The next step in Hollography: de Sitter

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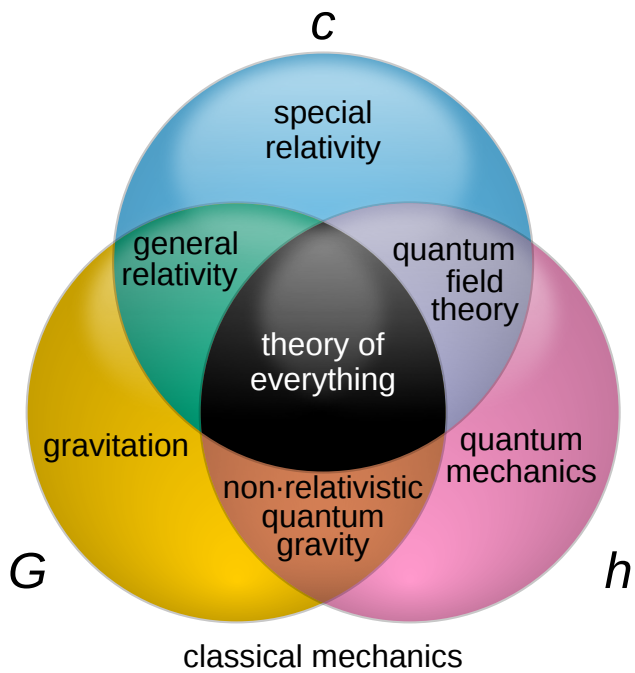
Gravity is still far from totally understood

- Nature works under QM



(CMG Lee, Wikipedia Illustrator)

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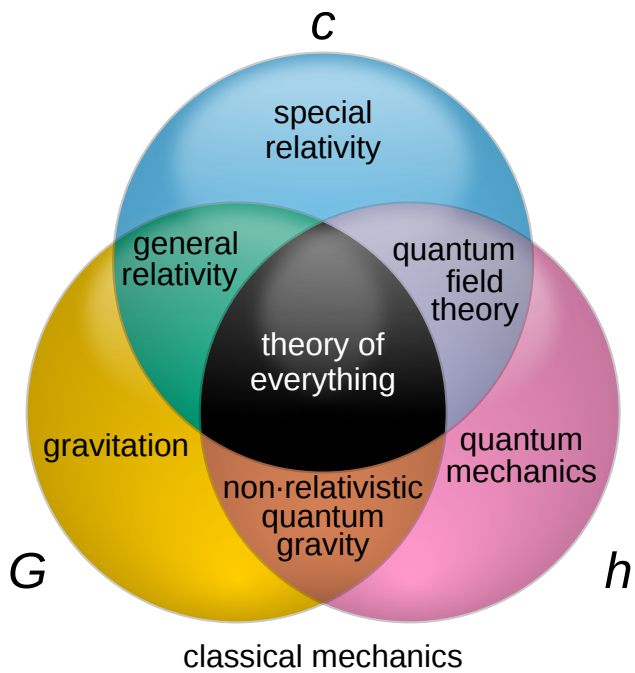

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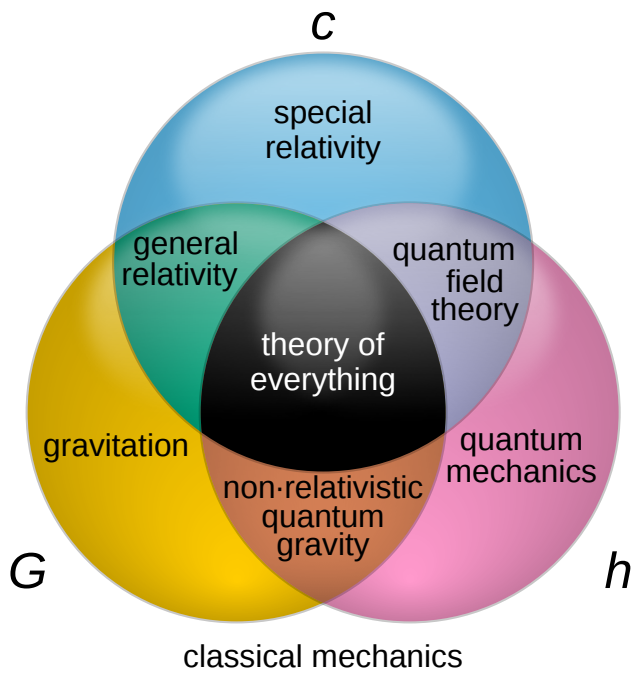
Gravity is still far from totally understood

