tetraquark states with masses below the mass of the J/Ψ and decaying to a $\Lambda\bar{\Lambda}$ pair were predicted. Since the above final state is dominated by well known decays via $\Psi \to \Sigma^{\pm}(1385)\ \bar{\Sigma}^{\mp}(1385)$, $\Psi \to \Xi^-\ \bar{\Xi}^+$ and $\Psi(2S) \to J/\Psi\ \pi^+\pi^-$, a partial wave analysis is performed using these contributions. Deviations from the PWA result, especially in the invariant $\Lambda\bar{\Lambda}$ mass, may be indications for exotic particles.

Supported by DFG (FOR 2359)

HK 22.7 Di 18:15 HZO 50

D_{21} — Evidence for Yet Another Dibaryon Resonance ?*. — •Tatiana Skorodko[1], Mikhail Bashkanov[2], and Heinz Clement[1] for the WASA-at-COSY-Collaboration — [1]Physikalisches Institut der Universität Tübingen — [2]School of Physics and Astronomy, University of Edinburgh, UK

Exclusive measurements of the quasi-free $pp \to pp\pi^+\pi^-$ reaction have been performed by means of pd collisions at $T_p = 1.2$ GeV using the WASA detector setup at COSY. Total and differential cross sections have been obtained covering the energy region $T_p = 1.08 - 1.36$ GeV ($\sqrt{s} = 2.35$ - 2.46 GeV), which includes the regions of $N^*(1440)$ and $\Delta(1232)\Delta(1232)$ resonance excitations. Calculations describing these excitations by t-channel meson exchange are at variance with experimental differential cross sections and underpredict substantially the measured total cross section. An isotensor ΔN dibaryon resonance with $I(J^P) = 2(1^+)$ produced associatedly with a pion is able to overcome these deficiences. It corresponds to the state D_{21} predicted by Dyson and Xuong and later-on by Gal and Garcilazo.

*supported by DFG (CL 214/3-1 and 3-2) and STFC (ST/L00478X/1)

HK 23: Heavy Ion Collisions and QCD Phases IV

Zeit: Dienstag 16:30–18:30 Raum: HZO 60

Gruppenbericht HK 23.1 Di 16:30 HZO 60

Measurement of light (hyper)nuclei and their antiparticles with ALICE at the LHC — •Alberto Caliva for the ALICE-Collaboration — GSI, Planckstraße 1, 64291 Darmstadt

The production of light nuclei, hypernuclei (nuclei with strangeness) and their antiparticles in high-energy hadronic and heavy-ion collisions can be described by the statistical hadronization model and by the coalescence approach. The measurement of the production yield, p_{T}-spectra and flow of light (hyper)nuclei are important to constrain these two models. Hypernuclei, in addition, offer the possibility to study the hyperon-hyperon and hyperon-nucleon interactions, contributing to the QCD theory development. The study of antimatter and hypermatter has also some important implications for astrophysical measurements and direct searches for dark matter.

In this talk, I will present an overview of the ALICE results on the measurements of light nuclei, hypernuclei, and their antiparticles. The measurement of the lifetime of hypertriton will be presented and its comparison to the lifetime of free Λ baryon will be discussed. The perspectives for the measurements of light nuclei and hypernuclei after the ALICE upgrade will be discussed and the searches for exotic bound states will also be presented.

HK 23.2 Di 17:00 HZO 60

Reconstruction of Weak Decays in Au+Au Collisions at 1.23A GeV with HADES — •Simon Spies for the HADES-Collaboration — Goethe-Universität Frankfurt

We use a high statistic data sample of 7.3×10^9 recorded Au(1.23A GeV)+Au events to investigate Λ^0 baryon and K_S^0 meson production below their free nucleon nucleon threshold. For the first time these hadrons have been investigated using a neural network to identify their weak decay topologys inside HADES. We highlight details of the analysis procedure such as event selection, particle identification and topological cuts on the decay kinematic before presenting and discussing the transverse energy spectra as well as production yields and their rapidity dependence. The results are confronted with phenomenological models.

This work has been supported by BMBF (05P15RFFCA), GSI and HIC for FAIR.

HK 23.3 Di 17:15 HZO 60

Λ production in Ar+Sc collisions at 40A GeV/c in NA61/SHINE experiment at CERN/SPS — •Hamda Cherif — for the NA61/SHINE Collaboration — Goethe-Universität Frankfurt am Main

NA61/SHINE is a fixed target experiment operating at the CERN Super-Proton-Synchrotron (SPS). The NA61/SHINE Collaboration studies properties of hadron production in nucleus-nucleus collisions. The primary aim is to uncover features of the phase transition between confined matter and quark gluon plasma. Within the current program data on p+p, Be+Be, Ar+Sc, Xe+La and Pb+Pb collisions at beam momenta in the range 13A-150A GeV/c has been recorded. Strangeness enhancement is one of the earliest signatures of the formation of a deconfined QGP. Strange particles are of particular interest in hadronic collisions since they carry a new quantum number not present in the colliding nuclei. The study of Λ hyperons allows to study simultaneously strangeness production and the effect of net baryon density. In this contribution, the status of Λ production in Ar+Sc collisions is presented and discussed as obtained from the recent data taken by NA61/SHINE collaboration at 40A GeV/c.

HK 23.4 Di 17:30 HZO 60

Lambda Polarization in Au+Au collisions at 1.23 AGeV measured with HADES — •Frederic Kornas[1], Tetyana Galatyuk[1,2], and Ilya Selyuzhenkov[2] for the HADES-Collaboration — [1]TU Darmstadt, Darmstadt, Germany — [2]GSI, Darmstadt, Germany

Through its self-analyzing nature the Λ hyperon allows to extract the spin orientation by measuring the outgoing proton momentum. A possible spin polarization with respect to the reaction plane could probe a global polarization of the fireball. This would be a hint for vortical effects at the very early stages of the collision.

Measurements of the Λ polarization by the STAR collaboration indicate a strong enhancement towards lower beam energies. In Au+Au collisions at $\sqrt{s}_{NN} = 7.7$ GeV they estimated the vorticity to be of the order $10^{21}\ s^{-1}$ which would be by far the most highest vorticity ever observed in the laboratory.

The contribution will report the status of the Λ polarization in Au+Au collisions at 1.23 AGeV measured with HADES.

HK 23.5 Di 17:45 HZO 60

Measurement of the p_T-differential yield of (Anti-)^{3}He in p–Pb collisions at $\sqrt{s_{NN}} = 5.023$ TeV with ALICE — •Sebastian Hornung for the ALICE-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany — Heidelberg University, Germany

The production mechanism of light (anti-)nuclei in ultra-relativistic hadron collisions is one of the open puzzles in high-energy physics.

On the one hand, the statistical hadronization model can describe the particle yields, including the yields of light nuclei, over a wide range of energies in AA collisions. The particle abundances are fixed at the chemical freeze-out, but since the binding energy of light nuclei is very small, at most a few MeV, it is not probable that they remain bound during the hadronic phase with temperatures between 100 MeV and 170 MeV.

On the other hand, the nuclei yields can be explained by the coalescence of protons and neutrons which are close by in phase space.

To address this topic, the ALICE collaboration has measured (anti-)nuclei up to A = 4 in Pb–Pb collisions as well as deuterons in pp and p–Pb collisions and ^{3}He in pp collisions. This study is now extended by measuring the yield of (anti-)^{3}He as a function of the transverse momentum in p–Pb collisions at $\sqrt{s_{NN}} = 5.023$ TeV. In addition, the anti-^{3}He-over-^{3}He ratio is calculated as a function of p_T. With this ratio the CPT invariance can be tested by comparing it to unity because the baryo-chemical potential is zero at the LHC.

HK 23.6 Di 18:00 HZO 60

Production of (anti-)t, (anti-)^{3}He and (anti-)^{4}He at $\sqrt{s_{NN}} = 5.02$ TeV with ALICE at the LHC — •Esther Bartsch for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

The high collision energies reached at the LHC lead to significant production yields of light (anti-)nuclei in proton-proton and, in particular, Pb–Pb collisions. The excellent particle identification capabilities of the Time Projection Chamber, using the specific energy loss (dE/dx), and the time-of-flight measurement, allow for the detection of these rarely produced particles. Furthermore the Inner Tracking System gives the possibility to separate primary nuclei from those coming from the decay of heavier systems.

New results on (anti-)tritons, (anti-)^{3}He and (anti-)^{4}He production in Pb–Pb collisions at $\sqrt{s_{NN}} = 5.02$ TeV will be presented. The goal is to study production mechanisms such as coalescence and thermal models, and to compare them to those in heavy-ion collisions at lower energies.

Supported by BMBF and the Helmholtz Association.

HK 23.7 Di 18:15 HZO 60

Multi-differential analysis of Σ hyperons in the CBM experiment — Ivan Kisel[1,2,3], •Pavel Kisel[1,3,4], Peter Senger[3], Iouri Vassiliev[3], and Maksym Zyzak[3] for the CBM-Collaboration — [1]Goethe-Universität Frankfurt — [2]Frankfurt Institute for Advanced Studies — [3]GSI Helmholtzzentrum für Schwerionenforschung GmbH — [4]Joint Institute for Nuclear Research

Strange particles are important probes of the properties of hot and dense nuclear matter produced in high-energy heavy-ion collisions. A large fraction of the produced strange quarks is carried by Σ^+ and Σ^- hyperons, which have decay modes with at least one neutral daughter particle.

In order to identify these hyperons, a missing mass method has been developed and implemented in the CBM KF Particle Finder package, which allows to reconstruct 18 decays with neutral daughter particles with high efficiency and large signal-to-background ratios. The results of a multi-differential analysis of Σ hyperon yields as function of momentum, rapidity, and transverse mass will be presented. The reconstructed distributions are in a good agreement with the Monte Carlo spectra.

HK 24: Structure and Dynamics of Nuclei IV

Zeit: Dienstag 16:30–18:30 Raum: HZO 70

Gruppenbericht HK 24.1 Di 16:30 HZO 70

NeuLAND Demonstrator at SAMURAI – Neutron Detection in Experiments with Radioactive Beams — •Julian Kahlbow[1], Thomas Aumann[1,2], Konstanze Boretzky[2], Igor Gasparic[3,2], Yosuke Kondo[4], Stefanos Paschalis[1,5], Dominic Rossi[1,2], Fabia Schindler[1], Haik Simon[2], and Hans Törnqvist[1,2] for the NeuLAND-SAMURAI-Collaboration — [1]TU Darmstadt — [2]GSI, Darmstadt — [3]RBI, Zagreb — [4]TITech, Tokyo — [5]U of York

NeuLAND is the new high-resolution neutron time-of-flight spectrometer under construction for the R^{3}B setup at FAIR. After the completion of the NeuLAND demonstrator in 2015, it was sent to the RI Beam Factory in Japan to be integrated into the neutron detection system NEBULA at the SAMURAI setup. SAMURAI is an experimental setup designed for experiments with radioactive ion beams in complete kinematics. During the 2-year stay, a variety of experiments requiring (multi-)neutron detection was performed with NeuLAND as one of the key detectors. It became possible for the first time to study reactions with up to 4 coincident neutrons in the exit channel and to determine their momenta. The report will highlight experiments such as the spectroscopy of the 4-/3-neutron-unbound systems ^{28}O & ^{27}O. Furthermore, the search for a resonant tetraneutron system will be discussed as well as other experiments to show the unique capabilities of this setup.

This work is supported by the DFG through grant no. SFB 1245, the BMBF under contract no. 05P15RDFN1, and the GSI-TU Darmstadt cooperation agreement.

HK 24.2 Di 17:00 HZO 70

Investigation of the 2n system by quasi-free α-knockout from ^{6}He — •Marco Alexander Knösel, Thomas Aumann, Fabia Schindler, and Vadim Wagner for the NeuLAND-SAMURAI-Collaboration — Technische Universität Darmstadt

The investigation of pure neutron systems has been a long-lasting goal in nuclear physics. State-of-the-art nuclear theories agree that light neutron clusters do not form bound states but struggle to handle the resonant case. Experimental information on these systems are of great importance but still scarce. An experiment to study the properties of both the 4n and the 2n system was performed at the SAMURAI setup at RIKEN, using the reactions ^{8}He(p,pα)4n and ^{6}He(p,pα)2n, respectively. This contribution will focus on the latter case. To investigate the n-n scattering system, the α-knockout reaction has been performed in inverse kinematics using a radioactive ^{6}He-beam and a liquid hydrogen target. As a result of the α-knockout the binding potential vanishes to let the neutrons interact only with each other at low relative energies. The combination of the neutron detector NEBULA (SAMURAI) and the NeuLAND demonstrator (for R3B at GSI/FAIR) allows for a kinematically complete measurement with a high neutron detection efficiency. Consequently, the dineutron relative-energy distribution can be determined and information on the the scattering length can be extracted by both the missing mass method and by measurement of the invariant mass of the 2n system. This work is supported by the DFG through grant no. SFB 1245, the BMBF under contract number 05P15RDFN1 and the GSI-TU Darmstadt cooperation agreement.

HK 24.3 Di 17:15 HZO 70

Low-energy dipole response of the halo nuclei ^{6,8}He — •Christopher Lehr[1] and Thomas Aumann[1,2] for the NeuLAND-SAMURAI-Collaboration — [1]TU Darmstadt — [2]GSI Helmholtzzentrum

The heaviest bound helium isotopes ^{6}He and ^{8}He are 2- and 4-neutron halo nuclei with a clear alpha plus 2n and 4n structure. The multi-neutron decay of ^{6}He and ^{8}He after heavy-ion induced electromagnetic excitation reactions has been measured kinematically complete to study the dipole response of these nuclei. An experiment was performed at the RIBF facility at the RIKEN Nishina Center in Japan. The combination of the neutron detectors NEBULA and NeuLAND at the SAMURAI setup and the high beam intensities available at RIBF made this measurement possible for the first time. The experimental method is based on the measurement of the differential cross section via the invariant-mass method, which allows to extract the dipole strength distribution dB(E1)/dE and the photo-absorption cross section. To induce electromagnetic excitation reactions of ^{6}He and ^{8}He a lead target was used. Additionally a series of targets with increasing Z was used

to get precise information about the nuclear contribution to the cross section. This is especially important in the region of high excitation energy, where the electromagnetic excitation might not be dominant. The experimental setup and the method are explained. Besides this the first steps of the ongoing analysis are presented.

This work is supported by the DFG through grant no. SFB 1245, the GSI-TU Darmstadt cooperation and the BMBF project 05P15RDFN1.

HK 24.4 Di 17:30 HZO 70

Proton Knockout Reactions from Neutron-Rich N Isotopes at R^{3}B — •Ina Syndikus[1,2], Marina Petri[3], and Thomas Aumann[1,2] for the R3B-Collaboration — [1]IKP, TU Darmstadt, Germany — [2]GSI, Germany — [3]University of York, UK

The R^{3}B/LAND setup at GSI was used to measure the proton-knockout reaction on neutron-rich N isotopes in a kinematically complete way.

The aim of this study is to determine the proton amplitude of the first 2^+ excited state of ^{16,18,20}C isotopes. This can be achieved by studying the proton-knockout reaction from ^{17,19,21}N to ^{16,18,20}C. By measuring the ratio of the cross sections for the population of the first excited 2^+ state and the ground state the proton amplitude can be determined.

An increase in the proton amplitude approaching the dripline can be explained by the reduction of the spin-orbit splitting between the proton $p_{3/2}$ and $p_{1/2}$ orbits due to the tensor and two-body spin-orbit components of the force between the protons and the added neutrons in the sd-shell [1]. This would explain the increase in the transition strength as observed in previous studies [2].

This work is supported by HIC for FAIR, GSI-TU Darmstadt cooperation and the BMBF project 05P15RDFN1.

[1] A. O. Macchiavelli et al., Phys. Rev. C **90** 067305 (2014)
[2] M. Petri et al., Phys. Rev. Lett. **107**, 102501 (2011)

HK 24.5 Di 17:45 HZO 70

Lifetime Measurement of the ^{26}O g.s. at SAMURAI — •Sonja Storck[1], Julian Kahlbow[1], Christoph Caesar[2], and Thomas Aumann[1,2] for the NeuLAND-SAMURAI-Collaboration — [1]Institut für Kernphysik TU Darmstadt, Darmstadt, Deutschland — [2]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Deutschland

A recent experiment and theory calculation suggest that the ground state of the neutron-unbound nucleus ^{26}O could have a lifetime in the pico-second regime. This would constitute the first case of a radioactive decay via neutron emission.

An experiment using a new method to determine the decay lifetime of the ^{26}O ground state with high sensitivity and precision was performed at the Superconducting Analyzer for multi-particle from Radio Isotope Beams (SAMURAI) at the Rare Isotope Beam Factory (RIBF) at RIKEN. Here, a ^{27}F beam was produced in the fragment separator BigRIPS and impinged on a W/Pt target stack where ^{26}O was produced. According to the lifetime, the decay of ^{26}O happens either in- or outside the target. Thus, the velocity difference between the decay neutrons and the fragment ^{24}O delivers a characteristic spectrum from which the lifetime can be extracted. In the report the new method as well as the experimental setup are introduced and the current analysis status is shown.

This work is supported by the DFG through grant no. SFB 1245, the BMBF under contract number 05P15RDFN1 and the GSI-TU Darmstadt cooperation agreement.

HK 24.6 Di 18:00 HZO 70

Prompt and delayed gamma-spectroscopy of neutron-rich krypton isotopes with N $\leq$ 60* — •Rosa-Belle Gerst, Kevin Moschner, and Andrey Blazhev — Institut für Kernphysik, Universität zu Köln

Low-lying excited states of the neutron-rich ^{94,95,96}Kr were measured at the RIBF at the RIKEN Nishina Center for Accelerator-Based Science as part of the SEASTAR campaign. The nuclei of interest were populated in nucleon knockout reactions using the MINOS device surrounded by the DALI2 array for prompt γ-spectroscopy. Additionally, the EURICA array was run in a parasitic mode to measure the delayed isomeric transitions in ^{95}Kr. In all three nuclei, previously unknown γ-transitions were observed. Even-even Sr and Zr nuclei in the A = 100 region show a sudden onset of deformation at N = 60 while the lighter isotopes up to N = 58 are rather spherical. Contrarily, the even krypton isotopes exhibit a smooth onset of collectivity up to N = 60 [1]. For ^{96}Kr, the measured new transitions imply the existence of low-lying low-spin non-yrast states, which we interpret as the shape coexisting states becoming yrast above N = 60 [2] in agreement with very recent IBM calculations [3]. For ^{95}Kr, the analysis of prompt γ-radiation with and without coincidence of delayed radiation identified the prompt γ-rays as either feeding or bypassing the known isomeric state in ^{95}Kr.

*Supported by the DFG under Grant No. BL 1513/1-1

[1] M. Albers *et al.*, Phys. Rev. Lett. 108, 062701 (2012)
[2] F. Flavigny *et al.*, Phys. Rev. Lett. 118, 242501 (2017)
[3] K.Nomura *et al.*, Phys. Rev. C 96, 034310 (2017)

HK 24.7 Di 18:15 HZO 70

Performance Test of the CALIFA Detector using the ^{16}O(p,2p) reaction — Roman Gernhäuser, •Benjamin Heiss, Philipp Klenze, and Felix Stark for the R3B-Collaboration — Technische Universität München

The 4π-calorimeter CALIFA is one of the major detectors of the R^{3}B-experiment at the upcoming Facility for Antiproton and Ion Research (FAIR) in Darmstadt. This calorimeter with 2464 CsI(Tl) crystals and 96 Phoswich detectors provides a high efficiency, good energy resolution of about 5 % at 662 keV γ energies and a large dynamic range, allowing a simultaneous measurement of γ rays at E > 100 keV and scattered protons up to E < 700 MeV. Especially in the forward section of CALIFA, the Endcap, the highest particle rates and energies paired with highly doppler shifted γ rays are expected. This talk will show first results of an experiment with 3 CALIFA Demontrator Petal detectors at the Bronowice Cyclotron Center in November 2017 in Cracow. This presentation will be on the calibration reaction ^{1}H(p,p) and the ^{16}O(p,2p) in direct kinematics at 200 MeV proton beam energy irradiating a liquid water fiber target. Excitation energy spectra and angular correlation prove the excellent resolution of CALIFA as an ideal tool for QFS studies also in normal kinematics. Supported by BMBF Project 05P15WOFNA.

HK 25: Structure and Dynamics of Nuclei V

Zeit: Dienstag 16:30–17:45 Raum: HZO 80

Gruppenbericht HK 25.1 Di 16:30 HZO 80

Investigation of Z-Yield Distributions of Fission Fragments using Calorimetric Low Temperature Detectors — •Santwana Dubey[1,2], Artur Echler[1,2], Peter Egelhof[1,2], Patrick Grabitz[1,2], Manfred Mutterer[1], Werner Lauterfeld[2], Aurelien Blanc[3], Ulli Köster[3], Saskia Kraft-Bermuth[4], Pascal Scholz[4], Shawn Bishop[5], Jose Gomez[5], and Friedrich Gönnenwein[6] — [1]GSI Darmstadt, Germany — [2]Univ. Mainz, Germany — [3]ILL, Grenoble, France — [4]Univ. Giessen, Germany — [5]TU München, Germany — [6]Univ. Tübingen, Germany

The investigation of isotopic yields of fission fragments is important for our understanding of fission process and for applications in reactor physics. The new concept of calorimetric low-temperature detectors (CLTDs) which provides fundamental advantages over ionization-mediated detectors was applied for the first time for the investigation of isotopic yields at the LOHENGRIN recoil separator, at the ILL Grenoble, using the degrader method. For ^{239}Pu and ^{241}Pu targets, the present method allowed for the first time direct nuclear charge yield measurements in the mass region approaching symmetry (up to A=112 for ^{241}Pu and up to A=113 for ^{239}Pu), and in the heavy mass region (A=128-137 for ^{239}Pu), where new data for masses inaccessible with gamma-spectroscopy could be obtained. Of particular interest was the behaviour of proton even-odd staggering in the transition region to symmetry which provides, insight in the fission mode. Furthermore, precise yields of ^{92}Rb and ^{96}Y for ^{235}U, ^{239}Pu and ^{241}Pu targets were determined, which are relevant for the reactor neutrino anomaly.

HK 25.2 Di 17:00 HZO 80

Towards a precise energy determination of the ^{229}Th nuclear clock transition — •Benedict Seiferle, Lars von der Wense, and Peter G. Thirolf — LMU München, Am Coulombwall 1, 85748

Garching

The first isomeric excited nuclear state of ^{229}Th (denoted with ^{229m}Th) exhibits the lowest excitation energy in nuclear physics which has been measured indirectly to be 7.8(5) eV. The uniquely low transition energy which corresponds to a wavelength of approximately 160 nm makes it possible to drive the transition with lasers. This in turn may pave the way for a long list of interesting applications (such as a nuclear optical clock) which has so far been hindered by the rather large uncertainty in the reported energy value. In this talk an experimental scheme is presented that uses internal conversion electrons which are mitted in the ground-state decay of ^{229m}Th [1,2] and first results are shown. With these measurements a precise and direct determination of the excitation energy is in reach.

[1] L. v.d. Wense et al., Nature 533, 47-51 (2016).
[2] B. Seiferle et al., PRL 118, 042501 (2017).
This work was supported by the European Union's Horizon 2020 research and innovation programme under grant agreement 664732 "nuClock" & by DFG Grant No. Th956/3-2.

HK 25.3 Di 17:15 HZO 80

Reduced transition probabilities for the gamma decay of the 7.8 eV isomer in ^{229}Th — •Adriana Pálffy[1] and Nikolay Minkov[1,2] — [1]Max-Planck-Institut für Kernphysik, Heidelberg, Germany — [2]Institute of Nuclear Research and Nuclear Energy, Sofia, Bulgaria

The ^{229}Th actinide isotope has a 3/2 isomeric state lying only 7.8 eV above the ground state. This extremely small energy renders for the first time a nuclear transition accessible to vacuum ultraviolet lasers. Novel applications such as a nuclear frequency standard with unprecedented accuracy based on this transition are anticipated.

In this work we predict the reduced magnetic dipole and electric quadrupole transition probabilities for the radiative decay of the ^{229}Th 7.8 eV isomer to the ground state within a detailed nuclear-structure model approach. We show that the presence and decay of this isomer can only be accounted for by the Coriolis mixing emerging from a remarkably fine interplay between the coherent quadrupole-octupole motion of the nuclear core and the single-nucleon motion within a reflection-asymmetric deformed potential [1]. The predicted magnetic dipole transition probability which determines the radiative lifetime of the isomer is considerably smaller than presently estimated. The so-far disregarded electric quadrupole component may have non-negligible contributions to the internal conversion channel. These findings support new directions in the experimental search of the ^{229}Th transition frequency for the development of a future nuclear frequency standard.
[1] N. Minkov and A. Pálffy, Phys. Rev. Lett. **118**, 212501 (2017).

HK 25.4 Di 17:30 HZO 80

Hunting for the long-lived isomer 188Hf — I Kulikov[1], •K Blaum[7], Y Litvinov[1], T Stöhlker[1], B Sun[6], P Walker[2], P Woods[8], T Yamaguchi[3], and Y Zhang[4,5] — [1]GSI, Germany — [2]University of Surrey, UK — [3]Saitama University, Japan — [4]Institute of Modern Physics, China — [5]Chinese Academy of Sciences — [6]Beihang University, China — [7]MPI Heildelberg, Germany — [8]Edinburgh University, UK

Isomers are long-lived nuclear states with nuclear properties different from the corresponding ground state formed by the same numbers of protons and neutrons. They can give a key information about nuclear structure, heavy-element nucleosynthesis and limits to particle stability. High-K isomers are predicted to coexist with well-deformed collective oblate rotation [1]. Significant contributions to this research field have already been made by GSI with the successful identification of isomers in exotic nuclei, using projectile-fragmentation reaction, A/q and Z selection in the FRS and the final isomer identification in the storage ring ESR. For instance, 183mHf, 184m2Hf and 186mHf isomers were discovered along with their excitation energies and half-life measurement [2]. The observation of 188Hf and confirmation of previous isomers is one of goals of the new experiment at the Experimental Storage Ring at GSI. The details of the experiment and the present status of preparations will be presented. References: [1]- G.D. Dracoulis et al., Rep. Prog. Phys. 79(2016) 076301. [2]- M.W. Reed et al., Phys. Rev. C 86 (2012) 054321.

HK 26: Astroparticle Physics I

Zeit: Dienstag 16:30–18:30 Raum: HZO 100

Gruppenbericht HK 26.1 Di 16:30 HZO 100

The XENON1T Dark Matter Search — •Daniel Coderre — University of Freiburg, Freiburg, Germany

XENON1T is a dual phase time projection chamber operated at the Gran Sasso underground national laboratory. Over 3 tons of ultra-pure liquid xenon are used as a target to measure WIMP-nucleon interactions. The detector was commissioned in 2016 and operated through 2017 and has collected the largest exposure of any detector of its type, giving unprecedented sensitivity to potential dark matter interactions. An in situ upgrade to triple the target mass, XENONnT, is in the development stages and will start construction later in 2018, opening up even more parameter space in the search for WIMPs.

This talk will give an overview of the experiment and present the latest results.

Gruppenbericht HK 26.2 Di 17:00 HZO 100

Everything you want to know about new Borexino results — •Zara Bagdasarian for the Borexino-Collaboration — IKP-2 Forschungszentrum Jülich

Borexino is located at the Laboratori Nazionali del Gran Sasso (LNGS) in Italy with the primary goal of detecting solar neutrinos, particularly those below 2 MeV, with unprecedentedly high sensitivity. The ultra-low radioactive background, Borexino's technical distinctive feature, is the basis of the outstanding achievements obtained so far. During Phase I (2007-2010), Borexino first detected and then precisely measured the flux of the Be7 solar neutrinos, ruled out any significant day-night asymmetry of their interaction rate, made the first direct observation of the pep neutrinos, and set the best available upper limit on the flux of solar neutrinos produced in the CNO cycle (carbon, nitrogen, oxygen). This talk will cover the most recent and precise solar neutrino measurements, along with a limit on neutrino magnetic moment and search for correlations with gravitational waves and gamma-ray bursts.

Gruppenbericht HK 26.3 Di 17:30 HZO 100

The Jiangmen Underground Neutrino Observatory — •Florian Kiel for the JUNO-Collaboration — III. Physikalisches Institut B, RWTH Aachen University

The Jiangmen Underground Neutrino Observatory (JUNO) is a next-generation neutrino experiment currently under construction in southern China, close to Kaiping. Below an overburden of 1900 m.w.e., the liquid scintillator detector with a target volume of 20kT will be used to measure reactor antineutrinos from two power plants at a distance of 53 km. The primary goal is the determination of the neutrino mass hierarchy from the reactor neutrino energy spectrum with better that 3σ significance. It is therefore necessary to reach an unprecedented energy resolution of 3% @ 1 MeV. Furthermore, JUNO can improve the precision on solar oscillation parameters to below 1% and allows the measurement of geo-neutrinos, supernova-neutrinos and atmospheric neutrinos. The start of data taking is planed for 2020. This talk will review the status of the project and physics potential.

HK 26.4 Di 18:00 HZO 100

Removal of noble gases from xenon by cryogenic distillation — •Michael Murra — Institut für Kernphysik, Münster

The operating XENON1T experiment, located in the Laborati Nazionali del Gran Sasso (LNGS), utilizes about 3.3 tons of liquid xenon for the direct detection of dark matter in the form of Weakly Interacting Massive Particles (WIMPS).

A key requirement to reach the desired sensitivity is the removal of intrinsic radioactive backgrounds such as Kr-85 and Rn-222, which create WIMP-like signals within the innermost of the detector.

By employing the differences in vapor pressure between krypton and radon with respect to xenon, a cryogenic distillation column is used to reduce such noble gas impurities.

This talk will present an overview of the performed distillation campaigns at XENON1T and will discuss possible improvements for the

future XENONnT experiment.

Different aspects of this project have been funded by DFG Großgeräte, BMBF and Helmholtz-Alliance for Astroparticle Physics (HAP).

HK 26.5 Di 18:15 HZO 100

Studies of the nucleosynthesis $^{12}C(\alpha,\gamma)^{16}O$ in inverse kinematic for the MAGIX experiment on MESA — •Stefan Lunkenheimer — Institut für Kernphysik der Universiät Mainz

MAGIX is a versatile fixed-target experiment and will be built on the new accelerator MESA (Mainz Energy-Recovering Superconducting Accelerator) in Mainz. The accelerator will deliver polarized electron beams with currents up to 1 mA and energy up to 105 MeV. Using its internal gas-target, MAGIX will reach a luminosity of $O(10^{35}\,\mathrm{cm^{-2}s^{-1}})$. This allows to study processes with very low cross section at small momentum transfer in a rich physical program.

We will present the planned measurements of the inverse kinematic of the nucleosynthesis process $^{12}C(\alpha,\gamma)^{16}O$ to determine its S-factor. In the experiment we will scatter electrons on oxygen atoms and we will detect the scattered electrons in coincidence with the produced α-particles. With this measurement we will determine the cross section as a function of the outgoing center of mass energy of the carbon-α-system to calculate the S-factor. Hereby we will present the results of the first simulations which can be used to understand the parameter range that MAGIX will be able to explore.

HK 27: Instrumentation IX

Zeit: Dienstag 16:30–18:30 Raum: Audimax H1

Gruppenbericht HK 27.1 Di 16:30 Audimax H1

Status of the KATRIN experiment and preparation for tritium measurements — •Jan David Behrens — Institut für Experimentelle Teilchenphysik, Karlsruher Institut für Technologie (KIT), Hermann-von-Helmholtz-Platz 1, 76344 Eggenstein-Leopoldshafen

The **KA**rlsruhe **TRI**tium **N**eutrino experiment aims to determine the mass of the electron antineutrino with a sensitivity of $0.2\,\mathrm{eV}/c^2$ (90% C.L.). The measurement of the shape of the tritium β-spectrum facilitates a model-independent investigation of the absolute neutrino mass scale. The setup consists of a 70 m long beam line that magnetically guides electrons from a gaseous, windowless tritium source to a silicon detector. The energy analysis of the electrons takes place in an electrostatic spectrometer (MAC-E filter) with an energy resolution of about 1 eV. In preparation for tritium data-taking, a measurement campaign was carried out with gaseous and condensed ^{83m}Kr sources in the main beam line. Due to its narrow conversion electron lines this krypton isotope is ideally suited to investigate the performance of the MAC-E filter and overall system stability. These measurements allow us to investigate the experiment's reponse function, the beam line alignment and simulation models which are vital analysis ingredients.

The talk gives an overview about the current status of the experiment, focusing on the results of the recent data-taking period with gaseous and condensed krypton sources. This project is supported by BMBF project 05A17VK2, the Helmholtz Society and the Young Investigators Group (YIG) VH-NG-1055.

Gruppenbericht HK 27.2 Di 17:00 Audimax H1

Accurate High Voltage measurements based on laser spectroscopy — •Kristian König[1], Christopher Geppert[2], Phillip Imgram[1], Jörg Krämer[1], Bernhard Maass[1], Johann Meisner[3], Ernst Wilhelm Otten[4], Stephan Passon[3], Tim Ratajczyk[1], Johannes Ullmann[1,5], and Wilfried Nörtershäuser[1] — [1]Institut für Kernphysik, TU Darmstadt — [2]Institut für Kernchemie, Johannes Gutenberg-Universität Mainz — [3]Physikalisch-Technische Bundesanstalt, Braunschweig — [4]Institut für Physik, Johannes Gutenberg-Universität Mainz — [5]Institut für Kernphysik, Westfälische Wilhelms-Universität Münster

The ALIVE experiment at the TU Darmstadt is a collinear laser spectroscopy setup that has been developed for the measurement of high voltages in the range of 10 to 100 kV with highest precision and accuracy. Here, ions with a well-known mass and transition frequency are accelerated with the voltage that has to be measured and their Doppler shift is examined precisely with laser spectroscopic methods. An accuracy of at least 1 ppm is targeted which is of interest for metrology as well as applications like, e.g. the KATRIN experiment. We will present the results we achieved with $^{40}Ca^+$ ions where the well-known $4S_{1/2} \rightarrow 4P_{3/2}$ and the $3D_{3/2} \rightarrow 4P_{3/2}$ transitions were used to identify the ion velocities before and after the acceleration which are already in the 5 ppm level. To improve this uncertainty, indium ions from a liquid metal ion source and an alternative pump and probe approach will be used in the next stage.

HK 27.3 Di 17:30 Audimax H1

Commissioning measurements of the CKrS with KATRIN — •Mariia Fedkevych — WWU Münster, Deutschland

The KArlsruhe TRItium Neutrino Experiment (KATRIN) is a model-independent measurement of the neutrino mass from the kinematics of tritium β-decay, aiming for a sensitivity of $0.2\ eV/c^2$ (90% C.L.). It uses an electrostatic spectrometer working in MAC-E-filter mode to analyze energies of beta-electrons generated in a windowless gaseous tritium source (WGTS). The experiment uses several sources for absolute energy calibration, monitoring and precise determination of the transmission function of the spectrometer. One of them is the ***C**ondensed **Kr**ypton **S**ource* (*CKrS*) developed in Münster which utilizes nearly monoenergetic conversion electrons from an adsorbed ^{83m}Kr layer on a graphite (HOPG) substrate. The substrate with the frozen ^{83m}Kr layer can be moved mechanically over the complete flux tube area at its position in the KATRIN beamline and therefore allows for per-pixel calibration of the KATRIN focal plane detector (FPD). The cleanliness of the substrate and the quality of the frozen radioactive films are crucial for the stability and reproducibility of the conversion electron spectrum and both are monitored by means of laser ellipsometry.

The source was recently installed at the KATRIN Cryogenic Pumping Section (CPS) and was successfully used in the KATRIN commissioning measurements in the summer 2017. Measurements regarding characterization of the source and spectroscopy with the CKrS are presented. This work is supported under BMBF contract 05A17PM3.

HK 27.4 Di 17:45 Audimax H1

Construction of the resonant position sensitive Schottky cavity — •Dmytro Dmytriiev[1], Shahab Sanjari[1], Yuri Litvinov[1], and Thomas Stohlker[1,2,3] — [1]GSI, Plankstrasse 1, 64291 Darmstadt, Germany — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH Branch Office Helmholtz Institute Jena Fröbelstieg 3, 07743 Jena, Germany — [3]Friedrich Schiller University Jena 07737 Jena

Resonant Schottky cavities are sensitive beam monitors. They are very useful for the beam diagnostics in the storage rings. In addition to their applications in measurements of the beam parameters they also can be used in non-destructive in-ring decay studies of radioactive ion beams. And position sensitive Schottky cavities enhance precision in the isochronous mass measurement technique.

The goal of this work is to create and test position sensitive cavity based on previous simulations and theoretical calculations. These cavities will allow measurement of a particle horizontal position using monopole mode in an elliptic geometry. This information can be further analyzed to increase the performance in isochronous mass spectrometry. A brief description of the detector and its application in mass and lifetime measurements will be provided in this contribution.

HK 27.5 Di 18:00 Audimax H1

Development of the next-generation cryogenic stopping cell for the Super-FRS — •Daler Amanbayev[1], Samuel Ayet San Andres[1,2], Timo Dickel[1,2], Hans Geissel[1,2], Ivan Miskun[1], 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 GmbH, Darmstadt, Germany

A novel cryogenic gas-filled stopping cell (CSC) is being developed for the Low-Energy Branch (LEB) of the Super-FRS Ion Catcher at FAIR. The CSC will thermalize exotic nuclei produced in the Super-FRS at relativistic energies, and make them available to the high-precision experiments MATS and LaSpec.

A prototype of the CSC – commissioned as a part of the FRS Ion

Catcher experiment at GSI – has already enabled an access to short-lived exotic nuclei, providing high areal densities of up to 6.3 mg/cm^2, short extraction times of 25 ms, high rate capabilities of more than 10^4 ions of interest per second and total efficiencies of 30%.

The current design of the future CSC introduces a number of novel concepts that yield in a five-fold increase in areal densities (30 mg/cm^2), five times faster extraction (5 ms), and 10^8 ions per second rate-capability without compromising the efficiency.

The major design features of the future CSC are presented (e.g. RF carpets) with the emphasis on the cryogenic system, that relies on electrically driven cryocoolers. To optimize the cryogenic system, the multiphysics simulations – static and dynamic – were performed.

HK 27.6 Di 18:15 Audimax H1

High-resolution spectrometer in the R^{3}B setup — •Sunji Kim, Thomas Aumann, and Heiko Scheit for the R3B-Collaboration — TU Darmstadt, Darmstadt, Germany

The international research facility FAIR is under construction for research on the nature of matter and the evolution of the universe. Among the four pillars of physics experiments at FAIR, NUSTAR Physics has a branch of R^{3}B to develop a versatile reaction setup for kinematical complete measurements.

In the planned R^{3}B setup, the High-resolution spectrometer (HRS) is one major part for the high-resolution measurement to obtain a relative momentum resolution of Δp/p$\sim 10^{-4}$ with high beam energies at around 1 A GeV of medium and heavy mass nuclei. In knockout reactions and quasi-free scattering, the orbital angular momentum of the recoiling fragment can be deduced from the momentum distribution by comparison with the calculated ones. Here, to distinguish the momentum distributions for different orbital angular momenta, around 20-30 MeV/c momentum resolution in σ in the laboratory frame is needed, corresponding to Δp/p$\sim 10^{-4}$. Therefore, the HRS, consisting of quadrupole triplets, dipoles, and tracking detectors, is being developed by simulations, and the status will be shown in the presentation.

This work is supported by the BMBF under contract number 05P15RDFN1 and the GSI-TU Darmstadt cooperation agreement.

HK 28: Instrumentation X

Zeit: Dienstag 16:30–18:15 Raum: HZO 90

HK 28.1 Di 16:30 HZO 90

DIRC-based PID for the EIC Central Detector — •Roman Dzhygadlo[1], Klaus Peters[1,2], Carsten Schwarz[1], and Jochen Schwiening[1] for the DIRC-at-EIC-Collaboration — [1]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt — [2]Goethe-Universität Frankfurt

The physics program for the Electron-Ion Collider (EIC) detector requires charged Particle Identification (PID) (e/π, π/K, K/p) over a wide momentum range. It is expected that the PID system will need to include one or more Cherenkov counters to achieve this goal. A radially compact DIRC (Detector of Internally Reflected Cherenkov light) counter is an attractive option in barrel region.

The ongoing R&D investigates ways to extend the momentum coverage of a DIRC counter for the EIC detector beyond the current state-of-the-art with clean π/K separation up to at least 6 GeV/c. Possible design improvements include a complex imaging system, comprising multi-component spherical lenses, a compact fused silica expansion volume, and multi-anode sensors with smaller pixels, providing fast single-photon timing in high magnetic fields, a time-based PID algorithm, and chromatic dispersion mitigation.

We will discuss the current status of the design studies with Geant simulations, improvements to the time-based imaging reconstruction, and the results of prototype tests with particle beams at CERN.

This work was supported in part by BNL under eRD4 and eRD14.

HK 28.2 Di 16:45 HZO 90

Prototype test for the PANDA Barrel DIRC — Ahmed Ali[1,2], Anastasios Belias[1], •Roman Dzhygadlo[1], Andreas Gerhardt[1], Marvin Krebs[1], Dorothe Lehmann[1], Klaus Peters[1,2], Georg Schepers[1], Carsten Schwarz[1], and Jochen Schwiening[1] for the PANDA-Collaboration — [1]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt — [2]Goethe-Universität Frankfurt

Excellent hadronic particle identification (PID) 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. It will cover the polar angle range of 22-140 degrees and separate charged pions from kaons for momenta between 0.5 GeV/c and 3.5 GeV/c with a separation power of at least 3 standard deviations.

A sophisticated prototype was constructed and tested in a hadronic particle beam at CERN during the fall of 2017 to test the PID performance of the final design. The prototype comprised a narrow bar made from synthetic fused silica, a complex multi-layer spherical lens system, and a prism-shaped fused silica expansion volume. An array of microchannel-plate photomultiplier tubes was used to measure the location and arrival time of the Cherenkov photons. Data were collected for different optics configurations at different beam angles and momenta. Results of the analysis and a comparison to the Geant4 simulation will be presented.

HK 28.3 Di 17:00 HZO 90

High Precision Measurements for the PANDA Barrel DIRC Radiators — •Marvin Krebs[1,2], Klaus Peters[1], Georg Schepers[1], Carsten Schwarz[1], and Jochen Schwiening[1] for the PANDA-Collaboration — [1]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt — [2]Goethe-Universität, Frankfurt

The PANDA experiment at FAIR (Facility for Antiproton and Ion Research in Europe) at GSI, Darmstadt, will study fundamental questions of hadron physics and QCD. A compact, fast focusing Ring Imaging Cherenkov counter using the DIRC (Detection of Internally Reflected Cherenkov light) technology, will provide charged particle identification (PID) in the barrel region of the PANDA experiment. To meet the PANDA PID requirements, the Barrel DIRC has to provide precise measurements of the Cherenkov angle, which is conserved for Cherenkov photons propagating through the radiator by total internal reflection. The radiators, rectangular bars made from synthetic fused silica, have to fulfill strict optical and mechanical requirements. This includes squareness and parallelism of the bar sides, sharp corners, and smoothly polished surfaces in the order of 10 Å, ensuring very little angular distortions and high transport efficiency. An optical setup, consisting of a computer-controlled positioning and multi-wavelength laser system, is used to evaluate the bars to obtain critical values like transmittance and reflectivity. Prototypes from various manufacturers using different production techniques have been tested to qualify vendors for the Barrel DIRC bar production. Setup, measuring procedure and measurement results will be presented in this contribution.

