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Transverse Single Spin Asymmetry of Electromagnetic Jets at Forward Rapidity in $p^\uparrow + p$ Collisions at STAR

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One of the big challenges facing proton spin structure is the unexpectedly large transverse single spin asymmetries (TSSA, A_{N}) in transversely polarized $p^\uparrow + p$ collisions. Significant non-zero TSSAs in inclusive hadron productions at forward rapidities have been observed in many experiments, including those at RHIC. Despite extensive theoretical efforts, including twist-3 contributions within collinear factorization and transverse momentum-dependent (TMD) frameworks, no theory has been able to fully explain the observed phenomena. Recent measurements from the STAR experiment suggested that diffractive processes may also contribute to the observed TSSAs, providing the motivation for this study.

This talk will present measurements of electromagnetic-jet A_{N} for inclusive and single diffractive processes in $p^\uparrow + p$ collisions at $\sqrt{s} = 200$ and 510 GeV. Preliminary results for A_{N} at $\sqrt{s} = 200$ GeV will be discussed, with a focus on the contribution of the single diffractive process to the overall inclusive A_{N} . Furthermore, the current status of the analysis for both inclusive and single diffractive processes at $\sqrt{s} = 510$ GeV at STAR will be presented. These studies aim to shed light on the underlying mechanisms driving the large TSSA.

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