

DNP12-2012-000152

Abstract for an Invited Paper  
for the DNP12 Meeting of  
the American Physical Society

### **Recent Results from the RHIC Longitudinal Spin Program**

RENEE FATEMI, University of Kentucky

The high energy, highly polarized proton beams at the Relativistic Heavy Ion Collider (RHIC) provide a unique opportunity to significantly expand our knowledge about the spin structure of the proton and the role of Quantum Chromodynamics in hadronic collisions. The PHENIX and STAR experiments have utilized the 100 GeV longitudinally polarized beams to measure inclusive pion and jet double spin asymmetries, providing the first significant constraints on the gluon contribution ( $\Delta G$ ) to the spin of the proton. As the spin program matures, and the integrated luminosity increases, the experimental focus naturally shifts toward correlation channels, which allow a more precise mapping of the gluon helicity distribution as a function of the gluon momentum fraction  $x_g$ . Measurements of inclusive and correlation channels at 250 GeV beam energies will extend experimental sensitivities to lower  $x$  gluons, reducing the total error on  $\Delta G$ . The advent of polarized proton collisions at  $\sqrt{s} = 500$  GeV, first demonstrated in the 2009 RHIC run, has also allowed STAR and PHENIX to embark on a program to constrain the flavor separated anti-sea quark helicity distributions ( $\Delta\bar{u}, \Delta\bar{d}$ ) via measurements of single spin asymmetries of the leptonic decay of  $W^{-(+)}$  bosons. The data collected during a very productive 2012 RHIC run will allow the experiments to substantially increase the statistical power and expand the kinematic reach of the initial 2009 measurements. Recent results, projected sensitivities and future detector upgrades for the RHIC  $\Delta G$  and W programs will be discussed.