ICTS Seminar

Title : Out of time ordered effective dynamics of a quartic oscillator

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Date : Friday, August 2, 2019

Time : 3:00 PM

Venue : Amal Raychaudhuri Meeting Room, ICTS Campus, Bangalore

Abstract : We study the dynamics of a quantum Brownian particle coupled to a thermal bath. For concreteness, we consider a specific model where the bath has two sets of harmonic oscillators. These oscillators couple to the particle via a cubic interaction involving the particle and two bath oscillators, one from each set. Integrating out the bath's degrees of freedom, we get an influence phase for the particle. Focussing on the quartic terms in this influence phase, we develop an effective theory framework which correctly reproduces the particle's 4-point functions. We show a duality between this quantum effective theory of the particle and a classical stochastic dynamics described by a nonlinear Langevin equation. Building on some previous works, we argue that this quantum effective theory, or the equivalent Langevin dynamics, is insufficient to determine the Out of Time Ordered Correlators (OTOCs) of the particle. To compute these OTOCs, we extend the effective theory paradigm and determine the additional couplings needed for this extension. We show how these effective couplings are related to the correlators of the bath. We explore the constraints imposed on the particle's dynamics by microscopic reversibility and thermality of the bath. We show that these constraints lead to a generalisation of fluctuation-dissipation relations between the effective couplings of the particle.