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Accessing proton GPDs in lattice QCD using a non-symmetric frame

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We present a numerical investigation of a novel Lorentz covariant parametrization to extract x -dependent GPDs using off-forward matrix elements of momentum-boosted hadrons coupled to non-local operators. The novelty of the method is the implementation of a non-symmetric frame for the momentum transfer between the initial and final hadron state and the parametrization of the matrix elements into generalized Ioffe-time distributions (ITD), which are frame independent. The generalized ITD can then be related to the standard light-cone GPDs, which are frame-dependent. GPDs are defined in the symmetric (Breit) frame, which requires a separate calculation for each momentum transfer value, increasing the computational cost significantly. The proposed method is powerful, as one can extract the GPDs at more than one momentum transfer value within the same computational cost. For this proof-of-concept calculation, we use one ensemble of $N_f = 2 + 1 + 1$ twisted mass fermions and a clover improvement with a pion mass of 260 MeV to calculate proton GPDs.

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