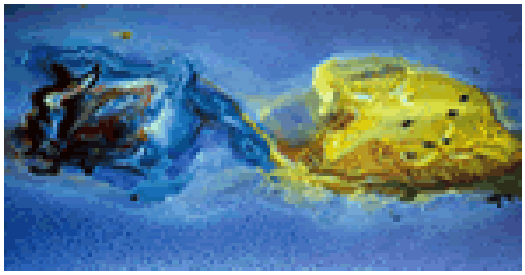

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Perturbative investigation of ”Wilson-line”-type operators in Parton Physics

Sunday, 5 August 2018 15:30 (30 minutes)

We consider a class of gauge-invariant nonlocal quark bilinear operators, including a finite-length Wilson-line (called Wilson-line operators). The matrix elements of these operators are involved in the recent “quasi-distribution” approach for computing parton distributions nonperturbatively.

In this work, we study the renormalization of two types of classes of Wilson-line operators: straight-line and “staple” operators, which are related to the parton distribution functions (PDFs) and transverse momentum-dependent distributions (TMDs) respectively. In particular, we calculate in Dimensional Regularization (DR), the 1-loop conversion factors of straight-line operators between RI’ (appropriate for nonperturbative renormalization on the lattice) and MS-bar (typically used in phenomenology) schemes for massive quarks, as well as the 1-loop conversion factors of staple operators for massless quarks. We also compute the RI’ renormalization factors of staple operators on the lattice, up to 1-loop level, using Wilson/clover fermions and Symanzik improved gluons.

A nontrivial aspect in the renormalization of such operators is the observed operator mixing, which is disentangled by introducing mixing matrices. The combination of the calculated conversion factors with the nonperturbative RI’-renormalized lattice calculation of a quasi distribution, as well as the matching formula between the quasi distribution and the corresponding physical distribution, computed in MS-bar, leads to a nonperturbative lattice estimate of a parton distribution.

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