

# OpenQMBP2023: New perspectives in the out-of-equilibrium dynamics of open many-body quantum systems



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## Complete Hilbert Space Ergodicity in Quantum Dynamics of Generalized Fibonacci Drives

*Thursday, June 22, 2023 2:30 PM (40 minutes)*

Ergodicity in quantum systems is often defined through statistical properties of energy eigenstates, such as Berry's conjecture for single particle chaotic systems, and the eigenstate thermalization hypothesis (ETH) for many-body systems. In this talk, I would like to pose the question whether there are quantum systems which can exhibit a stronger form of ergodicity, namely whether dynamics is such that any time-evolved state visits every point in Hilbert space uniformly over time. We call such a phenomenon Complete Hilbert Space Ergodicity (CSHE), and it represents a notion of ergodicity more akin to the intuitive notion of ergodicity as an inherently dynamical concept, i.e., that a system eventually explores all of its allowed 'phase space'. Naturally, CSHE cannot hold for systems which are time-independent or even time-periodic (owing to the existence of energy eigenstates which precludes exploration of the full Hilbert space), but I will show that there exists a family of simple, aperiodic, yet deterministic driving protocols — drives generated by the Fibonacci word and its generalizations — for which CQE can be proven to occur. Our results provide a basis toward understanding how thermalization arises in general time-dependent quantum many-body systems, and in fact implies a more stringent form of local equilibration called deep thermalization.

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