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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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Understanding the contribution of gluons to the spin of the proton is crucial for unraveling the proton spin puzzle. This has been one of the primary motivations behind the spin program conducted at the Relativistic Heavy Ion Collider (RHIC). The longitudinal spin structure of the proton is probed by colliding two protons with longitudinal polarization ($\vec{p}+\vec{p}$) and measuring the double-helicity asymmetry (A_{LL}) of the final-state particles such as hadrons, jets, and direct photons. While the measurements of hadrons and jets already indicate a nonzero gluon-spin contribution, it remains inconclusive whether the gluon spin positively or negatively contributes to the overall proton spin.

On the other hand, the direct-photon production, mainly originating from quark-gluon Compton scattering, provides a suitable channel to investigate the sign of the gluon-spin contribution. Additionally, the direct-photon production involves minimal fragmentation contributions, making it the "cleanest" channel when compared to hadron and jet production. However, there is a significant background of photon contributions from $\pi^0 \rightarrow \gamma\gamma$ decays, which need to be identified by reconstructing the invariant mass of the two decay photons. At RHIC, only the electromagnetic calorimeter at PHENIX is capable of reconstructing the two decay photons of π^0 up to approximately 30 GeV/c of photon transverse momentum.

In this presentation, I will present the measurements of the direct-photon cross-section and A_{LL} at a center-of-mass energy of $\sqrt{s}$ = 510 GeV in $\vec{p}+\vec{p}$ collisions at PHENIX. The results of our A_{LL} measurement strongly support calculations that include positive gluon-spin contributions.

Is this abstract from experiment?

Yes

Name of experiment and experimental site

PHENIX experiment at RHIC at BNL

Is the speaker for that presentation defined?

Yes

Details

Dr. Zhongling Ji, UCLA, US, https://www.pa.ucla.edu/

Internet talk

Yes

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