Abstract Submitted
for the DAMOP17 Meeting of
The American Physical Society

Analog Quantum Simulation of Complex Dynamics NATHAN LYSNE, KEVIN KUPER, POUL JESSEN, The University of Arizona — Recent advances in quantum control have made analog quantum simulation (AQS) a promising tool for the study of complex many-body physics. However, as experimental AQS grows in sophistication, questions arise about how much and in which ways we can trust the outcome of a given simulation. Notably, the absence of error correction makes it critical to understand the role of imperfections when the simulated dynamics are chaotic and therefore hypersensitive to errors. The quantum kicked top (QKT) is an ideal model for such studies. We discuss results from recent work using the d = 16 electronic ground state manifold of an individual Cs atom for AQS of a QKT with spin J = 15/2. As a baseline, we see close agreement between simulated and predicted dynamics in a mixed phase space over hundreds of kicks. Earlier studies have hinted at features in the QKT dynamics that reflect classical phase space structures even when the fidelity of microscopic behavior (quantum state) is poor, suggesting the existence of global properties that can be reliably simulated in the presence of errors. We present data from experiments and numerical simulations in the presence of deliberately applied errors, showing that the frequency content of the perturbation plays a central role in the robustness of AQS.

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Date submitted: 27 Jan 2017 Electronic form version 1.4