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Generalized Parton Distributions from lattice QCD: new developments

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Generalized parton distributions (GPDs) are important quantities that characterize the 3-D structure of hadrons and complement the information extracted from TMDs. They provide information about the partons'momentum distribution and also on their distribution in position space. The non-perturbative part of the cross-section of high-energy processes may be expanded in terms of the process's large energy scale. This gives rise to a tower of distribution functions labeled by their twist (mass dimension minus spin). The leading twist (twist-2) contributions have been at the center of experimental measurements, theoretical investigations, and lattice QCD calculations. It has been recognized that twist-3 contributions to distribution functions can be sizable and should not be neglected. However, it is challenging to disentangle them experimentally from their leading counterparts, posing limitations on the structure of the proton.

Most of the information from lattice QCD is on the Mellin moments of GPDs, namely form factors and their generalizations. Calculating the x-dependence of GPDs from lattice QCD has become feasible in the last few years due to novel approaches. In this work, we employ the approach of quasi-distributions, which relies on matrix elements of fast-moving hadrons coupled to non-local operators. The quasi-distributions are matched to the light-cone distributions using Large Momentum Effective Theory (LaMET). The approach has been extensively used for twist-2 PDFs, and is now extended to twist-2 GPDs. More recently, the feasibility of the approach for twist-3 PDFs and GPDs was discussed. In this talk, we present an overview of selected results on x-dependent GPDs. This demonstrates the potential of lattice QCD calculations to complement other theoretical and experimental efforts toward the 3-D structure of hadrons.

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