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Helicity and OAM at Low-x: an Exact Solution for Revised Helicity Evolution and the Small-x Asymptoics of OAM Distributions

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We present an exact analytic solution of the revised large-N_c small-x helicity evolution equations derived recently. We find the corresponding small-x asymptotics of the flavor-singlet helicity PDFs to be

\begin{align}
\Delta \Sigma (x, Q^2) \sim \Delta G (x, Q^2) \sim \left(\frac{1}{x} \right)^{\alpha_h}
\end{align}

with the intercept given by an exact analytic expression which numerically evaluates to $\alpha_h \approx 3.661\sqrt{tfrac\alpha_s N_c 2\pi}$. This appears to slightly disagree with the results of Bartels at al from 1996, where the intercept at large N_c is given by a different analytic expression, evaluating to $\alpha_h \approx 3.664\sqrt{tfrac\alpha_s N_c 2\pi}$. We also obtain the all-order small-x and large-N_c polarized anomalous dimension $\Delta\gamma_{GG}(\omega)$ and demonstrate that it agrees with the existing finite-order results up to the three known loops.

We then turn our attention to the orbital angular momentum (OAM) distributions. We derive new small-x evolution equations needed to extract small-x asymptotics of OAM distributions. Solving these equations we obtain

\begin{align}
L_{q + {\bar q}} (x, Q^2) \sim L_G (x, Q^2) \sim \left(\frac{1}{x} \right)^{\alpha_h}
\end{align}

with the same intercept as for the helicity PDFs.

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