

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

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6                    One of the big challenges facing proton spin structure is the unexpectedly  
7                    large transverse single spin asymmetries (TSSA,  $A_N$ ) in transversely polar-  
8                    ized  $p^\uparrow + p$  collisions. Significant non-zero TSSAs in inclusive hadron produc-  
9                    tions at forward rapidities have been observed in many experiments, includ-  
10                    ing those at RHIC. Despite extensive theoretical efforts, including twist-3 con-  
11                    tributions within collinear factorization and transverse momentum-dependent  
12                    (TMD) frameworks, no theory has been able to fully explain the observed  
13                    phenomena. Recent measurements from the STAR experiment suggested that  
14                    diffractive processes may also contribute to the observed TSSAs, providing the  
15                    motivation for this study.

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