Contribution ID: **23** Type: **not specified**

Back-to-back inclusive dijets in DIS at small x: Sudakov suppression and gluon saturation at NLO

Thursday 3 November 2022 16:10 (15 minutes)

Back-to-back dijet cross-sections in deeply inelastic scattering (DIS) at small x are suppressed by many-body multiple scattering and screening effects arising from gluon saturation at high parton densities. They are similarly sensitive in these kinematics to large Sudakov logarithms from soft gluon radiation. Uncovering novel physics in this DIS channel therefore requires understanding the interplay of the two phenomena. In this work, we compute the small x inclusive dijet DIS cross-section in back-to-back kinematics at next-to-leading order (NLO) in the Color Glass Condensate effective field theory (CGC EFT). Our result includes, for the first time, all real and virtual NLO contributions to the impact factor. These include all Sudakov double and single logarithm contributions, as well as all other finite O(αs) terms that contribute at this order. We demonstrate explicitly that resummations of small x and Sudakov logarithms can be performed simultaneously in the CGC EFT. This requires that the JIMWLK kernel for small x evolution of the Weizs¨acker-Williams (WW) gluon distribution satisfies a kinematic constraint imposed by lifetime ordering of successive gluon emissions; the corresponding modifications to the kernel, corresponding to resummations of large double transverse logarithms, are precisely of the type required to stabilize JIMWLK evolution beyond leading logarithmic accuracy. We compute the azimuthal harmonics of the NLO back-to-back distributions and show their sensitivity to both the unpolarized and linearly polarized WW gluon distributions. Finally, we discuss how TMD factorization is broken by an emergent saturation scale at small x.

References:

[1] Dijet impact factor in DIS at next-to-leading order in the Color Glass Condensate. JHEP 11 (2021) 222. arXiv:2108.06347

[2] Back-to-back inclusive dijets in DIS at small x: Sudakov suppression and gluon saturation at NLO. arXiv:2208.13872

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Session Classification: Parallel Session A: TMD in experiment: DIS