

NITheCS MINI-SCHOOL:

## Introduction to Quantum Thermodynamics: An Open Systems Perspective

Dr Graeme Pleasance (Stellenbosch University)

7, 14, 21 & 28 February 2024 | 14h00 – 15h00 SAST

Attend online

--- A certificate of attendance will be awarded to registrants who attend all four lectures ---

### ABSTRACT

In these lectures, I will cover some of the basic principles and applications of quantum thermodynamics, focusing on its nonequilibrium formulation according to the theory of open quantum systems.

I will start by providing a brief review of preliminary concepts, including foundational quantum mechanics and equilibrium descriptions of quantum systems. Then I will discuss the dynamics of open quantum systems within the framework of Markovian master equations, which are relevant to systems weakly coupled to one or more thermal reservoirs. This will lead us into deriving the first and second laws of thermodynamics, relating concepts of work, heat, and entropy. Applications to quantum thermal machines such as heat engines will also be considered. Finally, I will outline extensions of the framework to strongly interacting open systems.

### BIOGRAPHY



Graeme Pleasance is a postdoctoral researcher in the Quantum@SUN group at Stellenbosch University. He graduated with an MSci in Theoretical Physics from the University of Birmingham in the UK in 2013, and received his PhD from the University of Sussex in 2018. From 2018 to 2022, he held a postdoctoral research position in the Quantum Research Group at the University of KwaZulu-Natal. His current research focuses on the development of non-perturbative techniques for treating strongly-coupled open quantum systems, with applications to thermodynamics.

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