Contribution ID: **105** Type: **not specified**

Nucleon-pion-state contamination in the lattice determination of the axial form factors of the nucleon

Wednesday, July 25, 2018 2:00 PM (20 minutes)

The nucleon-pion-state ($N\pi$) contribution to QCD two- and three-point functions used in the calculation of the axial form factors of the nucleon are studied in chiral perturbation theory. For physical quark masses the $N\pi$ states are expected to dominate the excited-state contamination at large euclidean time separations. To leading order in chiral perturbation theory the results depend on two experimentally well-known low-energy constants only and the $N\pi$-state contamination can be reliably estimated. In the axial form factor $G_A(Q^2)$ it amounts to a 5 percent overestimation for source-sink separations of about 2 fm and shows essentially no dependence on the momentum transfer Q^2. In contrast, for the induced pseudo-scalar form factor $G_P(Q^2)$ the $N\pi$-state contamination shows a much stronger dependence on Q^2 and leads to a 20-40 percent underestimation of $G_P(Q^2)$ at small momentum transfers.

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Session Classification: Hadron Spectroscopy and Interactions

Track Classification: Hadron Spectroscopy and Interactions