Entanglement enhances cooling in small quantum refrigerators

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Abstract

Small self-contained quantum thermal machines function without external source of work or control but using only incoherent interactions with thermal baths. Here we investigate the role of entanglement in a small self-contained quantum refrigerator. We first show that entanglement is detrimental as far as efficiency is concerned-fridges operating at efficiencies close to the Carnot limit do not feature any entanglement. Moving away from the Carnot regime, we show that entanglement can enhance cooling and energy transport. Hence, a truly quantum refrigerator can outperform a classical one. Furthermore, the amount of entanglement alone quantifies the enhancement in cooling.

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