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String Theory in Greater Paris

Rencontres Théoriciennes

“Supergravité, théorie des cordes et théorie M”

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From Emergent Gravity to Dark Energy and Dark Matter

There are indications that Einstein gravity can be derived from a microscopic description of emergent spacetime in terms of entangled quantum information. An essential ingredient in the derivation is that the entanglement entropy obeys an area law, which in Anti-de-Sitter space is known to hold due to the work of Ryu and Takayanagi. We will argue that in de Sitter space due to the presence of the positive dark energy and the cosmological horizon, 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 contains the entropy associated with the horizon. We study how this contribution would affect the derivation of the emergent laws of gravity. We provide evidence for the fact that it leads to a modification compared to Einstein gravity that explains the phenomena in galaxies and clusters currently attributed to dark matter.

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