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Renormalization of transverse-momentum-dependent parton distribution on the lattice

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To calculate the transverse-momentum-dependent parton distribution functions (TMDPDFs) from lattice QCD, an important goal yet to be realized, it is crucial to establish a viable nonperturbative renormalization approach for linear divergences in the corresponding Euclidean quasi-TMDPDF correlators in large-momentum effective theory. We perform a first systematic study of the renormalization property of the quasi-TMDPDFs by calculating the relevant matrix elements in a pion state at 5 lattice spacings ranging from 0.03 fm to 0.12 fm. We demonstrate that the square root of the Wilson loop combined with the short distance hadron matrix element provides a successful method to remove all ultraviolet divergences of the quasi-TMD operator, and thus provide the necessary justification to perform a continuum limit calculation of TMDPDFs. In contrast, the popular RI/MOM renormalization scheme fails to eliminate all linear divergences.

Topical area

Structure of Hadrons and Nuclei

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