Measurement of Transverse Spin Dependent $\pi^+\pi^-$ Asymmetry and Unpolarized $\pi^+\pi^-$ Cross Section in polarized pp Collisions at RHIC

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The transversity distribution function of quarks, $h_1^q(x)$, encapsulates the transverse spin structure of the proton at leading twist, where x represents the longitudinal momentum fraction carried by the quark q. Extracting $h_1^q(x)$ poses a formidable challenge due to its chiral-odd nature. Measurements of final-state hadron pairs in transversely polarized proton-proton ($p^\uparrow p$) collisions directly probe collinear quark transversity through its coupling with a chiral-odd interference fragmentation function (IFF), $H_1^{\sphericalangle,q}$. This coupling leads to an experimentally measurable azimuthal correlation asymmetry, A_{UT}. To extract $h_1^q(x)$ from A_{UT} asymmetry measurements, precise knowledge of IFF and unpolarized di-hadron fragmentation functions is needed. The former is provided from e^+e^- experiments, owing to the factorization and universality of the physics mechanism in the collinear framework. On the other hand, the latter is largely unknown but can be extracted from unpolarized di-hadron cross-section measurements in pp collisions. In this presentation, we will present preliminary results of A_{UT} using $p^\uparrow p$ data collected in 2015 at $\sqrt{s} = 200\,\text{GeV}$ and in 2017 at $\sqrt{s} = 510\,\text{GeV}$, and the unpolarized cross section using pp data collected in 2012 for $\pi^+\pi^-$ pairs at $\sqrt{s} = 200$ GeV by the STAR experiment. The presentation will also discuss prospects for additional data at both $\sqrt{s} = 200\,\text{GeV}$ and $\sqrt{s} = 510\,\text{GeV}$.