Contribution ID: **417**   Type: **Contributed Talk**

Helicity at Small x: LLA Corrections

Wednesday, 14 April 2021 13:45 (18 minutes)

The small-x quark helicity evolution equations at double-logarithmic order, with the kernel $\sim \alpha_s \ln^2(1/x)$, had been derived previously, and the equations were solved analytically at large N_c and numerically at large N_c and N_f. (Here, N_c and N_f are the numbers of quark colors and flavors, respectively.) In this work, we derive the single-logarithmic corrections to the double-logarithmic equations derived previously, that is, we find the correction to order $\alpha_s \ln(1/x)$ of the evolution kernel. The new equations include the effects of the running coupling and the unpolarized small-x evolution, both of which are parametrically significant at single-logarithmic order. The large-N_c and large-$N_c \& N_f$ approximations to the equation are computed. Their solution will provide a more precise estimate of the quark helicity distribution at small x, contributing to the resolution of the proton spin puzzle.

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Session Classification: Spin Physics

Track Classification: Spin Physics