

Non-Markovian effects on the performance of a quantum Otto refrigerator

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- [3] A. El Allati, K. El Anouz, M.H. Ben Abdou Chakour, S. Al-Kuwari, Non-Markovian effects on the performance of a quantum Otto refrigerator, Physics Letters A 496 (2024) 129316

Abstract

Quantum thermodynamics is an important infrastructure for developing and performing many tasks in quantum technologies. In this paper, we propose a model for constructing an Otto refrigerator thermal machine via an auxiliary system and Markovian reservoir. Moreover, the proposed model induces Markovian and/or non-Markovian regimes on refrigerant systems. By increasing the coupling strength between the refrigerant and auxiliary systems, non-Markovian behaviors arise in different thermodynamic quantities. In addition, the different amounts of quantum thermodynamics, namely work, heat and coefficient of performance, are investigated as a function of the initial frequency of the refrigerant system. Our results show that the memory effects between the open system and the environment can enhance the power of the proposed Otto refrigerator, particularly in the finite-time strokes of the refrigerator, under some specific circumstances.

Figures

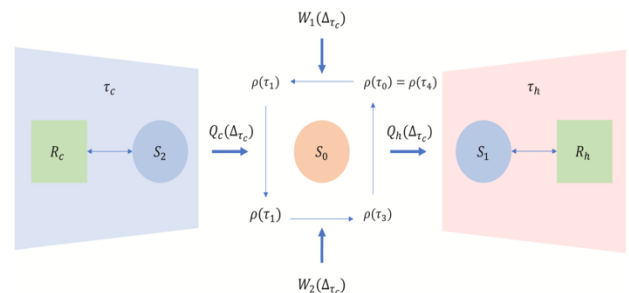


Figure 1: Schematic diagram of the Otto refrigerator composed by four strokes with hot and cold reservoirs, namely $S_1 - R_h$ and $S_2 - R_c$ interacting locally and separately with the single qubit refrigerant, namely S_0 .

References

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- [2] A. Levy, R. Kosloff, Quantum absorption refrigerator, Phys. Rev. Lett. 108 (2012) 070604

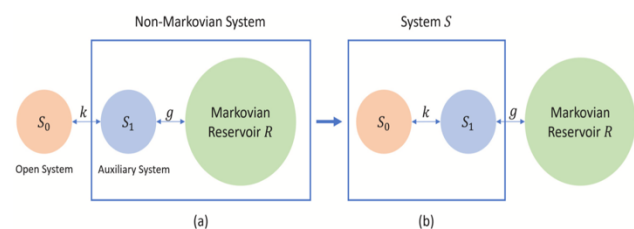


Figure 2: Description of the interaction between a system S_0 with an auxiliary system S_1 , and a Markovian reservoir R .