

HK 27: Hadronenstruktur und -spektroskopie

Zeit: Dienstag 14:00–16:15

Raum: HSZ-101

Gruppenbericht

HK 27.1 Di 14:00 HSZ-101

Electromagnetic form factors of the baryon octet in effective field theory — TORSTEN BAUER¹, JAN BERNAUER^{1,2}, ●PATRICIA BICKERT¹, and STEFAN SCHERER¹ — ¹Institut für Kernphysik, JGU, Mainz — ²Laboratory for Nuclear Science, MIT, Cambridge, USA

We present a calculation of the electromagnetic form factors of the nucleon to third chiral order in manifestly Lorentz-invariant effective field theory. The ρ and ω mesons as well as the $\Delta(1232)$ resonance are included as explicit dynamical degrees of freedom. To obtain a self-consistent theory with respect to constraints we consider the proper relations among the couplings of the effective Lagrangian. For the purpose of generating a systematic power counting, the extended on-mass-shell renormalization scheme is applied in combination with the small-scale expansion. The results for the electric and magnetic Sachs form factors are analyzed in terms of experimental data and compared to previous findings in the framework of chiral perturbation theory. Finally, we present the results of a three-flavor calculation of the baryon-octet form factors including vector-meson degrees of freedom.

HK 27.2 Di 14:30 HSZ-101

Studien zur Messung des elektromagnetischen Formfaktors des η' Mesons — ●SASCHA WAGNER, ACHIM DENIG und MARC UNVERZAGT für die A2-Kollaboration — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz

Elektromagnetische Übergangsformfaktoren liefern einen Einblick in die intrinsische Struktur der Hadronen. Zudem stellen die Formfaktoren von leichten pseudoskalaren Mesonen eine wichtige Größe dar, um die theoretische Unsicherheit der hadronischen Licht-Licht-Streuung in Bezug auf das anomale magnetische Moment des Myons zu reduzieren. In Beschleunigerexperimenten sind diese z. B. mit dem Crystal Ball Aufbau am Mainzer Mikrotron (MAMI) im zeitartigen Bereich über Zerfälle zugänglich.

Innerhalb der A2-Kollaboration am MAMI werden Experimente mit Bremsstrahlungsphotonen durchgeführt. Für die Messungen zum η' Meson kam im Jahr 2012 zum ersten Mal eine neue Photonenmarkierungsanlage (End-point Tagger) in Kombination mit dem Crystal Ball/TAPS-Aufbau zum Einsatz.

In diesem Beitrag wird speziell die Messung des Dalitz-Zerfalls $\eta' \rightarrow \gamma^* \gamma \rightarrow e^+ e^- \gamma$ mit dem Crystal Ball betrachtet. Es werden Simulationsstudien zum η' Dalitz-Zerfall und den wichtigsten Untergrundprozessen, sowie erste Analysen der in 2012 gemessenen Daten vorgestellt.

HK 27.3 Di 14:45 HSZ-101

New experimental approaches to determine the real part of the η' -nucleus potential* — ●MARIANA NANOVA for the CBELSA/TAPS-Collaboration — II. Physikalisches Institut, Justus Liebig Universität Gießen

Transparency ratio measurements provide information on the inelastic cross section and in-medium width of η' and thereby on the imaginary part of the η' -nucleus potential [1]. The real part of the η' -nucleus optical potential can be deduced from the measurement of the η' excitation function and of the η' momentum distribution which are sensitive to the sign and depth of the potential. Data taken in 2009 at CB/TAPS@ELSA on a carbon target have been analysed. The results are compared to model calculations [2] assuming different scenarios for the real part of the potential, related directly to the in-medium mass modification of the meson. The data are consistent with a weakly attractive η' -nucleus potential.

[1] M. Nanova et al., Phys. Lett. B 710 (2012) 600

[2] E. Paryev, arXiv 1209.4050 [nucl-th]

*Funded by DFG(SFB/TR-16)

HK 27.4 Di 15:00 HSZ-101

Measurement of the double polarization observable E in the reaction $\vec{\gamma} \vec{p} \rightarrow p \eta'$ — ●FARAH NOREEN AFZAL for the CBELSA/TAPS-Collaboration — HISKP, Bonn, Germany

The study of η' -photoproduction off protons allows an investigation of the not well understood high-lying resonances ($m_{N^*} > 1892$ MeV) of the nucleon excitation spectrum. The recent cross section data measured at CLAS and CBELSA/TAPS alone are not sufficient in order to disentangle all the different resonance contributions due to the

largely overlapping resonances. Additionally, the measurement of well chosen single and double polarization observables is needed for an unambiguous solution. Several of these polarization observables are measured with the CBELSA/TAPS experiment, utilizing a polarized photon beam and polarized nucleons. The setup provides a nearly full 4π angular coverage and a high detection efficiency for neutral final states. In this talk, the preliminary results of the double polarization observable E in the reaction $\vec{\gamma} \vec{p} \rightarrow \eta' p$, using a circularly polarized photon beam in combination with a longitudinally polarized butanol target, will be presented. Supported by the Deutsche Forschungsgemeinschaft (SFB/TR16).

