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Near-term quantum simulation of nuclear dynamics

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Quantum computers hold great promise for exact simulations of nuclear dynamical processes (e.g., scattering and reactions), which are paramount to the study of nuclear matter at the limit of stability and in the formation of chemical elements in stars. However, achieving this goal presents both conceptual and technological challenges, from formulating model mapping, quantum algorithms and measurement schemes for the desired nuclear dynamics, to developing noise-resilient protocols that will enable useful results with near term quantum technologies, to preparing for fault-tolerant quantum computers and more. In this talk I will focus on hybrid quantum classical co-processing schemes and digital-analog simulations leveraging hardware-aware and problem-informed custom gates. I will show how such protocols can be used in the near term to achieve noise-resilient simulations of real-time evolution and state preparation, characteristic components in quantum simulation of scattering and other dynamical processes.

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Primary author: QUAGLIONI, Sofia (LLNL)

Presenter: QUAGLIONI, Sofia (LLNL)

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