HK 28.4 Di 17:15 HZO 90

Concept and design of an alignment monitoring system for the CBM RICH mirrors* — •Jordan Bendarouach for the CBM-Collaboration — II. physikalisches Institut, Gießen

The Compressed Baryonic Matter (CBM) experiment at the future FAIR complex will investigate the phase diagram of strongly interacting matter at high baryon density and moderate temperatures in A+A collisions from 2-15 AGeV (SIS100).

One of the key detectors of CBM to explore this physics program is the RICH (Ring Imaging CHerenkov) detector, which is developed for efficient and clean electron identification and pion suppression. About 80 trapezoidal glass mirror tiles equally distributed in two half-spheres will serve as focusing elements with spectral reflectivity down to the UV range.

An important aspect to guarantee a stable operation of the RICH detector is the mirror alignment. To determine and quantify mirror misalignments, a method inspired from the HERA-B experiment is employed. The misalignment information is used in a correction cycle to allow a proper operation of the detector under these conditions.

A global correction cycle will be presented. Results from an automated correction routine and the impact of the corrections on the matching efficiency of the detector will be shown.

(*Supported by BMBF grants 05P15RGFCA, HIC for FAIR and HGS-HIRe)

HK 28.5 Di 17:30 HZO 90

Bau einer Cosmics-Teststation für Teilchendetektoren — •Simon Bodenschatz, Michael Düren, Erik Etzelmüller, Klaus Föhl, Avetik Hayrapetyan, Kristof Kreutzfeldt, Julian Rieke, Mustafa Schmidt und Marc Strickert — II. Physikalisches Institut, Justus-Liebig-Universität Gießen, Germany

Der hier entworfene Teststand nutzt kosmische Myonen zum Test von Detektoren der Teilchenphysik. Er besteht aus zwei Szintillatorplatten von 50x50 cm^2, die als Trigger fungieren und mit PMTs an allen vier Ecken ausgelesen werden. Zur Spurrekonstruktion der Myonen gibt es 2x2 Ebenen aus jeweils 48 überlappenden, 1,5 cm breiten Szintillatorstreifen in x- und y-Richtung, die eine Ortsauflösung von $\sigma = 4,5$ mm erlauben. Die Winkelauflösung durch diese beiden Doppelebenen im Abstand von bis zu 1,7 m beträgt bis zu 3 mrad für den Polar- und bis zu 20 mrad für den Azimuthalwinkel. Die Streifen werden durch SiPMs mit Hilfe von TOFPET-ASICs ausgelesen. Ein Bleiabsorber von ca. 45 cm Dicke zwischen den Spurdetektoren und dem unteren Trigger-Detektor erlaubt es Myonen mit einer Energie E > 750 MeV zu selektieren. Der Teststand wurde speziell zum Test des PANDA DIRC Cherenkov Detektors entwickelt.

HK 28.6 Di 17:45 HZO 90

DIRC detector upgrade for the GlueX experiment — •Ahmed Ali[1,2], Roman Dzhygadlo[1], Klaus Peters[1,2], Jochen Schwiening[1], and Carsten Schwarz[1] for the GlueX-Collaboration — [1]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstad — [2]Goethe-Universität Frankfurt

The upgrade of the GlueX experiment at Jefferson Lab with a DIRC (Detection of Internally Reflected Cherenkov light) counter will significantly improve the particle identification (PID) capabilities in the forward region of the detector by providing clean π/K separation for momenta up to 4 GeV/c.

The GlueX DIRC combines four bar boxes from the decommissioned BaBar DIRC detector with new compact photon cameras based on the SuperB FDIRC concept.

Geant4 simulations were used to design the focusing photon camera. Two reconstruction algorithms were developed to optimize the hadronic PID performance. We will discuss the status of the DIRC detector and the latest achievements in the reconstruction.

HK 28.7 Di 18:00 HZO 90

Di-Electron identification with the upgraded RICH detector at HADES — •Jan-Hendrik Otto for the HADES-Collaboration — Justus Liebig Universität Gießen

The HADES (High Acceptance DiElectron Spectrometer) detector, located at GSI, Darmstadt, has been built to study dense baryonic matter and hadronic properties such as form-factors using in particular electromagnetic probes. Currently several upgrades are done in order to improve the HADES performance at SIS18 during FAIR phase 0 experiments. The photon detector of the RICH detector is replaced by H12700 MAPMTs. In this contribution the expected performance of the RICH detector and studies of e^+e^- pair identification in heavy ion collisions are presented: Simulated UrQMD events of semi-central (44 %) Ag+Ag collisions at 1.65 AGeV beam energy enriched with an additionally embedded PLUTO signal of vector-meson decays have been used for these studies. The high efficient ring finding of the upgraded RICH detector allows for so far unreached background suppression and enables the extraction of an invariant mass spectrum of di-electrons from 50 MeV/c^2 up to masses beyond the phi meson pole.

HK 29: Jahrestreffen junger Wissenschaftler (yHEP, young High Energy Physicist association)

Zeit: Dienstag 19:00–20:00 Raum: HZO 50

Dauer 60 Minuten

HK 30: Hadron Structure and Spectroscopy V

Zeit: Mittwoch 14:00–16:00 Raum: HZO 50

Gruppenbericht HK 30.1 Mi 14:00 HZO 50

Feasibility studies for the measurement of time-like, electromagnetic form factors of the proton at PANDA-FAIR — Samer Ahmed[1], Luigi Capozza[1], Alaa Dbeyssi[1], Phillip Grasemann[1], Frank Maas[1,2], Oliver Noll[1], David Rodriguez Pineiro[1,2], Sahra Wolff[1], Manuel Zambrana[1,2], and •Iris Zimmermann[1] for the PANDA-Collaboration — [1]Helmholtz-Institut Mainz — [2]GSI Darmstadt

One of the main goals of the future PANDA experiment at FAIR (Darmstadt, Germany) is the investigation of the proton structure. Electromagnetic form factors (FF's) are fundamental quantities which parameterize the electric and magnetic structure of hadrons. In the time-like region, proton FF's can be accessed experimentally in $\bar{p}p \to l^+l^-$ (l = e, μ) annihilation processes, assuming that the interaction takes place through the exchange of one virtual photon. The expected statistical precision for the measurement of time-like electromagnetic proton form factors with PANDA was investigated in the framework of the PANDARoot software for detector simulation and event reconstruction for both muon and electron channels. These studies investigated the possibility to achieve an optimal signal-background separation and sufficient background suppression of the relevant background channels. Different methods have been used to generate and analyse the processes of interest. The results show, that time-like electromagnetic proton form factors can be measured at PANDA with high statistical accuracy over a large kinematical region.

HK 30.2 Mi 14:30 HZO 50

Monte Carlo Event Generation with Bremsstrahlung in Deep-Inelastic Scattering — •Nicolas Pierre for the COMPASS-Collaboration — Universität Mainz, Mainz, Deutschland

In order to apply QED corrections in the extraction of 1-photon cross-sections in deep-inelastic scattering, radiation of real photons has to be taken into account. In the COMPASS experiment, the production of hadrons is studied by scattering 160 GeV muons off nucleons. In the analysis, the event kinematics are calculated using the measurement of the incoming and scattered muons. Radiation of a real photons before or after the deep-inelastic scattering leads to different kinematics at the interaction vertex. Thus, this radiation has to be taken care of in the Monte Carlo simulation used to obtain the acceptance. The DJANGOH event generator is chosen as it describes well our data and was modified to be used in the Monte Carlo simulation of the COMPASS apparatus. The results for radiative corrections factors for both inclusive and semi-inclusive channels as well as comparison between Monte-Carlo and real data will be discussed.

HK 30.3 Mi 14:45 HZO 50

The axial-vector $a_1(1420)$ as a triangle singularity — •Mathias Wagner, Mikhail Mikhasenko, and Bernhard Ketzer for the COMPASS-Collaboration — Universität Bonn, Helmholtz-Institut für Strahlen- und Kernphysik, Bonn, Germany

The $a_1(1420)$, a resonance-like signal, was recently observed by the COMPASS experiment in the $J^{PC} = 1^{++}$ partial wave decaying to $f_0(980)\pi$. Fitting a Breit-Wigner form to the spin-density matrix, a mass of 1414^{+15}_{-13} MeV and a width of 153^{+8}_{-23} MeV was extracted [Phys.Rev.Lett. 115 (2015) no.8, 082001].

This talk focuses on the results of applying a new fit model to the data, in which the $a_1(1420)$ is interpreted as a triangle singularity appearing in the rescattering of $K^*\bar{K} \to f_0\pi$. I will explain the fit model and discuss the fit results as well as its statistical uncertainties obtained by applying a bootstrap method. Also the results of systematic studies are presented. The quality of the triangle fit will be compared to the simple Breit-Wigner model.

Supported by BMBF.

HK 30.4 Mi 15:00 HZO 50

ComPWA - The Common Partial Wave Analysis Framework — •Peter Weidenkaff[1], Miriam Fritsch[2], Klaus Götzen[4],

Wolfgang Gradl[1], Mathias Michel[3], Frank Nerling[4], Klaus Peters[4], and Stefan Pflüger[3] — [1]Johannes Gutenberg-Universität Mainz — [2]Ruhr-Universität Bochum — [3]Helmholtz-Institut Mainz — [4]GSI Helmholtzzentrum für Schwerionenforschung

One of the main challenges of hadron physics is the search for new hadronic states. Apart from conventional states also exotics, such as glueballs or hybrids, are realizable. In order to experimentally verify and classify hadronic states, an amplitude analysis is often mandatory. The analysis and comparison of data from multiple experiments is particularly interesting.

The new amplitude analysis framework ComPWA was specifically created to satisfy such demands and set new standards in the amplitude analysis frontier. Its modular design allows flexible amplitude analysis and framework extensions, most importantly the physics models and formalisms. Interfaces to the optimization libraries Minuit2 and Geneva are available. The ComPWA framework was already used for analysis of BESIII data. Since ComPWA is not specifically bound to any experiment, amplitude analysis of data from future experiments like PANDA are also awaited.

This talk presents the possibilities of the ComPWA framework, the current status and the ongoing development.

HK 30.5 Mi 15:15 HZO 50

Extended freed-isobar PWA at Compass — •Fabian Michael Krinner for the COMPASS-Collaboration — Technische Universität München

Compass is a multi-purpose two-stage spectrometer that constitutes the longest-running experiment at the CERN SPS at the moment. One of the primary goals of the experiment is to study the spectrum of light mesons. The flagship channel for this kind of analysis is the diffractive process $\pi^- p \to \pi^-\pi^+\pi^- p$, for which Compass has collected a sample of 46×10^6 events.

In order to extract 3π resonances from these data, a partial-wave analysis is performed. This analysis is based on the isobar model and relies on the complete knowledge of the dynamic amplitudes of the $\pi^+\pi^-$ resonances (isobars) that appear in the subsystems. In order to reduce the model-dependence that is introduced by the employed fixed parameterizations of the isobar amplitudes, we developed a novel method, the freed-isobar PWA, which allows to extract the dynamic isobar amplitudes directly from the data. We will discuss results obtained for waves with $J^{PC} = 3^{++}$ and 4^{++}.

This work was supported by BMBF, the DFG Cluster of Excellence "Origin and Structure of the Universe" (Exc 153), and the Maier-Leibnitz-Laboratorium der Universtiät und der Technischen Universität München

HK 30.6 Mi 15:30 HZO 50

Diffractively produced final states $\eta\pi$ and $\eta'\pi$ in the COMPASS experiment. — •Rocio Reyes Ramos, Mikhail Mikhasenko, and Bernhard Ketzer — Universität Bonn, Helmholtz-Institut für Strahlen- und Kernphysik, Bonn, Germany

The COMPASS experiment at CERN uses a 190 GeV/c π^- beam scattered off a hydrogen target to study the excitation spectrum of light isovector mesons. The final states $\eta\pi$ and $\eta'\pi$ are particularly interesting, because waves with odd angular momentum between the two pseudoscalar mesons must have spin-exotic quantum numbers. An earlier COMPASS analysis [1] exhibited clear structures in the P-waves of both final states, which could be signs of hybrid mesons with gluonic degrees of freedom.

In addition to resonance decay there is, however, a large non-resonant contribution to the signal, which becomes dominant for higher invariant masses of the final-state particles. The goal of this study is therefore to extend the previous analysis to higher invariant masses.

Compared to the previous analysis, we make use of an improved reconstruction of charged particles and especially an improved photon reconstruction in the calorimeters, which is expected to increase the data set. In this talk, we will present the status of the event selection and show the improvement with respect to the original analysis.
Supported by BMBF.
[1] The COMPASS Collaboration. Phys. Lett. B 740, (2015)

HK 30.7 Mi 15:45 HZO 50

Analysis of COMPASS data on DVCS — •Johannes Giarra — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz, Johann-Joachim-Becher-Weg 45, 55099 Mainz

In 2016 and 2017 a measurement of the Deeply Virtual Compton Scattering (DVCS) was performed at the M2 beamline of the CERN SPS by using 160 GeV positive and negative charged muon beams scattering off a liquid hydrogen target. The scattered muons and the produced real photons were detected by the COMPASS spectrometer, which was supplemented by an additional electromagnetic calorimeter for the detection of large angle photons. The recoil protons were detected by the CAMERA detector, which consists of two barrels of scintillators surrounding the 2.5 m long target. The time of flight (TOF) measurement performed by the detector is used to identify the protons.
To select the DVCS events after track reconstruction a precise determination of the target position is necessary. Also for a precise determination of the muon flux, which is needed for the calculation of the cross section, the position of the target is crucial.
The talk will cover a method to precisely determine the target position and will show its influence on the muon flux.

HK 31: Heavy Ion Collisions and QCD Phases V

Zeit: Mittwoch 14:00–15:45 Raum: HZO 60

Gruppenbericht HK 31.1 Mi 14:00 HZO 60

Low-mass dielectron measurements in pp, p-Pb and Pb-Pb collisions with ALICE at the LHC — •Raphaelle Bailhache for the ALICE-Collaboration — Institut für Kernphysik, Frankfurt, Deutschland

Low-mass dielectron measurements play a key role in the study of the Quark-Gluon Plasma (QGP) created in relativistic heavy-ion collisions. At low mass, the dielectron yield is sensitive to the properties of vector mesons in the dense medium and effects due to the chiral symmetry restoration. In the intermediate mass range, dielectrons originate mainly from semielectronic decays of correlated charm and beauty hadrons, which carry information on the energy loss and thermalisation of heavy quarks in the QGP. Finally, thermal radiations from the medium contribute to the dielectron yields in a broad mass range and provide information on the temperature of the medium. To be able to study the QGP signal characteristics, pp collisions are used as vacuum reference, whereas p-Pb collisions allow the study of the cold-matter effects. Moreover, observations of collective effects in high-multiplicity pp and p-Pb collisions show surprising similarities with those in heavy-ion collisions. In this talk, we will present an overview of the dielectron measurements with ALICE at the LHC in pp, p-Pb and Pb-Pb collisions. Its implications for the production of heavy quarks and virtual photons, will be discussed, as well as possible modifications of the dielectron yield in high-multiplicity pp collisions and in Pb-Pb collisions. Finally, we will report on the analysis of pp data taken with a low-magnetic field configuration of ALICE for Run-3.

HK 31.2 Mi 14:30 HZO 60

Azimuthal Anisotropy of Virtual Photons in Au+Au Collisions at $\sqrt{s_{NN}} = 2.4\,GeV$ — •Dominique Dittert for the HADES-Collaboration — TU Darmstadt

Virtual photons, that decay into dileptons, are penetrating probes which directly access the entire space-time-evolution of the fireball and escape from the collision zone without further interactions. Thus they provide unique information about the various stages of the collision. Collective observables like flow are used to describe the macroscopic properties of nuclear matter. Since the effective temperature extracted from the m_T spectra of dileptons results from the superposition of all fireball stages with decreasing temperature T but increasing radial flow over time, it is difficult to disentangle early and late emission sources. In comparison, the elliptic flow does not show this implicit time dependence and the combined dependence of elliptic flow of dileptons on their transverse momentum and their invariant mass provides a rich landscape of structures, which allows to set the observational window on specific stages of the fireball evolution. In this contribution the preliminary results on azimuthal anisotropy of e^+e^- excess radiation measured in Au+Au collisions at $\sqrt{s_{NN}} = 2.4\,GeV$ with HADES will be presented.

HK 31.3 Mi 14:45 HZO 60

Physics performance studies for the CBM-TRD at SIS100 energies — •Etienne Bechtel — IKF, Germany, Frankfurt

The CBM experiment will access a wide range of physics observables. The addition of the TRD is necessary for several of them, since this detector provides important electron and hadron identification capabilities. The pion suppression of the TRD, which is especially crucial in the momentum region above 1 GeV/c, will be used to look for thermal radiation from the early stages of the fireball with a sufficient signal to background ratio. This feature of the TRD is also very important for the measurement of the J/ψ,because due to it's high mass, the J/ψ predominantly decays into dielectrons in the higher momentum region, where the TRD is primarily providing the parti- cle identification. Additionally, the dE/dx information of the four TRD layers together with the mass measurement of the TOF-detector enables the separation of light nuclei with a good resolution. This will in particular be important for the hypernuclei program of CBM.

Supported by BMBF (05P15RFFC1)

HK 31.4 Mi 15:00 HZO 60

Measurement of Neutral Pions in pp Collisions at $\sqrt{s}$ = 5.02 TeV with the ALICE DCal — •Adrian Mechler for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

The ALICE experiment at the CERN LHC investigates the properties of the quark-gluon plasma (QGP) which is believed to be produced in Pb–Pb collisions at high collision energies. Hadron production measurements in pp collisions provide information about the underlying QCD processes and fragmentation functions. Furthermore, pp results provide an important baseline for heavy-ion collisions.

The talk focuses on a measurement of neutral pions (π^0) which are reconstructed via their two-photon decay. The ALICE calorimeters are used to measure the position and energy of the decay photons. To enlarge the acceptance coverage of the calorimeters in ALICE with respect to LHC-RUN1 the di-jet Calorimeter (DCal) has been added for the current RUN2 data taking.

We will present the status of the first analysis of the π^0 production in pp collisions at $\sqrt{s}$=5.02 TeV, measured with the DCal. Main analysis steps such as the extraction and various corrections of the π^0 yield will be discussed. Supported by BMBF and the Helmholtz Association.

HK 31.5 Mi 15:15 HZO 60

Dielectron production in pp collisions at $\sqrt{s}$=13 TeV measured in a dedicated low magnetic-field setting with ALICE — •Jerome Jung for the ALICE-Collaboration — Goethe Universität, IKF, Frankfurt am Main, Deutschland

Low-mass dielectrons are an important probe for the hot and dense medium which is created in ultra-relativistic heavy-ion collisions. Since leptons do not interact strongly and are produced throughout the whole collision process, they carry information from all collision stages with negligible final-state interaction.

The ALICE detector is well-suited to perform this measurement due to its excellent tracking and particle identification capabilities at low momenta. However, Dalitz decays and photon conversions lead to a high combinatorial background. Therefore, the minimization of the background is a key aspect of this analysis. The reconstruction efficiency of low-p_{T} electrons can be increased by reducing the magnetic field of the central barrel solenoid. This allows a better rejection of the electron background and simultaneously gives the opportunity to increase the accessible phase space.

In this talk, the status of the dielectron measurement in pp collisions at $\sqrt{s}$ = 13 TeV from pilot runs taken with B=0.2 T in the ALICE central barrel will be presented. The results will be compared to reference data recorded with the nominal field. Finally, the invariant-mass and pair-transverse-momentum distributions will be compared to the expected yield from known hadronic sources.
Supported by BMBF and the Helmholtz Association.

HK 31.6 Mi 15:30 HZO 60

Measurement of low-mass dielectrons in minimum-bias and high-multiplicity pp collisions at 13 TeV with ALICE — •Ivan Vorobyev for the ALICE-Collaboration — Technische Universität München, Excellence Cluster Universe

Electron-positron pairs are a unique experimental tool to investigate the hot and dense medium created in ultra-relativistic heavy-ion collisions. Such pairs are produced during all stages of the collision and do not interact strongly. Therefore, they carry information about the medium properties and the whole space-time evolution of the system.

The studies of dielectron production in minimum-bias proton-proton collisions provide an important vacuum reference for any modifications observed in heavy-ion collisions. The measurement of dielectron pairs from semi-leptonic decays of correlated heavy-flavour hadrons allow further studies of the primordial heavy-flavour production. Recent studies of proton-proton collisions with high charged-particle multiplicities showed interesting results similar to the observations previously done in heavy-ion collisions. Measurements of low-mass dielectrons could provide further insight into the underlying physics processes.

In this talk we present the current status of the dielectron analysis with ALICE central barrel in pp collisions at 13 TeV. A particular focus of the discussion is put on the modification of dielectron spectrum in pp collisions collected with a trigger on high charged-particle multiplicities compared to the minimum-bias events.

This work is supported by BMBF and the DFG cluster of excellence "Origin and Structure of the Universe"

HK 32: Structure and Dynamics of Nuclei VI

Zeit: Mittwoch 14:00–16:00 Raum: HZO 70

HK 32.1 Mi 14:00 HZO 70

Elastic NN-Scattering with Coupled NΔ-Channels in Chiral Effective Field Theory — •Susanne Strohmeier and Norbert Kaiser — Technische Universität München

We employ the dynamics of the coupled (NN, NΔ, ΔN, ΔΔ)-channels to study the elastic nucleon-nucleon scattering. The potentials arising from one- and two-pion exchange are derived from chiral effective field theory at next-to-leading order. Particular attention is paid to the subtraction of iterative contributions from the planar 2π-exchange box diagrams. The peripheral phase shifts and mixing angles are compared with the Nijmegen partial wave analysis up to I-waves. The short-range contact interaction in the coupled channels is constructed up to next-to-leading order (i.e. quadratic in momenta) and the associated low energy constants are determined in fits to NN-scattering data. The constraints on the low energy constants implied by a large-N_c counting are studied furthermore.
Work supported in part by DFG and NSFC (CRC110).

HK 32.2 Mi 14:15 HZO 70

Weinberg eigenvalue analysis based on chiral effective field theory interactions — •Jan Hoppe[1,2], Christian Drischler[3,1,2], Kai Hebeler[1,2], and Achim Schwenk[1,2,4] — [1]Institut für Kernphysik, Technische Universität Darmstadt — [2]ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung GmbH — [3]Department of Physics, University of California, Berkeley — [4]Max-Planck-Institut für Kernphysik, Heidelberg

We present a comprehensive Weinberg eigenvalue analysis of a representative set of modern nucleon-nucleon interactions derived within chiral effective field theory, containing recently developed local, semi-local, and nonlocal potentials. We demonstrate that a direct comparison of numerical cutoff values of different interactions is in general misleading due to the different analytic form of regulators. Our detailed comparison of Weinberg eigenvalues provides various insights into properties of chiral potentials for different orders and partial waves. This shows that Weinberg eigenvalues could be used as a helpful monitoring scheme when constructing new interactions.

*This work is supported by the DFG through Grant SFB 1245 and the ERC Grant No. 307986 STRONGINT.

HK 32.3 Mi 14:30 HZO 70

Electroweak currents from chiral EFT in few-nucleon systems — •Rodric Seutin[1,2,3], Sebastian König[1,3], and Achim Schwenk[1,2,3] — [1]Institut für Kernphysik, Technische Universität Darmstadt — [2]Max-Planck-Institut für Kernphysik, Heidelberg —

[3]ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung GmbH

Using chiral EFT one is able to construct current operators at the many-body level. As a result of this, it is guaranteed that the current operators can be evaluated consistently with the appropriate nuclear wave functions, obtained as well from chiral interactions. This consistency is a key advantage of the EFT framework. In this talk, we discuss the development of electroweak currents in few-nucleon systems and their applications to electromagnetic form factors as well as electroweak transitions.

*This work is supported by the IMPRS-PTFS and the DFG through Grant SFB 1245.

HK 32.4 Mi 14:45 HZO 70

Similarity Renormalization Group evolution for deuteron breakup in pionless effective field theory — •Marc Schönborn[1,2], Sebastian König[1,2], and Achim Schwenk[1,2,3] — [1]Institut für Kernphysik, Technische Universität Darmstadt — [2]ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung GmbH — [3]Max-Planck-Institut für Kernphysik, Heidelberg

Similarity Renormalization Group (SRG) methods are used to evolve nuclear interactions towards diagonal form by decoupling high- and low-energy contributions while low-energy observables remain unchanged. To ensure this, all operators have to be evolved consistently along with the Hamiltonian. One of the simplest reactions where this can be studied, which still covers all relevant physics aspects, is deuteron breakup. In the past, SRG evolution of this process has been studied using potential models. At low energies, where pions are not resolved, pionless effective field theory is very well suited for the description of the breakup process. In this work, we discuss how this simplification can be used to gain further insights into the SRG evolution of operators.

*This work is supported by the DFG trough Grant SFB 1245 and the ERC Grant No. 307986 STRONGINT.

HK 32.5 Mi 15:00 HZO 70

Parametrisations of relativistic mean-field models with density dependent couplings — •Stefan Typel — Institut für Kernphysik, Technische Universität Darmstadt, Germany

Relativistic mean-field (RMF) models with density dependent (DD) couplings have been used successfully to describe finite nuclei and nuclear matter. They usually assume a dependence of the nucleon-meson couplings on the so-called vector density that is derived from the baryon current. A dependence on other densities, in particular the scalar density, was not really explored although suggested in early introductions of the DD-RMF approach. In this contribution, properties of nuclei, the corresponding equations of state (EoS) and symmetry energies of different DD-RMF models are compared using DD couplings of various functional form and dependence on vector and scalar densities. They are obtained by fitting the same set of nuclear observables. The choice of the dependence changes the EoS and the characteristic nuclear matter parameters. Problems of some of the models are identified.

HK 32.6 Mi 15:15 HZO 70

Hyperon single-particle and chemical potentials in nuclear matter from SU(3) chiral effective field theory — •Dominik Gerstung and Norbert Kaiser — Physik Department, Technische Universität München, D-85747 Garching, Germany

Brueckner theory is employed to calculate the single-particle potentials of nucleons and hyperons in nuclear matter. The underlying two-body interactions consist of the next-to-leading order chiral two-baryon potentials and effective density-dependent baryon-baryon interactions derived from the leading order chiral three-baryon forces. We compute the chemical potentials of neutrons and $\Lambda(1116)$-hyperons from the energy density of strongly interacting baryonic matter. The implications for the possible occurrence of strange baryons in neutron-star matter are discussed.

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

HK 32.7 Mi 15:30 HZO 70

Energy density functionals from local chiral interactions — •Lars Zurek[1,2], Eduardo Antonio Coello Pérez[1,2], and Achim Schwenk[1,2,3] — [1]Institut für Kernphysik, Technische Universität Darmstadt — [2]ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung GmbH — [3]Max-Planck-Institut für Kernphysik, Heidelberg

We employ the density-matrix expansion introduced by Negele and Vautherin and further developed by Gebremariam et al. in order to rewrite off-diagonal density matrices in terms of local densities and their derivatives. The resulting approximations for the density matrices are applied to calculate the energy density functionals arising from the contributions to the Hartree-Fock energy due to different local two- and three-nucleon interactions which were derived from chiral effective field theory and fit in recent calculations. The resulting energy-density functionals and their results for energies are presented and compared to other calculations.

* This work is supported by the DFG through Grant SFB 1245.

HK 32.8 Mi 15:45 HZO 70

Recent progress in effective field theory for collective rotations and vibrations of triaxial nuclei — •Qibo Chen[1], Norbert Kaiser[1], Ulf-G Meissner[2,3], and Jie Meng[4] — [1]Physik-Department, Technische Universität München, D-85747 Garching, Germany — [2]Helmholtz-Institut für Strahlen- und Kernphysik and Bethe Center for Theoretical Physics, Universität Bonn, D-53115 Bonn, Germany — [3]Institute for Advanced Simulation, Institut für Kernphysik, Jülich Center for Hadron Physics and JARA-HPC, Forschungszentrum Jülich, D-52425 Jülich, Germany — [4]State Key Laboratory of Nuclear Physics and Technology, School of Physics, Peking University, Beijing 100871, China

In recent years, effective field theory has achieved many successes in hadronic and low-energy nuclear physics. In this talk, the recent progress in EFT for collective rotation and vibration of triaxial nuclei is reviewed. The Hamiltonian for the triaxial rotor is constructed up to NLO. Its applicability is examined by comparing with a five-dimensional rotor-vibrator Hamiltonian for the description of the energy spectra in Ru isotopes. It is found that by taking into account the NLO corrections, the ground state band in the whole spin region and the γ-band in the low spin region are well described. The deviations for high-spin states in the γ-bands point towards the importance of including vibrational degrees of freedom in the EFT formulation. Hence, the vibrational degree of freedom is further included in the construction of EFT formulation and a Hamiltonian for collective rotation-vibration is derived.

HK 33: Structure and Dynamics of Nuclei VII

Zeit: Mittwoch 14:00–15:45 Raum: HZO 80

Gruppenbericht HK 33.1 Mi 14:00 HZO 80

High-spin structures of transitional Xe nuclei in the $50 \leq Z, N \leq 82$ region — •Levent Kaya[1], Andreas Vogt[1], Peter Reiter[1], Marco Siciliano[2,3], Kasia Hadynska-Klek[2], Carl Wheldon[4], and J.J. Valiente-Dobón[2] — [1]IKP, Universität zu Köln — [2]INFN - LNL, Italy — [3]INFN Padova, Italy — [4]University of Birmingham, United Kingdom

The $50 \leq$ Z, N ≤ 82 region is a fertile testing ground for the predictions of modern shell-model calculations. Xe nuclei with $A \approx 130$ form an important link in the smooth evolution from spherical to deformed shapes. Transitional hard-to-reach Xe nuclei are investigated after multinucleon-transfer (MNT) employing the γ-ray tracking array AGATA coupled to the mass spectrometer PRISMA and after MNT employing the GAMMASPHERE spectrometer in combination with the gas-detector array CHICO. Furthermore, Xe isotopes were populated in fusion-evaporation reactions employing the HORUS γ-ray array at the University of Cologne. The high-spin level schemes of ^{131}Xe, ^{132}Xe and ^{133}Xe are considerably extended to higher energies. Evidence is found for a long-lived ($T_{1/2} \gg 1$ μs) isomer in ^{133}Xe. A pronounced backbending along the negative-parity band in ^{131}Xe is observed. Large-scale shell-model calculations employing the SN100PN, PQM130, GCN50:82, and realistic effective interactions re-

produce the experimental findings and provide guidance to the interpretation of the observed high-spin features. Supported by the German BMBF (05P12PKFNE TP4, 05P15PKFN9), ENSAR-TNA03, BCGS.

HK 33.2 Mi 14:30 HZO 80

Reduced transition probabilities in ^{80,82,83}Se — •Julia Litzinger for the PRISMA AGATA Plunger-Collaboration — Institute for Nuclear Physics, Cologne (D)

Selenium nuclei in the vicinity of the neutron shell closure at N=50 are of particular interest as a change of the nuclear structure was experimentally observed on the one hand within the yrast cascade of ^{82}Se noticeable by an isomeric yrast 8_1^+ state and in addition between neighboring even-even isotopes ^{78,80,82}Se induced by the filling of $\nu g_{9/2}$ orbital. Transition probabilities from lifetimes of excited states give insight to nuclear structure information and allow to probe nuclear models, i.e. the nuclear shell model. We performed a RDDS experiment at the INFN, Legnaro, using the Cologne Plunger, the PRISMA magnetic spectrometer for the event-by-event particle identification and the AGATA demonstrator for the γ-ray detection and tracking. Using a ^{82}Se beam and a ^{238}U target ^{80,82,83}Se nuclei were produced via neutron transfer reactions and Coulomb excitation. Furthermore, shell model calculations using the effective interactions JUN45 and jj44b were performed and analyzed focussing on the nuclear structure of mainly yrast states by analyzing leading configurations constructed by protons and neutrons coupled to different spins in the wave functions. In addition the role of $\nu g_{9/2}$ orbital for yrast states of Selenium isotopes near N=50 was investigated.

Experimental results on transition probabilities in ^{80,82,83}Se isotopes will be presented and discussed in terms of the shell model calculations.

HK 33.3 Mi 14:45 HZO 80

^{148}Ce as a good X(5) candidate from EXILL&FATIMA campaign — •Pavlos Koseoglou[1,2], V. Werner[1,3], N. Pietralla[1], S. Ilieva[1], M. Thürauf[1], R. B. Cakirli[4], J. Jolie[5], T. Kröll[1], J.-M. Régis[5], and N. Saed-Samii[5] — [1]IKP TU-Darmstadt, Germany — [2]GSI, Germany — [3]Yale University, USA — [4]MPIK Heidelberg, Germany — [5]IKP University of Cologne, Germany

The structure of the neutron-rich nuclide ^{148}Ce was studied at the high-flux reactor of the Institut Laue Langevin, Grenoble, within the EXILL&FATIMA campaign. A hybrid spectrometer consisting of the EXILL (high-resolution HPGe) and the FATIMA (fast $LaBr_3$) detectors was used to investigate fission fragments of ^{235}U and ^{241}Pu. Lifetimes in the ps range were measured due to the fast $LaBr_3$ detectors and both the slope- and generalized centroid difference method. This kind of analysis serves as preparation for the FATIMA experiments at FAIR. ^{148}Ce sits on the low-Z boundary of the $N = 90$ phase transitional region. The even-even $N = 90$ isotones undergo a first order quantum phase transition which is characterized by a sudden change of the shape of the nucleus. Sensitive signatures of these kind of changes are the $R_{4/2} = E(4_1^+)/E(2_1^+)$ and the $B_{4/2} = B(E2; 4_1^+ \rightarrow 2_1^+)/B(E2; 2_1^+ \rightarrow 0_1^+)$ ratios. The experimentally measured ratios will be compared with the theoretical predictions of the X(5) symmetry. The analysis of ^{148}Ce will be presented together with the indicators which highlight this nucleus as a good X(5) candidate.

HK 33.4 Mi 15:00 HZO 80

E2 Übergangsstärken in ^{112}Te — •Claus Müller-Gatermann, Dorothea Wölk, Alfred Dewald, Christoph Fransen, Julia Litzinger, Alina Goldkuhle, Thomas Braunroth, Marcel Beckers, Andrey Blazhev und Karl-Oskar Zell — Institut für Kernphysik, Universität zu Köln, Deutschland

Lebensdauern in ^{112}Te wurden mittels der Recoil Distance Dopplershift Methode unter Benutzung des Kölner Koinzidenzplungers und 12 HPGe-Detektoren bestimmt. Das Experiment wurde am Kölner FN Tandem Beschleuniger mit der Reaktion ^{92}Moa(^{23}Na,p2n)^{112}Te bei einer Strahlenergie von 81MeV durchgeführt. Die Differential Decay Curve Methode für Koinzidenzmessungen wurde benutzt um Lebensdauern für niedrigliegende yrast-Zustände zu extrahieren. Wie schon im Nachbarkern ^{114}Te verhalten sich die resultierenden E2 Übergangsstärken anormal im Vergleich zu den Vorhersagen gängiger kollektiver Modelle unter Berücksichtigung der Zustandsenergien, die einen vibrationsartigen Charakter zeigen.

HK 33.5 Mi 15:15 HZO 80

Formfaktoren der ersten angeregten Kernzustände von ^{129}Xe und ^{131}Xe* — •Philipp Christian Ries, Sergej Bassauer, Antonio D'alesion, Michaela Hilcker, Tobias Klaus, Michael Mathy, Peter von Neumann-Cosel, Norbert Pietralla, Maxim Singer, Gerhart Steinhilber und Volker Werner — Institut für Kernphysik, Technische Universität Darmstadt, 64289 Darmstadt

Flüssiges Xenon wird als Detektormaterial in der XENON100 Kollaboration zum Nachweis von bislang hypothetischen schwach wechselwirkenden massereichen Teilchen (WIMPs) eingesetzt. WIMPs gelten als Kandidaten für dunkle Materie und sollen über elastische und inelastische Stöße an den Xenonnukliden detektiert werden. Sollte die Wechselwirkung zwischen WIMPs und gewöhnlicher Materie spinabhängig sein, dominierten die Xenonisotope ungerader Massenzahl ^{129}Xe und ^{131}Xe diese. Aufgrund der niedrigen Anregungsenergien der beiden ersten angeregten Zustände von 40 bzw. 80 keV wird dabei ein erheblicher Beitrag durch inelastische Stöße erwartet. Diese Zustände werden am supraleitenden Darmstädter Elektronen-Lineabeschleuniger S-DALINAC mittels Elektronenstreuung vermessen, um Vorhersagen zu den Wellenfunktion der angeregten Zustände, die in eine Analyse der XENON100 Daten eingehen, zu testen.

*Unterstützt von der DFG im Rahmen des SFB 1245.

HK 33.6 Mi 15:30 HZO 80

Investigation of the photon strength function in ^{128}Te using the $(\gamma, \gamma'\gamma'')$ reaction* — •D. Savran[1], J. Isaak[2], B. Löher[3], T. Beck[3], M. Bhike[5], U. Gayer[3], FNU Krishichayan[5], N. Pietralla[3], M. Scheck[6], W. Tornow[5], V. Werner[3], A. Zilges[4], and M. Zweidinger[3] — [1]GSI, Darmstadt, Germany — [2]RCNP, Osaka, Japan — [3]IKP, TU Darmstadt, Germany — [4]IKP, Univ. zu Koeln, Germany — [5]Duke University, Durham NC, USA — [6]UWS, Paisley, UK

In most nucleosynthesis calculations the concept of photon strength functions (PSF) is used within the statistical model to describe the average EM decay properties of excited nuclei. The basis of this approach is the validity of the Brink-Axel hypothesis. The PSF's are assumed to be independent of the excitation energy and the specific properties of the involved excited states. Model-independent experimental data on the proof of this concept is still scarce. The new experimental technique of combining real photon scattering and coincidence γ-ray spectroscopy at the γ^3 setup [1] at HIγS allows to investigate the decay pattern of photo-excited states in great detail. Results on ^{128}Te will be presented, which show a clear discrepancy to the statistical model assumption of a constant PSF and thus disagrees with the Brink-Axel hypothesis for the presented case.

*Supported by DFG (SFB 1245, ZI 510/7-1) and EMMI.

[1] B. Löher et al., NIMA 723 (2013) 136-142

HK 34: Nuclear Astrophysics III

Zeit: Mittwoch 14:00–15:45 Raum: HZO 100

Gruppenbericht HK 34.1 Mi 14:00 HZO 100

High Density Fluctuations in Neutron Stars — •Konstantin Otto[1], Micaela Oertel[2], Mario Mitter[3], and Bernd-Jochen Schaefer[1] — [1]Institut für Theoretische Physik, Justus-Liebig-Universität Gießen, Germany — [2]Observatoire de Paris, CNRS, Meudon, France — [3]Department of Physics, BNL, Upton, NY 11973

The impact of thermal and quantum fluctuations at high baryon chemical potential on neutron stars is studied in the framework of the functional renormalization group (FRG) analysis with a quark-meson model truncation. Results for both $N_f = 2$ and $N_f = 2 + 1$ quark flavors are compared with each other such that the role of strangeness in compact objects can be addressed. The effect of vacuum fluctuations on the equation of state is investigated with corresponding mean-field approximations.

HK 34.2 Mi 14:30 HZO 100

Large scale DFT calculations and twist-averaged boundary conditions — •Bastian Schuetrumpf — Institut für Ker-

physik, Technische Universität Darmstadt, Schlossgartenstraße 2, 64289 Darmstadt, Germany — GSI Helmholzzentrum für Schwerionenforschung, Planckstraße 1, 64291 Darmstadt, Germany

Density functional theory is a powerful tool to study nuclear structure and dynamics, because such calculations can cover the entire nuclear landscape. Its applicability is not limited to finite nuclei. Also infinite systems, e.g. nuclear pasta matter as present in the inner crust of a neutron star can be covered. These infinite systems are usually simulated using a finite box with periodic boundary conditions. Despite computational resources have advanced tremendously in the last years, the size of the simulation boxes for such calculations are still limited. The consequences for the simulations are twofold: On the one hand the limited boxes introduces finite-volume effects due to the spurious quantization of the wave functions in the box. We show, that this effect can be immensely reduced by utilizing the twist-averaged boundary conditions for static and time-dependent calculations. Second, the finite size of the boxes limit the possible emerging shapes of the pasta matter. In order to make calculations with larger boxes we parallelized Sky3D and optimized its performance on distributed memory architectures. The parallelisation allows not only to simulate much larger systems, but also enables to include finite temperature or the pairing interaction.

This work is supported by the BMBF-Verbundforschungsprojekt number 05P15RDFN1.

HK 34.3 Mi 14:45 HZO 100

Nuclear uncertainties in the r-process nucleosynthesis — •Stylianos Nikas[1,2], Gabriel Martinez-Pinedo[1,2], André Sieverding[1,2], and Alexander Arzhanov[1,2] — [1]Institute of Nuclear Physics, Technische Universität Darmstadt, Darmstadt, Germany — [2]Theory Division, GSI Helmholzzentrum für Schwerionenforschung, Darmstadt, Germany

Neutron capture rates are one of the key ingredients to model the r-process nucleosynthesis. The Hauser-Feshbach theory allows us to model these reaction rates for nuclei out of the reach of the current experimental facilities. However, nuclear properties that are used to calculate the corresponding reaction rates using the Hauser-Feshbach theory are not well known for the majority of the nuclei in the path of the r-process. We explore the impact of a newly developed fully microscopic mass model on Hauser-Feshbach calculations of (n,γ) reaction rates and consequently on r-process yields.

This work is supported by the BMBF-Verbundforschungsprojekt number 05P15RDFN1.

HK 34.4 Mi 15:00 HZO 100

Electron capture processes in stellar degenerate cores — •Dag Fahlin Strömberg[1,2], Heiko Möller[1,2], and Gabriel Martinez-Pinedo[1,2] — [1]Institut für Kernphysik (Theoriezentrum), Technische Universität Darmstadt, Schlossgartenstraße 2, 64289 Darmstadt, Germany — [2]Gesellschaft für Schwerionenforschung Darmstadt, Planckstr. 1, D-64259 Darmstadt, Germany

Electron capture reactions play an important role in the evolution of degenerate stellar cores. These reactions do not only reduce the degeneracy pressure by removing electrons, but can also heat and cool the core through double electron capture and Urca processes.

In this talk we will focus on accreting ONe white dwarfs and their evolution until the ignition of oxygen. Following carbon burning, the composition of such cores is ^{16}O, ^{20}Ne, ^{23}Na, ^{24}Mg and ^{25}Mg. In addition, there can also be other nuclear species in the core due to a non-zero metallicity of the progenitor. We will discuss the effects of the above mentioned weak processes on the temporal evolution of the stellar core. In particular, we will focus on metallicity dependent effects. To do this we need accurate weak interaction rates, which at these conditions can be computed from a small number of dominant transitions.

This work is supported by the Deutsche Forschungsgemeinschaft through contract SFB 1245.

