

Weizsäcker-Williams Gluon Helicity Distribution and Inclusive Dijet Production in Longitudinally Polarized Electron-Proton Collisions

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It is well-known that the back-to-back (correlation) limit of inclusive quark-antiquark dijet production in unpolarized high energy electron-proton collisions can probe the Weizsäcker-Williams (WW) gluon transverse momentum-dependent distribution (TMD) at small x . In this paper, we consider a helicity-dependent version of the same process: we study the double-spin asymmetry for inclusive quark-antiquark dijet production in longitudinally polarized electron-proton scattering at high energies. We show that in the back-to-back limit this process probes the WW gluon helicity TMD. Furthermore, we derive the small- x evolution equation for the operator related to the WW gluon helicity distribution. We find that in the double-logarithmic approximation and in the large- N_c limit, the small- x asymptotics of the WW gluon helicity distribution is governed by exactly the same evolution equation as that for the dipole gluon helicity distribution. The longitudinal double-spin asymmetry for inclusive dijet production in the longitudinally polarized electron-proton collisions can thus test the small- x helicity evolution equations and facilitate constraining the initial conditions for phenomenology based on these equations.

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