

HK 16: Hadronenstruktur und -spektroskopie

Zeit: Dienstag 16:30–19:00

Raum: RW 2

Gruppenbericht

HK 16.1 Di 16:30 RW 2

Strangeness with HADES - past, present, future — ●ELIANE EPPLE — Excellence Cluster "Universe", 85748 Garching

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

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

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

HK 16.2 Di 17:00 RW 2

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

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

Diese Arbeit wurde unterstützt durch BMBF.

HK 16.3 Di 17:15 RW 2

Neutral Kaon Production in p+p and p+⁹³Nb Reactions at 3.5 GeV with HADES* — ●JIA-CHII BERGER-CHEN for the HADES-Collaboration — TU München, Boltzmannstr. 2, 85748 Garching, Germany

The kaon nucleus interaction is a subject of interest for experimental and theoretical study. A number of experiments have measured the kaon-nucleon/nucleus potential at normal nuclear density in p+A [1] and π^-+A [2] reactions and in heavy ion collisions [3] all obtaining a slightly repulsive potential. However, the determined strengths of the potential are not consistent with each other. Therefore we propose to analyse the K_S^0 production in p+p and p+⁹³Nb collisions at a kinetic beam energy of 3.5 GeV measured with HADES. The good event statistics of low p_t -kaons ($p_t < 100$ MeV) ensure the sensitivity of our measurements to the nuclear matter effects. The comparison of the K_S^0 differential yields may then provide access to the in-medium kaon nucleus potential at normal nuclear density. We present the data analysis method and preliminary results.

[1]M. Büscher et al. (ANKE), Eur. Phys. J. A 22, 301-317 (2004).

[2]M.L. Benabderrahmane et al. (FOPI), PRL 102, 182501 (2009).

[3]G. Agakishiev et al. (HADES), Phys. Rev. C 82:044907 (2010).

* supported by BMBF and Excellence Cluster "Universe"

HK 16.4 Di 17:30 RW 2

Production of Strangeness in π^- induced Reactions — ●OLAF N. HARTMANN for the FOPI-Collaboration — Stefan-Meyer-Institut der ÖAW, Wien

The FOPI Collaboration has acquired data in π^- induced reactions on nuclear targets. Beam momenta of 1.15 and 1.7 GeV/c have be

used. The measurements were done at the SIS accelerator of the GSI Darmstadt.

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

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

HK 16.5 Di 17:45 RW 2

Measurement Of The Baryonic $\Lambda(1520)$ Resonance With The ALICE Apparatus At The LHC — ●BENJAMIN DÖNIGUS for the ALICE-Collaboration — Research Division and ExtreMe Matter Institute EMMI, GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Germany — Helmholtz Research School H-QM, Frankfurt, Germany

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

[1] G. Torrieri and J. Rafelski, J. Phys. G 28, 1911 (2002)

[2] M. Bleicher and J. Aichelin, Phys. Lett. B 530, 81 (2002)

[3] A. Andronic, P. Braun-Munzinger, J. Stachel, Phys. Lett. B 673, 142 (2009); Erratum-ibid. B 678, 516 (2009); arXiv:0812.1186

[4] R.L. Jaffe, Phys. Rev. Lett. 38, 195 (1977)

HK 16.6 Di 18:00 RW 2

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

The study of photoproduction of pion pairs allows to investigate nucleon resonances which decay not directly to the nucleon ground state but via a cascade involving an intermediate excited state. During the last few years such reactions have been studied in quite some detail for the free proton. Their interpretation requires the measurement not only of angular - and invariant mass distributions of the pion pairs but also of polarization observables. More recently, a similar program has been launched for photoproduction off quasifree neutrons to explore the isospin degrees of freedom.

Preliminary results for the beam-helicity asymmetry measured with circularly polarized photons on unpolarized neutrons at MAMI with the Crystal Ball/TAPS setup will be discussed. Furthermore, first data have been taken at MAMI with a transversely polarized D-Butanol target to measure the target asymmetry T and the double polarization observable F for $\gamma n \rightarrow n\pi^0\pi^0$.

HK 16.7 Di 18:15 RW 2

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

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

Minimum-Bias Daten, sowie auch aus Daten, die mit einem speziellen Topologie-basierenden Trigger aufgenommen wurden.

HK 16.8 Di 18:30 RW 2

Photon Fusion Reactions in Chiral Perturbation Theory —
 •MAXIMILIAN DUELL and NORBERT KAISER — Physik Department,
 Technische Universität München, 85747 Garching

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

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

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

HK 16.9 Di 18:45 RW 2

Single π^0 -Photoproduction off Quasi-Free Protons and Neu-

trons — •MANUEL DIETERLE for the A2-Collaboration — Department of Physics, University of Basel, Klingelbergstrasse 82, 4056 Basel, Switzerland

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

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