

# Recent PHENIX Measurements Sensitive to the Gluon Polarization in the Proton

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## Abstract

Understanding the proton spin structure in terms of quark and gluon degrees of freedom is one of the key open questions in the field of hadron physics. Gluon helicity,  $\Delta g(x)$ , related measurements play an important role in solving this “Spin Puzzle”. The polarized proton+proton collisions at the Relativistic Heavy Ion Collider provide unique opportunities for studying  $\Delta g(x)$  by accessing it via a variety of probes through gluon-gluon or quark-gluon interactions at leading order. The double-helicity spin asymmetries ( $A_{LL}$ ) for  $\pi^0$  and jet production were measured at PHENIX and STAR, respectively, in 2009 using polarized  $p + p$  collisions at 200 GeV center-of-mass energy, revealing for the first time evidence of non-zero  $\Delta g(x)$  for Bjorken- $x$  in the range  $0.05 < x < 0.2$ . Yet  $\Delta g(x)$  for  $x < 0.05$  is still poorly constrained. In this talk, we will report recent PHENIX measurements sensitive to the gluon polarization. The  $\pi^0$   $A_{LL}$  measurements at central rapidity ( $|\eta| < 0.35$ ) at  $\sqrt{s} = 510$  GeV can provide constraints on gluon polarization down to  $x$  near  $10^{-2}$ . At forward rapidity ( $1.2 < |y| < 2.2$ ), also at 510 GeV, the measurement of  $A_{LL}$  for  $J/\psi$  production has sensitivity to  $\Delta g(x)$  for  $x \approx 2 \times 10^{-3}$ .