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Entropy of Isolated Quantum Systems after a Quench[1]

MARCOS RIGOL, Georgetown University, LEA SANTOS, Yeshiva University, ANATOLI POLKOVNIKOV, Boston University — A diagonal entropy, which depends only on the diagonal elements of the system's density matrix in the energy representation, has been argued to be the proper definition of thermodynamic entropy in out-of-equilibrium quantum systems. We study this quantity after an interaction quench in lattice hardcore bosons and spinless fermions, and after a local chemical potential quench in a system of hard-core bosons in a superlattice potential. The former systems have a chaotic regime, where the diagonal entropy approaches the equilibrium microcanonical entropy, coinciding with the onset of thermalization. The latter system is integrable. We show that its diagonal entropy is additive and different from the entropy of a generalized Gibbs ensemble, which has been introduced to account for the effects of conserved quantities at integrability [1].

[1] Lea F. Santos, Anatoli Polkovnikov, and Marcos Rigol, Phys. Rev. Lett. 107, 040601 (2011).

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