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A fresh perspective into quantum thermodynamics

Title of the dissertation	Work and energy fluctuations in open quantum systems
Contents of the dissertation	Due to technological advances over the past few decades, exciting new devices such as quantum heat engines and quantum computers are now within grasp. They hold the promise of operating beyond what is now possible with current technology, offering better energy efficiency and unparalleled computational power. In this dissertation, a new look into the thermodynamics of small quantum devices is provided based on an interpretation of quantum mechanics known as Bohmian Mechanics. It is shown that some conceptual challenges with previous approaches can be overcome, and a new theoretical framework to model these systems is provided. Over the past decade, the field known as Quantum Thermodynamics has flourished with theoretical and experimental work to explain how these machines work and explore their limits. Quantum mechanics and thermodynamics are two pillars of modern physics, upon which our understanding of the world around us is built. A particular consequence of quantum mechanics, as it is described in textbooks, is that the energy of any system is only defined when it is measured. This approach makes it problematic to provide clear and unambiguous answers to questions such as, how much energy is required by a device to perform a particular task. Several authors have come up with different answers, but no clear agreed-upon approach has emerged. Recent results even suggest that such questions might not have an answer. With Bohmian Mechanics this problem is avoided, with the possibility to inspire new experiments, novel numerical techniques to tackle complex simulation problems, and new solutions to outstanding problems in the foundations of quantum mechanics.
Field of the dissertation	Engineering Physics
Doctoral candidate	Rui Ferreira Sampaio, M.Sc. Born in Portugal in 1989
Time of the defence	15.02.2019 at 12 noon
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Opponent	Dr. Guillermo Albareda, Max Planck Institute for the Structure and Dynamics of Matter, and Center for Free-Electron Laser Science, Germany
Custos	Professor Tapio Ala-Nissilä, Aalto University School of Science, Department of Applied Physics
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A doctoral dissertation is a public document and shall be available at Aalto University, School of Science's notice board in Konemiehentie 2, Espoo at the latest 10 days prior to public defense.