UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

NITheCS
National Institute for Theoretical and Computational Sciences

INTERNATIONAL YEAR OF Quantum Science and Technology

S E M I N A R

Prof Dawood Kothawala
(Indian Institute of Technology (IIT) Madras, India)

Relics of a Quantum Spacetime

Date:
Monday, 19 May 2025

Time:
12h15-13h15 SAST

***Venues*:**
- NITheCS Seminar Room
  University of KwaZulu-Natal
  Westville Campus
  3rd Floor, H-Block,
  School of Chemistry and Physics
- Online

WHO SHOULD ATTEND?
The seminar should be accessible to advanced undergraduates and will highlight results towards the end that should interest advanced researchers.

ENQUIRIES:
Email Neli Mncube: neli.mncube@nithecs.ac.za

ABSTRACT:

The unification of three-dimensional space with time into a single, four-dimensional continuum – spacetime – is one of the deepest ideas in our efforts to understand natural phenomenon in our universe. It is more than a century since Einstein used this powerful notion of a spacetime continuum to describe that most ubiquitous interaction in the universe – *gravity*. Einstein's description involves interpreting gravity not as a force *a la* Newton, but rather as a manifestation of undulations and distortions – the so-called *curvature* – of the spacetime continuum.

Spacetime curvature, however, is sourced by the presence of matter, and the material world which we routinely encounter in our daily lives and laboratories is governed by the laws of quantum mechanics. This leads us to ask: *Does spacetime have quantum mechanical properties?* If the answer is "yes", it raises the next question: *How does one make measurements in a quantum spacetime?*

In this talk, I will present a broad overview of our efforts to incorporate certain generic implications of curved spacetime on quantum measurements. This requires an inherently non-local description of spacetime, beyond the usual one given by Einstein. A deeper look reveals a subtle interplay between non-locality and quantum effects, which can leave relics even at observational scales. The concluding part of the talk will describe some such relics – the *Cheshire* grin of a fundamentally non-local quantum spacetime.

***Prof Dawood Kothawala** is a professor in the Department of Physics at the Indian Institute of Technology Madras in India.*

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