Department of Theoretical Physics

THE QUANTUM SPACETIME SEMINAR SERIES

Entanglement dynamics from universal low-lying modes

Shreya Vardhan

(Stanford University)

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Zoom link shall be shared separately

Information-theoretic quantities such as Renyi entropies show a remarkable universality in their late-time behaviour across a variety of chaotic quantum many-body systems. Understanding how such common features emerge from very different microscopic dynamics remains an important challenge. In this talk, I will address this question in a class of Brownian models with random time-dependent Hamiltonians and a variety of different microscopic couplings. In any such model, the Lorentzian time-evolution of the n-th Renyi entropy can be mapped to evolution by a Euclidean Hamiltonian on 2n copies of the system. I will provide evidence that in systems with no symmetries, the low-energy excitations of the Euclidean Hamiltonian are universally given by a gapped quasiparticle-like band. These excitations give rise to the membrane picture of entanglement growth, with the membrane tension determined by their dispersion relation. I will establish this structure in a variety of cases using analytical perturbative methods and numerical variational techniques. I will also discuss qualitative differences in the behaviour of the second and third Renyi entropies. Overall, this structure provides an understanding of entanglement dynamics in terms of a universal set of gapped low-lying modes, which may also apply to systems with time-independent Hamiltonians.