HK 34.5 Mi 15:15 HZO 100

Pushing Core-Collapse SNe to Explosions in spherically symmetric simulations — •Kevin Ebinger[1], Sanjana Curtis[2], Carla Fröhlich[2], Matthias Hempel[3], Albino Perego[4], and Friedrich-Karl Thielemann[3] — [1]GSI Helmholtzzentrum für Schwerionenforschung GmbH ,Planckstrasse 1, 64291 Darmstadt, Germany — [2]Department of Physics, North Carolina State University, Raleigh NC 27695 — [3]Departement für Physik, Universität Basel, CH 4056 Basel, Switzerland — [4]Istituto Nazionale di Fisica Nucleare, Sezione Milano Bicocca, Gruppo Collegato di Parma, I-43124 Parma, Italy

Core-Collapse Supernovae (CCSNe) are violent explosions that occur at the end of the evolution of massive stars. After decades of research the detailed mechanism behind the explosion is still not fully understood. To investigate global properties of these events for a large sample of progenitor stars, multi-dimensional simulations are computationally too demanding and thus one has to rely on one-dimensional simulations in order to study large samples of progenitors. The PUSH method represents a suitable parametrized framework to investigate the neutrino-driven mechanism in spherically symmetric simulations to efficiently study many important aspects of CCSNe: the effects of the shock passage through the star, explosive nucleosynthesis and the progenitor-remnant connection. After calibrating the method to SN1987A and other observed CCSNe we explore a large mass range of available solar metallicity progenitors and investigate their explodability and the resulting explosion properties.

HK 34.6 Mi 15:30 HZO 100

Pre-supernova neutrino signal as a probe of neutrino mass hierarchy — •Gang Guo[1] and Yong-Zhong Qian[2] — [1]GSI, Darmstadt, Germany — [2]School of Physics and Astronomy, University of Minnesota, USA

Pre-supernova neutrinos provide an important probe of stellar interior as well as properties of neutrino. In this work, we investigate the possibility of using pre-supernova $\bar{\nu}_e$ signals at JUNO to probe neutrino mass hierarchy. We find for the 4 given stellar models, i.e., 12, 15, 20 and 25 $M_\odot$, if the progenitor and distance can be well measured, neutrino mass hierarchy can be determined at 5σ (3σ) C. L. for stars within about 0.25−0.75 (0.4−1.1) kpc. Take Betelgeuse as a realistic case, we find the normal hierarchy case can be distinguished at 5σ C. L. via pre-supernova neutrino signals, even both the progenitor and/or the distance of Betelgeuse are not well determined.

HK 35: Instrumentation XI

Zeit: Mittwoch 14:00–16:00 Raum: Audimax H1

HK 35.1 Mi 14:00 Audimax H1

Track Reconstruction for the CBELSA/TAPS TPC — •Philipp Bielefeldt, Markus Ball, Jonathan Ottnad, and Bernhard Ketzer for the CBELSA/TAPS-Collaboration — Universität Bonn, Helmholtz-Institut für Strahlen- und Kernphysik, Bonn, Germany

The current set-up of the CBELSA/TAPS experiment at the ELSA electron accelerator facility in Bonn is well-suited for the detection of neutral particles. It conducts measurements on the entire excitation spectrum of nucleons using a polarised photon beam on a polarised target. For a future upgrade, a gas-filled Time Projection Chamber with Gas Electron Multiplier read-out (GEM-TPC) is being developed. It will allow studies of charged particles in the final state and will improve particle identification and background suppression capabilities.

Track reconstruction within the GEM-TPC is developed based on GENFIT II, a sophisticated, experiment-independent tracking and reconstruction framework. GENFIT II will be used as a plug-in for ExPlORA, an analysis software developed for CBELSA. This framework, based on ROOT, allows the user to easily apply analysis and visualisation techniques, facilitating analyses through an XML front-end.

In this talk, the implementation of the GENFIT II framework for the GEM-TPC at CBELSA/TAPS will be explained. An overview of ExPlORA and the plug-ins used will be given. The pattern recognition and fitting performance of GENFIT II within the framework will be presented.

HK 35.2 Mi 14:15 Audimax H1

Quality Assurance of GEM-based Readout Chambers for the Time Projection Chamber of ALICE — •Lukas Kreis for the ALICE-Collaboration — GSI Helmholtzzentrum für Schwerio-

nenforschung GmbH, Darmstadt, Germany — Universität Heidelberg, Germany

The ALICE Time Projection Chamber is the main device for tracking and particle identification. Starting from 2021, LHC will provide Pb-Pb collisions at a rate of 50 kHz, about 4 times higher than the present collision rate. Recording collisions at this rate would not be possible with the current readout scheme which is based on multi-wire proportional chambers (MWPC) with a gating grid. Therefore during the LHC long shutdown, which is scheduled for 2019 - 2020, the MWPCs will be replaced by readout chambers based on gaseous electron multipliers (GEMs). The new readout chambers use a stack of 4 GEMs to preserve the present energy resolution while keeping the ion backflow into the drift volume of the TPC below 1 percent. At GSI Helmholtzzentrum für Schwerionenforschung, half of the outer readout chambers (OROC) are assembled and their performance is checked. In this talk we will present the ongoing production and the qa procedures and their results, which ensure that all chambers meet the specifications. These include tests of the leakage current of GEM foils, the gain and ion backflow uniformity and the stability in the presence of high-level ionizing radiation, as well as the gas tightness.

HK 35.3 Mi 14:30 Audimax H1

Investigation of ion transport properties of a GEM-stack — •Fabian Liebske for the ALICE-Collaboration — Institut für Kernphysik - Goethe Universität Frankfurt, Frankfurt am Main, Germany

With the Upgrade of the ALICE Time Projection Chamber (TPC) it is planned to replace the present MWPC-based readout chambers with detectors that employ stacks of Gas Electron Multipliers (GEMs). A key parameter of a GEM stack is the amount of ions that emerges from the amplification holes back into the drift volume. It limits the rate capability of the system because excessive ion back-flow leads to space-charge distortions of the drift field. In order to investigate the ion transport properties of GEM stacks, a dedicated test setup was developed. In a reversed-field configuration, ion currents can be studied in detail without the disturbing effects of electrons from amplification avalanches. In this talk, the test setup will be presented and results on the ion transport properties will be discussed.

HK 35.4 Mi 14:45 Audimax H1

The readout system of the upgraded ALICE TPC — •Lars Bratrud for the ALICE-Collaboration — Institut für Kernphysik - Goethe Universität, Frankfurt, Germany

With the planned upgrade of the ALICE Time Projection Chamber for operation at Pb-Pb interaction rates of up to 50 kHz, a new continuous readout system based on point-to-point links will be implemented.

A new Front-End Card (FEC) based on 5 SAMPA front-end ASICs has been developed, which allows to read 160 channels from the new GEM-based readout chambers. The data is sent via two radiation hard GigaBit Transceivers (GBTs) to the Common Readout Unit (CRU) in the counting room at a total data transfer rate of 1.1 GB/s per FEC. Data processing will be performed in the CRU: Data decoding, channel mapping, common mode correction, and cluster-finding. One downlink to the FEC is used for control and configuration through a dedicated Slow Control Adapter chip – the GBT-SCA. To monitor the header-less data stream from the FEC, the SAMPA ADC clocks are sent together with the actual data stream. The generation of a synchronization pattern in the SAMPA, triggered by the readout system, ensures correct (global) alignment of the data on all FECs.

Several verification studies have been performed with the new FEC to make sure that it meets the required specifications for resolution, dynamic range, data transfer rate, and reliability. In order to allow early testing of the Front-End Cards without CRU hardware, a temporary readout solution based on the current readout cards of ALICE was developed and parts of this system will be reused in the CRU.

HK 35.5 Mi 15:00 Audimax H1

An approach to optimising the geometry of the Gas Electron Multiplier — •Jonathan Ottnad, Markus Ball, and Bernhard Ketzer for the CBELSA/TAPS-Collaboration — Universität Bonn, Helmholtz-Institut für Strahlen- und Kernphysik, Bonn, Germany

Gas Electron Multipliers (GEM) are a sophisticated technology for the multiplication of charges in gaseous detectors. They are used in experiments like COMPASS, LHCb, and for the upgrades of the CMS muon system and the ALICE TPC at CERN. They will also be used for the CBELSA/TAPS TPC at Bonn. Multi-GEM systems provide stable operation, even at high incoming particle rates. Typically a spatial resolution of the order of 50 μm and an energy resolution of the order of 10 % for ^{55}Fe X-rays are reached. Stacking several GEM foils opens a wide parameter space for optimization with respect to experiment-specific demands.

The performance of GEMs is characterized by their ability to collect, multiply, and extract charges. While for a fixed GEM geometry the multiplication of charges (gain) mostly depends on the voltage settings across the GEM, the transfer properties depend on the complete electric field configuration on both sides of the GEM electrodes. Different geometric parameters of the foil, including the pitch of holes and the hole dimensions, modify these characteristics. We measured these properties for various different GEM geometries and compared them to the results of microscopic simulations. As a next step, an attempt to optimise the geometry of GEMs with respect to the transfer properties is made, utilising the same simulation framework.

HK 35.6 Mi 15:15 Audimax H1

Statusbericht der GEM-Entwicklung bei MAGIX — •Pepe Gülker für die MAGIX-Kollaboration — Institut für Kernphysik, Johannes Gutenberg-Universität, Mainz, Deutschland

Das geplante MAGIX-Experiment am im Bau befindlichen Teilchenbeschleuniger MESA wird zwei hochauflösende, drehbare Magnetspektrometer besitzen. Diese werden in einer Quadrupol-Dipol-Konfiguration realisiert und in der Fokalebene sollen GEM basierte Detektoren zum Einsatz kommen.

Es sollen Elektronenstreumessungen im Niederenergiebereich (<105 MeV) der Teilchenphysik durchgeführt werden. Dabei soll der Impuls der gestreuten Teilchen mit einer relativen Impulsauflösung von 10^{-4} und der Streuwinkel mit einer Genauigkeit von 0.9 mrad gemessen werden. Die Strahlungslänge des Detektorsystems und die damit verbundene maximale erreichbare Auflösung der Spektrometer ist damit, zusätzlich der geforderten Ortsauflösung der Detektoren und der hohen Ratenfestigkeit, äußerst delikat zu betrachten. Die Ergebnisse und Erkentnisse aus 2 Jahren Prototypenentwicklung und -tests sollen, mit einem Hauptaugenmerk auf dem Wechselspiel zwischen Detektoren und Spektrometern präsentiert und weiterführende Ideen diskutiert werden.

HK 35.7 Mi 15:30 Audimax H1

A model of charge-transfer processes in GEM foils — •Viktor Ratza, Jonathan Ottnad, Markus Ball, and Bernhard Ketzer for the ALICE-Collaboration — Universität Bonn, Helmholtz-Institut für Strahlen- und Kernphysik, Bonn, Germany

Tracking detectors based on GEM foils are widely used in ongoing experiments and are the choice for numerous upgrades in the near future. An example is the ALICE TPC upgrade at the LHC of CERN where the use of GEM foils will allow the TPC to be employed in a high-rate environment.
In order to optimize and predict the performance of GEM detectors in terms of gain, energy resolution and ion backflow, a good and quantitative understanding of charge-transfer processes of electrons and ions between the individual GEM foils is mandatory. Based on two–dimensional analytic electric flux calculations a model has been established to describe the charge-transfer for GEM foils in terms of the GEM geometry (hole size, pitch and thickness) and the applied electric potentials. Recent advances allow us to calculate the efficiencies in the full range of charge density configurations and as functions of the applied electric fields. Additionally, first three–dimensional approaches will be presented and compared to simulations.

Supported by BMBF.

HK 35.8 Mi 15:45 Audimax H1

dE/dx Resolution Studies of a Pre-Production Read Out Chamber for the ALICE GEM TPC — •Thomas Klemenz for the ALICE-Collaboration — TU München, Physik Department E62, Excellence Cluster 'Universe', Garching

The ALICE Collaboration is planning a major upgrade of its central barrel detectors to be able to cope with the increased LHC luminosity beyond 2019. In order to record at an increased interaction rate of up to 50 kHz in Pb–Pb collisions, the TPC will be operated in an ungated mode with continuous readout. This demands for a replacement of the currently employed gated Multi-Wire Proportional Chambers by GEM-based (Gas Electron Multiplier) readout chambers, while retaining the performance in particular in terms of particle identification capabilities via the measurement of the specific energy loss.

The increase in interaction rate and the requirements of a continuous

readout demand for significant modifications of the read out chambers, front-end cards and the corresponding software framework. To validate the performance of a newly built 4-GEM Inner Read Out Chamber from the pre-production equipped with the newly developed front end electronics, the $\mathrm{d}E/\mathrm{d}x$ resolution was evaluated with a beam of electrons and pions at the CERN proton synchrotron. The results are presented together with an overview on the digitization in the new software framework O^2, which is validated with the test beam data.

This research was supported by the DFG cluster of excellence 'Origin and Structure of the Universe', BMBF and HGF.

HK 36: Instrumentation XII

Zeit: Mittwoch 14:00–16:00 Raum: HZO 90

HK 36.1 Mi 14:00 HZO 90

Teststand für Submodule des elektromagnetischen Kalorimeters für das $\overline{\mathrm{P}}$ANDA-Experiment — •Florens Grimm für die PANDA-Kollaboration — Ruhr-Universität Bochum, Institut Experimentalphysik I, 44780 Bochum

Im $\overline{\mathrm{P}}$ANDA-Experiment wird ein kompaktes, homogenes Elektromagnetisches Kalorimeter zum Einsatz kommen, welches aus Bleiwolframat-Szintillatoren besteht. Submodule bestehen aus 16, abhängig von der Lage im Detektor, mit Avalanche-Photodioden (APD) bzw. Vakuum-Photo-Tetroden (VPTT) und entsprechenden Vorverstärkern bestückten Kristallen. Durch die Temperaturabhängigkeit des Szintillationslichtes sind zusätzlich Temperatursensoren notwendig, die im Submodul verbaut werden.
Nach Zusammenbau eines Submoduls wird dieses in einem Teststand auf seine Funktionstüchtigkeit hin überprüft. Dazu wird von einem Lichtpulser ein Lichtpuls erzeugt, dessen Form so optimiert wurde, dass es dem Szintillationslicht entspricht. Dieser Puls wird von hinten in den Kristall eingekoppelt. Die resultierenden Vorverstärkersignale werden über eine Adapterplatine, die auch die Spannungsversorgung der einzelnen Submodule-Kanäle ermöglicht, auf ein 16-Kanal SADC mit analogem Shaper-Eingang, wie später im Experiment verwendet, gegeben. Somit steht zum Test der einzelnen Submodul-Kanäle die gesamte $\overline{\mathrm{P}}$ANDA-Kalorimeter-Auslesekette zur Verfügung.

Gefördert durch das BMBF.

HK 36.2 Mi 14:15 HZO 90

Improved two-gamma decay measurement setup and NEPTUN status report — •Patrick van Beek[1], Thomas Aumann[1,2], Martin Baumann[1], Michael Beckstein[1], Daniel Körper[1,2], Bastian Löher[1,2], Heiko Scheit[1], and Dmytro Symochko[1] — [1]TU Darmstadt — [2]GSI Helmholtzzentrum

The low-energy photon tagging facility NEPTUN at the superconducting Darmstadt linear accelerator (S-DALINAC) can be used to study the photoabsorption cross section of nuclei in the energy regions of Pygmy Dipole and Giant Dipole Resonances. From the complete photo nuclear cross section spectrum one can calculate the diagonal dipole polarizability of the nucleus, which helps constraining the symmetry energy in the equation of state. A major upgrade of NEPTUN is underway, which will be presented.

One approach to investigate the off-diagonal dipole polarizability of nuclei is to study the two-gamma decay of excited nuclear states. A new experimental setup is being developed which will use state of the art $LaBr_3$ scintillators with excellent time and energy resolution in combination with Heidelberg-Darmstadt-Crystal-Ball NaI spectrometer. To suppress unwanted Compton events a collimating lead ball (BACCHUS) will be used. This promises significantly reduced background conditions and higher count rates compared to our previous setup.

Supported by DFG (SFB 1245).

HK 36.3 Mi 14:30 HZO 90

Vorbereitungen ür das Screening von Avalanche-Photodioden für das PANDA-Experiment — •Leon Knarr — RuhrUniversitätBochum, Institut für Experimentalphysik I

Das PANDA-Experiment ist eines der Schlüsselexperimente an der Beschleunigeranlage FAIR in Darmstadt. Die primären Forschungsziele des Experiments sind der Aufbau von Hadronen, die starke und schwache Wechselwirkung sowie exotische Materiezustände.
Hierbei kommt im Targetspektrometer ein homogenes elektromagnetisches Kalorimeter zum Einsatz, welches aus einem Fass-Teil und je einer Endkappe in Vorwärts- und Rückwärtsstrahlrichtung besteht, und in dem insgesamt 15644 Szintillatorkristalle aus Bleiwolframat eingesetzt werden. Für die Auslese der 768 Kristalle im inneren Bereich der Vorwärtsendkappe, wo eine höhere Strahlendosis zu erwarten ist, werden Vakuum-Phototetroden (VPPTs) genutzt. Die restlichen Szintillatoren werden von je zwei Avalanche-Photodioden (APDs) pro Kristall ausgelesen. Um Platz und Kosten zu sparen, werden Gruppierungen mehrerer APDs mit der selben Spannungsversorgung betrieben. Diese Gruppierungen müssen so gewählt werden, dass die APDs einer Gruppierung möglichst ähnliche Charakteristiken aufweisen. Wichtige Kriterien dafür sind die Spannungs- und Temperaturabhängigkeit des Verstärkungsfaktors der APDs. Dazu wird ein Verfahren entwickelt, welches es ermöglicht, über 30.000 APDs effizient bei +20 °C und -25 °C zu vermessen.

Gefördert durch das BMBF

HK 36.4 Mi 14:45 HZO 90

CALIFA at R^{3}B: The Q.A test stand and the gain monitoring system — •Han-Bum Rhee, Anna-Lena Hartig, Alexander Ignatov, and Thorsten Kröll for the R3B-Collaboration — Institut für Kernphysik, TU Darmstadt, Germany

CALIFA is a calorimeter and spectrometer that aims to detect gammarays and light charged particles. It is a part of the R3B experiment at GSI and the future FAIR facility. The functional units for the CALIFA demonstrator are called petals containing 64 CsI(Tl) crystals with APD readout each. Before assembling the detection units, a precise study of individual parts has to be done. This project aims to develop a quality assurance test stand for the APDs and crystals characterisation. Particularly, the inhomogeneity of the crystal light output is investigated with a collimated source.
The gain monitoring system (GMS) using the light signal from a pulsed LED is being developed by our group. The GMS distributes the signal to the detector elements via optical fibers and monitors the gain variance. In addition, our group developed a dedicated connetor PCB for the APD. PCB is used not only for the connection with the preamplifier, but also for the gain monitoring optical fiber and temperature sensor.
This work is supported by the German BMBF (05P15RDFN1), HIC for FAIR and GSI-TU Darmstadt cooperation contract.

HK 36.5 Mi 15:00 HZO 90

Investigation of $CeBr_3$ for its use in neutron capture experiments — •Benjamin Brückner[1], Uwe Zscherpel[2], and René Reifarth[1] — [1]Goethe Universität Frankfurt am Main, 60438 Frankfurt am Main — [2]Bundesanstalt für Materialforschung und Prüfung, 12205 Berlin

Measurements of neutron capture cross sections at energies up to a few hundred keV are important for constraining astrophysical processes relevant for the creation of heavy elements. The efficient detection of the prompt γ-rays emitted after the neutron capture is necessary to determine these cross sections. Scintillation detectors are commonly used for these measurements. Recently detectors made of the scintillator material $CeBr_3$ became available in larger volumes. Its advantage compared to lanthanum halide scintillators are the lower prices and the absence of intrinsic background while the light output is similar. An overview of the characteristics of a $CeBr_3$ scintillator and its possible use as a substitute for different scintillators such as $LaBr_3$(Ce), NaI(Tl) and BaF_2 will be presented.

HK 36.6 Mi 15:15 HZO 90

Development of LYSO detector modules for an EDM polarimeter at COSY — •Dito Shergelashvili for the JEDI-Collaboration — Ivane Javakhishvili Tbilisi State University, Chavchavadze ave. 1, Tbilisi 0128, Georgia

The JEDI collaboration (Jülich Electric Dipole moment Investigations) aims to measure the permanent electric dipole moments (EDMs) of

charged hadrons (proton, deuteron) in storage rings, which offers the possibility to measure EDMs of charged particles by ob- serving the influence of the EDM on the spin motion. The Cooler Synchrotron COSY at the Forschungszentrum Juelich provides polarized protons and deuterons up to a momentum of 3.7 GeV/c and is thus an ideal machine for development and commissioning of the nec- essary technology. The essential point would observe a tiny change of beam polarization over an extended period of time.

For the EDM measurements, a dedicated high precision polarimeter is required. To fulfill specifications, a fast, dense, high resolution (energy and time), and the radioactive hard novel crystal scintillating material is required. For that purpose, several detector modules, built from different types of LYSO crystals and light sensors (PMTs and SiPM arrays), have been tested at COSY with a polarized deuteron (proton) beam with different energies from 100 MeV up to 270 MeV. In this talk, the preliminary results of these measurements and accumulated experience of the module development will be presented.

HK 36.7 Mi 15:30 HZO 90

The EDM Polarimeter Development at COSY-Jülich — •Fabian Müller for the JEDI-Collaboration — Forschungszentrum Jülich, Institute for Nuclear Physics, Wilhelm-Johnen-Straße, 52428 Jülich

The JEDI (Jülich Electric Dipole moment Investigations) collaboration performs a set of experiments at the COSY storage ring in Jülich, within the R&D phase to search for the Electric Dipole Moments (EDMs) of charged particles. A measurement of proton and deuteron EDMs is a sensitive probe of yet unknown CP violation. The method of charged particle EDM search will exploit stored polarized beams in order to observe a miniscule rotation of the polarization axis as a function of time due to the interaction of a finite EDM with large electric fields. Key challenge is the provision of a sensitive and efficient method to determine the tiny change of the beam polarization. Elastic scattering of the beam particles on carbon nuclei will provide the polarimetry reaction. To perform these measurement, an EDM polarimeter needs to be developed. The polarimetry concept developed within the JEDI collaboration is based on a heavy crystal (LYSO) hadron calorimeter. LYSO as a fast, dense and radiation hard, novel scintillating material was chosen to fulfill these specifications. The polarimeter is designed in a compact and modular fashion consisting of modules made from LYSO crystals coupled to silicon photomultipliers (SiPM). This setup has been tested at COSY in a deuteron beam with five different energies from 100 MeV up to 270 MeV. The preliminary results of this measurements will be presented.

HK 36.8 Mi 15:45 HZO 90

Prototype Test Beam Results of the Crystal Zero Degree Detector for BES III — Achim Denig[1], Peter Drexler[1], Brice Garillon[1], •Leonard Koch[2], Wolfgang Kühn[2], Sören Lange[2], Werner Lauth[1], Yutie Liang[2], and Christoph Redmer[1] for the BESIII-Collaboration — [1]Johannes Gutenberg Universität Mainz — [2]Justus-Liebig-Universität Gießen

The BES III experiment at the BEPCII electron positron collider in Beijing is collecting data in the charm-τ mass region. Being strongly peaked towards small polar angles, photons from initial state radiation (ISR) are detected with limited efficiency.

In order to increase the detection efficiency of these photons, we develop a small detector comprised of two arrays of scintillating crystals separated by a small gap to be placed in the very forward and backward regions. The scintillation light will be collected by silicon photomultipliers (SiPMs) and the signals will be digitized by feature extracting flash ADCs. This data stream is correlated with the BES III trigger in realtime on FPGA based hardware.

In November '17, a prototype detector consisting of a single LYSO crystal, four SiPMs and the full readout chain was tested succesfully at the MAMI facility in Mainz.

This work is supported by grant DFG research group 2359.

HK 37: Hadron Structure and Spectroscopy VI

Zeit: Mittwoch 16:30–18:30 Raum: HZO 50

Gruppenbericht HK 37.1 Mi 16:30 HZO 50

Production of pseudoscalar mesons in proton-deuteron fusion with WASA-at-COSY — •Nils Hüsken, Kay Demmich, and Alfons Khoukaz for the WASA-at-COSY-Collaboration — Westfälische Wilhelms-Universität Münster

The production of pseudoscalar mesons in the proton-deuteron fusion to ^{3}HeX final states has received considerable interest in the past. In the production of η mesons, a strong final state interaction leads to an unexpected enhancement of the total cross section right at the production threshold. While this effect has been studied extensively already, the main production mechanism remains largely unexplored. A new dataset gathered with the WASA experiment, located inside the COSY accelerator complex, at 15 different excess energies between $Q_\eta = 13$ MeV and $Q_\eta = 81$ MeV (corresponding to $p_\mathrm{p} = 1.60$ GeV/c up to $p_\mathrm{p} = 1.74$ GeV/c) provides new insight both in the transition region where the final state interaction loses its importance, as well as into the region where the production mechanism is dominant. In addition, also the production of pions is studied. Within the accessible energy region, thus far only data for collinear single-pion production exists, exhibiting significant structures in both the cross section as well as in the contributing amplitudes and the tensor polarization in the backward direction. With the new dataset, a large part of the backward hemisphere is covered and detailed differential cross sections are extracted. This marks the first time, such data is available in this energy region. Recent results on both the η and the π^0 production will be reported and an outlook will be given on future possibilities.

HK 37.2 Mi 17:00 HZO 50

Helicity dependence of single neutral pion photoproduction on deuteron — •Federico Cividini for the A2-Collaboration — Institut für Kernphysik - Universität Mainz

During the pion production reaction, the nucleon is excited to an intermediate resonant state, and a complete analysis of the experimental data gives a determination of the main properties of the baryon resonances. A detailed knowledge of the spectrum of nucleon excited states gives essential constraints on models for nucleon structure. The data for the observables accessible using a polarised photon beam and/or polarised nucleon targets are scarce in many channels, especially in those induced on the neutron. A systematic measurement of all different observables is under way at the the Mainz facility by the A2@MAMI collaboration.

This talk will focus on the measurement performed at the Mainz Microtron using a circularly polarised photon beam and longitudinally polarised proton and deuteron target in combination with the large acceptance Crystal Ball/TAPS detection setup. An overview of the status of the experiment will be given together with the preliminary results of the helicity asymmetry of the single pi0 photoproduction reaction from the deuteron target.

Supported by DFG under contract SFB1044

HK 37.3 Mi 17:15 HZO 50

Proton Time-Like Electromagnetic Form Factor Measurement with the Scan Method at BESIII — •Christoph Rosner[1], Samer Ahmed[1], Alaa Dbeyssi[1], Paul Larin[1], Dexu Lin[1], Frank Maas[1,2,3], Cristina Morales[1], and Yadi Wang[1] for the BESIII-Collaboration — [1]Helmholtz-Institut Mainz, Mainz, Germany — [2]Institute of Nuclear Physics, Mainz, Germany — [3]PRISMA Cluster of Excellence, Mainz, Germany

Electromagnetic form factors (FF) provide valuable insight to the internal structure and dynamics of the proton. While they are well known in the space-like region through electron scattering experiments, the time-like region, typically accessed by annihilation experiments, is known with much less precision. Specifically the separation of the electric and magnetic FF has only been possible with low accuracy due to the low luminosity of previous data.

This contribution reports on the analysis based on 651 pb^{-1} scan data taken at 22 energy points between 2.0 and 3.08 GeV with the Beijing Spectrometer III (BESIII) at the Beijing Electron Positron Collider II (BEPCII). The efforts to extract both the cross section of $e^+e^- \to p\bar{p}$ as well as the individual electric and magnetic FF are presented.

HK 37.4 Mi 17:30 HZO 50

Search for polarization in the antiproton production process — •Dominika Alfs — Institut für Kernphysik, Forschungszentrum Jülich, Germany — Institute of Physics, Jagiellonian University, Kraków, Poland

A wide range of fundamental effects in the hadronic sector can be investigated only by means of controlling the spin degrees of freedom. However, for the time being, there is no convenient method for the production of a well-defined polarized antiproton beam with high intensity [1].

An alternative approach towards this problem would be possible if antiprotons had a non zero polarization degree when produced but until now there were no experimental studies in this direction. Such an experiment has been performed at the CERN/PS complex in order to test whether the production process under conditions typical for the antiproton beam preparation can be itself a source of polarization [2].

The polarization is measured by the asymmetry of elastic antiproton scattering on a liquid hydrogen target in the Coulomb-nuclear interference region with the expected analyzing power A_y equal to about 4.5% [2].

The experimental setup will be presented and the status of the ongoing analysis will be shown. Furthermore, plans for the forthcoming measurement with upgraded detector components will be explained.

[1] E. Steffens, AIP Conf. Proc. 1149, 80-89 (2009)
[2] D. Grzonka, et. al., Acta Phys. Polon. B 46 191 (2015)

HK 37.5 Mi 17:45 HZO 50

Measurement of the time-like π^0 transition form factor at BESIII — •Thomas Lenz, Achim Denig, and Christoph Florian Redmer for the BESIII-Collaboration — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz, Deutschland

Transition form factors of light pseudoscalar mesons play an important role in the calculations of hadronic contributions to the anomalous magnetic moment of the muon. The BESIII experiment at the $e^+\,e^-$ collider BEPCII in Beijing has collected more than $10\,\mathrm{fb}^{-1}$ of data at energies above 3.773 GeV. Based on these data the process $e^+\,e^- \to \pi^0\,\gamma$ is studied. The analysis aims at the determination of the transition form factor of the π^0 in a region of momentum transfer above $14\,\mathrm{GeV}^2$, which will also help to shed light on the discrepancy between results of the BaBar and Belle measurements in the space-like regime. In this presentation we will give an overview of the current status of the analysis.

Supported by DFG (SFB 1044).

HK 37.6 Mi 18:00 HZO 50

Analysis of $e^+e^- \to p\bar{p}X, X = \eta, \omega, \phi$ — •Marcel Rump, Johannes Bloms, Nils Hüsken, Alfons Khoukaz, and Frederik Weidner for the BESIII-Collaboration — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, 48149 Münster, Germany

Since the discovery of the X(3872) state by the BELLE experiment in 2003, a large number of new states was found in the mass region around $4\,\mathrm{GeV/c^2}$, which apparently do not fit into the scheme of conventional charmonium states. The possibility that some of these states could be of exotic nature has raised interest on charmonium physics to a new level. Investigations of the type $e^+e^- \to p\bar{p}X$ have recently been started using the datasets collected with the Beijing Spectrometer III (BESIII) in positron-electron annihilations at the Beijing Electron-Positron Collider (BEPCII) in the energy region between $\sqrt{s} = 3.8\,\mathrm{GeV/c^2}$ and $\sqrt{s} = 4.6\,\mathrm{GeV/c^2}$. Systematic searches can be performed on heavy resonances decaying to $p\bar{p}X$ as well as decays via different nucleon resonances. In this talk, preliminary results of the analyses of the channels $e^+e^- \to p\bar{p}\eta$, $e^+e^- \to p\bar{p}\omega$ and $e^+e^- \to p\bar{p}\phi$ will be presented. Data selection, background analysis and the extraction of cross sections will be discussed.

HK 37.7 Mi 18:15 HZO 50

Suche nach charmonium-artigen Zuständen im Reaktionskanal $e^+e^- \to \pi^+\pi^-\chi_{cJ}$ bei BESIII — •Patric Kiese[1] und Miriam Fritsch[2] für die BESIII-Kollaboration — [1]Helmholtz-Institut Mainz — [2]Ruhr-Universität Bochum

Seit der Entdeckung der ersten Charmonium-Zustände vor über 10 Jahren wurde eine ganze Reihe von Zuständen (XYZ) entdeckt, welche entweder keinen Platz im Charmonium-Spektrum finden oder unerwartete Eigenschaften haben, wie eine sehr schmale Linienform. Beides könnte damit zusammenhängen, dass diese Zustände komplizierter aufgebaut sind als einfache Mesonen. Nur die geladenen Z-Zustände müssen auf jeden Fall eine exotische, innere Struktur aufweisen. Da Charmonium-Zustände elektrisch neutral sind, muss die Ladung der $Z_c(3900)$-Resonanz durch zwei weitere Quarks erzeugt werden. Die Entdeckung des ersten geladenen Z_c bei BESIII mit Bestätigung dieses Zustandes durch andere Experimente und dem anschließenden Nachweis des ladungsneutralen Partners beschreibt ein komplettes Isospin Triplet, dessen Zustände nach $\pi^{\pm/0}\chi_{cJ}$ (J = 0,1, 2) zerfallen.
Mit dem BESIII-Experiment am BEPCII-Speicherring in Beijing wurde eine große Menge Daten bei Schwerpunktsenergien oberhalb von 4 GeV aufgezeichnet. Die sechs Datensätze mit der höchsten Luminosität werden in der vorgestellten Analyse verwendet, um nach weiteren charmonium-artigen Zuständen im Reaktionskanal $e^+e^- \to \pi^+\pi^-\chi_{cJ}$ zu suchen. Es wird eine Struktur im $\pi^\pm\chi_{cJ}$ Subsystem des Reaktionskanals vermutet. Es werden grundlegende Analyse-Strategien anhand von Monte Carlo Studien vorgestellt und erste Ergebnisse präsentiert.

HK 38: Hadron Structure and Spectroscopy VII

Zeit: Mittwoch 16:30–18:00 Raum: HZO 80

Gruppenbericht HK 38.1 Mi 16:30 HZO 80

Strangeness in pion-nucleus collisions at 1.7 GeV/c — •Joana Wirth for the HADES-Collaboration — Physik Department, TUM, Garching, Germany — Excellence Cluster "Universe", Garching, Germany

Pion-nucleus reactions allow for detailed investigations of open and hidden strange hadron production which are directly connected to the study of hadron in-medium properties at a well defined nuclear density. Overall, 10×10^7 and 13×10^7 events have been collected with HADES in $\pi^- + C$ and $\pi^- + W$ at $p_{\pi^-} = 1.7$ GeV/c, respectively.
In this contribution, we will present results on differential, acceptance and efficiency corrected yields including the following strange hadron: $K^{\pm,0}$, Λ and ϕ. Special emphasis will be on the study of K^- absorption driven by strangeness exchange processes. A direct indication of this effect can be seen by comparing the K^-/K^+ ratios measured in collisions with heavy targets (W) and lighter ones (C). Further, the contribution of the ϕ to the K^- production will be presented. For the first time also the ϕ absorption in different nuclei in pion-induced reactions will be discussed providing complementary information to results obtained with photon and proton beams. Besides, the exclusive channel $\pi^- + p \to K^0 + \Lambda$ ($\Lambda + p \to \Lambda + p$) is investigated to shed light on the repulsive short-range Λp interaction predicted by theory. A comparative discussion of these results with respect to Au(1.23 GeV/u)+Au collisions measured with HADES will be shown as well.
∗ supported by the DFG cluster of excellence "Origin and Structure of the Universe and SFB 1258"

HK 38.2 Mi 17:00 HZO 80

A FAIR phase-0 project at MAMI — Samer Ahmed[1,2], •Luigi Capozza[1], Alaa Dbeyssi[1], Phillip Grasemann[1,2], Frank Maas[1,2,3], Oliver Noll[1,2], David Rodríguez Piñeiro[1], Sahra Wolff[1,2], Manuel Zambrana[1,2], and Iris Zimmermann[1,2] for the PANDA-Collaboration — [1]Helmholtz-Institut Mainz, Mainz, Germany — [2]Institute of Nuclear Physics, Mainz, Germany — [3]PRISMA Cluster of Excellence, Mainz, Germany

In view of the current FAIR construction schedule on the one side and the state of development of some FAIR experiment setups on the other side, the so-called "phase-0" of the FAIR project has been proposed, within which FAIR equipment shall be used for physics experiments at other facilities before the actual start of FAIR.

The PANDA electromagnetic calorimeter (EMC), which is essentially already in the construction phase, can certainly be considered for such projects.

In this talk, the use of the backward endcap of the PANDA EMC at the MAMI electron accelerator in Mainz is explored. The physics channels which have been proposed are presented and some feasibility

issues are discussed.

HK 38.3 Mi 17:15 HZO 80

Femtoscopic studies of baryonic interactions with the ALICE detector — •Bernhard Hohlweger for the ALICE-Collaboration — Technische Universität München — Excellence Cluster Universe

The two body interaction of baryons with one partner containing strangeness is not well constrained, especially in the region of low momentum. Therefore data is usually obtained by conducting scattering experiments but recently a new method was proposed using femtoscopy. Here the observable is the correlation function of particle pairs, whereas in order to study the interaction of particles, the emission of the pairs needs to be constrained. In this analysis pp and pPb data recorded by the ALICE detector was used to study the proton-Λ interaction and Λ-Λ interaction. The source was constrained by simultaneously fitting the proton-proton correlation function, where the interaction of pairs is well understood. The formalism of λ-parameters was used to separate background contributions from the genuine correlation arising from the baryon-baryon interaction. The results are used to discuss the sensitivity to different potentials of the proton-Λ interaction obtained by LO and NLO calculations. Additionally a comparison of the Λ-Λ correlation to a previous measurement of the STAR collaboration is presented.

HK 38.4 Mi 17:30 HZO 80

Freed-isobar Partial-Wave Analysis of the Spin-Exotic $J^{PC} = 1^{-+}$ Wave at COMPASS — •Dmitri Rybachikov for the COMPASS-Collaboration — Physik-Department E18, Technische Universität München

COMPASS is a multi-purpose fixed-target experiment at the CERN Super Proton Synchrotron aimed at studying the structure and spectrum of hadrons. The spectrum of isovector light-meson resonances is studied in diffractive-dissociation reactions using a 190 GeV/c π^- beam. The flagship channel is the $\pi^-\pi^-\pi^+$ final state, for which COMPASS has recorded a large data sample of 46 million events. From these data, 3π resonances are extracted by performing a partial-wave analysis (PWA) using the isobar model. The model depedence of the PWA result is studied using a novel method, the freed-isobar PWA, which extracts the amplitudes of the $\pi^-\pi^+$ subsytems from the data. Using this method, we studied the spin-exotic partial wave with $J^{PC} = 1^{-+}$ quantum numbers, which decays via an isovector $\pi^-\pi^+$ subsystem with $J^{PC} = 1^{--}$. This wave is of particular interest because it has quantum numbers that are forbidden for $q\bar{q}$ systems in the non-relativistic limit. Continuous mathematical ambiguites may arise in the freed-isobar approach. We will discuss methods to resolve these ambiguities and present results of this analysis.

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 Mi 17:45 HZO 80

Simulating the phase space for the $\eta(\to \pi^+\pi^-\pi^0)\pi^-$ production at COMPASS. — •Waldemar Renz, Bernhard Ketzer, Mikhail Mikhasenko, and Mathias Wagner for the COMPASS-Collaboration — Universität Bonn, Helmholtz-Institut für Strahlen- und Kernphysik, Bonn, Germany

The COMPASS experiment at CERN studies the excitation spectrum of mesons by diffractive scattering of 190 GeV/c pions off a hydrogen target. The data are analyzed using amplitude analysis techniques to extract the contributions of individual partial waves. Monte Carlo simulations of the respective decay channels are needed in order to correct for the detector acceptance. For the $\eta\pi$ final state, a phase-space generator of the $\pi^- p \to \pi^+\pi^-\pi^-\gamma\gamma p_{\mathrm{recoil}}$ reaction has been developed, where the reaction is split up into $2 \to 2$ and $1 \to 2$ reactions. To reduce the number of random generated variables, several assumptions are made for the squared matrix element. The generator output is then processed by TGEANT, a new, simulation framework for COMPASS, based on Geant4, to simulate particle trajectories and interactions inside detectors.

From these simulated detector outputs, one can reconstruct the final states and filter for interesting events. The selected simulated data are finally compared to experimental data in order to validate the simulations. In this talk the status of the simulations will be presented.
Supported by BMBF.

HK 39: Heavy Ion Collisions and QCD Phases VI

Zeit: Mittwoch 16:30–18:15 Raum: HZO 60

Gruppenbericht HK 39.1 Mi 16:30 HZO 60

J/ψ production in pp and Pb-Pb collisions at mid-rapidity with ALICE — •Raul Tonatiuh Jimenez Bustamante for the ALICE-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany — Physikalisches Institut, University of Heidelberg, Heidelberg, Germany

Charmonium production is a key observable in pp and Pb-Pb collisions. The charmonium study in pp collisions can help to understand both fundamental QCD processes and hadronization mechanisms. J/ψ measurements as a function of multiplicity can help to explore the soft regime.

In the study of charmonium in Pb-Pb collisions several QGP effects have been observed, such as the suppression of charmonium states due to color screening. However, an enhancement due to (re)combination of uncorrelated charm and anti-charm quarks has been observed at LHC energies. This enhancement is more pronounced at low transverse momentum ($p_{\mathrm{T}} < 4.0$ GeV/c).

ALICE provides unique capabilities among the LHC experiments to measure J/ψ production in the mid-rapidity ($|y| < 0.9$) region down to p_{T} =0. In this talk, ALICE measurements in pp at $\sqrt{s} = 13$ TeV as a function of charged particle multiplicity will be shown. In addition, the inclusive J/ψ nuclear modification factor (R_{AA}) as a function of centrality and transverse momentum will be discussed and compared to model predictions.

HK 39.2 Mi 17:00 HZO 60

J/ψ production at LHC energies with the Statistical Hadronisation Model — Anton Andronic[1], Peter Braun-Munzinger[1], •Markus K. Köhler[2], and Johanna Stachel[2] — [1]Research Division and ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany — [2]Physikalisches Institut, Ruprecht-Karls-Universität Heidelberg, Germany

We present recent results on inclusive J/ψ production at LHC energies within the framework of the Statistical Hadronisation Model. The centrality and rapidity dependence are demonstrated to reproduce available data at LHC energies. Input parameters from hydrodynamical simulations are used to calculate the J/ψ transverse momentum dependence.

HK 39.3 Mi 17:15 HZO 60

Measurements of inclusive and non-prompt J/ψ production in p–Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 8$ TeV in ALICE at the LHC — •Minjung Kim for the ALICE-Collaboration — Physikalisches Institut, Universität Heidelberg

The measurement of J/ψ production in p–Pb collisions is an important probe to study possible cold nuclear matter effects as well as final state mechanisms, which can affect its production. In ALICE (A Large Ion Collider Experiment), J/ψ production has been measured in the dielectron decay channel at mid-rapidity as well as in the dimuon decay channel at forward rapidity.In the recent data taking period (Run 2), ALICE collected an enriched sample of high–p_{T} electron candidates using the electron trigger of the Transition Radiation Detector (TRD). In addition, J/ψ from weak decays of beauty hadrons (non-prompt J/ψ), can be separately at mid-rapidity due to the excellent primary and secondary vertex as well as impact parameter resolution of the Inner Tracking System (ITS). In this talk, we will present the status of the inclusive and non-prompt J/ψ measurement in p–Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 8.16$TeV with the TRD triggered data. This work was supported by BMBF.

HK 39.4 Mi 17:30 HZO 60

Charm measurements in heavy ion collisions by NA61/SHINE at CERN SPS — •Aleksandra Snoch for the NA61/SHINE-Collaboration — Goethe-University Frankfurt am Main

NA61/SHINE is a fixed target experiment operating at the CERN Super-Proton-Synchrotron (SPS). The NA61/SHINE Collaboration studies properties of hadron production in nucleus-nucleus collisions. The primary aim is to uncover features of the phase transition between confined matter and quark gluon plasma. Within the current program data on p+p, Be+Be, Ar+Sc, Xe+La, and Pb+Pb collisions at beam momenta in the range 13A-150A GeV/c has been recorded.

This program is currently extended by measurements of charm hadron production in heavy ion collisions, which requires a significant detector upgrade.

In this talk I will discuss three questions that motivate the NA61/SHINE open charm studies:

- What is the mechanism of charm production?
- How charm production is influenced by the onset of deconfinement?
- How J/ψ production is changed by the presence of quark-gluon plasma?

