Nonlocal heat engines with hybrid quantum dot systems

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The energy absorbed by a conductor from a non-equilibrium environment can be rectified to generate finite electrical power. Typically, this depends on tiny energy-dependent asymmetries of the device, formed by e.g. a quantum dot [1]. We show that larger currents are expected in hybrid systems, where a superconductor hybridizes the even-parity states in the quantum dot. We consider the environment to consist on a quantum dot Coulomb-coupled to the conductor one and tunnel-coupled to a hot reservoir. Two main mechanisms contribute to the generation of power. On one hand, the non-equilibrium charge fluctuations in the second dot correlate with the Andreev processes hence injecting Cooper pairs in the superconductor. This provides the necessary symmetry breaking energy transfer. On the other hand, this mechanism competes with quasiparticle contributions, which benefit from the sharp features of the superconducting density of states, and is able to increase the engine performance [3].

References

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