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Leading Power Accuracy in Lattice Calculations of Parton Distributions

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In lattice-QCD calculations of parton distribution functions (PDFs) via large-momentum effective theory, the leading power (twist-three) correction appears as $calO(\Lambda_{\rm QCD}/P^z)$ due to the linear-divergent self-energy of Wilson line in quasi-PDF operators. For lattice data with hadron momentum P^z of a few GeV, this correction is dominant in matching, as large as 30\% or more. We show how to eliminate this uncertainty through choosing the mass renormalization parameter consistently with the resummation scheme of the infrared-renormalon series in perturbative matching coefficients. An example on the lattice pion PDF data at $P^z = 1.9$ GeV shows an improvement of matching accuracy by a factor of more than $3 \sim 5$ in the expansion region $x = 0.2 \sim 0.5$.

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