

Title: Walls on a brane

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Abstract: TBA

WALLS ON A BRANE

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y O. PUJOLAS.



KNOWN

KNOWNNS

@ Hierarchy

KNOWNS.

② Hierarchy

$$\left(\frac{T}{6M^1}\right)^2 = \frac{1}{e^2}$$

KNOWNS

② Hierarchy

$$\left(\frac{T}{GM^1}\right)^2 = \frac{1}{e^2} \Rightarrow \text{flat 4D}$$

KNOWNS

② Hierarchy
 $\left(\frac{T}{6M^1}\right)^2 = \frac{1}{e^2} \Rightarrow \text{flat 4D}$

③ detuned RS.

KR \rightarrow mass gap

KNOWNNS

⑩ Hierarchy

$$\left(\frac{T}{6M^4}\right)^2 = \frac{1}{e^2} \Rightarrow \text{flat 4D}$$

⑪ detuned RS.

KR \rightarrow man gap

hep-th/0601218

KNOWNNS

⑩ Hierarchy
 $\left(\frac{T}{6M^4}\right)^2 = \frac{1}{e^2} \Rightarrow \text{flat 4D}$

⑪ detuned RS.

KR \rightarrow man gap

hep-th/0601218

⑫ CFT dual.

KNOWNNS

⊗ Hierarchy
 $\left(\frac{T}{6M^4}\right)^2 = \frac{1}{\ell^2} \rightarrow \text{flat 4D}$

⊗ detuned RS.

KR \rightarrow man gap
hep-th/0601218

⊗ CFT def.

UNKNOWNNS

⊗ BH's

KNOWNNS

⑩ Hierarchy
 $\left(\frac{T}{6M^4}\right)^2 = \frac{1}{e^2} \Rightarrow \text{flat 4D}$

⑪ detuned RS.
KR \rightarrow man gap
hep-th/0601218

⑫ CFT dual.

UNKNOWNNS @ BH's

\rightarrow stability

KNOWNNS.

① Hierarchy
 $\left(\frac{T}{6M^4}\right)^2 = \frac{1}{\ell^2} \Rightarrow \text{flat 4D}$

② detuned RS.
KR \rightarrow man gap
hep-th/0601218

③ CFT dual.

UNKNOWNNS @ BH'S

\rightarrow stability

④ IDW'S

KNOWNNS.

⊗ Hierarchy
 $\left(\frac{T}{6M^4}\right)^2 = \frac{1}{e^2} \Rightarrow \text{flat 4D}$

⊗ detuned
KR \rightarrow moduli
hep-th/0008097

⊗ CFT

UNKNOWNNS @ BH'S

\rightarrow stability

⊗ DW'S

- exact
- radiative

Plan

① Exact DW Solution
↪ diff's w/ 4D

②

Plan

- ① Exact DW Solution
↳ diff's w/ 4D
- ② Singularity will appear.
- ③ CFT radiative corr

Prelude DW in 4D

$$\sigma \rightarrow H$$

$$H_0 = \frac{\sigma}{4M_{pl}^2}$$

Prelude DW in 4D

$$\sigma \rightarrow H$$

$$H = \frac{\sigma}{4M_{\text{pl}}^2}$$

$$ds_{\text{ext}}^2 = d\xi^2 + R^2(\xi) ds_{\text{int}}^2$$

Prelude DW in 4D

$$\sigma \rightarrow +1$$

$$H_0 = \frac{\sigma}{4M_{\text{pl}}^2}$$

$$ds_{\text{eff}}^2 = d\xi^2 + R^2(\xi) \underbrace{ds_3^2}_{ds_3^2}$$

$$R(\xi) = |\xi| - \frac{1}{H}$$

$$S = \int_{AdS_4} d^4x \sqrt{g} \left(\frac{M^2 R^{(4)}}{2} - \Lambda \right) + \int_{brane} d^4x \sqrt{|g|} \mathcal{L} + \int_{ZW} d^4x \sqrt{|g|} \mathcal{L}$$

$$S = \int_{AdS_4} d^4x \sqrt{g} \left(\frac{M^2 R^2}{2} - \frac{1}{e} \right) + \int_{brane} d^4x \sqrt{-\gamma} \mathcal{T} + \int_{DW} d^4x \sqrt{-\gamma} \mathcal{G}$$

