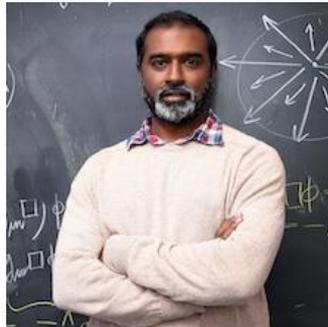


NITheP Colloquium

Monday, 21 September 2020, 16h00

Prof Jeff Murugan
University of Cape Town



Scrambling in Quantum Networks

Abstract: Many-body problems have seen a remarkable resurgence in recent years. In part, this is because of the increasing overlap between high energy particle physics and theoretical condensed matter. The discovery of the SYK model and the avalanche of work that followed is a testament to this state of affairs. Network theory (or graph theory) offers a powerful toolkit to study some of these systems. Among these, quantum small-worlds are quantum many-body systems that interpolate between completely ordered (nearest-neighbour, next-to-nearest-neighbour etc.) and completely random interactions. As such, they furnish a novel new laboratory to study quantum systems transitioning between regular and chaotic behaviour. In this talk, I will introduce these ideas and illustrate them in the context of the Heisenberg and Ising models, showing how to inject a small number of long-range interactions into the spin chain and study its ability to scramble quantum information using two primary devices: the out-of-time-order correlator (OTOC) and the spectral form factor (SFF). As an interesting, and perhaps timely, aside I will describe how these ideas relate to models of viral spreading in real-world systems.

Bio: Professor Jeff Murugan is a mathematical physicist and Deputy Dean of the Faculty of Science at the University of Cape Town. 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 Worcester 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 new

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