- Nature works under QM
- GR explains gravity
- Theory of everything?
- BHs as our laboratory



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Semiclassical aproaches unveiled quantum properties of Gravity

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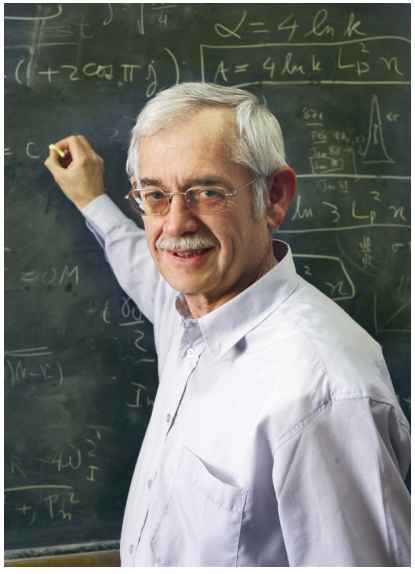

Jacob Bekenstein

$$S_{BH} \propto \frac{k_B}{l_P^2} A$$

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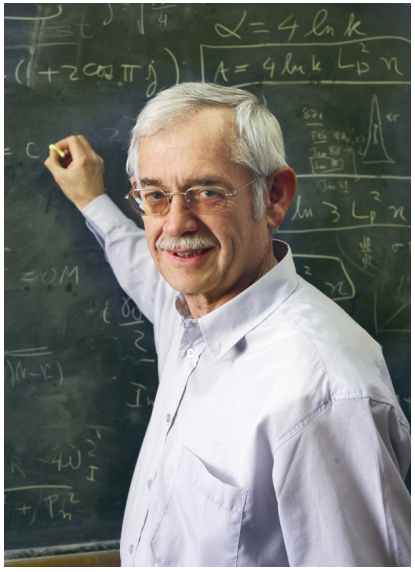

Jacob Bekenstein

$$T_{BH} = \frac{\hbar c^3}{8\pi k_B G M}$$

$$S_{BH} \propto \frac{k_B}{l_P^2} A$$

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Semiclassical aproaches unveiled quantum properties of gravity

John Wheeler

No-Hair Theorem

BHs can be completely characterized by only their mass, charge and angular momentum.

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- What are the microstates of this system?

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No-Hair Theorem

BHs can be completely characterized by only their mass, charge and angular momentum.

Then:

- What are the microstates of this system?
- Why is $S_{BH} \propto A$?

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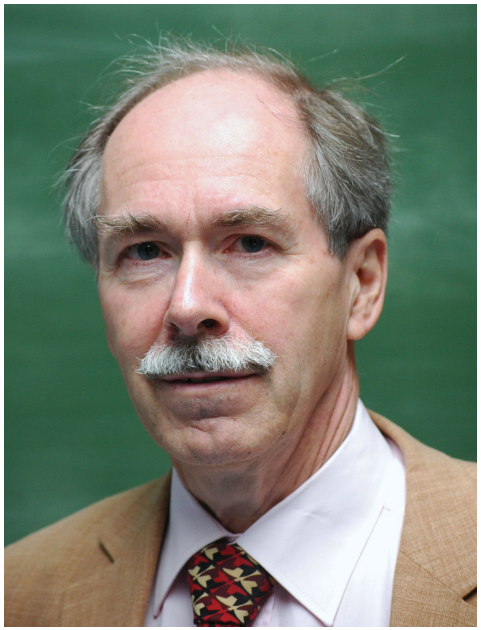
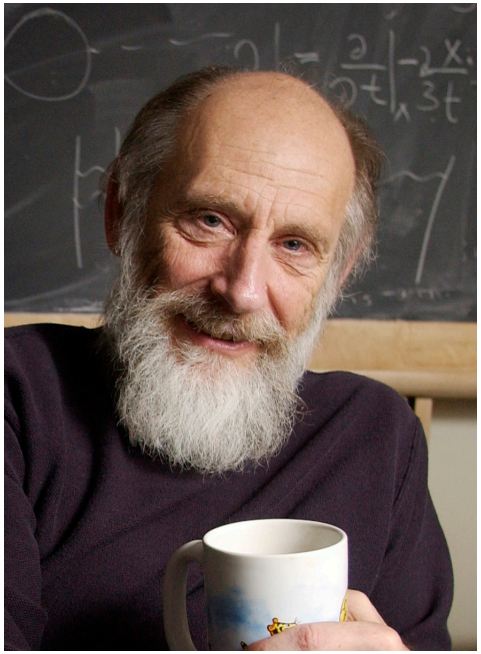
Quantum gravity is conjectured to be holographic



