Department of Theoretical Physics

THE QUANTUM SPACETIME SEMINAR SERIES

Exotic QFTs: Generalized Clausius inequality, error tolerant memory and the quantum null energy condition

(Zoom Seminar)

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Zoom link shall be shared separately

Quantum thermodynamics gives a generalization of the Clausius inequality stating that the irreversible entropy production is not only positive, but also has both a lower and an upper bound for a given physical process. It is, however, not possible generically to compute or even estimate these bounds. We show that the study of the quantum null energy condition in holographic quenches gives explicit upper and lower bounds for the irreversible entropy production in two-dimensional systems (near criticality) for transitions which are faster than any microscopic scale. For a given change in temperature, we explicitly compute the lower and upper bounds on the irreversible production of entropy, and also similar bounds on rates of growth of entanglement. We also apply these methods to obtain a refined version of Landuer principle, in which we compute the minimum irreversible entropy production needed to delete encoded quantum information, and obtain analytic results for a large number of encoding bits. We also find that, for certain forms of encoding, fast deletion is impossible if the encoded bits are squeezed over a sufficiently small length scale. This circumvents some issues in no-go theorems based on stabilizer codes which forbid self-correcting quantum memory in lower dimensions. The talk will be based on arXiv:2109.09914 (to appear in PRL), arXiv:2202.00022 and some upcoming works.

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