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## Lensing Mechanism Meets Small-x Physics: Single Transverse Spin Asymmetry in Polarized Proton-Proton and Polarized Proton-Nucleus Collisions

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We calculate the single transverse spin asymmetry (STSA) in polarized proton-proton and polarized proton-nucleus collisions ( $A_N$ ) generated by a partonic lensing mechanism. The polarized proton is considered in the quark-diquark model while its interaction with the unpolarized target is calculated using the small-x/saturation approach [1], which includes multiple rescatterings and small-x evolution. The phase required for the asymmetry is caused by a final-state gluon exchange between the quark and diquark, as is standard in the lensing mechanism of Brodsky, Hwang and Schmidt [2]. Our calculation combines the lensing mechanism with small-x physics in the saturation framework. The expression we obtain for the asymmetry  $A_N$  of the produced quarks has the following properties: (i) The asymmetry is generated by the dominant elastic scattering contribution and  $1/N_c^2$  suppressed inelastic (color quadrupole) contribution (with  $N_c$  the number of colors); (ii) The asymmetry does not fall off with the produced quark's momentum  $p_T$  until the momentum reaches the saturation scale  $Q_s$ , and then only falls off as  $1/p_T$  for larger momenta; (iii) The asymmetry decreases with increasing atomic number  $A$  of the target for  $p_T$  below or near  $Q_s$ , but is independent of  $A$  for  $p_T$  significantly above  $Q_s$ . We discuss how these properties may be qualitatively consistent with the data on  $A_N$  published by the PHENIX collaboration [3] and with the preliminary data on  $A_N$  reported by the STAR collaboration [4].

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[1]. Iancu, E., Venugopalan, R. (2003), The color glass condensate and high energy scattering in QCD, in *Quark Gluon Plasma*, World Scientific.

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[2]. S. J. Brodsky, D. S. Hwang, and I. Schmidt, Phys. Lett. B530, (2002).

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[3]. C. Aidala et al. (PHENIX Collaboration), Phys. Rev. Lett. 123, (2019) 122001.

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[4]. S. Heppelmann (STAR Collaboration), Preview from RHIC Run 15pp and pAu Forward Neutral Pion Production from Transversely Polarized Protons, in *Proceedings, 7th International Workshop on Multiple Partonic Interactions at the LHC*, (2016) p. 228.

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