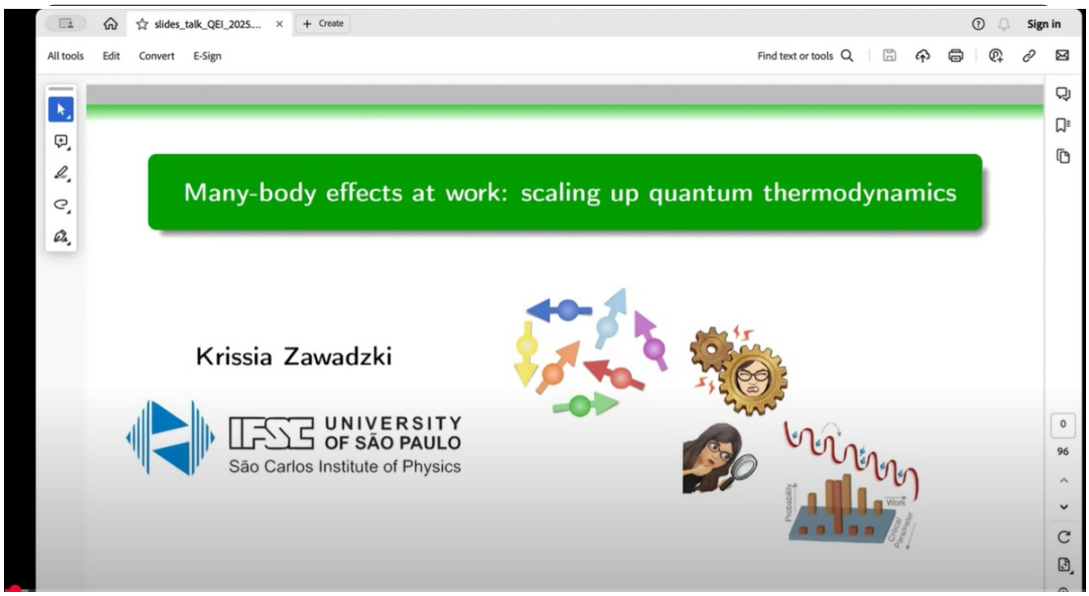

QEI Seminar - Krissia Zawadzki

Quantum Energy Initiative
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In this edition, we had the pleasure to welcome Dr. Krissia Zawadzki, from the University of São Paolo in Brazil. She told us about her work on Many-body effects at work: scaling up quantum thermodynamics.

Abstract: Understanding the role of many-body interactions in out-of-equilibrium thermodynamics can provide valuable insights for designing practical quantum thermal machines. Seminal studies on work fluctuations at quantum criticality have opened the way for an intensive exploration of a variety of models from condensed matter physics, including the paradigmatic Heisenberg and Hubbard Hamiltonians. One of the most exciting outcomes of these studies is the advantage offered by many-body effects, which can enhance work extraction and storage, and in some cases, even suppress unwanted fluctuations—two desirable features for boosting the efficiency of quantum heat engines and batteries. The underlying intuition is that many-body correlations give rise to entanglement, which can thereby serve as a thermodynamic resource. Yet, a direct connection between entanglement quantifiers and the moments of quantum thermodynamical distributions has only begun to be explored. In this talk, I will revisit these developments, with a focus on the role of correlations and finite-time dynamics in shaping the work statistics. I will present strategies to engineer many-body interactions in such a way as to simultaneously control the system's entanglement and the moments of the work distribution. Finally, I will discuss how non-adiabatic dynamics reshape entanglement in out-of-equilibrium states and consequently impact the work output.

The QEI seminar series invites speakers to present their research relating to the interdisciplinary topic of understanding and optimizing the physical resource cost of quantum technologies.

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