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Resumming large radiative corrections in the high-energy evolution of the Color Glass Condensate

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The Color Glass Condensate effective theory is the perturbative QCD description of the initial state for proton-nucleus and nucleus-nucleus collisions at RHIC and the LHC. The BK-JIMWLK equations describing the evolution of this theory with increasing energy have recently been extended to next-to-leading order (NLO) accuracy, which should allow for direct comparisons with the phenomenology. However, some of the NLO corrections turn out to be extremely large, since amplified by (double and single) 'collinear'logarithms, i.e. logarithms of ratios of transverse momenta. As a result, the evolution at NLO becomes unstable and void of any predictive power. This difficulty points towards the existence of large radiative corrections to all orders in α_s, which must be computed and resummed in order to restore the predictive power of the perturbative expansion.

In Ref. [1], we performed such a resummation for the largest corrections —those where each power of α_s is accompanied by a double transverse logarithm. Subsequently, in Ref. [2], we have extended this resummation by including single transverse logarithms and running coupling corrections. This led us to a 'collinearly improved'version of BK equation, which resums the largest radiative corrections to all orders. Numerical studies of this equation show that the evolution is now stable and also considerably slowed down by the resummation. To demonstrate the usefulness of this equation as a tool for phenomenology, for have used it for fits to the HERA data for electron-proton deep inelastic scattering at high energy [2]. We have obtained excellent fits with a reduced number of free parameters and with initial conditions at low energy taken from perturbative QCD.

[1] "Resumming double logarithms in the QCD evolution of color dipoles", arXiv:1502.05642, Phys. Lett. B744 (2015) 293.

[2] "Collinearly-improved BK evolution meets the HERA data", arXiv:1507.03651

On behalf of collaboration:

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