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Lecture: Characterizing Quantum Many-Body States via Entanglement Hamiltonian Tomography

Tuesday, 29 June 2021 09:00 (1h 30m)

The experimental characterization and quantification of entanglement properties, and the entanglement spectrum in particular, play a major role in our understanding of modern quantum many body physics in the lab. For most quantum lattice systems of interest, the reduced density matrix ρ of the lattice is described by a thermal state of a quasi-local Entanglement Hamiltonian H: $\rho = \exp(-\beta H)$. As a I will show in this talk, the parametrization of the reduced density matrix in terms of the Entanglement Hamiltonian allows for the determination of entanglement properties like the Schmidt-decomposition with a drastically reduced number of experimental runs. For ground states of a many-body systems, an efficient parametrization is suggested by the Bisognano-Wichmann theorem of axiomatic field theory, while for quantum quenches to a critical point an ansatz is provided by conformal field theory. Finally, I will discuss efficient quantum protocols to determine the Entanglement Hamiltonian whose properties can be investigated on the quantum device without any additional classical post-processing steps.

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