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Measurement of Direct Photon Cross Section and Double Helicity Asymmetry at $\sqrt{s}$ = 510 GeV in $\vec{p}+\vec{p}$ Collisions at PHENIX

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The proton spin decomposition provides key information about the structure of the nucleons. Since the late 1980s, experiments showed that the quark spin contributes only ∼30\% to the proton spin, with the remaining part coming from the gluon spin as well as the quark and gluon orbital angular momentum. While the quark spin contribution was better constrained by polarized deep inelastic scattering, the gluon spin contribution remains less known. The Relativistic Heavy Ion Collider (RHIC) is the only collider capable of producing two longitudinal polarized proton ($\vec{p}+\vec{p}$) beams. Direct photon, jet, and charged pion production in $\vec{p}+\vec{p}$ collisions can probe the gluon spin at leading order. Compared with hadron production, direct photon production is the most "clean" channel, since there is little fragmentation involved. However, the relatively small direct photon cross section compared to the hadron production makes it a challenging observable. To achieve this "golden channel" measurement, we utilize the RHIC 2013 run, which provides the largest integrated luminosity (155 pb^{-1}) in $\vec{p}+\vec{p}$, along with the PHENIX Electromagnetic Calorimeter, which has fine granularity to separate the two π^0 decay photons up to π^0 transverse momentum p_T of 12 GeV/c. A shower profile analysis extends the γ/π^0 discrimination to beyond 20 GeV/c. This poster will present the direct photon cross section and double helicity asymmetry for the direct photon p_T of 6–30 GeV/c and 6–20 GeV/c, respectively. When included in future global analyses, our results will provide an independent constraint on the gluon spin contribution to the proton spin.

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