Nonperturbative Determination of Collins-Soper Kernel from Quasi Transverse-Momentum Dependent Wave Functions

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In the framework of large-momentum effective theory at one-loop matching accuracy, we perform a lattice calculation of the Collins-Soper kernel which governs the rapidity evolution of transverse-momentumdependent (TMD) distributions. We first obtain

the quasi TMD wave functions at three different meson momenta

on a lattice with valence clover quarks on a dynamical HISQ sea

and lattice spacing a = 0.12 fm from MILC, and renormalize the pertinent linear divergences using Wilson loops. Through one-loop matching to the light-cone wave functions, we determine the Collins-Soper kernel with transverse separation up to 0.6 fm. We study the systematic uncertainties from operator mixing and scale dependence, as well as the impact from higher power corrections. Our results potentially allow for a determination of the soft function and other transverse-momentum dependent quantities at one-loop accuracy.

Summary

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