Power-efficiency trade-off for finite-time quantum harmonic Otto heat engines

Hyun-Myung Chun[1] and Jong-Min Park[2,3]
[1]*School of Physics, Korea Institute for Advanced Study*
[2]*Asia Pacific Center for Theoretical Physics*
[3]*Department of Physics, Postech*

The performance of a heat engine is often characterized by two key quantities: power and efficiency. Although it has long been known that high power and high efficiency are incompatible due to thermodynamic constraints, the explicit formula for the trade-off between power and efficiency has been discovered only recently. We extend the power-efficiency trade-off derived for classical steady-state heat engines to that of the quantum harmonic Otto heat engine, a paradigmatic quantum cyclic heat engine. To this end, we employ the phase-space approach using quasi-probability distributions. The resulting trade-off is valid for cycles with an arbitrary protocol that connects two isobaric branches and with arbitrary finite operation time. We further show that the maximum power limited by the trade-off is achievable with the maximum (quasistatic) efficiency of the Otto engine.

[1] J.-M. Park, S. Lee, H.-M. Chun, and J. D. Noh, Phys. Rev. E **100**, 012148 (2019)
[2] J.-M. Park and H.-M. Chun, in preparation