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Quantum recurrence in the kicked top model

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Quantum-classical correspondence plays an important role in understanding the emergence of classical chaos from an underlying quantum mechanics. Here we present several families of quantum dynamics, each parameterized by dimension, that do not approach the classically chaotic dynamics as predicted by Bohr's correspondence principle. The quantum dynamics take the form of stroboscopic unitary kicks acting on a single spin system, and have the same finite temporal periodicity for all dimensions including the semiclassical regime. This state independent periodicity implies that under these specific dynamics, no initial quantum state fully explores Hilbert space as a state vector or phase space as a quasi-probability distribution. We also consider the stability of these families as a function of the degree of chaos in the classical model. Our study suggests that even in the highly semi classical regime, there are specific parameter values for which a quantum system never behaves classically or displays signatures of chaos.

Keyword-1

Quantum Chaos

Keyword-2

Bohr's correspondence

Keyword-3

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