To answer these questions, results on total number of c$\bar{\text{c}}$ quark pairs produced in heavy ion collisions must be provided. Foreseen accuracy of the corresponding NA61/SHINE data will be presented in reference to the physics motivation.

HK 39.5 Mi 17:45 HZO 60

Measurement of Angular Correlations between Heavy-Flavour Electrons and Charged Particles in pp Collisions at $\sqrt{s} = 13$ TeV with ALICE — •Florian Herrmann for the ALICE-Collaboration — WWU Münster, Germany

Heavy flavour quarks (charm and beauty) are of special interest for the study of the Quark-Gluon Plasma as they are predominantly produced in the initial hard-scattering processes and participate in the entire evolution of the system. Moreover, heavy flavour productions is well under control of perturbative QCD. Thus, heavy flavours are an excellent probe to study pQCD in small systems as well as parton in medium energy loss and transport mechanisms in nuclear collisions by measuring, for instance, the spectra, angular correlations or the nuclear modification factor R_{AA}. Experimentally, heavy flavours are often investigated using measurements of electrons from heavy-flavour hadron decays. These electrons can be separated statistically from the background and their angular correlations with other heavy flavour electrons or with charged particles can be studied. In this talk, we will present a current approach to measure two-particle correlations of heavy flavour electrons with charged particles biased to higher p_{T} (> 2 GeV/c) or with the leading particle in pp collisions at $\sqrt{s} = 13$ TeV with the ALICE experiment. Monte Carlo calculations provide promising predictions to disentangle charm and beauty contributions and different heavy-quark production mechanisms in these correlation measurements. – Supported by BMBF and DFG GRK2149.

HK 39.6 Mi 18:00 HZO 60

Transverse momentum dependence of J/ψ production in Pb-Pb collisions at $\sqrt{s_{\mathrm{NN}}}$=5.02 TeV at mid-rapidity with ALICE — •Dennis Weiser for the ALICE-Collaboration — Physikalisches Institut, Im Neuenheimer Feld 226, Heidelberg

ALICE at the Large Hadron Collider (LHC) provides unique capabilities to study charmonium production at low transverse momenta. In the early and hottest phase of nucleus-nucleus collisions the formation of a Quark-Gluon Plasma (QGP) is expected. Several QGP induced effects, such as the melting of charmonium states due to color screening and/or a (re)combination of uncorrelated charm and anti-charm quarks, can play a role. While a suppression of J/ψ with respect to binary-scaled pp collisions was indeed observed in heavy-ion collisions at all energies, recent measurements in Pb-Pb collisions at $\sqrt{s_{\mathrm{NN}}}$=2.76 TeV indicate that (re)combination does seem to play an important role in the low p_{T} region at LHC energies.

At central rapidity, corresponding to the range $|y| < 0.9$, J/ψ are reconstructed down to zero p_{T} via their decay into two electrons. We will present results on the transverse momentum dependence of inclusive J/ψ production in Pb-Pb collisions at $\sqrt{s_{\mathrm{NN}}}$=5.02 TeV. In particular, we will present the centrality dependence of the J/ψ average transverse momentum ($< p_{\mathrm{T}} >$) and the p_{T} broadening ($r_{\mathrm{AA}} = < p_{\mathrm{T}}^2 >^{\mathrm{A-A}} / < p_{\mathrm{T}}^2 >^{\mathrm{pp}}$).

HK 40: Structure and Dynamics of Nuclei VIII

Zeit: Mittwoch 16:30–18:15 Raum: HZO 70

Gruppenbericht HK 40.1 Mi 16:30 HZO 70

Investigation of the dipole response in atomic nuclei in different mass regions in photon scattering experiments — •Julius Wilhelmy[1], Johann Isaak[2], Bastian Löher[3], Miriam Müscher[1], Simon G. Pickstone[1], Norbert Pietralla[4], Deniz Savran[3], Philipp Scholz[1], Mark Spieker[1,5], Werner Tornow[6], Volker Werner[4], and Andreas Zilges[1] — [1]Institute for Nuclear Physics, University of Cologne — [2]RCNP, Osaka — [3]GSI, Darmstadt — [4]Institute for Nuclear Physics, TU Darmstadt — [5]NSCL, Michigan State University — [6]Department of Physics, Duke University

The understanding of different generating mechanisms of electric (E1) and magnetic (M1) dipole excitations in atomic nuclei are of fundamental importance for the description of nuclear matter. Level lifetimes, γ-decay branching ratios and parity quantum numbers of excited $J = 1$ states are extracted from high resolution photon scattering experiments in a model-independent way. Experimental results of complementary measurements with continuous photon flux distributions (at the bremsstrahlung facilities DHIPS [1] and γELBE [2]) and quasi-monoenergetic beams (at HIγS [3]) for nuclei in the A≈50 and A≈140 mass regions will be presented and discussed. First results of the dipole response of ^{87}Rb will be shown.

Supported by the BMBF (05P15PKEN9), JW is supported by the Bonn-Cologne Graduate School of Physics and Astronomy.

[1] K. Sonnabend, D. Savran *et al.*, NIM A 640 (2011) 6-12
[2] R. Schwengner *et al.*, NIM A 555 (2005) 211
[3] B. Löher *et al.*, NIM A 723 (2013) 136

HK 40.2 Mi 17:00 HZO 70

Systematics of the Electric Dipole Response in Stable Tin Isotopes* — •Sergej Bassauer[1], Peter von Neumann-Cosel[1], and Atsushi Tamii[2] for the E422-Collaboration — [1]Institut für Kernphysik, TU Darmstadt, Darmstadt, Germany — [2]RCNP, Osaka, Japan

The electric dipole is an important property of heavy nuclei. Precise knowledge of the electric dipole response provides information on the electric dipole polarisability which in turn allows to extract important constraints on neutron-skin thickness in heavy nuclei and parameters of the symmetry energy. The tin isotope chain is particularly suited for a systematic study of the dependence of the electric dipole response on neutron excess as it provides a wide mass range of accessible isotopes with little change of the underlying structure. Recently an inelastic proton scattering experiment under forward angles including 0° on even-even $^{112-124}$Sn isotopes was performed at the Research Centre for Nuclear Physics (RCNP), Japan with a focus on the low energy strength and polarisability. In this talk first results will be discussed.

*Supported by the DFG through SFB 1245.

HK 40.3 Mi 17:15 HZO 70

Electric Dipole Response of Neutron Rich Tin Isotopes — •Andrea Horvat[1], Thomas Aumann[1,2], Philipp Schrock[3], Konstanze Boretzky[2], Igor Gasparic[4], Dominic Rossi[1], Dmytro Symochko[1], Fabia Schindler[1], and Lorenzo Zanetti[1] for the R3B-Collaboration — [1]TU Darmstadt, Germany — [2]GSI Helmholtzzentrum, Darmstadt, Germany — [3]CNS, The University of Tokyo — [4]Ruder Boskovic Institute, Zagreb, Croatia

The investigation of the nuclear equation of state (EOS), especially its isovector character, is at present one of the most active fields of pursuit in nuclear physics. It is already well established by various theoretical frameworks that observables related to the electric dipole response of heavy nuclei, such as the dipole polarizability, can be used to put constraints on isovector properties of the EOS.

In order to study the systematics of the E1 response on the neutron-rich side of the tin isotope chain ($^{124-132}$Sn) via the invariant mass method, a Coulomb excitation experiment has been carried out at the R3B/LAND setup at GSI (Helmholtzzentrum für Schwerionenforschung). The tin isotopes present an interesting case due to the doubly magic ^{132}Sn and the opportunity to compare the results to com-

plementary methods utilizing normal kinematics for the stable isotope ^{124}Sn. The experimental setup, analysis method and current status of the analysis will be presented.

This work is supported by HIC for FAIR, GSI-TU Darmstadt cooperation, NAVI, CSF project SR-ETNo and the BMBF project 05P15RDFN1.

HK 40.4 Mi 17:30 HZO 70

Looking below the threshold: low energy spectrum for neutron-rich Tin isotopes — •Lorenzo Zanetti[1], Thomas Aumann[1,2], Philipp Schrock[3], Kostanze Boretzky[2], Igor Gasparic[4], Dominic Rossi[1], Dmytro Symochko[1], Andrea Horvat[1], and Fabia Schindler[1] for the R3B-Collaboration — [1]TU Darmstadt — [2]GSI Helmholtzzentrum — [3]CNS, The University of Tokyo — [4]Ruder Boskovic Institute, Zagreb, Croatia

Research on the nuclear equation of state (EOS) is very active: many theoretical frameworks provide a way to put constraint on the EOS's isovector properties, using observables relating to the electric dipole response of neutron-rich nuclei. One of such observables is the dipole polarizability constant, α_D.

The S412 experiment at the GSI was a Coulomb excitation experiment investigating the E1 response of neutron-rich isotopes of Tin with the R3B/LAND setup. The data collected during the campaign, especially for ^{132}Sn, can be used to estimate α_D, provided a full energy spectrum for the gamma deexictation is available. We are currently analysing the lower energy (below the neutron separation threshold) part of the gamma spectrum in order to complete the picture.

This work is supported by HIC for FAIR, GSI-TU Darmstadt cooperation, NAVI, CSF project SR-ETNo and the BMBF project 05P15RDFN1.

HK 40.5 Mi 17:45 HZO 70

Study of the dipole response in ^{142}Ce — •Miriam Müscher[1], Anna Bohn[1], Michelle Färber[1], Johann Isaak[2], Simon G. Pickstone[1], Sarah Prill[1], Deniz Savran[3], Philipp Scholz[1], Mark Spieker[1,4], Vera Vielmetter[1], Michael Weinert[1], Julius Wilhelmy[1], and Andreas Zilges[1] — [1]Institute for Nuclear Physics, University of Cologne — [2]RCNP, Osaka, Japan — [3]GSI, Darmstadt — [4]NSCL, Michigan State University, MI 48824, USA

The $N = 84$ nucleus ^{142}Ce has been investigated in real photon scattering experiments to analyze the dipole response's evolution near the $N = 82$ shell closure. Two (γ,γ) experiments that selectively excite $J = 1$ states were performed. Firstly, ^{142}Ce was measured at the Darmstadt High Intensity Photon Setup (DHIPS) [1] using bremsstrahlung with an endpoint energy of 7.35 MeV. Secondly, an experiment was performed with a linearly polarized, quasi mono-energetic γ beam in the entrance channel at ten different beam energies at the High Intensity Gamma-Ray Source (HIγS) [2] facility of Duke University, Durham, USA. The photons of the subsequent decay provide information on ground state widths and parity quantum numbers of excited states. Within this contribution the experimental setups will be presented and first results will be discussed.

Supported by the DFG (ZI 510/7-1) and the Alliance Program of the Helmholtz Association (HA216/EMMI). JW is supported by the BCGS.

[1] K. Sonnabend *et al.*, Nucl. Instr. and Meth. A 640 (2011) 6-12
[2] B. Löher *et al.*, Nucl. Instr. and Meth. A 723 (2013) 136

HK 40.6 Mi 18:00 HZO 70

Study of the Pygmy Dipole Resonance in ^{64}Ni via particle $-\gamma$ coincidence measurements — •Johann Isaak for the CAGRA-Collaboration — Research Center for Nuclear Physics, Osaka Univ., Japan

The low-energy part of the electric dipole response in the region of the Pygmy Dipole Resonance (PDR) [1] is studied in the rare nickel isotope ^{64}Ni via inelastic proton and α-scattering with subsequent γ spectroscopy of the decay channel. The aim is to determine the full dipole strength distribution to fill the gap between existing data on the stable isotopes ^{58,60}Ni [2,3] and the unstable ^{68}Ni [4] for the systematic investigation of the PDR as a function of the neutron-to-proton ratio. The energy loss of inelastically scattered protons and α particles were measured using the high-resolution magnetic Grand Raiden spectrometer at RCNP [5]. In coincidence, γ rays emitted from the target nuclei were detected by the γ-ray detector array CAGRA, which consisted of 12 Clover detectors and 4 $LaBr_3$ scintillators. The recent status of the data analysis and preliminary results will be presented.

[1] D. Savran, T. Aumann and A. Zilges, PPNP 70 (2013) 210.
[2] M. Scheck et al., PRC 87 (2013) 051304(R).
[3] M. Scheck et al., PRC 88 (2013) 044304.
[4] D. Rossi et al., PRL 111 (2013) 242503.
[5] M. Fujiwara et al., NIM A 422 (1999) 484.

HK 41: Fundamental Symmetries II

Zeit: Mittwoch 16:30–17:45 Raum: HZO 100

Gruppenbericht HK 41.1 Mi 16:30 HZO 100

Recent Progress of the Storage Ring EDM Search with the JEDI Collaboration — •Maria Zurek for the JEDI-Collaboration — Forschungszentrum Jülich, Institut für Kernphysik, Jülich, Germany

Understanding the origin of the matter-antimatter imbalance in the universe is one of the grand challenges of modern physics. One of the necessary conditions to explain it is the violation of CP symmetry. Predictions given by the Standard Model are orders of magnitude too small to explain the observed preponderance of matter. Therefore, new sources of CP violation, coming from outside the realm of the Standard Model, are needed. They can manifest in Electric Dipole Moments (EDM) of elementary particles.

The efforts of the Jülich Electric Dipole Moment Investigations (JEDI) Collaboration concentrate on a direct measurement of the EDM of charged hadrons (protons and deuterons). The goal of the project is to develop the required technologies for a dedicated storage-ring experiment, and to perform a first precursor measurement at the Cooler Synchrotron (COSY) using an RF Wien Filter to demonstrate the feasibility of such a study.

In my talk, I will present the status of the project with emphasis on recent achievements of the collaboration. I will discuss the first results from the commissioning of the RF Wien Filter, as well as for the polarimetry database experiment on deuteron-carbon scattering.

Gruppenbericht HK 41.2 Mi 17:00 HZO 100

Search for a Permanent Electric Dipole Moment of the ^{129}Xe Atom — •Fabian Allmendinger[1], Olivier Grasdijk[3], Werner Heil[2], Klaus Jungmann[3], Hans-Joachim Krause[4], Ulrich Schmidt[1], Lorenz Willmann[3], and Stefan Zimmer[2] — [1]Physikalisches Institut, Universität Heidelberg — [2]Institut für Physik, Universität Mainz — [3]University of Groningen — [4]Peter Grünberg Institut, Forschungszentrum Jülich

A permanent electric dipole moment (EDM) of the ^{129}Xe atom would imply a breakdown of both parity P and time-reversal symmetry T and, through the CPT theorem, a breakdown of CP, the combined symmetries of charge conjugation and parity. Our goal is to improve the present experimental limit ($d_{\mathrm{Xe}} < 3 \cdot 10^{-27}$ ecm). To get more stringent limits, we perform a ^{3}He/^{129}Xe clock comparison experiment with the detection of free spin precession of gaseous, nuclear polarized ^{3}He and ^{129}Xe samples with SQUIDs as magnetic flux detectors. The precession of co-located ^{3}He/^{129}Xe nuclear spins are used as an ultrasensitive probe for non-magnetic spin interactions like the coupling of the EDM to an electric field. With our experimental setup at the research center Jülich we are able to observe spin coherence times T_2^* of several hours for both species. We report on technical improvements with first experimental results showing a factor of 10 higher EDM sensitivity achieved within the MIXed-collaboration.

HK 41.3 Mi 17:30 HZO 100

Development of compact, highly sensitive beam position monitors for storage rings — •Falasatine Abusaif for the JEDI-Collaboration — Forchungszentrum Jülich, IKP-2, Germany — RWTH Aachen University, Physics Institute B, Germany

The Jülich Electric Dipole Moment (JEDI) Collaboration is presently preparing for a first direct measurement of the deuteron Electric Dipole Moment (EDM) in a storage ring using a recently developed novel

waveguide RF Wien filter. A non-vanishing EDM signal would provide a new source for CP violation which could explain one of the biggest mysteries in contemporary cosmology; namely the matter over antimatter asymmetry of the Universe. Spin rotations due to an EDM are many orders of magnitude smaller than rotations due to magnetic dipole moment, and in order to suppress systematic effects, the beam position in the RF Wien filter has to be determined with high precision. To this end, a new type of Beam Position Monitor (BPM) was developed which is based on a Rogowski pickup coil.

In this talk, the development of a laboratory test station for the Rogowski coil BPMs, the calibration measurements, and the beam determination of the geometrical center of the pickup coil using a laser tracker system are introduced. The calibrated coils will be installed at the entrance and exit of the RF-Wien filter in the COSY accelerator in January 2018.

HK 42: Instrumentation XIII

Zeit: Mittwoch 16:30–18:00 Raum: Audimax H1

HK 42.1 Mi 16:30 Audimax H1

Expected Performance of NeuLAND in FAIR Phase 0 — •Jan Mayer[1], Konstanze Boretzky[2], Michael Heil[2], Elena Hoemann[1], Dmytro Kresan[2], and Andreas Zilges[1] for the R3B-Collaboration — [1]Institute for Nuclear Physics, University of Cologne — [2]GSI Gesellschaft für Schwerionenforschung GmbH, Darmstadt

At least 13 out of the planned 30 double planes of the New Large Area Neutron Detector NeuLAND will be available for the R^3B experiment in FAIR Phase 0. Here we present an overview about the progress in simulations, reconstruction, and the expected performance of this startup version.

The original multi-neutron multiplicity recognition depends on the calorimetric properties of the full detector. Simulations have shown that the separation of the individual neutron multiplicities is heavily affected by the reduced detector depth, which subsequently affects the interaction point reconstruction. We have developed a method based on scoring hit patterns to find the primary neutron interaction points, working around this limitation. This method can suppress secondary hits (false positives) with high precision at the expense of efficiency.

Supported by the BMBF (05P15PKFNA). JM is supported by the Bonn-Cologne Graduate School of Physics and Astronomy.

HK 42.2 Mi 16:45 Audimax H1

Instrumentation and optimization studies for a Beam Dump Experiment (BDX) @ MESA — •Mirco Christmann for the MAGIX-Collaboration — Institut für Kernphysik - Johannes Gutenberg Universität, Mainz, Deutschland

At the Institute for Nuclear Physics in Mainz the new electron accelerator MESA will go into operation within the next years. In the extracted beam operation (155 MeV, 150 μA) the P2 experiment will measure the weak mixing angle in electron-proton scattering in 10,000 hours operation time. Therefore the high-power beam dump of this experiment is ideally suited for a parasitic dark sector experiment.

In an ongoing MadGraph cross section generation and Geant4 simulation this beam dump experiment is studied. In theory dark photons A' are generated in the beam dump by a process analog to electromagnetic bremsstrahlung and they decay invisible to pairs of dark matter particles $\chi\,\overline{\chi}$. In a calorimeter behind the beam dump electrons, scattered off by dark matter particles, can be detected.

For an efficient experiment the number of produced dark photons and the probability of detecting dark matter particles has to be optimized. One topic of this talk is the optimization of the existing beam dump with a tungsten target. The quantity of high energy photons can be increased with this additional target. For the detection of the dark matter particles the performance of possible calorimeter materials (CsI(Tl), PbF_2, BGO and lead-glass) was investigated.

HK 42.3 Mi 17:00 Audimax H1

Using CAD models in Geant4 and ROOT — •Elena Hoemann, Jan Mayer, and Andreas Zilges — Institute for Nuclear Physics, University of Cologne

Monte-Carlo simulations of experiments require precise implementation of geometries. Creating these from scratch in Geant4 or ROOT is difficult, time-consuming, and error-prone. Although in nearly all cases exact CAD files exist, integration of the geometry is often done manually. Through the usage of tessellated and tetrahedral elements (solids), it is possible to include CAD figures into Geant4 [1]. To carry on we are expanding the ROOT framework by a dedicated tetrahedron class to enable the usage of CAD files as well.

We have compared the different methods in contrast to manually implemented geometries by including simple figures like spheres and boxes, as well as real setups such as the HORUS and SONIC spectrometer at the University of Cologne.

Supported by the BMBF (05P15PUEN9/ELI-NP)

[1] C.M. Poole, I. Cornelius, J.V. Trapp, C.M. Langton, Australas Phys Eng Sci Med 35 (2012) 329

HK 42.4 Mi 17:15 Audimax H1

Development of KoalaSoft for the KOALA experiment — •Yong Zhou and Huagen Xu for the PANDA-Collaboration — Institute for Nuclear Physics (IKP), Forschungszentrum Jülich, Germany

The KOALA experiment will measure antiproton-proton elastic scattering in a range of four-momentum transfer |t| from 0.0005 to 0.1 $(GeV/c)^2$ at the upcoming HESR ring of FAIR. It aims to provide key input parameters for PANDA's absolute luminosity determination. KoalaSoft is the dedicated simulation software package for the KOALA experiment. It is develped based on FairRoot. Due to the flexibility of FairRoot, KoalaSoft combines the simulation, reconstruction and analysis tasks into one framework. The full geometry of KOALA setup is realized using the ROOT geometry package. Digitization of the Recoil Detector is also finished and the results are compared directly with the test beam data. The latest results are presented in this talk.

HK 42.5 Mi 17:30 Audimax H1

ALICE HLT hardware cluster finding in Run 2 and HLS evaluations for Run 3 — •Heiko Engel for the ALICE-Collaboration — IRI, Universität Frankfurt am Main

The ALICE High Level Trigger (HLT) is a computing cluster for online reconstruction, compression and calibration of detector data. The main input and output interface of the HLT are PCI-Express based FPGA readout boards with serial optical links. The HLT uses these FPGAs for online data preprocessing of detector data already in the input FPGA. A cluster finding algorithm processes data from the Time Projection Chamber (TPC) detector on the fly. This cluster finding algorithm was extended to provide improved noise resiliance and increased data compression capabilities. In combination with software based adjustments these development raised the overall data compression ratio of the HLT from a factor of around 4 to above 7. This contribution describes the improvements of the existing ALICE HLT hardware cluster finder for Run 2 as well as cluster finder developments for the Run 3 ALICE readout evaluating High Level Synthesis (HLS/OpenCL) for data preprocessing in FPGAs.

HK 42.6 Mi 17:45 Audimax H1

Data-flow Conjugate Gradient Solver for Lattice QCD Calculations on FPGA Accelerator — •Thomas Janson and Udo Kebschull — IRI ,Goethe-Universität Frankfurt am Main, Senckenberganlage 31, 60325 Frankfurt am Main, Germany

In this talk, we discuss the Lattice QCD Conjugate Gradient solver as data-flow graph. Such a data-flow graph is described in the high-level language MaxJ from Maxeler, which is an openSPL based programming language, to deploy the algorithm on an FPGA accelerator. We show that such an implementation is power efficient and present first power measurement results. In this framework, all operators like the Dslash operator and the spinor field scalar product are deployed as data-flow kernels. Each kernel is a deep arithmetic pipeline and exposes the maximal possible parallelism, thus we reach a high arithmetic intensity. Such a kernel forms a basic block where each block is deployed as piece of hardware and a manager state machine orchestrates the data streams between. In addition, we discuss also the usage of mixed precision number representation like floating point and fixed-point, and present first numerical analysis and convergence tests.

HK 43: Instrumentation XIV

Zeit: Mittwoch 16:30–17:15 Raum: HZO 90

HK 43.1 Mi 16:30 HZO 90

A new plunger device for MINIBALL at HIE-ISOLDE — •Christoph Fransen[1], Thomas Braunroth[1], Alfred Dewald[1], Liam Gaffney[2], Alina Goldkuhle[1], Jan Jolie[1], Julia Litzinger[1], Claus Müller-Gatermann[1], Peter Reiter[1], Stefan Thiel[1], and Nigel Warr[1] — [1]Institut für Kernphysik, Universität zu Köln — [2]CERN, Geneva, Switzerland

The recoil distance Doppler-shift method (RDDS) is a very valuable technique for measuring lifetimes of excited nuclear states in the picosecond range from which absolute transition strengths between nuclear excitations can be deduced in an independent manner. Especially during the last years this method was intensively used in combination with radioactive beams for investigating exotic nuclei. A new dedicated plunger device was thus built by our group to implement this method at HIE-ISOLDE where a detection of the Doppler-shifted gamma-rays is realized with the MINIBALL spectrometer for reactions with radioactive beams in inverse kinematics. Besides multiple step Coulomb excitation excited states can be also populated with incomplete and complete fusion reactions. The availability of the new plunger device will open excellent prospects for detailed investigations of exotic nuclei at HIE-ISOLDE. Here we will present the concept of the new device including the special requirements for the use with radioactive beams with energies of several MeV/u. We will also show the performance of the plunger in a first experiment on ^{28}Mg. Supported by the BMBF, Grant No. 05P15PKFNA.

HK 43.2 Mi 16:45 HZO 90

Numerical correction methods of neutron damage in position-sensitive HPGe detectors — •Robert Hetzenegger, Benedikt Birkenbach, Bart Bruyneel, Peter Reiter, Jürgen Eberth, Herbert Hess, Rouven Hirsch, Lars Lewandowski, and Andreas Vogt — IKP, Universität zu Köln

The Advanced GAmma Tracking Array (AGATA) is based on the novel technique of γ-ray tracking in electrically segmented high-purity germanium (HPGe) crystals. The array is currently employed at the Grand Accélérateur National d'Ions Lourds (GANIL, France) in stable-beam experiments with high count rates. Fast neutrons are emitted after various types of nuclear reactions with projectile energies above the Coulomb barrier. These neutrons generate defects by dislocating Ge atoms within the HPGe crystal lattice. Dislocations act as hole traps within the HPGe detector material, causing a reduced charge collection efficiency of the detectors, observed as a left tailing in the energy-peak shapes. In order to avoid time consuming annealing procedures a software-based numerical method was developed employing pulse-shape analysis (PSA) to correct for and to minimize the trapping effects. The method will be described in detail as well as results of the correction applied to latest AGATA measurements comprising 35 HPGe crystals. The energy resolution (FWHM) is considerably improved. For detectors with severe neutron damage the final resolution value is better by a factor of two. The tailing of the peaks reflected by large FWTM values is reduced by a factor of three. Supported by the German BMBF 05P12PKFNE TP4 and 05P15PKFN9.

HK 43.3 Mi 17:00 HZO 90

Impact of Hole Mobility on Simulated Pulse Shapes in Highly Segmented HPGe Detectors — •Lars Lewandowski, Peter Reiter, Herbert Hess, Jürgen Eberth, Bart Bruyneel, and Benedikt Birkenbach for the AGATA-Collaboration — Institut für Kernphysik, Köln

The AGATA spectrometer is a γ-ray tracking array consisting of 36 fold segmented high purity germanium detectors. In contrast to conventional γ-ray spectrometers, AGATA relies on the γ-ray tracking method which reconstructs the path of a γ ray through the array. The tracking needs the interaction positions of the individual γ rays within the segments. These are obtained via pulse-shape analysis (PSA) of the 37 preamplifier signals. The measured signals are compared with simulations to obtain the interaction position. The drift velocity of the holes is crucial for these simulations. An essential ingredient for the velocity calculation is the hole mobility in germanium. The hole mobility that yields the best results was obtained empirically by maximizing the accuracy of the found interaction positions. As a complementary approach the difference in the time evolution of the of measured and simulated pulses was investigated, which is a crucial observable to determine correct drift velocities.

HK 44: Hauptvorträge II

Zeit: Donnerstag 11:00–12:30 Raum: Audimax

Hauptvortrag HK 44.1 Do 11:00 Audimax

Probing the quark-gluon plasma in ultrarelativistic heavy-ion collisions — •Alice Ohlson — Physikalisches Institut, Universität Heidelberg

In high-energy collisions of heavy nuclei, such as in collisions of lead ions at the Large Hadron Collider, the resulting state of matter attains such high temperatures and energy densities that quarks and gluons are no longer confined into hadrons. Known as the quark-gluon plasma (QGP), this matter occupies the high-temperature and high-density regime of the phase diagram of quantum chromodynamics (QCD). By probing the properties of the QGP, we are able to study QCD and the strong nuclear force in the extreme high temperature limit.

In this talk, a selection of key measurements will be presented which give insight into the space-time evolution of the QGP and its thermodynamical and hadrochemical properties, with particular emphasis placed on single- and multi-particle measurements of (un)identified light hadrons.

Supported by BMBF and SFB 1225 ISOQUANT.

Hauptvortrag HK 44.2 Do 11:30 Audimax

Transverse momentum dependent (TMD) factorization: status and progress — •Alexey Vladimirov — Regensburg University

The information on "3-dimensional imaging" of hadrons, encoded in unintegrated, transverse momentum dependent (TMD) parton densities and parton decay functions. At present it comes from two main sets of experimental data: low-qT Drell-Yan and semi-inclusive deep inelastic scattering (polarized and unpolarized). In each of these two cases, QCD factorization theorems allow one to relate observable cross sections to TMD parton distributions via perturbatively calculable kernels. We provide an overview of transverse momentum dependent (TMD) parton distribution functions and their application in high-energy physics phenomenology. The particular emphasis is made on the theoretical aspects TMD factorization, and on the recent development in this area.

Hauptvortrag HK 44.3 Do 12:00 Audimax

Measuring the free neutron lifetime with ultracold neutrons at TRIGA Mainz — •Dieter Ries for the tauSPECT-Collaboration — Institute of Nuclear Chemistry, Johannes Gutenberg University, Mainz, Germany

Ultracold Neutrons (UCN), neutrons with kinetic energies below 335 neV, provide a unique tool for fundamental neutron research with long observation times.

The τSPECT experiment, which is currently being commissioned at the pulsed UCN source of the TRIGA Mainz, aims to utilize this fact in order to precisely measure the free neutron lifetime.

In order to reduce systematic errors with respect to previous storage experiments using material bottles, τSPECT will implement 3D magnetic storage of UCN and will be able to measure both the decaying and the surviving UCN.

An introduction to UCN and their properties will be given as well as a description of the τSPECT experiment and the planned neutron lifetime measurements at the TRIGA Mainz.

HK 45: Hadron Structure and Spectroscopy VIII

Zeit: Donnerstag 14:00–16:00 Raum: HZO 50

Gruppenbericht HK 45.1 Do 14:00 HZO 50

Measurement of electromagnetic transition from factors in two-photon collisions at BESIII — Achim Denig, •Brice Garillon, Yuping Guo, and Christoph Florian Redmer for the BESIII-Collaboration — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz

Electromagnetic Transition Form Factors (TFFs) of light mesons provide valuable information on the nature of the strong interaction. At large momentum transfer Q^2, they shed light on mesons' structure. At small momentum transfer, the TFFs are important inputs to the calculation of the hadronic ligh-by-light scattering contribution to the Standard Model prediction of the anomalous magnetic moment of the muon $(g-2)_\mu$. The BESIII experiment at the e^+e^- collider BEPCII has collected more than 10 fb^{-1} at center-of-mass energies between 2.0 and 4.6 GeV. The data sets are analyzed for two-photon collisions in events of the type $e^+e^- \to e^+e^-\mathbf{P}$, with $\mathbf{P} = \pi^\mathbf{0}$, $\eta^{(\prime)}$, $\pi^0\pi^0$ and $\pi^+\pi^-$. The aim is to study the momentum transfer dependence of the respective electromagnetic TFFs in the space-like region relevant for the calculation of $(g-2)_\mu$. In this talk the current status and the prospects of the ongoing analyses will be presented.

HK 45.2 Do 14:30 HZO 50

Soft-photon corrections to the Bethe-Heitler process in the $\gamma\mathbf{p} \to \mathbf{l^+l^-p}$ reaction — •Matthias Heller — Johannes-Gutenberg Universität Mainz

High-precision calculations of electromagnetic processes become more and more important for the interpretation of electron-nucleon scattering experiments. One example is the Bethe-Heitler process, the lepton pair photoproduction on a proton target, which can be used as a test of lepton universality. Violation of this universality could shed light on the proton radius puzzle, the discrepancy between the charge radii measurements from muonic spectroscopy and data with electrons. An upcoming experiment at MAMI (Mainz) aims to compare the cross-sections of muon and electron pair production. A precise knowledge of the electromagnetic radiative corrections is needed for these measurements. As a first step, the leading QED radiative corrections are presented in the soft-photon approximation.

HK 45.3 Do 14:45 HZO 50

Future Measurement of the Proton Radius at COMPASS — •Sebastian Uhl for the COMPASS-Collaboration — Physik Department, Technische Universität München, Garching

The observed difference of the proton charge radius measured on the one hand in electron scattering experiments and in hydrogen spectroscopy and on the other hand in the spectroscopy of muonic hydrogen has triggered many efforts to clarify its origin. An elastic-scattering experiment using a high-energetic muon beam could provide a different view at this issue. Compared to electron scattering, such an experiment will be affected much less by radiative corrections.

We will present ideas, how such a measurement can be performed in the framework of a future COMPASS program.

HK 45.4 Do 15:00 HZO 50

Vertex reconstruction at the BGO-OD experiment* — •Patrick Bauer — Physikalisches Institut, Nussallee 12, D-53115 Bonn

The BGO-OD experiment at the ELSA accelerator facility in Bonn investigates the mechanisms of photoproduction of mesons from nucleons. One focus is the associated strangeness production, i.e. γp $\to$ (KY)$^+$ or γn $\to$ (KY)^0. In order to identify such events, the displacement of decay vertex of involved strange particles, relative to the primary vertex can be used.
Therefore a key feature of the experiment is the capability to reconstruct the decay vertices of particles decaying into multiple charged final state particles. To achieve this the experiment uses the tracks of charged child particles, measured by the newly commissioned cylindrical MWPC, to determine the decay vertices of the mother-particles.
In this Talk the reconstruction procedure for the vertices and preliminary results will be presented.

*Supported by DFG (PN 50165297).

HK 45.5 Do 15:15 HZO 50

$\mathbf{K^+\Lambda(1405)}$ production at extreme forward angles — •Georg Scheluchin for the BGO-OD-Collaboration — Physikalisches Institut, Nussallee 12, D-53115 Bonn

One aim of the BGO-OD experiment is the investigation of hyperon photoproduction. The setup combines a large aperture forward magnetic spectrometer and a central BGO crystal calorimeter.

Since the discovery of the $\Lambda(1405)$, it remains poorly described by conventional constituent quark models, and it is a candidate for having an "exotic" meson-baryon or "penta-quark" structure, similar to states recently reported in the hidden charm sector.

The $\Lambda(1405)$ can be produced in the reaction $\gamma p \to K^+\Lambda(1405)$. One decay mode is into $\Sigma^0\pi^0$, which is prohibited for the mass-overlapping $\Sigma(1385)$. BGO-OD is ideally suited to measure this decay with the K^+ in the forward direction. Using the newest available data at the BGO-OD experiment preliminary results will be presented.

*Supported by DFG (PN 50165297).

HK 45.6 Do 15:30 HZO 50

$K^0_S\Sigma^0$ photoproduction at the BGO-OD experiment — •Katrin Kohl for the BGO-OD-Collaboration — Physikalisches Institut, Nussallee 12, D-53115 Bonn

The BGO-OD experiment at the ELSA accelerator facility uses an energy tagged bremsstrahlung photon beam to investigate the internal structure of the nucleon.

The setup with a BGO calorimeter surrounding the target and an open dipole spectrometer covering the forward region is ideally suited for investigating low momentum transfer processes, in particular the investigation of strangeness photoproduction.

The photoproduction of K^0_S is crucial to understand the role of K^* exchange mechanisms. A cusp-like structure observed in $\gamma p \to K^0_S\Sigma^+$ excitation spectra is accurately described by including dynamically generated resonances from vector meson-baryon interactions. Such interactions are predicted to give a peak like structure in the $K^0_S\Sigma^0$ excitation spectra.

I will present a preliminary study of $\gamma n \to K^0_S\Sigma^0$ from a deuterium target dataset, in preparation for high statistics data anticipated next year.

*Supported by DFG (PN 50165297).

HK 45.7 Do 15:45 HZO 50

$K^+\Lambda$ and $K^+\Sigma^0$ photoproduction at extremely forward angles with the BGO-OD experiment — •Thomas Jude for the BGO-OD-Collaboration — Physikalisches Institut, Universität Bonn, Germany

The BGO-OD experiment at the ELSA accelerator facility uses an energy tagged bremstrahlung photon beam to investigate the internal structure of the nucleon. The setup consists of a highly segmented BGO calorimeter surrounding the target, with a particle tracking magnetic spectrometer at forward angles.

BGO-OD is ideal for investigating low momentum transfer processes due to the acceptance and high momentum resolution at forward angles. In particular, this enables the investigation of strangeness photoproduction where t-channel exchange mechanisms play a dominant role. As part of an extensive strangeness photoproduction experimental programme, the differential cross section measurements for $K^+\Lambda$ and $K^+\Sigma^0$ photoproduction at centre of mass polar angles between 4° to 25° will be presented.

These first data at extremely forward angles are important for partial wave analyses, and models where accurate knowledge of t-channel mechanisms are required. The data also constrain models for hypernuclei electroproduction, where at very low Q^2, the $K^+\Lambda$ cross section is comparable to photoproduction.

Preliminary differential cross sections, and recoiling baryon asymmetries will be shown.

Supported by DFG (PN 50165297).

HK 46: Heavy Ion Collisions and QCD Phases VII

Zeit: Donnerstag 14:00–16:00 Raum: HZO 60

Gruppenbericht HK 46.1 Do 14:00 HZO 60

Status of the CBM Experiment — •Christian Sturm for the CBM-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung GmbH

The Compressed Baryonic Matter experiment (CBM) at FAIR will measure nucleus-nucleus collisions at beam energies up to 14 AGeV during the first stage and up to 45 AGeV in a second stage. The key objective of CBM is to investigate the QCD phase diagram in the region of the highest net-baryon-densities. A rich phase structure is conjectured in this region where chiral symmetry is expected to be restored and a first order phase transition could occur, representing a substantial discovery potential at FAIR energies.

As a fixed-target experiment CBM is consequently designed to cope with unprecedented interaction rates up to 10 MHz which will allow to study extremely rare probes with high precision. To achieve the high rate capability CBM will be equipped with fast and radiation hard detectors readout by a free-streaming data acquisition system transporting data with up to 1 Tb/s to a large scale computer farm providing a first level event selection. With *mCBM@SIS18* ("mini-CBM") we are presently constructing a CBM full-system test-setup at GSI/FAIR comprising final prototypes of all CBM detector subsystems. The primary aim is to study, commission and test the complex interplay of the different detector systems with the free-streaming data acquisition and the fast online event reconstruction and selection under realistic experiment conditions. A status of the CBM experiment as well as an overview on the *mCBM@SIS18* project will be given.

HK 46.2 Do 14:30 HZO 60

Nuclear and Quark Matter with Fluctuations beyond LPA — •Johannes Weyrich and Lorenz von Smekal — JLU, Gießen

We study the QCD phase diagram and its chiral phase transition in the low energy hadronic sector including quark and mesonic degrees of freedom at finite temperature and chemical potential. In a similar way the vicinity of the liquid-gas transition of nuclear matter is explored introducing nucleons as degrees of freedom. In our approach mesonic and fermionic fluctuations beyond mean-field are taken into account by means of the functional renormalization group (FRG). The systematic derivative expansion of the effective average action is taken beyond local potential approximation (LPA) including scale dependent wave function renormalization factors for both quarks/baryons and mesons, and the influence of this improved truncation on the first order critical lines is discussed.

HK 46.3 Do 14:45 HZO 60

Quarks and pions at finite chemical potential — •Pascal Gunkel and Christian S. Fischer — Institut für Theoretische Physik, Justus-Liebig Universität Gießen

We report on recent results on the the phase structure of strongly interacting matter, using the functional Dyson-Schwinger approach of QCD. Building upon previous works [1], we use different truncation schemes and explore their effects on the properties of the quark propagator and the resulting (pseudo-)scalar mesons at finite chemical potential. We discuss results for the masses, wave functions and decay constants below and above the first order transition at $T = 0$ and study the validity of the Silver Blaze property.
[1] C. S. Fischer, J. Luecker, C. A. Welzbacher, Phys. Rev. D 90 (2014) 34022

HK 46.4 Do 15:00 HZO 60

Taylor coefficients of the quark pressure from Dyson-Schwinger equations — •Philipp Isserstedt[1], Michael Buballa[2], and Christian Fischer[1] — [1]Institut für Theoretische Physik, Justus-Liebig-Universität Gießen — [2]Institut für Kernphysik, Theoriezentrum, Technische Universität Darmstadt

We report on an investigation of the Taylor coefficients of the quark pressure using the non-perturbative framework of Dyson-Schwinger equations. The rainbow-ladder truncation is used to get a closed system of equations for the quark propagator and the derivatives of the latter with respect to the chemical potential are calculated self-consistently instead of using a difference quotient. We compare our results for the second and fourth coefficient to a previous Dyson-Schwinger study and results from lattice QCD.

HK 46.5 Do 15:15 HZO 60

Dynamic Critical Behaviour of ϕ^4 Theory — •Dominik Schweitzer[1], Sören Schlichting[2], and Lorenz von Smekal[1] — [1]Justus-Liebig-Universität, Gießen, Germany — [2]University of Washington, Seattle, USA

The theory of QCD is expected to have a critical point at the end of the chiral transition line at finite temperature and baryon chemical potential. To ultimately locate this critical endpoint, one will have to find signatures of critical behaviour in collision experiments. However, since collision experiments are of a very dynamic nature, one has to know about the dynamic critical behaviour of QCD to make accurate predictions. An interesting quantity in that respect is the dynamic critical exponent z.

The one-component ϕ^4 scalar field theory is perfectly suited to test numerical methods on it, since it is very well-known, easy to implement and can be efficiently simulated. Its static critical behaviour is contained in the Ising universality class, whose static critical exponents are known with great precision. Therefore we use it to test a method to calculate the dynamic critical exponent z from first principles.

The spectral function of the theory is calculated in the vicinity of the critical point, using a classical statistical approximation. We show that this approximation is valid in the critical regime, where low frequencies dominate. The shape of the spectral function is analyzed to extract an estimate for z by means of finite size scaling methods. The estimate is used to confirm that the critical dynamics of the theory is described by model C in the classification scheme of Halperin and Hohenberg.

HK 46.6 Do 15:30 HZO 60

Time-based reconstruction of free-streaming data in the CBM experiment. — •Valentina Akishina[1], Iouri Vassiliev[2], Ivan Kisel[1,2,3], and Maksym Zyzak[2] for the CBM-Collaboration — [1]Goethe-Universitat Frankfurt am Main — [2]GSI Helmholtzzentrum fur Schwerionenforschung GmbH — [3]Frankfurt Institute for Advanced Studies

The CBM experiment at FAIR will focus on very rare probe measurements. In order to obtain sufficient statistics, the experiment will operate at high interaction rates of up to 10 MHz. In this case resolving different collisions, which overlap in time, is a nontrivial task. Moreover, most of the trigger signatures are complex and require information from several detector subsystems. This makes traditional trigger architectures inapplicable for the CBM experiment. Thus, CBM needs a novel data read-out and analysis concept based on free streaming front-end electronics. CBM will collect time-stamped data into a read-out buffer and deliver it to a large computer farm called First Level Event Selection (FLES) for online reconstruction.

Event building requires full online event reconstruction taking into account not only space coordinates, but also time measurements, so-called 4D reconstruction. The FLES reconstruction package consists of several modules: track finding, track fitting, event building, short-lived particles finding, and event selection, which allow reconstructing time-slices in parallel (between processor cores). The reconstruction procedure and the obtained results for simulated collisions in CBM are presented.

