Title: FRW/CFT

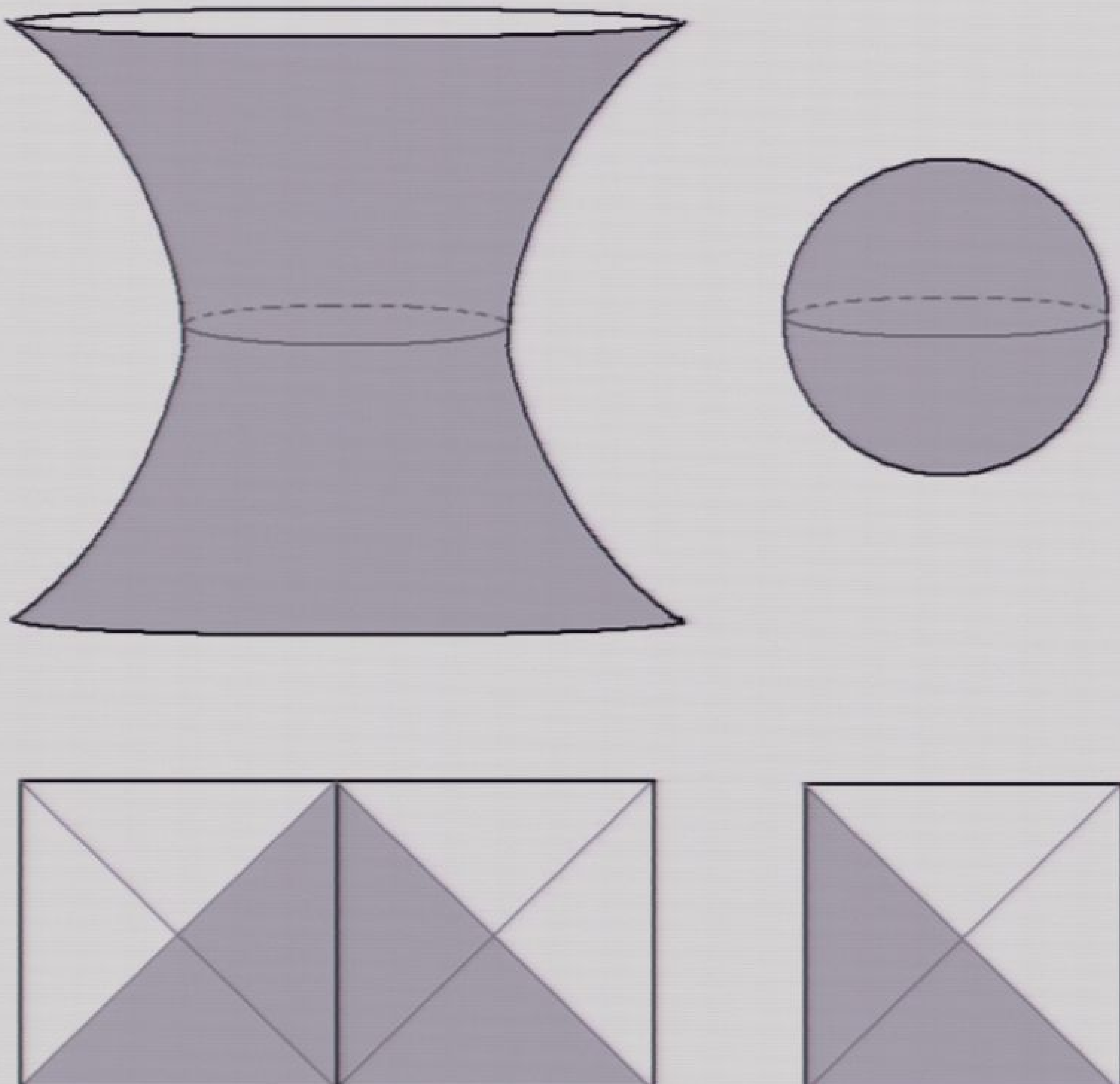
Date: Sep 22, 2009 12:30 PM

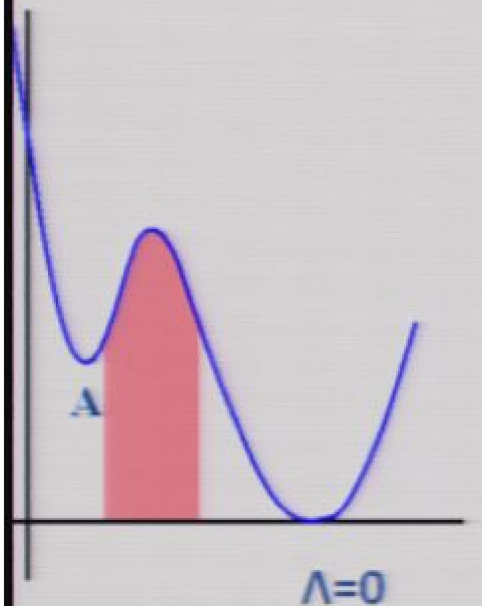
URL: http://pirsa.org/09090101

Abstract:

FRW/CFT

(or maybe FRW/M)

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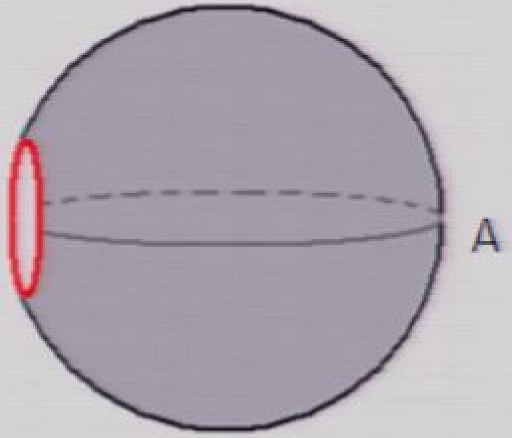
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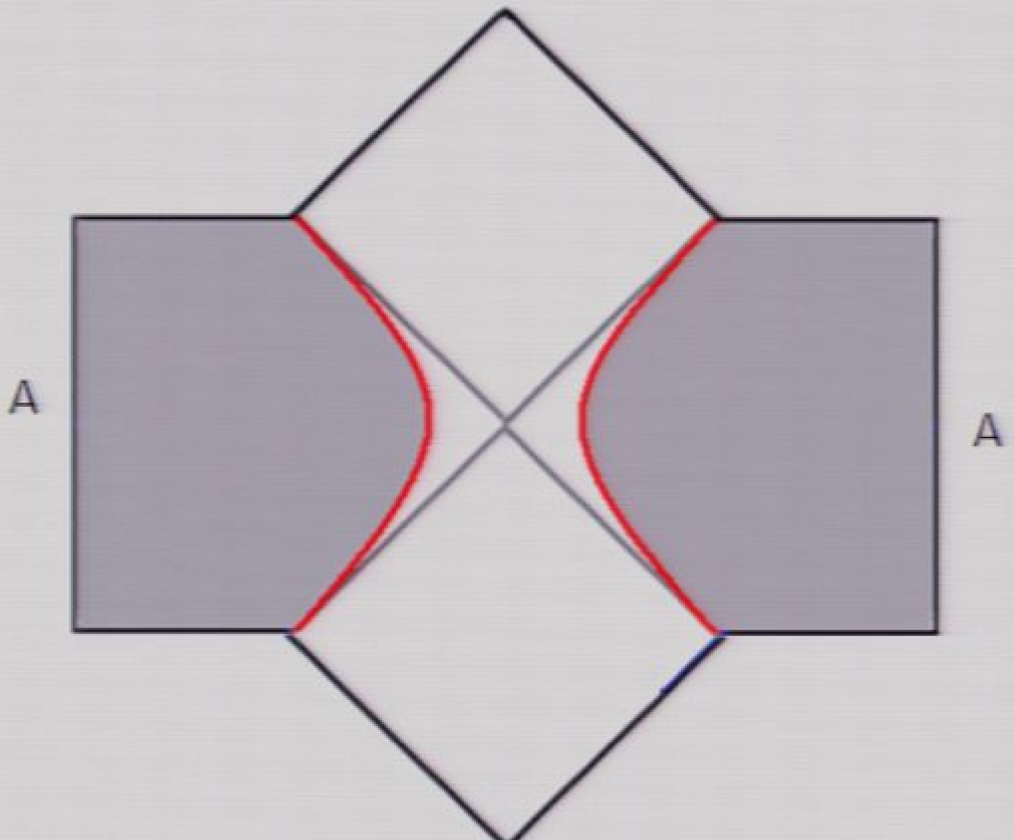
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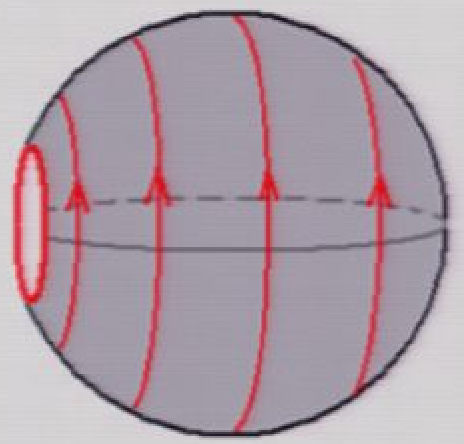
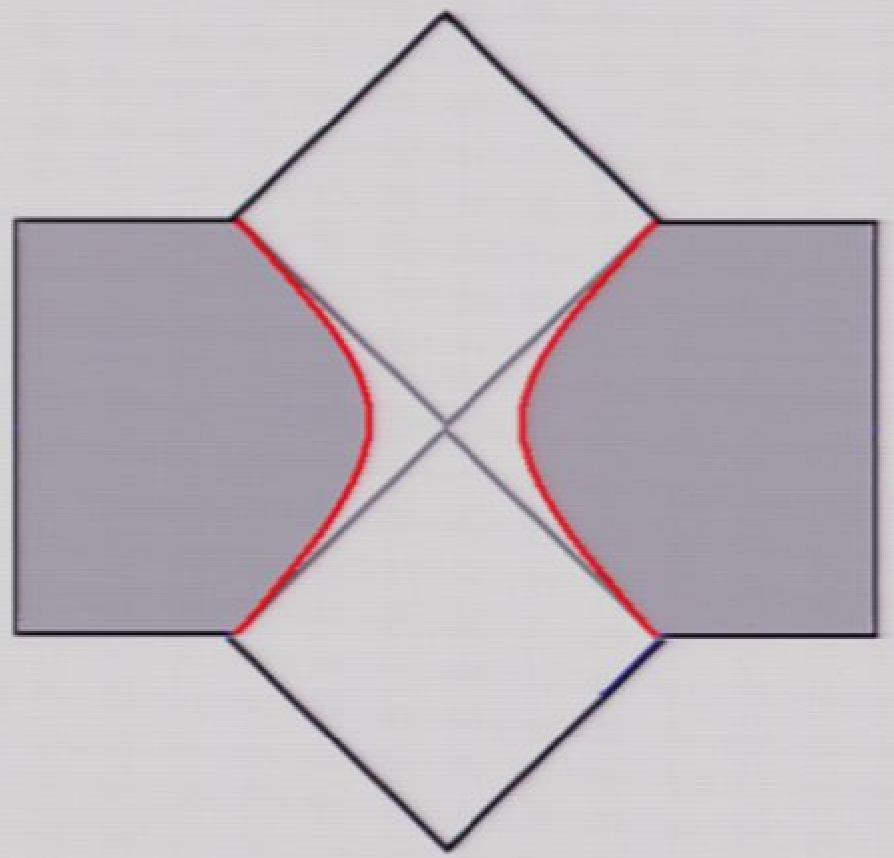
A

