

ICTS PhD Synopsis Seminar

Title : Transport and correlations in one-dimensional interacting particle systems

Speaker : Avijit Das, ICTS-TIFR, Bangalore

Date : Friday, April 16, 2021

Time : 10:00 AM

Abstract : Hamiltonian systems can be broadly classified as integrable and non integrable. An integrable Hamiltonian system is characterised by having sufficiently large number of independent constants of motion, whereas a non-integrable or chaotic system possesses only a handful number of, in most cases just one or two, conserved quantities. One probe of transport properties is through equilibrium correlation functions of conserved quantities — the difference observed here typically is ballistic scaling for integrable systems and diffusive scaling for non-integrable ones. Recently much progress in our understanding of transport in one-dimensional systems using the theory of non-linear fluctuating hydrodynamics (for non-integrable, mostly classical) and generalised hydrodynamics (for integrable, both classical and quantum systems). A different probe that has recently been used to characterise chaos in many-body quantum systems is the so-called OTOC. This quantifies the propagation of chaos and attempts are currently being made to relate this to transport. We consider a specific paradigmatic example of a non-integrable one-dimensional system, namely the classical Heisenberg spin chain. (a) Some predictions of nonlinear fluctuating hydrodynamics on anomalous scaling of correlation functions at low temperatures are tested via simulations. (b) A classical analogue of the OTOC is studied to understand chaos propagation in this system and its possible relation to transport. Then we consider an integrable version of the classical Heisenberg spin chain and ask whether recent observations of anomalous transport properties in quantum integrable spin chains are also seen in the classical system. In the end, we take the quantum harmonic chain and study the effective dynamics of a tagged particle and emergence of quantum Brownian motion — one main interest is to understand precisely the Ohmic and Drude limits and the detailed form of the mean square displacement and velocity autocorrelation function.

Venue : Online seminar

Zoom link:

<https://zoom.us/j/99737447219?pwd=S0JodGNTY085dnF4R0dDYkIxVmt3QT09>

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