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Excited-state contamination in nucleon correlators from chiral perturbation theory

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Techniques to compute hadron properties from lattice QCD rely upon the limit of long time separation. For baryons, the signal-to-noise problem often restricts one to time separations that are not ideally long, and for which couplings to excited states can obstruct the isolation of ground-state baryon properties. We consider excited-state contamination in nucleon two- and three-point functions. Using chiral perturbation theory, we determine couplings to pion-nucleon and pion-delta excited states. In two-point functions, these contributions are small, in accordance with general properties of the spectral density on a torus. For the axial-current correlation function in the nucleon, the sign of excited-state contributions suggests overestimation of the nucleon axial charge. Thus contamination from pion-nucleon excited states will not likely explain the trend in lattice QCD data.

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