HK 46.7 Do 15:45 HZO 60

The Kalman filter based track fit in TPC detector — •Artemiy Belousov[1,2], Yuri Fisyak[4], Ivan Kisel[1,2,3], and Maksym Zyzak[3] for the CBM-Collaboration — [1]Goethe University Frankfurt — [2]FIAS, Germany — [3]GSI, Germany — [4]Brookhaven National Laboratory

Modern experiments in high energy physics tend to increase the amount of data to be processed, thus, the speed of the algorithms become crucial. However, the efficiency and precision of the applied procedures can not be compromised. Therefore, the Kalman filter method is usually used as the core for reconstruction of collisions, as it satisfies all the requirements.

Current implementation of the Kalman filter method for reconstruction of charged particle trajectories is added to the TPC CA track finder of the STAR experiment within the FAIR Phase 0 program. The algorithm will be applied in the High Level Trigger of STAR during the Beam Energy Scan II (BES II) program, which requires high operational speed. At the same time, quality of the fitting procedure

should stay high. The developed Kalman filter based track fit is fully SIMDised and highly optimised, that allows to fulfil the speed requirements.

As a part of preparation to the BES II program the track fiting procedure is required to be extended to the outer ToF and MTD detectors, where the magnetic field and the TPC gas parameters are not homogeneous. The Kalman filter based track fit was modified to cope with these complicated conditions, it shows correct distributions of track parameter residuals and pulls, and χ^2.

HK 47: Heavy Ion Collisions and QCD Phases VIII

Zeit: Donnerstag 14:00–16:00 Raum: HZO 80

Gruppenbericht HK 47.1 Do 14:00 HZO 80

Transverse momentum distributions of charged particles in pp and nuclear collisions with ALICE at the LHC — •Edgar Perez Lezama for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

The charged-particle transverse momentum spectrum in pp collisions is an important observable for testing pQCD (perturbative QCD) calculations and serves as a reference for pPb, Pb-Pb and Xe-Xe collisions to study the initial state effects and the properties of deconfined matter created in nucleus-nucleus collisions. The study of inclusive charged particle spectra gives information on parton energy loss in the medium created in AA collisions, leading to a suppression of hadron production at high transverse momentum (p_{T}). This effect can be investigated by calculating the nuclear modification factor (R_{AA}), defined as the ratio between the p_{T} spectrum measured in nucleus-nucleus collisions and a reference spectrum in pp collisions scaled by the number of binary collisions. ALICE measured pp collisions in a large energy range $\sqrt{s}$ = 13TeV, 7TeV, 5.02TeV and 2.76TeV, p-Pb at 5.02TeV, Xe-Xe at 5.44TeV and Pb-Pb at 2.76TeV and 5.02TeV. We discuss the p_{T} spectra in pp and nuclear collisions as well as the nuclear modification factors, which are compared to theoretical models.

Gruppenbericht HK 47.2 Do 14:30 HZO 80

Measurement of short-lived baryons and mesons reconstructed in Au+Au collisions at 1.23A GeV with HADES.* — •Georgy Kornakov for the HADES-Collaboration — TU Darmstadt

The study of hadron properties in hot and dense QCD matter is one of the main topics in nuclear physics. The short-lived states (∼1 fm/c), produced and decayed within the QCD matter created in relativistic heavy-ion collisions, contain fundamental information about their properties and how they are modified by the surrounding medium. HADES measures rare and penetrating probes in the regime of 1-2 GeV kinetic energy per nucleon, where excitation of baryonic resonances is a key mechanism for meson, dilepton and strangeness production. However, reconstruction of the resonant signal is challenging. Despite the large branching ratios into charged pions and protons, the large combinatorial background demands precise techniques to identify the true signal. For such a purpose, an iterative method for background estimation has been developed. The measured $\pi^{+/-}p$ and $\pi^{+}\pi^{-}$ differential spectra from Au+Au collisions are going to be presented in this contribution as well as the developed methods for their reconstruction.
**This work has been supported by the VH-NG-823, Helmholtz Alliance HA216/EMMI and GSI*

HK 47.3 Do 15:00 HZO 80

Can Baryon Stopping be understood within the String Model? — •Justin Mohs[1,2], Sangwook Ryu[1], and Hannah Petersen[1,2] — [1]Frankfurt Institute for Advanced Studies, Frankfurt, Germany — [2]Institute für Theoretische Physik, Goethe Universität, Fankfurt, Germany

Baryon stopping, experimentally established by the changing shape of net-proton rapidity distributions as a function of beam energy, is still lacking a proper theoretical understanding. In this work, baryon stopping in heavy ion collisions is investigated. In a hadronic transport approach the colliding nucleons form a string, which fragments, producing new hadrons. From the comparison with data, it is possible to fix parameters of the string model (for example the formation time of the produced hadrons) and to find out whether baryon stopping can be described within the string model or other mechanisms are needed.

HK 47.4 Do 15:15 HZO 80

Transverse momentum distributions of charged particles and nuclear modification factor in Xe-Xe collisions with ALICE at the LHC — •Michael Habib for the ALICE-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Planckstraße 1, 64291 Darmstadt

The study of charged particle production indicates a suppression of hadrons at high transverse momentum (p_{T}) when compared to pp collisions, as a consequence of parton energy loss in the medium.

In October 2017, a 6 hour pilot run with with colliding Xenon beams opened up the opportunity to study system-size effects when compared to the usual operation with Lead beams.

In this talk we present transverse momentum spectra and nuclear modification factors (R_{AA}) in Xe-Xe collisions at $\sqrt{s_{\mathrm{NN}}}$ = 5.44 TeV for nine centrality classes. Comparison to results in Pb-Pb collisions at $\sqrt{s_{\mathrm{NN}}}$ = 5.02 TeV are given.

HK 47.5 Do 15:30 HZO 80

Bayesian unfolding of charged particle p_{T} spectra with ALICE at the LHC — •Mario Krüger for the ALICE-Collaboration — Institut für Kernphysik, Goethe-Universität Frankfurt

The study of the Quark-Gluon Plasma created in ultrarelativistic heavy-ion collisions at the CERN-LHC is complemented by reference measurements in proton-lead (p–Pb) and proton-proton (pp) collisions, where the effects of multiple-parton interactions and hadronization beyond independent string fragmentation can be investigated.

In this talk, we present a Bayesian unfolding procedure to reconstruct the correlation between transverse momentum (p_{T}) spectra of charged particles and the corresponding charged particle multiplicities N_{ch}. The unfolded spectra are presented in single multiplicity (ΔN_{ch} = 1) bins and are used to derive moments of the p_{T} distributions.

We illustrate the unfolding procedure of the p_{T} spectra with MC simulations for pp collisions and compare the resulting $\langle p_{\mathrm{T}} \rangle$ of different systems and collision energies.

Supported by BMBF and the Helmholtz Association.

HK 47.6 Do 15:45 HZO 80

Multiplicity dependent nuclear modification of transverse momentum distributions in p-Pb collisions at $\sqrt{s_{\mathrm{NN}}}$ = 5.02 TeV — •Patrick Huhn for the ALICE-Collaboration — Universität Frankfurt

The ALICE experiment at the LHC is designed to investigate the properties of the Quark-Gluon Plasma by studying high-energy pp, p-Pb and Pb-Pb collisions. Parton energy loss in the medium can be examined by measuring the production of charged particles and their nuclear modification factor at high transverse momentum.
In this talk, we present the measurement of transverse-momentum distributions of charged particles and their dependence of multiplicity and centrality in p-Pb collisions at $\sqrt{s_{\mathrm{NN}}}$ = 5.02 TeV recorded in the LHC run 2 data taking period in 2016. In particular, we focus on the multiplicity dependent nuclear modification factor Q_{pPb} to investigate a possible presence of parton energy loss in high multiplicity p-Pb collisions.
Supported by BMBF and the Helmholtz Association.

HK 48: Structure and Dynamics of Nuclei IX

Zeit: Donnerstag 14:00–16:00 Raum: HZO 70

HK 48.1 Do 14:00 HZO 70

Lifetime Measurement of Higher-Lying Excited States in ^{16}C — •Michael Mathy[1] and Marina Petri[2,1] — [1]IKP, TU Darmstadt, Germany — [2]DoP, University of York, United Kingdom

Electromagnetic properties of the neutron-rich carbon isotopes provide an exciting opportunity to directly test theoretical models using NN+3N Hamiltonians derived from chiral EFT. Indeed, the EM properties of ^{16}C are particularly sensitive to the inclusion of 3N forces in the calculations [1]. However, the experimental information on ^{16}C are limited to the lifetime of the first excited state and an upper limit of 4 ps for the higher-lying states [2,3]. To investigate lifetimes of the higher-lying states (2_2^+, 3^+, 4^+) a fusion-evaporation reaction has been performed at the Argonne National Laboratory. Evaporated charged particles were identified using the μ-Ball detector and emitted gamma rays were identified using the Gammasphere array. Lifetimes of the excited states can be extracted using the Doppler-shift attenuation method. In the talk the measurement techniques and preliminary gamma spectra of ^{16}C, which can be used to give a first approximation of the magnitude of the lifetime, will be presented. Also ideas for further analysis methods using realtistic Geant4 simulations will be outlined and illustrated for an example case. This work was supported by the DFG under contract No. SFB 1245 and The Royal Society.

[1] C. Forssén, et al., J. Phys. G: Nucl. Part. Phys. 40, 055105 (2013). [2] M. Wiedeking et al., PRL 100 152501 (2008). [3] M. Petri et al., Phys. Rev. C 86 044329 (2012).

HK 48.2 Do 14:15 HZO 70

Präzissionsmessung der B(E2)-Stärke des 2_1^+ Zustandes von ^{12}C — •Antonio D'Alessio, Sergej Bassauer, Michaela Hilcker, Tobias Klaus, Michael Mathy, Peter von Neumann-Cosel, Norbert Pietralla, Philipp C. Ries, Maxim Singer, Gerhart Steinhilber und Volker Werner — IKP TU Darmstadt

Das elektrische Quadrupolmoment des 2_+^1-Zustandes von ^{12}C ist ein Schlüsselfaktor, um ab-initio-Vorhersagen aus theoretischen Betrachtungen für Quadrupolkorrelationen zu begrenzen. Dieser Wert ist momentan nur mit einer Unsicherheit von 50% bekannt [W. Vermeer, et al., Physics Letters B 122, 23 (1983)].
Im November 2017 wurde am Magnetspektrometer LINTOTT an der TU Darmstadt ein Elektronenstreuexperiment am S-DALINAC durchgeführt, um das Erreichen einer Präzision von unter 2% der B(E2)-Stärke vorzubereiten. Es wurde der Formfaktor des angeregten Zustandes bei Impulsüberträgen kleiner 0,3 fm^{-1} gemessen, um eine möglichst präzise Extrapolation zum Photonenpunkt zu gewährleisten. Erste Ergebnisse der Analyse und das Messprogramm werden präsentiert.
Durch eine Kombination aus der so zu gewinnenden B(E2)-Stärke und Ergebnissen aus Coulex Experimenten unter Rückwärtswinkeln kann das Quadrupolmoment genauer extrahiert werden als bisher möglich. *Gefördert durch die DFG unter dem Sonderforschungsbereich 1245 und dem Graduiertenkolleg GRK 2128 AccelencE (Accelerator Science and Technology for Energy-Recovery Linacs).*

HK 48.3 Do 14:30 HZO 70

Electromagnetic transition rates in ^{21}O — •Sebastian Heil[1], Marina Petri[2], and Thomas Aumann[1,3] — [1]TU Darmstadt, Germany — [2]University of York, UK — [3]GSI Helmholtzzentrum

Experimental studies of electromagnetic transition rates in neutron-rich nuclei are very important for testing NN+3N calculations. The case of ^{21}O is particularly interesting because calculations show that the transition strengths from the first $\frac{1}{2}^+$ and second $\frac{3}{2}^+$ excited states to the ground state $\frac{5}{2}^+$ will discriminate between the NN+3N and USDB interactions.

An experiment at NSCL was performed, producing ^{21}O. The usage of the TRIPLEX plunger allows the determination of the lifetime of the state of interest. The S800 spectrometer and GRETINA were used for the fragment identification and gamma-ray detection. This presentation will report on the experiment as well as the current status of the analysis.

This work was supported by the DFG within the framework of the SFB 1245 and by HIC for FAIR within the framework of the LOEWE program launched by the State of Hesse.

HK 48.4 Do 14:45 HZO 70

Using the Doppler-shift attenuation method to extract lifetimes in ^{20}Ne — •David Werner[1], Andrey Blazhev[1], Alfred Dewald[1], Jan Jolie[1], Claus Müller-Gatermann[1], Pavel Petkov[1,2,3], and Karl Oskar Zell[1] — [1]Institute for Nuclear Physics, University of Cologne, Cologne — [2]INRNE, Bulgarian Academy of Sciences, Sofia, Bulgaria — [3]National Institute for Physics and Nuclear Engineering, Bucharest, Romania

In this investigation lifetimes in ^{20}Ne were determined using the Doppler-shift attenuation method. The experiment was performed at the Cologne FN-Tandem accelerator in October 2017 using a ^{16}O(^{9}Be,nα)^{20}Ne reaction with a 0.9 $\frac{mg}{cm^2}$ Be target on a 2.7 $\frac{mg}{cm^2}$ Mg backing at 4 beam energies between 30 and 38 MeV. For the line shape analysis an improved version of DESASTOP [1] was used. A detailed discussion of the used analysis method as well as preliminary results will be presented and compared to the systematics of light nuclei. In the series of Ne isotopes it becomes apparent that for ^{20}Ne and ^{22}Ne the increase in B(E2; $2^+ \rightarrow 0^+$) strength, compared to more neutron rich Ne isotopes, cannot be reproduced by shell model calculations. Because of this discrepancy we were motivated to revisit this topic experimentally.

[1] G.Winter, NIM **214** (1983) 537
[2] J. Le Blois *et al.*, Phys. Rev. C **89** (2014) 011306(R)

HK 48.5 Do 15:00 HZO 70

Bestimmung der Lebensdauern von angeregten Zuständen der Grundzustandsbande von ^{46}Ti — •A. Goldkuhle, A. Dewald, K. Arnswald, M. Beckers, T. Braunroth, C. Fransen, J. Litzinger, C. Müller-Gatermann und D. Werner — Institut für Kernphysik, Köln

Neutronenreiche Titan Isotope sind für die Untersuchung der Schalenevolution in der Ti-Cr-Fe-Region jenseits von $N = 28$ von besonderem Interesse. Aus bereits existierenden Daten über 2_1^+-Zustände in $N = 32$ Isotonen wird das Auftreten eines Phasenübergangs von vorherrschenden kollektiven Strukturen in ^{58}Fe zu einem Neutronen-Unterschalenabschluss in ^{56}Cr, ^{54}Ti erwartet. Angeregte Zustände in $^{46-54}$Ti wurden von Multinukleonentransferreaktionen am GANIL zur Bestimmung von Lebensdauerinformationen mittels der Recoil Distance Doppler Shift Methode (RDDS) bevölkert. Aufgrund von strahlinduzierten Veränderungen des Targets konnten die Abstände von Target- und Degraderfolie nicht exakt bestimmt werden. Ein Ansatz zur Problemlösung ist die Bestimmung der Abstände aus präzisen Lebensdauerinformationen. Daher wurde ein RDDS Experiment mit der Reaktion ^{40}Ca(^{9}Be, $2p1n$)^{46}Ti und dem Kölner Plunger am Tandembeschleuniger Köln durchgeführt. Mit Hilfe von 12 Germanium-Detektoren wurden $\gamma\gamma$-Koinzidenzspektren gemessen, aus denen mittels der Differential Decay Curve Method präzise Niveau-Lebensdauern mit $\Delta\tau_{\mathrm{rel}} \leq 5\,\%$ der Grundzustandsbande von $J = 2^+$ bis 8^+ gewonnen werden konnten. Das Projekt wurde gefördert von der DFG, Fördernummer DE 1516/3-1.

HK 48.6 Do 15:15 HZO 70

Lifetime measurements in the vicinity of doubly-magic ^{56}Ni — •K. Arnswald, P. Reiter, A. Blazhev, T. Braunroth, A. Dewald, M. Droste, C. Fransen, C. Müller-Gatermann, A. Goldkuhle, R. Hirsch, L. Kaya, L. Lewandowski, D. Rosiak, D. Schneiders, M. Seidlitz, A. Vogt, K. Wolf, and K.O. Zell — Institut für Kernphysik, Universität zu Köln

Reduced transition strengths expressed by B(E2) values are sensitive signatures to describe collective excitations of atomic nuclei and the evolution of shell structures. Along the $N = Z$ line in the $0f1p$ shell they provide stringent tests of present shell-model interactions. Recently determined $B(\mathrm{E2}, 2_1^+ \rightarrow 0_{\mathrm{g.s.}}^+)$ values for self-conjugate nuclei in the $0f_{7/2}$ shell showed an enhanced collective behavior [1]. The soft shell closure at $N = Z = 28$ is of particular interest as it has been shown that the doubly-closed shell structure is substantially broken [2]. In order to investigate the interplay between single-particle and collective characters of low-lying states, lifetime measurements employing the Doppler-shift attenuation method (DSAM) were performed at the FN tandem accelerator at the IKP, Cologne. Excited states in $^{44}_{22}$Ti, $^{48}_{24}$Cr, $^{52}_{26}$Fe, and $^{56}_{28}$Ni were populated with fusion-evaporation reactions. The emitted γ rays were detected by an array of 11 HPGe detectors.

First results on lifetimes and corresponding B(E2) values will be presented and discussed.
[1] K. Arnswald *et al.* Phys. Lett. B **772**, 599 (2017)
[2] Otsuka *et al.* Phys. Rev. Lett. **81**, 1588 (1998)

HK 48.7 Do 15:30 HZO 70

Lifetime measurements in neutron-rich Mn isotopes — •Thomas Braunroth[1], Alfred Dewald[1], Christoph Fransen[1], Hironori Iwasaki[2], Jan Jolie[1], and Silvia M. Lenzi[3] — [1]Institut für Kernphysik, Universität zu Köln, Germany — [2]National Superconducting Cyclotron Laboratory, MSU, USA — [3]Dipartimento di Fisica e Astronomia, Universitá di Padova, Italy

The sudden increase in collective behavior along neutron-rich even-even chromium and iron isotopes toward $N = 40$ triggered several studies in recent years. Large-scale shell-model calculations can reproduce this trend, which demonstrates the crucial role of neutron scattering into the $g_{9/2}$ and $d_{5/2}$ orbitals [1] in this region. Less attention has been spent on neighbouring odd-mass manganese isotopes with $Z = 25$, although they are able to provide complementary sensitivity to state-of-the-art (shell model) interactions.
Within this talk, we will present new data on level lifetimes of low-lying excited states in ^{59,61,63}Mn, which were deduced from a recoil distance Doppler-shift measurement with fast radioactive beams. These isotopes were produced in side reactions of an experiment whose central aim was the determination of level-lifetimes in ^{58,60,62}Cr [2]. The present results are discussed within the shell-model framework using the established fp interaction KB3G as well as the modern interaction LNPS-m and indicate a phase transition close to $N = 36$. This work is supported by the BMBF under contract number 05P15PKFNA.

[1] S. M. Lenzi *et al.*, Phys. Rev. C **82**, 054301 (2010).
[2] T. Braunroth *et al.*, Phys. Rev. C **92**, 034306 (2015).

HK 48.8 Do 15:45 HZO 70

Cross-shell excitations from the fp shell: Lifetime measurements in ^{61}Zn — M. Queiser[1], A. Vogt[1], •M. Seidlitz[1], P. Reiter[1], T. Togashi[2], N. Shimizu[2], Y. Utsuno[3], T. Otsuka[2], M. Honma[4], P. Petkov[5], K. Arnswald[1], A. Blazhev[1], T. Braunroth[1], A. Dewald[1], J. Eberth[1], C. Fransen[1], R. Hetzenegger[1], R. Hirsch[1], J. Jolie[1], V. Karayonchev[1], L. Kaya[1], L. Lewandowski[1], C. Müller-Gatermann[1], J.M. Régis[1], D. Rosiak[1], K. Wolf[1], and K.O. Zell[1] — [1]Institut für Kernphysik, Universität zu Köln — [2]University of Tokyo, Japan — [3]JAEA Tokai, Japan — [4]University of Aizu, Fukushima, Japan — [5]IFIN-HH, Bucharest, Romania

Lifetimes of excited states in the neutron-deficient nucleus ^{61}Zn were measured employing the Recoil-Distance Doppler-Shift (RDDS) and the Fast-Timing Method in fusion-evaporation reactions at the University of Cologne. Five lifetimes were measured for the first time, including the $5/2^- \rightarrow 3/2^-$ transition depopulating the 124-keV isomer. Short lifetimes from the RDDS analysis were corrected for Doppler-Shift Attentuation (DSA) effects in the stopper foil. Ambiguous results from previous measurements were resolved. The obtained lifetimes are compared to predictions from different sets of shell-model calculations in the fp, $f_{5/2}pg_{9/2}$, and multishell fp-$g_{9/2}d_{5/2}$ model spaces. The inclusion of cross-shell excitation into the $1d_{5/2}$ orbital is found to be decisive for the description of collectivity in the first excited positive-parity band.

A.V. and L.K. are supported by the BCGS.

HK 49: Astroparticle Physics II and Applications

Zeit: Donnerstag 14:00–15:30 Raum: HZO 100

Gruppenbericht HK 49.1 Do 14:00 HZO 100

Latest results from the GERDA experiment and status of the LEGEND experiment — •Bernhard Schwingenheuer — Max-Planck-Institut Kernphysik, Heidelberg

Since the discovery of neutrinos more than 60 years have passed. Despite intensive research many if their properties are still unknown. Especially relevant for particle physics and cosmology is the question whether neutrinos are their own anti-particles. In this case, neutrinoless double beta decay should exist: (A,Z) –> (A,Z+2) + 2e-. Because of its relevance there are many experimental programs ongoing searching for this decay. One isotope of interest is Ge-76. The GERDA collaboration is operating germanium detectors made out of material with enriched Ge-76 isotope fraction, i.e. source and detector are identical. The experimental signature is a line at the Q value of the decay. Germanium detectors offer currently the best energy resolution and GERDA reaches the lowest background if normalized by the energy resolution at the Q value. This motivates the extension of the program which is pursued by the LEGEND collaboration. This talk reviews the latest results from GERDA and the status of the planned LEGEND experiment.

Gruppenbericht HK 49.2 Do 14:30 HZO 100

Status of the COBRA Experiment — •Robert Temminghoff for the COBRA-Collaboration — TU Dortmund, Lehrstuhl für Experimentelle Physik IV, Otto-Hahn-Straße 4, 44227 Dortmund

The COBRA collaboration searches for neutrinoless double beta-decay ($0\nu\beta\beta$) which, if it exists, could give insights in physics beyond the Standard Model. COBRA uses commercially available room-temperature CdZnTe semiconductor detectors which are operated at the LNGS underground laboratory in Italy.

In the current demonstrator phase of the experiment, 64 detectors with a total mass of about 400 g are installed. This array has been used to set limits on the $0\nu\beta\beta$-decay of several isotopes. In a dedicated low-threshold run, the fourfold-forbidden non-unique single-beta decay of ^{113}Cd is currently under investigation. The spectral shape of this decay is closely connected to the effective value of axial vector coupling strength g_A.

In 2018, the COBRA demonstrator will be upgraded with nine additional detectors of larger size, nearly doubling the total detector mass. In this so called Extended Demonstrator (XDEM) phase, several techniques will be implemented that could result in a lower background and enhance the physics performance compared to the demonstrator setup.

In this talk, the results from the COBRA demonstrator will be summarized and an overview of the status of the XDEM will be presented.

HK 49.3 Do 15:00 HZO 100

The electron capture in ^{163}Ho experiment - ECHo — •Loredana Gastaldo for the ECHo-Collaboration — Kirchhoff-Institut für Physik, Universität Heidelberg

Direct determination of the electron neutrino m(ν_e) and anti-neutrino mass m($\bar{\nu}_e$) can be obtained by the analysis of electron capture and beta spectra respectively. In the last years, experiments analysing the ^{3}H beta spectrum reached a limit on m($\bar{\nu}_e$) of 2 eV. The upper limit on m(ν_e) is still two orders of magnitudes higher, at 225 eV. The Electron Capture in ^{163}Ho experiment, ECHo, is designed to investigate m(ν_e) in the sub-eV region and reach the same sensitivity as foreseen for m($\bar{\nu}_e$) in new ^{3}H-based experiments. In ECHo, high sensitivity on a finite m(ν_e) will be reached by the analysis of the endpoint region in high statistics and high resolution calorimetrically measured ^{163}Ho spectra. To perform this experiment, high purity ^{163}Ho source will be enclosed in a large number of low temperature metallic magnetic micro-calorimeters which are readout using the microwave multiplexing technique. This approach allows for a very good energy resolution, below $\Delta E_{\mathrm{FWHM}} < 5$ eV and for a fast time resolution well below 1 μs. Thanks to the modular approach, the ECHo experiment is designed to be stepwise up-graded. The first on-going phase, ECHo-1k, is characterized by a ^{163}Ho activity of about 1 kBq enclosed in about 100 pixels. The statistics of 10^{10} events in the ^{163}Ho spectrum will allow to improve the limit on m(ν_e) by more than one order of magnitude. In this talk, the present status of the ECHo-1k experiment will be discussed as well as the plans for the next phase, ECHo-100k.

HK 49.4 Do 15:15 HZO 100

Non-destructive studies using a new Neutron Depth Profiling instrument at the Heinz Maier-Leibnitz Zentrum in Garching near Munich — •Markus Trunk[1], Roman Gernhäuser[2], Bastian Märkisch[1], Zsolt Revay[3], Lukas Werner[1], Hubert Gasteiger[4], Morten Wetjen[4], and Ralph Gilles[3] — [1]TU München, LS Elementarteilchen bei niedrigen Energien — [2]TU München, Zentrales Technologielabor — [3]TU München, Heinz Maier-

Leibnitz Zentrum — [4]TU München, LS Technische Elektrochemie

Neutron Depth Profiling is a non-destructive, isotope specific, high-resolution nuclear analytical technique, which is sensitive to several light isotopes like He-3, B-10, Li-6, N-14, O-17. Upon neutron capture the investigated nuclei undergo nuclear reactions and emit charged particles. The energy loss through matter is correlated to depth information and a depth profile of elemental concentrations are obtained. We present the first material measurements at the recently established N4DP setup at the NL4b beamline, where cold neutrons are used to irradiate the samples with a flux of up to 3E10 s-1cm-2. We introduce the method, show applications in different material science branches and present results from an ex situ study of new electrode coating materials for lithium-ion batteries. Special interest here is the formation of passive solid-electrolyte-interfaces (SEI), where NDP offers the opportunity to monitor the depth dependent SEI evolution. This project is supported by BMBF No. 05K16WO1.

HK 50: Instrumentation XV

Zeit: Donnerstag 14:00–15:45 Raum: Audimax H1

Gruppenbericht HK 50.1 Do 14:00 Audimax H1

Upgrade of the ALICE TPC — •Robert Münzer for the ALICE-Collaboration — Institut für Kernphysik - Goethe Universität, Frankfurt, Germany — CERN, Geneva, Germany

During the long shutdown 2 (LS2) of the LHC in 2019-2020, the ALICE TPC will be upgraded to be able to take data at the increased luminosity expected for Run 3. During LS2, the present multi-wire proportional chambers (MWPC) will be replaced by chambers based on Gas Electron Multiplier (GEM) technology, keeping the spatial and energy resolution of the present TPC. This allows to overcome the intrinsic rate limitation imposed by the necessity of a gating grid for MWPC-based readout and reading out continuously at Pb-Pb interaction rates up to 50 kHz at limited space-charge distortions.
The use of GEM technology together with the continuous readout mode requirement asked for a complete re-design of the readout electronics. Furthermore, an advanced high-voltage power supply concept is required, based on so-called cascaded power supply modules.
After an extensive R&D program, carried out during the last years, the mass production of the 80 quadruple-GEM readout chambers has been started in 2017. To ensure an adequate performance of the new chambers, an advanced quality assurance and testing procedures across various construction institutes was established.
In this presentation, the recent status of the ongoing activities will be presented.
This work is supported by BMBF and HGF

HK 50.2 Do 14:30 Audimax H1

Application of micron-size plasma for precision measurement of gas parameters in resistive plate chambers and drift detectors with an unique laser-driven test facility — •Xingming Fan[1], Lothar Naumann[1], Mathias Siebold[1], Daniel Stach[1], Christian Wendisch[2], and Michael Wiebusch[3] — [1]Institut für Strahlenphysik, Helmholtz-Zentrum Dresden-Rossendorf, Dresden, Germany — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany — [3]Institut für Kernphysik, Goethe-Universität, Frankfurt, , Germany

A high precision Laser-driven detector test facility has been developed at Helmholtz-Zentrum Dresden-Rossendorf. Primary ionizaion with well-defined position, start time and electron number is created in special designed gas detector samples.

Experiments on samples of Resistive Plate Chamber (RPC) with varies gap widths is operated. Precise value of Townsend coefficient and electron drift velocity is obtained on different filed strengths. Comparison between our results and other works has shown disagreement in 100 kV/cm field, but comparible parameters in 50 kV/cm field.

Mini Drift Chamber (MDC) sample is designed representing the MDC detector with complex and inhomogeneous field design in HADES experiment. A very precise 2D and 3D drift velocity distribution is obtained for Ar/CO_2 filled MDC. An individual drift tube sample allows the comparison of gas parameters, the estimation of the multiphoton ionization coefficient and the Debye length of ionization at laser focus.

HK 50.3 Do 14:45 Audimax H1

Ar-CF_4 mixtures as counting gas for fission fragments — •Marius Peck[1], Joachim Enders[1], Alf Göök[2], Franz-Josef Hambsch[2], and Stephan Oberstedt[2] — [1]Institut für Kernphysik, TU Darmstadt, Germany — [2]European Commission, JRC-IRMM, Geel, Belgium

The use of ionization chambers (IC) for the study of charged particles relies on the accurate determination of the energy deposition in the gas. One of the major issues related to accurate energy determination is the so-called pulse height defect (PHD). The term is used to summarize effects that cause a non-linear response of the pulse height to highly ionizing particles, such as fission fragments. To our knowledge, the only gas for which the PHD has been directly measured with ions of known energies is P-10 ($90\%Ar + 10\%CH_4$) [1]. However, evidence exists [2] that these results can be directly applied to pure CF_4. While pure CF_4 has disadvantages due to the very high stopping power, mixing Ar and CF_4 would be more applicable for typical set-ups employed for detecting fission fragments. However for $Ar + CF_4$ mixtures not much is known in terms of electron mobility and PHD. Hence, counting gas properties in different mixtures of $Ar + CF_4$ have been studied using a twin Frisch-grid IC. The PHD in the different gas mixtures has been determined relative to the reference gas P-10 using the well-known ^{252}Cf(sf) decay.

[1] Budtz-Jørgensen, Nucl. Instr. Meth. Phys. Res, Vol. 258, 1987.
[2] Tovesson, J NUCL SCI TECHNOL, Supplement 2, 2002.
Supported by CHANDA and by BMBF (05P15RDENA).

HK 50.4 Do 15:00 Audimax H1

Optimization of the HV scheme for GEM-based detectors — •Lukas Lautner for the ALICE-Collaboration — TU München, Physik Department E62, Excellence Cluster 'Universe', Garching

Gas Electron Multiplier (GEM) - based detectors are widely used in many experiments (COMPASS, LHCb, TOTEM) and future upgrades (ALICE, CMS, sPHENIX). Electrical discharges that may occur during operation of those detectors are possibly harmful to hardware and electronics and can damage it permanently in form of increased leakage currents or electric short circuits that render the detector effectively blind. Initital discharges, caused by high charge densities obtained in a single GEM hole may trigger a secondary discharge between two GEMs in a stack or between the last GEM and the readout anode. The latter is especially dangerous - as the front-end electronics can be severely affected by high energy released in a discharge event. The behaviour of the electric field in the gap between GEM foils or a GEM foil and the readout anode after an initial spark cannot explain the appearance of the secondary discharges which nature is still not fully understood. However the thorough optimization of the HV scheme, in terms of its RC characteristics, allows to minimize the propagation probability. A set of recommendations has been compiled which will be employed in the optimization procedure for the HV scheme of the upcoming ALICE TPC Upgrade.

This research was supported by BMBF, HGF and the DFG cluster of excellence 'Origin and Structure of the Universe'.

HK 50.5 Do 15:15 Audimax H1

Long-term efficiency analysis of GEM detectors at the COMPASS experiment — •Elizaveta Fotina, Mathias Wagner, Rocio Reyes Ramos, Mikhail Mikhasenko, and Bernhard Ketzer for the COMPASS-Collaboration — Universität Bonn, Helmholtz-Institut für Strahlen- und Kernphysik, Bonn, Germany

Detectors based on the Gas Electron Multiplier (GEM) are the backbone of the inner tracking system of the COMPASS experiment at CERN. They provide high position resolutions of the order of 70 μm even at very high particle rates close to the beam. The detectors have been built in 2001-2002 and have been used continuously since then. The data taken with COMPASS until now provide a unique basis to investigate the long-term performance of these detectors in high-intensity muon and hadron beams. As a first step, we investigate the 2D efficiencies of all 22 detector planes, extracted from physics runs and compare

the results for different years, using data from the 2008 hadron run and from the 2015 Drell-Yan run, and discuss the observed effects. Supported by BMBF.

HK 50.6 Do 15:30 Audimax H1

Understanding leakage current of GEMs - quality assurance of GEM foils for the ALICE TPC upgrade — •Pascal Becht for the ALICE-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

The scheduled upgrade of the LHC at CERN, which will result in a higher luminosity and thus a higher heavy-ion interaction rate, made an upgrade of the ALICE experiment's Time Projection Chamber (TPC) mandatory. During the long shutdown 2 (2019 - 2020) the current Multiwire Proportional Chamber (MWPC) readout will be replaced by Gas Electron Multiplier (GEM) based readout chambers, which are able to provide a continuous readout at rates up to 50 kHz in Pb-Pb collisions.

For that reason the chamber production has already started and makes progress. There an indispensable issue is the extensive quality assurance (QA) done on the GEM foils before they finally get assembled in the chambers. One parameter to quantify the foil's quality is the *leakage current* through the foil.

This talk will present the procedure of leakage current tests, done at GSI. Furthermore, the investigation of determining factors of the leakage current through a GEM foil, such as area, pitch size and the hole size, will be discussed.

HK 51: Instrumentation XVI

Zeit: Donnerstag 14:00–15:15 Raum: HZO 90

Gruppenbericht HK 51.1 Do 14:00 HZO 90

The neutron lifetime experiment PENeLOPE — •Dominic Gaisbauer — TU München Physik E18, 85748 Garching, Deutschland

The neutron lifetime 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 Sigma 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 51.2 Do 14:30 HZO 90

Compensation of a magnetic octupole field for the lifetime experiment τSPECT — •Kim Ulrike Ross[1], Peter Blümler[2], Werner Heil[2], Jan Kahlenberg[2], Jan Karch[2], and Dieter Ries[1] — [1]Institute of Nuclear Chemistry, Johannes-Gutenberg-University Mainz — [2]Institute of Physics, Johannes-Gutenberg-University Mainz

The neutron lifetime experiment τSPECT at TRIGA Mainz uses full magnetic storage of ultracold neutrons (UCN) to avoid neutron losses on material walls due to upscattering or absorption. Therein the neutrons are radially stored by a Halbach octupole and in longitudinal direction between two high field bumps produced by superconducting coils. The latter also serve to polarise the neutrons as they enter the τSPECT cryostate. Only *high field seekers* (HFS) are accelerated into the cryostate, the *low field seekers* (LFS) are being reflected at the magnetic potential wall of the first bump. For the storage of the neutrons in the low field region of the magnetic trap, the HFS need to be transformed into LFS. This is done by an RF coil (birdcage resonator), which irradiates a transverse magnetic field. In their rest-frame, the neutrons experience a rotating field, which adiabatically rotates their spin by 180°. However this resonator does not work efficiently enough in the high radial gradient field of the magnetic octupole. Therefore a second octupole is built which fits into the first one and ideally compensates the radial magnetic field in the spin-flipping region.
In this talk field compensation simulations are shown, the realisation of the inner octupole together with field measurements on the quality of the field compensation.

HK 51.3 Do 14:45 HZO 90

High Resolution Neutron Detection by the yTPC method — •Markus Köhli[1,2], Markus Gruber[1], Fabian Schmidt[1], Jochen Kaminski[1], and Klaus Desch[1] — [1]Physikalisches Institut, Universität Bonn, Bonn, Germany — [2]Physikalisches Institut, Universität Heidelberg, Heidelberg, Germany

The world of detectors used in thermal neutron scattering instrumentation has changed. By alerts on the future Helium-3 supply, critical to perspectives of the large-scale research infrastructures, the run on substitutional technologies started. Most of the solutions could be adapted from developments of particle physics and are comprised of one or more layers of Boron-10. The Time Projection Method achieves a very high resolution by projecting ionization tracks onto a readout with dense spatial and time information. The University of Bonn is developing a novel system employing the TimePix technology - CMOS based chips with 55 μm sized pixels operated at clock speeds up to 80 MHz. In a first prototype with 8 TimePix chips, which are arranged in parallel to a boron layer, the track topology with this unrivaled high resolution has been studied. By reconstructing the origin of the conversion ions a time resolution below 50 ns and a spatial resolution of 100 μm has been achieved.

HK 51.4 Do 15:00 HZO 90

Ultracold neutron sources and applications at the research reactor TRIGA Mainz — •Christian Gorges[1], Christopher Geppert[1], Werner Heil[2], Jan Kahlenberg[2], Jan Karch[2], Sergei Karpuk[1], Tobias Reich[1], Dieter Ries[1], Kim Ulrike Ross[1], Yury Sobolev[1], and Norbert Trautmann[1] — [1]Institut für Kernchemie, Johannes Gutenberg-Universität Mainz — [2]Institut für Physik, Johannes Gutenberg-Universität Mainz

The inherent safe research reactor TRIGA Mainz is able to produce short neutron pulses with an energy of 10 MWs for a short time of 30 ms. This makes it a perfect tool for the investigation of the free neutron's lifetime and for fundamental neutron research in general.

A source for Ultracold Neutrons (UCN) (neutrons with kinetic energies below 335 neV) has been built and is in operation at the research reactor TRIGA Mainz. A UCN density of up to 8.5 UCN per cm^3 per neutron pulse was established [1]. At the TRIGA Mainz, a second UCN source can be used in the continuous reactor operation mode with 100 kW thermal reactor power, e.g., to test and improve the properties of experimental components like detectors etc.

The research reactor itself is also a powerful tool to simulate accelerated aging and to test radiation hardness of electronic components in radiative areas. After a short introduction of the facility and a few applications, the talk will concentrate on the UCN production mechanism and the infrastructure of the UCN source.

[1] J. Kahlenberg et al., Eur. Phys. J. A (2017) 53: 226

HK 52: Poster

Zeit: Donnerstag 16:30–18:45 Raum: Audimax Foyer

HK 52.1 Do 16:30 Audimax Foyer

Radiative corrections on $\bar{p}p \to e^+e^-$ with the PANDA experiment at FAIR — Samer Ahmed[1,2], Yuri M. Bystritskiy[5], Luigi Capozza[1], Alaa Dbeyssi[1], Phillip Grasemann[1,2], Frank Maas[1,2,3], Oliver Noll[1,2], David Rodríguez Piñeiro[1], Egle Tomasi-Gustafsson[4], Sahra Wolff[1,2], •Manuel Zambrana[1,2], Iris Zimmermann[1,2], and Vladimir A. Zykunov[5] — [1]Helmholtz-Institut Mainz, Germany — [2]Institute of Nuclear Physics, Mainz, Germany — [3]PRISMA Cluster of Excellence, Mainz, Germany — [4]CEA, IRFU, SPhN, Saclay, France — [5]Joint Institute for Nuclear Research, Dubna, Russia

Simulations studies have shown that the PANDA detector at FAIR will be capable of measuring the timelike electromagnetic form factors of the proton via the reaction $\bar{p} \to e^+e^-$ with a precision of a few percent at low q^2, thus demanding to take into account radiative corrections. First order radiative corrections to $\bar{p}p \to e^+e^-$ have been calculated in the point-like approximation, including both virtual and real corrections, and interference effects. Soft and hard photon emission regimes are covered in the calculation. Suitable event generators to be used in the framework of the PANDA experiment have been developed on the basis of the calculated cross section.

HK 52.2 Do 16:30 Audimax Foyer

Study of the transverse beam spin asymmetries at forward angles in $\vec{e}$-p scattering at A4 — D. Balaguer Ríos[1], S. Baunack[1,3], L. Capozza[1], J. Diefenbach[1,2], B. Gläser[1,2], •B. Gou[2], Y. Imai[1,2], E.-M. Kabuss[1], J.H. Lee[1], F. Maas[1,2,3], M. C. Mora Espí[1,2], E. Schilling[1], D. von Harrach[1], and C. Weinrich[1] — [1]Institut für Kernphysik, Johannes Gutenberg-Universität Mainz — [2]Helmholtz-Institut Mainz — [3]PRISMA Cluster of Excellence, Johannes Gutenberg-Universität Mainz

The one-photon exchange approximation in the electron-nucleon scattering had been regarded as sufficient in probing the nucleon structure, until the discrepancy between the Rosenbluth separation and the polarization transfer methods in measuring the proton form factor ratio arose. The two-photon exchange process has been proposed to account for this discrepancy. It is imperative to study the two-photon exchange amplitudes quantitatively, in order to understand how the two-photon exchange process may affect various observables. The imaginary parts of the two-photon exchange amplitudes are accessible via the single normal spin asymmetries in the polarized electron-nucleon scattering. The A4 collaboration has embarked on a systematic study of the transverse beam spin asymmetries in the intermediate energy regime using polarized electron beams scattering on hydrogen/deuterium targets. Measurements have been performed at both forward and backward angles at energies between 210 MeV and 1.5 GeV. In this poster we present the investigation of the forward measurements.

HK 52.3 Do 16:30 Audimax Foyer

Lambda-Proton Correlation in Pion-Induced Reactions at 1.7 GeV/c — •Steffen Maurus for the HADES-Collaboration — Technisches Universität München, München

Worldwide data on Λp scattering in pion-induced reactions are quite scarce.
The HADES Collaboration performed in 2014 an experimental campaign with pion-nucleon reactions $\pi^- + A$ $(A = C, W)$ at 1.7 GeV/c. With the aid of the exclusive channel $\pi^- + p \to K^0 + \Lambda$ $(\Lambda + p \to \Lambda + p)$ we may provide information on the Λp scattering and further shed light on the short range interaction with simulations as a reference.
Presented in this poster are the analysis strategy, the event and observable selection along with the preliminary comparison to transport simulations.
∗ supported by the DFG cluster of excellence "Origin and Structure of the Universe"

HK 52.4 Do 16:30 Audimax Foyer

Measurements of Neutron Cross Section and Form Factors using 2015 Scan Data at BESIII — •Samer Ahmed[1], Alaa Dbeyssi[1], Paul Larin[1], Dexu Lin[1], Frank Maas[1,2,3], Cristina Morales[1], Cristoph Rosner[1], and Yadi Wang[1] for the BESIII-Collaboration — [1]Helmholtz-Institut Mainz, Mainz, Germany — [2]Institute of Nuclear Physics, Mainz, Germany — [3]PRISMA Cluster of Excellence, Mainz, Germany

The neutron structure and dynamics can be understood via the study of its electro- magnetic form factors. In the time-like region few experments had been performed so far, none of them had the possibility to determinate the ratio of the electric and magnetic form factors. Therefore, a large data sample in a wide range of center of mass energies [2.0 - 3.08 GeV] has been collected in Beijing Spectrometer III (BESIII) at the Beijing Electron Positron Collider II (BEPCII). With the collected data, it is expected to determine the electric and the magnetic FFs of neutron separately, determine Born cross section with higher precision and therefore enhance the knowledge of neutron structure. In this contribution, we will present our strategy of selecting $e^+e^- \to n\bar{n}$ signal and the expected precision in the determination of Born cross section and electro-magnetic form factors.

