HK 16: Hadron Structure and Spectroscopy III

Zeit: Dienstag 14:00–16:00 Raum: HZO 50

Gruppenbericht HK 16.1 Di 14:00 HZO 50

The NA64 experiment for searches of rare events at CERN — •Michael Hösgen and Bernhard Ketzer for the NA64-Collaboration — Universität Bonn, Helmholtz-Institut für Strahlen- und Kernphysik, Bonn, Germany

We report on the recent activity of the NA64 experiment at the SPS of CERN. The NA64 experiment uses a beam dump setup to conduct missing energy searches with a high intensity electron beam.

In 2016 and 2017 separate dedicated searches for two mediators between standard model and dark sector, a new light vector boson A' and a new short-lived neutral boson X, were performed. The A' was proposed as a possible explanation for magnetic moment anomalies of muons. It could be created in electron on target reactions $e^-Z \to e^-ZA'$ and supposedly decay invisible into lighter dark sector particles ($A' \to \chi\bar{\chi}$). The X is motivated by an excess of e^+e^--pairs in ^{8}Be* excited state nuclear transitions. It could be produced in bremsstrahlung interactions $e^-Z \to e^-ZX$ and decay into standard model leptons ($X \to e^+e^-$).

We show the experimental setup and the analysis strategies of the searches for both bosons. We present the data from 2016 and take a first glance at the data recorded in 2017.

HK 16.2 Di 14:30 HZO 50

Search for the Y(2175) in Photo-Production at GlueX — •Abdennacer Hamdi[1,2], Klaus Götzen[1,2], Frank Nerling[1,2], and Klaus Peters[1] for the GlueX-Collaboration — [1]GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany. — [2]Goethe University Frankfurt

A long-standing goal of hadron physics has been to understand how the quark and the gluonic degrees of freedom that are present in the fundamental Quantum Chromodynamics Lagrangian manifest themselves in the spectrum of hadrons. Of particular interest is how the gluonic excitations give rise to exotic states. One class of such states are hybrid meson, theses states are predicted by phenomenological models and Lattice Quantum Chromodynamics calculations. A candidate for hybrid mesons is the Y(2175), as observed in electron-positron experiments.

We present the status and plans to search for this hybrid state in photo-production at the GlueX experiment in Jefferson Lab's Hall D, which had its first full production run in spring of 2017.

This work is supported by HGS-HIREe.

HK 16.3 Di 14:45 HZO 50

Nucleon quasi-parton distribution functions within the chiral quark soliton model — •Hyeon-Dong Son, Asli Tandogan-Kunkel, and Maxim V. Polyakov — Institut für Theoretische Physik II Fakultät für Physik und Astronomie Ruhr-Universität Bochum 44780 Bochum Deutschland

Quasi-Parton Distribution Functions(qPDFs), recently suggested by X. Ji, are of great importance as they open access to usual parton distribution functions in the lattice simulation of the QCD. It is meaningful to achieve a reliable calculation of them from a QCD-effective approach at low energy regime to provide a better insight. In this context, we present our recent studies on the nucleon qPDFs within the framework of the chiral quark-soliton model. We describe the evolution of the qPDFs as the nucleon velocity approaches to the light-like limit $v \to 1$ and discuss the relevant sum rules as well.

HK 16.4 Di 15:00 HZO 50

π^0 transition form factor measurement with A2 — •Lena Heijkenskjöld for the A2-Collaboration — Institute for Nuclear Physics, JGU Mainz

Meson transition form factors (TFFs) describe the dynamics of the transition between photons and hadrons and hence provide a probe of the intrinsic structure of hadrons. Within the singly-virtual time-like region, the TFF of the π^0 meson can be accessed via the Dalitz decay process $\pi^0 \to \gamma e^+e^-$. Due to the low branching ratio of the π^0 Dalitz decay (∼1.2%), a high statistics experiment is needed. The A2 experiment at MAMI, where π^0 mesons are produced by photo-induced reactions on protons, provides a high yield of π^0 Dalitz decays, and thus allows for a precision measurement of the π^0 TFF. Both completed and upcoming contributions of the A2 collaboration to the precision measurements of the π^0 TFF will be presented.

HK 16.5 Di 15:15 HZO 50

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

The electric (α_{E1}) and magnetic (β_{M1}) 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. In the past, the values of α_{E1} and β_{M1} were determined from the unpolarized differential cross-section of the Compton scattering $\gamma p \to \gamma p$. The measurement of the beam asymmetry Σ_3, provides an alternative approach to the extraction of the scalar polarizabilities, with different sensitivity and systematics compared to the unpolarized cross-section.
This asymmetry was measured for the first time below the pion photoproduction threshold by the A2 Collaboration with the Crystal Ball/TAPS experiment at MAMI (Mainz, Germany). A linearly polarized photon beam impinged on a liquid hydrogen target and the scattered photons were detected with the Crystal Ball/TAPS setup, providing almost 4π coverage. A new high precision measurement of both unpolarized cross-section and beam asymmetry Σ_3 is ongoing at MAMI and polarizabilities α_{E1} and β_{M1} will be extracted with unprecedented precision. The impact of the recently obtained and expected results on the extraction of the scalar polarizabilities will be discussed in this talk.
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HK 16.6 Di 15:30 HZO 50

Radiative pion-photoproduction in covariant chiral perturbation theory — •Jan Rijneveen — Ruhr-Universität, Bochum, Deutschland

Radiative pion-photoproduction is studied in the framework of covariant chiral perturbation theory with and without explicit Delta degrees of freedom. This reaction is of special interest as it allows one to extract the value of the magnetic moment of the Delta isobar using the recent experimental data at MAMI.

HK 16.7 Di 15:45 HZO 50

Femtoscopy studies using the "Correlation Analysis Tool using the Schrödinger equation" (CATS) — •Dimitar Mihaylov and Laura Fabbietti — James-Franck-Straße 1, 85748 Garching, Germany

The femtoscopy method can be used to investigate both the emission source and the interaction potential between particle pairs by measuring their correlation function. Recent studies have demonstrated that femtoscopy can be deployed to study the hyperon-nucleon interaction at low relative distances and momenta. The deeper understanding of those interactions is relevant not only in nuclear physics, but is strongly linked to the equation of state which in turn relates to the structure of neutron stars.

Femtoscopy analyses performed in high energy pp collisions at ALICE demonstrated bigger sensitivity to the interaction potentials due to the small emission source. However the currently available analysis tool in the field tend to be approximate and only applicable to larger source radii. This motivated us to develop the "Correlation Analysis Tool using the Schrödinger equation" (CATS) which entirely relies on numerical methods to evaluate the correlation function.

In this talk we will explain the basic working principles of the new tool, we will test it against established benchmark methods in the field and finally we will present the results from the first physics studies performed with CATS.

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