



Constructing Space out of Quantum Entanglement

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Gravity

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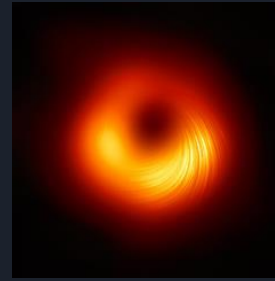
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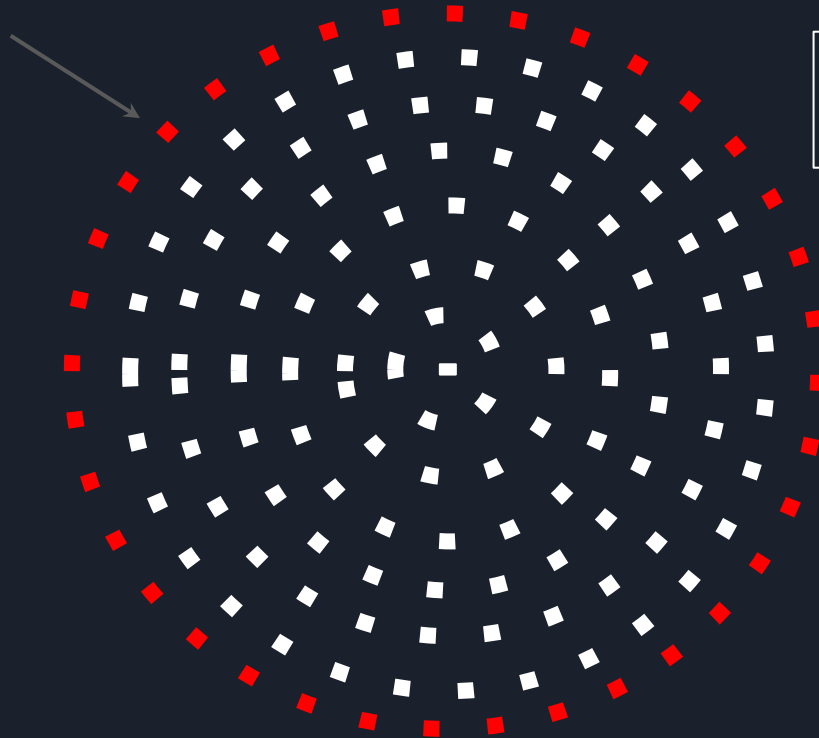
Quantum Mechanics

What we know

Holographic principle



Region



“Surface degrees of freedom contains all the information about the bulk”

■ Information

Information ~~∝~~ Volume

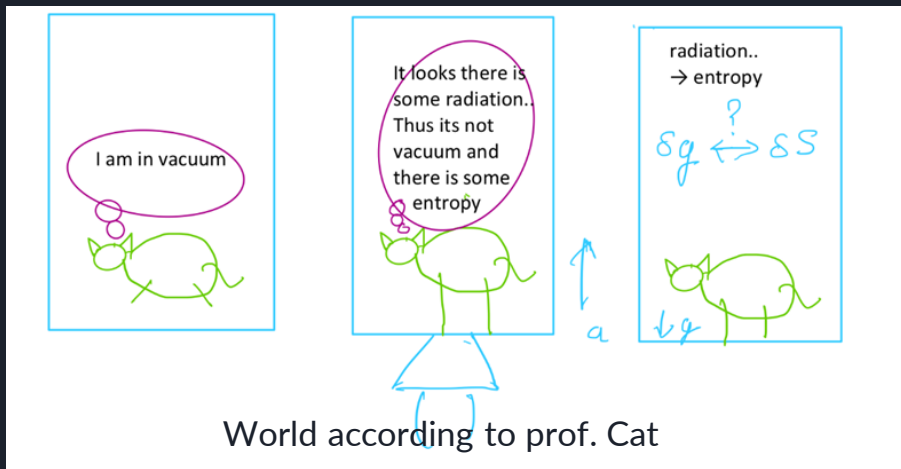


Information ~~∝~~ Area



$$\text{i.e., Entropy, } S \leq \frac{\text{Area}}{4}$$

Gravity as an emergent phenomenon



Finite DOF $\leftrightarrow$ Finite Hilbert space

In quantum mechanics entropy arises from entanglement, i.e. entanglement entropy

Assume: That space emerges from quantum mechanics thus depend on entanglement entropy

- Entanglement changes entropy
- Perturbation In entropy $\rightarrow$ Perturbation in boundary area $\rightarrow$ Perturbation in geometry $\rightarrow$ curvature in space $\rightarrow$ gravity

My work: Expanding the theory to expanding universe



Some quality content to enjoy, read, and study

PBS Spacetime recent videos:

What If Gravity is NOT A Fundamental Force? | Entropic Gravity

Does Space Emerge From A Holographic Boundary?

The Black Hole War- Lenny (Pop science)

Papers to read:

The holographic principle - Raphael Bousso 2002

Space from Hilbert space: Recovering geometry from bulk entanglement - ChunJun Cao, Sean M Carroll, Spyridon Michalakis 2017

Holographic phenomenology via overlapping degrees of freedom - Oliver Friedrich, et al. 2024



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