HK 52.5 Do 16:30 Audimax Foyer

Σ^0 Baryon Production in pp Collisions at $\sqrt{s} = 13$ TeV measured with the ALICE experiment — •Andreas Mathis for the ALICE-Collaboration — TU München, Physik Department E62, Excellence Cluster 'Universe', Garching

Even though it has been recently demonstrated that gravitational wave observations of binary neutron star mergers are a powerful tool to determine the neutron star equation of state (EOS), the latter still remains a puzzle. In particular, for the description of such a system in the presence of Hyperons a thorough understanding of the Hyperon-Nucleon interaction is mandatory. Recently much progress has been made for the case of the Λ-N interaction, by employing femtoscopy as a complementary method compared to scattering data. For other Hyperons, however, the knowledge of the interaction is rather poor. In particular, since Σ hypernuclei have not been observed so far and since also scattering data for Σ hyperon beams are scarce, the Σ -Nucleon interaction remains to be probed.

As a first step, we measure the production of the Σ^0 baryon at an unprecedented energy of $\sqrt{s} = 13$ TeV in pp collisions. The Σ^0 baryon is reconstructed via the decay $\Sigma^0 \to \Lambda\gamma$ with subsequent decays $\Lambda \to p\pi$ in coincidence with a dielectron pair stemming from photon conversions employing the unique capability of the ALICE detector to measure low energy photons. The yield of the Σ^0 is compared to that of Λ baryons, which have the same quark content but different isospin.

This research was supported by the DFG cluster of excellence 'Origin and Structure of the Universe' and the SFB 1258.

HK 52.6 Do 16:30 Audimax Foyer

The P2-Experiment - A high precision determination of the proton's weak charge — •Dominik Becker[1], Kathrin Imai[1], David Rodriguez Pineiro[2], Sebastian Baunack[1], Krishna S. Kumar[4], and Frank E. Maas[1,2,3] — [1]Institut für Kernphysik, Mainz, Ger — [2]Helmholtz-Institut, Mainz, Ger — [3]GSI, Darmstadt, Ger — [4]Stony Brook, NY, USA

The goal of the P2 collaboration is to perform a high precision determination of the electroweak mixing angle $\hat{s}_Z^2$ at low momentum transfer to a relative precision of 0,15 %. This can be achieved by measuring the proton's weak charge to a relative precision of 1,9 %. The parity violating asymmetry in elastic electron-proton-scattering grands experimental access to the weak charge of the proton.

The P2-Experiment will be carried out at the new electron accelerator facility MESA to be constructed in Mainz. The poster we present features the experimental concept, calculations regarding the achievable precision in the determination of the proton weak charge as well as results of Geant4-simulations carried out to validate the experimental setup.

HK 52.7 Do 16:30 Audimax Foyer

Can Experimental Data From HADES Be Described With Thermal Models? — •Julia Stumm and Roman Hensch for the HADES-Collaboration — Goethe-Universität, Frankfurt am Main

The study of particle production in heavy ion collisions is of great interest for our understanding of medium properties in dense baryonic matter. Using the HADES detector at the "Helmholtzzentrum für Schwerionenforschung" in Darmstadt, Au+Au Collisions at 1.23A GeV have been studied and particle multiplicities for different centrality classes have been measured. Special attention has been paid

to strange hadron production, which occurs at sub threshold energies. An important finding was that about 30% of the K^- Mesons do not actually originate directly from the fireball, but instead stem from ϕ-Decays. Therefore, to interpret the spectra one has to disentangle the various particle sources. We used the statistical model THERMUS to estimate the fireball parameters, in particular temperature, volume and the baryochemical potential, and to compare hadron multiplicities. We further explore how well transverse hadron spectra can be described by a superposition of various thermal sources, in addition to a radial expansion of the fireball.
This work has been supported by BMBF (05P15RFFCA), GSI and HIC for FAIR.

HK 52.8 Do 16:30 Audimax Foyer

Measurement of η and ω mesons via their three pion decay with ALICE in pp collisions at $\sqrt{s} = 7$ TeV — •Florian Jonas for the ALICE-Collaboration — Institut für Kernphysik, Westfälische-Wilhelms Universität, Münster, Deutschland

ALICE is designed as a heavy ion experiment and its research mainly focuses on the properties of the quark gluon plasma (QGP) – a phase in which quarks and gluons exist as unconfined particles. Due to the high energy densities reached in PbPb collisions, the creation of the QGP is expected and supported by measurements up to this point.

One way to probe the medium are photons radiated by the hot QGP. Due to their lack of strong interaction, they can transverse unaffected through the later stages of the plasma and then be detected by ALICE detectors. But the direct photons are only a small contribution to the total amount of photons that are detected in each collision. This motivates the reconstruction of mesons like the π^0, η, ω and others, given the fact that a good knowledge of their spectra is directly linked to the amount of decay photons.

In this contribution, the current status on the reconstruction of the ω and the η meson, using their $\pi^+\pi^-\pi^0$ decay channel in pp collisions at $\sqrt{s} = 7$ TeV will be presented. ALICE's two calorimeters PHOS and EMCal, the so called Photon Conversion Method (PCM) and two hybrid methods will be used to detect the photons needed to reconstruct the neutral pions, profiting from the different resolutions and reconstruction efficiencies of each detection method.

HK 52.9 Do 16:30 Audimax Foyer

Application of the Hydrodynamic Event Generator THESEUS to CBM — •Elena Volkova for the CBM-Collaboration — The University of Tübingen, Tübingen, Germany

The Compressed Baryonic Matter experiment (CBM) at FAIR will measure nucleus-nucleus collisions at beam energies up to 14AGeV. The key objective of CBM is to investigate the QCD phase diagram in the region of the highest net-baryon-densities. The experiment is well suited to explore the Equation-of-State of nuclear matter at densities as they might occur in the interior of neutron stars or during neutron star mergers.

Recently, a new event generator (P. Batyuk et al. "Three-fluid Hydrodynamics-based Event Simulator Extended by UrQMD final State interactions (THESEUS) for FAIR-NICA-SPS-BES/RHIC energies") based on the three-fluid hydrodynamics approach for the early stage of the collision, followed by a particlization at the hydrodynamic decoupling surface to join to a microscopic transport model, UrQMD, to account for hadronic final state interactions has been developed. The generator allows, e.g., to employ different Equations-of-State for the description of nuclear matter.

In this poster, we present first results obtained with this new Event Generator apply it to the description of heavy-ion collisions in the CBM experiment.

HK 52.10 Do 16:30 Audimax Foyer

Separation of Heavy-Flavour Production Mechanisms via Two-Particle Angular Correlations in Proton-Proton Collisions at $\sqrt{s} = 2.76$ TeV — •Katharina Garner for the ALICE-Collaboration — WWU Münster, Germany

In high-energy particle collisions, heavy quarks are – due to their large mass – mainly generated in interactions with large momentum transfers. Because of this, their production can be described perturbatively and heavy-flavour production rates offer the possibility to validate predictions of perturbative QCD. In addition, heavy flavours experience the whole evolution of the collision system and can therefore serve to investigate the properties of the Quark-Gluon Plasma generated in heavy-ion collisions. As a reference for heavy-ion collisions, smaller collision systems like proton-proton collisions are examined.

Heavy-flavour production processes can be classified in three categories: pair creation, flavour excitation and gluon splitting, each of them leading to a characteristic angular distribution of the outgoing particles. Measurements on angular correlations of heavy-flavour particles might thus provide information on the contribution of individual production processes.

Based on Monte Carlo simulations with the event generator PYTHIA 8, the feasibility of investigating production processes of charm and bottom quarks in 2.76 TeV proton-proton collisions via azimuthal correlations between heavy-flavour decay electrons (HFEs) and between HFEs and hadrons is discussed.

HK 52.11 Do 16:30 Audimax Foyer

Results of mini-CBM mRICH simulations* — •Gregor Pitsch for the CBM-Collaboration — Justus Liebig Universität Gießen

The Compressed Baryonic Matter Experiment (CBM) will be built at the future Facility for Antiproton and Ion Research (FAIR) in Darmstadt and aims the exploration of the QCD phase diagram using high-energy nucleus-nucleus collisions. For testing the interplay of the subsystems of CBM, the data acquisition and the fast online event reconstruction, a full test setup comprising all prototypes or pre-series components is proposed, named *mini-CBM*. Mini-CBM will analyze the particle production of 1.24GeV Au + Au collisions provided by the SIS18 accelerator. One of the CBM subsystems is the Ring Imaging Cherenkov Detector (RICH), will be used for high quality electron identification for p<8GeV/c. In this contribution we present simulation results of an mRICH detector in the mCBM setup which will work as proximity focusing RICH detector using aerogel as radiator serving for pion-proton separation. This radiator type has been chosen due to space constraints, but also to improve particle identification in mCBM.
* supported by BMBF(05P15RGFCA)

HK 52.12 Do 16:30 Audimax Foyer

Performance Studies on Light Nuclei and Hypernuclei Measurements with the TRD in the CBM-Experiment — •Susanne Glässel for the CBM-Collaboration — Goethe-Universität Frankfurt

The Compressed Baryonic Matter (CBM) experiment at the Facility for Antiproton and Ion Research (FAIR) will be dedicated to the exploration of the QCD phase-diagram in the region of high net-baryon densities. A high statistics measurement of double-Λ hypernuclei as a part of the CBM-measurement programm will represent a breakthrough in this field of physics, since up to now only very few double-Λ hypernuclei events have been identified.

The Transition Radiation Detector (TRD) will significantly extend the number of hypernuclei states accessible within the CBM physics program. For the identification of ${}^{6}_{\Lambda\Lambda}$He, which decays as ${}^{6}_{\Lambda\Lambda}\mathrm{He} \rightarrow {}^{5}_{\Lambda}\mathrm{He} + \mathrm{p} + \pi^-$ and subsequently as ${}^{5}_{\Lambda}\mathrm{He} \rightarrow {}^{4}\mathrm{He} + \mathrm{p} + \pi^-$, the separation of d und ^{4}He is particularly important. The m/Z measurement of hadrons alone, as provided by the Time of Flight Detector (TOF), is not able to distinguish between the two different charge states. The TRD contributes to the separation of charged hadrons with a measurement of the specific energy loss in its four layers of Multi-Wire Proportional Chambers.

Simulations demonstrate how a unique identification of d and ^{4}He can be performed by combining TOF and TRD information, allowing to identify double-Λ hypernuclei with high efficiency.
Supported by the German BMBF-grant 05P15RFFC1.

HK 52.13 Do 16:30 Audimax Foyer

Protons and light nuclei in Au+Au Collisions at 1.23A GeV with HADES — •Melanie Szala for the HADES-Collaboration — Goethe Universität Frankfurt

As light hadrons have successfully been analysed, ongoing studies try to extend the set of identified particles towards light nuclei.

Light nuclei are expected to form at a later stage of the evolution and can probe the final freeze-out. The production of nuclei in heavy ion collisions is commonly discussed within two different scenarios: the thermal-statistical model and the coalescence model.

Furthermore higher order moments of conserved quantities (e.g. baryon number, charge, strangeness) are predicted to be sensitive to a first order phase transition and especially to the critical point of the QCD phase diagram. The HADES experiment started analysing the higher moments of proton number distributions but as the fully conserved quantity is the baryon number, further investigations will focus on including the light nuclei to the analysis.

In 2012 the HADES experiment at GSI Helmholtzzentrum für Schw-

erionenforschung in Darmstadt measured Au+Au collisions at $\sqrt{s_{NN}}$ = 2.41 GeV. In this contribution, we present results on protons and light nuclei.

This work has been supported by BMBF (05P15RFFCA), GSI and HIC for FAIR.

HK 52.14 Do 16:30 Audimax Foyer

Commissioning and First Experiments with TITAN's Multiple-Reflection Time-of-Flight Isobar Separator and Mass Spectrometer — •C. Hornung[1], S. Ayet[1,4], M.P. Reiter[1,2], S. Beck[1,4], J. Bergmann[1], T. Dickel[1,4], J. Dilling[2,3], A. Finlay[2,3], H. Geissel[1,4], F. Greiner[1], C. Jesch[1], A.A. Kwiatkowski[2], E. Leistenschneider[2,3], W.R. Plass[1,4], C. Scheidenberger[1,4], D. Short[2], C. Will[1], M. Yavor[5], and the TITAN collaboration[2] — [1]Justus-Liebig-Universität, Gießen — [2]TRIUMF, Vancouver — [3]University of British Columbia, Vancouver — [4]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt — [5]Russian Academy of Sciences, St. Petersburg

Exotic nuclei can be produced with very high rates at the ISOL facility ISAC at TRIUMF (Vancouver, Canada). TRIUMF's Ion Trap for Atomic and Nuclear Science (TITAN) is a multiple ion-trap system for high-precision mass measurements and in-trap decay spectroscopy. Recently a Multi-Reflection Time-of-Flight Mass Separator and Spectrometer (MR-TOF-MS) has been installed and commissioned at TITAN. It is based on an established concept applied at the FRS Ion-Catcher at GSI. The ion of interest can be spatially separated from isobaric contaminations with mass-selective dynamic re-trapping. Furthermore, the device is well suited to perform high precision mass measurements, particularly for short-lived isotopes produced at low rate. High-precision mass measurements of neutron-rich titanium isotopes were performed by the MR-TOF-MS to probe the existence of the N=32 sub-shell closure above calcium.

HK 52.15 Do 16:30 Audimax Foyer

Lifetime determination of nuclear levels using a new Doppler-shift attenuation approach — •Anna Bohn[1], Michelle Färber[1], Miriam Müscher[1], Simon G. Pickstone[1], Sarah Prill[1], Philipp Scholz[1], Mark Spieker[1,2], Vera Vielmetter[1], Michael Weinert[1], Julius Wilhelmy[1], and Andreas Zilges[1] — [1]Institute for Nuclear Physics, University of Cologne — [2]NSCL, Michigan State University, MI 48824, USA

The measurement of nuclear level lifetimes via the Doppler-shift attenuation method (DSAM) using proton-γ coincidences is well established at the 10 MV FN-Tandem accelerator in Cologne [1]. The SONIC@HORUS setup allows to determine excitation energy, recoil velocity and direction of the target nuclei [2]. In the standard analysis, the attenuation factor F(τ) has been determined by comparing the Doppler-shift at different photon emission angles θ and using that F(τ) represents the slope of $E_\gamma(cos(\theta))$. In this contribution a new approach will be introduced, in which the data are first Doppler-corrected and summed up, assuming different F(τ) values. Then, for each line, the optimum F(τ) yielding the best peak shape is determined. Due to the highly improved peak-to-background ratio, lifetimes of weaker transitions might also be extracted. Furthermore, first results from DSAM experiments on ^{130}Te and ^{128}Te using this method will be presented.

Supported by DFG (ZI 510/7-1). JW is supported by the Bonn-Cologne Graduate School of Physics and Astronomy.

[1] A. Hennig *et al.*, NIM A 794 (2015) 171
[2] S. G. Pickstone *et al.*, NIM A 875 (2017) 104

HK 52.16 Do 16:30 Audimax Foyer

Dipole strength in ^{164}Dy below the neutron separation threshold * — •O. Papst[1], T. Beck[1], J. Beller[1], C. Bernards[2], M. Bhike[3], N. Cooper[2], B. P. Crider[4,5,6], U. Gayer[1], J. Isaak[1,7], J. Kleemann[1], FNU Krishichayan[3], B. Löher[1], F. Naqvi[2], E. E. Peters[4], N. Pietralla[1], F. M. Prados-Estevez[4], P. C. Ries[1], R. S. Ilieva[8], T. J. Ross[4], D. Savran[9], M. Scheck[1,10], M. Schilling[1], W. Tornow[3], J. R. Vanhoy[4,11], V. Werner[1,2], S. W. Yates[4], and M. Zweidinger[1] — [1]IKP, TU Darmstadt — [2]WNSL, Yale University, New Haven, CT, USA — [3]TUNL, Duke University, Durham, NC, USA — [4]UKY, Lexington, KY, USA — [5]MSU, East Lansing, MI, USA — [6]MSU, Starkville, MS, USA — [7]RCNP, Osaka, Japan — [8]UNIS, Guildford, UK — [9]GSI, Darmstadt — [10]UWS, Paisley, UK — [11]USNA, Annapolis, MD, USA

In several nuclei, on the low-energy tail of the giant dipole resonance, concentrated electric dipole strength has been observed that is commonly referred to as the pygmy dipole resonance. In the proposed picture of neutron skin oscillations, this resonance should be sensitive to the nucleus' symmetry axes, separating into two parts for axially deformed nuclei. However, little data is available for such nuclei. In nuclear resonance fluorescence experiments conducted at the γ^3 setup at the High Intensity γ-ray Source (HIγS) in Durham, NC, USA, the dipole strength above 4 MeV of the strongly deformed nucleus ^{164}Dy has been studied using a completely polarized, quasi-monochromatic γ-ray beam. Contributions to $E1$ and $M1$ strength are discussed.

* Supported by the DFG, Collaborative Research Center 1245.

HK 52.17 Do 16:30 Audimax Foyer

Coulomb excitation of ^{142}Xe — •Corinna Henrich for the IS548-MINIBALL-Collaboration — TU Darmstadt, Darmstadt, Germany

The nucleus ^{142}Xe lies in the proximity of the doubly magic nucleus ^{132}Sn, a region through which the r-process is expected to pass. ^{142}Xe was studied in a "safe" Coulomb excitation experiment at HIE-ISOLDE (CERN) in 2016 in order to follow quadrupole and octupole collectivity in this area. Also, ^{144}Ba, which exhibits the largest octupole collectivity in the region, is located just two protons above ^{142}Xe. Both beam and target nuclei were measured using an array of segmented Si detectors (C-REX), covering forward as well as backward angles. The MINIBALL spectrometer was used to detect the emitted gamma rays in coincidence. The status of the analysis will be presented.

This work is supported by BMBF under contract 05P15RDCIA, by the EU under contract ENSAR 262010 and by ISOLDE.

HK 52.18 Do 16:30 Audimax Foyer

Lifetime Measurements at SONIC@HORUS: The Doppler-shift attenuation method using pγ coincidences — •Vera Vielmetter[1], Anna Bohn[1], Michelle Färber[1], Pavel Petkov[1,2,3], Simon G. Pickstone[1], Sarah Prill[1], Mark Spieker[1,4], Michael Weinert[1], and Andreas Zilges[1] — [1]Institute for Nuclear Physics, University of Cologne — [2]INRNE, Bulgarian Academy of Sciences, Sofia — [3]National Institute for Physics and Nuclear Engineering, Bucharest-Magurele — [4]NSCL, Michigan State University, MI 48824, USA

Recently, the Doppler-shift attenuation method (DSAM) using pγ coincidences has been established in Cologne as a new technique for measuring lifetimes of excited states in the range of femtoseconds [1]. The SONIC@HORUS setup [2] with 14 HPGe detectors and several silicon detectors is used to extract the centroid energy shifts from proton-gated γ-ray spectra, yielding lifetime values that are independent of feeding contributions. In this poster the (p,p'γ) DSAM technique will be introduced and results of several experiments, such as ^{96}Ru [1], ^{98}Ru, ^{112,114}Sn, ^{94}Zr and ^{128,130}Te, will be shown.

Supported by the DFG (ZI-510/7-1). JW is supported by the Bonn-Cologne Graduate School for Physics and Astronomy.

[1] A. Hennig *et al.*, Nucl. Instr. and Meth. A 794 (2015) 717
[2] S.G. Pickstone *et al.*, Nucl. Instr. and Meth. A 875 (2017) 104-110

HK 52.19 Do 16:30 Audimax Foyer

A direct nuclear laser excitation scheme for ^{229m}Th — •Lars von der Wense[1], Benedict Seiferle[1], Simon Stellmer[2], Johannes Weitenberg[3], Georgy Kazakov[2], Adriana Pálffy[4], and Peter G. Thirolf[1] — [1]Ludwig-Maximilians-Universität München, 85748 Garching, Germany — [2]Technische Universität Wien, 1040 Vienna, Austria — [3]Max-Planck-Institut für Quantenoptik, 85748 Garching, Germany — [4]Max-Planck-Institzt für Kernphysik, 69117 Heidelberg, Germany

Direct nuclear laser excitation has been a long-standing goal. By today there is only one nuclear excitation known which would allow for direct laser excitation due to its exceptionally low energy of only a few eV above the ground state. This is the metastable first excited state in ^{229}Th. While direct nuclear laser excitation of ^{229}Th ions in a Paul trap is still hindered by insufficient knowledge of the exact isomeric energy value, here a new laser excitation scheme for neutral ^{229}Th atoms on a surface will be presented [1]. This excitation scheme circumvents the requirement of an improved knowlede of the isomeric energy, thereby paving the way for nuclear laser spectroscopy of ^{229m}Th. It is making use of the recently detected internal conversion decay channel of the isomeric state [2] in combination with a short isomeric lifetime [3].

[1] L. v.d.Wense et al., PRL 119, 132503 (2017).
[2] L. v.d.Wense et al., Nature 533, 47-51 (2016).
[3] B. Seiferle et al., PRL 118, 042501 (2017).

Supp. by DFG (TH956/3-2) and Horizon 2020 (664732 "nuClock").

HK 52.20 Do 16:30 Audimax Foyer

Study of high angular momentum states in ^{105,106}Pd — Angel Angelov[1], •Liliya Atanasova[2], Dimiter Balabanski[3], Andrey Blazhev[4], Jan Jolie[4], Mattias Rudigier[4,5], and Ralitsa Stanoeva[1] — [1]South-West University, Blagoevgrad, Bulgaria — [2]Medical University of Sofia, 1431 Sofia, Bulgaria — [3]ELI-NP, Horia Hulubei National Institute of Physics and Nuclear Engineering, 077125 Magurele, Romania — [4]IKP, Universität zu Köln, D-50937, Köln, Germany — [5]Department of Physics, University of Surrey, Guildford, GU2 7XH, United Kingdom

The high spin states of the ^{105,106}Pd have been studied via the fusion-evaporation reactions ^{96}Zr(^{13}C, 3nγ)^{106}Pd and ^{96}Zr(^{13}C, 4nγ)^{105}Pd. The Zr beam with energies 40 MeV and 50 MeV respectively, was provided from the Tandem accelerator at IKP, University of Cologne. The gamma rays were detected with HORUS spectrometer. The preliminary results from the data analysis will be presented. Previous experiments on Pd and the present results have shown that the majority of states populated by (HI, xn) reactions in Pd nuclei are members of decoupled collective bands built on quasineutron states. These nuclei provide an unusually simple and complete illustration of the relation between particle and collective motion in slightly deformed nuclei. These experiments provide ample evidence that the yrast states populated in (HI, xn) reactions are in good agreement with a slightly deformed-rotor description of these nuclei.

HK 52.21 Do 16:30 Audimax Foyer

Measurement of the ^{96}Ru(p,γ)^{97}Rh reaction cross section in an activation experiment — •Markus Reich[1], Jan Glorius[2], Joachim Goerres[3], Yuri Litvinov[2], Rene Reifarth[1], Edward Stech[3], Meiko Volknandt[1], and Michael Wiescher[3] — [1]Goethe Universität Frankfurt, 60438 Frankfurt am Main — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH, 64291 Darmstadt — [3]University of Notre Dame, Notre Dame, Indiana 46556, USA

The use of storage rings offers new opportunities to measure reaction cross sections on unstable nuclei. In 2015, a proof-of-principle experiment was performed at the experimental storage ring ESR at GSI, Darmstadt, where the reaction cross section of the reaction ^{96}Ru(p,γ)^{97}Rh has been measured in inverse kinematics at energies between 9 and 11 MeV. The luminosity was determined with two methods. Both methods are based on theoretical predictions for electron capture events, which occur in the H_2 gas. An independent activation experiment was performed at Notre Dame, USA to test the results of the experiment at the ESR.
The ^{96}Ru(p,γ)^{97}Rh cross section has been measured at 3.2 MeV to compare with a previous activation experiment as well as between 9 and 11 MeV. The preliminary results of this experiment are presented.

This project is supported by BMBF-CRYRING, HGS-HIRe and HIC for FAIR.

HK 52.22 Do 16:30 Audimax Foyer

Detector for a Measurement of Shape Factors in Beta Decay — •Karina Bernert[1], Thierry Lasserre[2], Bastian Märkisch[1], Christoph Roick[1], Heiko Saul[1], and Stefan Schönert[1] — [1]Physik Department, Technische Universität München, 85748 Garching b. München, Germany — [2]Institute of Research into the Fundamental Laws of the Universe, French Alternative Energies and Atomic Commission, 25 rue Leblanc, 75015 Paris, France

The search for a sterile neutrino, a viable candidate for dark matter, requires an improved understanding of the shape factors of non-unique forbidden beta decays. We present the design of a scintillation detector read out by mesh type photomultiplier tubes. It will be used in the PERKEO III spectrometer, which was initially developed for neutron beta decay, to measure electron spectra of various beta decays with high precision. We show the progress in designing the light guide form that yields the optimal performance with simulations using Geant4, and present a way of calibrating the detector with sufficient precision.

HK 52.23 Do 16:30 Audimax Foyer

Implementation and test of a setting generator for the GSI fragment separator FRS in the LHC Software Architecture LSA — •Jan-Paul Hucka[1], Joachim Enders[1], Stephane Pietri[2], Helmut Weick[2], David Ondreka[2], Jutta Fitzek[2], and Bernd Schlei[2] — [1]Institut für Kernphysik TU Darmstadt — [2]GSI Helmholtzzentrum

At the GSI facility, the LSA [1] framework is used to implement a new control system for accelerators and beam transfers.

This was already completed and tested for the SIS18 accelerator. The implementation at CRYRING and ESR is currently being finalized. In addition, controls of the fragment separator FRS [2] and later also the superconducting fragment separator Super-FRS at FAIR will be provided by this framework. For the implementation at the FRS the interaction of the beam with matter in the beamline and the beam's associated energy loss must be taken into account. This energy loss is determined using input from ATIMA [3] and has been included into the code of the LSA framework. The implemented setting generator was simulated and benchmarked by comparison to results of earlier measurements. Furthermore recent developments included the modeling of slits and of the propagation of charge states through matter.

[1] M. Lamont et al., LHC Project Note 368
[2] H. Geissel et al., NIM B 70, 286 (1992)
[3] H. Weick et al., NIM B 164/165 168(2000)
Supported in part by BMBF through grant 05P15RDFN1

HK 52.24 Do 16:30 Audimax Foyer

The Cylindrical Gas Electron Multiplier Inner Tracker for the BESIII Spectrometer — •Cristina Morales Morales for the BESIII-Collaboration — Helmholtz-Institut Mainz, Staudingerweg 18, 55129 Mainz, Germany

The BESIII experiment is a multi-purpose detector operating at the electron-positron collider BEPCII in Beijing. The experiment has been in operation since 2008 and has collected the world's largest data samples at the main charmonium resonances and XYZ exotic states. The innner drift chamber used as inner tracker will be replaced. In 2014 an upgrade was proposed based on the Cylindrical Gas Electron Multipliers (CGEM) technology with several innovations. The new mechanical support for the GEM foils will reduce the total radiation length of the detector and improve its tracking performance. An innovative design of the CGEM anode will allow for smaller capacitance and hence for bigger signals. The relatively strong BESIII magnetic field requires a new analogue charge and time readout. Full custom front-end electronics, including a dedicated ASIC, will be designed and produced for optimal data collection. Specific software will be developed to first simulate, and then reconstruct the CGEM hits to detect the reaction products. Proper benchmark channels will be identified and investigated to maximise the outcome of the project. In this contribution, an overview of the project will be presented.

HK 52.25 Do 16:30 Audimax Foyer

Assignment of Avalanche Photodiodes with respect to their operational parameters — •Benjamin Wohlfahrt[1], Kai-Thomas Brinkmann[1], Gerrit Eichner[2], Christopher Hahn[1], Markus Moritz[1], Andrea Wilms[3], and Hans-Georg Zaunick[2] for the PANDA-Collaboration — [1]II. Physikalisches Institut, Justus-Liebig-Universität Gießen — [2]Mathematisches Institut, Justus-Liebig-Universität Gießen — [3]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt

The PANDA experiment will investigate physics in the strong interaction regime utilizing antiproton-proton annihilations. The PANDA detector will comprise a Target Spectrometer as well as a Forward Spectrometer. In the target region, a barrel-shaped electromagnetic calorimeter with end-caps on both sides will be used. It will play a major role in detecting photons utilizing about 15500 PbWO4 crystals. Each of these crystals is read out by two independent Avalanche Photo Diodes. To ensure a close-as-possible similar behaviour, an optimization algorithm groups APDs into pairs based on a distance function applied to a number of selection-criteria. A threshold scan of the distance function gathers the best matching criterion. Hence, a model selection has been performed to obtain most precise operating parameters out of the APD measurements. *The Project is supported by BMBF and HIC for FAIR

HK 52.26 Do 16:30 Audimax Foyer

Picosec Gaseous Detectors for Fast-timing Applications — •Lukas Sohl — Ruhr-Universität Bochum, Institut für Experimentalphysik I, 44780 Bochum

The future strategy of experimental particle physics plans to build colliders with increasing luminosity and energy to todays machines. Especially at increasing luminosities the correct separation of vertices becomes more difficult. This is only possible with detector systems that provide time resolution in the range of some 10 ps. The RD51 collaboration "Development of Micro-Pattern Gas Detectors Technologies" have presented a detector concept with an expected time resolution

in the demanded range. The Picosec gaseous detector prototypes are based on the working principles of Micromegas detectors. A time jitter of some nanoseconds is inevitable due to different positions of the primary ionization cluster in the drift zone of a Micromegas. Instead the Picosec detector have a Cherenkov radiator in front of the gaseous volume. The photons of this radiator are converted in a photocathode. The drift gap can be reduced to some 100 micrometres as all primary ionized electrons are located in the photocathode. Several prototypes of this detector were tested in 2017 at the SPS beam at CERN. A time resolution of up to 24 ps was reached during this measurements. The poster introduces the concept of the Picosec detector as well as the beam setup and first results from the 2017 beam measurements.

HK 52.27 Do 16:30 Audimax Foyer

Aufbau und Test eines Flüssig-Heliumtargets für Elektronenstreuexperimente — •Michaela Hilcker, Jens Conrad, Norbert Pietralla, Gerhart Steinhilber und Peter von Neumann-Cosel — Institut für Kernphysik, TU Darmstadt, Deutschland

Am Institut für Kernphysik der TU Darmstadt werden mittels hochauflösender, inelastischer Elektronenstreuung Untersuchungen der Kernstruktur bei niedrigen Impulsüberträgen durchgeführt. Das QClam-Spektrometer, eines der beiden großen Magnetspektrometer des Instituts, dient der Bestimmung des Impulses der gestreuten Elektronen.

Im Rahmen des Sonderforschungsbereich 1245 „Nuclei: From Fundamental Interaction to Structure and Stars“ ist ein Elektronenstreuexperiment bei niedrigem Impulsübertrag zur Untersuchung des ersten angeregten 0^+ Zustandes in ^{4}He geplant, da bisherige Experimente [1] stark von aktuellen „ab initio“ Rechnungen im Rahmen der chiralen EFT [2] abweichen. Um eine ausreichend gute Statistik der Messdaten in annehmbarer Messzeit erhalten zu können, ist die Verwendung von flüssigem Helium als Targetmaterial notwendig. Ein geeigneter Aufbau inklusive Heliumkryostat und einer dazu passenden neuen Streukammer, werden vorgestellt und erste Funktionstests gezeigt.

[1] T. Walcher, Phys. Lett. B **31**, 442 (1970).
[2] S. Bacca, N. Barnea, W. Leidemann, and G. Orlandini, Phys. Rev. Lett. **110**, 042503 (2013).

Gefördert durch die DFG im Rahmen des SFB 1245.

HK 52.28 Do 16:30 Audimax Foyer

The Cologne Clover Counting Setup in a face-to-face configuration — •Marvin Körschgen, Felix Heim, Elena Hoemann, Philipp Scholz, and Andreas Zilges — Institute for Nuclear Physics, University of Cologne

The Institute for Nuclear Physics of the University of Cologne has a detector setup dedicated for activation measurements for Nuclear Astrophysics - the Cologne Clover Counting Setup. Since the activity of reaction products in Nuclear Astrophysics are usually very low, knowledge and optimizations of laboratory background and efficiency of the setup are very important. Here we present the construction of this setup and its advantages. Further more we describe a summing correction for a close detector geometry via Geant4 simulations.

Supported by the DFG under the contracts DFG (ZI 510/8-1) and INST (216/544-1). Additional support was received within the ULDETIS project of the UoC Excellence Initiative institutional strategy.

HK 52.29 Do 16:30 Audimax Foyer

Status of the Development of a HPGe-BGO Pair Spectrometer for ELI-NP — •Ilja Homm, Alexander Ignatov, Stoyanka Ilieva, and Thorsten Kröll — Technische Universität Darmstadt, Germany

At the moment, the new european research facility called ELI-NP (The **E**xtreme **L**ight **I**nfrastructure - **N**uclear **P**hysics) is being built in Bucharest-Magurele, Romania. ELI-NP offers unprecedented opportunities for photonuclear reactions with high intensity, brilliant and fully polarized photon beams at energies up to 19.5 MeV.

The 8 HPGe CLOVER detectors of ELIADE are important instruments for the gamma spectroscopic study of photonuclear reactions. We investigate the possibility to operate an advanced version of an anti-Compton shield (AC shield) as escape γ-rays pair spectrometers for two of the ELIADE CLOVERS to extend the high-resolution spectroscopy to photon energies of several MeV where the pair production process dominates. The BGO shield operated as a stand-alone device can be used as intensity monitor too. The main tasks are to develop and test such an AC shield: a pair spectrometer consisting of BGO and CsI(Tl) crystals with APD (avalanche photodiode) or SiPM (silicon photomultiplier) readout. The results of prototype testing are reported.

This work is supported by the German BMBF (05P15RDENA).

HK 52.30 Do 16:30 Audimax Foyer

Precision high voltage divider for the electron cooler at CRYRING — T. Dirkes[1], V. Hannen[1], W. Nörtershäuser[2,3], H.-W. Ortjohann[1], O. Rest[1], •D. Roth[1], Ch. Weinheimer[1], and D. Winzen[1] — [1]Institut für Kernphysik, Uni Münster — [2]Institut für Kernchemie, Uni Mainz — [3]GSI, Darmstadt

The heavy ion storage ring CRYRING at GSI provides a unique possibility to test atomic structure calculations with slow exotic ion beams at energies in the range of 0.3 MeV/u up to 15 MeV/u. In order to cool the ions and thus achieve a low momentum spread of the stored beam, CRYRING features an electron cooler, where the ion beam is superimposed with a monoenergetic electron beam. In earlier measurements of hyperfine transitions in hydrogen- and lithiumlike ions at Experimental Storage Ring (ESR), the limiting uncertainty was the voltage measurement of the electron cooler. That uncertainty could be removed by an in-situ precision measurement of the cooler voltage using a precision high voltage divider provided by PTB on a temporary basis. Therefore the construction of a high-precision divider for voltages up to 35 kV for the CRYRING electron cooler is ongoing in our group. The concept is similar to the ultrahigh-precision voltage dividers which have been constructed for use at the KATRIN experiment. The precision of the divider is designed to be in the low ppm range and will allow for measurement uncertainties in the $< 10^{-5}$ region. We will present characterization measurements of the precision parts and first calibration measurements of the finished divider. This work is supported by BMBF under contract number 05P15PMFAA.

HK 52.31 Do 16:30 Audimax Foyer

Preparatory tests for (e,e',γ) coincidence experiments at the S-DALINAC * — •Gerhart Steinhilber, Tobias Klaus, Norbert Pietralla, Dmytro Symochko, and Peter von Neumann-Cosel — Institut für Kernphysik, TU Darmstadt

At the Institut für Kernphysik, TU Darmstadt high resolution electron scattering experiments are performed at low momentum transfer using the Superconducting Darmstadt Linear Accelerator and electron spectrometers Lintott and QClam.

Experiments of inelastically scattered electrons in coincidence with real photons have the big advantage that the probe is purely electromagnetic and hence allows for nuclear structure studies of highest precision. In the framework of the CRC 1245 two coincidence experiments investigating the gamma-decay branching ratio of the giant dipole resonance of ^{112,124}Sn and the vorticity in ^{92}Zr are planned using the QClam spectrometer and a detector array consisting of 17 LaBr:Ce detectors is under construction.

During a beam time in fall 2017 three LaBr:Ce detectors have been placed around the scattering chamber of the Lintott spectrometer to test the coincidence data acquisition (DAQ). The concept of the DAQ and first results from the test will be presented.

* Supported by the DFG within the CRC 1245.

HK 52.32 Do 16:30 Audimax Foyer

A Spark-Detection-System for GEM foils — •Philip Hauer, Steffen Urban, Viktor Ratza, Markus Ball, and Bernhard Ketzer for the ALICE-Collaboration — Universität Bonn, Helmholtz-Institut für Strahlen- und Kernphysik, Bonn, Germany

Gas Electron Multipliers (GEM) are widely used as an amplification stage in gaseous detectors exposed to high rates. The GEM consists of a polyimide foil which is coated by two thin copper layers. GEM have a high density of holes, where charges are multiplied if suitable voltages are applied. One example where GEM foils will be used is the Time Projection Chamber (TPC) of ALICE (A Large Ion Collider Experiment) after its upgrade which will take place during the long shutdown 2 of the Large Hadron Collider (LHC). Over 700 GEM foils will be manufactured for the read-out chambers, each with a size of several hundred square centimeters. In order to assure the quality of each individual GEM foil, a strict quality-control protocol is followed. One important step in this protocol is the leakage-current measurement. For this measurement, a voltage of 500 V is applied on a GEM foil for 15 minutes and the current is measured with a pA-meter. While the high voltage is applied, it is possible that discharges occur in one or more holes of the GEM. Until now, these sparks can only be measured by eye which is cumbersome and not precise. With the help of the Spark-Detection-System (SDS), the detection is automized and accuracate to approximately 1 mm. A camera observes the GEM during the

measurement and the video stream is analyzed by a LabView software. Supported by BMBF.

HK 52.33 Do 16:30 Audimax Foyer

Untersuchung systematischer Effekte für das P2-Experiment — •Sebastian Baunack[1], Dominik Becker[1], Kathrin Imai[1], Frank Maas[1,2,3] und David Rodriguez Pineiro[2] — [1]Johannes Gutenberg-Universität Mainz — [2]Helmholtz-Institut Mainz — [3]PRISMA Cluster of Excellence, Mainz

Die P2-Kollaboration bereitet derzeit eine Messung des schwachen Mischungswinkels $\sin^2\theta_w$ mittels elastischer Elektron-Proton-Streuung vor. Die angestrebte relative Genauigkeit beträgt 0.15% und ist damit vergleichbar mit den derzeit genauesten Messungen am Z-Pol. Diese Messung bei niedrigem Impulsübertrag ist sensitiv für Physik jenseits des Standardmodells. Das Experiment soll am neu zu errichtenden Elektronenbeschleuniger MESA in Mainz durchgeführt werden.

Die erreichbare Präzision hängt sowohl von der zu erreichenden statistischen Unsicherheit in der Messung der paritätsverletzenden Asymmetrie als auch von zahlreichen systematischen Effekten ab, z.B. den helizitätskorrelierten Differenzen in den Parametern Lage, Intensität und Energie des Elektronenstrahls. Eine frühzeitige Untersuchung dieser Effekte ermöglicht es, die noch in Entwicklung befindlichen aktiven Strahlstabilisierungssysteme auf die Bedürfnisse des Experiments anzupassen.

HK 52.34 Do 16:30 Audimax Foyer

Compact signal processing of a Compton camera system for medical imaging — •Peter G. Thirolf[1], Silvia Liprandi[1], Vasiliki Anagnostatou[1], Tim Binder[1], George Dedes[1], Maria Kawula[1], Florian Lüke[2], Robert Schneider[2], Ingrid Valencia Lozano[1], and Katia Parodi[1] — [1]LMU München, Germany — [2]Mesytec GmbH, Putzbrunn, Germany

At LMU in Garching we are developing a Compton camera for ion beam range verification in particle therapy. The system is designed to detect prompt γ-rays induced by nuclear reactions during the irradiation of tissues. Our prototype consists of a stack of 6 double-sided silicon strip detectors (2x128 ch. each) as scatterers and an absorber formed by a $LaBr_3$(Ce) scintillator coupled to a multi-anode (8x8 or 16x16) photomultiplier (PMT). A $CeBr_3$ scintillator is also under comparative investigation. The system requires the signal processing of up to 2000 channels: the previous (ASIC-based) readout electronics provided several shortcomings (input polarities acceptance, trigger capability, noise level and rate limitations) that were now removed by an upgrade. We are presently testing a compact frontend-board and VME-based signal processing and DAQ electronics built from discrete components. The system is capable of handling data rates up to 30 MB/s. First tests offline and online using the new readout and data acquisition system will be presented. This work was supported by the DFG Cluster of Excellence MAP (Munich Centre for Advanced Photonics) and CALA (Centre for Advanced Laser Applications).

HK 52.35 Do 16:30 Audimax Foyer

Teilautomatisierte Produktion von Ultra-Thin-Pt-Temperatursensoren für PANDA — •Niels Boelger — Ruhr-Universität Bochum, Institut für Experimentalphysik I, 44780 Bochum

Das PANDA-Experiment ist eines der Schlüsselexperimente an der zukünftigen Beschleunigeranlage FAIR in Darmstadt. Es dient der Untersuchung des Aufbaus von Hadronen und von Aspekten sowohl der starken und schwachen Wechselwirkung als auch exotischer Materiezustände. Der PANDA-Detektor wird über ein homogenes, mit Bleiwolframat-Szintillatoren bestücktes elektromagnetisches Kalorimeter im Bereich des Targetspektrometers verfügen. Die Intensität des erzeugten Szintillationslichtes innerhalb der Bleiwolframat-Kristalle ist temperaturabhängig, weshalb ein System zur Temperaturmessung direkt an den Szintillatoren notwendig ist. Aufgrund der kompakten Bauweise und der Tatsache, dass Sensoren passender Bauform nicht kommerziell verfügbar sind, ist es notwendig, die Sensoren selbst zu produzieren. Die Produktion solch kleiner Bauteile, also das Winden eines Platindrahts mit 0,025 mm Durchmesser auf eine Kaptonfolie ist Präzisionsarbeit. Bei benötigter Stückzahl von 1634 verwendbaren Sensoren, wobei nur circa 40% der bisher produzierten Sensoren verwendbar sind, ist die Produktion von Hand zu aufwendig. Deshalb soll ein modifizierter 3D-Drucker diese Aufgabe übernehmen. Dem vom 3D-Drucker geführten Platindraht wird ein elektrischer Strom aufgeprägt, sodass ein Mini-Magnet-Array genutzt werden kann, um den Draht präzise in die gewünschte Position zu bringen.

