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Proton structure functions at NLO in the dipole picture with massive quarks

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A crucial ingredient in all calculations in the Color Glass Condensate framework is the non-perturbative input to the perturbative small- x evolution equation such as the Balitsky-Kovchegov (BK) equation. Due to the non-perturbative nature, it has to be determined from experimental data, most naturally from total DIS cross section measurements.

So far it has not been possible in leading order calculations to simultaneously describe the total and heavy quark production data from HERA without introducing additional quark flavor dependent parameters. This has been a major source of uncertainty in the studies of gluon saturation in the CGC framework.

In this work we predict heavy quark production cross sections in Deep Inelastic Scattering at high energy by applying the CGC effective theory. We demonstrate that when the calculation is performed consistently at next-to-leading order accuracy with massive quarks it becomes possible, for the first time in the dipole picture with perturbatively calculated center-of-mass energy evolution, to simultaneously describe both light and heavy quark production data at small x . We furthermore show how the heavy quark cross section data provides additional strong constraints on the extracted non-perturbative initial condition for the small- x evolution equations.

Reference:

H. Hänninen, H. Mäntysaari, R. Paatelainen, J. Penttala, arXiv:2211.03504 [hep-ph]

Submitted on behalf of a Collaboration?

No

Participate in poster competition?

No

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