HK 10: Hadron Structure and Spectroscopy II

Zeit: Montag 16:30–18:30 Raum: HS 13

Gruppenbericht HK 10.1 Mo 16:30 HS 13

Measurement of the Proton Polarizabilities at MAMI — •Vahe Sokhoyan for the A2-Collaboration — Universität Mainz, Institut für Kernphysik

Polarizabilities are fundamental properties related to the internal dynamics of the nucleon. They play a crucial role not only in our understanding of the nucleon, but also in other areas such as precision atomic physics. A program performed by the A2 Collaboration at the MAMI accelerator facility in Mainz aims for the first individual extraction of the nucleon scalar and spin polarizabilities using Compton scattering on the nucleons. The Crystal Ball and TAPS 4π spectrometer setup is used for the corresponding measurements. After the upgrade of the photon tagging system, a new high-statistics data set has been obtained for the determination of both unpolarized cross-section and beam asymmetry Σ_3 below pion production threshold. This data set will allow us to extract the proton scalar polarizabilities with unprecedented precision. Moreover, for the extraction of the spin polarizabilities, the beam asymmetry Σ_3 and the beam-target asymmetries Σ_{2x} and Σ_{2z} were measured at higher energies, where the sensitivity to the spin polarizabilities increases. In this talk, the current results and the plans for the upcoming measurements with the A2 setup at MAMI will be presented.

HK 10.2 Mo 17:00 HS 13

SIDIS Pion Beam Spin Asymmetries measured with CLAS 12 at 10.6 GeV — •Stefan Diehl for the CLAS-Collaboration — University of Connecticut, Storrs, USA — Justus Liebig University Giessen, Giessen, Germany

The CLAS12 detector at Jefferson Laboratory (JLab) started data taking with a polarized 10.6 GeV electron beam in February 2018. One of the first quantities which could be extracted from the new data is the moment $A^{LU}_{sin(\phi)}$ corresponding to the polarized electron beam spin asymmetry in semi-inclusive deep inelastic scattering. $A^{LU}_{sin(\phi)}$ is a twist-3 quantity which provides information about the quark gluon correlations. The study was performed with a 10.6 GeV longitudinally polarized electron beam and an unpolarized liquid hydrogen target. The talk will present a simultaneous study of all three pion channels (π^+, π^0 and π^-) over a large kinematic range with virtualities Q^2 ranging from 1 GeV^2 up to 8 GeV^2. The measurement in a large range of z, x_B, P_T and Q^2, including up to now not measured kinematic regions, enables a comparison with different reaction models.

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HK 10.3 Mo 17:15 HS 13

Analysis of COMPASS data on DVCS — •Johannes Giarra — on behalf of the COMPASS collaboration - 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 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.
The talk will summarize the steps needed to determine the DVCS cross section as well as the current status of the analysis of the COMPASS DVCS data.

HK 10.4 Mo 17:30 HS 13

Measurement of the transverse beam spin asymmetry in elastic electron proton 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] for the A4-Collaboration — [1]Institut für Kernphysik, Johannes Gutenberg-Universität Mainz — [2]Helmholtz-Institut Mainz — [3]PRISMA Cluster of Excellence, Johannes Gutenberg-Universität Mainz

The study of the two-photon exchange is motivated by the discrepancy between the Rosenbluth separation and polarization transfer data on the proton form factor ratio. In order to extract the hadron-structure information correctly in the high-precision electron scattering experiments, one needs to understand how the two-photon exchange may affect various observables. The transverse single spin asymmetries, which arise due to the interference between the one-photon and two-photon exchange amplitudes, provide an excellent opportunity to test our understanding of the two-photon exchange mechanism. The A4 collaboration at the MAMI accelerator has performed measurements on the transverse beam spin asymmetry at various beam energies between 300 MeV and 1.5 GeV. The latest results will be presented in this talk.

HK 10.5 Mo 17:45 HS 13

Proton Time-Like Electromagnetic Form Factor Measurement with the Scan Method at BESIII — •Christoph Rosner[1], Yadi Wang[1], Samer Ali Nasher Ahmed[1], Alaa Dbeyssi[1], Paul Larin[1], Dexu Lin[1], Frank Maas[1,2,3], and Cristina Morales[1] for the BESIII-Collaboration — [1]Helmholtz-Institut Mainz, 55128 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 688.5 pb^{-1} of 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 born cross section of $e^+e^- \to p\bar{p}$ is measured with the energy scan technique for the first time. Additionally, the absolute value of the proton electric and magnetic FF as well as their ratio are measured with high accuracy by analysing the helicity angular distribution of the outgoing protons.

HK 10.6 Mo 18:00 HS 13

Spectral functions of electromagnetic and axial nucleon form factors: 3π-continua at low energies — •Norbert Kaiser[1] and Emilie Passemar[2] — [1]Physik Department T39, TU München — [2]Department of Physics, Indiana University, Bloomington, USA

We study the imaginary parts of the isoscalar electromagnetic and isovector axial form factors of the nucleon close to the 3π-threshold in covariant baryon chiral perturbation theory. At the two-loop level, the contributions arising from leading and next-to-leading order chiral πN-vertices, as well as pion-induced excitations of virtual $\Delta(1232)$-isobars, are calculated. It is found that the heavy baryon treatment overestimates substantially these 3π-continua. From a phenomenological analysis, that includes the narrow $\omega(783)$-resonance or the broad a_1-resonance, one can recognize small windows near threshold, where chiral 3π-dynamics prevails. However, in the case of the isoscalar electromagnetic form factors $G^s_{E,M}(t)$, the radiative correction provided by the $\pi^0\gamma$-intermediate state turns out to be more significant therein.
Work supported in part by DFG and NSFC (CRC110).

HK 10.7 Mo 18:15 HS 13

Measurement of the beam-normal single-spin asymmetry for electrons scattered off ^{12}C. — •Anselm Esser, Harald Merkel, Sören Schlimme, Concettina Sfienti, and Michaela Thiel — A1 Kollaboration, Inst. f. Kernphysik, Uni Mainz

The beam-normal single-spin asymmetry A_n arises in the elastic scattering of electrons polarised perpendicular to the scattering plane off unpolarised nuclei. It not only contributes as an important background to parity violation experiments, but has recently gained interest as a probe for multi photon exchange amplitudes. At the Mainz Microtron, A_n was measured for 570 MeV electrons scattered off ^{12}C, covering the Q^2 range between 0.02 and 0.05 GeV^2/c^2. Custom-build quartz Cherenkov detectors located in the focal plane of magnetic spectrometers were used for electron detection. The readout of the attached PMTs was performed with integrating ADCs allowing for particle rates too high for counting. The resulting asymmetry shows a significant deviation from the theoretical predictions in the covered Q^2 range.