⊙ for from DW

$$S = \int d^4x \sqrt{g} \left(\frac{M^2 R^2}{2} - \Lambda \right) + \int d^4x \sqrt{g} \mathcal{L}_F + \int d^4x \sqrt{g} \mathcal{L}_G$$

for from DW

$$ds^2 = f(r) dt^2 + \frac{dr^2}{f(r)} + R^2 ds^2_{k=0,1,-1}$$

brane (Z, R)

$$ds_4 = \left[f(\varrho) z'^2 + \frac{R'^2}{f(\varrho)} \right] d\xi^2 + R^2 ds_n^2$$



Prelude DW in 4D

$$G \rightarrow H$$

$$H_0 = \frac{G}{4M_{\text{pl}}^2}$$

$$ds_{\text{eff}}^2 = d\xi^2 + R^2(\xi) \underbrace{ds_{\text{K}}^2}_{ds_3^2}$$

$$R(\xi) = |\xi| - \frac{1}{H}$$

base (Z, R)

$$ds_1 = \underbrace{\left[f(\theta) z'^2 + \frac{R'^2}{f(\theta)} \right]}_{\text{bracketed term}} d\theta^2 + R^2 ds_n^2$$

brane (Z, R)

$$ds_4 = \underbrace{\left[f(r) z'^2 + \frac{R'^2}{f(r)} \right]}_{=1} d\zeta^2 + R^2 ds_n^2$$

$$K_{\mu\nu} = \frac{1}{2M^2} (T_{\mu\nu} - \frac{1}{2} T_{\mu\nu})$$

brane (Z, R)

$$ds_4 = \underbrace{\left[f(\varrho) z'^2 + \frac{R'^2}{f(\varrho)} \right]}_{=1} d\zeta^2 + R^2 ds_n^2$$

$$K_{\mu\nu} = \frac{1}{2M^2} (T_{\mu\nu} - \frac{1}{2} T g_{\mu\nu})$$

- along DW $2M^2 \frac{\sqrt{f(\varrho) \cdot R'^2}}{R} = \frac{T}{3}$

- (ξ, ξ)

Δ

brane (Z, R)

$$ds_4 = \underbrace{\left[f(r) z'^2 + \frac{R'^2}{f(r)} \right]}_{=1} d\xi^2 + R^2 ds_n^2$$

$$K_{\mu\nu} = \frac{1}{2M^2} (T_{\mu\nu} - \frac{1}{2} T g_{\mu\nu})$$

- along DW $2M^2 \frac{\sqrt{f(r) \cdot R'^2}}{R} = \frac{T}{3}$

- (ξ, ξ)



Δ orthon $\frac{R'}{\sqrt{f(r) \cdot R'^2}} = \frac{g}{2M^2}$

brane (Z, R)

$$ds_4 = \left[f(\rho) z'^2 + \frac{R'^2}{f(\rho)} \right] d\xi^2 + R^2 ds_{S^2}^2$$

brane

$$K_{\mu\nu} = \frac{1}{2M^2} (T_{\mu\nu} - \frac{1}{2} T_{\alpha\alpha} \eta_{\mu\nu})$$

- along DW

- (ξ, ξ)



$2M$

$$\frac{R'^2}{R} = \frac{2}{3} M$$

$$\frac{R'}{\sqrt{f(\rho)}} = \frac{6}{2/3} M$$

AdS_5

AdS_5



brane (Z, R)

$$ds_4 = \left[f(r) z'^2 + \frac{R'^2}{f(r)} \right] d\xi^2 + R^2 ds_2^2$$

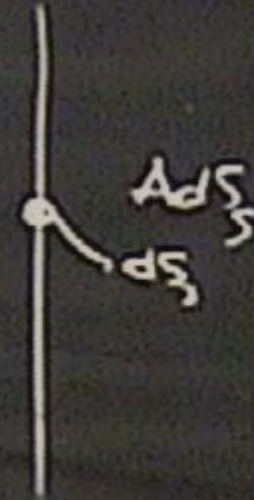
$$K_{\mu\nu} = \begin{pmatrix} -1 \\ T_{\mu\nu} \end{pmatrix}$$

