

NITheCS COLLOQUIUM:

Evolution of Quantum Systems Subjected to Noise

Prof Marco Merkli (Memorial University of Newfoundland, Canada)

DATE: Monday, 25 March 2024 | 16h00 – 17h00 SAST

VENUES:

- Neelsie Cinema @ Stellenbosch University
- NITheCS Seminar Room @ University of KwaZulu-Natal – Westville Campus (3rd Floor, H-Block, School of Chemistry and Physics)
- Online

ABSTRACT

The Schrödinger equation describes the evolution of isolated quantum systems. But when subjected to external noises, the dynamical equation of a quantum system becomes entirely different, both from a physical and a mathematical point of view. Such open systems exhibit typically irreversible behaviour in the dynamics. They are found everywhere in nature and are the subject of theoretical and experimental study in Physics, Chemistry, Biology and Mathematics. With rare exceptions, the complexity of the equations of motion prohibits us from finding the exact solution for the dynamics of open systems. One then resorts to plausible simplifying approximations, such as the widely used Born and Markov approximations, which result in a more tractable situation, analytically and numerically. To ensure the accuracy of the approximations with precision is very difficult, however! I will outline some results on the validity of the Born and Markov approximation, based on a mathematically rigorous method, and present applications to concrete models from quantum optics and quantum chemistry.

BIOGRAPHY

Marco Merkli is a faculty member of the Department of Mathematics and Statistics at Memorial University in St. John's, Canada. As a mathematical physicist, his research primarily revolves around elucidating the dynamics of open quantum systems. His expertise lies in developing mathematical tools tailored for analyzing the evolution of systems under external influences. This endeavour aims to establish a robust mathematical framework for the theory of open quantum systems, ensuring the precision of physical predictions and reducing uncertainties in the field. Merkli's mathematical inquiries have also uncovered novel physical phenomena, particularly concerning the impact of quantum correlations (entanglement) on the dynamics of open systems. He endeavours to foster dialogue between the mathematical and physical communities interested in quantum sciences.



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