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MINI-COURSE

Many-Body Physics & Second Quantization: A Pedagogical Introduction to Schrödinger Field Theory

Dr Partha Nandi (NITheCS)

Wednesdays 29 April, 6 & 13 May 2026 | 15h00-16h00 SAST

Venues:
NITheCS Seminar Room, Merensky Building, Stellenbosch University and Online

ABSTRACT

This lecture series provides a pedagogical introduction to the formalism of second quantisation and its application to non-relativistic quantum many-body systems through the Schrödinger field theory framework. Beginning with the limitations of the first-quantised description, we motivate the need for a field-theoretic approach and develop the operator formalism in terms of creation and annihilation operators.

Key concepts such as Fock space, particle statistics, and the distinction between bosonic and fermionic fields will be discussed in a clear and intuitive manner. The lectures will also highlight how collective behaviour naturally emerges in many-body systems within this framework.

Designed for Honours and Master's students, this series aims to build a solid conceptual and technical foundation for advanced topics in condensed matter physics, quantum field theory, and quantum statistical mechanics.

BIOGRAPHY

Dr Partha Nandi is a theoretical physicist specialising in the interface between quantum mechanics and gravity. He completed his PhD in 2022 at the S. N. Bose National Centre for Basic Sciences in Kolkata, India, where he developed a strong foundation in quantum field theory, general relativity, and the foundational aspects of quantum theory. He then joined Stellenbosch University as a postdoctoral fellow, where he worked for two years on quantum aspects of gravitational phenomena, and he continues his research as a postdoctoral research associate at NITheCS.

His research focuses on uncovering the quantum nature of spacetime, with particular emphasis on gravitational waves as a potential observational window into quantum gravity. He investigates phenomena such as gravity-induced decoherence, entanglement generation, and the behaviour of quantum systems interacting with dynamical spacetime backgrounds.

His work aims to bridge the gap between abstract formulations of quantum gravity and physically testable scenarios, providing new insights into how quantum coherence and correlations manifest in gravitational settings. In parallel, he is committed to teaching and mentoring, with a strong emphasis on conceptual clarity and rigorous development of formalism.

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