Contribution ID: **113** Type: **Parallel Session Presentation**

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

Friday, 22 October 2021 09:10 (20 minutes)

The proton spin decomposition provides key information about the structure of the nucleons. Since late 1980s, experiments showed that the quark spin contributes only $\sim$30\% to the proton spin, with remaining part coming from gluon spin as well as quark and gluon orbital angular momentum. While the quark spin contribution was better constrained by polarized deep inelastic scattering (DIS), the gluon spin contribution remains less known, because it is probed through higher order processes (suppressed by $\sim$0.2 comparing to leading order processes) in DIS. The Relativistic Heavy Ion Collider (RHIC) is the only collider capable of producing two longitudinal polarized proton ($\vec{p}+\vec{p}$) beams. Direct photon, jet and charged pion productions in $\vec{p}+\vec{p}$ collisions can probe the gluon spin at leading order. Comparing with hadron productions, direct photon production is the most clean" channel, since there is little fragmentation involved, and is considered thegolden" channel. However, the relatively small direct photon cross section compared to the hadron productions made it a challenging observable, until the RHIC 2013 run, which provides the largest integrated luminosity (155 pb^{-1}) in $\vec{p}+\vec{p}$. In addition, the Electromagnetic Calorimeter at PHENIX has fine granularity to separate the two π^0 decay photons up to π^0 transverse momentum p_T of 12 GeV/c, and a shower profile analysis extends the γ/π^0 discrimination to beyond 20 GeV/c. These conditions finally made this "golden" measurement come to reality. In this talk, I will present the isolated and inclusive direct photon cross sections and their ratio for photon p_T of 6–30 GeV/c, as well as the isolated direct photon double helicity asymmetry (A_{LL}) for photon p_T of 6–20 GeV/c. When included in global analyses in the future, our results will provide an independent constraint on the gluon spin contribution to the proton spin.

Primary author: Mr JI, Zhongling (Stony Brook University)

Presenter: Mr JI, Zhongling (Stony Brook University)

Session Classification: Nucleon Helicity Structure

Track Classification: Parallel Sessions: Nucleon Helicity Structure