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DIS on light nuclei with spectator tagging: New applications at intermediate and small x

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An Electron-Ion Collider would enable next-generation measurements of DIS on light nuclei (deuteron, ^3He , ...) with detection of nucleons and fragments in the nuclear fragmentation region ("spectator tagging"). Such measurements allow one to control the nuclear configuration during the high-energy process and could greatly advance our understanding in several areas of partonic structure and QCD: (a) precision measurements of neutron structure functions (including spin) in electron-deuteron scattering with proton tagging, eliminating nuclear binding through on-shell extrapolation in the recoil proton momentum; (b) controlled studies of the nuclear modifications of quark and gluon densities (EMC effect, antishadowing), using the recoil momentum dependence to control the size of nuclear configurations; (c) novel studies of coherence and nuclear shadowing at $x \ll 0.1$ using tagged DIS. We present an overview of the physics applications of spectator tagging at intermediate and small x and comment on theoretical challenges and experimental requirements. We report about results of an R&D project aiming to demonstrate the feasibility of spectator tagging with EIC and quantify the physics impact.

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