

S E M I N A R



Dr Anosh Joseph
(University of the Witwatersrand)

Date:

Tuesday, 25 November 2025

Time:

13h15-14h15 SAST

Venues:

- P213, Physics Building, East Campus, WITS
- Online

Who should attend?

All are welcome!

Enquiries:

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When Fields Feel Warm: Estimating Temperature in Quantum Simulations

ABSTRACT:

We introduce a field-configuration-based temperature estimator for lattice gauge theories, constructed from the gradient and Hessian of the Euclidean action. Inspired by geometric formulations of entropy in classical statistical mechanics, this configurational temperature provides a gauge-invariant and non-kinetic probe of thermodynamic consistency in Monte Carlo simulations. We validate the approach in compact $U(1)$ lattice gauge theories in one, two, and four dimensions. We demonstrate quantitative agreement between the configurational and conventional temperatures determined by the lattice temporal extent. While promising to overcome the sign problem in theories with complex actions, the complex Langevin method can yield incorrect results even under apparently stable evolution. Existing diagnostics primarily monitor drift distributions or Langevin-time evolution but do not directly assess whether configurations are sampled with the correct Boltzmann weight. Our configurational temperature offers a complementary, field-theoretic diagnostic of sampling correctness, providing new insight into the reliability of complex Langevin simulations.

Dr Anosh Joseph is a Senior Lecturer in Theoretical Physics at the University of the Witwatersrand.

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