A Measurement of g_2^p and the Longitudinal-Transverse Spin Polarizability

Melissa Cummings
The College of William and Mary
2013 Jefferson Lab Users Group Meeting
(For the Jefferson Lab Hall A E08-027 Collaboration)

The proton's composition of quarks and gluons, which exhibit many-body interactions, make scattering from a proton significantly more complicated than a point-like particle. The four structure functions; F_1, F_2, g_1 and g_2 describe the deviation of a nucleon from point-like behavior in an inclusive scattering experiment. These functions cannot be determined analytically, but instead must be measured experimentally. The g_2^p experiment was completed in Hall A at Jefferson lab in the spring of 2012, providing the first measurement of g_2 for the proton in the resonance region; $0.02 < Q^2 < 0.2\ GeV^2$. This data will shed light on outstanding physics puzzles, such as why Chiral Pertubation Theory calculations fail to predict the behavior of the longitudinally-transverse spin polarizability (δ_{LT}). It will also provide a test of the Burkhardt-Cottingham Sum rule, which says that the integral of g_2 over certain kinematic variables tends to zero. This rule, while satisfied for the neutron, has yet to be verified for the proton, and has important ramifications in many-body nuclear interactions, such as QCD. Additionally, it will contribute to precision measurements of the proton, such as hydrogen hyperfine splitting and the proton charge radius. This presentation will give an overview of the theory and motivation for the experiment as well as discuss the current status of the analysis.