$O(5) \rightarrow O(4)$





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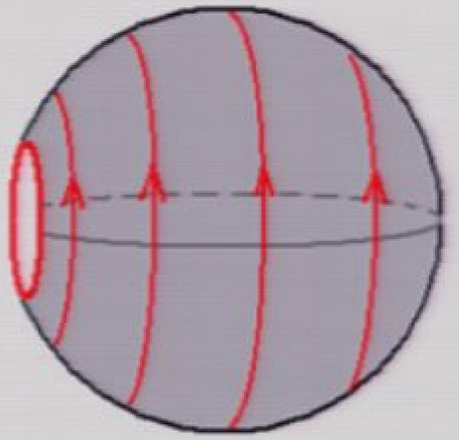
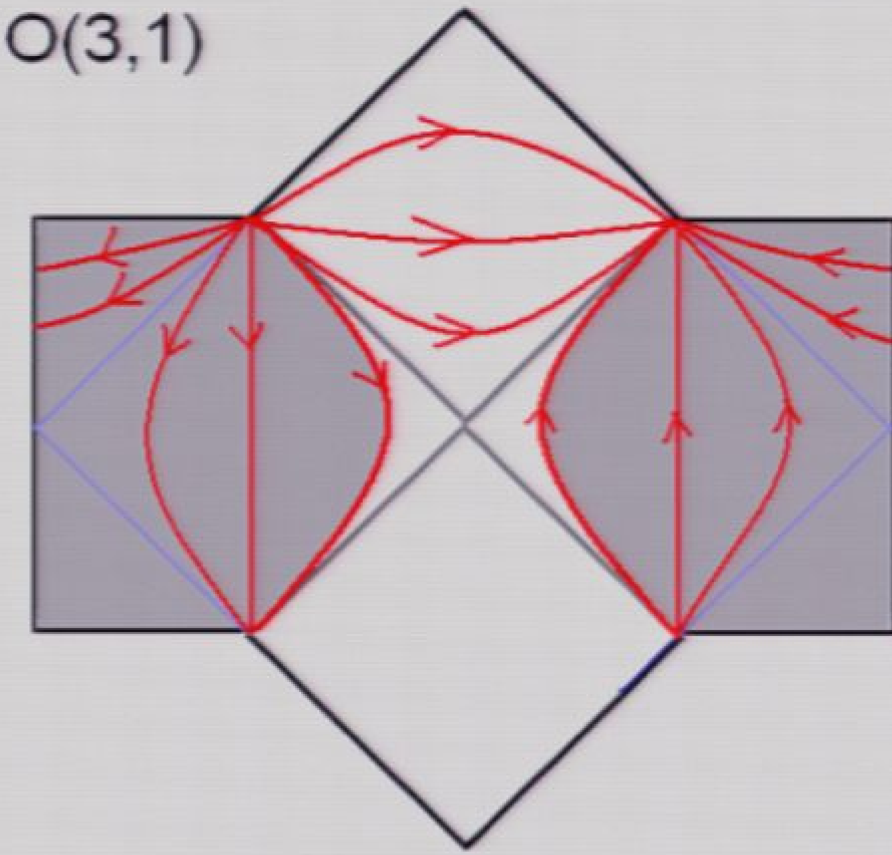
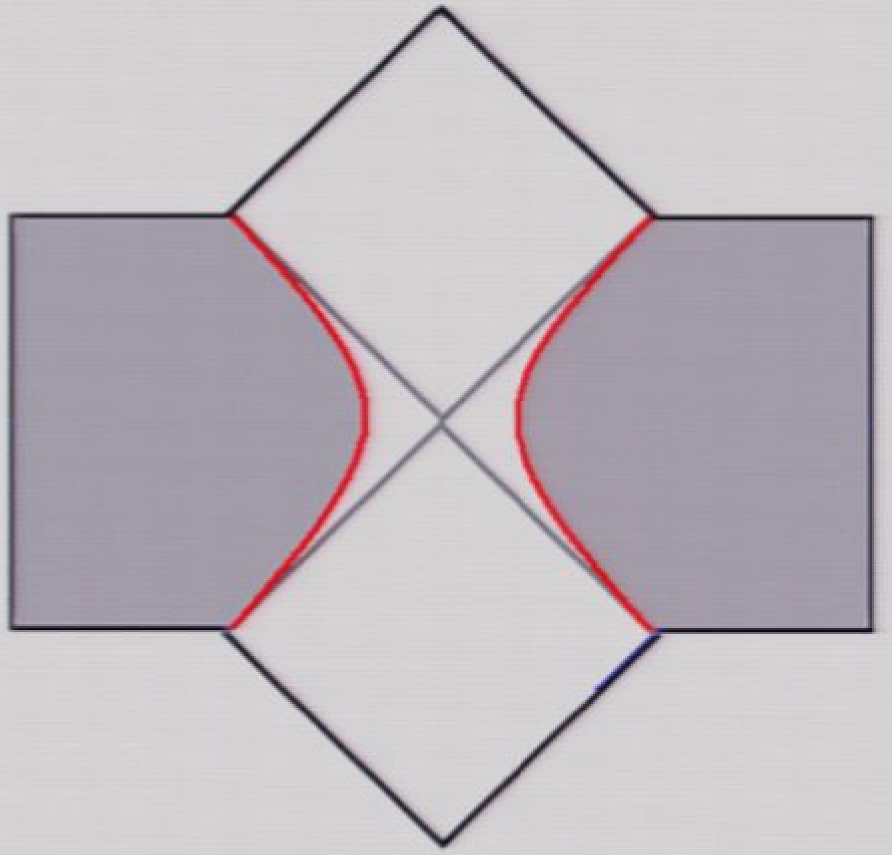


$O(4,1) \rightarrow O(3,1)$





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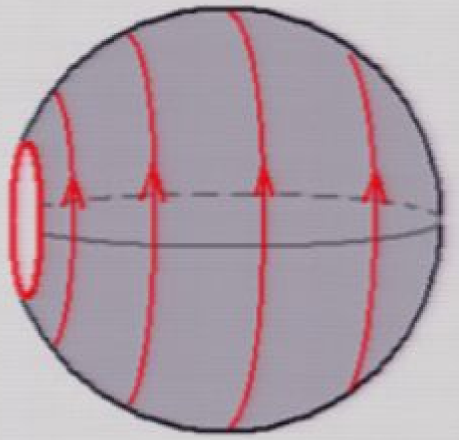

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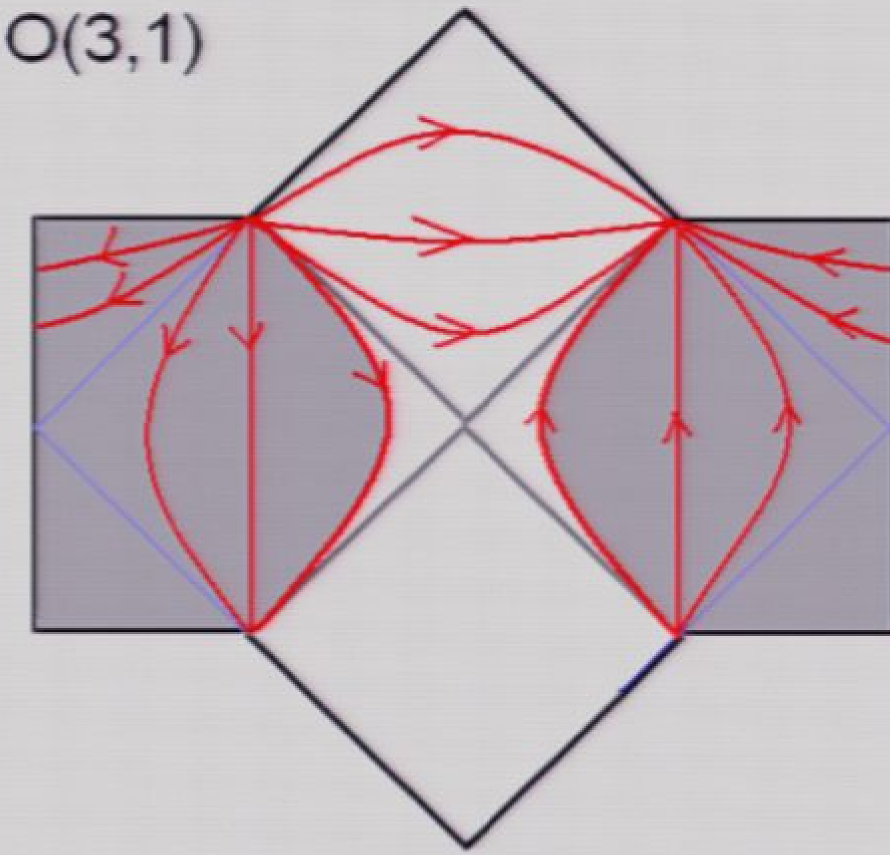