This project is supported by the BMBF Gefördert durch das BMBF

HK 52.36 Do 16:30 Audimax Foyer

Performance of the silicon vertex tracker used in the ^{8}He(p, pα)^{4}n experiment at SAMURAI — Thomas Aumann[1], Michael Böhmer[2], Florian Dufter[2], Laura Fabbietti[2], Roman Gernhäuser[2], Sebastian Reichert[2], Dominic Rossi[1], Masaki Sasano[3], and •Vadim Wagner[1] for the NeuLAND-SAMURAI-Collaboration — [1]Technische Universität Darmstadt — [2]Technische Universität München — [3]RIKEN Nishina Center, Wako, Japan

An experiment at the SAMURAI setup at RIKEN was performed to study the existence of a resonant state of four neutrons in a quasi-free α-knockout reaction in inverse kinematics from ^{8}He. For this the missing-mass method will be used, which requires to know precisely the reaction vertex inside the 5 cm thick liquid hydrogen target. The channel of interest is selected by the detection of a fast proton and a slow α, i.e., low and high deposited energies, respectively, with a very small angle. Therefore a silicon strip detector system, consisting of 6 planes (3 horizontal and 3 vertical) with 100 μm pitch size, was built. Additionaly this detector allows, amongst others, background-subtraction and transverse momentum reconstruction. The design and performance of this detector during the experiment will be presented. This work is supported by the DFG through grant no. SFB 1245, the BMBF under contract number 05P15RDFN1 and 05P15WOFNA and the GSI-TU Darmstadt cooperation agreement.

HK 52.37 Do 16:30 Audimax Foyer

Lifetime measurements with the DSA method — •Maximilian Droste, Andreas Vogt, Konrad Arnswald, Peter Reiter, Claus Müller-Gatermann, and Alfred Dewald — Institute for Nuclear Physics, University of Cologne

The Doppler shift attenuation method (DSAM) is the method of choice for the measurement of lifetimes of nuclear excited states in the sub-picosecond region. DSAM experiments employ thin production targets mounted on a thick stopper foil (backing) in which the recoiling nuclei of interest slow down and stop in a well-defined manner. The emission of γ rays during this time leads to the observation of a Doppler-broadened lineshape whose details are sensitive to the lifetime and the time evolution of the population of the level of interest. The APCAD analysis code (Analysis Programm for Continuous-Angle DSAM) [1] is a versatile tool for the analysis of γ-ray lineshapes. The code simulates the slowing-down history of the recoiling ions and fits the distinct lineshapes to the observed spectra. Excited states in ^{20}Ne and ^{47}V were populated in fusion-evaporation reactions with the tandem accelerator of the IKP, University of Cologne to test and benchmark the analysis procedures with APCAD. Different stopping approximations (SRIM and GEANT4) are investigated and the impact of nuclear and electronic stopping powers on the fitted lineshapes is studied in detail. Results of these variations as well as a first results for the lifetime of the 4^+ state of ^{48}Cr will be presented. A.V. supported by BCGS.
[1] C. Stahl *et al.*, Comput. Phys. Commun. 214 (2017) 174-198.

HK 52.38 Do 16:30 Audimax Foyer

Monitoring the CBM-TRD Performance with a ^{55}Fe-Source — •Dennis Spicker for the CBM-Collaboration — Institut für Kernphysik, Goethe Uni Frankfurt

The Compressed Baryonic Matter (CBM) experiment at FAIR is designed to investigate the properties of strongly interacting matter at highest net-baryon densities. The Transition Radiation Detectors (TRD) main purpose is the identification of dielectrons in the low and intermediate mass region (up to m(J/Ψ)). Another important contribution of the CBM-TRD is the measurement of the specific energy loss, in order to differentiate between nuclear fragments with the same m/Z -ratio but different Z.

In September 2017, test measurements were performed at DESY with four TRD chambers, equipped with full-size foam radiators, in an electron beam with 1 to 4 GeV momentum. The main goals of the test campaign were a performance test of the radiators, to measure spatial resolution, a test of the readout electronics and a calibration of the gas-gain for the new Xe/CO_2 mixture. For the latter, a ^{55}Fe source was placed in front of one detector.

For this contribution, analyses of ^{55}Fe spectra were performed, in order to determine the performance and energy resolution of the latest TRD chamber design.

Supported by the German BMBF-grant 05P15RFFC1

HK 52.39 Do 16:30 Audimax Foyer

Simulating the Radiation Exposure of Medical Staff Caused by Radiologic Interventions — •Elena Hoemann[1,2],

H. Eberhardt[2], J. Endres[2], A. Günther[2], J. Kopp[3], G. Östreicher[3], F.-N. Sentuc[2], and A. Zilges[1] — [1]Institute for Nuclear Physics, University of Cologne — [2]Gesellschaft für Anlagen- und Reaktorsicherheit, Köln — [3]Klinikum Augsburg

Interventional radiology provides the possibility for a surgeon to execute image-based minimally invasive operations. Due to the need of X-ray-live-images during the procedure, the medical experts are daily exposed to varying amounts of radiation doses. The total amount of this exposure depends, among others, on type, duration and frequency of interventions, the usage of protective equipment and the position of the executing person. The determination of the radiation exposure, especially of equivalent doses in certain organs or tissues, is a major challenge, because an adequate measurement of these quantities during an operation is difficult.

Motivated by that, Geant4-simulations of a medical setup are performed to determine dose distributions, as well as equivalent doses for the surgery team. These simulations provide a powerful tool for investigating influences of protective equipment and other parameters with the objective of optimizing radiation protection for the medical staff.

To evaluate the results of the simulations, experimental measurements are performed at the Klinikum Augsburg. First preliminary results show the consistency of simulated and experimental data.

Funded by the BMUB (3616S42335).

HK 52.40 Do 16:30 Audimax Foyer

A Data Acquisition System for the Prototypes of the PANDA Micro Vertex Detector Front-End Electronics — Alessandra Lai[1], •Kai-Thomas Brinkmann[2], Daniela Calvo[3], Valentino Di Pietro[2], Tommaso Quagli[2], Alberto Riccardi[2], James Ritman[1], Angelo Rivetti[3], Manuel Rolo[3], Robert Schnell[2], Tobias Stockmanns[1], Richard Wheadon[3], André Zambanini[1], and Hans-Georg Zaunick[2] — [1]Forschungszentrum Jülich GmbH — [2]II. Physikalisches Institut, Justus-Liebig-Universität Gießen — [3]INFN, Sezione di Torino

The readout of the PANDA Micro Vertex Detector will require novel ASICs for the readout of the strip and pixel sensors. The assessment of the front-end chips performance is a mandatory task, in order to verify the requirements imposed by the experiment. In order to characterize the prototype front-end chips, the Jülich Digital Readout System (JDRS) has been designed to enable both laboratory and in-beam tests. The main features of the JDRS are flexibility and modularity. The functionality of the data acquisition system will be shown together with test results on measurements with the strip front-end ASIC PASTA.

HK 52.41 Do 16:30 Audimax Foyer

A GEM PCB simulator — •Piotr Gasik and Laura Fabbietti — TU München, James-Franck-Str. 1, 85748 Garching, Germany

The key parameter for a long-term operation of GEM-based detectors in the harsh environment of high-rate experiments is their stability against electrical discharges. To mitigate the results of violent discharge events, an optimised HV system is mandatory. Behaviour of the system in case of a spark occurrence, propagated discharges or an emergency shutdown of a power supply is of a great importance. The possibility of an over-voltage across any GEM foil must be avoided as it may lead to the development of a destructive discharge. In order to test the reaction of the powering scheme on the events listed above, we have designed and built a multi-GEM detector simulator based on the conventional electronic elements. It can serve as a testing tool for the assessment of the HV scheme without a need to use a real detector.

The device allows for the simulation of a short in one of the GEM segments using HV relays or a spark occurrence by employing a Gas Discharge Tube. Voltages on electrodes in question can be monitored on a scope using standard test probes via decoupling HV capacitors, included in the design. The GEM PCB simulator has been successfully used to test several powering schemes commonly used with GEM detectors, such as: passive voltage divider, multi-channel and a so-called "cascaded" power supply. The results of these tests will be presented in the contribution.

This research was supported by the DFG cluster of excellence "Origin and Structure of the Universe".

HK 52.42 Do 16:30 Audimax Foyer

Design of an optimized Cluster-Jet Target for CryoFlash — •L. Lessmann, D. Bonaventura, S. Grieser, and A. Khoukaz — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, 48149 Münster, Germany

The CryoFlash experiment investigates the interaction of the high intensity, short-pulse Ti:Sa laser of the Arcturus Facility Düsseldorf with a cryogenic cluster-jet target constructed at the University of Münster. The main fields of research are the generation of femtosecond X-ray pulses for pump-probe experiments and furthermore the acceleration of electrons and ions up to the MeV scale within a tabletop setup. The cluster-jet target provides a continuous flow of micro- to nanometer sized particles which are of approximately solid density by pressing pre-cooled gas through a Laval nozzle. This combines the advantages of gas-jet targets (continuous flow) and solid targets (high density).

A first cluster-jet target, constructed at the University of Münster, has already been installed at the Arcturus Facility Düsseldorf. First measurements of the interaction of the high intensity, short-pulse laser with the cluster-jet have been taken. The results and experience of the first measurements have been used to design a new and optimized cluster-jet target. The concept and design of this new target will be presented and discussed.

HK 52.43 Do 16:30 Audimax Foyer

ELIADE@ELI-NP: A multi-detector array for NRF studies — •Simon G. Pickstone[1], Calin A. Ur[2], Andreas Zilges[1], Norbert Pietralla[3], Jacob Beller[3], Bertrand De Boisdeffre[2], Mihail O. Cernaianu[2], Bastian Löher[3], Catalin Matei[2], George Pascovici[2], Cristian Petcu[2], Deniz Savran[4], Gabriel Suliman[2], Emil Udup[2], Volker Werner[3], and Julius Wilhelmy[1] — [1]Institute for Nuclear Physics, University of Cologne — [2]ELI-NP, IFIN-HH, Bucharest, Romania — [3]Institute for Nuclear Physics, University of Darmstadt — [4]GSI, Darmstadt

Laser-Compton Backscattering facilities provide unique possibilities to study the interaction of γ-rays with atomic nuclei. Using the Nuclear Resonance Fluorescence (NRF) technique, many experimental quantities can be deduced in a model independent way, such as level energies and widths, γ-decay branching ratios, and spin and parity quantum number. The new γ-beam system at the ELI-NP (Extreme Light Infrastructure – Nuclear Physics) facility will provide unprecedented intensities at very narrow bandwidths.

This contribution will present an overview and the current status of ELIADE, a multi-detector array comprised of HPGe detectors and large-volume $LaBr_3$ detectors currently under construction at ELI-NP.

Supported by the Project Extreme Light Infrastructure – Nuclear Physics (ELI-NP) – co-financed by the Romanian Government, the European Union through the European Regional Development Fund and the BMBF (05P2015/ELI-NP).

HK 52.44 Do 16:30 Audimax Foyer

Modification of the GEM response due to etching effects from high irradiation — •Michael Jung for the ALICE-Collaboration — Institut für Kernphysik Frankfurt

For the Upgrade of the ALICE Time Projection Chamber (TPC) with Gas Electron Multipliers (GEMs) an aging test setup was built to evaluate the long-term performance of GEMs in high-luminosity experiments. These tests revealed that the insulating kapton layer between the copper electrodes is worn out after long-term operation of the GEM stack with high gain. This phenomenon, which is changing the hole geometry of the irradiated area, leads to a modification of the GEM response, which is now investigated with simulations of a single GEM. The simulations of the electric fields were performed with ANSYS 16.1 and the operation process of the detector is simulated with the Garfield^{++} toolkit.

The simulations focus on the details of the amplification process to understand the change in gain and multiplication of etched GEMs as well as the decrease of the energy resolution.

HK 52.45 Do 16:30 Audimax Foyer

Development of an Optical System for the Backward End-Cap of PANDA — •Samer Ahmed[1], Luigi Capozza[1], Alaa Dbeyssi[1], Phillip Grasemann[1], Frank Maas[1,2,3], Oliver Noll[1], David Rodriguez Pineiro[1], Sara Wolff[1], Manuel Zambrana[1], and Iriz Zimmermann[1] for the PANDA-Collaboration — [1]Helmholtz-Institut Mainz, Mainz, Germany — [2]Institute of Nuclear Physics, Mainz, Germany — [3]PRISMA Cluster of Excellence, Mainz, Germany

The PANDA experiment at the upcoming FAIR accelerator facility will study antiproton annihilation reactions at antiproton beam momenta from 1.5 GeV/c up to 15 GeV/c. The PANDA homogeneous electromagnetic calorimeter has been designed to meet the physics goals of the PANDA experiment. The calorimeter consists of lead tungstate (PbWO4) crystals and ensures an efficient photon/electron detection

in a wide range of energy with a high resolution. In order to achieve the required energy resolution of the electromagnetic calorimeter, the individual crystal channels have to be calibrated and their radiation damage must be monitored and recovered. An optical fiber distribution system has been developed for the backward end-cap of the PANDA electromagnetic calorimeter. The optical prototype system provides light uniformity better than 95% which enable us to precisely calibrate the crystals. In this contribution, a description of the technical design and the performance of this prototype is presented.

HK 52.46 Do 16:30 Audimax Foyer

Ladder Assembly for the Silicon Tracking System of the CBM Experiment at FAIR — •Shaifali Mehta for the CBM-Collaboration — Universität Tübingen, Tübingen, Deutschland — GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Deutschland

In the CBM Experiment, the track reconstruction of the charged particles followed by the momentum measurements are carried out using the Silicon Tracking System (STS). The detector comprises of 896 detector modules, based on double- sided silicon microstrip sensors distributed on 8 tracking stations. The Stations are made from mechanical half units onto which carbon fibre detector ladders are mounted holding the modules. A concept tool has been designed to study the feasibility of the ladder assembly. The size of the tool has been chosen to mount two $6.2 \times 6.2\,\mathrm{cm}^2$ sensors on the ladder, one of the four sensor variants in the STS.
This work focuses on assembly and testing of the ladders with sensors. This way one can ensure that handling and gluing of sensors does not effect the performance of the detector system. The ladder structure, its components (sensors, micro-cables, read-out chips, front end boards) will be presented along with the assembly techniques in order to mount the modules with mechanical precision better than 100 μm.

HK 52.47 Do 16:30 Audimax Foyer

Entwicklung eines neuen Triggerdetektors für das Lintott-Spektrometer am S-DALINAC* — •Isabelle Brandherm, Maxim Singer und Peter von Neumann-Cosel — Institut für Kernphysik, TU Darmstadt

Das Lintott-Spektrometer ist ein hochauflösendes Elektronenspektrometer für (e, e')-Experimente am S-DALINAC in Darmstadt. Das Detektorsystem besteht aus einem ortsaufgelösten Siliziumstreifenzähler, sowie einem Triggerdetektor [1]. Dabei liefert der Triggerdetektor das Startsignal für die Auslese der Siliziumstreifen. Um das Signal-Untergrund-Verhältnis zu verbessern, wurde dieser neu entwickelt. Er besteht jetzt aus zwei hintereinander angeordneten Szintillatoren, sowie einem Tscherenkow-Detektor. Das Triggersignal wird durch eine Dreifachkoinzidenzschaltung zwischen den einzelnen Detektoren erzeugt. Ein mögliches Tracking der Elektronenbahnen durch eine ortsauflösende Messung mit den beiden Szintillatoren wird diskutiert.
[1] A. Lenhardt et al., NIM A 562,320 (2006).
Gefördert durch die DPG im Rahmen des SFB 1245.

HK 52.48 Do 16:30 Audimax Foyer

Entwicklung eines neuen Datenaufnahmesystems für das Lintott-Spektrometer am S-DALINAC * — •Maxim Singer, Adrian Brauch, Michaela Hilcker, Peter von Neumann-Cosel und Maximilian Spall — Institut für Kernphysik, TU Darmstadt

Am supraleitenden Elektronenbeschleuniger S-DALINAC wurde für das hochauflösende Lintott-Magnetspektrometer ein neues Datenaufnahmesystem für Elektronenstreuexperimente entwickelt. Das Detektorsystem des Spektrometers besteht aus einem ortsauflösenden Siliziumstreifendetektor und einem Triggerdetektor[1]. In dem neu entwickelten Datenaufnahmesystem werden die analogen Spannungssignale der einzelnen Siliziumstreifenmodule mit Hilfe eines Flash ADCs digitalisiert und erlauben nun eine flexible Online-Analyse von (e,e')-Events. Gezeigt wird das Konzept der Datenaufnahme, sowie das speziell darauf zugeschnittene Online-Monitoring-Programm Lintomon. Die Funktionsfähigkeit und mögliche Erweiterungen des Systems werden anhand von Messergebnissen aus einer aktuellen Strahlzeit diskutiert.
[1] A. Lenhardt et al., NIM A 562, 320 (2006).
* Gefördert durch die DFG im Rahmen des SFB 1245.

HK 52.49 Do 16:30 Audimax Foyer

Design and Performance of the Jet Target for MAGIX at MESA — •S. Grieser, P. Brand, D. Bonaventura, C. Hargens, and A. Khoukaz — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, 48149 Münster, Germany

The future electron accelerator MESA (Mainz Energy-recovering Superconducting Accelerator) at the University of Mainz will focus on low energy measurements with high precision to verify the Standard Model of particle physics. For the MAGIX experiment (MESA Gas Internal target eXperiment) MESA will provide a beam with energies up to 105 MeV with a beam current of 1 mA in the energy-recovering sector, allowing high luminosities of 10^{35} $1/\mathrm{cm}^2\mathrm{s}$. Essential for the experiment is the jet target with highest thicknesses of 10^{19} atoms/cm^2 directly behind the nozzle which was designed, built up and set successfully into operation at the University of Münster. To realise this high thickness in combination with good vacuum conditions, the target will be operated at low temperatures in the cluster mode where a well defined beam leaves the nozzle. Therefore, investigations and measurements with a Mach-Zehnder interferometer and with different nozzle geometries and stagnation conditions were made to improve the performance of the target. The nozzles originate from an improved production process developed at the University of Münster. Additionally, first successful beam times at MAMI (MAinz MIcrotron) were performed. The production line of nozzles, the target design and the studies on the cluster beam will be presented and discussed.

HK 52.50 Do 16:30 Audimax Foyer

GEM Tracking Detectors for the NA64 Experiment at CERN — •Michael Hösgen, Markus Ball, and Bernhard Ketzer — Universität Bonn, Helmholtz-Institut für Strahlen- und Kernphysik, Bonn, Germany

The NA64 experiment conducts rare–event searches at the SPS of CERN. The poster will present the triple GEM tracking detectors with 2D strip readout that are part of the beam spectrometer of the NA64 experiment.

In 2016 and 2017 separate dedicated searches for two mediators between standard model and dark sector, a new light vector boson A' and a new short-lived neutral boson X, were performed. The event selection process of both searches includes the clean identification of the incident 100 GeV beam electrons, which is achieved with a magnetic spectrometer. As tracking detectors $8 \times 8\,\mathrm{cm}^2$ Micromegas and $10 \times 10\,\mathrm{cm}^2$ triple Gas Electron Multiplier (GEM) detectors are used.

I document the manufacturing of two GEM detectors starting from the design, to the production and quality assurance of the components and the calibration of the full detectors. I will present the performance at the SPS at CERN and discuss possible improvements.

HK 52.51 Do 16:30 Audimax Foyer

Characterization of ultra-nanocrystalline diamond films as reflector for ultra-cold neutrons — Hadwig Sternschulte[1,2], Stephan Wlokka[2], •Andreas Frei[2], Peter Geltenbort[3], and Stefan Wenisch[2] — [1]Fakultät für Geistes- und Naturwissenschaften, Hochschule Augsburg, Germany — [2]Heinz Maier-Leibnitz Zentrum, Technische Universität München, Germany — [3]Institut Laue-Langevin, Grenoble, France

Diamond is an excellent reflector for ultra-cold neutrons (UCN) due to the high atom density in combination with a large bound coherent scattering length and low loss cross sections. As a material with high radiation hardness it is especially suitable for UCN reflectors close to a reactor core or a spallation target. Ultra-nanocrystalline diamond (UNCD) films have a very low surface roughness independent of the film thickness. They can be grown on various substrates with 3D geometries by chemical vapour deposition and are therefore promising candidates for UCN reflecting layers in superthermal sources for UCN, which are currently build up. UNCD films have so far not been used as UCN reflectors.

In this work we present the first measurements of the UCN storage properties of UNCD films. In a storage chamber made from stainless steel four side walls were covered with several μm thick UNCD films grown on 6" Si substrates. The experiments show a significant increase of the effective UCN storage time compared to the pure stainless steel chamber. The influence of the surface termination of the UNCD films on the effective UCN storage time will be discussed.

HK 52.52 Do 16:30 Audimax Foyer

Construction and Assembly of the First Barrel Slice for the Electromagnetic Calorimeter of the PANDA Experiment — •Markus Moritz, Hans-Georg Zaunick, and Kai-Thomas Brinkmann for the PANDA-Collaboration — II. Pysikalisches Institut, Justus Liebig Universität, Gießen

The first major assembly stage of the barrel part of the electromagnetic calorimeter (EMC) of the PANDA experiment at the future FAIR facil-

ity will be presented. This consists in the construction of the first of 16 slices of the EMC barrel. The full EMC will be composed of two endcaps and a barrel, consisting of more than 11.300 tapered PbWO4 crystals. Each scintillator module is read out via two large area avalanche photo diodes connected to custom made ASIC-preamplifiers. The construction of the first segment comprises a full length slice beam holding in total 18 module blocks. Each block consists of a matrix of 4x10 crystals. The assembly procedure of single detector modules, module blocks and the overall slice segment, respectively, will be highlighted. Test results of single components and fully assembled detector modules will be discussed and compared with earlier prototype in-beam and lab tests.

Supported by BMBF, GSI and HIC for FAIR.

HK 52.53 Do 16:30 Audimax Foyer

Research and Development for the PANDA Backward End-Cap of the Electromagnetic Calorimeter — Samer Ahmed[1,2], Luigi Capozza[1], Alaa Dbeyssi[1], Phillip Grasemann[1,2], Frank Maas[1,2,3], Javier Mateo Cardena[1], Oliver Noll[1,2], •David Rodriguez Pineiro[1], Sahra Wolff[1,2], Manuel Zambrana[1,2], and Iris Zimmermann[1,2] for the PANDA-Collaboration — [1]Helmholtz-Institut Mainz, Mainz, Germany — [2]Institute of Nuclear Physics, Mainz, Germany — [3]PRISMA Cluster of Excellence, Mainz, Germany

The PANDA experiment will be one of the key projects of the new accelerator facility FAIR in Darmstadt. With its mature detector system, it will be able to observe a variety of physical channels. Thus it will make a huge contribution to the understanding of the strong interaction. The electromagnetic process group (EMP) in Mainz is developing the backward end-cap (BWEC) of the electromagnetic calorimeter. For its construction various tests regarding mechanics have been carried out and are foreseen within the R&D framework. A full prototype of the moving support system was built and tested, comprising insertion rails and a movable trolley base. The rails were divided into two sections (fixed and removable in PANDA). A big change in the crystal support is being implemented making the detector more modular. FR4 holders in different configurations (fiber orientation and positioning) were tested. In addition, thermal studies using our current proto16 are being performed.

HK 52.54 Do 16:30 Audimax Foyer

Study of pedestals and noise of an IROC prototype for the upgrade of the ALICE TPC — •Hendrik Schulte for the ALICE-Collaboration — Institut für Kernphysik, Goethe Universität Frankfurt

In the LHC Run 3 period (2021 and beyond) the collision rate in Pb–Pb will be increased to 50 kHz. To cope with this data rate, the Time Projection Chamber (TPC) of ALICE will be upgraded with a GEM-based readout system for continous readout. In the course of that, also the front-end electronics will be replaced.

The requirements to this new readout system are stable pedestal values and a noise level of around 1 ADC value. In May 2017, a test beam campaign at the CERN Proton Synchroton was performed, employing a pre-production Inner Readoutchamber (IROC) module of the final design.The detector is equipped with advanced prototypes of the new Front-End Cards (FECs), employing the newly developed SAMPA readout chip. The aim of this test is to demonstrate that the readout requirements are fulfilled in a realistic setup, and finally to verify the PID performance of the system using pion and electron beams.

This poster shows investigations on pedestal and noise values in data from the beam test in May 2017.

HK 52.55 Do 16:30 Audimax Foyer

Nachweis hochenergetischer Strahlung im CALIFA-Detektor — Roman Gernhäuser, Benjamin Heiss, •Philipp Klenze, Patrick Remmels und Felix Stark — Physik Department, Technische Universität München

Das CALIFA Kalorimeter mit seinen etwa 2600 Szintillationskristallen ist eine der wesentlichen Komponenten des R^3B-Experiments. Neben geladenen Teilchen wie Protonen wird es vor allem auch Gammastrahlen nachweisen.

Am Tandembeschleuniger des *Campus Tecnológico e Nuclear* (CTN) der Universität Lissabon wurde ein Experiment zur Charakterisierung der Barrelsegmente von CALIFA durchgeführt. In einer $^{27}\mathrm{Al}(\mathrm{p},\gamma)^{28}\mathrm{Si}$ Reaktion bei Strahlenergien von $2.2 - 3.1$ MeV wurden selektiv hochangeregte Zustände in ^{28}Si bevölkert. Dank des hohen Q-Wertes der Reaktion von 11.6 MeV konnten Gammas mit einer Energie von über 10 MeV nachgewiesen werden.

Der vorliegende Beitrag wird sich primär mit Methoden der Clusterbildung und zur Rekonstruktion der Gamma-Energien beschäftigen.

Gefördert durch BMBF (05P15WOFNA).

HK 52.56 Do 16:30 Audimax Foyer

Energy Calibration of the Münster Dual-Phase Xenon Time Projection Chamber — •Kevin Gauda and Henning Schulze Eissing — Institut für Kernphysik, WWU Münster

The Münster dual-phase xenon time projection chamber (TPC), an experiment of the Institut für Kernphysik in Münster, is designed according to the XENON100 TPC, which aimed for direct detection of dark matter. Due to its high atomic number, the self-shielding against gamma-rays and the high purity, liquid xenon is a very capable material for detectors in particle and astroparticle physics and specifically for dark matter direct detection experiments.

The Münster TPC contains a maximum of 2.6 kg pure liquid xenon in a highly reflecting polytetrafluoroethylene (PTFE) vessel and is equipped with 14 photomultipliers (PMTs). Its signals are analyzed by the processor for analyzing XENON (PAX), which was developed for XENON1T.

A deep understanding of the detector is necessary for any future scientific work. Therefore, the characterization of the TPC will be shown, i.e. the energy calibration with the radioactive sources Kr-83m and Cs-137. This includes the determination of the electron drift lifetime, light collection efficiency and light yield.

HK 52.57 Do 16:30 Audimax Foyer

A small-sized multi-purpose data-logging device — •Mario Engel, Philip Hauer, Philipp Bielefeldt, Markus Ball, and Bernhard Ketzer — Universität Bonn, Helmholtz-Institut für Strahlen- und Kernphysik, Bonn, Germany

For the operation of gaseous detectors it is crucial to monitor environmental parameters such as pressure and temperature. For the quality assurance of GEM-foils (HV-measurements) and in the process of gluing the relative humidity plays an important role. If GEM foils or detector parts are transported it is important to record possible external shocks which might damage the components. We have developed a compact multi-functional data-logging device that has the flexibility to fulfill all these numerous requirements. The micro-controller-based device consists of modules for each parameter (temperature, pressure, humidity, acceleration). The data can be stored on a compact microSD card if there is no access to the device (e.g. during transport). It is possible to send the data automatically via WiFi. The poster will present a first characterization of the device in terms of parameter measurements and power consumption.

HK 52.58 Do 16:30 Audimax Foyer

The A1 - Jet-Target-Project — •Stephan Aulenbacher — Institut für Kernphysik, Mainz, Deutschland

In the year 2017 a new target has been installed @A1 in Mainz. This target is a Cluster-Jet-Target, which means that a hydrogen jet streams through the vacuum chamber, perpendicular to Mamis electron beam. By cooling down to gas temperatures of 40 K, the gas jet gets high densities in the core, due to the formation of clusters. The Jet-Target enables high precision measurements due to its windowless design. This poster shows the details of the entire construction and the first performed measurements regarding the density profile of the jet and the cooling behavior of the system.

HK 52.59 Do 16:30 Audimax Foyer

A cosmics telescope for the compact GEM-TPC. — •wael alkakhi, markus ball, philipp bielefeldt, jonathan ottnad, dimitri schaab, and bernhard ketzer — Universtät Bonn, Helmholtz-Institut für Strahlen- und Kernphysik, Bonn, Germany

We are setting up a cosmic-ray triggering and tracking telescope for the characterization of a compact GEM-TPC. Such a TPC is currently being developed for a future upgrade of the CBELSA/TAPS experiment at the ELSA facility at Bonn. The setup consists of a trigger hodoscope made up of two planes of four scintillator panels, each read out on both sides by photomultiplier tubes, and four $10 \times 10\,\mathrm{cm}^2$ GEM (Gas Electron Multiplier) detectors with 2D strip readout on a movable platform. Applying a programmable trigger matrix to the hodoscopes, we make a coarse selection of cosmic tracks through the TPC. The GEM detectors deliver two space points on each side of the TPC and thus provide a precise external track reference for TPC resolution studies.

The poster will describe the setup, the characterization of the trigger hodoscope, and the status of the GEM detectors.

HK 52.60 Do 16:30 Audimax Foyer

Ray Optics Simulation of the KATRIN Rear Wall Illumination — •Benedikt Bieringer — Institut für Kernphysik, Münster, Deutschland

The KArlsruhe TRItium Neutrino (KATRIN) experiment is designed to measure the mass of the electron antineutrino from the shape of the tritium β-decay spectrum with a sensitivity of $0.2\,eV/c^2$ (90 % CL). An electrostatic spectrometer of MAC-E filter type is used for the analysis of the decay electrons generated in the Windowless Gaseous Tritium Source (WGTS). The decaying tritium produces a plasma inside the WGTS with a high conductivity along the magnetic flux lines inside the source. Electrons that are emitted in the backward direction (away from the spectrometer) or reflected from the spectrometer because of not passing the high energy filter are magnetically guided and absorbed in the so-called rear wall (a gold-plated stainless steel disc). To prevent a net positive charge of the plasma, the rear wall can be illuminated homogeneously with UV light to produce photoelectrons which neutralize the plasma. For this purpose, a broad light spectrum is generated from a xenon short-arc lamp and then filtered using two dichroic beam splitters. The remaining beam with wavelengths between approx. 200 and 260 nm is enlarged using a refracting telescope. This illumination setup was optimized using 3D ray-tracing simulations performed with COMSOL to investigate the homogeneity of the illumination, the total intensity of the illumination and the size of the setup. The optimization process of the rear wall illumination setup is presented. This work is supported under BMBF contract number 05A17PM3.

HK 52.61 Do 16:30 Audimax Foyer

Radiation Hardness of pcCVD Detectors and precise IC Calibration — •Steffen Schlemme[1,2], Mladen Kis[1], Chiara Nociforo[1], Fabio Schirru[1], Joachim Enders[2], P. Figuera[3], J. Frühauf[1], A. Kratz[1], N. Kurz[1], S. Löchner[1], A. Musumarra[3,4], S. Salamone[3], B. Szczepanczyk[1], M. Träger[1], and R. Visinka[1] — [1]GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany — [2]Schlossgartenstr. 9 — [3]LNS-INFN Catania, Italy — [4]University of Catania, Italy

A new in-flight separator Super-FRS is under construction at FAIR/Darmstadt. Ion rates up to 3×10^{11} ^{238}U/spill demand an adaptation of detectors to a high radiation environment. Test experiments to investigate the radiation hardness and absolute efficiency of single- (SC) and polycrystalline (PC) diamond detectors have been performed at the LNS-INFN in Catania using a ^{12}C beam at 62MeV/u and intensities of up to 1.5pnA. Counting efficiencies of 100% and 95% were found for the SC and PC respectively. While the SC showed a decrease in signal quality after 25KGy the signal quality of the PC did not show a significant decrease after 3.5MGy. Further the prototypes of an ionisation chamber (IC) and secondary electron monitor (SEM) designed for the use at the Super-FRS have been tested. Both detectors were operationable and a calibration of the IC and SEM using each the SC as reference achieved precisions of 1% and 5% respecively concluding that C is the far lower limit for a direct calibration of the SEM using the SC directly.

HK 52.62 Do 16:30 Audimax Foyer

Practical Approaches for Usage of Raspberry Pis in Slow Control Systems — •Maik Biroth, Patrick Achenbach, Werner Lauth, and Andreas Thomas for the A2-Collaboration — Institute for Nuclear Physics, Mainz

In nuclear physics single-board computers like Raspberry Pis are enjoying growing popularity for an usage in slow control applications based on a decentralized network infrastructure like EPICS. This work gives an overview of known everyday issues and approaches of detailed electronic solutions. Main topics are: How to convert NIM signals to the LVTTL level that they can be processed by the Raspberry Pi; how to build an uninterruptible power supply to avoid a corrupted file system after breakdown of the voltage; how to use an microcontroller as a front processor to reboot the computer if a software error leads to a crash of the network connection.

HK 52.63 Do 16:30 Audimax Foyer

The second step of the fission reaction. — Genevieve Mouze[1], Christian Ythier[1], Hong-Yin Han[2], and •Jean-Francois Comanducci[3] — [1]Universite de Nice, 06108 Nice cedex 2, France — [2]CIAE, Beijing , 102413, China — [3]LE-AIEA, 4, Quai Antoine Premier, 98000 Monaco

This rearrangement step begins by a collision between the bare 82-proton phase of the 208Pb core and the charged cluster. A proof is furnished by the symmetric fission of 258Fm. There, the 132Sn product can be formed only by the fusion of the 50Ar cluster with the whole 82 proton phase, whereas the complementary product 126Sn comes from the 126 neutron phase. This rearrangement can occur only thanks to the intervention of a new boson field allowing not only a modification of the quark-constitution of core and cluster but also the sharing- out of the charge between the two products; and all that occurs within an extremely short time interval. The value, 0.17 yoctosecond, of this lifetime results from the uncertainty in the mass, neutron number and charge number, 4, about 2.4 and about 1.6 respectively, observed in transfer reactions and in fission. In the lighter nucleus 235U, due to confinement, the nucleons of the cluster are shared-out between p- and n- phases; its fission is asymmetric.

HK 52.64 Do 16:30 Audimax Foyer

The third step of the fission reaction — Genevieve Mouze[1], Christian Ythier[1], Hong-Yin Han[2], and •Jean-Francois Comanducci[3] — [1]Universite de Nice, 06108 Nice cedex 2, France — [2]CIAE, Beijing 102413, China — [3]LE-AIEA, 4, Quai Antoine Premier, 98000 Monaco

As in the emission of an alpha particle by a nucleus, the separation of the two nuclei from a fission- product pair involves a Coulomb barrier. The barrier- free fission of 258Fm was discovered in 2005 [1]; there, only two pairs, 126Sn- 132Sn and 128Sn- 130Sn, are emitted, the others are confined; and all nuclei lighter than 258Fm fission asymmetrically, due to the confinement. Even 252Cf, in which a single pair, 126In- 126In, could have been formed in the collision of its 44S cluster with the 82 p-phase, and which should have led to two products of A >126 and so could be the lighter nucleus fissioning symmetrically, still fissions asymmetrically because 126In- 126In is confined. Thanks to the concept of confinement, a new fission barrier Bf can be taken into consideration, and defined as the difference between the Coulomb barrier Bc and the fission energy Q, where Bc has to be corrected for the sphericity of the involved fission products. [1] G. Mouze, Intern. Winter Meeting on Nuclear Physics, Bormio, Universita di Milano, 2005,p.250 .

HK 52.65 Do 16:30 Audimax Foyer

Where is inertia coming from ? — Christian Ythier[1] and •Jean-Francois Comanducci[2] — [1]Universite de Nice, 06108 Nice cedex 2, France — [2]LE- AIEA 4 Quai Antoine Premier, 98000 Monaco

Newtons experiment with a vessel shows how much he wished to find an explanation of the centrifugal force. The body in rotation was water; each part, even the smallest, of the water has the property of withstanding the centripetal force; so, the cause of inertia lies in the elementary particles. Electrons and quarks have a rest mass, but can it be represented by Einsteins equation, that contains a frequency? Indeed, how can an electron at rest vibrate or rotate? According to Zisman, or Feynman, electrons can move along the time axis. In the time, why do they not rotate perpendicularly to the 3D-space? It could be the cause of inertia! The same could hold for each of the three quarks of a proton or neutron, as it has an angular frequency. So we propose that matter, because it is made of electrons and quarks, is submitted to centripetal forces and for this reason has inertia and mass. We mention some consequences of this new idea.

HK 53: Mitgliederversammlung

Zeit: Donnerstag 19:00–20:00 Raum: HZO 50

Dauer 60 Minuten

HK 54: Hauptvorträge III

Zeit: Freitag 11:00–12:30 Raum: Audimax

Hauptvortrag HK 54.1 Fr 11:00 Audimax

The Origin of the Elements: Studying Stellar Reactions in the Laboratory — •Claudia Lederer-Woods — School of Physics and Astronomy, University of Edinburgh, Edinburgh, UK

The evolution of the universe has left an imprint in the form of the chemical elements. The abundances of elements we see in our solar system, distant stars, meteorites, and in stellar explosions provide us with clues about how the elements came to be produced in a variety of different processes and stellar environments. Dramatic progress has been made in Astronomy from detailed observations of chemical abundances in individual stars, to the first observation of neutron star mergers, which are a prime candidate for heavy element production. This has provided a challenge to nuclear physicists to provide similarly detailed information on the reactions and properties of key nuclei responsible for the formation of these elements. I will talk about stellar nucleosynthesis, recent nuclear reaction studies and their relevance to our understanding of the origin of the elements.

Hauptvortrag HK 54.2 Fr 11:30 Audimax

Accelerator mass spectrometry for a wide range of applications: from climate studies to geology and nuclear astrophysics — •Markus Schiffer — Institute for Nuclear Physics, University of Cologne, Germany

CologneAMS is a new centre for accelerator mass spectrometry (AMS) at the University of Cologne dedicated for measurements of cosmogenic nuclides. It was funded by the German Research Foundation (DFG) to improve the experimental measurement capabilities, especially for those German scientists which apply the high sensitivity of the AMS technique for their scientific research in the fields of geoscience, environmental physics and nuclear astrophysics.

The status of the facility will be presented as well as examples of projects by the University of Cologne, from climate studies, erosion, exposure and burial dating to nuclear waste management. The development of a new AMS setup at the 10 MV FN accelerator opens the field of research to nuclear astrophysics, as for instance the search for ^{60}Fe and ^{244}Pu in lake sediment drilling cores with respect to astrophysical models.

Hauptvortrag HK 54.3 Fr 12:00 Audimax

New Phenomena in Gamma-Ray Strength Functions — •Ronald Schwengner — Helmholtz-Zentrum Dresden-Rossendorf

The excitation and deexcitation of atomic nuclei by electromagnetic radiation are fundamental processes in reactions of this many-body quantum system. At high excitation energy and high level density, statistical models are applied to describe reaction rates, which use γ-ray strength functions (γSF) to describe the average transition probabilities in a certain range of excitation energy. The experimental determination and the theoretical understanding of the properties of γSF are important for the accurate description of photonuclear reactions and radiative-capture reactions, which play a central role in the synthesis of the elements in various stellar environments.

We report photon-scattering experiments using bremsstrahlung at the γELBE facility (HZDR) and quasi-monoenergetic, polarized γ beams at the HIγS facility (TUNL, Duke Univ., Durham, USA). Systematic studies of the dipole strength revealed new phenomena that are not described by the analytical approximations currently used in reaction codes. The (γ,γ') experiments at high energy show considerable contributions to the γSF from the quasicontinuum of states. Combined with (γ,n) cross sections, the (γ,γ') data provide experimental input γSF for statistical reaction codes.

The experimental studies are complemented by theoretical investigations. Enhancements of γSF at low energy are described on the basis of statistics of transitions from large-scale shell-model calculations.

HK 55: Hadron Structure and Spectroscopy IX

Zeit: Freitag 14:00–15:45 Raum: HZO 50

Gruppenbericht HK 55.1 Fr 14:00 HZO 50

Measurements of Meson Transition Form Factors — •Susan Schadmand — Forschungszentrum Jülich

This talk will give an experimental overview of the electromagnetic transition form factors of light mesons. In particular, the results from WASA-at-COSY and CLAS6 are presented. At Forschungszentrum Jülich, π^0 and η mesons were produced in proton-proton reactions at the COSY accelerator where the WASA detector was used to detect all final-state particles. At Jefferson Lab, the g12 experimental run used a tagged photon beam on protons to produce mesons up to the ϕ meson where the CLAS6 detector recorded charged particles including final states with dileptons.

HK 55.2 Fr 14:30 HZO 50

Feasability Studies for a FAIR Phase-0 Project at MAMI — S. Ahmed[1,2], L. Capozza[1], A. Dbeyssi[1], P. Grasemann[1,2], F. Maas[1,2,3], O. Noll[1,2], D. Rodriguez Pineiro[1], •S. Wolff[1,2], M. Zambrana[1,2], and I. Zimmermann[1,2] — [1]Helmholtz-Institut Mainz, Mainz, Germany — [2]Institute of Nuclear Physics, Mainz, Germany — [3]PRISMA Cluster of Excellence, Mainz, Germany

Within the FAIR phase-0 project, the use of FAIR equipment at other facilities before the completion of the civil construction is envisaged. The PANDA EMC is a good candidate for FAIR phase-0, due to the advanced state of its development. In particular, the backward endcap (BWEC) of the PANDA EMC, which is developed and built at HIM in Mainz, could be ready by 2020, three years before its foreseen installation. Therefore, possible experiments at the MAMI electron beam facility making use of the BWEC are under consideration.
One candidate is the measurement of the π_0 electromagnetic transition form factor via the electroproduction on a nuclear Coulomb field. To select this channel, the momentum distribution of the π_0 needs to be measured by detecting the decay γ particles in an EMC.
Since the relevant γs are emitted at forward angles, where high particle fluxes are expected, the affordable luminosity is limited by the maximum event rate of the detector. Therefore, the total event rate at different scattering angles with various targets need to be determined. Monte Carlo simulations are ongoing and a beam test with a prototype calorimeter was scheduled for January 2018 in order to address these questions. The status of these feasibility studies will be presented.

HK 55.3 Fr 14:45 HZO 50

The ^{3}Heη final state in dp fusion at the magnetic spectrometer ANKE — •Christopher Fritzsch and Alfons Khoukaz for the ANKE-Collaboration — Westfälische Wilhelms-Universität, Münster, Germany

Total and differential cross sections of the reaction $d+p \to {}^3\mathrm{He}+\eta$ are of special interest since they differ strongly from a pure phase space behavior near threshold. The observation of the asymmetry factor α of the differential cross sections show a distinct effect of an s- and p-wave interference, caused by a rapid variation of the relative phase. These observations are an indication for an unexpected strong final state interaction between the ^{3}He nuclei and the η mesons which could lead to a quasi bound state of the ^{3}Heη system. Current investigations on high precision data of the internal fixed target experiment ANKE of the storage ring COSY enable the extraction of additional total and differential cross sections for the η production up to an excess energy of $Q = 15\,\mathrm{MeV}$. These cross sections with significantly improved accuracy will allow to study the behavior of the asymmetry factor α with high resolution. Recent results will be presented and discussed.

*This work has been supported by the COSY-FFE program of the Forschungszentrum Jülich and the Deutsche Forschungsgemeinschaft (DFG) through the Research Training Group "GRK 2149: Strong and Weak Interactions - from Hadrons to Dark Matter".

