HK 54: Poster - Hadronenstruktur und -spektroskopie

Zeit: Mittwoch 16:45–16:45 Raum: HSZ 3.OG

HK 54.1 Mi 16:45 HSZ 3.OG

Ein allgemeines Partialwellen-Analyse-Framework für PANDA — Florian Feldbauer[1,2], Miriam Fritsch[1,2], Klaus Götzen[1,4], Prometeusz Jasinski[1,2], Anastasia Karavdina[2], Bertram Kopf[3], •Mathias Michel[1,2], Klaus Peters[1,4] und Matthias Steinke[3] für die PANDA-Kollaboration — [1]HI Mainz — [2]Universität Mainz — [3]Universität Bochum — [4]GSI Darmstadt

Ein Großteil des Physikprogramms des PANDA-Experiments an FAIR (Darmstadt) beschäftigt sich mit der Suche nach neuen konventionellen sowie exotischen hadronischen Zuständen wie z.B. Hybriden oder Gluebällen. Zur Identifizierung möglicher Kandidaten und zur eindeutigen Einordnung bereits bekannter Zustände wird bei PANDA in einem Großteil der Analysen eine Partialwellenanalyse (PWA) benötigt. Zu diesem Zweck wird ein neues, flexibles und effizientes PWA-Framework entwickelt. Es wird modular gestaltet, was es erlaubt, problemlos weitere Modelle und Formalismen hinzuzufügen, wie auch gleichzeitig mehrere Datensätze (auch verschiedener Experimente) anzupassen. Außerdem werden verschiedene Minimierungs- und Bewertungsroutinen zur Verfügung gestellt. Ziel ist es, die Software mit Daten laufender Experimente wie z.B. BaBar oder BESIII zu verwenden und zu testen. Bei der Erstellungen der Anforderungen an das Programm-Paket wurden Erfahrungen anderer PWA-Programme berücksichtigt, um mögliche Einschränkungen zu vermeiden. Das Poster wird den Status der Implementierung des Software-Frameworks für die PANDA-PWA sowie erste einfache Tests vorstellen.

HK 54.2 Mi 16:45 HSZ 3.OG

Search for ppK^- - Status of the FOPI p-p Experiment* — •Robert Muenzer — Excellence Cluster Universe - TU München

The investigation of the kaon-nucleon interaction has been intensified in the last year due to new results on $\Lambda(1405)$ (1) and indications on the existence of the ppK^- bound state (2).
In a dedicated experiment at the FOPI Sepctrometer at GSI in Darmstadt the possible production of this state in proton proton collision is investigated. During this experiment an additional detector was used to select during data taking events containing Lambda Hyperons (3). This contribution will show the status of the ongoing analysis, expecially the reconstuction of the $pK^+\Lambda$ final state, with the help of a kinemtical refit tool, which allows an improvement of the signal quality.
(1) L. Fabbietti, J. Siebenson / arXiv:1208.0205
(2) T. Yamazaki, M. Maggiora, P. Kienle / PRL 104 / 132502 (2010)
(3) M. Berger, L. Fabbietti, R. Muenzer / in press

HK 54.3 Mi 16:45 HSZ 3.OG

Starke Wechselwirkung in Pionischen Atomen — •Jan Muehlhans, Stefanie Lourenco und Horst Lenske — Institut für Theoretische Physik, Universität Gießen

Aus der Klein-Gordon Gleichung für ein Pion im Coulombpotential eines ^{208}Pb Kerns werden numerisch die Radialwellenfunktionen und Bindungsenergien berechnet. Die endliche Ausdehnung der Kernladungsverteilung wird in verschiedenen Näherungen berücksichtigt. Die starke Wechselwirkung wird in Form eines komplexen optischen Potentials eingeführt. Dieses beinhaltet Beiträge für s- und p-Wellen-Streuung. Die Klein-Gordon Gleichung wird um den Realteil des optischen Potentials erweitert, während der Beitrag des Imaginärteils störungstheoretisch abgeschätzt wird. Die störungstheoretische Behandlung des Imaginärteils liefert verläßliche Korrekturen zur Bindungsenergie aber unterschätzt die Zerfallsbreiten. Der Vergleich der Radialwellenfunktionen für reines Coulomb und Coulomb mit optischem Potential zeigt den abstoßenden Charakter der starken Wechselwirkung. Die Ergebnisse werden mit anderen Rechnungen verglichen.

