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The Calculation of Parton Distributions from Lattice QCD

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Although parton distribution functions are the fundamental objects describing the inner structure of hadrons, they were so far not calculated from first principles.

In the past, lattice QCD has successfully been employed for the computation of hadronic spectra and form factors. Yet calculations of quark distributions are still missing, since they are given by light-cone correlation functions and light-like distances are not accessible on an Euclidean lattice.

This could possibly be overcome by a recent proposal which allows the light-cone distributions to be extracted from purely spatial correlations, being thus accessible to lattice methods. In order to test the feasibility of this method, we present the latest results of our effort to perform a lattice calculation of the non-singlet combination for the momentum, helicity and transversity distributions of the nucleon using twisted mass fermions.

We will also give first results for the application of a newly proposed momentum improved smearing, which has the potential to reach higher nucleon momenta as required for a safe matching procedure to the physical distribution functions.

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