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QCD: From the lattice to the quantum computer

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A century of coherent experimental and theoretical investigations uncovered the laws of nature that underly nuclear physics Quantum Chromodynamics (QCD) and the electroweak interactions. While analytic techniques of quantum field theory have played a key role in understanding the dynamics of matter in high energy processes, they become inapplicable to low-energy nuclear structure and reactions, and dense systems. Expected increases in computational resources into the exascale era will enable Lattice QCD calculations to determine a range of important strong interaction processes directly from QCD. However, important finite density systems, non equilibrium systems, and inelastic processes, that typically experience exponential growth in required computational resources, are expected to remain a challenge for conventional computation. There is now excitement in our community that the emergence of quantum computing may provide significant benefit in understanding these systems. In this presentation, I will discuss the state-of-the-art Lattice QCD calculations, progress that is expected in the near future, and the potential of quantum computing to address Grand Challenge problems in nuclear physics.