

Helicity Dependent Cross Sections in η Photoproduction off Quasi-Free Protons and Neutrons

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The identification of the relevant effective degrees of freedom of QCD is the most important step in order to understand the structure of the nucleon.

Since the resonance contributions to the excitation spectrum are often broad and overlapping, the comparison of experimental data and theoretical models is rather difficult.

Single and double polarization observables allow the determination of the quantum numbers of the contributing resonances and are therefore an ideal tool to investigate the excitation spectrum of the nucleon.

A very selective channel in this context is the photoproduction of η mesons. Due to the isoscalar property of the η , Δ resonances can not decay to the ground state by emitting a η .

Furthermore $P_{11}(1440)$ and $D_{13}(1520)$ resonances have a very small branching ratio into the $N\eta$ final state (close to threshold high orbital angular momenta are strongly suppressed).

Especially, the investigation of photoproduction of η mesons is very interesting as the resulting cross section on the neutron shows a large resonance-like structure, beyond the dominating $S_{11}(1535)$, which is not seen on the proton.

In this work we will present results of the double polarization observable E and the corresponding helicity dependent cross sections $\sigma_{1/2}$ (photon and target spin anti-parallel) and $\sigma_{3/2}$ (photon and target spin parallel) of η -photoproduction off quasi-free protons and neutrons which will help to constrain the origin and quantum numbers of this unknown structure.

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