Coherent quantum dot heat engine

Jaegon Um[1], Konstantin Dorfman[2], and Hyunggyu Park[3]

[1] CCSS, CTP and Department of Physics and Astronomy, Seoul National University, Seoul 08826, Korea

[2] State Key Laboratory of Precision Spectroscopy, East China Normal University, Shanghai 200062, China

[3] School of Physics, Korea Institute for Advanced Study, Seoul 02455, Korea

We investigate a coherent two-level quantum dot system coupled to two reservoirs characterized by the chemical potential and temperature, where the coherence is induced by interaction between system and environment. Using the Lindblad master equation derived from the microscopic Hamiltonian of total system and varying an interference factor phenomenologically introduced in order to control the coherence strength, we find that the steady state of system is identical to the solution of master equation in the incoherent two-level quantum dot system, except for the perfectly coherent case which can be achieved in the degenerated two-level system. It turns out that in the steady state of coherent engine output power can be enhanced in comparison with the incoherent engine while the efficiency defined by the ratio of the output power and input heat is independent of the quantum coherence. We also discuss the efficiency at the maximum power in the coherent and incoherent quantum dot engines.