DW

$$2M' \frac{\sqrt{f(r) \cdot R'^2}}{R} = \frac{7}{3}$$

$$\Delta_{\text{orizon}} = \frac{R'}{\sqrt{f(r) \cdot R'^2}} = \frac{9}{2M}$$

brane



brane (Z, R)

$$ds_4 = \left[f(\rho) z'^2 + \frac{R'^2}{f(\rho)} \right] d\xi^2 + R^2 ds_{S^2}$$

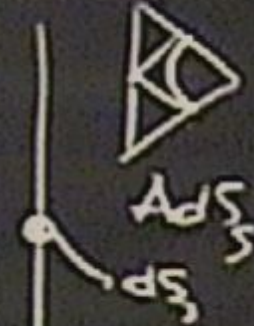
$$K_{\mu\nu} = T_{\mu\nu} - \frac{1}{2} T g_{\mu\nu}$$

DW

$$2M' \frac{\sqrt{f(\rho) \cdot R'^2}}{R} = \frac{2}{3}$$

$$\Delta_{\text{orizon}} = \frac{R'}{\sqrt{f(\rho) \cdot R'^2}} = \frac{9}{2M}$$

brane



AdS₅

AdS₅

ds₃

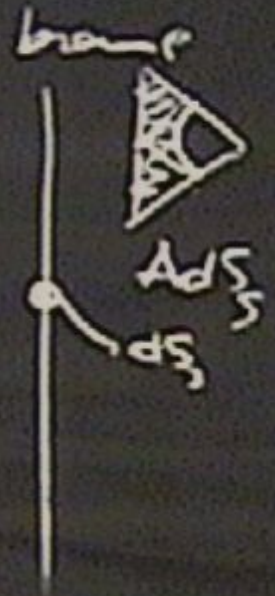
brane (Z, R)

$$ds_4 = \left[f(r) z'^2 + \frac{R'^2}{f(r)} \right] d\xi^2 + R^2 ds_2^2$$

$$K_{\mu\nu} = \frac{1}{2l} \begin{pmatrix} 1 & \\ & -1 \end{pmatrix} \begin{pmatrix} 1 \\ 1 \end{pmatrix} \begin{pmatrix} 1 \\ 1 \end{pmatrix}$$

