HK 57: Hadron Structure and Spectroscopy VI

Time: Thursday 14:00–15:30 Location: SCH/A316

Group Report HK 57.1 Thu 14:00 SCH/A316

Multi-meson photoproduction off the proton - recent results from the CBELSA/TAPS experiment — •Philipp Mahlberg for the CBELSA/TAPS-Collaboration — Helmholtz-Institut für Strahlen- und Kernphysik, Universität Bonn, Deutschland

The nucleon excitation spectrum is dominated by mostly broad resonances, so partial wave analyses (PWA) are needed to extract the overlapping resonances from the experimental data. In order to find an unambiguous solution, the measurement of polarization observables is indispensable.

Meson photoproduction experiments have provided an extensive database which in turn let different partial wave analyses converge to similar results. The findings fit surprisingly well in an ordering scheme imposed by a non-relativistic quark model. Within the higher mass regime, the PWA solutions are less constrained and not all model-predicted states have been confirmed by experiments. Here, multi-meson decay channels gain importance and sequential decay chains can be studied.

The Crystal Barrel/TAPS experiment is, due to its good energy resolution, high photon detection efficiency and its almost complete solid angle coverage, ideally suited to measure such multi-meson final states in which neutral mesons decay into photons.

For the $p\pi^0\pi^0$ and $p\pi^0\eta$ final states, recent results – obtained with a linearly polarized photon beam at different coherent edge positions (up to 1850 MeV), impinging on an either transversely polarized or unpolarized target – will be presented.

HK 57.2 Thu 14:30 SCH/A316

Sensitivity study for baryon resonances searches in pion-proton collisions with HADES — •Jan Gollub[1], Ahmed Foda[2], Johan Messchendorp[2], and James Ritman[2] for the HADES-Collaboration — [1]Ruhr-Universität Bochum, 44801 Bochum, Germany — [2]GSI Helmholtzzentrum für Schwerionenforschung GmbH, 64291 Darmstadt, Germany

Pion-induced reactions provide unique opportunities for a description of baryonic resonances and their coupling channels. The two-pion production in $\pi^- - p$ reactions at pion beam momenta between 0.650 GeV/c and 0.786 GeV/c was already analysed. The next step is to investigate these reactions at center of mass energies up to $\sqrt{s}$ = 1.76 GeV with the HADES detector in 2024.

In this work, a sensitivity study of the expected results using the Bonn-Gatchina partial wave analysis framework has been performed. In this talk MC simulated invariant mass spectra and angular distributions will be presented.

HK 57.3 Thu 14:45 SCH/A316

Study of the Δ++ baryon at BESIII — •Dong Liu[1,2], Christoph Rosner[1], and Frank Maas[1,3,4] for the BESIII-Collaboration — [1]Helmholtz Institute Mainz, Mainz, Germany — [2]University of Science and Technology of China, Hefei, China — [3]Institute of Nuclear Physics, Mainz, Germany — [4]PRISMA+ Cluster of Excellence, Mainz, Germany

The common baryons are the baryon octet and the baryon decuplet states. The wave functions of baryons in the octet are antisymmetric under quark exchange, and they have been extensively studied in electron-positron collision experiments, including proton, neutron, Λ, Σ, Ξ, etc. The wave functions of decuplet baryons are symmetric under quark exchange and there are few studies on them, including Δ, Σ^*, Ξ^*, Ω, etc. Among them, Δ particles are the lightest ones and have the highest cross section in electron-positron collisions. The measurement of the Δ production cross section at the BESIII experiment is a complement to the study of baryons and provides an experimental basis for theoretical studies of the intrinsic structure of baryons. The analysis of the Δ++ baryon pair production process is carried out at the BESIII experiment, giving the upper limit of the cross section for the process in the energy range from the threshold up to 2.645 GeV, which constrain the theoretical prediction for the decuplet pair production process. Meanwhile, the cross section and error for the Δ++p-π- process at a centre-of-mass energy of 2.645 GeV is also reported.

HK 57.4 Thu 15:00 SCH/A316

Determination of the polarization observables T,P and H in the reaction $\gamma p \to p\pi^0$ — •Sebastian Ciupka for the CBELSA/TAPS-Collaboration — HISKP, Uni Bonn

It is experimentally and theoretically challenging to determine the exact number of exited nucleon states and their properties, since the short lifetime of these exited states leads to strongly overlapping resonances. Using a polarized beam, a polarized target or using the polarization of the recoil nucleon helps to measure single or double polarization observables, that are needed for an unambiguous partial wave analysis solution.

The CBELSA/TAPS experiment in Bonn provides a polarized photon beam as well as a longitudinally or transversely polarized target, allowing for the determination of single and double polarization observables. The Crystal Barrel (CB) calorimeter, together with the MiniTAPS calorimeter in forward direction, give the opportunity for close to 4π coverage for the measurements.

This talk will present preliminary results of the determination of the polarization observables T, P and H, for energies between 600MeV and 3200MeV, using data collected after the recent upgrade of the CB calorimeters readout electronics and these results are compared to previous data and model predictions.

HK 57.5 Thu 15:15 SCH/A316

Resonance Regions: Partial Wave Analysis in the HADES Experiment — •Ahmed Marwan Foda — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt

The High Acceptance Di-lepton Spectrometer (HADES) collaboration uses a pion beam to study features of baryonic resonances and their decay channels. This allows the production of baryonic resonances at a fixed center of mass energy, i.e. in the s-channel, thus giving these beams a significant advantage relative to proton proton reactions. Partial Wave Analysis (PWA) techniques are used to study the coupling of the resonances to different final states. Analysis of the baryonic resonances decays to ρN and ωN final states will provide insight into baryon-vector meson couplings essential for the understanding of the melting of the ρN meson in a dense baryonic matter and description of dilepton emissions from Heavy Ion collisions.

A new implementation of the Bonn-Gatchina framework is being developed in preparation for a more detailed mapping of the resonance regions in pion-proton collisions. Example fits will be presented showing current status and the potential of the new framework.