

Holography: Entangled, Applied, and Generalized

Monday 26 October 2015 - Friday 30 October 2015

Scientific Programme

Alejandra Castro (University of Amsterdam)

3D Quantum Gravity: A Survey on Non-Perturbative and Non-Local Effects

Three dimensional gravity has the potential to be the simplest model of quantum gravity. In particular it has shown to provide novel insight to the fundamental mechanics behind holography. In these lectures I'll overview recent progress on non-perturbative aspects of these theories with particular emphasis on black holes and its associated thermodynamics. The lectures will cover as well the relation between Chern-Simons theory and 3D gravity, which provides an interesting arena to explore locality--and the lack of it. To the extent that entanglement is an important clue to understanding holography, the last portion of the lectures will focus on how to formulate entanglement entropy for these theories and some interesting applications of these new developments.

Jelle Hartong (Université Libre de Bruxelles)

Newton-Cartan Geometry in Holography and Condensed Matter Theory

Newton-Cartan Geometry in Holography and Condensed Matter Theory There are many areas of physics, notably non-AdS holography and condensed matter physics, but also for example Horava-Lifshitz gravity, where the theories of interest are non-relativistic in the sense of a non-relativistic light cone structure. These theories do not live on Minkowski space-time or any of its curved pseudo-Riemannian analogues but on something called Newton-Cartan space-time. In these lectures I will introduce the geometrical foundation of Newton-Cartan space-times and discuss the coupling of field theories and fluids to such backgrounds focusing on global symmetry properties. In the second part we will see that the dynamics of Newton-Cartan space-times leads to Horava-Lifshitz gravity. Finally, I will discuss the appearance of non-relativistic geometries in some examples of non-AdS holography.

Tadashi Takayanagi (Kyoto University & IPMU)

Entanglement Entropy and Holography

In the first part of this lecture, I will explain the properties of entanglement entropy and show how to compute it in quantum field theories. Later I will move on to calculations of entanglement entropy in AdS/CFT and will eventually introduce a recent interpretation of gravitational spacetimes in terms of quantum entanglement.