Thermodynamics of Complex, Chaotic Quantum Systems

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Characterizing the work statistics of driven complex quantum systems is generally challenging because of the exponential growth with the system size of the number of transitions involved between different energy levels. We consider the quantum work distribution associated with the driving of chaotic quantum systems described by random matrix Hamiltonians and characterize exactly the work statistics associated with a sudden quench for arbitrary temperature and system size.

In addition, a universal relation is established between the quantum work probability distribution of an isolated driven quantum system and the Loschmidt echo dynamics of an entangled state between two copies of the system of interest, the thermofield double state. So knowledge of the work statistics gives us the echo dynamics, which is dictated by the spectral form factor. We discuss its relation to frame potentials and its use to assess information scrambling.