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TATA INSTITUTE OF FUNDAMENTAL RESEARCH

ICTS Postdoc Seminar

Title : Spatio-temporal chaos in classical open and closed systems: an OTOC approach

Speaker : Amit Kumar Chatterjee (ICTS-TIFR, Bangalore)

Date : Monday, 19th October 2020

Time : 05:30 pm (IST)

Abstract : Out-of-time-ordered correlator (OTOC) has been extensively used as a major tool for exploring quantum chaos. We incorporate a recently proposed classical analogue of OTOC to analyze spatio-temporal chaos both in open and closed classical many-body systems. Specifically, as models, we consider (i) a driven dissipative chain of coupled Duffing oscillators [1] and (ii) a discrete nonlinear Schrödinger chain (DNLS), respectively as open and closed systems. For Duffing chain, the OTOC space-time heat-maps clearly exhibits the existence of three different dynamical regimes, namely sustained chaos, transient chaos and non-chaotic regimes. With variation of drive, dissipation and coupling, the Duffing chain shows interesting transitions between sustained chaos and non-chaotic regimes along with intermittent transient chaos regimes. Moreover, one can extract entities like finite time Lyapunov exponent, instantaneous speed and velocity dependent Lyapunov exponent, directly from the OTOC for further characterization of the spatial and temporal features of these dynamical regimes. In the context of DNLS, having an intriguing non-separable Hamiltonian structure, we study thermalization in both microcanonical and grand-canonical ensembles. The equivalence of ensembles is established through the computation of virial theorem in both the ensembles. The OTOC, Lyapunov exponents and instantaneous speeds are investigated in both the ensembles to characterize the underlying spatio-temporal chaotic structure.

[1] Amit K. Chatterjee, Anupam Kundu, Manas Kulkarni [Physical Review E, 2020, in press]

Venue : Online Seminar

Please click on the below link to join the zoom meeting

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