

## Collins-Soper kernel from lattice QCD at the physical pion mass

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This work presents a determination of the quark Collins-Soper kernel, which relates transverse-momentum-dependent parton distributions (TMDs) at different rapidity scales, using lattice Quantum Chromodynamics (QCD). This is the first lattice QCD calculation of the kernel at quark masses corresponding to a close-to-physical value of the pion mass, with next-to-next-leading order matching to TMDs from the corresponding lattice-calculable distributions, and includes a complete analysis of systematic uncertainties arising from operator mixing. The kernel is extracted at transverse momentum scales  $240 \text{ MeV} < q_T < 1.7 \text{ GeV}$  with a precision sufficient to discriminate between different phenomenological models in the non-perturbative region.

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