Neutron Elastic Form Factor Ratio from Recoil Polarization

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The GEn-RP experiment is among various form factor experiments with the Super-Bigbite Spectrometer (SBS) setup at Hall-A, Jefferson Lab and measures the ratio of electric to magnetic elastic form factors of the neutron, G_E^n/G_M^n using recoil polarimetry techniques at $Q^2 = 4.3\left(\frac{GeV}{c}\right)^2$ in quasi-elastic electron-neutron scattering "from a deuterium target". The ratio of these form factors is measured from the ratio of the transverse P_x and the longitudinal P_z components of the spin polarization, that is transferred to the recoiling neutron from the incident, longitudinally polarized electron beam. Both high-momentum, small-angle neutrons produced during $np \to np$ elastic scattering and high-momentum small-angle protons produced by $np \to pn$ (charge exchange) are used to analyze the neutron polarization components after precessing through known magnetic fields. In addition, low momentum, large-angle protons produced during $np \to np$ elastic scattering are detected, as a proof-of-principle measurement of the analyzing power.

This experiment will yield G_E^n/G_M^n at the highest Q^2 kinematic point yet recorded with recoil polarization and the experimental figure-of-merit information on the polarimetry along with the analyzing power will be used to optimize the future measurements of G_E^n/G_M^n to reach higher Q^2 values using recoil polarimetry techniques.

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