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A dispersive analysis of low energy pion photo- and electroproduction

A dispersive representation based on unitarity and analyticity is used to study the low energy $\gamma N \to \pi N$ and $\gamma^* N \to \pi N$ partial wave amplitudes.
Final state interactions of the πN system are critical to this analysis.
The left-hand cut contribution is estimated by invoking $\mathcal{O}(p^2)$ baryon chiral perturbation theory results, while the right-hand cut contribution responsible for final state interaction effects is taken into account via an Omnes formalism with elastic phase shifts as input.
It is found that a good numerical fit can be achieved with only one subtraction parameter, and the experimental data of the multipole amplitudes E_0^+, S_0^+ in the energy region below the $\Delta(1232)$ are well described when the photon virtuality $Q^2 \leq 0.1\text{GeV}^2$.
Furthermore, we extend the partial wave amplitudes to the second Riemann sheet to extract the couplings of the subthreshold resonance $N^*(890)$.
The values of residue of the multipole amplitudes E_0^+, S_0^+ are almost the same as that of the $N^*(1535)$ resonance, indicating that $N^*(890)$ strongly couples to the πN system.

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