

Small- x Physics in eA Collisions at the LHeC: Understanding the Initial State of Ultra-Relativistic Heavy Ion Collisions

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The proposed Large Hadron-electron Collider at CERN will collide 60 GeV electrons and positrons against the LHC beams, providing center-of-mass energies around 1 TeV per nucleon. It will give access to a completely unexplored region of extremely small x at relatively large Q^2 , which exceeds those explored in previous DIS experiments by a factor 20 for protons and by four orders of magnitude for nuclei. Thus, it will open the window to a novel regime of QCD at small x in which the hadron becomes a dense but weakly coupled parton system, and parton densities saturate. In the case of nuclei, this low x system represents the initial state of heavy ion collisions and its understanding is fundamental to a complete description of the dynamics of quark gluon plasma formation. After a brief introduction, the possibilities for establishing the relevance of physics beyond the standard, fixed-order perturbative DGLAP approach - either linear resummation schemes or non-linear dynamics - will be discussed. First, inclusive cross sections will be examined. Then the possibilities in diffraction and exclusive vector meson production will be analysed. Finally, hadron and jet measurements sensitive to the QCD dynamics at small x will be presented.