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Frame-independent methods to access GPDs from lattice QCD

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Traditionally, lattice QCD computations of GPDs have been carried out in a frame, where the transferred momentum is symmetrically distributed between the incoming and outgoing hadrons. However, such frames are inconvenient for lattice QCD calculations since each value of the momentum transfer requires a separate calculation, increasing the computational cost. In a recent work (arXiv:2209.05373), we lay the foundation for more effective calculations of GPDs applicable for any frame, with freedom in the transferred momentum distribution. An important aspect of the approach is the Lorentz covariant parameterization of the matrix elements in terms of Lorentz-invariant amplitudes, which allows one to relate matrix elements in different frames. We demonstrate the efficacy of the formalism through numerical calculations using one ensemble of N_f=2+1+1 twisted mass fermions with a clover improvement. The value of the light-quark masses lead to a pion mass of about 260 MeV. Concentrating on the proton and zero skewness, we extract the invariant amplitudes from matrix element calculations in both the symmetric and asymmetric frame, and obtain results for the twist-2 light-cone GPDs for unpolarized quarks, H and E.

Presenter: CONSTANTINOU, Martha (Temple University)

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