Constraining the Proton's Gluon Helicity Distribution with Inclusive Jet and Dijet Measurements at STAR

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Abstract

A quantitative understanding of how gluonic spin contributes to the spin of the proton has been a central goal of the RHIC spin program. In polarized pp collisions, the large kinematic coverage of the Solenoidal Tracker At RHIC (STAR) provides sensitivity to gluons over a broad range in their momentum fraction x through the qg and gg scattering processes that dominate jet production at RHIC energies. The gluon helicity function, $\Delta g(x)$, can be probed via measurements of the longitudinal double-spin asymmetry A_{LL} in inclusive jet and dijet production, which are vital input to global analyses. Inclusive jet results from STAR at mid-rapidity ($|\eta| < 1$) using 2009 pp data at $\sqrt{s} = 200$ GeV, when added to such analyses, indicated substantial positive polarization (*i*.e., aligned with the proton spin direction) for gluons with $x > 0.05$. Since then, higher statistics data sets were collected in 2015 at the same energy, while significantly larger data samples have been recorded at $\sqrt{s} = 510$ GeV in 2012 and 2013. In addition, new analyses have pushed the kinematic reach to higher pseudorapidities (up to $\eta \sim 1.8$) and have been extended to study dijet production as well, all of which provide new and much needed constraints in the largely unexplored region $x < 0.05$. The status of these analyses and their potential impact on $\Delta g(x)$ will be discussed.