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Status of high momentum-transfer form factor program at JLab and EIC

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The investigation of nucleon elastic electromagnetic form factors (EMFFs) at large momentum transfer has generated a large and increasing amount of experimental and theoretical interest over the last several decades. EMFFs provide precision benchmarks for theoretical modeling of nucleon structure and ab initio predictions in lattice QCD. Additionally, precise knowledge of the form factors at large Q^2 values is required as input to the interpretation of many other experiments in nuclear and hadronic physics, including studies of the Generalized Parton Distributions (GPDs) in Deeply Virtual Compton Scattering (DVCS). The experimental study of nucleon EMFFs at very large Q^2 is presently a unique worldwide capability of the Continuous Electron Beam Accelerator Facility at Jefferson Lab (JLab). The Super BigBite Spectrometer (SBS) Collaboration is presently carrying out a comprehensive program of high-Q^2 measurements of proton and neutron form factors in JLab's Hall A. The program started in October 2021, is approximately 50% complete as of this writing, and will continue to occupy Hall A through early 2025. In terms of luminosity and access to relevant kinematics for the measurement of polarization observables in elastic electron-nucleon scattering, the existing 11 GeV CEBAF and a proposed upgraded CEBAF to 22+ GeV are superior to the planned Electron-Ion Collider (EIC). However, the high center-of-mass energies available at the planned EIC allow for a significantly higher Q^2 reach than will ever conceivably be accessible in fixed-target experiments. Moreover, the detector and luminosity requirements for currently envisioned measurements of DVCS and other hard exclusive processes at the EIC are similar to those required for elastic form factor measurements. As such, the EIC can make a unique contribution to the knowledge of elastic electron-nucleon scattering cross sections at very large Q^2, albeit only for longitudinally polarized virtual photons. In this talk, I will review the current status of the SBS form factor program, including ongoing and planned experiments, the analysis of partially collected data, and the preliminary results of already completed experiments. I will also discuss the challenges involved in such measurements, and the prospects for extending their Q^2 reach beyond the SBS program, at the planned Electron-Ion Collider (EIC) and elsewhere.

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