HK 47: Hadron Structure and Spectroscopy VI

Time: Wednesday 15:45–17:15 Location: HBR 62: EG 19

Group Report HK 47.1 Wed 15:45 HBR 62: EG 19

Multi-meson photoproduction with the CBELSA/TAPS experiment — •Tobias Seifen for the CBELSA/TAPS-Collaboration — Helmholtz-Institut für Strahlen- und Kernphysik, Nussallee 14-16, 53115 Bonn

One important step in understanding the baryon spectrum is a precise knowledge of the excited states and their decays. In order to extract the contributing resonances from experimental data a partial wave analysis needs to be performed. To resolve ambiguities, the measurement of polarization observables is indispensable. In the regime of high-mass baryon resonances multi-meson final states are of particular importance. Here sequential decays of resonances are observed.

The CBELSA/TAPS experiment is ideally suited to measure the photoproduction of neutral mesons decaying into photons due to its good energy resolution, high detection efficiency for photons, and the nearly complete solid angle coverage. In combination with a longitudinally or transversely polarized target and an energy tagged, linearly or circularly polarized photon beam the experiment allows the measurement of a large set of polarization observables.

This talk will focus on results on neutral double pion production obtained with a linearly polarized photon beam and either an unpolarized hydrogen target or a transversely polarized butanol target. Part of the results were included in the Bonn-Gatchina partial wave analysis. Observed systematic differences in the branching ratios for decays of N^* and Δ^* resonances are attributed to the internal structure of these excited nucleon states.

HK 47.2 Wed 16:15 HBR 62: EG 19

Coherent $\pi^0\eta$ photoproduction off the deuteron at the BGOOD experiment — •António João Clara Figueiredo for the BGOOD-Collaboration — Physikalisches Institut, Universität Bonn

The BGOOD photoproduction experiment at the ELSA facility is uniquely designed to explore kinematics where a charged particle is identified in the forward spectrometer and a recoiling hadronic system is reconstructed in the central calorimeter at low momentum transfer.

The setup enables studies of coherent reactions off the deuteron at forward deuteron angles. This kinematic region would be expected to be suppressed due to the large momentum transfer to the deuteron. Measurements at BGOOD however have found this to not be the case.

Results on the coherent $\pi^0\eta$ photoproduction off the deuteron at the BGOOD experiment are presented. A full kinematic reconstruction was made, with final state deuterons identified in the forward spectrometer and π^0 and η decays in the central calorimeter. The differential cross section is an order of magnitude higher than expected. The distribution is described well by a simple model of a quasi-free reaction followed by pion exchange and the subsequent coalescence of the proton and neutron to the deuteron.

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HK 47.3 Wed 16:30 HBR 62: EG 19

Determination of the polarization observables Σ, I_c and I_s in the reaction $\gamma p \to p\pi^0\eta$ — •Georg Urff for the CBELSA/TAPS-Collaboration — Helmholtz-Institut für Strahlen- und Kernphysik, Universität Bonn, Nussallee 14-16, 53115 Bonn

The excited states of the nucleon appear as broad and overlapping structures in the experimental data. The challenge of extracting information from the data is tackled by partial wave analyses (PWA) used to disentangle the contributing resonances and aiming to find unambiguous solutions. Whether unambiguous solutions can be found strongly depends on additional constraints provided by polarization observables. In addition, to gain a complete picture of baryon resonances and their properties, multi-meson decays are of large interest, particularly at higher energies.

The CBELSA/TAPS experiment provides an energy tagged linearly or circularly polarized photon beam impinging on a longitudinally or transversally polarized target, allowing for the determination of single and double polarization observables. The Crystal Barrel calorimeter combined with the MiniTAPS calorimeter in forward direction provide a nearly 4π angular coverage. Due to their high photon detection efficiency and good energy resolution the experiment is ideally suited to find states with neutral mesons decaying into photons.

This presentation covers results for polarisation observables Σ, I_c and I_s in the $p\pi^0\eta$ final state obtained with a linearly polarized photon beam at coherent edge positions of 1750 MeV and 1850 MeV with an unpolarized target.

HK 47.4 Wed 16:45 HBR 62: EG 19

Partial Wave Analysis for Pion-Induced Resonance Studies in the HADES Experiment — •Ahmed M. Foda for the HADES-Collaboration — GSI Helmholtzzentrum für Schwerionenforschung, Darmstadt, Deutschland

The High Acceptance Di-lepton Spectrometer (HADES) collaboration at GSI employs a pion beam to examine the characteristics of baryonic resonances and their decay channels. This pion-beam facility possess a significant advantage over proton-induced reactions and provides complementary information to photo-induced studies. Furthermore, HADES has a particular interest in studying the role and medium modification of vector mesons in heavy-ion collisions in baryon-dense matter. Elementary pion-induced studies on the proton combined with a partial wave analysis (PWA) will provide insights into the couplings of baryonic resonances to ρN and ωN final states in greater detail, will provide insights into the impact of the melting of the ρ meson in heavy ion collisions and the involvement of intermediary vector mesons in dilepton emissions.

In anticipation of conducting a more comprehensive exploration of the resonance regions in pion-proton collisions, a new implementation of the K-Matrix & N/D frameworks is currently under development. This updated implementation aims to offer a refined mapping of these regions. Example fits will be presented showing the current status and the potential of the new framework.

HK 47.5 Wed 17:00 HBR 62: EG 19

Truncated partial-wave analysis with Bayesian inference — •Philipp Krönert, Yannick Wunderlich, Farah Afzal, and Annika Thiel — Helmholtz-Institut für Strahlen- und Kernphysik, Universität Bonn, Nussallee 14-16, 53115 Bonn

In Baryon spectroscopy, several models for partial-wave analysis are available for extracting physical quantities from measured polarization observables. Notable examples are the Bonn-Gatchina K-matrix model, the Jülich-Bonn dynamical coupled-channel approach, and the Eta-MAID unitarised isobar-model. All of these models incorporate an energy-dependent parameterization for the complex spin amplitudes. Truncated partial-wave analysis provides a model-independent approach.

Truncated partial-wave analysis has been combined with Bayesian inference for the first time, allowing for unrivalled estimation of parameter uncertainty and a unique interpretation of results in comparison to the traditional maximum likelihood approach. In addition, this approach facilitates the investigation of the structure of so-called ambiguities in the analysis results.

The talk will discuss the challenges of using Bayesian inference with a multimodal posterior. Furthermore, model independent estimates of multipole parameters and predictions of yet unmeasured polarization observables for the reaction $\gamma p \to \eta p$ just above the production threshold.