

Measurement-induced Spectral Transition

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Ken Mochizuki^{1,2} and Ryusuke Hamazaki^{2,3}

¹ Department of Applied Physics, University of Tokyo, Tokyo 113-8656, Japan

² Nonequilibrium Quantum Statistical Mechanics RIKEN Hakubi Research Team, RIKEN Cluster for Pioneering Research (CPR), 2-1 Hirosawa, Wako 351-0198, Japan

³ RIKEN Interdisciplinary Theoretical and Mathematical Sciences Program (iTHEMS), 2-1 Hirosawa, Wako 351-0198, Japan

Spectral transitions of time-independent generators of dynamics have been an essential indicator for phase transitions, such as the Hamiltonian's gap closing transition at the quantum critical point. Recently, measurement-induced phase transition has been discovered as a new type of non-equilibrium quantum phenomenon caused by the interplay between unitary dynamics and non-unitary measurement. In particular, changing the strength of measurement causes sudden change of, e.g., entanglement and purification properties. However, since measurement causes noisy trajectories in time, the transition cannot be understood from conventional spectral transitions for time-independent generators.

In this talk, we demonstrate that the measurement causes gap-closing spectral transitions for the Lyapunov spectrum, which is defined from the non-unitary time-evolution operator of quantum trajectories. We use unitary circuit and mid-circuit measurement with tunable errors and find that the gapless/gapped phases correspond to volume/area law entanglement phases. We also show that this spectral transition indicates the sudden transition of the relaxation timescale for any observables, in addition to the purification timescale.