$$2M' \frac{\sqrt{f(r) \cdot R'^2}}{R} = \frac{7}{3}$$

$$\Delta_{orizon} = \frac{R'}{\sqrt{f(r) \cdot R'^2}} = \frac{9}{2M}$$



$$R(s) = 131 - \frac{1}{s}$$

$$R(s) = B \cdot \frac{1}{A}$$

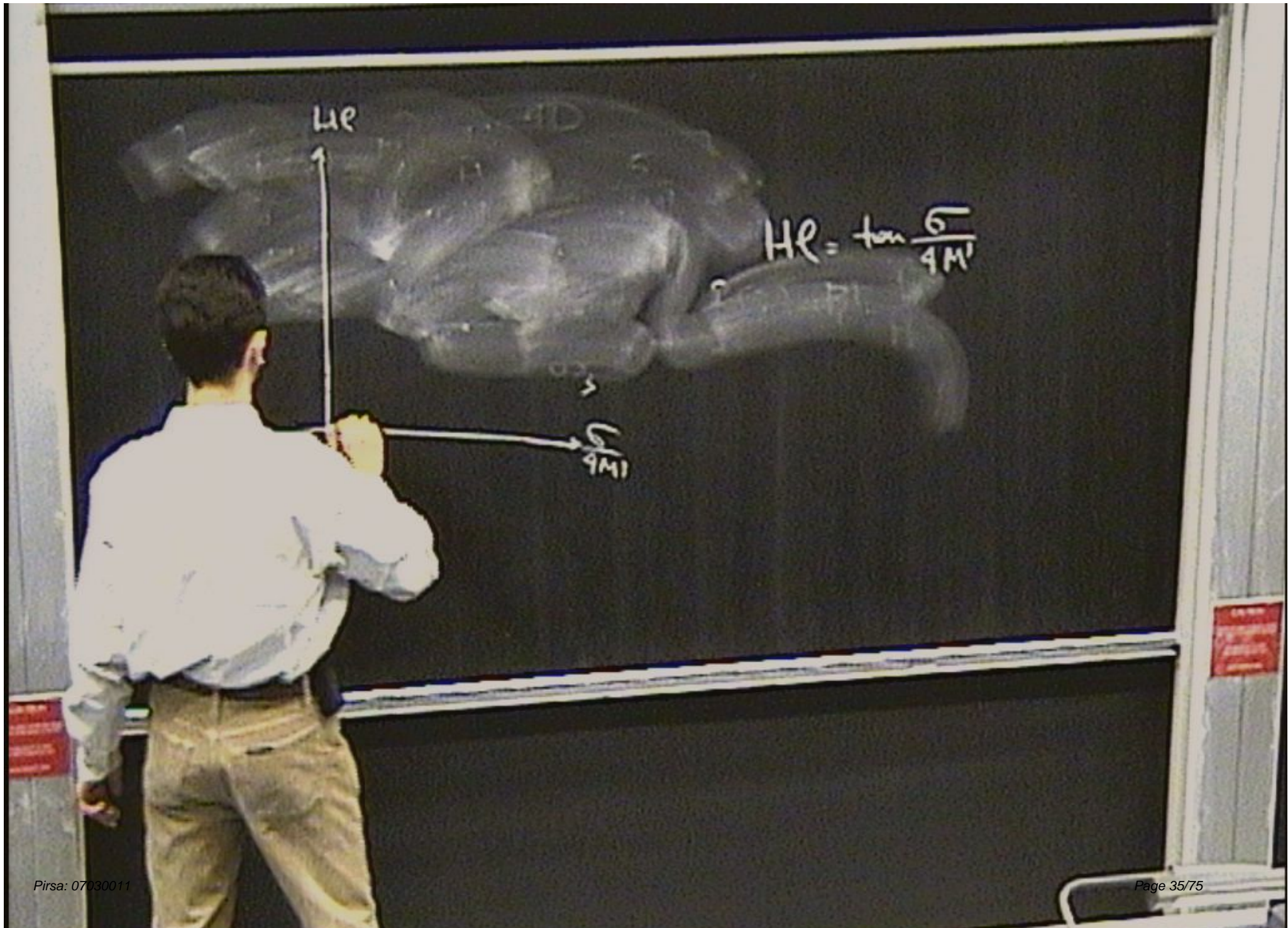
action $\frac{|R'|}{\sqrt{f(R) - R'^2}} = \int \dots$ $HR =$

