HK 4: Hadron Structure and Spectroscopy I

Time: Monday 16:30–18:30 Location: H3

Group Report HK 4.1 Mon 16:30 H3

Observation of a structure in the M(pη) invariant mass distribution at 1700 MeV in the γp - p πη reaction — •Volker Metag and Mariana Nanova for the CBELSA/TAPS-Collaboration — II. Physikalisches Institut Universität Giessen

The present work extends earlier studies of the $\gamma p \to p\pi^0\eta$ reaction and has been motivated by the recently claimed observation of a narrow structure around an excitation energy of 1678 MeV [1]. The existence of this structure cannot be confirmed. Instead, for E_γ = 1400 - 1500 MeV and the cut $M_{p\pi^0} \leq 1190$ MeV a statistically significant structure in the $M_{p\eta}$ invariant mass distribution near 1700 MeV is observed with a width of $\Gamma \approx 35$ MeV.The most likely interpretation is that it is due to a triangular singularity in the $\gamma p \to p a_0 \to p\pi^0\eta$ reaction.

[1] V. Kuznetsov *et al.*, JETP Lett. **106**, 693 (2017).

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HK 4.2 Mon 17:00 H3

$K^0_S\Sigma^0$ photoproduction at the BGOOD experiment — •Katrin Kohl for the BGOOD-Collaboration — Physikalisches Institut, Nussallee 12, D-53115 Bonn

The BGOOD experiment at the ELSA accelerator facility uses an energy tagged bremsstrahlung photon beam to investigate hadronic excitations in meson photoproduction.

The associated photoproduction of K^0_S and hyperons is of particular interest. A cusp-like structure observed in the $\gamma p \to K^0_S\Sigma^+$ reaction at the K^* threshold is described by models including multi-quark resonances through dynamically generated vector meson-baryon interactions. This is the same model which predicted the P_C pentaquark states observed at LHCb through D^*-Σ_c interactions. In analogy, in the s-quark sector a peak like structure in $K^0_S\Sigma^0$ photoproduction off the neutron is predicted, associated with a K^*-Σ type configuration.

This talk presents the measurement of the $\gamma n \to K^0_S\Sigma^0$ differential cross section from threshold to a beam energy of 2600 MeV. Within the available statistics the results appear consistent with the predicted peak like structure.

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HK 4.3 Mon 17:15 H3

a_0 photoproduction at the BGOOD experiment — •Adrian Sonnenschein for the BGOOD-Collaboration — Physikalisches Institut, Nussallee 12, D-53115 Bonn

In recent years hadron spectroscopy has experienced a renaissance due to the discovery of tetra- and pentaquark systems including c and b quarks. Similar structures are expected similar structures are expected in the sector of light u,d,s quarks. The BGOOD experiment at the ELSA electron accelerator facility is studying this through the photoproduction of mesons close to production threshold. Recent results suggestthat the $K\bar{K}$ threshold is of particular interest.

This is where the isovector meson resonances $a_0(980)$ is located, slightly below the $K\bar{K}$ threshold. Photoproduction of a $\pi^0\eta$ pair off a proton $\gamma p \to \pi^0\eta p$ is a favourable reaction channel to study the $a_0 p$ threshold, since $a_0(980)$ has a dominant $\pi_0\eta$ decay mode.

This talk presents the measurement of the $\pi_0\eta$ mass distribution and the determination of differential cross sections.

*Supported by DFG projects 388979758/405882627 and the European Unions's Horizont 2020 programm, grant 824093.

HK 4.4 Mon 17:30 H3

Determination of the target asymmetry T in the reaction $\gamma p \to p\pi^0$ — •Sebastian Ciupka — Helmholtz-Institut für Strahlen- und Kernphysik, Universität Bonn

Photoproduction experiments provide a tool to further our understanding of the experimentally observed nucleon excitation spectra, which show discrepancies to predictions based on e.g. lattice QCD. Since the resonances are strongly overlapping, a partial wave analysis is needed to disentangle the states. To unambiguously determine the complex amplitudes of the analysis, it is not enough to conduct unpolarised measurements, therefore measurements with a polarised beam, a polarised target or with a recoil nucleon polarimeter have to be realised.

