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Parton Distributions from Boosted Fields in the Coulomb Gauge

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In this talk, we will discuss a new method to calculate parton distribution functions (PDFs) from correlations of boosted quarks and gluons in the Coulomb gauge.
Compared to the widely used quasi-PDFs defined from gauge-invariant Wilson-line operators, such correlations offer advantages including absence of linear power divergence, enhanced long-range precision, and accessibility to larger off-axis momenta. We verify the validity of this method at next-to-leading order in perturbation theory and use it to calculate the pion valence quark PDF on a lattice with spacing $a = 0.06$ fm and valence pion mass $m_\pi = 300$ MeV.
Our result agrees with that from the gauge-invariant quasi-PDF at similar precision, achieved with only half the computational cost through a large off-axis momentum $|\vec{p}| \sim 2.2$ GeV.

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