Gluon Polarization from Longitudinally Polarized Proton Collisions at STAR

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The contribution to the spin of the proton from its constituents has been one of the unresolved questions in nuclear physics. The longitudinal spin program at STAR is exploring a wide range of measurements to determine the gluon helicity distribution inside the proton. The inclusive jets and pions in the kinematic range accessed by RHIC are dominated by quark-gluon and gluon-gluon scattering processes. The longitudinal double-spin asymmetry ($A_{LL}$) is sensitive to polarized parton distributions and can be used to extract information about the gluon helicity contribution ($\Delta G$) to the spin of the proton. The 2009 STAR inclusive jet $A_{LL}$ measurements at $\sqrt{s} = 200$ GeV showed the first evidence of polarized gluons for gluon momentum fractions above 0.05. The data collected at $\sqrt{s} = 510$ GeV will extend the current constraints on $\Delta G$ to lower gluon momentum fractions, and the measurement of dijet $A_{LL}$ will allow for the reconstruction of the partonic kinematics at leading order. This presentation will focus on the recent results from the $A_{LL}$ measurements at STAR, and how they extend the sensitivity to the gluon spin contributions at lower momentum fractions.