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Entropy Production in Open Systems: The Predominant Role of Intra-Environment Correlations

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We show that the entropy production in small open systems coupled to environments made of extended baths is predominantly caused by the displacement of the environment from equilibrium rather than, as often assumed, the mutual information between the system and the environment. The latter contribution is strongly bounded from above by the Araki-Lieb inequality, and therefore is not time-extensive, in contrast to the entropy production itself. Furthermore, we show that in the thermodynamic limit the entropy production is associated mainly with generation of the mutual information between initially uncorrelated environmental degrees of freedom. We confirm our results with exact numerical calculations of the system-environment dynamics.

Summary

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