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Forum de Physique Statistique @ ENS

Mercredi 26 Juin 2019, 12 :00
LPENS, Conf IV
Domaines : cond-mat.stat-mech

Titre : *Entanglement Spectrum Statistics as a Probe of Irreversibility and Universality in Quantum Circuits*

Orateur : **Claudio Chamon (Boston University)**

Résumé : *We study the problem of irreversibility when the dynamical evolution of a many-body system is described by a stochastic quantum circuit. In contrast to Hamiltonian evolution, energy levels are not well defined, and the well- established connection between the statistical fluctuations of the energy spectrum and irreversibility cannot be made. We show that the entanglement spectrum level statistics may provide the connection in this case. As a quantum state initialized as a product state evolves unitarily via a random quantum circuit, it generically gets asymptotically maximally entangled. Disentangling the final state is a tall order without knowledge of the exact (reverse) circuit. The entanglement spectrum level statistics, not the entanglement entropy, can capture the difficulty of finding a disentangling circuit using a Metropolis-like algorithm. We show that irreversibility corresponds to Wigner- Dyson statistics in the level spacing of the entanglement eigenvalues, and that this is obtained from a quantum circuit made from a set of universal gates for quantum computation. If, on the other hand, the system is evolved with a non- universal set of gates, the statistics of the entanglement level spacing deviates from Wigner-Dyson (e.g., Poisson distribution) and the disentangling algorithm succeeds.*