HK 1: Hadron Structure and Spectroscopy I

Zeit: Montag 14:00–15:45 Raum: S1/01 A5

Gruppenbericht HK 1.1 Mo 14:00 S1/01 A5

Proton polarizability program at CB-MAMI — •Cristina Collicott for the A2-Collaboration — Institut für Kernphysik, Mainz, Deutschland — George Washington University, Washington DC, USA

Nucleon polarizabilities are fundamental structure observables, like the nucleon mass or charge, which are sensitive to the internal quark dynamics of the nucleon. Scalar and spin polarizabilities quantify the response of the proton's structure and spin respectively when an external electromagnetic field is applied. Polarized Compton scattering off the proton, where the photon acts as an electromagnetic probe, can be used to study the polarizabilities of the proton, thus probing its internal structure. While the scalar polarizabilities have been studied previously, albeit with large uncertainties, the spin polarizability terms have yet to be determined experimentally.

This talk will discuss an ongoing experimental program at MAMI to study both the scalar and spin terms of the proton polarizabilties. This program makes use of the Crystal Ball and TAPS detector system within the A2 collaboration at MAMI. Through a series of Compton scattering experiments, this program aims to reduce the large experimental uncertainties on the proton scalar polarizabilities, as well as determine the proton spin polarizabilities experimentally for the first time. A program overview and current results will be presented. This program is supported by the DFG under contract SFB1044, along with international support from the USA and Canada.

HK 1.2 Mo 14:30 S1/01 A5

Measurement of the proton scalar polarizabilities at MAMI — •Edoardo Mornacchi for the A2-Collaboration — Institut für Kernphysik, Universität Mainz

The electric (α_{E_1}) and magnetic (β_{M_1}) scalar polarizabilities are fundamental properties related to the internal structure of the nucleon. They play a crucial role not only in our understanding of the nucleon, but also in other areas such as atomic physics, where they provide e.g. corrections to the Lamb Shift. In order to determine the scalar polarizabilities of the proton, the beam asymmetry Σ_3 was measured, for the first time for the Compton scattering, below the pion photoproduction threshold. The measurement was performed at the MAMI accelerator facility in Mainz.

The linearly polarized primary photons impinged on a liquid hydrogen target and the outgoing particles were detected in a nearly 4π detector setup, composed by Crystall Ball and TAPS calorimeters.

In this talk the results on the Compton scattering beam asymmetry Σ_3 and their influence on the extraction of α_{E_1} and β_{M_1} will be discussed.

Supported by DFG under contract SFB1044.

HK 1.3 Mo 14:45 S1/01 A5

Measurement of the Proton Electromagnetic Form Factor in Time-like Region with the ISR Method at BESIII — •Dexu Lin[1,2], Samer Ali Nasher Ahmed[1,2], Alaa Dbeyssi[1], Paul Larin[1], Frank Maas[1,2,3], Cristina Morales[1], Christoph Rosner[1,2], and Yadi Wang[1] for the BESIII-Collaboration — [1]Helmholtz-Institut Mainz, 55128 Mainz, Germany — [2]Johann-Joachim-Becherweg 36 — [3]PRISMA Cluster of Excellence, Johannes Gutenberg Universität Mainz, 55099 Mainz, Germay

The structure of the proton can be understood through the study of its electromagnetic (EM) form factors. Electron scattering experiments (space-like region) have explored the proton EM form factors with a high accuracy. Only few data on the proton form factors in the time-like region, and only a very coarse determination of the individual electric and magnetic form factors (or their ratio) has been possible so far.

The BESIII (Beijing Spectrometer III) at BEPCII (Beijing Electron Positron Collider II) has collected large data samples from J/ψ-mass up to 4.60 GeV. These data can be used to measure proton EM form factors by means of Initial-State-Radiation (ISR) events with the process $e^+e^- \to p\bar{p}\gamma_{ISR}$. With 7.408 fb^{-1} total luminosity of seven data samples from 3.773 -4.600 GeV, the proton form factors and the cross section of $p\bar{p}$ have been analyzed with ISR-tagged method. In this talk, the status of this work will be reported together with a discussion of the analysis of the background.