Gerard t'Hooft



Leonard Susskind

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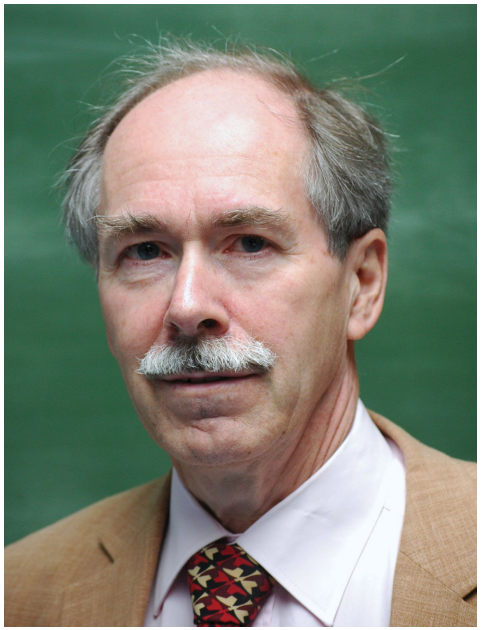

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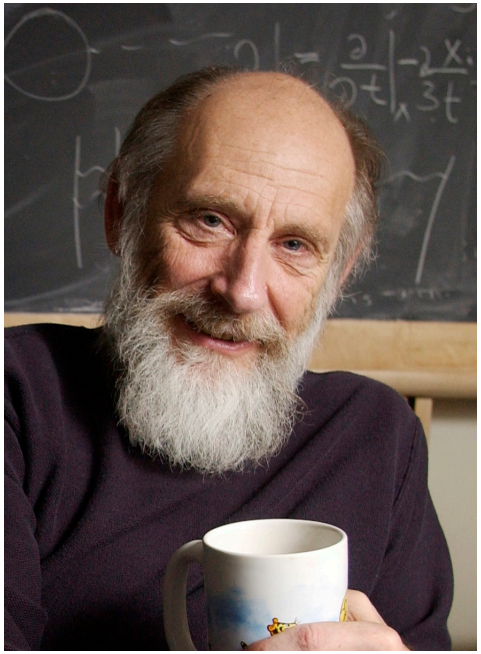

Leonard Susskind

Holographic Principle

Any (d+1)-dimensional gravitational theory must have a description in terms of a d-dimensional QFT without gravity.

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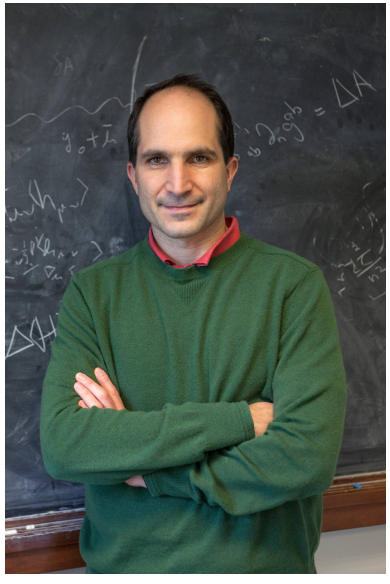
AdS/CFT is the first and only realization of this principle



Juan Maldacena

AdS/CFT correspondence

AdS spacetimes can be described in terms of a CFT that lives on the boundary and vice versa

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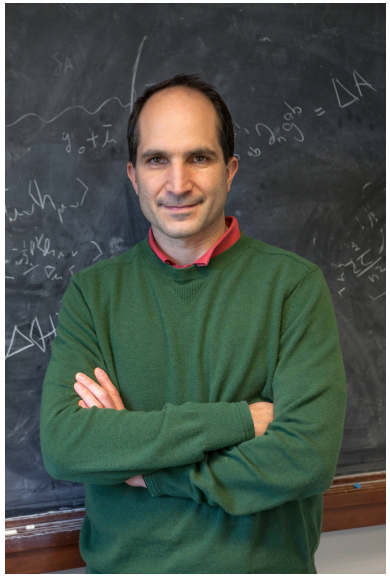

