Abstract Submitted
for the 4CS20 Meeting of
The American Physical Society

Reliability of analog quantum simulation in chaotic systems KARTHIK CHINNI, PABLO POGGI, IVAN DEUTSCH, University of New Mexico — The era of Noise Intermediate Scale Quantum (NISQ) information processing is characterized by the absence of fully fault-tolerant quantum error correction, which raises a question about the reliability of such devices in the presence of imperfections. We seek to quantify the reliability of an analog quantum simulator in the presence of perturbations that render the dynamics chaotic in the classical limit. Quantum chaos is associated with hypersensitivity to perturbations, which may make a NISQ device unreliable. We do study this in the Lipkin-Meshkov-Glick (LMG) model, a simple many-body system that exhibits a quantum phase transition in its ground state and also a dynamical nonequilibrium quantum phase transition. We show that the critical point estimates of these phase transitions, obtained from the quantum simulation of its dynamics, are somewhat robust to the presence of this chaotic perturbation, even though other aspects of the system are fragile and therefore cannot be reliably extracted from this simulator.

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Date submitted: 30 Sep 2020 Electronic form version 1.4