

**Stony Brook University  
The Graduate School**

**Doctoral Defense Announcement**

**Abstract**

Double Longitudinal Helicity Asymmetries in Pion Production from Proton Collisions,  
Studies of Relative Luminosity Determination, and the Impact on Determination of the  
Gluon Spin in the Proton

By

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Polarized proton-proton collisions at RHIC are being used to study the origin of proton spin, which arises from the spin and orbital angular momentum of its constituent quarks and gluons. Measurements at the PHENIX experiment at  $\sqrt{s} = 200$  GeV of  $A_{LL}^{\pi^0}$ , the double longitudinal helicity asymmetry in neutral pion production, are used in global analyses of world polarized scattering data, where they are particularly important in constraining the sector of gluon polarization. These measurements have ruled out maximal gluonic spin contributions and are consistent with a small or zero contribution. In the latest measurements, the statistical precision of the data has reached the systematic limit, prompting investigation into the largest of the systematic uncertainties, the determination of relative luminosity. Details of the 2009 measurement at PHENIX of  $A_{LL}^{\pi^0}$  and its inclusion in the global analysis will be presented along with recent studies on systematic uncertainties, including a 2012 study that varied the angles of the beams in the PHENIX interaction region.

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