

HK 46: Hadron Structure and Spectroscopy I

Time: Wednesday 14:00–16:00

Location: H-ZO 20

Invited Group Report HK 46.1 We 14:00 H-ZO 20
Overview of the MAMI facility in Mainz — ●ACHIM DENIG —
 Institut für Kernphysik, Johannes Gutenberg-Universität Mainz, Germany

The Mainz Microtron MAMI, a racetrack accelerator operated by the Institute of Nuclear Physics, produces a high-quality polarised CW electron beam. The latest stage MAMI-C is in operation since 2007 and offers a maximum beam energy of 1.5 GeV, which allows a wide program of research in the field of nucleon structure (form factors, sum rules, polarisabilities), baryon spectroscopy, hypernuclear physics, as well as tests of fundamental symmetries in eta-decays.

Three major experimental setups are installed at MAMI and recent results of these experiments are presented. The A1-collaboration investigates electron scattering with large magnetic spectrometers. The A2-collaboration using the Crystal Ball and TAPS detectors performs measurements with real photons, which are generated by Bremsstrahlung. The A4-collaboration studies parity violating electron scattering with a fast photon calorimeter. Special emphasis is placed on results, which are possible due to the upgraded machine energy and an outlook for the future is given.

HK 46.2 We 14:30 H-ZO 20

Helicity asymmetries in double pion photoproduction off deuterium — ●MARKUS OBERLE for the A2-Collaboration — Department of Physics, University of Basel

Recently, the measurement of the beam helicity asymmetry of pion pairs off the proton, using circularly polarized photon beams, has revealed surprising deficiencies in most reaction models for double pion production. With the present experiment a first attempt was made to measure such asymmetries also for photoproduction off the neutron, using a deuteron target. It was done at the Mainz MAMI accelerator for photon energies from 400 MeV to 1.5 GeV, using the combined Crystal Ball and TAPS electromagnetic calorimeters. In a first step the data for quasi-free protons were compared to free proton data. Good agreement indicates that the measurement is not seriously disturbed by nuclear Fermi motion. Very preliminary results seem to indicate that in the studied energy range, the asymmetries for $n(\gamma, \pi^0\pi^0)n$ are rather similar to $p(\gamma, \pi^0\pi^0)p$.

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HK 46.3 We 14:45 H-ZO 20

Study of the $\eta \rightarrow \gamma e^+ e^-$ decay with the WASA-at-COSY* — ●MALGORZTA HODANA for the WASA-at-COSY-Collaboration — Institute für Kernphysik, 52428 Jülich, Germany — Nuclear Physics Division Jagiellonian University, 30059 Cracow, Poland

In October 2008 the WASA-at-COSY collaboration has collected more than 10^7 events for the $pd \rightarrow {}^3\text{He}\eta$ reaction. One of the aims of currently conducted analyses is the determination of the invariant mass of the lepton pairs created in the Dalitz decay $\eta \rightarrow \gamma e^+ e^-$. The shape of the $e^+ e^-$ invariant mass spectrum is directly related to the distribution of the four-momentum squared of the virtual photon from the $\eta \rightarrow \gamma\gamma^*$ process and hence it allows for the study of the transition form factors which in turn reflects the spatial structure of the decaying meson. Experimentally we endeavor to determine the transition form factor as a function of the momentum transfer in the time-like region, in particular we intend to establish the so-called form factor slope parameter for the $\eta \rightarrow \gamma e^+ e^-$ process and to compare the results with the predictions based on the Chiral Perturbation Theory as well as Vector-Meson Dominance and Quark-triangle Loop models. The experimental methods used, the current status of the analysis of the data, and the physics motivations for the study of the Dalitz decay of the eta meson will be presented and discussed.

*Supported by BMBF and Wallenberg Foundation

HK 46.4 We 15:00 H-ZO 20

First Results on the ABC Effect from Kinematically Complete Measurements of the Double-Pionic Fusion to ${}^4\text{He}^*$ — ●ANNETTE PRICKING for the WASA-at-COSY-Collaboration — Physikalisches Institut der Universität Tübingen

The ABC effect – an intriguing low-mass enhancement in the $\pi\pi$ invariant mass spectrum – is known from inclusive measurements of two-pion

production in nuclear fusion reactions to the few-body systems d, ${}^3\text{He}$ and ${}^4\text{He}$. Its explanation has been a puzzle for 50 years.

