Theory and computation highlights in October, 2022
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Dr. Ringer of Theory explored the use of machine learning-based jet and event identification at the future Electron-Ion Collider (EIC) [arXiv:2210.06450]. The work establishes first benchmarks and proposes applications in the key research areas at the future EIC, including enhancing constraints on parton distribution functions and improving experimental access to spin asymmetries. The studies presented are relevant to several aspects of the EIC detector design, and the paper provides an outlook for connecting these machine learning-based methods with first principles calculations in quantum chromodynamics.

Generalized parton distributions (GPDs) are important nonperturbative functions that provide tomographic images of partonic structures of hadrons. Dr. Qiu and collaborators introduces a new type of exclusive process, called single diffractive hard exclusive process (SDHEP), that discusses the necessary and sufficient conditions for SDHEPs to be factorized into GPDs [arXiv:2210.07995]. The work demonstrates that the SDHEP is not only sufficiently generic to cover all known processes for extracting GPDs, but also well motivated for the search of new processes for the study of GPDs.

A recent global QCD analysis [Phys. Rev. D105 (2022) 074022] of jet production and other polarized scattering data found the presence of negative solutions for the gluon helicity distribution in the proton, Δg, along with the traditional $\Delta g > 0$ solutions. A new paper by Drs. Sato, Melnitchouk and collaborators [arXiv:2210.12295], including an undergraduate student with the REU program, considers polarized semi-inclusive deep-inelastic scattering for hadrons produced with large transverse momentum as a means of constraining the dependence of Δg on the parton momentum fraction. Focusing on the double longitudinal spin asymmetry, the paper identifies the kinematics relevant for future experiments at Jefferson Lab and the Electron-Ion Collider which are particularly sensitive to the polarized gluon channel and could discriminate between the different Δg behaviors.