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Using chaotic quantum maps as a test of current quantum computing hardware fidelity[1] MAX PORTER, ILON JOSEPH, JEFF PARKER, ALESSANDRO CASTELLI, VASILY GEYKO, FRANK GRAZIANI, STEPHEN LIBBY, YANIV ROSEN, YUAN SHI, JONATHAN DUBOIS, Lawrence Livermore National Laboratory — In this work, the dynamics of chaotic quantum maps is explored via simulation as a means to test the fidelity of emerging quantum computing hardware. Quantum computers promise to deliver enormous gains in computational power that can potentially be used to benefit Fusion Energy Sciences (FES). Through the quantum-classical correspondence principle, quantum systems of sufficiently large quantum number (or number of qubits) can approximate classical dynamics. Here we study the simplest types of chaotic dynamical systems, defined by classical and quantum maps. It's been shown that quantum maps with simple noise models can recreate small-scale classical phase space structures in the limit of many qubits [G. Benenti, et al. Phys. Rev. Lett. **87**, 227901-1 (2001)]. They can also deviate from the classical dynamics and display dynamical Anderson localization. A key next question is whether phase space structures can be clearly observed with current hardware, such as the LLNL Quantum Design and Integration Testbed (QuDIT) quantum computing platform. This is examined via simulations with experimentally derived noise models for the QuDIT platform.

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