LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

ARNOLD SOMMERFELD CENTER FOR THEORETICAL PHYSICS

Sommerfeld Theory Colloquium

Prof. Erik Verlinde

Amsterdam University

From Emergent Gravity to Dark Energy and Dark Matter

The observed deviations from the laws of gravity of Newton and Einstein in galaxies and clusters can logically speaking be either due to the presence of unseen dark matter particles or due to a change in the way gravity works in these situations. Until recently there was little reason to doubt that general relativity correctly describes gravity in all circumstances. In the past few year insights from black hole physics and string theory have lead to a new theoretical framework in which the gravitational laws are derived from the quantum entanglement of the microscopic information that is underlying space-time. An essential ingredient in the derivation is of the Einstein equations is that the vacuum entanglement obeys an area law, a condition that is known to hold in Anti-de Sitter space due to the work of Ryu and Takayanagi. We will argue that in de Sitter space due to the positive dark energy, that the microscopic entanglement entropy also contains also a volume law contribution in addition to the area law. This volume law contribution is related to the thermal properties of de SItter space and leads to a total entropy that precisely matches the Bekenstein-Hawking formula for the cosmological horizon. We study the effect of this extra contribution on the emergent laws of gravity, and argue that it leads to a modification compared to Einstein gravity. We provide evidence for the fact this modification explains the observed phenomena in galaxies and clusters currently attributed to dark matter.

Wednesday, 7 June 2017, 16:15h, Room A348/349, Theresienstr. 37/III

Prof. Dieter Lüst