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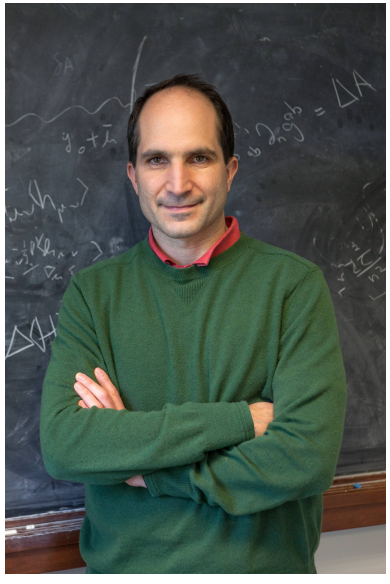

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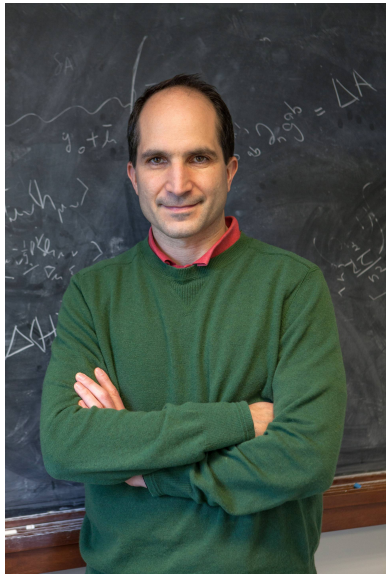

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- Not exactly proven
- Numerous examples

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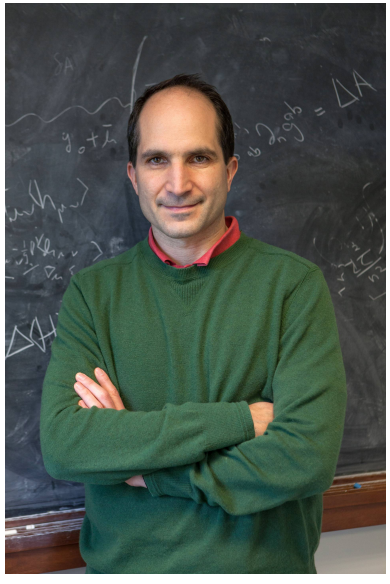

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AdS/CFT correspondence

AdS spacetimes can be described in terms of a CFT that lives on the boundary and vice versa

- Not exactly proven
- Numerous examples
- However we do not live on AdS

There is currently several proposals of dS holography

Andrew Strominger

- dS/CFT with several problems

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- dS/CFT with several problems
- Unknown particular CFT

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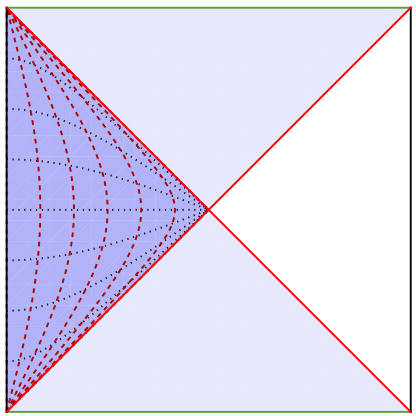
There is currently several proposals of dS holography

Andrew Strominger

- dS/CFT with several problems
- Unknown particular CFT
- Alternatives:
  - Static-Patch holography
  - Observer dependent holography
  - ...
- Toy models may help

My collaborators and I used a brickwall model



Static Patch

- dS static patch (with and withou a BH)

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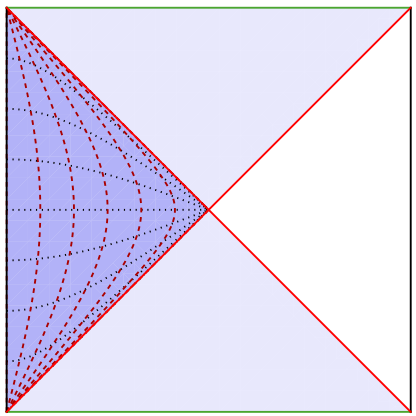