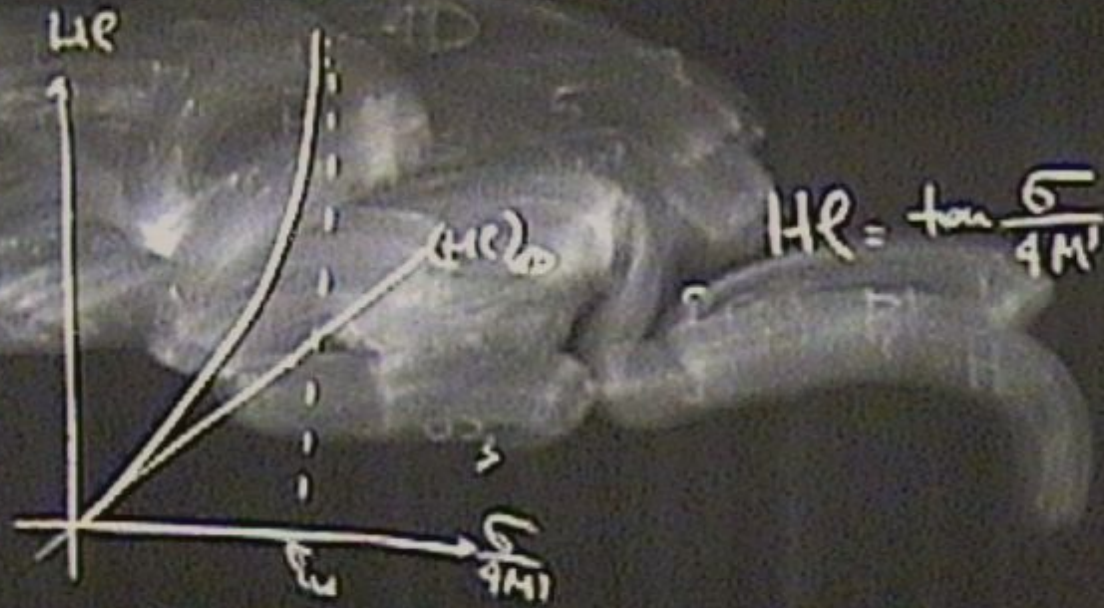
$$R(s) = 131 - \frac{1}{s}$$

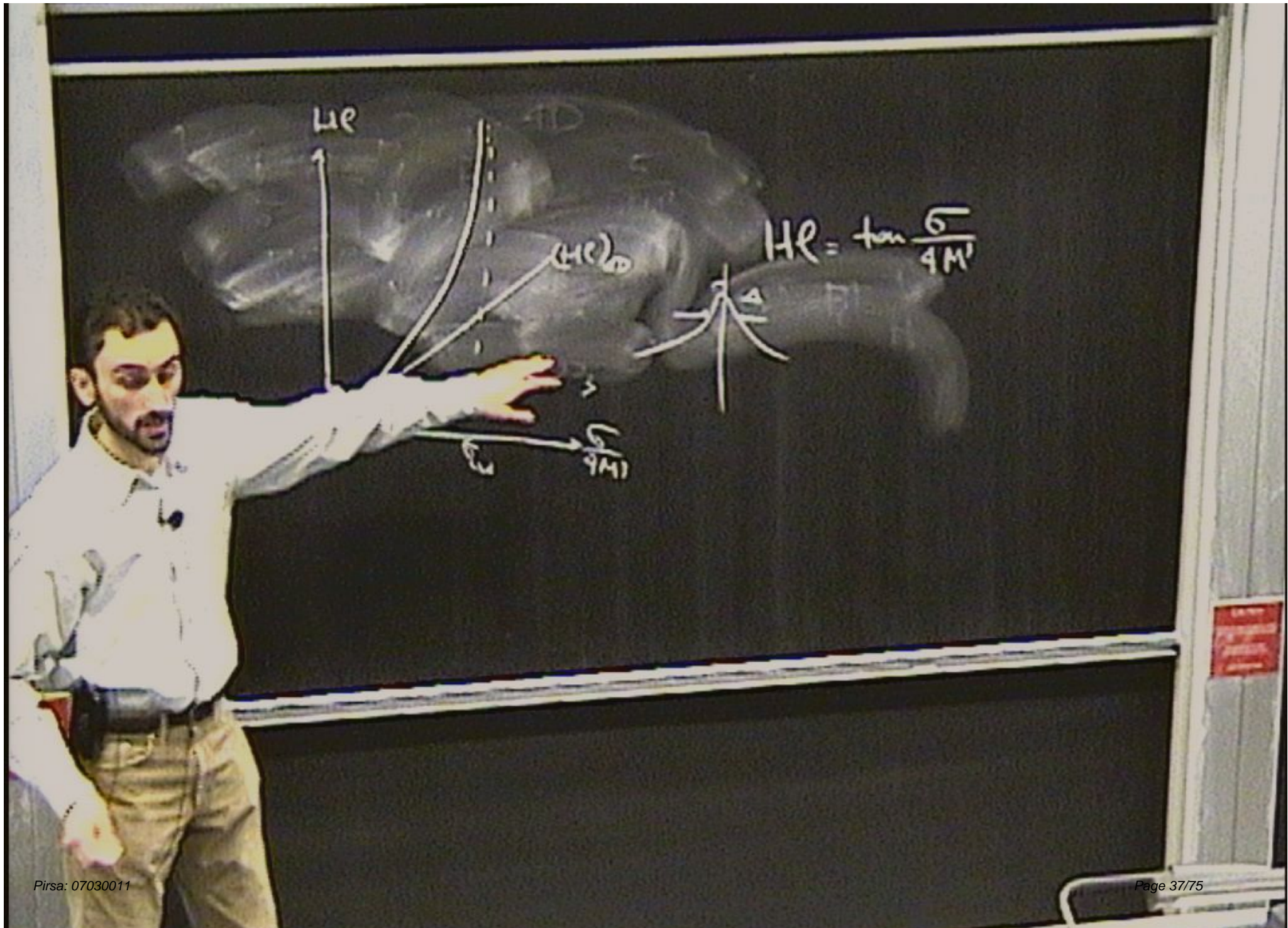