At the CBELSA/TAPS experiment in Bonn a linearly polarised photon beam and a longitudinally or transversely polarised target are provided, giving access to single and double polarization observables. The two main detectors of the experiment are the Crystal Barrel (CB) calorimeter and the MiniTAPS calorimeter in forward direction, which in combination provide nearly 4π coverage.

This talk presents preliminary results for the target asymmetry T in π photoproduction, determined from data collected after the upgrade of the CB readout system at the end of 2017. The data are compared with previously collected data and theoretical predictions.

HK 4.5 Mon 17:45 H3

Prospects for a Partial Wave Analysis of the $\overline{\Xi}\Lambda K^-$ Final State at $\overline{\mathrm{P}}$ANDA — •Jennifer Pütz and James Ritman for the PANDA-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

For a deep insight 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 $\bar{\mathrm{p}}\mathrm{p}$ 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 channel.

In earlier Monte Carlo studies, it has been demonstrated that with an expected cross section in the order of μb $\overline{\mathrm{P}}$ANDA will be able to observe the $\overline{\Xi}^+\Lambda K^-$ channel with a negligible background contribution. In this study, the feasibility of $\overline{\mathrm{P}}$ANDA to determine the mass, width, spin and parity of two specific Ξ resonances, $\Xi(1690)$ and $\Xi(1820)$, is investigated by making use of a partial wave analysis employing the PAWIAN framework.

HK 4.6 Mon 18:00 H3

Two-particle correlations with high-p_T Λ baryons and K^0_S mesons in pp collisions at ALICE — •Lucia Anna Husová — IKP, WWU Münster, Germany

Complementary to jet reconstruction, two-particle correlations in $\Delta\eta$ and $\Delta\varphi$ are used to study jets, in particular, their particle composition. While in Pb–Pb collisions, this is done to characterize the Quark-Gluon Plasma, pp and p-Pb collisions serve as a reference and are of interest on their own for their input into the understanding of particle production mechanisms. Recent ALICE results on the production of strange particles in small systems (pp and p–Pb collisions) reveal the possibility of having similar strange hadron production mechanisms in all collision systems. We study two-particle correlations triggered with strange hadrons ($K^0_S, \Lambda, \bar{\Lambda}$) in pp collisions at 13 TeV.

In this talk, the dependence of the per-trigger yields of primary charged hadrons on the wide range of the transverse momenta of the trigger and associated particles, as well as on the event multiplicity, will be presented on both the near-side and away-side. Moreover, the ratios of these yields to the yields extracted from the h-h correlation function will be shown. The presented results will be compared among the three hadron species. In addition, a comparison to different MC generators will be presented, which will allow us to better understand the strangeness production in jets.

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HK 4.7 Mon 18:15 H3

New experimental limits on the effective hadron interaction with strangeness = -3 by ALICE — •Georgios Mantzaridis for the ALICE-Collaboration — Technische Universität München

Accessing experimentally the hadron-hadron interactions for systems of various quark content is essential to validate theoretical calculations, first principles and effective models alike. In the case of nucleon-nucleon (NN) interactions scattering experiments provide good constrains for the theory. However, the nucleon-hyperon (NY) interaction is difficult to access with traditional experimental techniques, and mostly limited to the strangess -1 sector.

Recent results from the ALICE collaboration demonstrated the feasibility of using two-particle correlation techniques to investigate the interaction between pairs containing multi-strangeness. We present

measurements in the strangeness -3 sector using the p-Ω^- and the Λ-Ξ^- channels, both studied in high-multiplicity pp collisions at $\sqrt{s}$ = 13 TeV with ALICE at the LHC.

We have compared the p-Ω^- interaction to first principle lattice QCD calculations and found that they agree with the measured data if the inelastic channels are neglected. In particular the p-Ω^- system couples to Λ-Ξ^- and the strength of this coupling depends on the strength of the interaction itself. Thus, we have measured the Λ-Ξ^- correlation and compared the results to chiral effective field theory calculations. A shallow Λ-Ξ^- interaction is supported, which is compatible with a weak contribution to the p-Ω^- correlation.