Experimentally probing Landauer's principle in the quantum many-body regime

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Landauer's principle establishes a bridge between information theory and thermodynamics by fundamentally relating the erasure of a single bit of information to a minimum amount of heat dissipation. While extensively explored in the context of few-body quantum systems, the question arises whether this insight can be extended and potentially leveraged in complex quantum many-body systems, where thermodynamics emerges as an effective coarse-grained description. This talk aims to present the first experimental measurement of Landauer's principle in a quantum field simulator consisting of two coupled one-dimensional ultra-cold Bose gases. We characterized (generalized) entropy production along a global mass quench from a Klein-Gordon to a Luttinger liquid model. Additionally, we may briefly discuss theoretical work on the quantum thermodynamics of local quantum quenches in the many-body domain.