HK 54.4 Mi 16:45 HSZ 3.OG

Feasibility studies for the measurement of the time-like form factors of the proton in $\bar{p}p \to \mu^+\mu^-$ at the PANDA experiment. — •Iris Zimmermann — HIM Mainz

The process of annihilation of proton and antiproton into a pair of charged leptons can be used to investigate the inner structure of the proton. Simulations using the software package PANDARoot can provide information about the feasibility of using such processes. A challenge will be the suppression of the large hadronic background, mainly coming from $\pi^+\pi^-$, because of the similar masses of muon and pion. First simulation studies have been done to investigate the behaviour of the signal and background process inside the PANDA detector.

HK 54.5 Mi 16:45 HSZ 3.OG

Upper limit of the Hypertriton production in the Ar+KCl collision system at 1.76 AGeV with HADES — •Timo Scheib for the HADES-Collaboration — Goethe-Universität, Frankfurt am Main

In September 2005 data of the collision system Ar+KCl at a kinetic beam energy of 1.76 GeV per nucleon was measured with HADES. In this context several strange particles, which are suitable probes of the high density phase in heavy ion collisions, have been successfully reconstructed. Among them is the hypertriton, the lightest of the so called hypernuclei, which decays into a helium nucleus and a negative pion with a branching ratio of about 35%.
In this contribution we present the results of this investigation. Since the hypertriton is not observed in the given system, we calculate an upper limit for the production of this particle.
Supported by BMBF (06FY9100I and 06FY7114), HIC for FAIR, EMMI, GSI and HGS-Hire.

HK 54.6 Mi 16:45 HSZ 3.OG

Light meson production in nucleon-nucleon reactions — •Khaled Teilab[1], Susanna Gallas[1], Francesco Giacosa[1], and Dirk H. Rischke[1,2] — [1]Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Straße 1, D-60438 Frankfurt — [2]Frankfurt Institute for Advanced Studies (FIAS), Ruth-Moufang-Straße 1, D-60438 Frankfurt

We study the production of mesons in nucleon-nucleon reactions at center-of-mass energies of a few GeV using an $N_f = 2$ linear sigma model, extended by including the $N_f = 2$ multiplets of (pseudo-) scalar and (axial-) vector mesons and a doublet of the nucleon together with its chiral partner (the $N^*(1535)$ or $N^*(1650)$ resonance). Results of the calculations are compared to experimental data.

HK 54.7 Mi 16:45 HSZ 3.OG

Feasibility studies of proton time-like electromagnetic form factors with the PANDA detector — •Dmitry Khaneft for the PANDA-Collaboration — Helmholtz-Institut Mainz, Mainz, Deutschland

Perspectives of measuring proton electromagnetic form factors in the time-like region at FAIR with the $\bar{\text{P}}$ANDA detector are presented. The official software framework of the $\bar{\text{P}}$ANDA collaboration ($\bar{\text{P}}$ANDAroot) has been used for performing Monte Carlo simulations of the signal process $\bar{p}p \to e^+e^-$ as well as of the most important background process $\bar{p}p \to \pi^+\pi^-$, in order to study signal detection efficiency and background suppression. The three hypotheses $G_E/G_M = 0, 1, 3$ have been considered for the generation of signal events. A set of cuts were implemented into the analysis procedure for separating the signal from the background. Preliminary results for the estimation of the statistical error are shown.

HK 54.8 Mi 16:45 HSZ 3.OG

P2 - The weak charge of the proton — •Dominik Becker — Institut für Kernphysik, Mainz

Since early 2012, a new high precision measurement of the proton weak charge is being prepared in Mainz. It is our goal to determine the electroweak mixing angle $\sin^2(\theta_W)$ to a relative precision of 0.15 %, which can be achieved by measuring the proton weak charge to a relative uncertainty of 1.9 % through the parity-violating asymmetry in elastic electron-proton-scattering at low momentum transfer. We will present studies of the achievable precision in the determination of $\sin^2(\theta_W)$ within P2. Furthermore, we are going to show results of GEANT4 simulations, which are being done to explore the future experimental setup.

