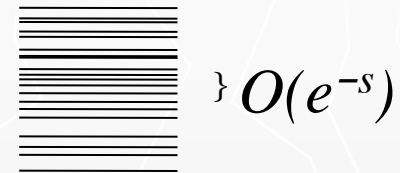# Limitations of Gauge/Gravity Duality (Matrix theory, AdS/CFT, …)

Santa Barbara Gravity Workshop II
Joe Polchinski

GGD → no information loss, no remnants

and if we assume we can solve the gauge theory

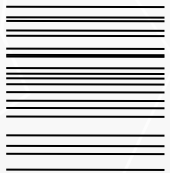→fine structure of microstates:

$$\left.\rule{0pt}{2.5em}\right\} O(e^{-s})$$

Tempting to believe that it is a complete description of bulk quantum gravity.

So we ask it, are there firewalls?

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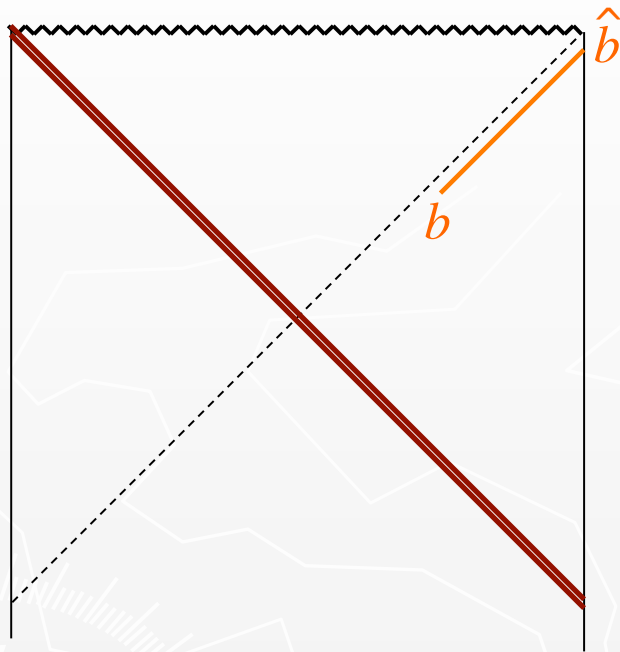
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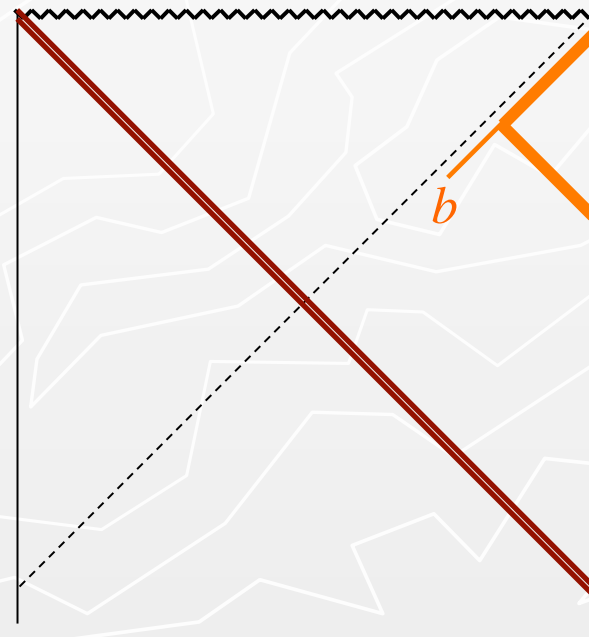
So we ask it, are there firewalls?

