# HK 43: Hadron Structure and Spectroscopy VIII

Time: Wednesday 14:00–15:30 Location: HK-H9

**Group Report** HK 43.1 Wed 14:00 HK-H9

**Prospects for Spin-Parity Determination of Ξ Resonances in the $\overline{\Xi}\Lambda K^-$ Final State at $\overline{\mathrm{P}}$ANDA** — •Jennifer Pütz for the PANDA-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung

In order to deepen our insights into the mechanisms of non-perturbative QCD it is essential to understand the excitation pattern of baryons. Up to now only the nucleon excitation spectrum has been subject to systematic experimental studies while very little is known about the excited states of double or triple strange baryons.
In studies of antiproton-proton collisions the $\overline{\mathrm{P}}$ANDA experiment is well-suited for a comprehensive baryon spectroscopy program in the multi-strange sector. A large fraction of the inelastic $\bar{\mathrm{p}}$p cross section is associated to final states with a baryon-antibaryon pair together with additional mesons, enabling high rate studies of excited states both in the baryon and the antibaryon channel.
In Monte Carlo studies, it has been demonstrated that $\overline{\mathrm{P}}$ANDA will be able to observe the $\overline{\Xi}^+\Lambda K^-$ channel with high statistics, and at the same time kinematic constraints will suppress the background to negligible levels. In this study, the feasibility of $\overline{\mathrm{P}}$ANDA to determine the mass, width, spin and parity of two specific Ξ resonances, Ξ(1690) and Ξ(1820), is investigated by making use of a partial wave analysis employing the PAWIAN framework. This talk will present results demonstrating the capability of the $\overline{\mathrm{P}}$ANDA experiment to determine the spin-parity of these resonances using a data sample that can be collected within three days of data collection.

HK 43.2 Wed 14:30 HK-H9

**GPD measurements with PANDA based on antiproton scattering** — •Stefan Diehl for the PANDA-Collaboration — II. Physikalisches Institut, JLU Giessen, Germany

Generalized parton distributions (GPDs) are a well-established tool to study the three-dimensional nucleon structure in terms of the transverse position and the longitudinal momentum component of the partons. Classically, GPDs are measured in hard exclusive lepton scattering processes such as deeply virtual Compton scattering and deeply virtual meson production, which are currently extensively studied at Jefferson Laboratory with experiments such as CLAS12. While PANDA at FAIR has been designed to study antiproton annihilation, which yields access to time-like GPDs, also known as generalized distribution amplitudes (GDAs), it can also be used to study hard exclusive antiproton scattering processes such as $\bar{p}p \to \bar{p}pe^+e^-$ and $\bar{p}p \to \bar{p}p\mu^+\mu^-$. Such processes can be theoretically described with a dual handbag approach based on classical GPDs. The talk will present a feasibility study for the measurement of hard exclusive lepton pair production in antiproton scattering with PANDA and discuss its impact on the measurement of GPDs. A special focus will be set on the application of neural networks to optimize the particle ID and background suppression.

*Supported by BMBF within ERUM-FSP T08:PANDA and HFHF.

HK 43.3 Wed 14:45 HK-H9

**Testing the Chiral Anomaly from Primakoff Reactions in COMPASS Data** — •Nan-Hee Kang and Dominik Ecker for the COMPASS-Collaboration — Institute for Hadronic Structure and Fundamental Symmetries, Technische Universität München

In the years 2009 and 2012, the COMPASS collaboration at CERN has measured pion-photon scattering reactions via the Primakoff effect. In these reactions, high-energetic pions scatter off quasi-real photons stemming from the Coulomb field of a nucleus. The low-energy dynamics of the single-$\pi^0$ production ($\pi^-\gamma^{(*)} \to \pi^-\pi^0$) is driven by the chiral anomaly and described by the low-energy theorem for $F_{3\pi}$. Previous extractions of the chiral anomaly date back to the Serpukhov experiment in 1987, are restricted to the kinematic threshold region, and extracted $F_{3\pi}$ to a 10%-level. COMPASS measured the invariant mass spectrum including the $\rho(770)$-resonance which allows for more precise extraction of $F_{3\pi}$. The contribution will present the status of the analysis of the 2009 data set and compare its kinematic distributions to the larger 2012 data set.

HK 43.4 Wed 15:00 HK-H9

**Diffractively produced $f_1(1285)\pi$ system in the reaction $\pi^- + p \to \pi^-\pi^+\pi^-\eta + p$ at 190 GeV/c from COMPASS** — •David Spülbeck, Henri Pekeler, Mathias Wagner, Simon Havemann, and Bernhard Ketzer for the COMPASS-Collaboration — Helmholtz-Institut für Strahlen- und Kernphysik der Universität Bonn, Bonn, Germany

Hybrids are strongly interacting bound states with explicit gluonic degrees of freedom. Models and recent lattice QCD simulations alike predict the lightest hybrid state with spin-exotic quantum numbers $1^{-+}$ to have a strong branching into $f_1(1285)\pi$. This particular decay can be studied well using the data recorded by the COMPASS collaboration on the scattering of a 190 GeV/c pion beam off a fixed hydrogen target. Selecting diffractive reactions of the kind $\pi^- + p \to \pi^-\pi^+\pi^-\eta + p$ yields the world's largest data sample for a partial wave analysis that includes the $f_1(1285)\pi$ channel of interest. This contribution introduces the fundamental principles of the event selection for the $\pi^-\pi^+\pi^-\eta$ final state using COMPASS data. We discuss the selected data sample in detail and show the contributions of several resonances by identifying decay chains that end up in the four-body final state in question. A comparison to the data sample of the E852 collaboration will be made, which gave evidence for the spin-exotic state to decay into $f_1(1285)\pi$. As the COMPASS data sample is about eight times larger, a PWA in bins of the 4-momentum transfer and the invariant mass will be possible, giving important constraints to disentangle resonant and non-resonant processes. Supported by BMBF.

HK 43.5 Wed 15:15 HK-H9

**New experimental frontiers in the study of many-hadron systems with ALICE at the LHC** — •Raffaele Del Grande for the ALICE-Collaboration — TUM, Munich, Germany

The femtoscopy technique has recently been extended by the ALICE Collaboration to study the strong interaction among hadrons in three-particle systems. Three-body forces involving both nucleons and hyperons are necessary in the theoretical description of nuclear bound objects and represent an important ingredient in the calculation of the nuclear equation of state of neutron stars. Solid experimental constraints to the interaction models are currently missing and therefore, direct measurements of three-hadron interactions are strongly demanded.

The results presented in this talk are obtained using high-multiplicity pp collisions at $\sqrt{s} = 13$ TeV measured by ALICE at the LHC. The first measurement of p–p–p and p–p–Λ correlations will be shown. The corresponding genuine three-particle correlations are obtained by subtracting the known two-body effects from the measured correlation functions of the triplets. A non-zero three-particle cumulant is observed providing an insight on the three-body dynamics for p–p–p and p–p–Λ. The same approach has been used in the measurement of p–p–$K^+$ and p–p–$K^-$ correlations. The study of these systems is relevant, in particular, for the search of exotic bound states of antikaons and nucleons, whose possible formation is driven by the attractive nature of the isospin I=0 $\bar{K}$N interaction below the mass threshold.