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Coherent Deep Virtual Compton Scattering on ^{4}He with CORE@EIC

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Coherent deep virtual exclusive scattering (DVES) is an important tool for mapping the quark- and gluon-matter densities of nuclei. The separation of quark and gluon contributions can be achieved by combining the $e\,^Z\mathrm{A} \to e\,^Z\mathrm{A}\gamma$ (DVCS), $e\,^Z\mathrm{A} \to e\,^Z\mathrm{A}\phi$ and $e\,^Z\mathrm{A} \to e\,^Z\mathrm{A}J/\Psi$ reactions. This talk will describe the potential of the proposed "COmpact detectoR for Eic" (CORE) to achieve precision measurements of coherent DVCS on the α-particle at the U.S. Electron Ion Collider (EIC).

Two key challenges for DVES on nuclei are (1) measuring the net invariant momentum transfer squared t to the target ion with sufficient resolution to resolve the diffractive structure; and (2) selecting truly exclusive events without excitation in the final state. Due to the large intrinsic transverse momentum spread of nuclear beams in the EIC, the t-resolution in DVES is optimally determined by e.g. $(e, e'J/\Psi \to \mu^+\mu^-)$ or $(e, e'\phi \to K^+K^-)$ kinematics. In the DVCS reaction, we must rely upon the EM calorimeter resolution to resolve the $(e, e'\gamma)$ kinematics. With CORE, this is achieved with high resolution $PbWO_4$ calorimetry covering the entire backward (electron going) hemisphere of pseudo-rapidity $-3.5 \leq \eta \leq 0$. Establishing exclusivity is particularly favorable for the $e\alpha \to e\alpha\gamma$ reaction, as the helium nucleus has no bound excited states. The far-forward trackers ($\eta > 4.5$) and zero-degree-calorimeter (ZDC) can tag (and veto) all nuclear break-up channels of the four-nucleon system.

This talk will present the projected ^{4}He DVCS yield, and reconstruction resolution with CORE in a variety of EIC kinematics. Extensions to heavier nuclei, will also be discussed.

Submitted on behalf of a Collaboration?

Yes

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