Quantum Dynamics and Chaos: Modern Perspectives

Venue: Ashoka University, AC04-LR-004

1st Day: 9th of March, 2024 (Saturday)

Schedule

Time	Speaker	Talk Title
9:00 am - 9:45 am	Anatoly Dymarsky (online)	Krylov complexity in quantum chaotic systems
10:00 am - 11:00 am	Arpan Bhattacharyya	Some explorations into Krylov Complexity (Overview/perspective talk)
11:00 am - 11:30 am	*Discussion/Break*	
11:30 am - 12:15 pm	Diptarka Das	Dynamical phases in non-equilibrium Conformal Field Theories.
12:30 pm - 2:00 pm	*Lunch*	
2:00 pm - 2:45 pm	Aranya Bhattacharya (online)	Spread complexity of states under projective measurements and Zeno effect
3:00 pm - 3:30 pm	Ankit Gill	Spread Complexity and Two point Measurements
3:45 pm - 4:15 pm	*Tea Break*	
4:15 pm - 4:45 pm	Ankit Shrestha	Spread Complexity for Floquet dynamics
5:00 pm - 5:45 pm	Vaibhav Madhok	Quantum chaos and Krylov complexity through quantum state reconstruction
6:00 pm onwards	*Discussion*	

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2nd Day: 10th of March, 2024 (Sunday)

Schedule

Time	Speaker	Talk Title
9:30 am - 10:30 am	Somendra Bhattacharjee	The nature of Dynamical Quantum Phase Transitions (Overview/perspective talk)
10:30 am - 11:00 am	*Discussion/Break*	
11:00 am - 11:45 am	Sachin Jain	Thermalization in Open Quantum Systems
12:00 pm - 12:30 pm	Shakil Khan	
12:30 pm - 2:00 pm	*Lunch*	
2:00 pm - 2:45 pm	Sumilan Banerjee	Information scrambling in spin glasses
3:00 pm - 3:45 pm	Arnab Kundu	Quantum Aspects of Black Holes from Brickwalls
3:45 pm - 4:15 pm	*Tea Break*	
4:15 pm - 5:00 pm	Sthitadhi Roy	Entanglement dynamics and eigenstate correlations in disordered quantum systems
5:00 pm - 6:00 pm	*Discussion*	
6:00 pm - 7:00 pm	*Cultural Event (Venue: AC-04-304)*	
7:30 pm onwards	*Workshop Dinner*	

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3rd Day: 11th of March, 2024 (Monday)

Schedule		
Time	**Speaker**	**Talk Title**
9:30 am - 10:15 am	Arul Lakshminarayan	Dual Unitary Circuits as Models of Many-Body Quantum Chaos
10:30 am - 11:15 am	Soumi Ghosh	Eigenvector correlation across localisation transition in non-Hermitian systems
11:30 am - 12:15 pm	Shiroman Prakash	Magic State Distillation: An overview and some new results
12:30 pm - 2:00 pm	*Lunch*	
2:00 pm - 2:45 pm	Subroto Mukerjee	Chaos and PT symmetry breaking in a non-Hermitian driven system
3:00 pm - 3:45 pm	Adolfo del Campo (online)	Shortcuts to Adiabaticity in Krylov Space
3:45 pm - 4:15 pm	*Tea Break*	
4:15 pm - 4:45 pm	Sounak Pal	OTOC to SFF in 2d Quantum gravity
5:00 pm - 5:30 pm	Suman Das	What is the simplest linear ramp?
5:30 pm onwards	*Discussion*	

Talk Abstracts

Speaker: Anatoly Dymarsky
Title: *Krylov complexity in quantum chaotic systems*
Abstract: I will review recent progress understanding typical features of Krylov complexity, and the underlying Lanczos coefficients, in quantum chaotic systems. This includes temperature dependence, cutoff dependence in lattice systems, chaoticity vs integrability, and use of Krylov method as a probe of quantum chaos.

Speaker: Adolfo del Campo
Title: *Shortcuts to Adiabaticity in Krylov Space*
Abstract: Shortcuts to adiabaticity provide fast protocols for quantum state preparation in which the use of auxiliary counterdiabatic controls circumvents the requirement of slow driving in adiabatic strategies. While their development is well established in simple systems, their engineering and implementation are challenging in many-body quantum systems with many degrees of freedom. We show that the equation for the counterdiabatic term, equivalently the adiabatic gauge potential, is solved by introducing a Krylov basis. The Krylov basis spans the minimal operator subspace in which the dynamics unfolds and provides an efficient way to construct the counterdiabatic term. We apply our strategy to paradigmatic single- and many-particle models. The properties of the counterdiabatic term are reflected in the Lanczos coefficients obtained in the course of the construction of the Krylov basis by an algorithmic method. We examine how the expansion in the Krylov basis incorporates many-body interactions in the counterdiabatic term.

Speaker: Aranya Bhattacharya
Title: *Spread complexity of states under projective measurements and Zeno effect*
Abstract: Spread complexity measures the spread of a state in the Krylov basis under Schrodinger evolution. I will discuss the behaviour of spread complexity if projective measurements are made on a simple system. In such a case, the effective evolution of the system can be represented by a non-hermitian Hamiltonian. The non-hermitian part is controlled by the time interval (\tau) between two consecutive measurements. We study the behaviour of spread complexity for various choices of \tau and initial state. When the frequency of measurements is increased, we observe that it takes longer and longer for the state to start spreading. This is the famously known quantum Zeno effect. Finally, I will discuss a similar non-hermitian model in which we can also capture the parity-time (PT) symmetry breaking by looking at the behaviour of the spread complexity. These works extend the notion of spread complexity for non-hermitian Hamiltonian evolution and quantum channels.

Speaker: Arul Lakshminarayan
Title: *Dual Unitary Circuits as Models of Many-Body Quantum Chaos*
Abstract: Dual-unitary circuits are being studied as models of many-body quantum systems that can span a range of dynamical features. We discuss how a quantum ergodic hierarchy can be identified in such systems wherein the peak is occupied by quantum Bernoulli like systems constructed of perfect tensors. The talk will also discuss algorithms to construct dual-unitary and multi-unitary or perfect tensors.

Speaker: Shiroman Prakash
Title: *Magic State Distillation: An overview and some new results*
Abstract: We will discuss an approach to fault-tolerant quantum computing introduced by Bravyii and Kitaev called Magic State Distillation. Since the audience may not have much background in this subject, most of the talk will be a review/introduction, but I will present some new results regarding low overhead routines if time permits. We may also discuss how the formalism of magic state distillation naturally leads to the identification of a quantum resource known as "magic" that can be viewed an abstract generalization of entanglement, and ask if it plays a role in the dynamics of quantum many body systems.