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Quantum work statistics at strong reservoir coupling

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Friday, 9 June 2023 @ 14h00 SAST
Venue: Physics Seminar Room, Stellenbosch University, and online

ABSTRACT
Calculating the stochastic work done on a quantum system while strongly coupled to a reservoir is a formidable task, requiring the calculation of the full eigenspectrum of the combined system and reservoir. In this talk I will show that this issue can be circumvented by using a polaron transformation that maps the system into a new frame where weak-coupling theory can be applied. It is shown that the work probability distribution is invariant under this transformation, allowing one to compute the full counting statistics of work at strong reservoir coupling. Crucially this polaron approach reproduces the Jarzynski fluctuation theorem, thus ensuring consistency with the laws of stochastic thermodynamics. I will apply the formalism to a system driven across the Landau-Zener transition, where clear signatures in the work distribution arising from a non-negligible coupling to the environment are identified. These results provide a new method for studying the stochastic thermodynamics of driven quantum systems beyond Markovian, weak-coupling regimes.

BIOGRAPHY
Ahsan Nazir is the Head of Theoretical Physics and Equality, Diversity, and Inclusion Lead within the Department of Physics and Astronomy at the University of Manchester. His group works on the theory of open quantum systems, quantum thermodynamics, solid-state quantum optics, and quantum electrodynamics, with a focus on the role of correlations, non-Markovianity, and strong coupling phenomena.

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