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Progress towards full NLO accuracy and massive quarks in dipole picture fits to HERA data

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Color Glass Condensate (CGC) effective field theory (EFT) at leading order describes well the Deep Inelastic Scattering (DIS) inclusive cross section data at small-x as measured by the HERA experiments [1-3]. Recently the inclusive DIS impact factors have been calculated in Next-to-Leading Order (NLO) accuracy in CGC EFT [4-6], and the soft gluon divergence present at NLO has been factorized successfully [7].

In this talk we discuss our recent work [8] on the first comparisons of the NLO DIS cross sections to HERA data. Fitting the HERA reduced cross section data determines a parametrization for the non-perturbative initial condition to the BK evolution. Since the available NLO DIS inclusive cross sections are calculated in the massless quark limit, we construct and fit a dataset of light-quark-only cross sections using an independent parametrization of HERA total and heavy quark data. We find an excellent description of the HERA data. As the NLO BK is computationally challenging [9], we compare a number of beyond-LO prescriptions that approximate the full NLO BK, including the recent evolution parametrized in target momentum fraction [10]. These beyond-LO evolution equations include important higher order contributions by resumming corrections enhanced by large transverse logarithms. The determined initial condition is a necessary input for all NLO calculations in the GCC framework.

To assess the impact of the full NLO BK equation on the fits, we study how well the fit parametrizations describe HERA data when NLO BK evolution is used. We find that the NLO BK is approximated quite well by the enhanced BK equations.

The NLO DIS cross sections for massive quarks are becoming available, the longitudinal case already having been published [11], and the transverse case will soon follow. These massive quark results will have immeadiate improvement on the fit analysis as they enable us to take into account the substantial charm and bottom contributions present in the HERA data. This talk will also discuss recent progress on including massive quarks in the fit.

[1] T. Lappi, H. Mäntysaari, Phys.Rev. D88 (2013) 114020, arXiv:1309.6963 [hep-ph]
[2] E. Iancu, J.D. Madrigal, A.H. Mueller, G. Soyez, D.N. Triantafyllopoulos, Phys.Lett. B750 (2015) 643-652, arXiv:1507.03651 [hep-ph]
[3] B. Ducloué, E. Iancu, G. Soyez, D.N. Triantafyllopoulos, Phys.Lett.B 803 (2020) 135305, arXiv:1912.09196 [hep-ph]
[4] G. Beuf, Phys.Rev. D94 (2016) no.5, 054016, arXiv:1606.00777 [hep-ph]
[5] G. Beuf, Phys.Rev. D96 (2017) no.7, 074033, arXiv:1708.06557 [hep-ph]
[6] H. Hänninen, T. Lappi, R. Paatelainen, Annals Phys. 393 (2018) 358-412, arXiv:1711.08207 [hep-ph]
[7] B. Ducloué, H. Hänninen, T. Lappi, Y. Zhu, Phys.Rev. D96 (2017) no.9, 094017, arXiv:1708.07328 [hep-ph]
[8] G. Beuf, H. Hänninen, T. Lappi, H. Mäntysaari, Phys.Rev. D102 (2020) 074028, arXiv:2007.01645 [hep-ph]
[9] T. Lappi, H. Mäntysaari, Phys.Rev. D91 (2015) no.7,074016, arXiv:1502.02400 [hep-ph]
[10] B. Ducloué, E. Iancu, A.H. Mueller, G. Soyez, D.N. Triantafyllopoulos, JHEP 04 (2019) 081, arXiv:1902.06637 [hep-ph]
[11] G. Beuf, T. Lappi, R. Paatelainen, Phys.Rev. D104 (2021), 056032, arXiv:2103.14549 [hep-ph]

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