Parton Distributions and Lattice Calculations (PDFLattice 2024)



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Non-perturbative Collins-Soper kernel: Chiral quarks and Coulomb-gauge-fixed quasi-TMD

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We present the first lattice QCD calculation of the rapidity anomalous dimension of transverse-momentumdependent distributions (TMDs), i.e. the Collins-Soper (CS) kernel, employing the recently proposed Coulombgauge-fixed quasi-TMD formalism as well as a chiral-symmetry preserving lattice discretization. This unitary lattice calculation is conducted using the domain wall fermion discretization scheme, a fine lattice spacing of approximately 0.08 fm, and physical values for light and strange quark masses. The CS kernel is determined analyzing the ratios of pion quasi-TMD wave functions (quasi-TMDWFs) at next-to-leading logarithmic (NLL) perturbative accuracy. Thanks to the absence of Wilson-lines, the Coulomb-gauge-fixed quasi-TMDWF demonstrates a remarkably slower decay of signals with increasing quark separations. This allows us to access the non-perturbative CS kernel up to transverse separations of 1 fm. For small transverse separations, our results agree well with perturbative predictions. At larger transverse separations, our non-perturbative CS kernel clearly favors certain global fits.

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