INSTITUTE SEMINAR

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TITLE

Implications of Coupling in Quantum Thermodynamic Machines

ABSTRACT

We, study in the present work, coupled quantum systems as the working media of thermodynamic machines. Under a suitable phase-space transformation, the coupled systems can be expressed as composition of independent subsystems. We find that for the coupled systems, the figures of merit, that is the efficiency for engine and the coefficient of performance for refrigerator, are bounded (both from above and from below) by the corresponding figures of merit of the independent subsystems. We also show that the optimum work extractable from a coupled system is upper bounded by the optimum work obtained from the uncoupled system, thereby showing that the quantum correlations do not help in optimal work extraction. Further we study two explicit examples; coupled spin-1/2 systems and coupled quantum oscillators with analogous interactions. Interestingly, for particular kind of interactions, the efficiency of the coupled oscillators outperforms that of the coupled spin-1/2 systems when they work as heat engines. However, for the same interaction, the coefficient of performance behaves in a reverse manner, while the systems work as refrigerator. Thus same coupling can cause opposite effects in the figures of merit of heat engine and refrigerator.