In an effort to solve this long-standing problem by exclusive and kinematically complete high-statistics experiments, we have measured the fusion reactions to d, ${}^3\text{He}$ and ${}^4\text{He}$ with WASA at COSY. Here we report on the measurements of the double-pionic fusion reactions $dd \rightarrow {}^4\text{He} \pi^0\pi^0$ and $dd \rightarrow {}^4\text{He} \pi^+\pi^-$, which have been carried out at nine beam energy settings in the range $T_p = 0.8 - 1.4$ GeV covering thus the full energy region, where the ABC effect has been observed previously in inclusive reactions.

As a first result we find a strong low-mass enhancement in the $\pi\pi$ -invariant mass in agreement with previous results. However, we do not observe the high-mass enhancement suggested by the inclusive data and predicted in conventional t -channel $\Delta\Delta$ calculations. But this finding is in support of a dibaryonic s -channel resonance as it is observed for the basic $pn \rightarrow d\pi^0\pi^0$ reaction. Further results from the analysis of these reactions will be discussed, in particular also with respect to the energy dependence of the observed ABC effect. * supported by BMBF, COSY-FFE, DFG (Eur. Graduate School) and Wallenberg Foundation

HK 46.5 We 15:15 H-ZO 20

Kaon photo- and electroproduction in a Regge-plus-resonance approach — ●PIETER VANCRAEYVELD, LESLEY DE CRUZ, JAN RYCKEBUSCH, and TIM VAN CAUTEREN — Department of Subatomic and Radiation Physics, Ghent University, Belgium

We present an effective-Lagrangian model describing electromagnetic production of $K^+\Lambda$ [1], $K^+\Sigma^0$ and $K^0\Sigma^+$ [2] off protons. These reaction channels are dominated by a non-resonant background, which complicates the task of extracting the resonance information. In our model we fix the non-resonant amplitude, modeled in terms of t -channel Regge-trajectory exchange, at high energies where the amplitude is devoid of resonant contributions. In a next step, this amplitude is extrapolated into the resonance region and enriched with N^* and Δ^* exchange in the s -channel, resulting in a hybrid “Regge-plus-resonance” (RPR) model. In the electromagnetic vertex, we have incorporated the running of the coupling constants by using form factors as computed in the Bonn constituent-quark model. The RPR model yields a unified description of kaon photo- and electroproduction [3] from threshold up to invariant masses of several GeV. It provides a satisfactory account of the world data, notwithstanding the small number of free parameters. Beside model comparison with polarization data, we will present predictions for kaon production observables off neutrons.

- [1] T. Corthals et al., Phys. Rev. C 73, 045207 (2006).
- [2] T. Corthals et al., Phys. Rev. C 75, 045204 (2007).
- [3] T. Corthals et al., Phys. Lett. B 656, 186 (2007).

HK 46.6 We 15:30 H-ZO 20

Production of charged pions off nuclei at HARP within the GiBUU model — ●KAI GALLMEISTER and ULRICH MOSEL — Institut für Theoretische Physik, Universität Giessen, Germany

We compare calculations for the production of charged pions by pion or proton beams off nuclei calculated within our coupled channel transport model (GiBUU) with recent data of the HARP collaboration for beam energies from 3 up to 13 GeV. While originally designed for calibrating the flux for neutrino induced experiments, the data from this experiment represents a valuable check for hadronic final state models. Work supported by DFG.

HK 46.7 We 15:45 H-ZO 20

Use of the coherent ${}^{12}\text{C}(\gamma, \pi^0)$ reaction to measure photon polarisation — ●IAN JAMES DOUGLAS MACGREGOR, JAMIE ROBINSON, and KEN LIVINGSTON for the A2-Collaboration — University of Glasgow, Glasgow, UK

Photonuclear cross sections depend on numerous factors, some of which are masked in the unpolarized case, where sums and/or averages are performed over spin states. The use of linearly polarized photons allows investigation into the difference between parallel and perpendicular responses through photon asymmetry Σ measurements. Σ is particularly sensitive to angular momentum contributions to nuclear currents and to interference between contributions thus providing a

more sensitive observable to test theories of nuclear interactions.

Accurate Σ measurements rely on an accurate determination of the degree of photon linear polarization. We present measurements of photon polarization performed using the highly segmented 4π Crystal Ball detector at Mainz. Coherent photoproduction of π^0 mesons from carbon is used as a polarimeter reaction while investigating the physics of two-nucleon emission in the $^{12}\text{C}(\gamma, pp)$ reaction. Since both the π^0 and

the nucleus are spin zero, all information regarding the linear polarization of the photon is passed to the π^0 azimuthal distribution. The photon asymmetry $\Sigma(\gamma, \pi^0)$ equals 1 over the energies and angles of the experiment and thus photon polarization can be extracted directly from the azimuthal distribution of the emitted pion. This technique is used to determine photon polarization as a function of photon energy on a run by run basis.