Recent Spin Results at STAR: Constraining the Gluon Polarization Distribution with Jet, Dijet, and Neutral Pion Probes at STAR

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The origin of the proton's intrinsic spin has remained a puzzle for 30 years. The STAR experiment at Brookhaven's Relativistic Heavy Ion Collider (RHIC) has played a major role in showing that the spins of gluons with at least a moderate fraction (x) of the proton's momentum play a role at least as important as the spins of quarks. But, a significant fraction of the proton's spin remains unaccounted for. The STAR detector is well suited for a campaign of spin asymmetry measurements with excellent tracking in the mid-rapidity ($|\eta| < 1.3$) region, useful for jet measurements, while mid-rapidity ($|\eta| < 1.0$) and intermediate-rapidity calorimetry ($1.09 < \eta < 2.00$) contribute to jet measurements and both of these calorimeters and a forward system ($2.65 < \eta < 4.0$) allow measurements with neutral pions. A forward upgrade is now underway and will augment our capabilities with tracking, electromagnetic, and hadronic calorimetry. Inclusive jet measurements at mid-rapidity remain a core part of the STAR program while measurements with correlated observables like dijets provide more precise information about the initial-state parton kinematics. Moving to forward η and higher $\sqrt{s}$ allows us to probe lower partonic momenta and better constrain the gluon polarization distribution, $\Delta g(x)$. We will present the status of a variety of asymmetry measurements and the results of others using jet, dijet and neutral pion probes with longitudinally polarized $p + p$ datasets at $\sqrt{s} = 200$ GeV and $\sqrt{s} = 510$ GeV.