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Single-energy partial wave analysis for pion photoproduction with fixed-t analyticity

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Experimental data for pion photoproduction including differential cross sections and various polarization observables from four reaction channels, γp→π0p, γp→π+n, γn→π−p and γn→π0n from threshold up to W=2.2~GeV have been used in order to perform a single-energy partial wave analysis with minimal model dependence by imposing constraints from unitarity and fixed-t analyticity in an iterative procedure. Reaction models were only used as starting point in the very first iteration. We demonstrate that with this procedure partial wave amplitudes can be obtained which show only a minimal dependence on the initial model assumptions.

We have performed a fixed-t single-energy partial wave analysis of pion photoproduction in full isospin on the world collection of data. In an iterative two-step process the single-energy multipoles are constrained by fixed-t Pietarinen expansions fitted to experimental data. This leads to a partial wave expansion that obeys fixed-t analyticity with a least model dependence. In the energy range of W=1.09–2.20~GeV we have obtained electric and magnetic multipoles Eℓ±,Mℓ±, up to F waves.
We compared our four SE solutions in their predictions for unmeasured polarization observables. At lower energies the spread of these predictions is rather small, but it becomes larger at higher energies, where it will help to propose new measurements in order to get a unique PWA.

Presenter: OMEROVIC, Rifat (University of Tuzla)

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