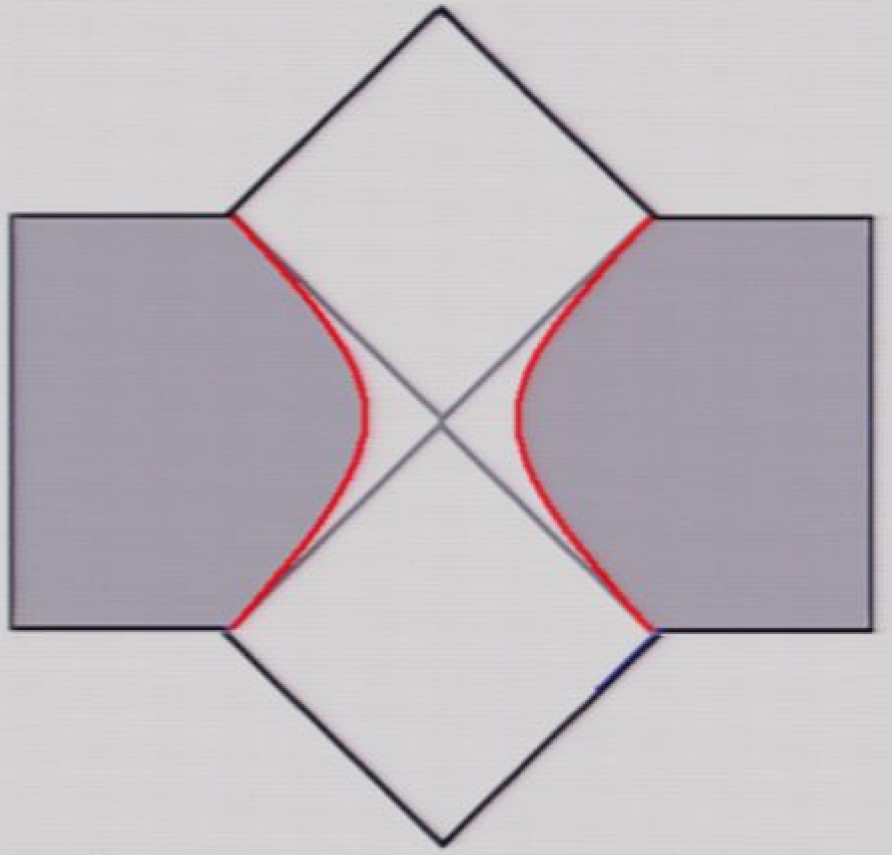

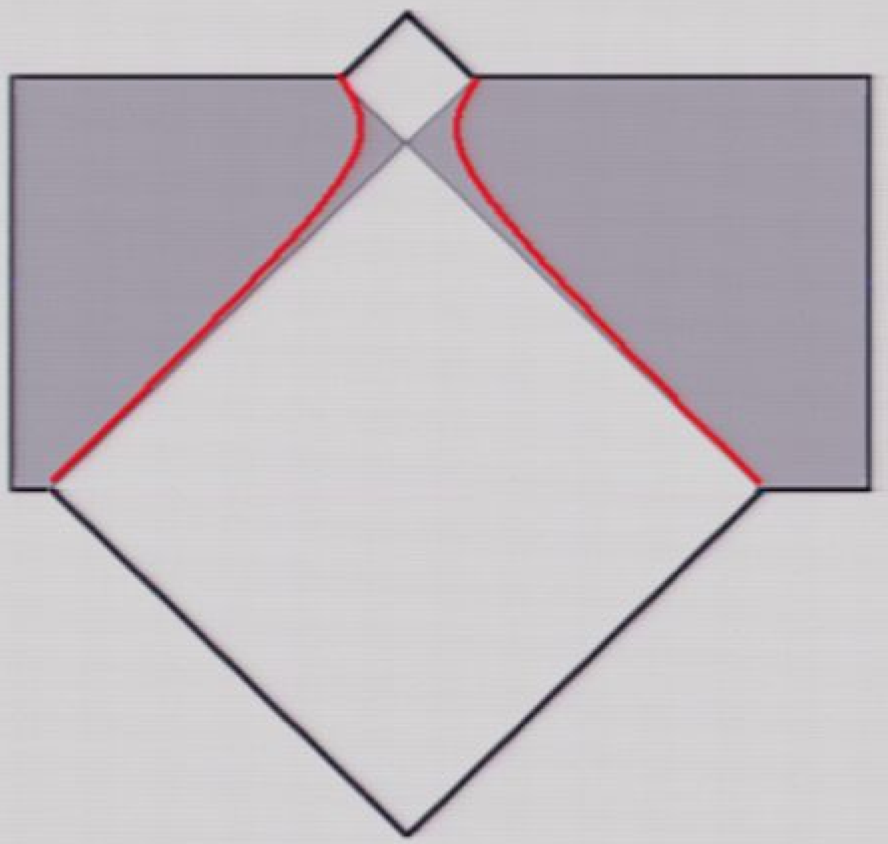

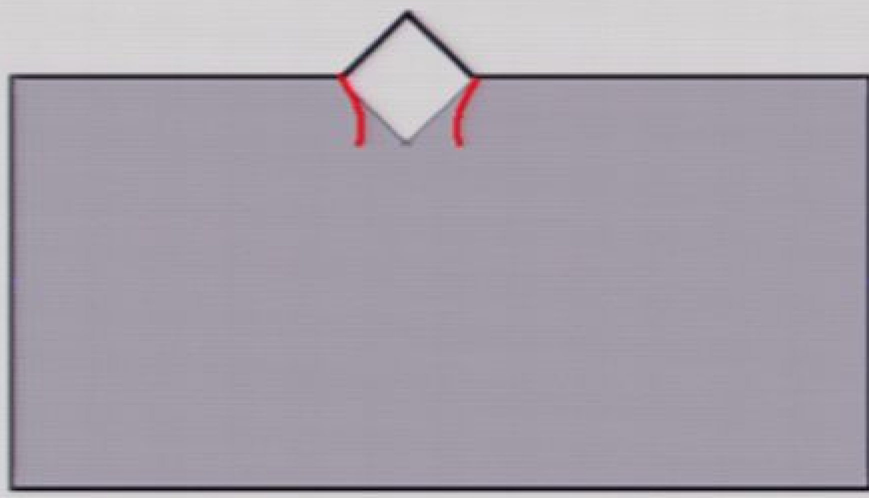

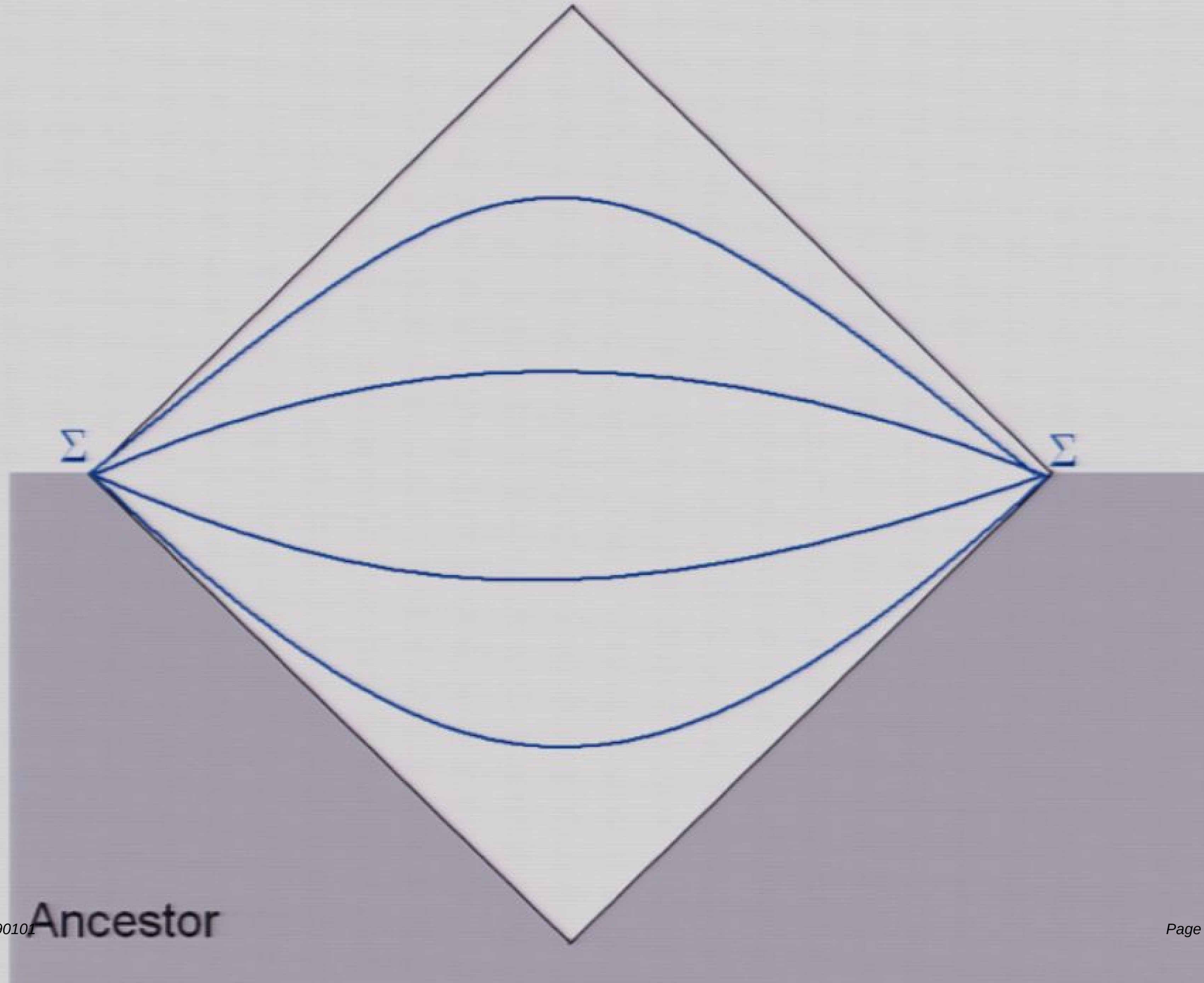
Σ
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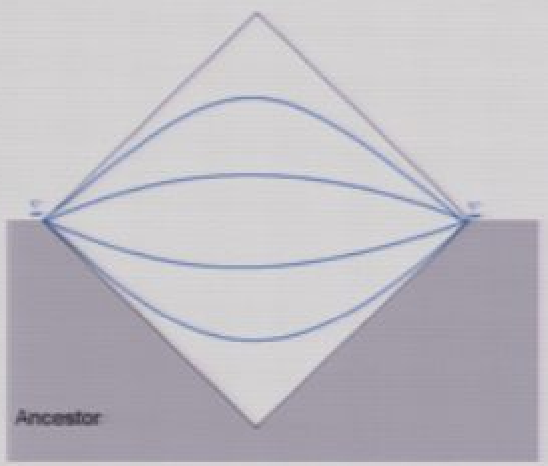
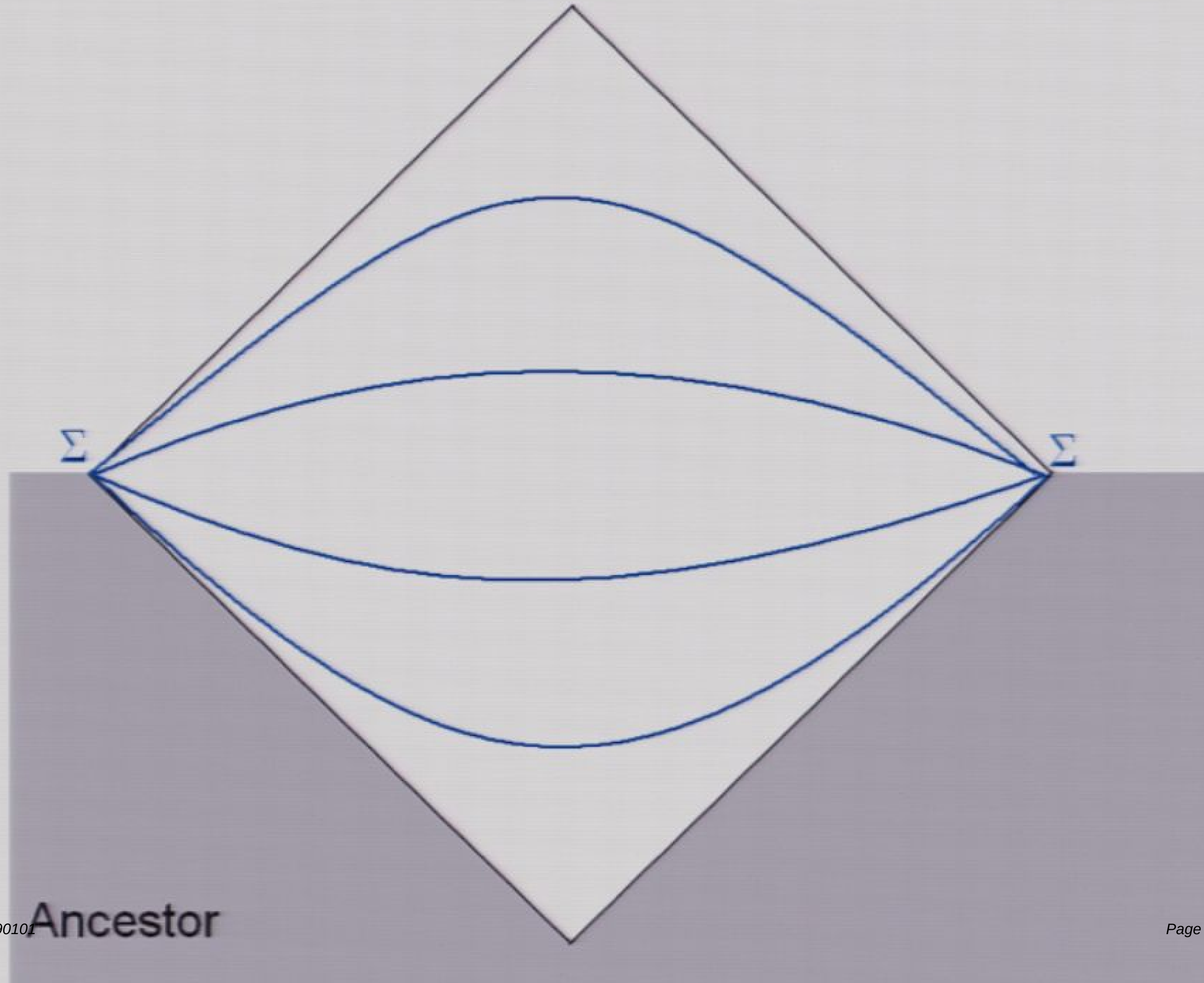
Ancestor