acton

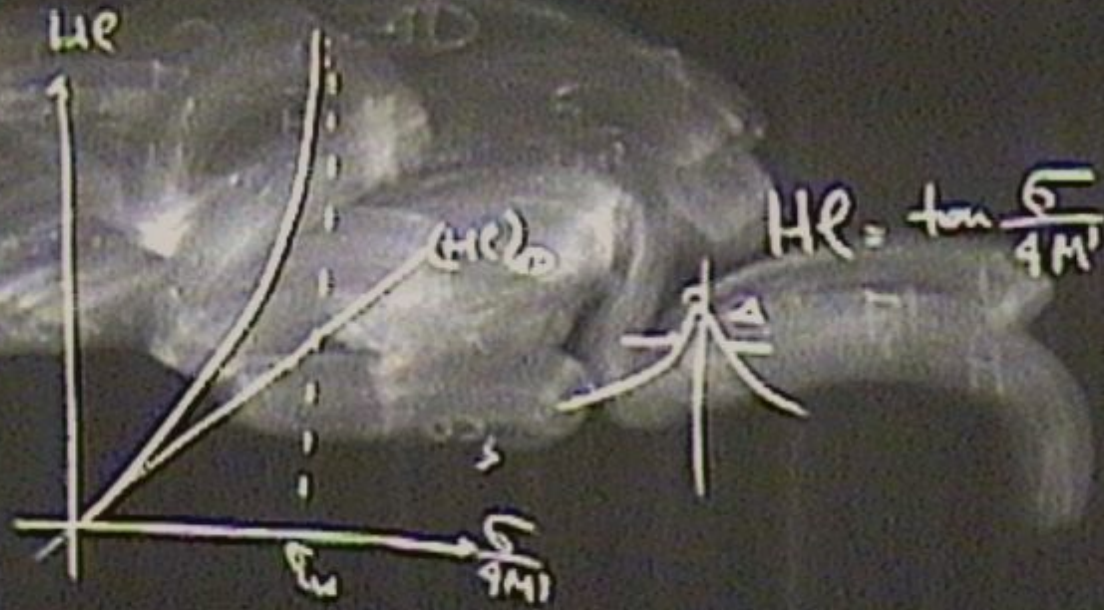
$$\frac{|R'|}{\sqrt{f(R) - R^2}} = \frac{6}{4M}$$

