TATA-INFOSYS LECTURE SERIES:

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Lecture 1 Mon, 22 Jun, 11:00 – 1:00, (A 304)

Lecture 2 Tue, 23 Jun, 11:00am – 1:00pm, (A 304)

Lecture 3 Thu, 25 Jun, 11:00am – 1:00pm, (A 304)

Quantum complexity of time evolution

Abstract: I will describe new ideas for quantifying the complexity of quantum time evolution. One approach treats physical change of the wavefunction as a computation, and bounds the smallest quantum circuit that computes the required transformation. A second approach quantifies how ergodically and rapidly a quantum state explores the accessible part of the Hilbert space. A third approach characterizes how small changes to the initial state, or small perturbations to the Hamiltonian, are amplified in the state at late times. To illustrate these measures, I will show how they separate integrable and chaotic quantum systems in examples including particles on group manifolds, spin chains, quantum billiards, and Random Matrix Theory. I will then describe an application to a conjecture that geometrizes complexity in quantum gravity. Finally, I will discuss a way of thinking about Effective Field Theory as a low complexity (as opposed to a low energy) description of physics, and explain why such descriptions necessarily break down at times exponential in the entropy of a system.

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