Abstract Submitted
for the DNP20 Meeting of
The American Physical Society

**Efficient excited state preparation for linear response** CHENYI GU, University of Tennessee, Knoxville, ALESSANDRO BARONI, JOSEPH CARLSON, Los Alamos National Laboratory, THOMAS PAPENBROCK, University of Tennessee, Knoxville, ALESSANDRO ROGGERO, University of Washington —
Quantum computing holds a huge promise in simulating the dynamics of quantum systems. In this work, we are interested in the preparation of excited states, which is a necessary step in studying quantum dynamics problems, and we describe two different strategies. The first strategy approximates the Hermitian excitation operator $O$ by $\sin(\gamma O)/\gamma$, valid for small $\gamma$, using the time evolution operator and one additional qubit. The second strategy performs the excitation operation in an exact way using the linear combination of unitary (LCU) algorithm. We apply these two strategies to a toy version of the nuclear $n(p,d)\gamma$ reaction, and perform on the IBM machine. We show that the LCU based method is more efficient than the first method in most cases and is asymptotically more resilient to depolarizing noise.

Chenyi Gu
University of Tennessee, Knoxville

Date submitted: 25 Jun 2020 Electronic form version 1.4