HK 16: Hadron Structure and Spectroscopy III

Zeit: Dienstag 14:00–16:00 Raum: S1/01 A5

Gruppenbericht HK 16.1 Di 14:00 S1/01 A5

Measurement of the Two-Photon Exchange in the Elastic $e^{\pm}p$ Scattering at the OLYMPUS Experiment at DESY — •Dmitry Khaneft and OLYMPUS Collaboration — Helmholtz-Institut Mainz, Mainz, Deutschland

The OLYMPUS experiment aims to resolve the experimental discrepancy in the determination of the ratio of the proton electric to magnetic form factor, $R = G_E/G_M$, extracted using Rosenbluth separation and polarization transfer technique. This discrepancy can be explained by a two-photon exchange contribution in lepton-nucleon scattering. A measurement of the elastic scattering cross section ratio $\sigma_{e^+p}/\sigma_{e^-p}$ will allow a direct measurement of the two-photon exchange amplitude. The OLYMPUS experiment was carried out at DESY Hamburg, Germany using 2 GeV electron and positron beams in the DORIS storage ring incident on an internal hydrogen gas target. Multiple independent luminosity monitors were operated in parallel to the main spectrometer during data taking to allow for a precise relative luminosity measurement. Approximately 4.45 fb^-1 of integrated luminosity were collected. The OLYMPUS experiment and the status of the analysis will be discussed.

HK 16.2 Di 14:30 S1/01 A5

Solenoid spectrometer studies for the P2 experiment at MESA — •Dominik Becker[1], Kathrin Gerz[1], Sebastian Baunack[1], Thomas Jennewein[1], Krishna S. Kumar[3], Frank E. Maas[1,2], Razvan D. Bucoveanu[4], and Hubert Spiesberger[4] for the P2-Collaboration — [1]PRISMA Cluster of Excellence and Institute of Nuclear Physics, Johannes Gutenberg University, Mainz, Germany — [2]Helmholtz Institue Mainz, Germany — [3]Department of Physics and Astronomy, Stony Brook University, Stony Brook, USA — [4]PRISMA Cluster of Excellence and Institute of Physics, Johannes Gutenberg University, Mainz, Germany

The goal of Project P2 is to determine the electroweak mixing angle $\sin^2(\theta_W)$ to a precision of 0.15 % at low momentum transfer ($Q^2 = 0.004\ \mathrm{GeV}^2/\mathrm{c}^2$). The experiment will be performed at the future MESA accelerator facility in Mainz. The experimental method comprises a measurement of the proton's weak charge Q_W^p to a relative uncertainty of 1.9 % via the parity violating asymmetry in elastic electron-proton scattering. In the talk, the experimental method as well as the achievable precision in the determination of the electroweak mixing angle will be presented. Furthermore, results of Geant4 simulations which were carried out to study a possible experimental setup will be shown.

HK 16.3 Di 14:45 S1/01 A5

Measurement of the electromagnetic form factors of the proton in the Q^2 range 0.5 to 2 $\mathrm{GeV}^2/\mathrm{c}^2$ — •Julian Müller for the A1-Collaboration — Institut für Kernphysik, Mainz

In spring 2015 a new measurement of the form factors of the proton was performed at the MAMI accelerator in Mainz. The form factors will be determined via elastic electron proton scattering, measured with the three spectrometer facility of A1. Now, that the higher beam energies provided by a third stage of the accelerator are available, we were able to increase the limit in Q^2 from 0.5 up to 2 GeV^2/c^2. Therefore, the main focus of this experiment will be the precise determination of the magnetic form factor of the proton. This talk will cover the experimental setup and the current status of the analysis. Together with previous experiments at A1 at lower values of Q^2, we aim to contribute to the solution of the proton radius puzzle.

HK 16.4 Di 15:00 S1/01 A5

Feasibility studies for the measurement of time-like proton electromagnetic form factors in reactions of the type $\bar{p}p \to \mu^+\mu^-$ at PANDA-FAIR — •Iris Zimmermann, Alaa Dbeyssi, Dmitry Khaneft, Frank Maas, Manuel Zambrana, and Cristina Morales for the PANDA-Collaboration — Helmholtz-Institut Mainz

