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One-loop light cone wave functions with massive quarks

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A central ingredient in calculations of scattering processes in the high energy saturation regime of QCD is the light cone wavefunction. It is a universal QCD quantity encoding the light cone gauge partonic structure of a high energy projectile, and a necessary ingredient in cross section calculations for different scattering processes. This talk will report on the recent calculation of the light cone wave functions for a longitudinal [1] or transverse [2] virtual photon to split into quark-antiquark states, including for the first time quark masses at one loop accuracy. These wave functions can be used to calculate cross sections for several precision probes of perturbative gluon saturation at the Electron-Ion Collider. Using these wave functions we derive, for the first time, the total dipole picture DIS cross sections for longitudinal and transverse virtual photons with quark masses. The calculation has required solving a longstanding issue concerning quark mass renormalization in light cone perturbation theory. The quark masses are renormalized in the pole mass scheme, satisfying constraints from the requirement of Lorentz invariance of the quark Dirac and Pauli form factors.

[1] G. Beuf, T. Lappi and R. Paatelainen, Phys.Rev.D 104 (2021) 5, 056032, [2103.14549 [hep-ph]]

[2] G. Beuf, T. Lappi and R. Paatelainen, in preparation.

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