Physics with polarized light ions at an EIC

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The Electron-Ion Collider (EIC) is a next-generation facility for nuclear physics currently pursued by the scientific community in the United States and worldwide. The physics program for the EIC has been outlined in Ref [1]. Both Brookhaven (BNL) and Jefferson Lab (JLab) are working on implementations based on their respective infrastructure: RHIC and 12 GeV CEBAF. An important part of the program involves physics with light nuclei, where the JLab design in particular has the ability to provide not only polarized proton and He-3 beams, but also vector- and tensor-polarized deuterium. A significant effort in developing the JLab detector concept has been directed towards providing a capability of detecting all nuclear fragments in coincidence with the scattered electron and various particles produced in the reaction. Deepinelastic processes on light nuclei with identified lowmomentum spectators transcends the traditional boundaries between different aspects of nuclear physics as it requires a combination of theoretical methods for highmomentum transfer processes (QCD factorization, partonic structure) and lowenergy nuclear structure (nuclear wave functions from manybody theory, spectral functions). A program with light nuclei at an EIC would include: 1) Neutron structure. Spectator tagging will permit accurate measurements of the neutrons partonic structure, including spin structure. This is essential for quark flavor decomposition of the nucleon spin and the extraction of flavor nonsinglet sea quark distributions sensitive to non-perturbative QCD interactions. The neutron generalized parton distributions (GPDs) measured in exclusive processes are needed to separate the u and d quark orbital angular momentum. 2) The bound nucleon in QCD. Spectator tagging will allow to identify the modifications of the single nucleons quark/gluon structure due to nuclear binding, shedding light on the quark/gluon origin of nuclear force. It will also make it possible to control the effects of finalstate interactions. 3) Collective quark/gluon fields. Highenergy scattering processes on light nuclei with recoil detection will provide novel ways of studying the collective quark/gluon fields in nuclei in a controlled manner. Coherent scattering, in which the nucleus remains intact, probes the quark/gluon field of the entire nucleus. Similar information comes from diffractive scattering on deuterium. The tensor polarized structure function of deuterium is zero in singlenucleon scattering (impulse approximation) and precisely identifies the QCD doublescattering contribution. Such measurements are of fundamental interest and provide insight into the onset of gluon saturation at higher energies. In this talk I will give an overview of the experimental capabilities and show examples of processes that will be studied.

[1] A. Accardi et al., arXiv:1212.1701 [nucl-ex] (2012).

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