

Energy frontier electron-ion physics with the LHeC and the FCC-eh

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Energy-frontier DIS can be realised at CERN through an energy recovery linac that would produce 60 GeV electrons to collide with the HL-LHC or later HE-LHC (LHeC) or eventually the FCC hadron beams (FCC-eh). It would deliver electron-lead collisions with centre-of-mass energies in the range 0.8-2.2 TeV per nucleon, and luminosities exceeding $5 \times 10^{32} \text{ cm}^{-2}\text{s}^{-1}$. In this talk we will present novel ways for the accurate determination of nuclear PDFs, in a hugely extended space of x and Q^2 , and the resulting constraints for the theory of parton dynamics in nuclei. We will then discuss diffractive physics and, finally, the possibilities for establishing the existence of a new non-linear regime of QCD at small x beyond the dilute regime described by collinear factorisation. Furthermore, we will comment on the possibilities at the LHeC and FCC-eh for analysing the transverse partonic structure of hadrons and nuclei and its corresponding fluctuations, with expected strong, direct implications on our understanding of the results obtained in present and future high-energy heavy-ion programmes.

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