

DIS2023: XXX International Workshop on Deep-Inelastic Scattering and Related Subjects



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Complete Formalism of Cross Sections and Asymmetries for Longitudinally and Transversely Polarized Leptons and Hadrons in Deep Inelastic Scattering

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The electron-ion collider (EIC) will be the first collider capable of simultaneously polarizing the spin of both the leptons and hadrons involved. This opens the possibility for measurements of the nucleon spin structure and Parity-Violating (PV) asymmetry in Deep Inelastic Scattering (DIS), for the first time, at a collider setting. At the meantime, it also calls for a complete derivation of DIS inclusive scattering cross sections, given that existing formalism at Jefferson Lab omitted electroweak contribution, while that developed for high energy ep colliders (such as HERA) omitted the mass of the hadrons and rarely included the transversely polarized hadrons. In addition, the scattering between transversely polarized leptons and hadrons, with the latter either unpolarized or polarized, do not yet exist in explicit forms that can be applied to experiments in a straightforward way. In this talk, we will present the cross section calculations for DIS with both longitudinally and transversely polarized leptons and hadrons, with no approximations made, and with all three contributions – $\gamma\gamma, \gamma Z, ZZ$ – included. With these calculations, we now have cross sections for every relevant set of polarizations for the leptons and hadrons. We will also, for the first time, provide an explicit expression for PVDIS asymmetry with transversely polarized leptons, that can be related to existing data on beam-normal single-spin asymmetry (BNSSA) measured in past PV electron scattering experiments. This will also possibly help explore new physics observables or experiments at Jefferson Lab, EIC, and elsewhere.

Submitted on behalf of a Collaboration?

No

Participate in poster competition?

Yes

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