Jefferson Lab's GEn-II Experiment: Using a Novel ^{3}He Target for the Measurement of the Neutron Electric Form Factor at High Q^2

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Nucleon electromagnetic form factors offer insight into the internal structure of those nucleons. The Super Bigbite Spectrometer (SBS) program at Thomas Jefferson National Lab conducts experiments measuring nucleon form factors at high Q^2 values. Previous electric form factor measurements for the proton, G_E^p, were measured for $Q^2 = 8.5$ GeV^2, where as the neutron's, G_E^n, had only been measured to $Q^2 = 3.4$ GeV^2.

By colliding a polarized electron beam with a polarized ^{3}He target (with novel convection cell), experiment E12-09-016 (September 2022 - October 2023), GEn-II, measured the double spin asymmetry of the $e-n$ cross section in order to extract the form factor ratio G_E^n/G_M^n at Q^2 values of 2.9, 6.6, and 9.7 GeV^2. The changes in the target cell's geometry allowed for higher beam currents coupled with high SEOP (Spin Exchange Optical Pumping) polarizations. These effects helped lead to luminosities previously unattainable in form factor experiments. This talk will cover will cover performance aspects of the ^{3}He target during GEn-II.

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