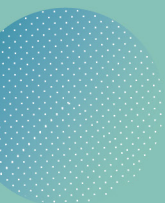




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Nucleon resonance parameters from Roy–Steiner equations

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Abstract

A reliable determination of the pole parameters and residues of nucleon resonances is notoriously challenging, given the required analytic continuation into the complex plane. We provide a comprehensive analysis of such resonance parameters accessible with Roy–Steiner equations for pion–nucleon scattering—a set of partial-wave dispersion relations that combines the constraints from analyticity, unitarity, and crossing symmetry—most prominently of the $\Delta(1232)$ resonance. Further, we study the Roper, $N(1440)$, resonance, which lies beyond the strict domain of validity, in comparison to Padé approximants, comment on the role of subthreshold singularities in the S-wave, and determine the residues of the $f_0(500)$, $\rho(770)$, and $f_0(980)$ resonances in the t-channel process $\pi\pi \rightarrow N N$. The latter allows us to test, for the first time, Goldberger–Treiman relations formulated fully model-independently in terms of the respective residues.

