A small quantum absorption refrigerator with reversed couplings

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Abstract

Small quantum absorption refrigerators have recently attracted renewed attention. Here we present a missing design of a two-qubit fridge, the main feature of which is that one of the two machine qubits is itself maintained at a temperature colder than the cold bath. This is achieved by 'reversing' the couplings to the baths compared to previous designs, where only a transition is maintained cold. We characterize the working regime and the efficiency of the fridge. We demonstrate the soundness of the model by deriving and solving a master equation. Finally, we discuss the performance of the fridge, in particular the heat current extracted from the cold bath. We show that our model performs comparably to the standard three-level quantum fridge, and thus appears appealing for possible implementations of nano thermal machines.

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