FRW metric with conformal time:

$$ds^2 = a(T)^2 \{ -dT^2 + d\mathcal{H}_3{}^2 \}$$

$$d\mathcal{H}_3{}^2 = dR^2 + \sinh^2 R \, d\Omega^2$$

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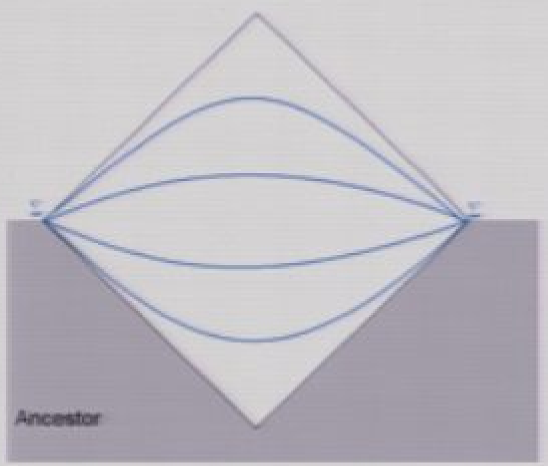
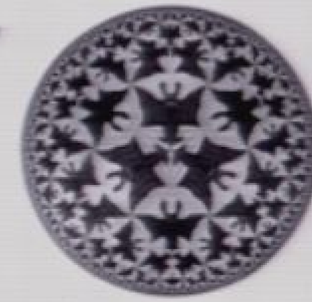


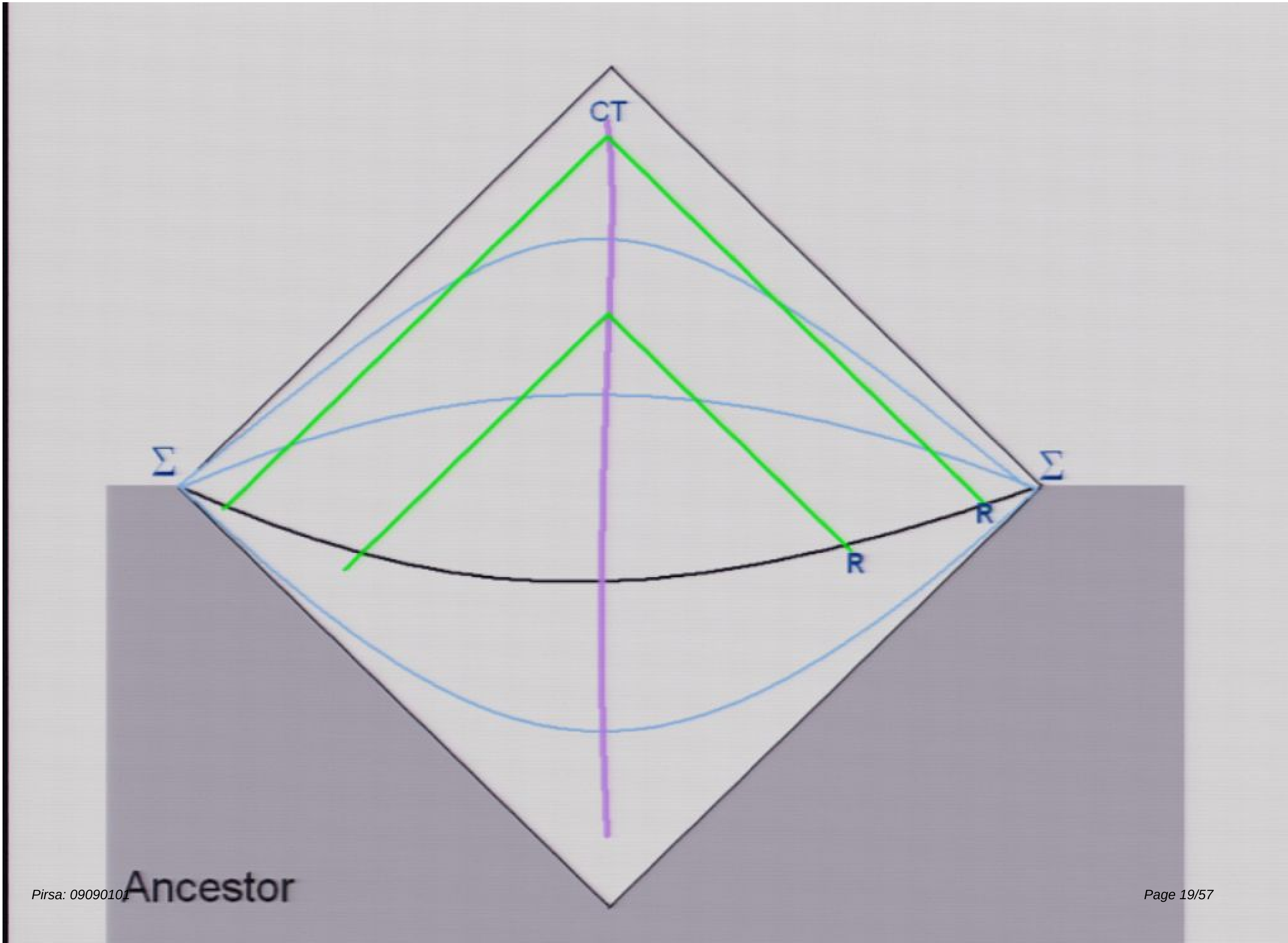
O(3,1) acts in the bulk as "translations" and rotations.



On the boundary it is the conform transformations.

Note that $\mathcal{H}_3$ is the same as Euclidean ADS(3).

