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Chiral Extrapolation of Lattice QCD Nucleon Masses using Two-Loop Baryon Chiral Perturbation Theory

We calculate the nucleon mass in a manifestly relativistic baryon chiral perturbation theory up to the leading two-loop order. Through dimensional counting analysis, we perform the chiral expansion and verify the validity of the extended-on-mass-shell scheme at the two-loop level. As a result, we obtain the complete chiral representation of the nucleon mass up to $\mathcal{O}(p^5)$, which preserves the original analytic properties and satisfies the correct power counting. The obtained chiral result is well-suited for chiral extrapolation and provides an excellent description of lattice QCD data across a broad range of pion masses.

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