

Integral fluctuation theorem for hidden entropy production

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In the general process of eliminating dynamic variables in Markovian models, there exists a difference in the irreversible entropy production between the original and reduced dynamics. We call this difference the hidden entropy production [1,2], since it is an invisible quantity when only the reduced system's view is provided. Understanding such hidden entropy is important for example in discussing the efficiency of Brownian heat engines [3,4], and more generally the origin of the arrow of time. We show that this hidden entropy production obeys a new integral fluctuation theorem under a certain condition, therefore supporting the intuition that entropy production should decrease by coarse graining. It is found, however, that in cases where the condition for our theorem does not hold, entropy production may also increase due to the reduction. Explicit examples for both scenarios will be discussed.

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- [2] Y. Nakayama and K. Kawaguchi, arxiv 1211.3805 (2012).
- [3] M. Buttiker, Z. Phys. B: Condens. Matter 68, 161 (1987).
- [4] R. Landauer, J. Stat. Phys. 53, 233 (1988).