清华大学高等研究院

Institute for Advanced Study, Tsinghua University

物理学术报告
Physics Seminars (biweekly)

Title: **Quantum Entanglement, the Architecture of Space-time and Tensor Networks**

Speaker: **Bartek Czech**

(Stanford Institute for Theoretical Physics)

Time: **4:00pm, Wednesday, Dec 9, 2015**

(3:30~4:00pm, Tea, Coffee, and Cookie)

Venue: **Conference Hall 322, Science Building, Tsinghua University**

Abstract

The holographic duality (AdS/CFT correspondence) reformulates a conformal field theory (CFT) in terms of an emergent gravitational space-time (AdS) with an extra spatial dimension. Recent advances occasioned a fascinating but still unproven conjecture about the fabric of the AdS space-time: that it is made up of and held together by quantum entanglement in the CFT. I will discuss how in the AdS3/CFT2 context this rough statement becomes a precise, quantitative dictionary, with consequences ranging from quantum gravity to new findings in many-body physics. A key trick is to view the AdS3 space-time as a network of geodesics (straight lines). We will discover that each geodesic is a basic carrier of quantum correlations (conditional mutual information) in the CFT. In fact, weaving a space-time from interlocking geodesics is a familiar operation in many-body physics: it is equivalent to drawing a Multi-scale Entanglement Renormalization Ansatz (MERA) tensor network for the wave-function of the CFT state. I will explain how this insight allows us to effortlessly extract the thermal density operator from a MERA representation of the ground state wave-function. The talk will end with a discussion of the many future prospects of relating the architecture of space-time to quantum entanglement.