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(I) The Electron-Ion Collider: A New Microscope for Nuclear Matter

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Most of the visible mass in the universe consists of quarks and gluons bound in protons and neutrons. But, there remain several big questions about some surprisingly basic properties of the protons and neutrons (or nucleons, collectively). How does the mass of the nucleon arise from the much lighter quarks and massless gluons? How does the spin ½ of the nucleon arise from the spin ½ quarks inside it? What are the emergent properties of dense gluons systems? To investigate these questions, the US Department of Energy is building the Electron-Ion Collider (EIC) at Brookhaven National Laboratory on Long Island, NY. Polarized electrons will be accelerated to 5-18 GeV and collide with polarized protons, light ions, or unpolarized heavy nuclei accelerated to 40-275 GeV. The expected peak luminosity will be as high as 1034 cm-2s-1 to allow for precision "nuclear femtography."As part of large international collaborations, several Canadian universities are shaping the development of the EIC experiments and their detectors.

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