The Science and Prospects of the Future Electron Ion Collider

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Abstract

While no one doubts that Quantum Chromodynamics (QCD) is the correct theory of Strong Interactions, our understanding of it remains far from complete. Intellectually compelling questions of high significance remain unanswered: How does the gluon distribution look in hadron & nuclei at extremely high energy? Do the gluons saturate forming a new saturated state of matter as predicted by some non-linear extensions of perturbative QCD? What role do the partons, and in particular, gluons play in imparting the properties of a proton such as mass and spin? Do the partons move transversely inside the nucleon & contribute dynamically to the proton spin?

Data collected over the past three decades at SLAC, CERN, DESY, BNL and Jefferson Laboratory have revealed these questions, but their resolution will require construction of a new high-energy high-luminosity Electron Ion Collider (EIC), capable of colliding polarized electrons with polarized light ions, and a broad range of heavy ions at high energies. If the highest machine luminosity currently under consideration is realized, the EIC, it will also allow precision electroweak physics measurements at the heart of testing the Standard Model (SM) – potentially opening possibilities of searches beyond the SM. The US nuclear science community with collaborators from Europe, and some institutions in Asia is now moving towards realization of this project. I will present status of the EIC project, the aspirations of the EIC collaborators and extend an invitation to the Indian nuclear science community towards high-impact contributions on machine, detector and physics fronts.

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