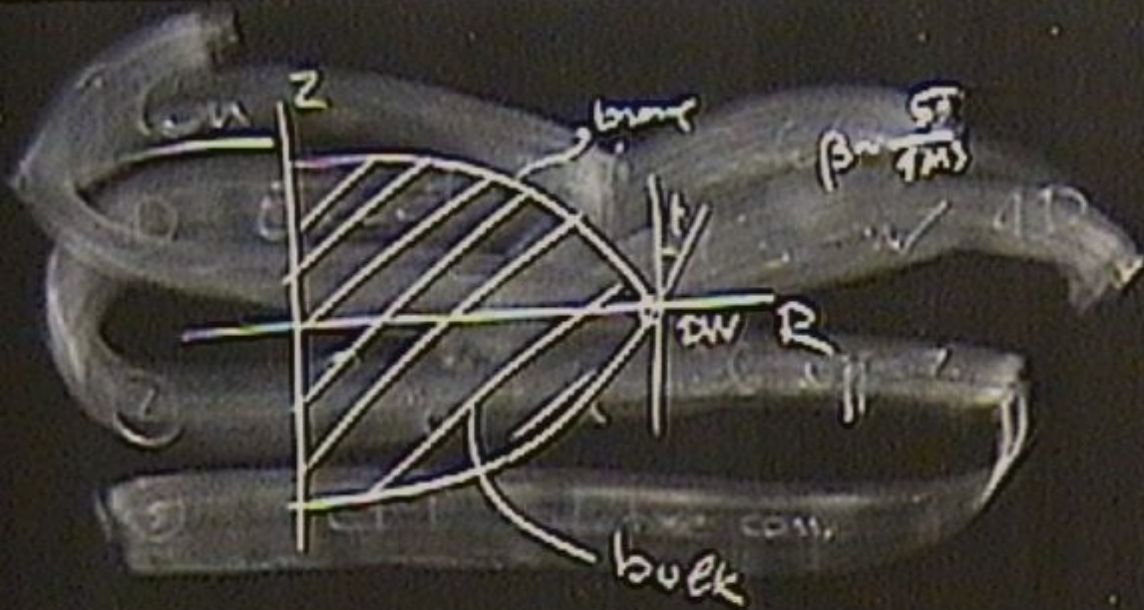
$$HR = \tan \frac{6}{4M}$$

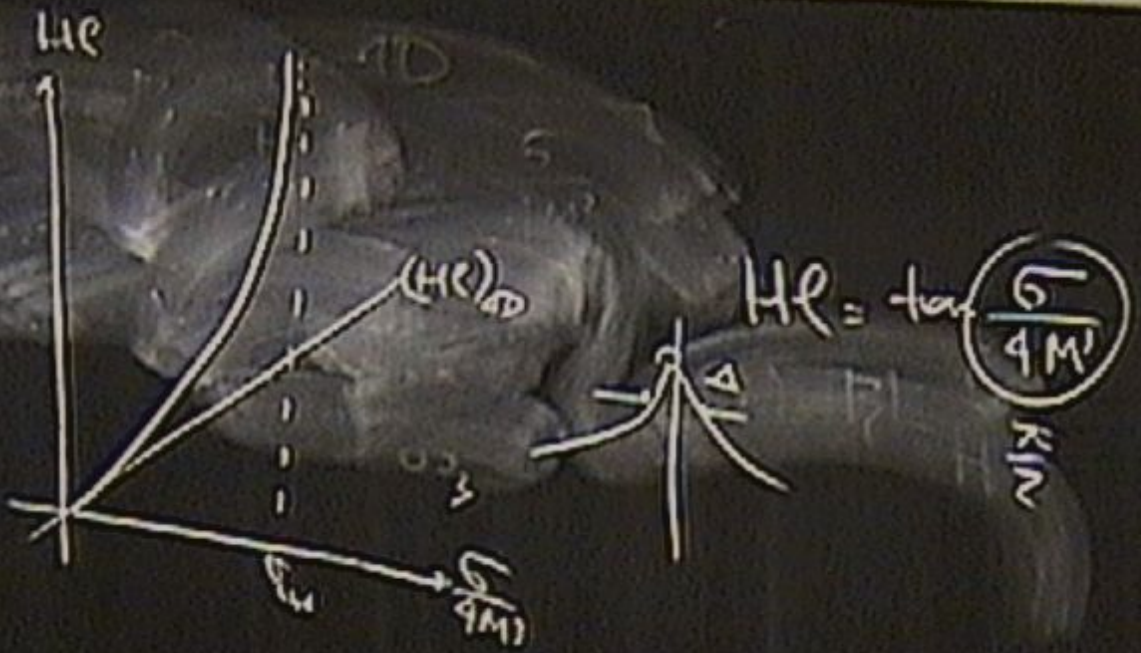


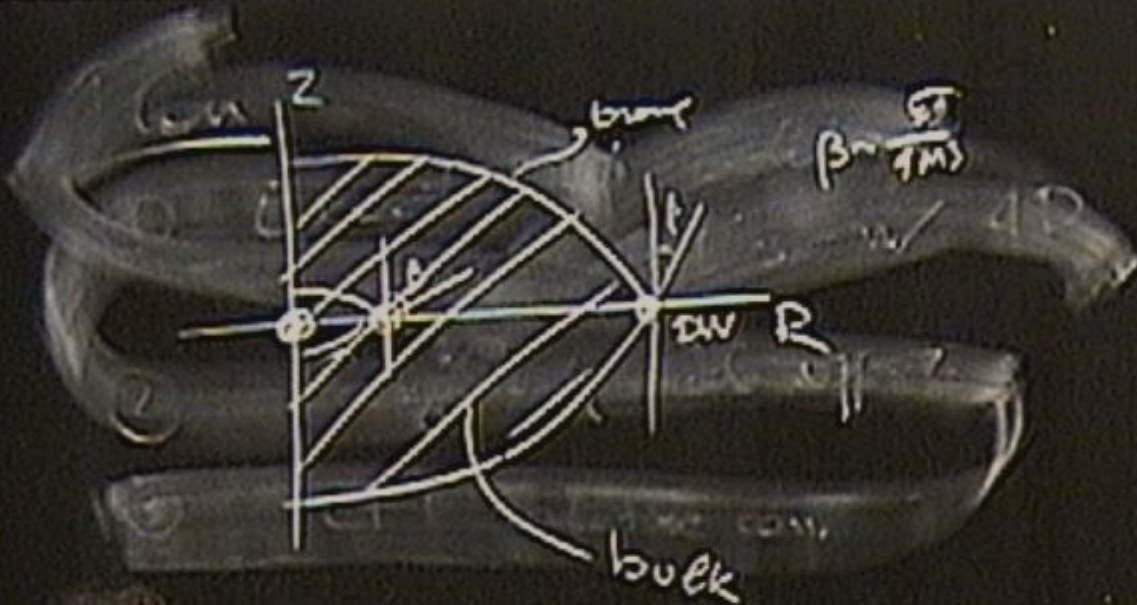












RSII \longleftrightarrow CFT w/ Λ coupled gravity
 $N^2 \gg 4$



RSII \longleftrightarrow CFT w/ Λ coupled gravity,
 $N^2 \gg 4$

$$H_E = -\text{tr} \frac{\mathcal{G}}{4M^2} \rightarrow \frac{\mathcal{G}}{4M^2} = \text{action HE}$$
$$\sim \text{HE} \left(1 - \frac{1}{3} (\text{HE})^2 \right)$$

RS II \longleftrightarrow CFT w/ Λ coupled gravity
 $N^2 \gg 4$

$$H_E = -\tan \frac{\phi}{4M^2} \rightarrow \frac{\phi}{4M^2} = \text{outgoing } H_E$$
