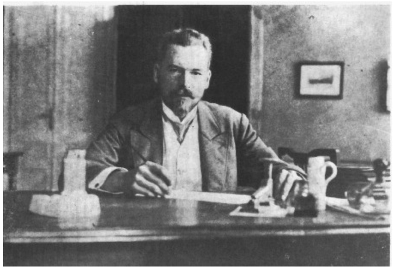

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Optimal Work Protocols in Non-Markovian Baths

Tuesday, 26 September 2023 15:05 (25 minutes)

Optimal protocols have been a subject of intense research in stochastic thermodynamics due to their importance for the understanding of biological processes and the operation of heat engines at the micro- and nanoscale. In this study, we experimentally investigate protocols to transport a Brownian particle over a given distance within a finite time using an optical trap that minimize the work spend on the particle. When performing such optimal protocols in viscous, i.e., Markovian baths, we find that the optimal protocol is characterized by sudden jumps of the trap position at the start and end of the protocol interconnected by a continuous linear motion. Our findings are in quantitative agreement with theoretical predictions. When performing similar experiments in a viscoelastic fluid which exhibits a relaxation time on the order of the protocol duration, pronounced differences are observed. While the still having symmetric jumps at the beginning and end, the corresponding protocol now follows a non-linear *S* shaped curve. Even though a point symmetric trap motion does not guarantee optimality, we find, that the averaged particle trajectories during the optimal work protocols are always point symmetric. Interestingly, this is the case both for Markovian and non-Markovian baths. Our findings do not only provide a deeper understanding of the underlying principles governing optimal protocols, but also give insight into the general characteristics of transport in non-Markovian environments.

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