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Irreversibility in an optical parametric driven optomechanical system

Abstract

This study investigates the role of nonlinearity via optical parametric oscillator on the entropy production rate and quantum correlations in a hybrid optomechanical system. Specifically, the modified entropy production rate of an optical parametric oscillator placed in the optomechanical cavity is derived, which is well described by the two-mode Gaussian state. The irreversibility and quantum mutual information associated with the driving the system far from equilibrium are found to be controlled by the phase and strength of nonlinearity. This analysis shows that the system entropy flow, heating, or cooling, are determined by choosing the appropriate phase of the self-induced nonlinearity. It is further demonstrated that this effect persists for a reasonable range of cavity decay rate.

Keywords: