Information in mesoscopic quantum thermal machines

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The roles of information in classical and quantum thermal machines are completely different. While the former is routinely exploited within control engineering to optimize processes via feedback, fundamental questions regarding the role of quantum information are still open. Indeed, in quantum systems, observations generally alter the system state, and hence acquiring and exploiting information is a much more subtle issue. In particular, thermal machines that exhibit quantum coherence do not necessarily benefit from increasing the available classical information because observations collapse the sensitive quantum states. In addition, quantum information is a very valuable and hard-to-produce resource for information processing and sensing. It generally requires time-controlled schemes, avoiding dissipation and thermal environments.

In this talk, I will discuss several mesoscopic quantum thermal machines that allow for investigating the subtle role of quantum information. I will start by presenting a phase-coherent heat engine based on a Aharonov-Bohm interferometer that exhibits close-to-optimal thermoelectric properties. I will then present a family of entanglement quantum engines, able to generate steady-state bipartite and multipartite entangled states, exploiting exclusively incoherent couplings to thermal baths.