

## NITheCS Webinar

Friday, 24 June & 1 July 2022, 14h00 – 15h00 SAST

Pratik Nandy (Centre for High Energy Physics, Indian Institute of Science (IISc), Bangalore, India)

### 'Recent progress on Krylov complexity'



#### ABSTRACT

While the meaning of classical chaos is fairly understandable, the definition of quantum chaos is still elusive. Several direct and indirect measures have been proposed to diagnose quantum chaos, for example, the level statistics and the out-of-time-ordered correlator (OTOC).

In the first lecture, I will introduce a new diagnostic of quantum chaos, known as Krylov complexity. The fundamental principle is to capture the operator growth by applying the recursive Lanczos algorithm. I will discuss the universal operator growth hypothesis and the associated complexity in detail with an application to well-known spin-chain models.

In the second lecture, I will discuss how to generalise it in the state picture, which provides a well-defined notion of state complexity. Although the formulation applies generally, we can extract useful information using the symmetry of the corresponding Hamiltonian. Here, I will also give a few simple toy models as well as realistic situations with experimental relevance and outline some future prospects.

#### BIOGRAPHY

Pratik Nandy is finishing his PhD at the Centre for High Energy Physics, Indian Institute of Science (IISc), Bangalore. He will be joining the Extreme Universe (ExU) collaboration at Yukawa Institute for Theoretical Physics (YITP), Kyoto University as a postdoctoral fellow in September 2022.

He is interested in quantum field theory, quantum many-body systems and holography. Specifically, he is working on the applications of various quantum-information-theoretic tools, namely complexity and entanglement in these fields.

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