

Precision Measurements of GMn to High Momentum Transfer with SBS

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The nucleon electromagnetic form factors (EMFFs) are among the most fundamental observables and are sensitive to the spatial distributions of charge and magnetization within the proton or neutron. However, apart from the proton magnetic form factor (G_M^p), high-precision data for the nucleon EMFFs at large momentum transfers (high Q^2) remain limited due to the experimental challenges involved. To address this, the Super BigBite Spectrometer (SBS) collaboration has carried out a series of experiments between 2021 and 2025 in Hall A at Jefferson Lab to extend high-precision measurements of the remaining nucleon EMFFs up to or beyond $Q^2 = 10 \text{ (GeV}/c)^2$. The first SBS experiment, SBS-GMn, extended the Q^2 reach of high-precision neutron magnetic form factor (G_M^n) measurements by more than a factor of two—up to $13.5 \text{ (GeV}/c)^2$ —using the “ratio” method. In this approach, systematic uncertainties are significantly reduced by extracting G_M^n from the ratio of neutron-coincident $[D(e, e'n)]$ to proton-coincident $[D(e, e'p)]$ quasi-elastic electron scattering from deuterium. This talk will provide an overview of the SBS-GMn experiment, emphasizing the physics analysis methodology and presenting preliminary results. I will also discuss the implications of these findings for the flavor decomposition of the nucleon form factors into up- and down-quark contributions.