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Using quantum fidelity to measure quantum chaotic behavior with the delta-kicked rotor JIATING NI, SIAMAK DADRAS, WAKUN LAM, Oklahoma State Univ, SANDRO WIMBERGER, Università di Parma, GIL SUMMY, Oklahoma State Univ, DEPARTMENT OF PHYSICS, OKLAHOMA STATE UNIVERSITY COLLABORATION, DIPARTIMENTO DI FISICA E SCIENCE DELLA TERRA, UNIVERSITÀ DI PARMA COLLABORATION — The quantum delta-kicked rotor has been one of the workhorses in the experimental investigation of quantum chaos. Most experiments have been performed using ultra-cold atoms that are exposed to a spatially and temporally periodic optical potential. The measurement of the atomic momentum distribution after such an interaction has taken place can allow for the observation of many interesting phenomena such as quantum resonances, dynamical localization, ratchets, and accelerator modes. Nevertheless, there are other aspects of this system that remain difficult to study through the momentum distribution alone. For example, understanding what makes a quantum system "chaotic" in the classical sense of exponentially diverging trajectories in phase space is an open question. In this presentation we show how quantum fidelity, defined as the overlap between two quantum states, may be used to address this problem. We will present results showing how the fidelity between states that have undergone different interactions with the optical potential depends on both the strength of the interactions and the temporal period of the potential. We also show how this can be used to infer information about the underlying quantum chaotic phase space.

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