And it says, "I dunno"
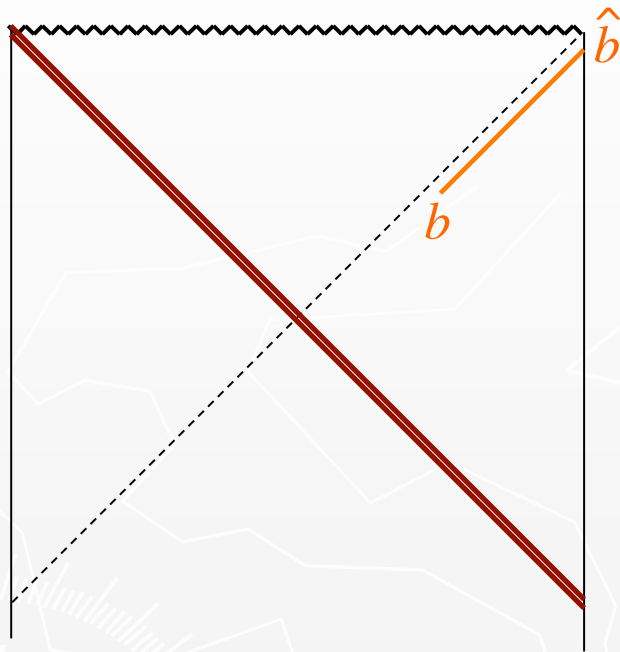
Outside the horizon:

b has an image $\hat{b}$ in the CFT: we can see whether it is occupied.

Note, however, Vladimir's talk — near the horizon the view gets fuzzy: cf. also Daniel's talk, Susskind.
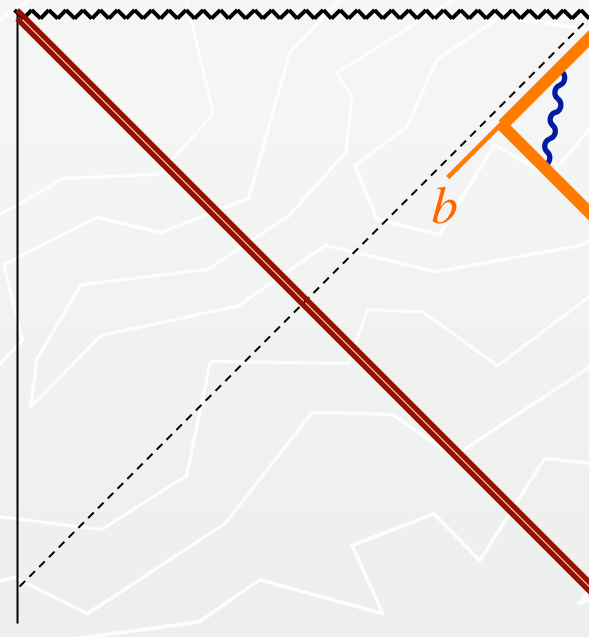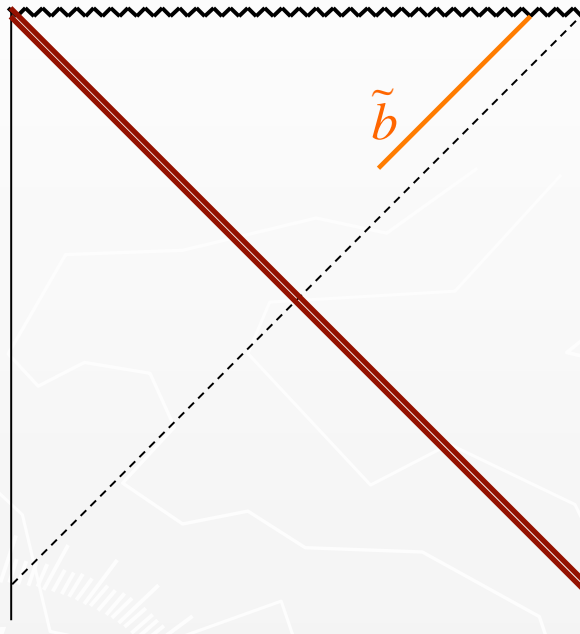
Outside the horizon:

