

OpenQMBP2023: New perspectives in the out-of-equilibrium dynamics of open many-body quantum systems



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Emergent hydrodynamics and Pauli blocking in quasi-1D Bose gases

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Confining atoms to a single line (1D) results in a system, whose elementary excitations are quasi-particles with properties that may differ significantly from the atoms; in a Bose gas, correlation effects due to interactions in 1D prevent two quasi-particle excitations from occupying the same quantum state. This imposed Pauli exclusion leads to effective fermionization of the quantum Bose gas in 1D, even for weak interatomic repulsion.

In our experiment, we study the dynamics of a Bose gas of weakly interacting rubidium atoms under tight transverse confinement on an Atom Chip. We probe a regime far beyond conventional limits of 1D, where excitations in the transverse confining potential are energetically possible. However, even deep in this regime, we observe dynamics in agreement with purely 1D physics. Our observations represent a manifestation of the emergent Pauli blocking of excitations, resulting in the gas remaining effectively 1D.

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