The Census Taker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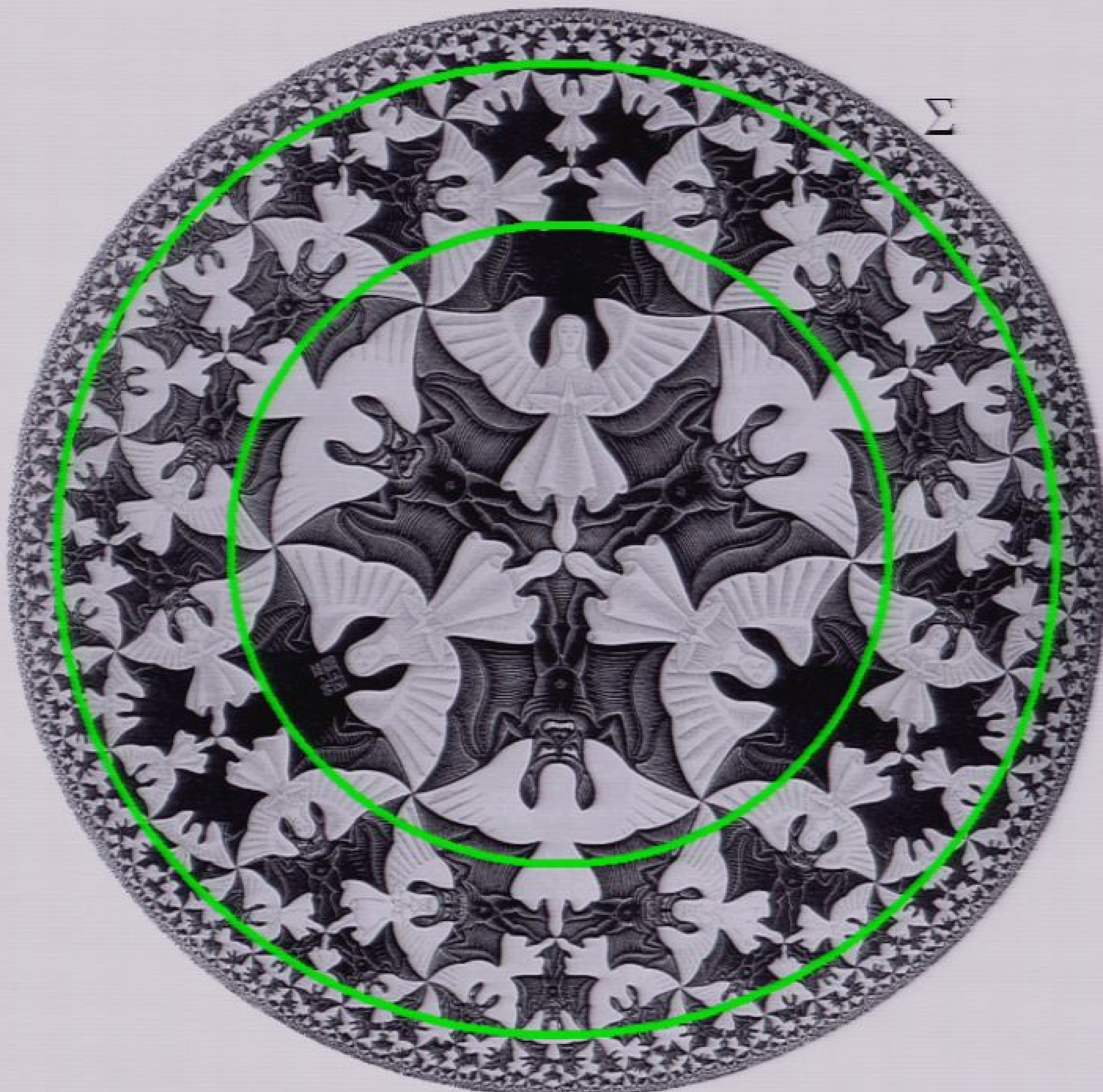
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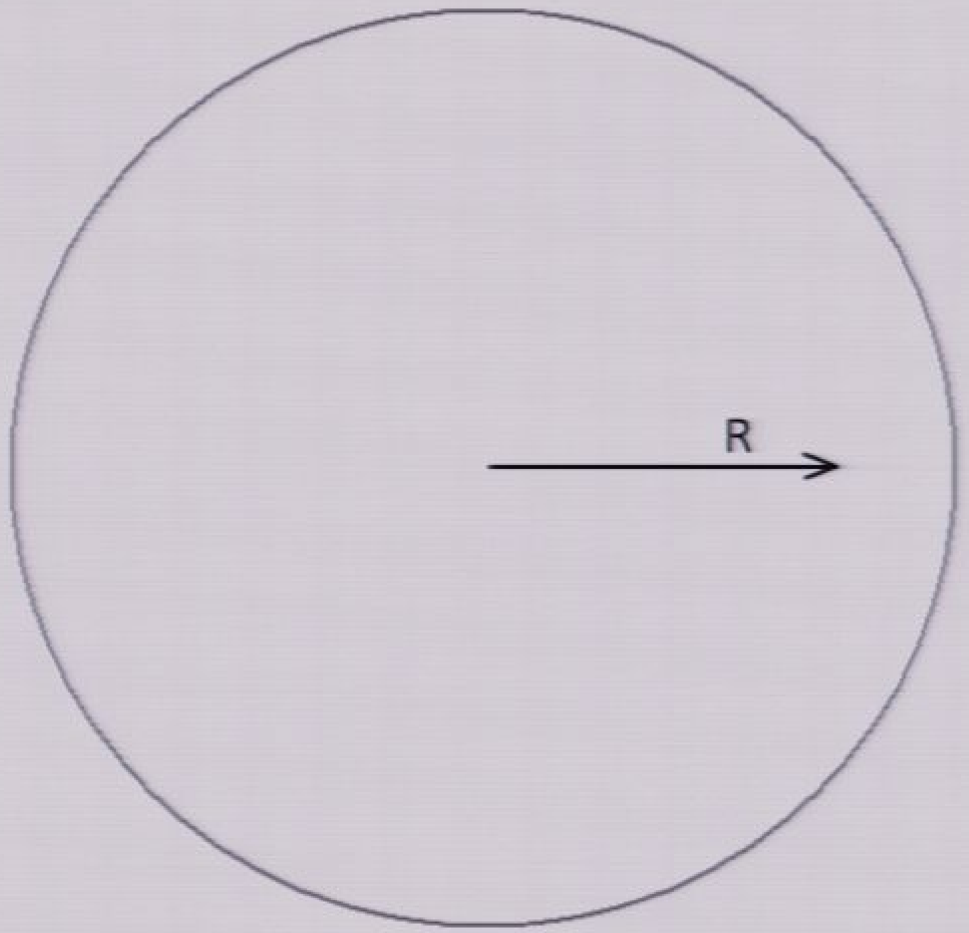
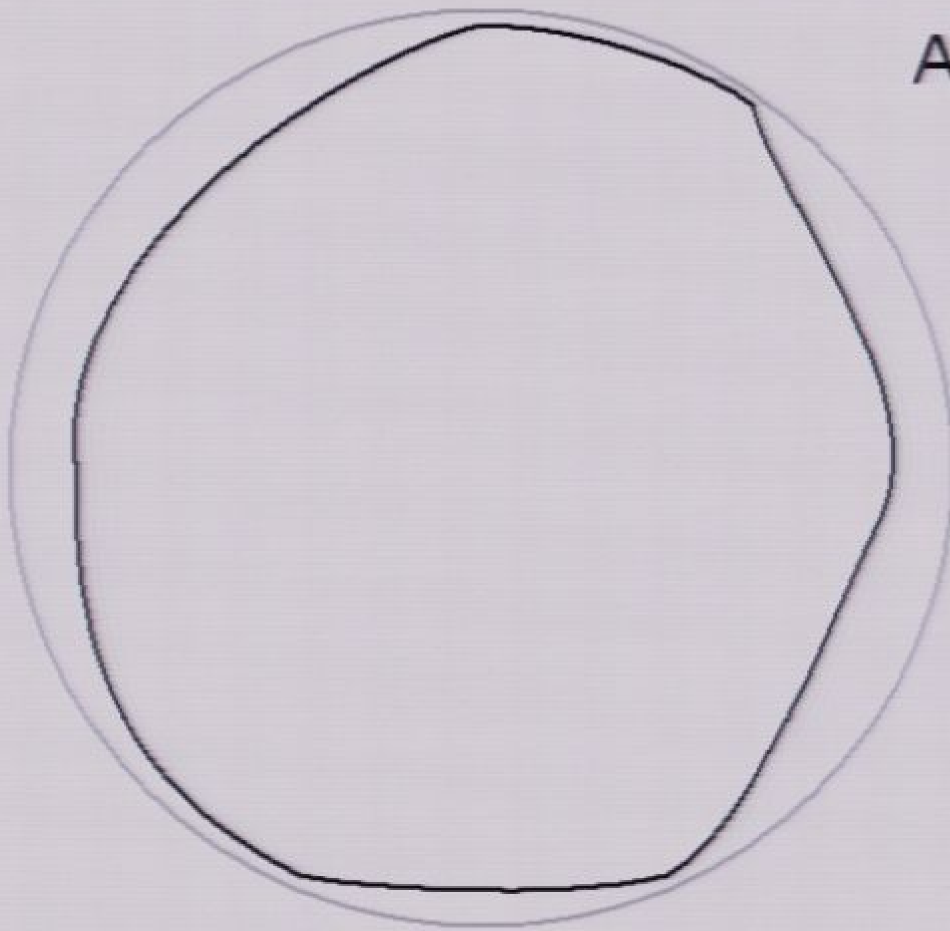
ADS and RG flow: the emergence of R



ADS and RG flow: the emergence of R



ADS IR cutoff
at $R(\Omega)$
is also the UV
cutoff of the
dual
description.

CFT "reference metric" $ds_R^2 = \sinh^2 R(\Omega)\ d\Omega^2$

renormalization scale = 1

FRW/CFT$_{\text{(Euclidean)}}$?

If R is the RG flow parameter as in ADS/CFT,

What is T?

Time as scale-factor.

Wheeler DeWitt theory.

$\Psi^* \Psi = \text{measure}$

$\Psi(g_{mn}, f)$ has no time dependence—but it does depend on the scale-factor.

