CMP Seminar
Michigan State University

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Quantum information scrambling and out-of-time-order correlators in finite open systems

Quantum information scrambling and chaotic behaviour in quantum systems are characterised by four-point out-of-time-order correlators (OTOCs) of the form <A(t)B(0)C(t)D(0)>, where A, B, C and D are local Hermitian operators. Such quantities are also expected to distinguish between many-body-localised and many-body-delocalised phases of disordered interacting systems. This talk is devoted to OTOCs in an open quantum system weakly coupled to a dissipative environment. Such an open system may serve as a model of, e.g., a small region (``localisation cell'') in a disordered interacting medium coupled to the rest of this medium considered as an environment. I will demonstrate that for a system with discrete energy levels the OTOC saturates exponentially to a constant value at large times t, in contrast with quantum-chaotic systems which exhibit exponential growth of OTOCs. Focussing on the case of a two-level system, we calculate microscopically the characteristic times of the saturation and the value of the saturation constant. Because some OTOCs are immune to dephasing processes and some are not, such correlators may decay on two sets of parametrically different time scales related to inelastic transitions between the system levels and to pure dephasing processes, respectively. In the case of a classical environment, the evolution of OTOCs can be mapped onto the evolution of the density matrix of two systems coupled to the same dissipative environment, which allows for explicit experimental measurements of OTOCs.

Monday, September 11, 2017
4:10 p.m.
BPS 1400
Prof. Mohammad Maghrebi - Host