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Emergence of local equilibrium in a boundary-driven quantum chaotic system MICHAEL GULLANS, DAVID HUSE, Princeton University — Quantum chaos is expected to be sufficient to allow even single eigenstates of a many-body Hamiltonian to achieve thermal equilbrium. Here we investigate the role of quantum chaos in reaching local equilbrium for a classic non-equilibrium scenario: a system in contact with two reservoirs held at different chemical potentials. To realize quantum chaotic behavior in our model we study a two-parameter family of Brownian circuits acting on a chain of spin-1/2s or qubits, such that the only conserved quantity is the total z component of the spin. We find that, for all parameters of the model, the time-averaged correlation functions agree and are close to local equilibrium; however, computing the total entropy of the system shows that there are, in fact, three distinct phases of the driven problem, with local equilibrium only emerging in the quantum chaotic region of parameter space. Our results suggest a generic picture for the emergence of local equilibrium in current driven quantum chaotic systems, as well as provide insights into methods to stabilize highly-entangled many-body states out of equilibrium.

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