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DIS structure functions at low x at NLO in the dipole factorization : including massive quarks

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Deep Inelastic Scattering (DIS) is the cleanest tool available to probe the content of a fast proton or nucleus. In the regime of low Bjorken x, one enters in the nonlinear regime of gluon saturation, where the gluons are better described as a strong coherent semi-classical field (a.k.a. Color Glass Condensate) than as a collection of quasi on-shell partons. Hence, that regime lies outside the validity range of the collinear factorization, and is better described within the dipole factorization of DIS observables which allows to resum coherent multiple scattering on the target, and also to resum the high-energy leading logarithms (LL). One of the motivations to study in detail the regime of gluon saturation in proton and nuclei is that it drives the physics of the earliest stages of heavy collisions, leading to the formation of the Quark-Gluon Plasma.

So far, phenomenological studies have been performed successfully at LO+LL accuracy in the dipole factorization using HERA data for proton DIS. However, in order to reach precision, NLO corrections should be included as well as high-energy NLL resummations. This is important not only to extract as much knowledge as possible out of the HERA data, but also in prevision of future electron-proton and/or electron-nucleus colliders.

In this talk, we will present the first complete calculation of the (fixed order) NLO corrections to DIS structure functions on a dense target in the dipole factorization picture in the massless quark case, and present new results on the massive quarks contribution (which is known to be sizable in DIS) at NLO. We will also discuss issues related to the implementation of that result in practical phenomenological studies, such as new fits of the dipole-target amplitude.

Summary

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