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Generalized parton distributions of the proton from lattice QCD

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Generalized parton distributions (GPDs) are among the most fundamental quantities for describing the internal structure of hadrons, providing information about the momentum and spatial distributions of quarks and gluons. Exclusive scattering processes offer a natural framework to extract GPDs from experiments. However, the exclusivity of the process and their indirect relation to the corresponding cross-sections, through Compton form factors, make their determination very challenging.
In this talk, we discuss results on isovector GPDs of the proton obtained within lattice QCD. We use the quasi-distribution formalism, which relies on computations of correlation functions that, for sufficiently fast-moving hadrons, can be matched to light-cone distributions using Large Momentum Effective Theory (LaMET). The calculation is performed on an ensemble of $N_f = 2 + 1 + 1$ maximally twisted mass fermions, with pion mass $M_\pi = 260$ MeV and lattice spacing $a \simeq 0.093$ fm. The proton is boosted up to 1.67 GeV, which exhibits convergence. Results are presented for unpolarized, helicity, and transversity GPDs at zero and non-zero skewness with controlled statistical uncertainties. Comparisons with their forward limit show qualitative features anticipated from model calculations.

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