HK 69: Hadron Structure and Spectroscopy I

Time: Thursday 16:30–19:00 Location: H-ZO 20

Invited Group Report HK 69.1 Th 16:30 H-ZO 20

Probing resonance matter with virtual photons — •Tetyana Galatyuk for the HADES-Collaboration — Institut für Kernphysik, Goethe-Universität, Frankfurt am Main, Germany

The HADES experiment, installed at GSI, Darmstadt, has measured di-electron production in $^{12}C+^{12}C$, $^{40}Ar+^{39}KCl$, $p+p$, $d+p$ and $p+^{93}Nb$ collisions. The results of the $^{12}C+^{12}C$ data taken at a kinetic beam energy of 1 GeV/u and 2 GeV/u suggest that a substantial fraction of electron pairs with masses larger than 0.15 GeV/c^2 stem from Dalitz decays of baryonic resonances. For a better understanding of the dielectron production in heavy ion collisions HADES has therefore studied elementary $p+p$ and $d+p$ interactions at E_{kin} = 1.25 GeV/u. The main interests here are the investigation of iso-spin effects in baryonic resonance excitation and the off-shell production of vector mesons. We observe indeed a large difference in dielectron production in $p+p$ and $d+p$ reactions measured at the same beam energy.

The production of e^+e^- pairs in $^{40}Ar+^{39}KCl$ collisions at a beam energy of 1.75 GeV/u was measured in August 2005. Results of these data will be discussed and compared to results of the $^{12}C+^{12}C$ runs.

In May 2007 data with high statistics were taken for $p+p$ interactions at E_{kin} = 3.5 GeV. We use this data to study ω meson production, in particular its free line shape. Precise ω reconstruction in this reactions will serve as a reference for studies of the ω line shape in $p+^{93}Nb$ reactions. Dielectron production in $p+^{93}Nb$, was recently measured with HADES to search for medium effects at nuclear ground state density. Preliminary results of the data analysis will also be reported.

Group Report HK 69.2 Th 17:00 H-ZO 20

The η' meson structure, width and interaction with nucleons investigated at the COSY–11 facility — •Eryk Czerwiński[1,2], Paweł Moskal[1,2], Joanna Klaja[1,2], and Paweł Klaja[1,2] for the COSY–11-Collaboration — [1]Institut für Kernphysik and Jülich Center for Hadron Physics, Forschungszentrum Jülich, D-52425 Jülich, Germany — [2]Jagiellonian University, Cracow, Poland

Recent results of studies on the properties of the η' meson with the COSY–11 facility will be presented and discussed. In particular, new results on the isospin dependence of the η' production cross section in nucleon-nucleon collisions will be discussed in view of the η' meson structure. Next, the results of comparative analysis of the invariant mass distributions for the $pp \to pp\eta'$ and $pp \to pp\eta$ reactions will be shown in the context of the proton-eta and proton-eta-prime interaction. Finally, the value of the total width of the η' meson will be reported as derived directly from the measurement of the mass distribution. The presentation of the results will include an explanation of the experimental technique used on order to achieve a precision about an order of magnitude better then former experiments.

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HK 69.3 Th 17:30 H-ZO 20

Coherent photoproduction of multiple mesons off the deuteron — •Igal Jaegle for the CBELSA/TAPS-Collaboration — Department of Physics, University of Basel

The coherent photoproduction of $\eta\pi^o$-pairs, $\omega\pi^o$-pairs, $\pi^o\pi^o\pi^o$-triplets and $\eta\pi^o\pi^o$-triplets have been measured for the first time at a tagged photon beam of the Bonn ELSA electron accelerator with the combined Crystal Barrel - TAPS electromagnetic calorimeter for incident photon energies up to 2.5 GeV. A clear identification of the coherent signal is possible by detecting the mesons in coincidence with the recoil deuterons. This coherent productions may lead to novel approaches for the search of mesic nuclei. For example, in the reaction $\gamma d \to \eta\pi^o d$, the η-mesons are emitted with very small kinetic energies, so that it can be used as a tool to study the much discussed η-nucleon, η-deuteron interaction at small relative momenta. Furthermore, the inclusive measurement (i.e. without detecting the recoil deuterons) of the coherent photoproduction of multiple mesons is also possible. This development might open a new possibility for the observation of in medium effects in heavy nuclei. Funded by the Swiss National Fund and the DFG (TR16).

HK 69.4 Th 17:45 H-ZO 20

Photon- and pion asymmetry in near-threshold ω photoproduction * — •Frank Klein for the CBELSA/TAPS-Collaboration — Physikalisches Institut, Universität Bonn, Germany

The photoproduction of ω mesons off protons has been studied from threshold to E_γ=1700 MeV in the reaction $\vec{\gamma}p \to \omega p$. The photon-beam asymmetry, Σ, and, for the first time, the pion asymmetry Σ_π related to the $\omega \to \pi^0\gamma$ decay have been measured [1].

The experiment was performed at the tagged photon beam of the ELSA electron accelerator of the University of Bonn. Using electron beams of E_0=3.2 GeV linearly polarized photons were produced by coherent bremsstrahlung. The ω meson was identified through it's neutral decay mode into $\pi^0\gamma$. The corresponding three decay photons and the proton were detected in a combined setup of the Crystal Barrel and the TAPS calorimeters. Large photon asymmetries Σ in excess of 50 % were obtained. The pion asymmetries Σ_π were found close to zero. This provides a new indication that, on top of t-channel exchange processes, baryonic s-channel resonances play an important role in ω photoproduction. The photoproduction of ω mesons thus continues to be a promising channel to find so far undetected baryonic resonances predicted by current quark models. Ongoing measurements at ELSA of further double polarization observables will be indispensable to fully disentangle the process.

