

SEMINAR: Thermalization with noncommuting conserved quantities

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12:00 to 13:00

Seminar Room

Thermodynamic systems typically conserve quantities (i.e. charges) such as energy and particle number. The charges are often assumed implicitly to commute with each other. Yet quantum phenomena such as uncertainty relations rely on observables' failure to commute. How do noncommuting charges affect thermodynamic phenomena? This question, arising at the intersection of quantum information theory and thermodynamics, spread recently across many-body physics. Until recently, the issue has remained theoretical. I will give an overview of noncommuting-charge thermodynamics, focusing on our experimental testing of its predictions, with a trapped-ion simulator. We prepare 6-21 spins in an approximate microcanonical subspace, a generalization of the microcanonical subspace for accommodating noncommuting charges, which cannot necessarily have well-defined nontrivial values simultaneously. We simulate a Heisenberg evolution using laser-induced entangling interactions and collective spin rotations. The noncommuting charges are the three spin components. We find that small subsystems equilibrate to near a recently predicted non-Abelian thermal state. This work bridges quantum many-body simulations to the quantum thermodynamics of noncommuting charges, the predictions of which can now be tested.

Hosted by: Prof. Dr. Maciej Lewenstein