Polarization observables in double pion photoproduction with circularly polarized photons off transversely polarized protons

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The study of excited states of the nucleon facilitates the understanding of the internal structure of the nucleon and of its underlying symmetry and couplings. A main goal of the N^* program at Thomas Jefferson National Accelerator Facility is to investigate the decays of the baryon resonances and assist in identifying the "missing" nucleon resonances that are predicted by the theoretical models. Nucleon resonances cannot be simply identified using only cross-section data and thus polarization observables are extracted, which provide more information e.g. access to the transition amplitudes of the reaction. Double pion photoproduction contributes strongly to the total cross-section at high energies and thus it plays an important role in probing the nucleon resonance spectrum in the non-perturbative Quantum Chromodynamics. The CLAS g9 (FROST) experiment accumulated double pion photoproduction data using transversely polarized protons and circularly polarized photons, with center of mass energies between 1.4 GeV and 2.3 GeV. Five polarization observables ($I^{\odot}$, $P_x^{\odot}$, $P_y^{\odot}$, P_x, P_y) were extracted for the $\gamma p \to p\pi^+\pi^-$ reaction, and four observables ($P_x^{\odot}$, $P_y^{\odot}$, P_x, P_y) are first-time measurements. The results are reported and compared with the calculations of an effective Lagrangian model. The results will help deepen the current knowledge of hadronic resonance decays and possibly assist in identifying new baryon resonances via Partial Wave Analysis (PWA) and in this way will contribute to a more comprehensive understanding of the strong interaction.

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