

Theory and computation highlights in June, 2023  
(*Contribution to the Director's Monthly Report to JSABOD*)  
July 15, 2023

Generalized parton distributions (GPDs) provide tomographic quark/gluon images of hadrons as functions of the active partons' momentum fraction  $x$ , and their  $x$ -moments reflect many emergent hadronic properties. A new type of exclusive process for extracting GPDs has been proposed by Dr. Jianwei Qiu in order to overcome the lack of  $x$  sensitivity of currently studied processes [arXiv:2305.15397]. The analysis demonstrated, quantitatively, the enhanced sensitivity to extracting the  $x$  dependence of various GPDs from photoproduction cross sections. The analysis also demonstrated the asymmetries constructed from the photon polarization and hadron spin that could be measured at JLab Hall D and future facilities.

The important role of hadron structure-dependent two-photon exchange in electromagnetic processes has been highlighted over the past two decades in experiments at Jefferson Lab and elsewhere. A new paper by Dr. W. Melnitchouk and collaborators [arXiv:2306.02540] calculates the beam and target normal single-spin asymmetries in electron-proton elastic scattering from two-photon exchange amplitudes with resonance intermediate states. The latest CLAS exclusive meson electroproduction data are used as input for the transition amplitudes from the proton to the excited resonance states. The calculated beam normal asymmetries compare well with the measured values from the A4 (Mainz) and Qweak (JLab) experiments.