HK 54.9 Mi 16:45 HSZ 3.OG

Paritätsverletzende Elektronstreuung an MAMI und MESA — •Sebastian Baunack — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz

In den vergangenen Jahren wurde von der A4-Kollaboration am Elek-

tronenbeschleuniger MAMI ein Experiment zur paritätsverletzenden Elektronstreuung betrieben. Ziel der Messungen war primär die Bestimmung der Strangequarkbeiträge zu den Vektorformfaktoren des Nukleons.

Ab diesem Jahr wird ein neues Paritätsexperiment vorbereitet, welches an der neuen Beschleunigereinheit MESA unter anderem Tests des Standardmodells durchführen wird.

Die im Rahmen des A4-Experiments gewonnenen Erkenntnisse und Erfahrungen werden skizziert und es werden Planungen und Anforderungen für das neue Paritätsexperiment an MESA vorgestellt.

HK 54.10 Mi 16:45 HSZ 3.OG

Feasibility Study of a Transversely Polarized Target in PANDA — •Bertalan Feher — Helmholtz-Institut Mainz

PANDA (Antiproton Annihilation at Darmstadt) is a key project at the Facility for Antiproton and Ion Research (FAIR), i. e. an accelerator facility currently under construction at GSI Darmstadt. PANDA is a state of the art detector for antiproton-proton fixed target experiments. A transversely polarized target in PANDA allows the determination of the electromagnetic time-like form factors with unprecedented accuracy and the first extraction of the imaginary part from the latter. The measurement of this will open a new window for investigating the nucleon structure. Since the PANDA spectrometer is based on a longitudinal solenoid field, the target region needs to be shielded in order to have a transverse polarization. A high-temperature type-2 superconducting shield will be used for this purpose. Simulations using a finite element method were performed to calculate the resulting field map.

HK 54.11 Mi 16:45 HSZ 3.OG

Study of the $\Lambda(1116)$ interaction with the cold nuclear environment — •Oliver Arnold for the HADES-Collaboration — Excellence Cluster "Universe", Boltzmannstr. 2, 85748, Garching, Germany

The question of the existence of $\Lambda(1116)$-hyperons in the interior of a neutron star is not clarified at the moment. The attractive potential of Λ-hyperons eventually leads to the appearance of this particle in the neutron star core and this might substantially soften the nuclear equation of state. This hypothesis should be critically examined in the view of a recent precise measurement of a two-solar-mass neutron star, which disfavours a soft equation of state. Therefore, the strength of the potential is an important parameter in theoretical models of nuclear equations of state.

In order to get information about the Λ interaction strength with nuclear matter at ground state density, we confront the HADES results on Λ production in proton-niobium collisions at a beam kinetic energy of 3.5 GeV with the predictions of different transport models. In particular, we discuss the influence of different parameters of the model (such as production and scattering cross-sections) with help of the GIBUU code.

HK 54.12 Mi 16:45 HSZ 3.OG

Luminosity Determination at ANKE with Different Reference Reactions — •Christopher Fritzsch, Paul Goslawski, Malte Mielke, Michael Papenbrock, Daniel Schröer, Alexander Täschner, and Alfons Khoukaz — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, D-48149 Münster, Germany

A high precision measurement on the mass of the eta meson was the main objective of the COSY proposal Nr. 187. In detail the meson production reaction $dp \to {}^3\mathrm{He}\,X$ has been studied with X being the eta meson identified by the missing mass technique. However, parallel to the already very successfully performed eta mass determination [1], the obtained data also allow for studies on total and differential cross sections for the reaction $dp \to {}^3\mathrm{He}\,\eta$ close to threshold as well as for a study of the ABC-effect in the channel $dp \to {}^3\mathrm{He}\,\pi^+\pi^-$. For this purpose a careful data normalization and luminosity determination is required. While dp-elastic scattering is commonly used as reference reaction for the luminosity determination at ANKE, an independent normalization channel is of high interest as cross reference. Therefore, the ${}^3\mathrm{He}\,\pi^0$ final state is analyzed in parallel and the results are compared to the dp-elastic scattering data. The method and recent results will be presented.
Supported by COSY FFE.

