The Second Law of Thermodynamics in a Quantum Heat Engine Model

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Abstract: The second law of thermodynamics has been proven by many facts in classical world. Is there any new property of it in quantum world? In this paper, we calculate the change of entropy in T.D. Kieu's model for quantum heat engine (QHE) and prove the broad validity of the second law of thermodynamics. It is shown that the entropy of the quantum heat engine neither decreases in a whole cycle, nor decreases in either stage of the cycle. The second law of thermodynamics still holds in this QHE model. Moreover, although the modified quantum heat engine is capable of extracting more work, its efficiency does not improve at all. It is neither beyond the efficiency of T.D. Kieu's initial model, nor greater than the reversible Carnot efficiency.

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