

The Transverse Gauge Links in Soft-Collinear Effective Field Theory

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Soft-Collinear Effective Theory (SCET) has been in covariant gauges. We argue that SCET, as it stands, is not capable to define in a gauge invariant way certain non-perturbative matrix elements that are an integral part of many factorization theorems. Those matrix elements involve two quark or gluon fields separated not only in light-cone direction but also in the transverse one. This observation limits the range of applicability of SCET. To remedy this we argue that one needs to introduce a new Wilson line as part of the SCET formalism, that we call T . We discuss how to modify SCET Lagrangian applicable in both classes of gauges: regular and singular ones. This extends the range of applicability of SCET. The new Lagrangian must be used to obtain factorization theorems in cases where the transverse momenta of the particles in the final states are not integrated over, such as semi-inclusive deep inelastic scattering, Drell-Yan and the Higgs production cross-section at low transverse momentum. By doing so all non-perturbative matrix elements appearing in the factorized cross-sections are gauge invariant.

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