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HYBRID EVENT

NITheCS and the Department of Physics at Stellenbosch University jointly present a

COLLOQUIUM:

Universal cooling dynamics toward a quantum critical point

Emma King *(present affiliation: University of Saarland, Saarbrücken, Germany; the work I will present was done at Stellenbosch University)*

Attend in person* or online

***Venue:** Merensky 1011 (Physics Department), Stellenbosch University

Friday, 3 March 2023 | 15h00 – 16h00 SAST

ABSTRACT

Curiosity surrounding concepts such as critical phenomena, scaling laws and universality in out-of-equilibrium settings has inspired vibrant research in the field of nonequilibrium many-body systems. While experimental advances continue to pave the way for probing the dynamics of such systems, we aim to complement these developments by analysing the imprint of equilibrium phase transitions on a system's nonequilibrium dynamics. In this talk we will focus on one aspect of this, in particular the loss of adiabaticity when cooling a many-body quantum system from an initial thermal state toward a quantum critical point. The excitation density, which quantifies the degree of adiabaticity of the dynamics, is found to obey scaling laws governed by the critical exponents of the quantum phase transition (QPT). As an example, we will demonstrate the scaling of the excitation density for a Kitaev quantum wire coupled to Markovian baths, a 'minimal model' that can be solved analytically. Interestingly, we will show that quantum critical properties can be probed dynamically at finite temperature, without even varying the control parameter of the QPT. In closing, we will mention some interesting future research directions.

BIOGRAPHY

Emma King completed her BSc at Stellenbosch University (SU) in 2018. Afterwards she continued with a BSc Honours in Theoretical Physics, with a research focus on atom-cavity systems acting as nodes in quantum networks. In 2020 she started her MSc. During this time, she and her supervisors analysed the dynamics at quantum phase transitions in the Kitaev Chain, with a key component being the investigation of universal scaling behaviour. After completing her degree, Emma moved to Germany to work as a doctoral researcher at the University of Saarland. Her research focuses on understanding how an environment, as well as its coupling to a system, can be engineered to exploit the unavoidable effects of decoherence for performance enhancement.

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