Contribution ID: **256** Type: **not specified**

Small-x Contributions of the Quark and Gluon Helicity to the Proton Spin

Thursday 19 April 2018 11:20 (30 minutes)

The contribution of the quark and gluon helicity distributions to the proton spin requires integrating these helicity PDFs over the entire range of x. This necessarily involves an extrapolation of the measured PDFs at finite values of x into their small-x asymptotics. As is well-known in the case of the unpolarized quark and gluon distributions, the small-x asymptotics are governed by evolution equations, leading to a determination of the intercept: the exponent of the power-law behavior of the PDFs at small x. In this talk, I will present the derivation and solution of the corresponding small-x evolution equations for the quark and gluon helicity PDFs. Because the transfer of spin to small x is a sub-eikonal effect, the small-x evolution equations for helicity are significantly different from the unpolarized ones. The helicity evolution equations I will present resum double logarithms of 1/x, and they are sensitive to the detailed transverse structure of the polarized quark / gluon splitting kernels. The solution of these equations yields a leading-log evaluation of the quark and gluon helicity intercepts, which predict an enhancement of the helicity PDFs in the small-x tails. Preliminary estimates suggest that the enhancement of the proton spin contribution from polarized quarks may be significant, but is much milder for gluons.

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Session Classification: WG6: Spin and 3D structure

Track Classification: WG6: Spin and 3D structure