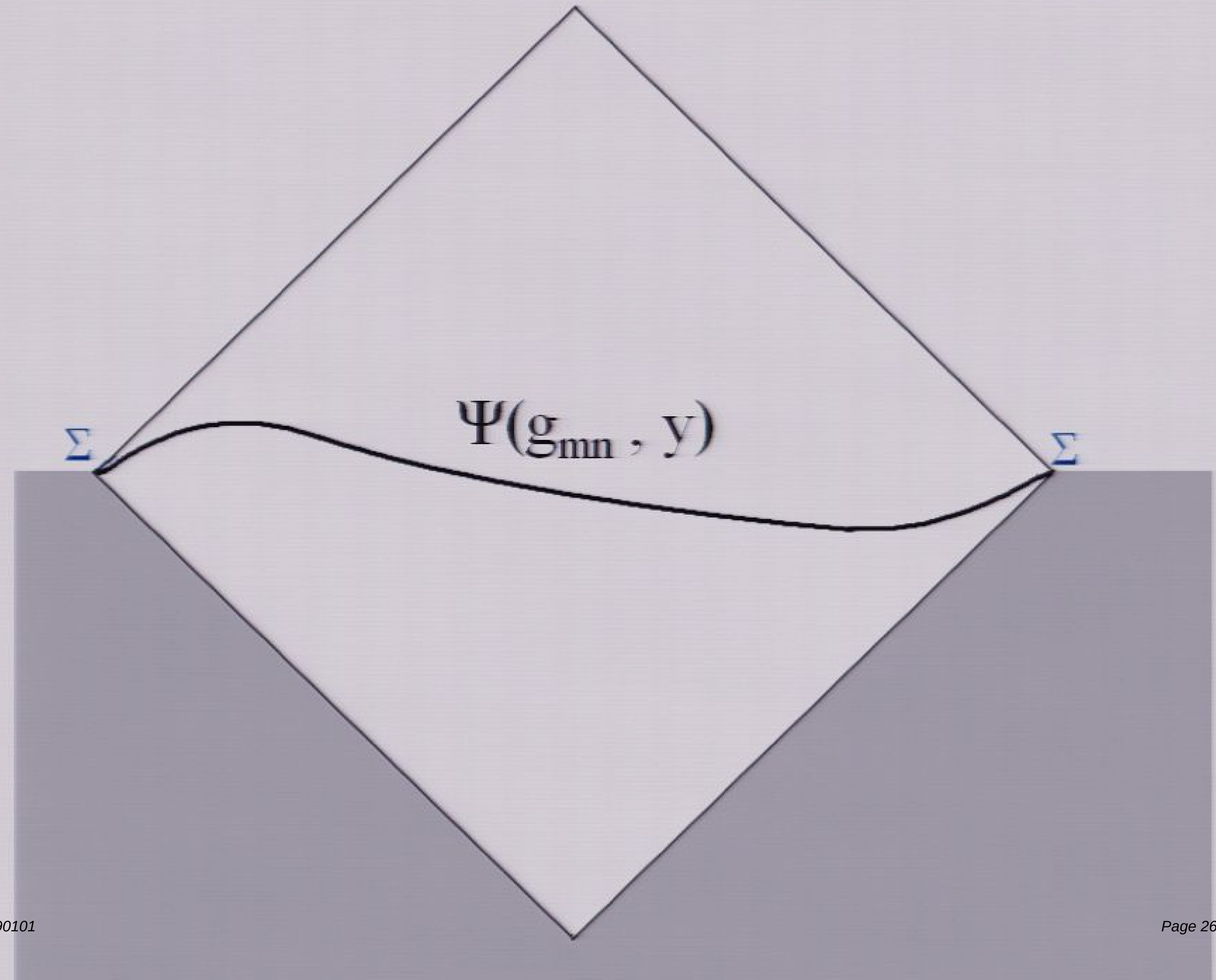
$a = \int |g|^{1/2} \, d^3x$

$\Psi(a, \text{everything else})$

Large-a limit the WDW equation becomes the Schrodinger equation with a replacing time.

Local scale-factor time can also be defined

$t(x) = |g|^{1/2}$



$\Psi(g_{mn}, y)$
Σ
Σ

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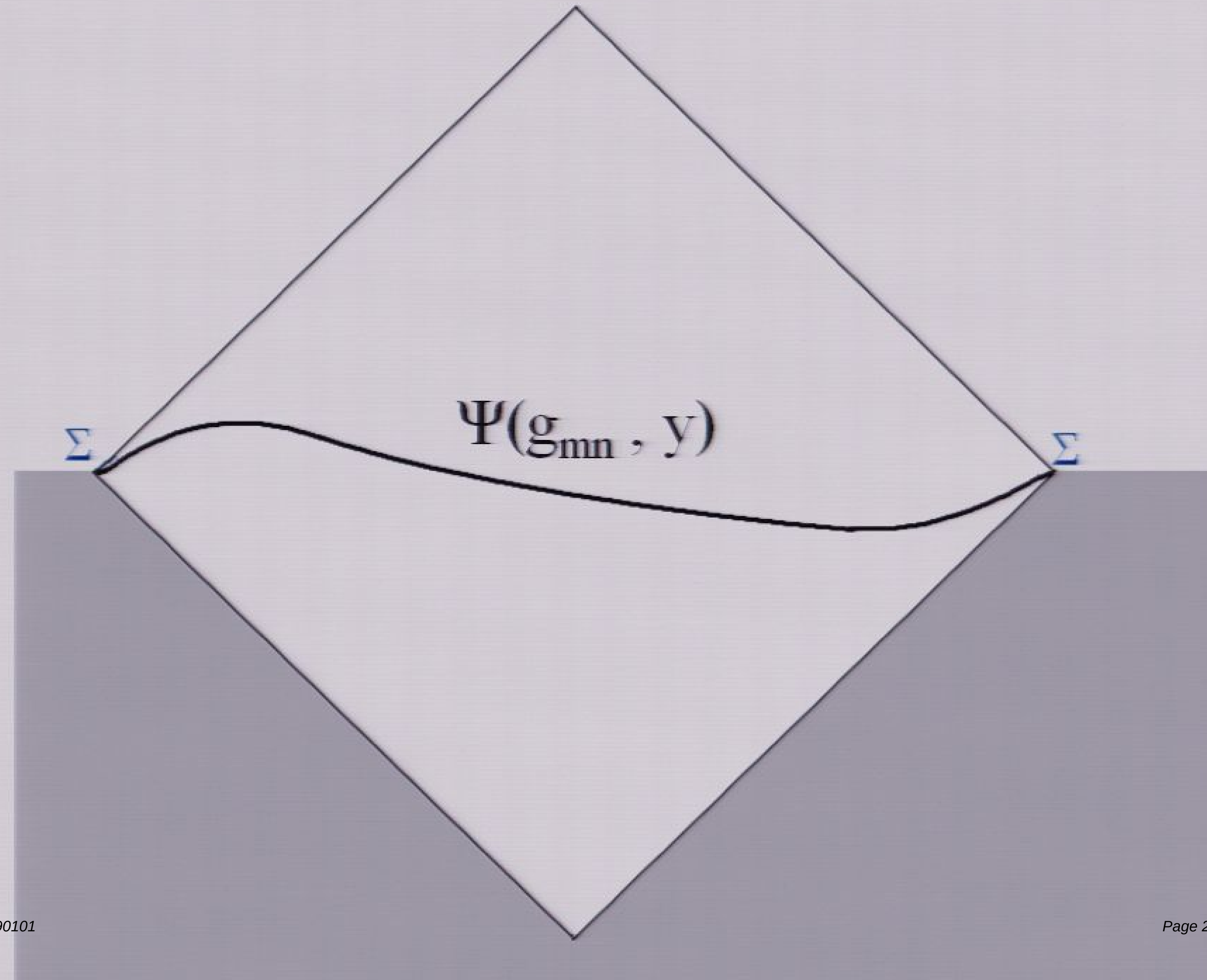

