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Entanglement Renormalization and Two Dimensional String Theory

Monday, 27 June 2016 10:00 (1 hour)

Recently, new tools coming from quantum information theory have been used to understand the way space-time could emerge from underlying microscopic building blocks. These tools allow to systematically analyze the structure of the quantum correlations in the quantum states of quantum many body systems in condensed matter and quantum field theories. Remarkably, it has been hypothesized that they could provide relevant insights into the physics of black holes, horizons and emergent spacetimes.
In this talk, I will first briefly review on one of these tools known as Entanglement Renormalization Tensor Networks, in both its discrete and continuous versions. Then I will present some recent results in which the entanglement renormalization flow of a (1+1) free boson is formulated as a path integral over some auxiliary scalar fields. It will be shown how the resulting effective theory for these fields amounts to the dilaton term of non-critical string theory in two spacetime dimensions. A connection between the scalar fields in these two theories will be provided. The results might help to understand how spacetimes may emerge from distributions of quantum states, or more concretely, from the structure of the quantum entanglement concomitant to those distributions, allowing to acquire novel insights into how a theory of gravity emerges from the entanglement structure of another one without gravity.
I will conclude mentioning a list of relevant challenges in the field.

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