HK 1.4 Mo 15:00 S1/01 A5

Measurements of $e^+e^- \to n\bar{n}$ cross Section from 2015 Scan Data at BESIII — •Samer Ahmed[1,2], Alaa Dbeyssi[1,2], Paul Larin[1,2], Dexu Lin[1,2], Frank Maas[1,2,3], Cristina Morales[1,2], Christoph Rosner[1,2], and Yadi Wang[1,2] for the BESIII-Collaboration — [1]Helmholtz-Institut Mainz, Germany — [2]Institute of Nuclear Physics, Johannes Gutenberg-University of Mainz, Germany — [3]PRISMA Cluster of Excellence, Mainz, Germany

The neutron structure and dynamics can be understood through the study of its electromagnetic form factors (FFs). In the time-like region few experiments had been performed so far, none of them had the possibility to determinate the electric and magnetic FFs and even their ratio. Therefore, a large data sample [2.0 - 3.08 GeV] with a total luminosity of 523.5 pb^{-1} has been collected in Beijing Spectrometer III (BESIII) at the Beijing Electron Positron Collider II (BEPCII). With the collected data, it is expected to separately determine the electric and the magnetic FFs of neutron and enhance the knowledge of its structure. In this contribution, we will present the current status of $n\bar{n}$ analysis and the efforts of extracting the ratio of the neutron FFs.

HK 1.5 Mo 15:15 S1/01 A5

Bestimmung von Hadronmultiplizitäten am COMPASS Experiment — •Johannes Giarra — for the COMPASS collaboration - Institut für Kernphysik, Johannes Gutenberg-Universität Mainz, Johann-Joachim-Becher-Weg 45, 55099 Mainz

Quarks lassen sich ausserhalb des Nukleons nicht als einzelne Quarks sondern nur im Verbund von zwei oder mehr Quarks (Hadronen) beobachten. Die Hadronisierung eines Quarks wird durch Fragmentationsfunktionen (FF) beschrieben. Diese Funktionen lassen sich, durch Messung von Hadronmultiplizitäten, flavourseparіert in der semi-inklusiven tiefinelastischen Lepton-Nukleon Streuung (SIDIS) bestimmen. Als Hadronmultiplizitäten bezeichnet man die Anzahl der Hadronen pro DIS Ereignis.
2012 wurde am COMPASS Experiment (CERN) eine SIDIS-Messung mit einem Myonstrahl, der an einem Flüssigwasserstofftarget gestreut wird, durchgeführt. Zur Hadronenidentifikation wird ein ringabbildendender Cherenkov-Detektor genutzt.
Der Vortrag behandelt die Bestimmung von Detektoreffizienzen und Spektrometerakzeptanzen die zur Extraktion von Multiplizitäten benötigt werden.

HK 1.6 Mo 15:30 S1/01 A5

Kaon fragmentation functions from COMPASS 2006 kaon multiplicities* — •Daniel Hahne — Physikalisches Institut Bonn

Knowledge of unpolarized fragmentation functions (FFs) is essential for the flavor separation of spin dependent parton distribution functions (PDFs). Fragmentation functions are extracted based on hadron multiplicities in semi-inclusive deep inelastic scattering where at least one final state hadron is identified. I will present the latest results of kaon FFs extracted from COMPASS 2006 $K^{\pm}$ multiplicities on an isoscalar target.

Due to different experimental acceptances for the reconstruction of charged and neutral kaons, K^0_S multiplicities have an extended kinematic range compared to $K^{\pm}$ multiplicities. I will discuss the possible impact of additional K^0_S multiplicities on the extraction of kaon FFs.
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