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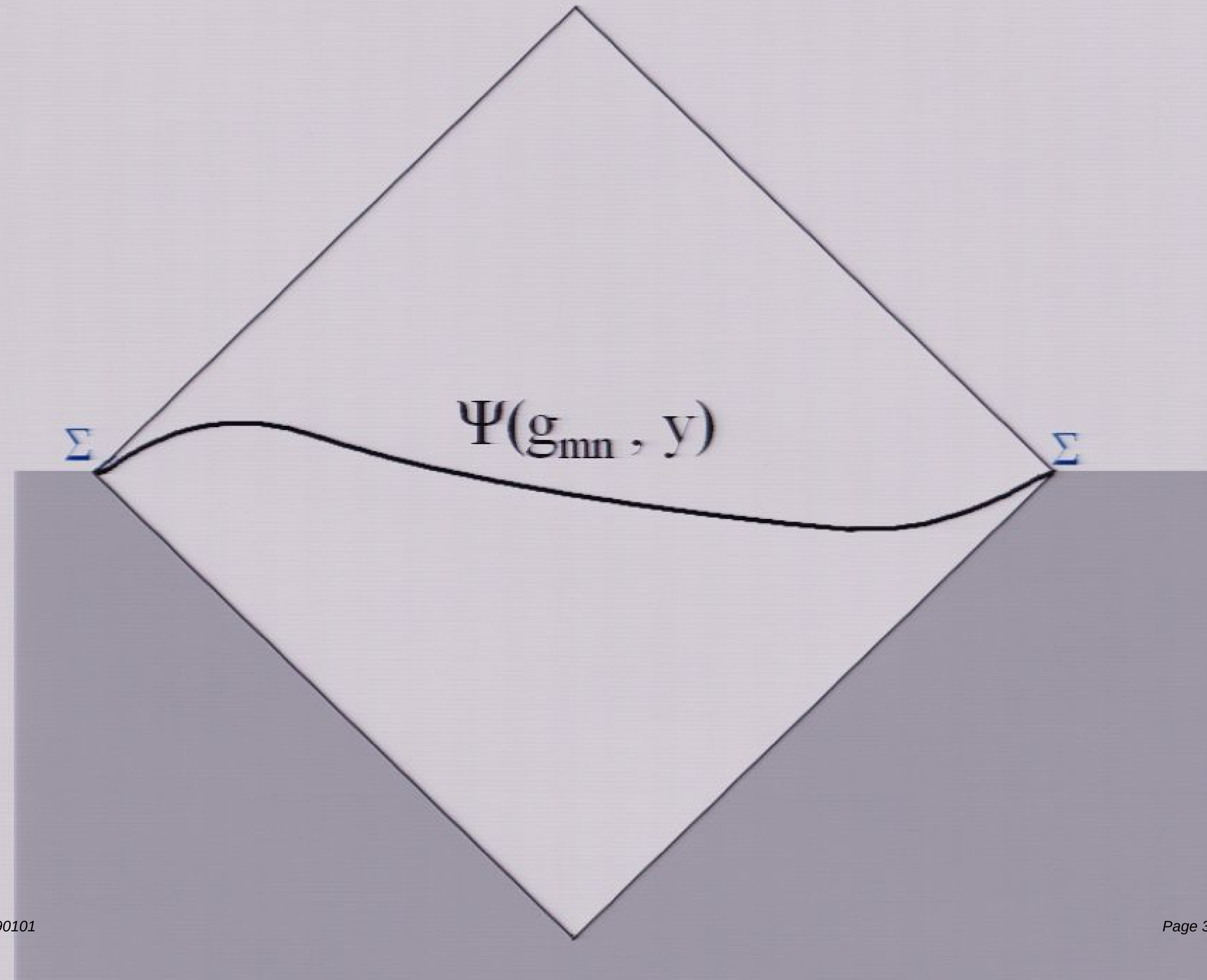
Σ
Ψ(g_mn , y)
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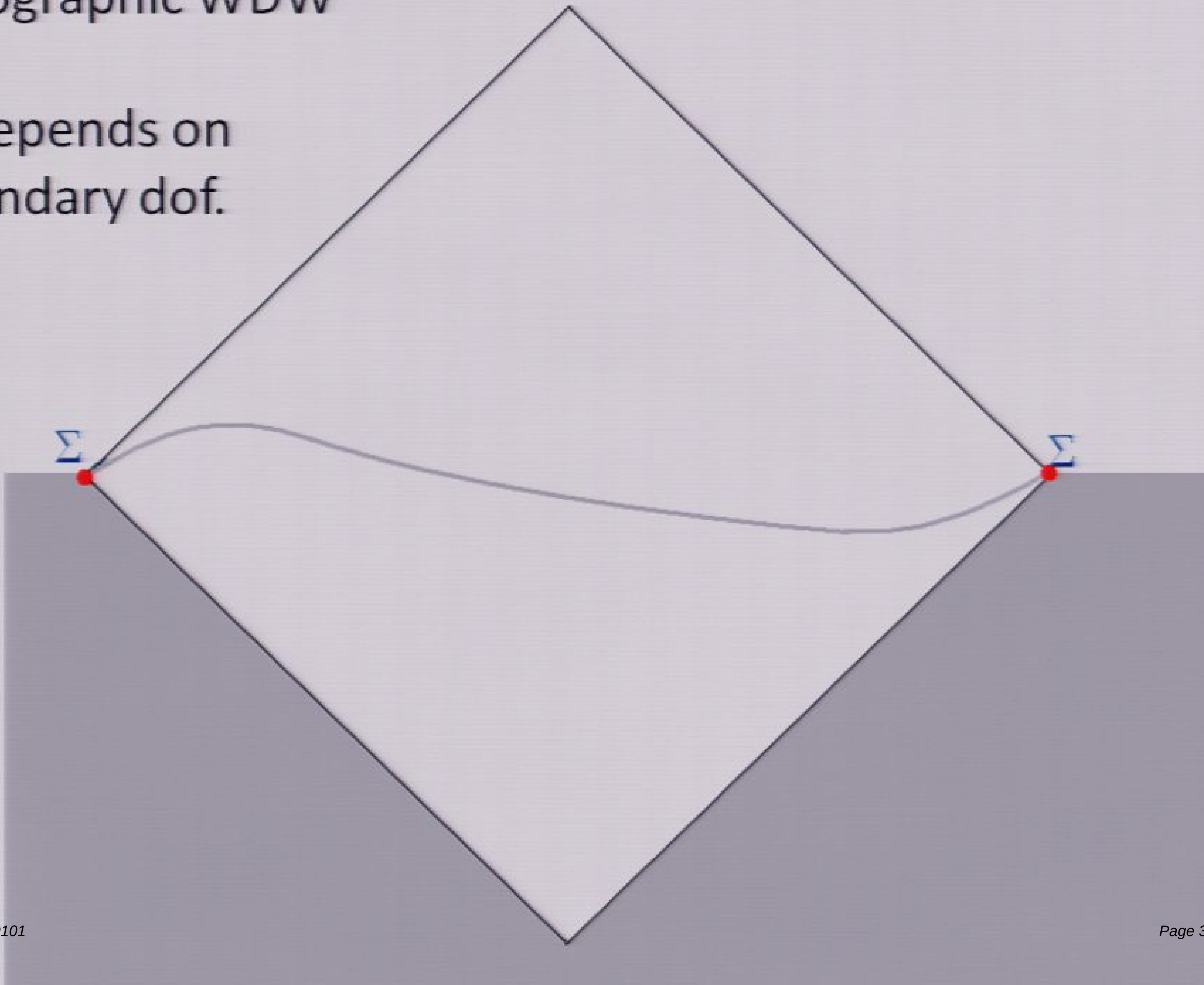
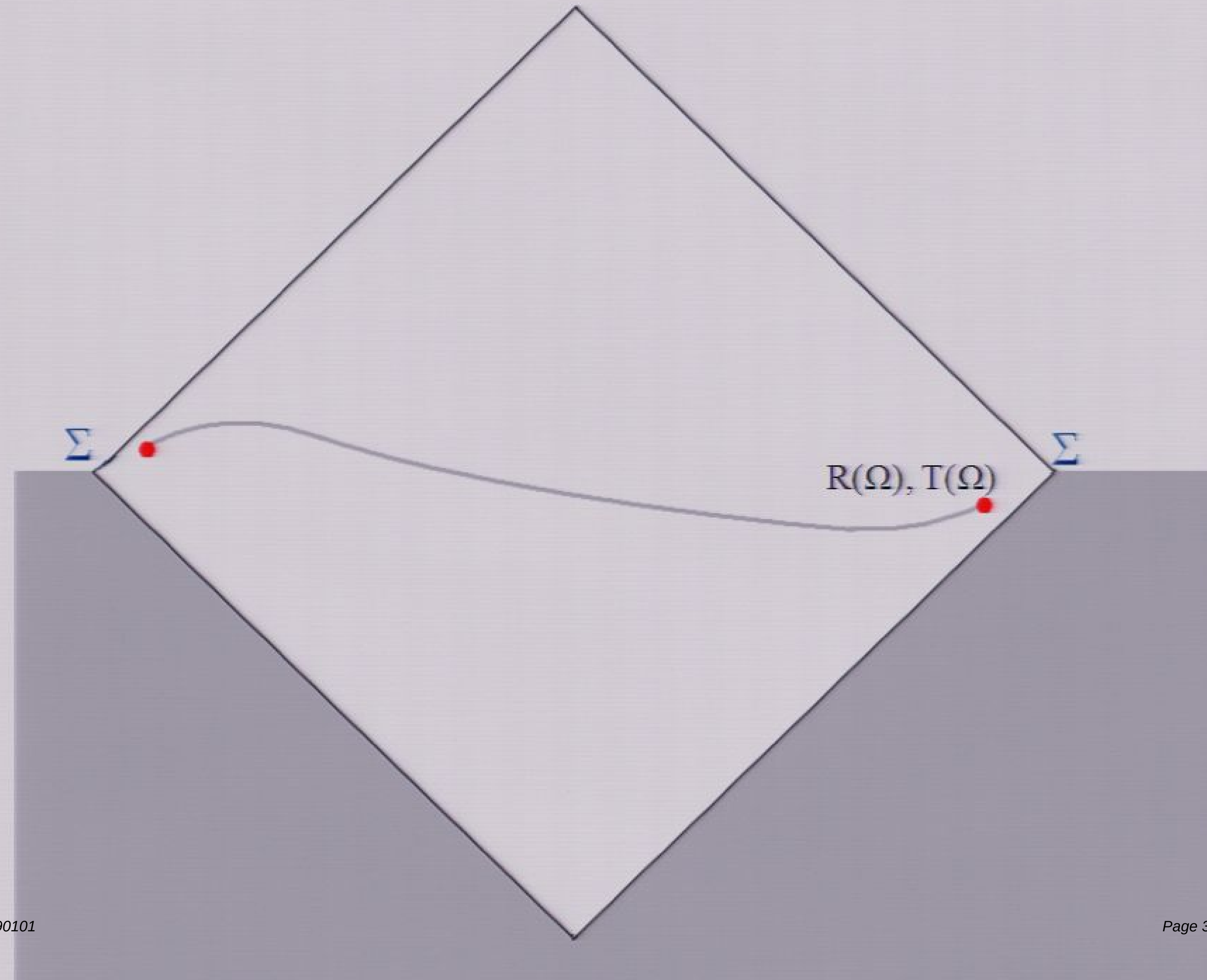
Holographic WDW

Ψ depends on boundary dof.

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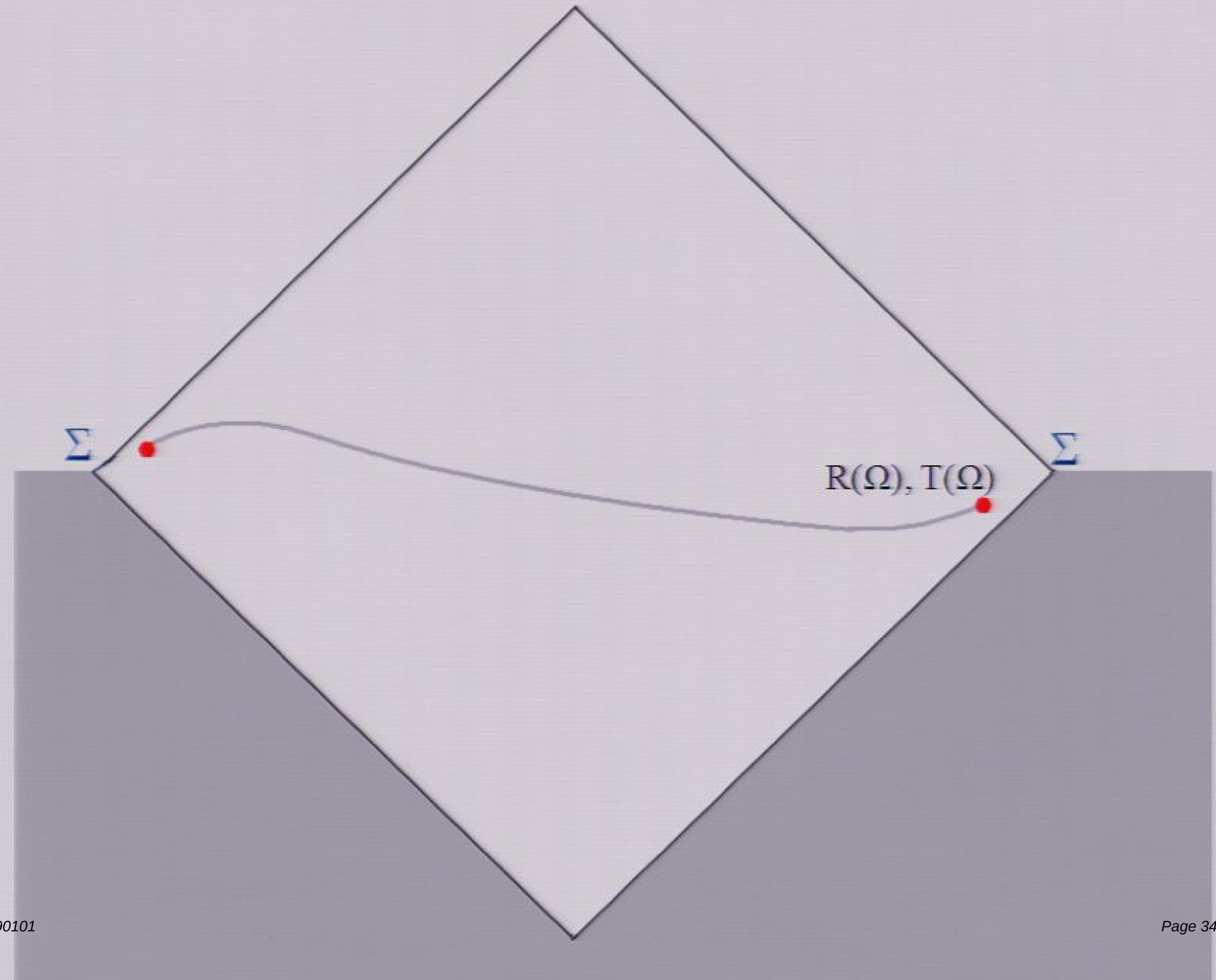
R(Ω), T(Ω)