HK 55.4 Fr 15:00 HZO 50

Pion Double Parton Distribution within Chiral Quark Soliton Model — •Asli Tandogan — Ruhr University Bochum

The importance of double parton scattering is being revised with the appearance and expectations in the near future of experimental results on multiple hard scattering at LHC. DPDs' contribition increases when momentum fractions x_1 and x_2 of two partons coming from the same hadron become small. In our study we consider pion double parton distribution within the chiral quark soliton model. The leading diagram of pion DPD in the model is vanishing which sugggests that quark interaction due to goldstone boson exchange is important to describe the correlations in double parton distributions. In this talk, we present our investigation of the subleading terms in large N_c limit.

HK 55.5 Fr 15:15 HZO 50

The search for symmetry violating η decays — •Cristina Collicott for the A2-Collaboration — Johannes Gutenberg University, Mainz, Germany

A continued interest in forbidden decay modes of light mesons comes from the idea that there are mechanisms which would allow a violation of the standard law of physics at a very small level. The experimental challenge for such kind of physics is mostly in the accumulated experimental statistics needed for those mesons to reach the necessary sensitivity in searching for such violations. The A2 Collaboration at the Mainz Microtron, MAMI, has collected 6.2×10^7 η mesons, produced via the $\gamma p \to \eta p$ reaction. This large statistics data set allows further improvement of the existing upper limits for branching ratio (BR) of several forbidden decays of the η meson into neutral final states.

New results for the CP violating decay mode, $\eta \to 4\pi^0$ and, for the C violating decay modes, $\eta \to 3\gamma$ and $\eta \to \pi^0\gamma$ will be presented.

HK 55.6 Fr 15:30 HZO 50

The quest for chiral symmetry restoration - experimental determination of meson-nucleus potentials and the search for meson-nucleus bound states — •Volker Metag[1], Mariana Nanova[1], and Eduard Paryev[2] — [1]II. Physikalisches Institut, Universität Giessen, Deutschland — [2]Russian Academy of Sciences, Moscow, Russia

Assuming a partial restoration of chiral symmetry in a nuclear medium, chiral model calculations predict modifications of meson properties within nuclei. An overview will be given on current experiments studying in-medium properties of mesons and the meson-nucleus interaction to extract meson-nucleus potentials [1]. The real part of the meson nucleus potential describes whether the interaction is attractive or repulsive causing a lowering or increase of the meson in-medium mass, respectively, while the imaginary part is a measure for the meson absorption in nuclei. The real part of the potential can be determined by comparing measured meson momentum distributions or excitation functions with collision model or transport model calculations. The imaginary part is extracted from transparency ratio measurements. Results on $K^+, K^0, K^-, \eta, \eta', \omega$ and ϕ mesons turn out to be largely consistent with chiral model predictions. The criteria and chances for observing meson-nucleus bound states will be discussed. The most promising candidates appear to be the K^-, η and η' meson.

[1] V. Metag, M. Nanova, E. Ya. Paryev, Prog. Part. Nucl. Phys. 97 (2017) 199

HK 56: Heavy Ion Collisions and QCD Phases IX

Zeit: Freitag 14:00–15:30 Raum: HZO 60

Gruppenbericht HK 56.1 Fr 14:00 HZO 60

Hard probe measurements with the ALICE detector in Tübingen — •Martin Völkl for the ALICE-Collaboration — Universität Tübingen

Hard probes are useful tools in the investigation of QCD effects. In heavy-ion collisions they are produced almost exclusively at the early times of the interaction and their production cross section is accessible to perturbative calculations. The investigations in Tübingen currently focus on the measurement of beauty quarks and the identified fragmentation functions of jets. Both provide complementary information: The single particle measurement answers the questions about the exchange of energy of a hard parton with the system, while the measurement of fragmentation functions provides information about how the energy of the original parton appears in the final state. This provides an insight into whether the particle production in jets is modified in p–Pb collisions via cold-nuclear-matter effects or how beauty quarks participate in the collective expansion of the system in Pb–Pb collisions. In this report, the current status and results of the analyses will be presented.

HK 56.2 Fr 14:30 HZO 60

Transport coefficients in a generalized quasiparticle model — •Thorsten Steinert — Institut für Theoretische Physik, JLU Giessen, 35392 Giessen, Germany

The QCD equation of state as predicted by lattice QCD calculations (lQCD) is well reproduced in terms of effective quasiparticle models. We present a generalised quasiparticle model where the partonic propagators explicitly depend on the three-momentum with respect to the medium. Within this extended model we reproduce simultaneously the equation of state and the susceptibilties as provided by lQCD. We calculate the shear and bulk viscosity as well as the electric conductivity and compared them to default quasiparticle models and available lattice data. We discuss the behavior of the transport coefficients as a function of finite chemical potential.

HK 56.3 Fr 14:45 HZO 60

Electric conductivity of a hadron gas — •Jan Hammelmann[1,2], Juan Torres-Rincon[4], Jean-Bernard Rose[1,2], Moritz Greif[2], and Hannah Petersen[1,2,3] — [1]Frankfurt Institute for Advanced Studies, D-60438 Frankfurt am Main, Germany — [2]Institut für Theoretische Physik, Goethe-Universität, D-60438 Frankfurt am Main, Germany — [3]GSI Helmholtzzentrum für Schwerionenforschung GmbH, D-64291 Darmstadt, Germany — [4]Department of Physics and Astronomy, Stony Brook University, US-11794 Stony Brook, USA

The electric conductivity of a hadron gas is calculated within the hadronic transport approach SMASH (Simulating Many Accelerated Strongly-interacting Hadrons). Microscopic non-equilibrium models are well suited to calculate transport coefficitents that synthesize the information on the many-particle dynamics. The temperature dependence of the electric conductivity is extracted using the Green-Kubo formalism for $T \sim 100 - 200$ MeV. The results for the electric conductivity show good agreement compared to analytic results from literature [Phys.Rev.D 93, 096012 (2016)] for systems with small number of particle species and simple interactions. Furthermore, the influence of a finite lifetime of resonances on the electric conductivity is investigated. After validating the approuch results for the electric conductivity of a more realistic hadron gas including more particle species are presented.

HK 56.4 Fr 15:00 HZO 60

Jet-hadron correlations in Pb–Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 5.02$ TeV — •Jiyoung Kim for the ALICE-Collaboration — Physikalisches Institut, Universität Heidelberg

A Large Ion Collider Experiment (ALICE) is dedicated to study properties of Quark Gluon Plasma (QGP), which is created in ultra relativistic heavy ion collision. Jets are used as a probe to explore the strong-interacting matter, since they interact with the QGP and lose a part of their energy while passing through the medium. A quantitative understanding of the mechanisms of energy loss and the interaction of parton and medium is not yet established. Model calculations suggest the formation of Mach cones as a result of the interaction between high energetic partons and the QGP.

We present an analysis of azimuthal correlations of inclusive hadrons and identified protons with respect to the axis of charged jets in Pb–Pb collisions at $\sqrt{s_{\mathrm{NN}}} = 5.02$ TeV with the ALICE detector. Jet-hadron correlations allow to study medium response including the Mach cone effect. Moreover, Jet-proton correlations allow to disentangle signals from the medium and from jet fragmentation by using different proton abundances in both cases. We present correlation functions fully corrected for acceptance and tracking efficiency.

This work is supported by BMBF and HGS-HIRe.

HK 56.5 Fr 15:15 HZO 60

Reconstruction of short lived particle spectra with KF

Particle Finder — •Maksym Zyzak[1], Ivan Kisel[1,2,3], Pavel Kisel[1,3,4], and Iouri Vassiliev[1] for the CBM-Collaboration — [1]GSI Helmholtzzentrum für Schwerionenforschung — [2]Frankfurt Institute for Advanced Studies — [3]Goethe-Universität Frankfurt — [4]Joint Institute for Nuclear Research

Short-lived particles that have very small production probability or small branching ratio are of particular interest in the future heavy-ion experiment CBM at FAIR. Such particles can be reconstructed and investigated only through their decay products. The KF Particle Finder package was developed for reconstruction of short-lived particles in the CBM experiment. Currently its reconstruction scheme contains more than 100 decay channels.

Large multiplicities of charged particles produced in heavy ion collisions lead to combinatorial background in the reconstructed spectra of short-lived particles. KF Particle Finder provides the machinery to correctly take into account the background and obtain the signal spectra. It allows to collect efficiency plots, extract efficiency corrected spectra and perform their multi-differential analysis. The rich functionality of KF Particle Finder makes it a universal platform for physics analysis.

HK 57: Heavy Ion Collisions and QCD Phases X

Zeit: Freitag 14:00–15:30 Raum: HZO 80

Gruppenbericht HK 57.1 Fr 14:00 HZO 80

Collective flow and correlations measurements with HADES in Au+Au collisions at 1.23 AGeV — •Behruz Kardan — Goethe-Universität, Frankfurt am Main

HADES provides a large acceptance combined with a high mass-resolution and therefore allows to study dielectron and hadron production in heavy-ion collisions with unprecedented precision. With the high statistics of seven billion Au-Au collisions at 1.23 AGeV, the investigation of collective effects and particle correlations is possible with so far unprecedented accuracy. At low energies v1 and v2, related to directed and elliptic flow, have been measured at the BEVALAC and SIS18, but so far high-order harmonics have not been studied. They allow to characterize the properties of the dense hadronic medium produced in these collisions, such as its viscosity, and provide thus an important reference to measurements at higher energies. We will present data on higher-order flow harmonics (v3 and v4) of protons and first results on multi-particle azimuthal correlation analyses. Furthermore, data on directed and elliptic flow of light nuclei will be shown. Information on radial flow can be obtained from the analysis of pion HBT-correlations, deuteron coalescence and transverse momentum spectra of identified particles. We will present new results on these observables extracted from the HADES data and discuss their correlations. From these a consistent picture emerges which provides strong evidence for a substantial radial expansion already at these low beam energies.

Supported by BMBF (05P15RFFCA), HGS-HIRe and H-QM.

HK 57.2 Fr 14:30 HZO 80

Performance for anisotropic flow measurements of the future CBM experiment at FAIR — •Viktor Klochkov[1,2] and Ilya Selyuzhenkov[1,3] for the CBM-Collaboration — [1]GSI Helmholtzzentrum für Schwerionenforschung, Planckstraße 1, Darmstadt, Germany — [2]Goethe University Frankfurt, Max-von-Laue-Straße 1, Frankfurt am Main, Germany — [3]National Research Nuclear University MEPhI (Moscow Engineering Physics Institute), Kashirskoe highway 31, Moscow, 115409, Russia

The Compressed Baryonic Matter experiment (CBM) at FAIR aims to study the area of the QCD phase diagram at high net baryon densities and moderate temperatures using collisions of heavy ions at center-of-mass energies of a few GeV per nucleon. Anisotropic transverse flow is among the key observables to study the properties of matter created in such collisions.

The CBM performance for anisotropic flow measurements is studied with Monte-Carlo simulations using gold ions at SIS-100 energies with lab momentum of 2-10 AGeV employing different heavy-ion event generators. Various combinations of CBM detector subsystems are used to investigate the possible systematic biases in flow measurement and to study effects of detector azimuthal non-uniformity. The resulting performance of CBM for flow measurements is demonstrated for different harmonics of identified charged hadron anisotropic flow as a function of rapidity and transverse momentum in different centrality classes.

HK 57.3 Fr 14:45 HZO 80

Magnetic fields and charm quarks in heavy-ion collisions — •Andrea Dubla for the ALICE-Collaboration — GSI Helmholtz Center for Heavy Ion Research

Under extreme conditions of high temperature and pressure, Quantum Chromodynamics predicts the formation of a new state of matter, the so-called Quark-Gluon Plasma (QGP). Heavy-ion collisions at ultra-relativistic energies at the Large Hadron Collider produce the optimal conditions to form the QGP in the laboratory. The hot QCD matter is produced within an unprecedented strong magnetic field, which properties and effects have not been yet fully explored. The magnetic field is early created in heavy-ion collisions by the charged spectator nucleons from the incident nuclei that do not participate in the collision. The charm quark is an ideal candidate to probe the properties of this magnetic field, because its formation time scale is comparable to the time scale when the magnetic field attains its maximum value and in addition the kinetic relaxation time of charm is similar to the QGP lifetime. Measuring the directed flow of D mesons will give access to early time dynamics, which are the least understood till now. The progress and status of the measurement of the D meson directed flow will be shown. This measurement could be the first observation of an effect of the magnetic fields produced in heavy-ion collisions, which will shed light on fundamental and unexplored proprieties of the QGP (e.g. conductivity and initial density) and it will allow to constrain theoretical models.

HK 57.4 Fr 15:00 HZO 80

Effects of late stage hadronic rescattering with SMASH — •Jean-Bernard Rose[1,2], Sangwook Ryu[1], Jan Staudenmaier[1,2], and Hannah Petersen[1,2,3] — [1]Frankfurt Institute for Advanced Studies, Ruth-Moufang-Strasse 1, Frankfurt am Main, 60438, Germany — [2]Institute for Theoretical Physics, Goethe University, Max-von-Laue-Strasse 1, 60438 Frankfurt am Main, Germany — [3]GSI Helmholtzzentrum für Schwerionenforschung, Planckstr. 1, 64291 Darmstadt, Germany

Transport models are often being used to simulate the hadronic rescattering (or so-called afterburners) that is thought to happen at late stages of heavy ion collisions at RHIC and the LHC. In this work we use a new transport model, SMASH (Simulating Many Accelerated Strongly interacting Hadrons), to investigate the specific effects of including such an afterburner on hadronic observables. Amongst others, we notably present results for yields, elliptic flow and mean-p_T, with and without SMASH. Effects of using Cooper-Frye sampling algorithms that conserve quantum numbers (strangeness, baryon number and charge, specifically) and energy-momentum on an event-by-event basis are also investigated.

HK 57.5 Fr 15:15 HZO 80

Two-Pion Intensity Interferometry for Imaging Collisions of Au+Au at 1.23A GeV with HADES — •Robert Greifenhagen[1,2] and Roland Kotte[1] for the HADES-Collaboration — [1]Helmholtz-Zentrum Dresden-Rossendorf — [2]Technische Universität Dresden

We present first results on identical pion intensity interferometry (HBT) to study space-time features of collisions of Au+Au at 1.23A GeV. The data are taken with the HADES set-up at SIS18/GSI Darmstadt. Our data allow access to the dependence of the pion emitting source on both the pair transverse momentum and the collision centrality. Comparing our femtoscopic results at $\sqrt{(}s_{NN}) = 2.4$ GeV to similar results achieved for heavy-ion collisions in a broad band of beam energies we see a very smooth evolution of the source parameters.

HK 58: Structure and Dynamics of Nuclei X

Zeit: Freitag 14:00–15:30 Raum: HZO 70

Gruppenbericht HK 58.1 Fr 14:00 HZO 70

Level densities and broken axial symmetry in stable heavy nuclei — •Eckart Grosse[1] and Arnd R. Junghans[2] — [1]Institute of Nuclear and Particle Physics, Technische Univ. Dresden, 01062 Dresden, Germany — [2]Institute of Radiation Physics, Helmholtz-Zentrum Dresden-Rossendorf, 01314 Dresden, Germany

From spectroscopic information for (especially odd) heavy nuclei and from multiple Coulomb excitation more and more hints on broken axial symmetry in nuclei also in the valley of stability have been found. But in quasi all prescriptions for the prediction of level densities axial symmetry is assumed ad hoc and thus it is important to investigate the consequence of symmetry breaking, e.g. by a tri-axial Fermi gas model like the TLO used for IVGDR shapes [EPJA 53(2017)225].

For excitation energies above 20 MeV a comparison of state densities from the Fermi gas approach to those extracted from combinatorial considerations indicates discrepancies which cannot be removed by a modification of the back-shift energy, but by the use of a reduced 'level density' parameter â, in accordance to nuclear matter studies.

At low energy a test using the accurately determined spacings of neutron capture resonances indicates a similar result, but for even targets only spin 1/2 states are populated for which the a spin cut-off is unimportant. Using recent results from measurements at the Oslo cyclotron the non-axial Fermi gas model proposed is verified now also for higher spin values in variously deformed nuclei.

HK 58.2 Fr 14:30 HZO 70

Quadrupole and octupole collectivity in doubly-magic ^{132}Sn — •D. Rosiak and P. Reiter for the MINIBALL IS551 and HIE-ISOLDE-Collaboration — IKP, Universität zu Köln

The vibrational first 2_1^+ and 3_1^- states of the doubly-magic nucleus ^{132}Sn were excited via safe Coulomb excitation (CE) employing the recently commissioned HIE-ISOLDE accelerator at CERN in conjunction with the highly efficient MINIBALL array. The ^{132}Sn ions were accelerated to an energy of 5.5 MeV/nucleon and impinged on a ^{206}Pb target. Dexciting γ rays from the first excited states of the target and the projectile nucleus were recorded in coincidence with scattered particles. The optimized beam energy, the high-energy resolution and good efficiency of the HPGe spectrometer provide a beneficial combination to master the challenging measurement characterized by small CE cross sections and excitation energies above 4 MeV. The reduced transition strengths were determined for $0^+_{\text{g.s.}} \rightarrow 2_1^+$, $0^+_{\text{g.s.}} \rightarrow 3_1^-$, and $2_1^+ \rightarrow 3_1^-$ in ^{132}Sn. In the past first preliminary results for the B(E2;$0^+_{\text{g.s.}} \rightarrow 2_1^+$) value were obtained with an efficient BaF2 array at ORNL [1]. The results on excited collective states in ^{132}Sn provide crucial information on cross shell configurations that are expected to be dominated by a strong proton contribution. State-of-the-art large-scale shell model calculations and new mean field predictions are compared to the results. [1] R.L. Varner, et al., Eur. Phys. J. A 25, s01, 391 (2005). Supported by the German BMBF 05P12PKFNE and 05P15PKFN9.

HK 58.3 Fr 14:45 HZO 70

Spektroskopische Analyse von ^{146}Nd über (n,$\gamma\gamma$)-Messung — •Martin von Tresckow für die 146Nd-FIPPS-Kollaboration — Institut für Kernphysik, TU Darmstadt

Kürzlich konnte in ^{144}Nd ein isovektorieller Oktupolzustand nachgewiesen werden [1], wodurch die Suche nach weiteren isovektoriellen Oktupolzuständen in dieser Region ausgeweitet wird.
In ^{146}Nd können zwei 3^--Zustände bei 2335 keV bzw. 2525 keV als potentielle Kandidaten für einen niederenergetischen isovektoriellen Oktupolzustand vorgeschlagen werden. Isovektorielle Oktupolzustände, sog. „mixed-symmetry" Zustände, werden durch das sdf-IBM 2 vorhergesagt und tragen einen wesentlichen Anteil zum Verständnis des Oktupolfreiheitsgrades in der Proton-Neutron-Wechselwirkung bei. Im bisherigen experimentellen Kenntnisstand fehlt der notwendige starke $M1$-Übergang von den oben genannten Kandidaten in den 3_1^--Zustand.
Zudem ist die Kenntnis der Levelstruktur von ^{146}Nd lückenhaft und nicht immer eindeutig. Diesbezüglich wurden in einer (n,$\gamma\gamma$)-Kampagne mit FIPPS am ILL experimentelle Daten gesammelt und ein verbessertes Levelschema ausgearbeitet.
* Gefördert durch die DFG (KR-1796/2-1/-2) und ILL.
[1] M. Thürauf; Dissertation (TU Darmstadt, 2016)

HK 58.4 Fr 15:00 HZO 70

208Pb — •Andreas Heusler — Gustav-Kirchhoff-Str. 7/1 69120 Heidelberg

Einer der interessantesten Kerne ist 208Pb. Er wird auf vielfätige Art angeregt: (1) Paarungsvibrationen, (2) tetraedrische Rotationen und Vibrationen, (3) dodekedrische Vibrationen, (4) Einteilchen-Einloch-Anregungen und (5) Mehrteilchen-Mehrloch-Anregungen im Schalenmodell. Dazu kommen Koppelungen der elementaren Anregungen (1)-(5). Es wird vor allem über neu entdeckte tetraedrischen Vibrationen berichtet, die bisher [1] noch nicht sicher nachgewiesen wurden.
[1] A. Heusler EPJ A 53:215 (2017)

HK 58.5 Fr 15:15 HZO 70

The first step of the fission reaction — Genevieve Mouze[1], Christian Ythier[1], Hong-yin Han[2], and •Jean-Francois Comanducci[3] — [1]Universite de Nice,06108 Nice cedex 2, France — [2]CIAE, Beijing , 102413, China — [3]LE-AIEA, 4, Quai Antoine Premier, 98000 Monaco

In the capture of a thermal neutron by 235U, the formation of a dual system made of a 28 neon cluster and a 208Pb core releases an internal energy of 59.46 MeV great enough for initiating the fission reaction. 238U fissions only with 1.5- MeV neutrons because the harmonic oscillator made of the 82 proton and 126 neutron phases of 208Pb must reach its four phonon level at about 51.47 MeV, the sum of neutron energy and internal energy in 30Ne- 209Pb. Now, according to a reinterpretation of the 1988 alpha- neutron coincidence experiment of ref [1], this level de-excites by two DGDRs, each of 26 MeV, enough for expelling either up to 3.25 neutrons or an alpha of 15.9 MeV on average. Moreover, 51.47 MeV is enough to cause a shifting of p- and n- phases and therefore a dramatic collision between charged cluster and bare 82-proton phase. [1] H. -Y. Han et al., IAEA Report INDC (NDS) -220, 113 (1989).

HK 59: Nuclear Astrophysics IV

Zeit: Freitag 14:00–15:30 Raum: HZO 100

HK 59.1 Fr 14:00 HZO 100

Bound-state beta-decay of bare 205Tl ions at the ESR — •Ragandeep S. Sidhu for the Bare 205Tl experiment at GSI-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany

In the present study we aim to determine the bound-state beta-decay rate of fully-ionized 205Tl, which is needed to determine the matrix element for the electron capture decay of the 2.3 keV excited state in 205Pb to the ground state of 205Tl. This matrix element is important for the determination of neutrino capture probability into the 2.3 keV state of 205Pb. In this talk, the production of bare 205Tl81+ from 206Pb beam, it's separation from contaminants, transmission, storage and beam preparation in the ESR, as well as detection of decay events and auxiliary calibration measurements will be discussed. [1]M.K. Pevicevic et al., Nucl. Instr. and Meth. A 621, 282 (2010). [2]J.B. Blake and D.N. Schramm, Astroph. J. 197, 615-629 (1975).

HK 59.2 Fr 14:15 HZO 100

Direct measurement of the ^{96}Ru(p,γ)^{97}Rh capture cross section — •Meiko Volknandt[1], Markus Reich[1], René Reifarth[1], Jan Glorius[2], Yuri Litvinov[2], Michael Wiescher[3], Joachim Goerres[3], and Edward Stech[3] — [1]Goethe Universität, Frankfurt, Germany — [2]GSI, Darmstadt, Germany — [3]University of Notre Dame, Notre Dame, USA

Comparing the solar abundances of ^{96}Ru to theoretical p-process calculations shows a large underproduction of the nucleus in the models. Therefore the nuclear data input needs to be constrained by experiments.

In 2015, a proof-of-principle experiment was performed at the experimental storage ring ESR at GSI, Darmstadt, where the reaction cross section of the reaction ^{96}Ru(p,γ)^{97}Rh has been measured in inverse kinematics at energies between 9 and 11 MeV.

To verify this method, an activation experiment was performed at the Instutute for Structure and Nuclear Astrophysics at Notre Dame, USA.

The ^{96}Ru(p,γ)^{97}Rh cross section has been directly measured at 3 MeV to compare with a previous activation experiment as well as between 9 and 11 MeV. An overview of the experiment as well as the preliminary results is presented.

Funded by the HGS-HIRe Abroad program.

HK 59.3 Fr 14:30 HZO 100

Neutroneneinfangquerschnitte von ^{85,87}Rb — •Franz Pfeifer[1], Bayarbadrakh Baramsai[2], Aaron Couture[2], Stefan Fiebiger[1], Charles Kelsey[2], Deniz Kurtulgil[1], Shea Mosby[2], René Reifarth[1], Gencho Rusev[2], John Ullmann[2], Mario Weigand[1] und Clemens Wolf[1] — [1]Goethe-Universität Frankfurt am Main, Deutschland — [2]Los Alamos National Laboratory, USA

Neutroneneinfänge und β-Zerfälle konkurieren während der Entstehung von Elementen schwerer als Eisen im langsamen Neutroneneinfangprozess (s-Prozess). Nahe des Verzweigungspunktes von ^{85}Kr werden die Neutroneneinfangquerschnitte von ^{85,87}Rb untersucht. Diese können wichtige Informationen zum ^{87}Rb/^{87}Sr-Cosmochronometer und somit zum Alter des Universums liefern.

Flugzeitmessungen an ^{nat}Rb in Form von RbCl und PVC für den ^{35,37}Cl-Untergrundabzug sind am Los Alamos National Laboratory (USA) durchgeführt worden. Ein 1/v-Neutronenenergiespektrum traf nach 20m auf das Target. Der das Target in 4π umgebende BaF_2-Detektor ist in der Lage mit hoher Effizienz Gammasstrahlung aus Zerfallskaskaden zu detektieren. Messdaten und erste Ergebnisse der Auswertung werden präsentiert.

Dieses Projekt wird durch EU-Projektmittel der Nummer 615126 gefördert.

HK 59.4 Fr 14:45 HZO 100

FLUKA simulations of the neutron flux in the Dresden Felsenkeller — •Marcel Grieger[1,2], Daniel Bemmerer[1], Thomas Hensel[1,2], Stefan E. Müller[1], and Kai Zuber[2] — [1]Helmholtz-Zentrum Dresden-Rossendorf — [2]Technische Universität Dresden

The Dresden Felsenkeller is a shallow-underground site featuring a rock overburden of 47 m which hosts a 5 MV Pelletron accelerator in tunnels VIII and IX. Using previous measurements in the low-background γ-counting facility in tunnel IV as a benchmark, a FLUKA simulation has been developed to predict the neutron flux in tunnels VIII and IX. The simulation results provide insight into local neutron field inhomogeneities caused by the measurement environment itself.

HK 59.5 Fr 15:00 HZO 100

Spectral neutron flux from 10 meV up to 100 MeV in the Dresden Felsenkeller — •Thomas Hensel[1,2], Daniel Bemmerer[1], Marcel Grieger[1,2], Stefan E. Müller[1], Tamás Szücs[1], and Kai Zuber[2] — [1]Helmholtz-Zentrum Dresden-Rossendorf — [2]Technische Universität Dresden

Neutron flux measurements with moderated ^{3}He proportional counters have been performed in three distinct laboratories of the underground site Felsenkeller. The six polyethylene moderators of a previous measurement have been complemented by a new moderator with a lead liner to provide information about the neutron flux above 10 MeV. The results quantify the shielding's influence on the neutron flux and inform the planning of future underground laboratories.

HK 59.6 Fr 15:15 HZO 100

Performance and testing of Ultra High Vacuum compatible silicon strip detectors at Gsi storage rings — •Laszlo Varga for the Uhv Si strip detectors-Collaboration — Gsi, Germany

In the nucleosynthesis of the so-called p nuclei radiative capture reactions like (p,γ) or (α,γ) play an important role to model the reaction network and to explain the stellar production yields in different explosive scenarios [1]. The storage rings at Gsi, the Experimental Storage Ring (Esr) and the Cryring, provide unrivaled opportunity to allow the corresponding reaction studies. Both grant the storage of sufficient amount of ions in a nearly background-free environment for reaction studies in inverse kinematics.

After the successful investigation of the cross section of 96Ru(p,γ) in 2009 [2] and the cross sections of 124Xe(p,γ) in 2016, the performance and commissioning of improved Esr and Cryring detection system designs are carried out for the first experiments in 2018. The particle detection with a nearly 100% efficiency is realized by ultra high vacuum (Uhv) compatible double-sided silicon strip detectors (Dsssd), which are excellent candidate to measure first time the proton-capture inside the Gamow-window using stored, radioactive ions.

References: [1] - M. Pignatari et al. 2016 Int. J. Mod. Phys. E 25 1630003 [2] - B. Mei et al., Phys. Rev. C92 (2015) 035803

HK 60: Instrumentation XVII and Accelerators

Zeit: Freitag 14:00–15:45 Raum: Audimax H1

Gruppenbericht HK 60.1 Fr 14:00 Audimax H1

The MAGIX experiment: the most recent developments — •Sabato Stefano Caiazza for the MAGIX-Collaboration — Intitut für Kernphzsik - Johannes Gutenberg Universität, Mainz, Deutschland

The new MESA accelerator under development at the Institute for Nuclear Physics in Mainz is planned to be commissioned at the beginning of the new decade. By that time, the MAGIX experiment, which will sit on the energy recover line of the accelerator. Therefore MAGIX will use an innovative jet-target system coupled without windows with a couple of magnetic spectrometers. In the focal plane of those spectrometers we will install a GEM-based tracker. Additionally we will integrate a recoil detector in the scattering chamber and a luminosity and zero-degree in the forward direction. All the instrumentation is currently under development and the most recent updates will be presented in this talk.

HK 60.2 Fr 14:30 Audimax H1

Kohlenstofffasern als Primärtarget bei $\overline{\text{P}}$ANDA — •Birte Sauer[1], Patrick Achenbach[1,2], Sebastian Bleser[1], Michael Bölting[1], Josef Pochodzalla[1,2], Falk Schupp[1], Marcell Steinen[1] und Christian Tiefenthaler[1] — [1]Helmholz-Institut Mainz — [2]Institut für Kernphysik Mainz

Einer der Schwerpunkte des PANDA-Experiments wird die γ-Spektroskopie von Doppel-Λ-Hyperkernen sein. Dazu ist eine Modifikation des Standard-PANDA-Detektors nötig. Diese besteht unter anderem aus einem speziellen internen Kohlenstofftarget. Dazu wird das dediziertes Tagetsetup unmittelbar vor dem zentralen Detektor eingebaut. Alle Komponenten des Aufbaus müssen im starken Magnetfeld und im hohen Teilchenfluss innerhalb des PANDA-Detektors betrieben werden können.
Dieser Beitrag zeigt den aktuellen Entwicklungsstand des Primärtargets, mit Fokus auf der dafür verwendeten Kohlenstofffaser. Insbesondere wird dabei auf die Eignung der Faser eingegangen.

HK 60.3 Fr 14:45 Audimax H1

Studies on Laval Nozzles for the $\overline{\text{P}}$ANDA Cluster-Jet Target — •S. Grieser, D. Bonaventura, B. Hetz, and A. Khoukaz for the PANDA-Collaboration — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, 48149 Münster, Germany

The $\overline{\text{P}}$ANDA experiment (antiProton ANnihilation at DArmstadt) at the future accelerator facility FAIR (Facility for Antiproton and Ion Research) will focus on investigations on the strong interaction and on questions about hadronic matter. Therefore, a cluster-jet target as an internal target was designed and built up at the University of Münster. Such a target achieves high and constant beam thicknesses, which can be adjusted over several orders of magnitude during operation. By the expansion of pre-cooled gases within fine Laval nozzles a cluster source

produces a continous flow of cryogenic solid clusters. The geometry of the Laval nozzle determines the production and the properties of the clusters. In the past, at the University of Münster an improved production process for Laval nozzles with their complex inner geometry was developed and first Laval nozzles were successfully produced and operated. The production of Laval nozzles ensures the operation of cluster-jet targets, e.g. for the $\overline{\text{P}}$ANDA or the MAGIX@MESA experiment, and opens the way for studies on the optimisation of these nozzles to match the required target performance. Measurements and their results with the new nozzles at the $\overline{\text{P}}$ANDA cluster-jet target prototype will be presented and discussed.

HK 60.4 Fr 15:00 Audimax H1

Magnetically-coupled piston pump for ultra-clean noble gas experiments — •Denny Schulte — Westfälische Wilhelms-Universität, Münster, Germany

Experiments employing noble gas targets such as xenon and argon make use of the characteristic ionization and scintillation process occurring in case of an interaction. In order to enable high light as well as charge yields, electronegative impurities have to be removed from the inert gas. A continuous circulation through a purification system is indispensable and requires specialized pumps.

For this reason, together with partners from Stanford University and Rensselaer Technical Institute we developed a magnetically-coupled piston pump, which fulfills all important requirements for current as well as future multi-ton and low background experiments (e.g. XENONnT and nEXO) such as absence of oil-based lubrication, ultra-low radon emanation and high performance.

An enhanced magnetic gradient boosts the coupling strength of the piston to 3500 N. Thus, gas flows of more than 200 standard liters per minute and compressions of up to 1.9 bar are possible.

This talk will zoom in on characterization and last upgrades of the pump and is supported by BMBF under contract 05A17PM2.

HK 60.5 Fr 15:15 Audimax H1

Beam and Vacuum Studies of the $\overline{\text{P}}$ANDA Cluster-Jet Target — •Benjamin Hetz, Daniel Bonaventura, Silke Grieser, Ann-Kathrin Hergemöller, and Alfons Khoukaz for the PANDA-Collaboration — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, 48149 Münster, Germany

The internal cluster-jet target build up at the University of Münster will be the phase one target for the upcoming $\overline{\text{P}}$ANDA experiment at the antiproton storage ring HESR at FAIR. This cluster-jet target in close to final $\overline{\text{P}}$ANDA geometry is by now successfully set into operation, including the final vacuum and beam monitor systems and the final beam dump of the $\overline{\text{P}}$ANDA experiment. Thicknesses of more than 2×10^{15} atoms/cm^2 in distances of 2.25 m away from the cluster-jet generator demonstrate the benefits of Münster cluster-jet targets for high luminosity 4π experiments which require a constant thickness in time.

The current results of the $\overline{\text{P}}$ANDA target thickness and vacuum studies in Münster will be presented. This includes the results of different beam monitor systems, i.e. destructive and non-destructive systems, realized at different vacuum chambers along the jet beam path into the beam dump of the $\overline{\text{P}}$ANDA target. Furthermore, the vacuum conditions at different stages of the jet beam line and the gas back flow rates of the $\overline{\text{P}}$ANDA beam dump will be discussed.

Additionally, a preview of the planed 2018 beam time with the $\overline{\text{P}}$ANDA cluster-jet target at the COSY accelerator in Jülich will be given.

HK 60.6 Fr 15:30 Audimax H1

Zur Minimierung des Ankunftszeitjitters für lasergetriebene Plasma-Wakefield-Beschleuniger — •Stefano Mattiello[1], Holger Schlarb[2] und Andreas Penirschke[1] — [1]Technische Hochschule Mittelhessen, Friedberg, Deutschland — [2]DESY, Hamburg, Deutschland

Für laserbetriebene Plasma-Wake-Feld-Beschleuniger (PWA) ist die Synchronisation der Elektronenpakete zum plasmatreibenden Laserpuls im Bereich einiger Femtosekunden notwendig, damit eine stabile Beschleunigung erfolgen kann. Zur Minimierung des Ankunftszeitjitters des extern injektierten Elektronenstrahls wird in diesem Projekt ein neuartiges Feedbacksystem mit einer angestrebten zeitlichen Auflösung von 1fs entwickelt, welches mit Hilfe des plasmatreibenden Laserstrahles THz-Pulse erzeugt, die direkt auf den Elektronenstrahl zurückkoppeln, um diesem eine Energiemodulation zu induzieren.

Die Erzeugung der THz-Pulse soll durch die optische Rektifikation des hochenergetischen Femtosekunden-Laserstrahls mittels eines nichtlinearen Kristalls erfolgen. Die Wahl des geeigneten Kristalls ist entscheidend für eine effiziente und stabile THz-Generation. In diesem Beitrag untersuchen wir systematisch den Einfluss der optischen Eigenschaften des Kristalls, und insbesondere des Absorptionskoeffizienten von Lithiumniobat auf die Effizienz der Erzeugung der THz-Pulse.

HK 61: Instrumentation XVIII

Zeit: Freitag 14:00–15:45 Raum: HZO 90

Gruppenbericht HK 61.1 Fr 14:00 HZO 90

The Silicon Tracking System of the CBM Experiment at FAIR — •Evgeny Lavrik for the CBM-Collaboration — Universität Tübingen, Tübingen, Deutschland

The Compressed Baryonic Matter (CBM) experiment at the future Facility for Antiproton and Ion Research (FAIR) aims to study the properties of nuclear matter at high net-baryon densities and moderate temperatures.

The Silicon Tracking System (STS) is the key detector to reconstruct with a high efficiency up to 1000 charged particle trajectories created in heavy-ion collisions at interaction rates of up to 10 MHz. It will determine the momentum of the particles with a momentum resolution $\Delta p/p \approx$ 1-2% which requires ultra-low detector material budget of 0.3-1% X_0 per layer. The detector comprise eight layers of double-sided silicon microstrip sensors and will be placed inside the 1 Tm superconducting magnet which limits the space available, which in turn requires advanced cooling approaches and mechanical design with precise tracking layers alignment. The microstrip sensors have to be radiation hard and checked for their quality optically and electrically before the assembly.

This presentation summarizes the status of developments for the CBM STS as well as for the detector demonstrator in a framework of mCBM campaign at SIS18@GSI.

HK 61.2 Fr 14:30 HZO 90

Thermal Management of the CBM Silicon Tracking System — •Kshitij Agarwal for the CBM-Collaboration — Physikalisches Institut - Eberhard Karls Universität Tübingen, Tübingen, Germany

As the core detector of the CBM experiment, the Silicon Tracking System (STS) located in the dipole magnet provides track reconstruction & momentum determination of charged particles from beam-target interactions. Due to the expected irradiation damage, the sensors will dissipate some power and have to be kept at or below -5°C at all times by complete removal of the heat dissipated by the front-end electronics boards (∼40kW). The heat must be removed to avoid thermal runaway and reverse annealing of the irradiated silicon sensors. To achieve this, the STS will be operated in a thermal insulation box and will use bi-phase CO_2 cooling system for the FEE.

Given the space constraints for STS integration, a high-density feedthrough panel system for all services is needed while maintaining the thermal environment needed for detector operation. In this presentation, the assembly and thermal tests for HV-LV feedthrough panels will be shown. This is part of an effort towards building a cooling demonstrator for two STS half-stations to show that the CBM-STS cooling concept is viable. The respective future plan for its completion followed by the initial construction R&D will be presented.

This work is supported by GSI/FAIR.

HK 61.3 Fr 14:45 HZO 90

Report on Track Based Alignment Procedures of the CBM Silicon Tracking Detector — •Susovan Das for the CBM-Collaboration — Physikalisches Institut, Eberhard Karls Universität Tübingen

The CBM experiment at FAIR is being designed for the study of the QCD phase diagram in the region of the high baryon chemical potential at relatively moderate temperatures. The Silicon Tracking System (STS) is the central detector for momentum reconstruction of the pro-

duced charged-particles in the CBM experiment. It consists of 8 layers of altogether ∼900 double-sided silicon micro-strip sensors. Limited mechanical precision(>100μm) during the mounting, temperature differences result in misalignment to the detector component positions. Therefore, the intrinsic spatial resolution(∼20μm) of the detector components has to be recovered by a track based alignment method.
In this contribution, we will present the current status of the implementation of the alignment algorithm. For this work, We will employ GBL(General broken line)track refit model to create the necessary input data structure to provide to the standalone PEDE part of the χ^2 minimisation based MILLEPEDE alignment algorithm.
• This work was supported by grant BMBF-05P16VTFC1

HK 61.4 Fr 15:00 HZO 90

Testing of silicon strip detectors with a spatially resolved infrared laser test-stand* — •Martin Kesselkaul, Kai-Thomas Brinkmann, Tommaso Quagli, Robert Schnell, and Hans-Georg Zaunick for the PANDA-Collaboration — II. Physikalisches Institut, Justus-Liebig-Universität Gießen, Heinrich-Buff-Ring 16, D-35392 Gießen

The PANDA experiment at the future accelerator facility FAIR will investigate proton-antiproton reactions at a stationary target. The Micro Vertex Detector (MVD), as the innermost detector of PANDA, will measure the tracks of charged particles and secondary decay vertices close to the interaction point with high precision. It is comprised of various layers of silicon-pixel and -strip sensors.
For the characterization and quality measurement of the double-sided silicon strip detectors used in the PANDA MVD, a laser test-stand has been developed. An automated xy-table with an position accuracy of 50 nm places an infrared laser above the sensor while recording the spatially resolved response of the sensor. This contribution will focus on the analysis of the data taken with this setup. The quantities of interest are the charge collection efficiency (CCE), as well as the charge sharing characteristics between adjacent strips, which are inferred for analysis of the sensor quality. The latter will be discussed in detail for different measurement parameters to deduce the spatial resolution of the sensor.
*Funded by BMBF and HIC for FAIR

HK 61.5 Fr 15:15 HZO 90

Radiation Hardness Test of Silicon Sensors under Realistic Conditions at the Tübingen Van-de-Graaf Accelerator — •Eduard Friske for the CBM-Collaboration — Universität Tübingen, Tübingen

The silicon strip sensors used in CBM will be subjected to high amounts of NIEL damage. The accumulated dose over several years of operation will be of the order of $10^{13} n_{\mathrm{eq}}(1MeV)/cm^2$. To investigate the effects of the damage under realistic conditions an irradiation setup employing neutrons has been designed and produced. The main feature of the setup at the Tübingen Van-de-Graaf accelerator is the capability to deliver a relativly high neutron flux over an extended period of time (in the order of weeks), thus being closer to the actual irradiation scenario as compared to instantaneous irradiation at reactors.

The setup uses a cryogenic gas target and a 2.4 MeV deuteron beam to produce neutrons via D-D fusion. The irradiated sensor can be read out in place by two beetle chips to assess the possible degradation in performance due to radiation damage. Preliminary data from the irradiation campaign will be presented.

HK 61.6 Fr 15:30 HZO 90

TRB basierte Ausleseelektronik für SKIROC ASICs zur Tiefenprofilanalyse — •Lukas Werner[1], Christian Berner[1], Michael Böhmer[1], Roman Gernhäuser[1], Ralph Gilles[2], Bastian Märkisch[1], Zsolt Revay[2] und Markus Trunk[1] — [1]Technische Universität München, Physikdepartment, James-Franck-Str., Garching — [2]Heinz-Maier-Leibniz Zentrum, Garching

Bei der Neutronentiefenprofilmessung wird z.B die Li6(n,He4)H3 Reaktion verwendet, um die räumliche Verteilung von Lithium in einer Probe zu untersuchen. Dazu muss einerseits die Energie der Teilchen mit spektroskopischer Auflösung über einen weiten Bereich bestimmt werden, andererseits will man in ortsauflösenden Verfahren auch hochsegmentierte Detektoren bei höchsten Neutronenflüssen verwenden. Im neuen N4DP Messplatz am NL4B Strahlrohr des FRM2 wird gerade dieses neue Konzept der orts- und zeitaufgelöste Tiefenprofilanalyse realisiert.

Eine Kombination von Silizium-Microstrip-Detektoren (DSSDs) mit extrem dünnen Eintrittsfenstern und ASICs der SKIROC Familie (SKIROC-2A , SKIROC-CMS) ist dafür ideal geeignet. Für die komplexe Ansteuerung, Datenvorverarbeitung und Auslese dieser ASICs wurde ein FPGA basiertes Frontendboard für das TRB-System (GSI, Darmstadt) entwickelt. Wir zeigen hier das Konzept der Präzisonsmessung niederenergetischer Ionen mit DSSDs und dessen vielseitige Einsatzmöglichkeiten.
Supported by BMBF Nr. 05K16WO1