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Nucleon-pion-state contamination in lattice computations of the nucleon electromagnetic form factors

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The nucleon-pion-state contribution to QCD two-point and three-point functions relevant for lattice calculations of the nucleon electromagnetic form factors are studied in chiral perturbation theory.
To leading order the results depend on a few experimentally known low-energy constants only, and the nucleon-pion-state contribution to the form factors can be estimated. The nucleon-pion-state contribution to the electric form factor $G_{\mathrm{E}}(Q^2)$ is at the +5 percent level for a source-sink separation of 2 fm, and it increases with increasing momentum transfer Q^2. For the magnetic form factor the nucleon-pion-state contribution leads to an underestimation of $G_{\mathrm{M}}(Q^2)$ by about 5 percent that decreases with increasing Q^2. For smaller source-sink separations that are accessible in present-day lattice simulations the impact is larger, although the ChPT results may not be applicable for such small time separations. Still, a comparison with lattice data at $t \approx 1.6$ fm works reasonably well.

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