Time as
Liouville field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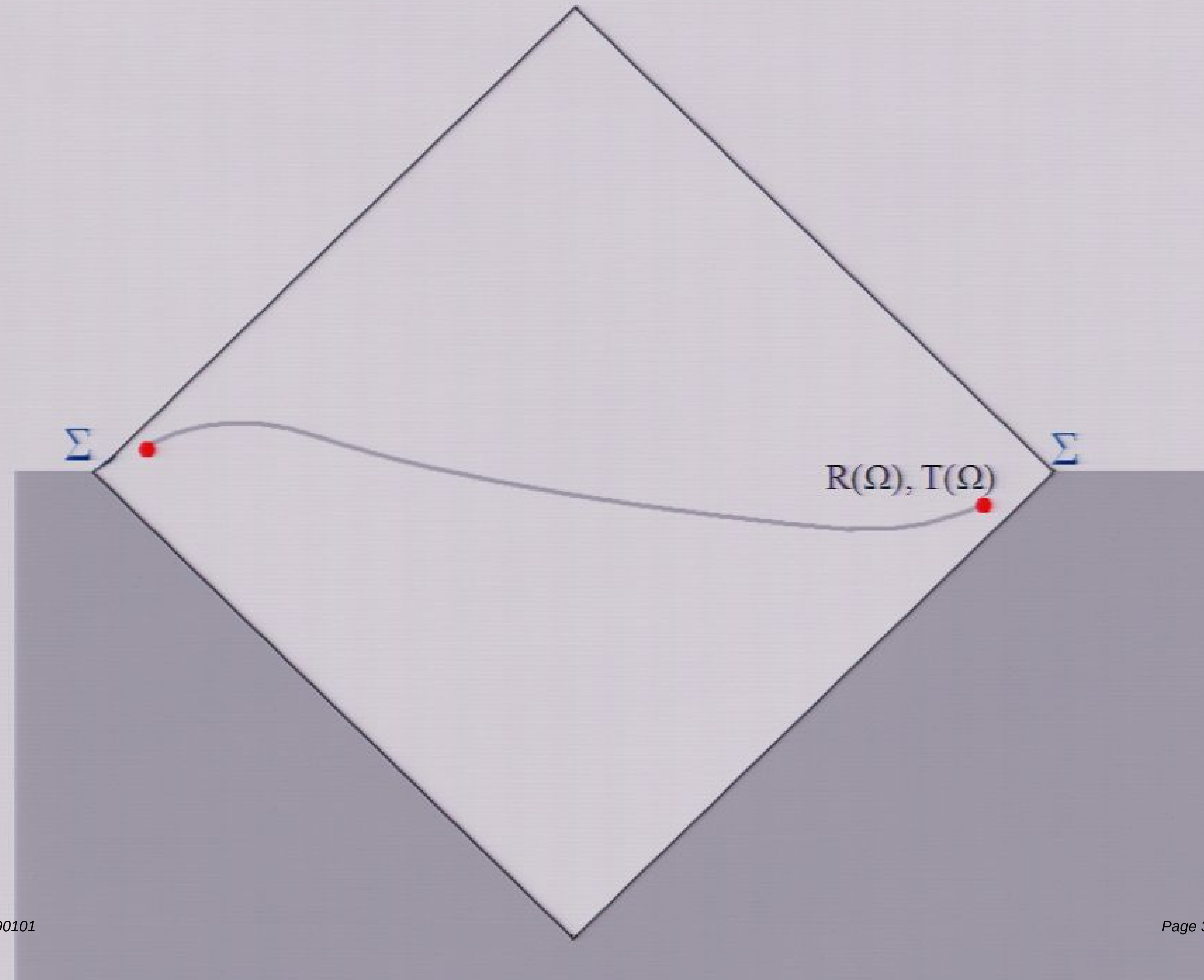
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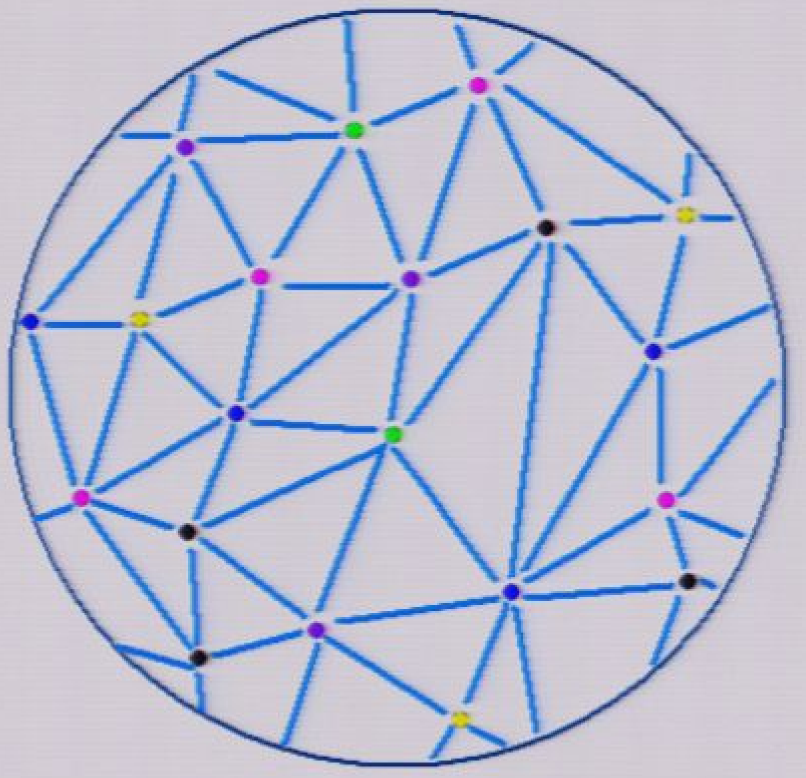
Liouville and Fishnets



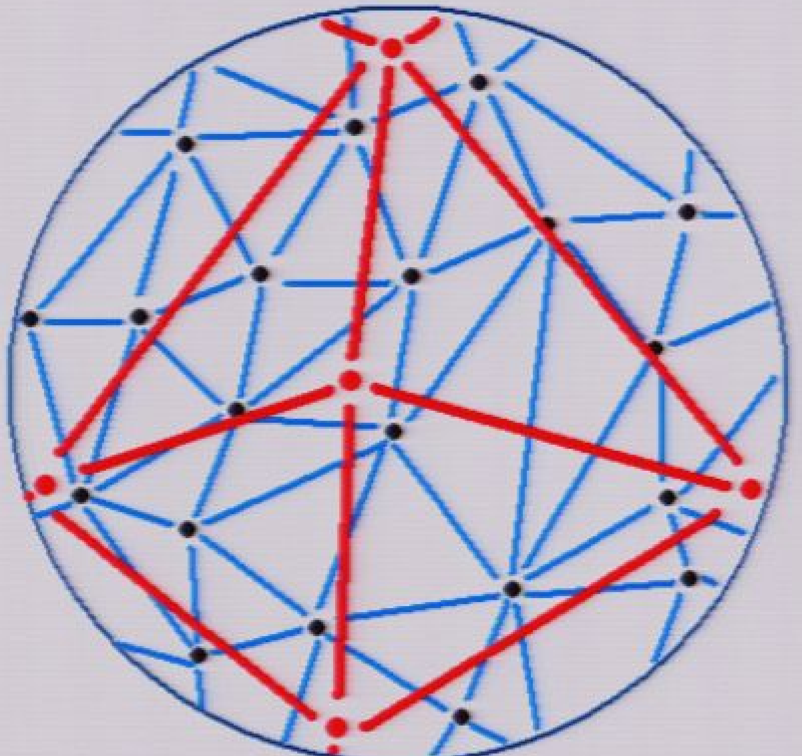
$$ds^2 = a(\Omega)^{-2}\ d\Omega^2$$

Reference metric

$dS_r^2 = A(\Omega)^{-2}\ d\Omega^2$

"True" metric

$ds^2 = a(\Omega)^{-2}\ d\ \Omega^2$



Liouville:

$ds^2 = e^{2U}\ dS_r^2$

Back to FRW

$$ds^2 = a(T)^2 \{-dT^2 + dR^2 + \sinh^2 R \, d\,\Omega^2 \}$$

$$ds^2 = a(T(\Omega))^2 \{ \qquad \sinh^2 R(\Omega)\, d\,\Omega^2 \}$$

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$$ds^2 = \{e^{2U(\Omega)}\} \{ \sinh^2 R(\Omega)\, d\,\Omega^2 \}$$

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Liouville   Reference metric

Liouville Dynamics

$$c_L + c_M = 0$$

$$L = - c \sqrt{\hat{g}} \left\{ \hat{\Delta} U \; \hat{\Delta} U + \hat{R} U \right\}$$

$$+ \lambda \sqrt{\hat{g}} \; e^{2U}$$

Liouville with negative c has a classical solution. The geometry is a 2-sphere:

$$e^{2U} = \lambda^{-1}$$

or

$$e^{T} = \sqrt{\lambda}$$

λ is a Lagrange multiplier that scans time.

The central charge c_M computed by (FSSY, SS)

$$c_M = H_A^{-2}$$

$$= S_A$$

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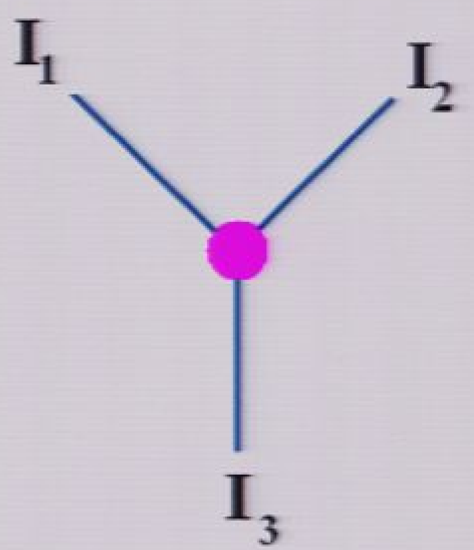
Liouville and Matrices

M^I_{ab} = a collection of NXN matrices labeled by a "flavor" index I that runs from 1 to n.

$$\int e^{-\mathrm{Tr}\,\{MM + V(M)\}}\, dM$$

Expand in powers of V → Feynman diagram.



Limit $N \rightarrow \infty$ gives planar graphs. This is Liouville coupled to "matter" with c related to the number and couplings of the flavors.