

Experimental study of η meson photoproduction reaction at MAMI

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The most baryon spectroscopy data have been obtained using πN scattering data. Pion photoproduction on nucleons is some additional tool for the investigation of the nucleon resonances, especially in case of small πN partial width. Compared to pion, η photoproduction has some additional advantages: isospin $J = 0$ and small non-resonance background, that simplify the extraction of the nucleon resonance parameters.

New data for the total and differential cross sections, polarization observables T, F, and E in the reaction of η photoproduction on proton from the threshold up to a center-of-mass energy of $W=1.9$ GeV are presented. The data were obtained with the Crystal-Ball/TAPS detector setup at the Glasgow tagged photon facility of the Mainz Microtron MAMI. The polarization measurements were made using a frozen-spin butanol target and circular polarization photon beam. The results are compared to existing experimental data and different PWA predictions: MAID, SAID, BnGa, Giessen model.

The data solve a long-standing problem related the angular dependence of older T data close to threshold. The unexpected relative phase motion between s - and d -wave amplitudes required by the old data is not confirmed. At higher energies, all model predictions fail to reproduce the new polarization data indicating a significant impact on our understanding of the underlying dynamics of η meson photoproduction.

Furthermore, we present a fit of the new data and existing data from GRAAL for Σ asymmetry, based on an expansion in terms of Associated Legendre polynomials, together with the corresponding model predictions. A Legendre decomposition shows the sensitivity to small partial-wave contributions. The sensitivity of the Legendre coefficients to the nucleon resonance parameters is shown using the MAID isobar model.

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