Contribution ID: **5** Type: **Invited oral**

Quantum computing for nuclear reactions

Thursday, 11 July 2024 09:50 (30 minutes)

Description of quantum many-body dynamics is extremely challenging on classical computers, as it requires taking into account many degrees of freedom. In nuclear physics, this translates on a large number of break up channels that have to be taken into account depending on the energy of the reaction. Even using classical computing exascale capabilities will not allow a full description of dynamical processes beyond drastic approximations. On the other hand, the dynamics can be naturally implemented on quantum hardware that is designed to easily handle unitary transformations, and hence the hope that in the future we will be able to obtain reaction observables from first principles. Any application will require three major steps: (i) preparing the initial state, (ii) time evolution by applying exp(-iHt) on the initial state, and (iii) measurements and computation of desired observables. In this talk, I will provide an overview of our efforts to apply quantum computing to the nuclear many-body problem using interactions that mimic the complexity of realistic nucleon-nucleon interactions, and a first application to electron-deuteron scattering, as a case of the simplest dynamics problem in nuclear physics.

This work was performed at Los Alamos National Laboratory, under the auspices of the National Nuclear Security Administration of the U.S. Department of Energy. Partial support by the Advanced Simulation and Computing (ASC) program is gratefully acknowledged. Los Alamos National Laboratory report no LA-UR-24-21443.

Primary author: STETCU, Ionel (Los Alamos National Laboratory)

Presenter: STETCU, Ionel (Los Alamos National Laboratory)

Session Classification: R-matrix, Reactions

Track Classification: Nuclear Reaction Mechanisms (direct, compound, preequilibrium)