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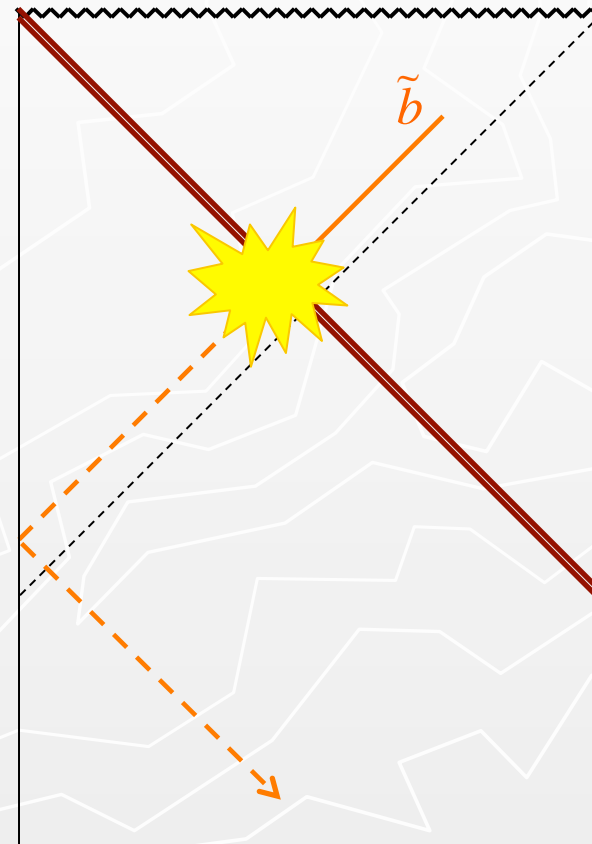we can see whether it is
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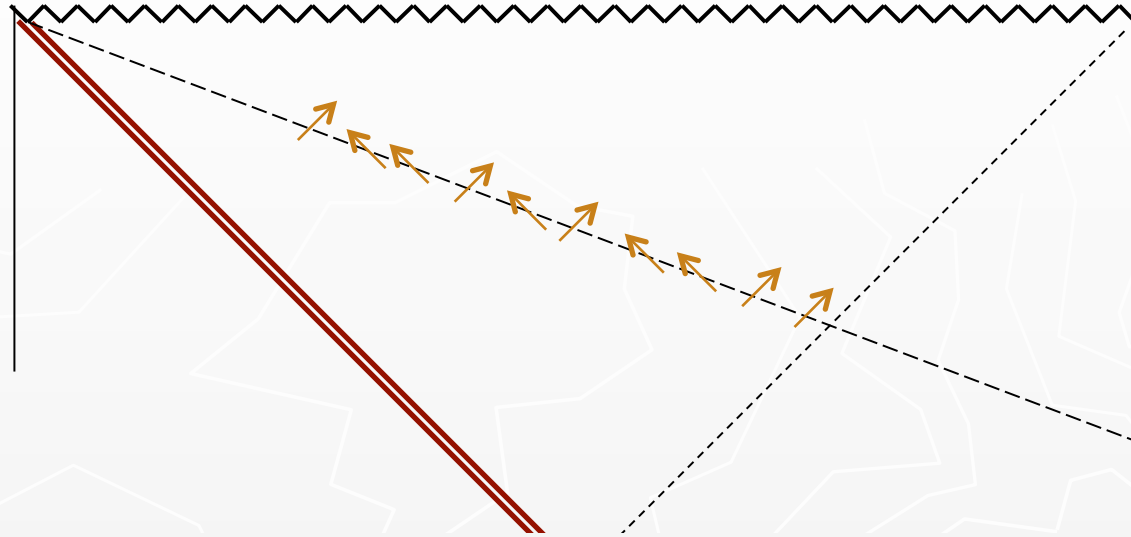Susskind.

Inside the horizon:

$\tilde{b}$

If we run the mode forward, we hit the singularity.

$\tilde{b}$

If we run it backwards, we need to solve a trans-Planckian problem (after the scrambling time)

Inside the horizon II:

If $\tilde{b}^\dagger$ has an image in the CFT, we can use it to create excited states behind the horizon $\rightarrow$ most states have firewalls (assuming no shenanigans). If the adiabatic principle holds (no firewall), then this image can't exist:

$$\mathcal{H}_{\text{interior EFT}} \not\subseteq \mathcal{H}_{\text{CFT}}$$

We are all looking at scenarios, we need a theory, beyond gauge/gravity duality.