[1] P. Goslawski et al., Phys. Rev. D85 (2012) 112011

HK 54.13 Mi 16:45 HSZ 3.OG

PANDA EMC backward end-cap mechanics — Luigi Capozza, Jorge Ceballos, Dexu Lin, Frank Maas, •David Rodriguez, Roserio Valente, and Felix Welzel for the PANDA-Collaboration — Helmholtz-Institut Mainz

The PANDA experiment at the FAIR facility will be a multipurpose hermetic spectrometer covering the full solid angle range. A key role for several physics cases will be played by the electromagnetic calorimeter. This includes ca. 15000 PbWO4 scintillating crystals arranged in a central barrel, a forward and a backward end-cap.

The backward end-cap of the PANDA electromagnetic calorimeter is composed by 540 straight crystals covering the scattering angles between 147* and 161*. They are housed in the so-called alveoli which are carbon fibre boxes, providing both strength and low material budget.

The crystals are to work at -25*C in order to improve the light yield. To achieve this temperature a cooling system and thermal insulation are needed. The cooling system removes the heat coming from the electronics and through walls, cables and mechanical supports. Vacuum insulated panels are installed as a thermal shielding.

Avalanche Photodiodes (APD) have been chosen as photon detectors, since they are still functional under strong magnetic fields. ASIC chips will be used to amplify the APD signal, this preamplifier features low noise and low heat generation.

Due to the weight of this detector, it will be supported from the outside of the PANDA target spectrometer in a counter lever arm position.

HK 54.14 Mi 16:45 HSZ 3.OG

Measurement of Polarization Observables T, P, and H in Pseudoscalar Meson Photoproduction with the CBELSA/TAPS Experiment — •Jan Hartmann for the CBELSA/TAPS-Collaboration — HISKP, Universität Bonn

In order to extract the contributing resonances in photoproduction experiments, partial wave analyses need to be performed. Here, a complete experiment is required to unambiguously determine the contributing amplitudes. This involves the measurement of carefully chosen single and double polarization observables.

The Crystal Barrel/TAPS experiment with a longitudinally or transversely polarized target and an energy tagged, linearly or circularly polarized photon beam allows the measurement of a large set of polarization observables. Due to its good energy resolution, high detection efficiency for photons, and the nearly complete solid angle coverage it is ideally suited for the measurement of photoproduction of neutral mesons decaying into photons.

Preliminary results for the target asymmetry T, recoil polarization P and the double polarization observable H will be presented for π^0 and η photoproduction off the proton.
Supported by DFG within CRC16

HK 54.15 Mi 16:45 HSZ 3.OG

Carbon-12 target for P2 — •Kathrin Gerz — Institut für Kernphysik Mainz

The P2-Experiment at the Mesa accelerator - due to be operational in 2017 - in Mainz aims to determine the electro-weak mixing angle with a relative precision of 0.15% by measuring the parity-violating asymmetry in elastic scattering of electrons from nuclei at low Q^2.

The current approach is based on a 60cm long liquid hydrogen target. Studies are under way to investigate alternative target materials. This poster will show first results of simulations for an experimental setup with a graphite target as well as potential advantages and experimental challenges as compared to cryogenic hydrogen.

HK 54.16 Mi 16:45 HSZ 3.OG

Background estimations for the A4 experiment — •Luigi Capozza — Helmholtz-Institut Mainz, Mainz, Germany

The A4 experiment at the MAMI accelerator facility at Mainz studies the nucleon structure by measuring single spin asymmetries in elastic electron-proton and quasi-elastic electron-deuteron scattering. Elastic and inelastic events are separated by measuring the energy of the scattered particles in an homogeneous PbF_2 electromagnetic calorimeter. Besides inelastic events, gammas from the π^0 decay constitute another source of background which is particularly important in backward angle measurements. An electron tagger made of plastic scintillating slabs is used at backward angles for suppressing most of this background. In order to correct for the remaining background contributions, MC simulations of the relevant scattering processes and of the detector re-

sponse are used. Backward results on a hydrogen target have already been published for the beam energy of 315 MeV. There are analyses ongoing on data at other beam energies and both on hydrogen and deuterium targets. Upgrades of the MC for treating these cases will be presented.