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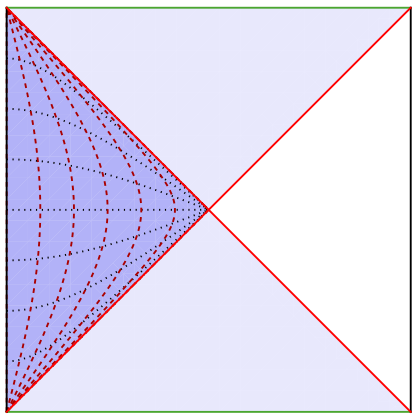

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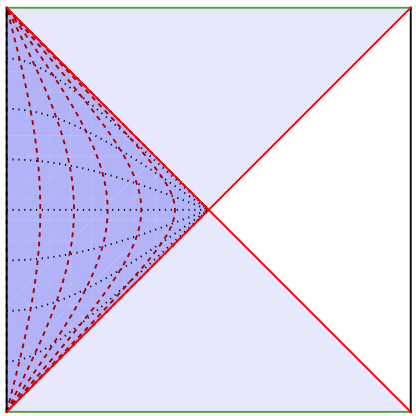

Static Patch

- dS static patch (with and withou a BH)
- Minimally coupled scalar field
- Boundary conditions close to the horizon
- Obtained its normal modes

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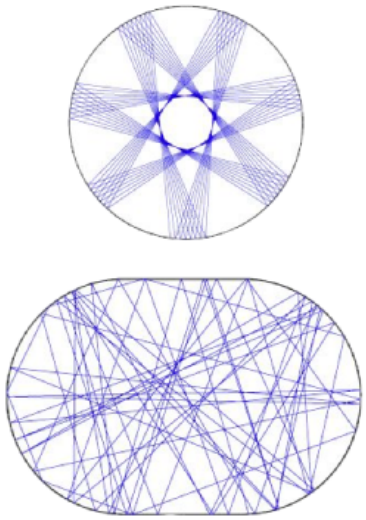
We probed for Chaotic Behaviour



Classical Chaos

- We extracted statistics of the modes

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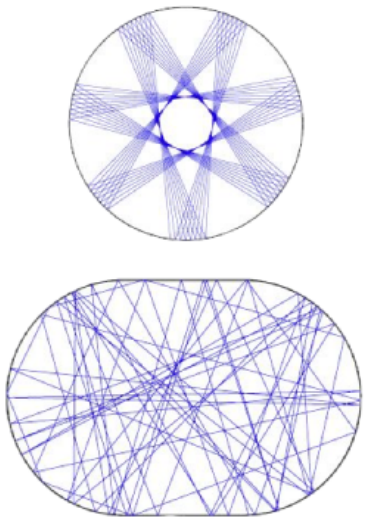

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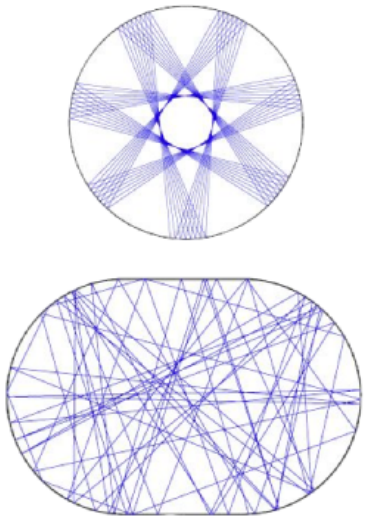

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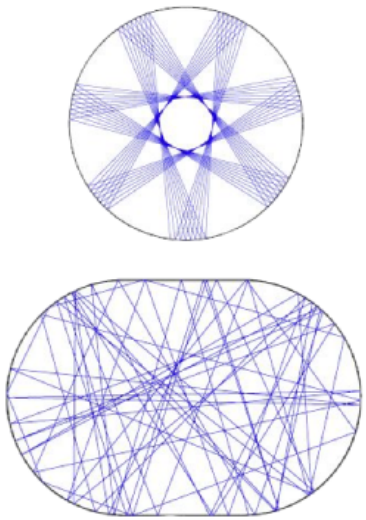

Classical Chaos

- We extracted statistics of the modes
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- This results may constrain the the boundary theory
- Little steps toward a consistent description

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Thank you for your attention!