[1] arXiv:0807.0594 [hep-ex]

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HK 69.5 Th 18:00 H-ZO 20

COMPASS Measurements with Hadron Beams — •Jan Michael Friedrich for the COMPASS-Collaboration — Physik Department E18, Technische Universität München, 85748 Garching

Muon and hadron beams from the CERN Super Proton Synchrotron are used in the COMPASS experiment for high-energy scattering reactions off fixed targets, aiming at measurements of non-perturbative aspects of quantum chromodynamics.

With pion beams, the meson spectrum can be examined via diffractive dissociation, where the existence of hybrid or exotic states is a much discussed issue. The double-diffractive process of central production, which can be measured also with a proton beam, is a promising approach for the search for glueballs. At extremely small momentum transfer, electromagnetic processes are accessible via the Primakoff effect and aim at the determination of QCD low energy constants as the pion polarisability and the chiral anomaly.

The muon program, focused on deep inelastic scattering, took place in the years 2002 to 2007. During this time, in autumn 2004, also a first pilot run with a pion beam was taken with the focus on diffractive and Primakoff measurements. Preliminary results and conclusions are presented.

Data taking with a pion beam was resumed in 2008, where large statistics for diffractive scattering was collected. First insights, also in view of the findings of previous experiments, are presented, as well as the planning for continuation of data taking in 2009.

HK 69.6 Th 18:15 H-ZO 20

Measurement of the double polarization asymmetry G in π^0 and η photoproduction — •Annika Thiel for the CBELSA/TAPS-Collaboration — Helmholtz-Institut für Strahlen- und Kernphysik, Nußallee 14-16, D-53115 Bonn

The excitation spectrum of the proton consists of several overlapping resonances, which are difficult to disentangle. To determine the exact contributions and identify the resonances, a solution of the partial wave analysis has to be found. For a complete experiment, which leads to an unambiguous solution, at least 8 well chosen single and double polarization observables are needed. With the new Crystal-Barrel/TAPS experiment at ELSA, the measurement of double polarization parameters like E and G in different reactions is possible by using a circularly or linearly polarized photon beam on a longitunally polarized butanol target. The Crystal-Barrel/TAPS setup provides a nearly 4π angular coverage and a high detection efficiency for neutral states, which gives an ideal condition for the study of final state comprising neutral mesons. In this talk the first results of the G asymmetry measurement in the reactions $\vec{\gamma}\vec{p} \to p\pi^0$ and $\vec{\gamma}\vec{p} \to p\eta$, which utilizes linearly polarized photons in combination with the longitudinally polarized target, will be presented.

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HK 69.7 Th 18:30 H-ZO 20

Atomic target mass dependence of ϕ-meson production in proton-nucleus collisons. — •Andrey Polyanskiy for the ANKE-Collaboration — Institut für Kernphysik, Forschungszentrum Jülich GmbH — Jülich Center for Hadron Physics

The modification of the vector meson properties in a strongly interacting environment is currently a hot subject in terms of spontaneous chiral symmetry breaking and partial restoration of this symmetry in nuclear matter. The dropping of the vector-meson mass by about 20% has been predicted already at normal nuclear density. However, according to theoretical investigations the ϕ-meson mass shift in matter is small and the main medium effect on the ϕ is a sizable increase of its width up to an order of magnitude compared to the vacuum value of $4.4\,\mathrm{MeV/c^2}$. The in-medium width of a meson is related to the imaginary part of the nuclear optical potential which is responsible for the meson absorption in nuclear matter. Therefore, information about the ϕ-meson width can be obtained by analysing the target mass dependence of the ϕ-meson production cross sections. An ANKE experiment aimed at the measurement of the ϕ width in the nuclear matter of normal density in proton-nucleus collisions at maximum COSY energy of 2.83 GeV. The ϕ-mesons were detected in the K^+K^- decay channel. The total amount of ϕ's collected from carbon, cooper, silver and gold targets is about 15000. In the talk the measured A-dependence of the ϕ production cross sections will be compared with available theoretical predictions.

Supported by the COSY-FFE program.

HK 69.8 Th 18:45 H-ZO 20

Linearly Polarized Photons at ELSA* — •Holger Eberhardt for the CBELSA/TAPS-Collaboration — Physikalisches Institut der Universität Bonn

To investigate the nucleon resonance regime in meson photoproduction, double polarization experiments are currently performed at the electron accelerator ELSA in Bonn. The experiments make use of a polarized target and circularly or linearly polarized photon beams. Linearly polarized photons are produced by coherent bremsstrahlung from an accurately aligned diamond crystal. The orientation of the crystal with respect to the electron beam is measured using the *Stonehenge-Technique*. Both, the energy of maximum polarization and the plane of polarization, can be deliberately chosen for the experiment. The linearly polarized beam provides the basis for the measurement of azimuthal beam asymmetries, such as Σ (unpolarized target) and G (polarized target). These observables are extracted in various single and multiple meson photoproduction channels.

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