HK 27.5 Di 15:15 HSZ-101

Bestimmung von Polarisationsobservablen in der ω Photoproduktion* — ●HOLGER EBERHARDT für die CBELSA/TAPS-Kollaboration — PI Uni Bonn

Ziel des Crystal-Barrel/TAPS-Experimentes am Bonner Elektronen-Beschleuniger ELSA ist die Untersuchung der Nukleon-Resonanzstruktur durch Photoproduktion von Mesonen. Zur Messung der für diesen Zweck notwendigen Polarisationsobservablen werden zur Zeit Doppelpolarisationsexperimente mit polarisiertem Target und polarisierten Photonen durchgeführt. Untersuchungen der ω Photoproduktion in Schwellennähe, sowohl mit unpolarisierten Photonen als auch mit polarisierten Photonen zeigen, neben den dominierenden t-Kanal Beiträgen, signifikante s-Kanal Beiträge in diesem Kanal. Zur Ermittlung der beitragenden Resonanzen kann insbesondere die Strahl-Target-Helizitätsasymmetrie beitragen, da diese Observable als „Spinfilter“ im s-Kanal wirkt. Durch eine Partialwellenanalyse gemessener Observablen ist es möglich dominierende Resonanzbeiträge in der untersuchten Reaktion zu extrahieren.

* gefördert durch die Deutsche Forschungsgemeinschaft (SFB/TR-16)

HK 27.6 Di 15:30 HSZ-101

Polarisation Observables F and T in Double π^0 Photoproduction — ●STEFANIE GARNI for the A2-Collaboration — Departement of Physics, University of Basel, CH-4056 Basel, Switzerland

The measurement of single and double polarisation observables gives information about the different resonance contributions to the cross section and hence leads to a better understanding of the nucleon and its excited states. Double π^0 photoproduction is a very interesting reaction for the investigation of nuclear resonances. Photoproduction of pion pairs allows to study states which decay preferentially via intermediate resonances. The double neutral channel has the additional advantage of only small non-resonant background contributions.

Double π^0 -photoproduction off a transversally polarized H-butanol target has been measured using circularly polarized bremsstrahlung photons produced by MAMI-C with incident energies up to 1.5 GeV. The double π^0 reaction was identified using a combined setup of the Crystal Ball calorimeter and a TAPS forward wall which results in an almost 4π acceptance. Preliminary results on the single polarization observable T and double polarization observable F will be presented.

HK 27.7 Di 15:45 HSZ-101

Measurements of azimuthal asymmetries in DVCS and associated processes at HERMES — ●ERIK ETZELMÜLLER, AVETIK AIRAPETIAN, IRINA BRODSKI, MICHAEL DÜREN, and MARIAN STAHL for the HERMES-Collaboration — II. Physikalisches Institut, Justus-Liebig-Universität Gießen, 35392 Gießen, Germany

Azimuthal asymmetries in exclusive electroproduction of real photons by the longitudinally polarized HERA positron beam scattering off an unpolarized hydrogen target ($ep \rightarrow e\gamma$) are measured at HERMES. The asymmetries arise from deeply virtual Compton scattering (DVCS) and its interference with the Bethe-Heitler process. These asymmetries provide the theoretically cleanest access to Generalized Parton Distributions. A recoil detector has been installed in HERMES that allows for the detection of all final state particles in the process $ep \rightarrow e\gamma$. It consisted of a silicon strip detector, a scintillating fibre tracker and a photon detector surrounded by a 1 T superconducting magnet.

In previous publications, associated processes $ep \rightarrow e\gamma\pi^0$ and $ep \rightarrow e\gamma n\pi^+$ contributed as background processes about 12% to the DVCS signal. The new ability of HERMES to detect the recoil particles allows to select and measure the associated processes, and it also allows

to select clean DVCS processes by reducing the associated background processes to a negligible level. Recent HERMES results on azimuthal asymmetries obtained in DVCS and in the associated processes are presented.

HK 27.8 Di 16:00 HSZ-101

COMPASS results on transverse spin asymmetries in identified two-hadron production in SIDIS — ●CHRISTOPHER BRAUN
— for the COMPASS collaboration — Uni Erlangen

The parton distribution function h_1 of a transversely polarized quark inside a transversely polarized nucleon, is chiral-odd and therefore not accessible in inclusive deep inelastic scattering. It can only be observed in semi-inclusive deep inelastic scattering (SIDIS) in combination with another chirally odd function like the two-hadron interference fragmentation function (IFF) H_1^\perp . The 160 GeV/c polarized μ^+ beam of

CERN's M2 beamline allows COMPASS to investigate the spin structure of the nucleon using polarized solid state targets.

In this contribution an overview of COMPASS results for the azimuthal asymmetries in two-hadron production is given. This includes the results on a polarized deuteron target from the data taken in the years 2002-04, as well as the first data set on a transversely polarized proton target taken in the year 2007 and a data set taken on the same target during 2010 to increase precision. An extraction of h_1 using the two-hadron IFF H_1^\perp has been carried out for the 2007 data. The COMPASS spectrometer allows an efficient particle identification, which can be used to determine the composition of the h^+h^- pairs in terms of pions and kaons. The results for the possible combinations, obtained very recently, will be discussed. In particular the asymmetries for $\pi^+\pi^-$ pairs will be compared to model predictions and the corresponding results from HERMES. — Supported by German BMBF