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Precision calculations for high energy scattering: SIDIS and Inclusive DIS at next-to-eikonal order

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Studying high-energy hadronic scattering processes to understand the structure of nuclei has been the focus of experimental and theoretical studies for more than three decades now. The Color Glass Condensate (CGC) effective theory has been developed and used to study particularly high-energy dilute-dense collisions. One of the main approximations adopted in the Color Glass Condensate is the so-called eikonal approximation, which amounts to neglecting power-suppressed corrections in the high-energy limit. This approximation is well justified for asymptotically high energies. However, corrections to it might be sizable in practice, in particular at the Relativistic Heavy Ion Collider and the upcoming Electron-Ion Collider. Therefore, we need to bring precision in theory to analyze the upcoming data from the colliders. For this, we have to compute observables like scattering cross sections beyond the leading order of energy. Deep inelastic scattering (DIS) is one of the clean channels used to study CGC beyond eikonal order.
In my talk, I will briefly review the eikonal approximation and how to go beyond eikonal order. Furthermore, I will present its application to semi-inclusive deep inelastic scattering (SIDIS) and Inclusive DIS. Specifically, I will present computations of new contributions to the cross-section of SIDIS at next-to-eikonal accuracy stemming from the t-channel quark exchange, by including the effect of the quark background field for the target and obtain its relation to Transverse momentum dependent (TMD) calculations in small-x limit. I will also present similar studies for inclusive DIS.

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