Entropy production rate of a nonlinear hybrid quantum optomechanical system

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We study the irreversible entropy produced in an interacting nonlinear hybrid optomechanical cavity system by stationary-driven dissipation process. The influence of the nonlinearity resulting from the optical parametric oscillators on the entropy production and quantum correlations is scrutinized in detail. We derive the modified entropy production rate of an optical parametric oscillator placed in a cavity modelled by the two-mode Gaussian system. Our findings show a substantial digression in the irreversibility and quantum mutual information for minute detuning. It is further shown that the nonlinearity effect persists for a reasonable range of cavity decay rates. The findings from our study would benefit the current effort toward the optimization of quantum thermal devices and a better understanding of the energetic cost of cooling optomechanical systems