

J/Psi Transverse Single Spin Asymmetries (TSSA) and Spin Alignment to Decay Leptons in p+p Collisions at RHIC

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The J/ψ , a bound state of charm and anti-charm quark with spin 1, decays into lepton pairs with a large branching ratios. Its production in polarized and unpolarized p+p collisions sheds light on different aspects of QCD. At RHIC energies, charmonium production in $p+p$ collisions is dominated by gluon-gluon interaction. As a result, measurements of the TSSA in polarized $p+p$ collisions are sensitive to initial state spin-momentum correlation effects such as gluon Qiu-Sterman or tri-gluon correlation in collinear factorization and gluon Sivers effects in the transverse momentum dependent (TMD) formalism. Hadronization of charmonium in unpolarized $p+p$ collisions, is also accessible in more robust nonrelativistic QCD formalism due to the relatively large quark mass relative to the hadronization scale. Measuring how the spin of a decay lepton aligns with the spin of J/ψ s can test and map out various production mechanisms. Recent results of forward and backward TSSA measurements for $p+p$, $p+Al$ and $p+Au$ collisions from PHENIX data taken at $\sqrt{s} = 200$ GeV in 2015 and the status of mid-rapidity and forward-rapidity measurements of the J/ψ polarization for $p+p$ collisions from data taken at $\sqrt{s} = 510$ GeV in 2013 will be presented.

Primary author: Dr LEE, Sook Hyun (Iowa State University)

Presenter: Dr LEE, Sook Hyun (Iowa State University)

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