NITheCS
National Institute for
Theoretical and Computational Sciences

NITheCS Colloquium

Monday, 29 August 2022, 16h00 – 17h00 SAST

Prof Jeff Murugan (University of Cape Town)

'The Mathematical Physics of Quantum Batteries'

ABSTRACT

Classical batteries are predicated on the principles of classical thermodynamics and electrochemistry that were established in the 18th century already. Even contemporary state-of-the-art energy storage technology – impressive as it is – is a refinement of these ideas.

Quantum batteries on the other hand are a novel class of energy storage technology, built on the emerging science of quantum thermodynamics. In particular, a number of recent works have demonstrated that under certain circumstances, such systems exhibit a decided advantage over classical batteries in terms of charging power and stable energy retention. Key to these properties are (i) quantum entanglement and (ii) collective behaviour in quantum many-body systems.

In this colloquium, I will give a brief introduction to the mathematics and physics principles underlying many-body quantum batteries.

BIOGRAPHY

Jeff Murugan is a Professor of Mathematical Physics at the University of Cape Town (UCT).

After completing his undergraduate studies and an MSc in Mathematical Physics at UCT, he was awarded a Lindbury Fellowship to pursue a PhD jointly at UCT and Worchester College, Oxford University, where he worked on Noncommutative Geometry in String Theory.

Prof Murugan was a postdoctoral fellow in Brown University's High Energy Theory group, a member of the School of Natural Sciences of the Institute for Advanced Study in Princeton, a Research Associate in the Division of Physical Sciences at the American Museum of Natural History in New York, and a newly appointed Simons Associate at the International Center for Theoretical Physics in Trieste.

A String Theorist by training, his work currently lies at the nexus of quantum information and quantum matter. He is one of the co-discoverers of the 3-dimensional web of dualities and, together with Douglas Stanford and Edward Witten, is in the MSW class of disordered conformal field theories.

He is also the recipient of UCT's Distinguished Teacher Award for 2018.

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