Abstract Submitted
for the CUWIP22 Meeting of
The American Physical Society

Engineering And Visualizing Quantum States[1] SRISHTI NAUTIYAL, GREGORY BENTSEN, BRIAN SWINGLE, Brandeis University — Quantum states are resources for storing and processing quantum information with applications to quantum simulation and computation. Here we describe techniques to engineer and visualize quantum states in single SU(2) spins. For visualization, we use the Wigner function to represent a quantum state on a Bloch Sphere. These quantum states are engineered using scrambling dynamics and weak measurements. Scrambling dynamics delocalize quantum information throughout a quantum system, and are achieved here using chaotic spin dynamics generated by a combination of squeezing and rotations. Conversely, weak measurements disturb a quantum state very little by partially collapsing the state. Consequently, there is a competition between scrambling and Measurement, leading to a measurement-induced phase transition (MIPT) between a delocalized quantum state where information is inaccessible to simple probes or a collapsed quantum state where information is easily accessible to simple probes. These delocalized states are robust to perturbation because there is a Quantum Error Correcting Code to protect quantum information from errors. Future work will explore possibilities for using such codes to robustly store quantum information in single SU(2) spins.

[1]DOE GeoFlow program (DE-SC0019380)

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Date submitted: 11 Jan 2022 Electronic form version 1.4