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Baryon resonance studies via meson photoproduction at the LEPS2/BGOegg experiment

Meson photoproduction is a helpful tool for studying baryon resonances thanks to many possibilities of final-state meson-baryon combinations, e.g., πN, ηN, ωN, or multi meson final states.
In addition, the spin information of intermediate resonances can also be obtained by utilizing the high polarization of a photon beam.
The πN final states can couple to both I = 1/2 states (N^* resonances) and I = 3/2 states (Δ resonances).
On the other hand, the ηN and ωN states can couple to only baryons with isospin 1/2, which is called an isospin filter.
Moreover, an eta meson contains $s\bar{s}$ components, and an omega meson has spin 1.
From these features, the η- and ω-meson photoproduction are expected to offer an attractive capability of coupling with the resonances that do not couple well with the πN state.
The differential cross sections measured in past experiments were inconsistent with each other, and the data of photon beam asymmetries were scarce above 2 GeV.
We studied photoproduction reactions of a π^0, η, and ω meson on the proton at the LEPS2/BGOegg experiment using a GeV photon beam produced by the backward Compton scattering.
This photon beam is highly linear polarized, and this polarization degree is
more than 90 % in the highest energy region around the Compton edge.
We measured differential cross sections, photon beam asymmetries, and spin density matrix elements with high statistics and broad angular coverage by using a large acceptance calorimeter (BGOegg) and forward-angle charged-particle detectors.
This calorimeter can identify mesons that decay into multiple γ's, and its energy resolution is the world's best among the experiments conducted in a similar energy range.
A bump-like enhancement of differential cross sections can only be seen at backward angles in the η photoproduction reaction.
Its strength increases as the η emission angles become more backward.
This enhancement indicates the existence of high-spin nucleon resonances that contain a large $s\bar{s}$ component.
We report the photon beam asymmetries and spin density matrix elements in a wide polar angle range for the photon beam energy above 2 GeV for the first time, providing additional constraints to nucleon resonance studies at high energies.

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