

Irreversibility and correlations in open quantum systems

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Correlations shared within composite quantum systems are the fundamental resource for several tasks in quantum information processing. When considering an open dynamics, such correlations are necessarily accompanied by the production of entropy. We address the link between irreversibility and correlations in the non-equilibrium steady state of coupled quantum harmonic oscillators. We present a theoretical framework to assess the rate of entropy produced by an open quantum system in a non-equilibrium steady state. The entropy production rate is expressed in terms of accessible quantities. Our results can be applied to a nano-mechanical resonator or a Bose-Einstein condensate interacting with a cavity field. Then, we unveil a quantitative relation between the entropy production rate and the correlations, both total and quantum, built between the two oscillators. In the small coupling limit we show that the entropy production rate is proportional to both the mutual information and the quantum correlations.

[1] M. Brunelli et al, arXiv:1602.06958 (2016).

[2] M. Brunelli and M. Paternostro, arXiv:1610.01172 (2016).