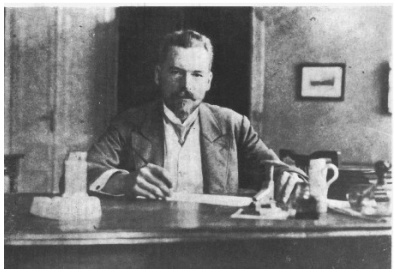

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Non-Markovianity boosting the performance of a quantum Otto engine

Tuesday, 28 September 2021 09:50 (20 minutes)

It is investigated whether the non-Markovianity, i.e., the memory effects resulting from the coupling of the system to its environment, can be beneficial for the performance of quantum heat engines. Specifically, a version of a single-qubit Otto engine is studied in which the standard thermalization strokes are replaced with so-called extremal thermal operations, which cannot be realized without the memory effects [1]. The performance of such a device is compared with both the Markovian (memoryless) Otto engine and the three-stroke engine studied by Łobejko *et al.* [2], in which the cycle consists of two extremal thermal operations and a single qubit rotation. It is first demonstrated that the non-Markovian Otto engine can generate more work per cycle for a given efficiency than its Markovian counterpart, which, on the other hand, exceeds the performance of the three-stroke engine. Secondly, the ratio of the work fluctuations to the mean work is analyzed. It is shown that both the non-Markovian Otto engine and the three-stroke engine produce less work fluctuations than the Markovian setup (thus providing a more stable operation), whereas their relative performance depends on the target efficiency and work-per-cycle. This leads to the conclusion that the non-Markovian effects can improve the performance of quantum heat engines.

References

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