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Physics for Future Facilities for QCD

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Quantum Chromo Dynamics (QCD) is the theory of the strong nuclear force. In the US, there are currently two facilities focused on unveiling its mysteries. At RHIC, nuclear matter can be studied at extreme temperatures (quark gluon plasma) in high-energy collisions between gold ions. With the 12 GeV upgrade, Jefferson Lab will be able to precisely map the behavior of the three valence quarks confined by the strong force within protons and neutrons by scattering electrons on various nuclei. The next generation facility would be a machine capable of colliding electrons and nuclei to probe the sea of virtual quarks, and directly measure the glue that constitutes the strong force, providing a more complete map of the spatial and spin landscape of the nucleon, and the transition from quarks and gluons into protons and other hadrons.