In this contribution the latest status of the feasibility studies for the measurement of time-like proton electromagnetic form factors (FF's) using reactions of the type $\bar{p}p \to \mu^+\mu^-$ at the PANDA experiment at FAIR will be presented. Electromagnetic form factors are fundamental quantities which parameterize the electric and magnetic structure of hadrons. In the time-like region, the FF's can be accessed through reactions of the type $p\bar{p} \to l^+l^-$, where l = e, μ, under the assumption of one photon exchange. It will be the first time that muon pairs in the final state will be used for the measurement of the TL em FF's of the proton. One advantage of using this channel is that radiative corrections due to final state radiation are suppressed by the heavy mass of the muon. Measuring $\bar{p}p \to \mu^+\mu^-$ will also serve as a consistency check of the TL em FF data from $\bar{p}p \to e^+e^-$. In frame of the PANDARoot software, which encompasses full detector simulation and event reconstruction, the statistical precision at which the proton FF's will be determined at PANDA is estimated for the signal reaction $p\bar{p} \to \mu^+\mu^-$ at different antiproton beam momenta. The signal identification and the suppression of the main background process ($p\bar{p} \to \pi^+\pi^-$) are studied. For the analysis of the processes of interest, different methods have been used and are compared.

HK 16.5 Di 15:15 S1/01 A5

Study of Excited Ξ Baryons in Antiproton-Proton Collisions with the PANDA Detector — •Jennifer Pütz, Albrecht Gillitzer, and James Ritman for the PANDA-Collaboration — Forschungszentrum Jülich

Understanding the excitation pattern of baryons is indispensable for a deep insight into the mechanism of non-perturbative QCD. Up to now only the nucleon excitation spectrum has been subject to systematic experimental studies while very little is known on excited states of double or triple strange baryons.
In studies of antiproton-proton collisions the PANDA experiment is well-suited for a comprehensive baryon spectroscopy program in the multi-strange and charm sector. A large fraction of the inelastic $\bar{p}p$ cross section is associated to final states with a baryon-antibaryon pair together with additional mesons, giving access to excited states both in the baryon and the antibaryon sector.
In the present study we focus on excited Ξ states. For final states containing a $\Xi\bar{\Xi}$ pair cross sections up to the order of μb are expected, corresponding to production rates of $\sim 10^6$/d at a Luminosity $L = 10^{31}\ \mathrm{cm}^{-2}\ \mathrm{s}^{-1}$ (5% of the full value). A strategy to study the excitation spectrum of Ξ baryons in antiproton-proton collisions will be discussed. The reconstruction of reactions of the type $\bar{p}p \to \Xi^*\bar{\Xi}$ (and their charge conjugated) with the PANDA detector will be presented based on a specific exemplary reaction and decay channel.

HK 16.6 Di 15:30 S1/01 A5

Upper limit determination of the η-decay $\eta \to \pi^0 + e^+ + e^-$ with WASA-at-COSY* — •Florian Bergmann, Kay Demmich, Nils Hüsken, Karsten Sitterberg, and Alfons Khoukaz for the WASA-at-COSY-Collaboration — Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, Germany

Investigations on symmetries and symmetry breaking is a major part of the WASA-at-COSY physics program. They allow for a better understanding of the physics within the standard model. An elegant way to search for violation of conservation laws, which are directly connected to symmetry breaking effects, is the study of rare meson decays. At the WASA-at-COSY facility an extensive physics program on η-meson decays has been performed with high statistics which are required to obtain new limits on, e.g., the C, P and T symmetry breaking or combinations thereof.
In this contribution the status of the analysis of the C-violating η-decay $\eta \to \pi^0 + e^+ + e^-$ using the high statistics $p + d \to {}^3He + \eta$ data obtained with WASA-at-COSY will be presented and discussed. The dominant C-conserving contribution to this decay via a $\pi^0 + \gamma^* + \gamma^*$ intermediate state has an expected branching ratio of less than 10^{-8} in the standard model. An observation of a significantly higher branching ratio would indicate the presence of a C-violating process.

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HK 16.7 Di 15:45 S1/01 A5

Messung des elektromagnetischen Formfaktors des η' Mesons — •Sascha Wagner und Achim Denig für die A2-Kollaboration — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz

Elektromagnetische Übergangsformfaktoren gewähren uns 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. 2014 fanden gezielte Experimente zur Photoproduktion von η' und ω Mesonen mit dem neuen End-point Tagger statt, einer Photonmarkierungsanlage, die hauptsächlich für Messungen des η' entwickelt wurde.

In diesem Beitrag wird speziell auf die Messung des Dalitz-Zerfalls $\eta' \to \gamma^*\gamma \to e^+e^-\gamma$ mit dem Crystal Ball/TAPS-Aufbau eingegangen. Es werden Simulationsstudien für die wichtigsten Untergrundprozesse sowie erste Analysen der in 2014 gemessenen Daten vorgestellt.

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