$$\sim H_E \left(1 - \frac{1}{3} (H_E)^2 \right)$$

\updownarrow
 \mathcal{O}

Duff-Lio



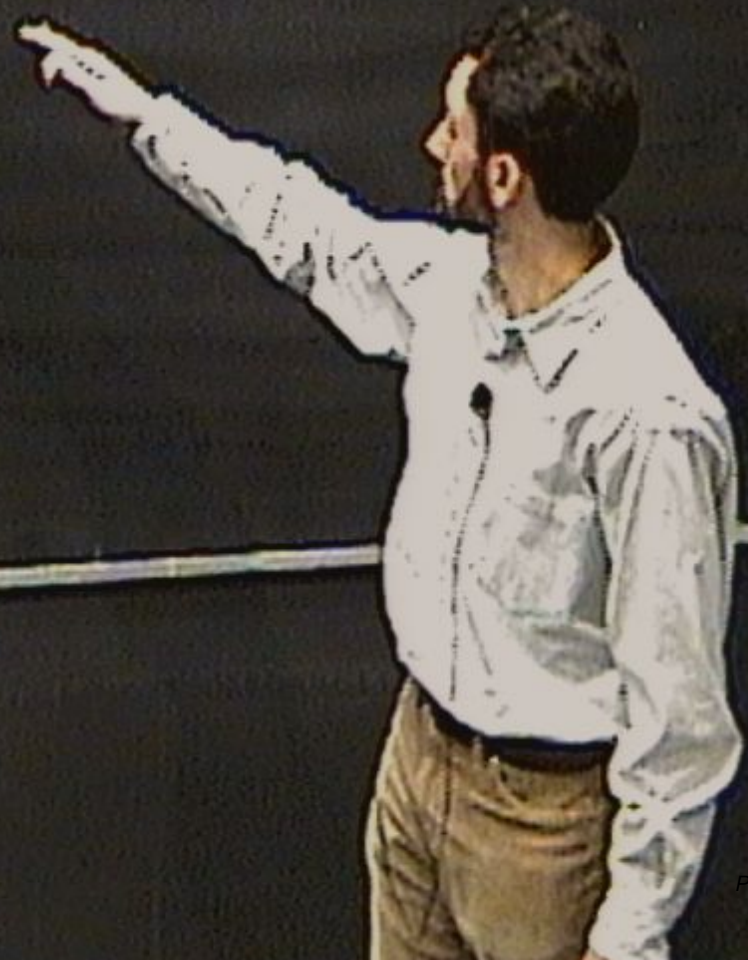
Duff-Liu

$$\min + \max$$



Duff-Liu

$$\dot{T}_{\text{tot}} = \sigma \begin{pmatrix} 1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 0 \end{pmatrix} \delta(p) \delta''(\vec{p})$$



Duff-Liu

$$\dot{T}_{\mu\nu} = \sigma \begin{pmatrix} 1 & & & \\ & -1 & & \\ & & -1 & \\ & & & 0 \end{pmatrix} \delta(\rho) \delta''(\tilde{r})$$

$$g_{prop}^{2d} = \text{det } g_{prop} \leftarrow 16\pi G_H \left(2\pi_2(\rho) \hat{T}_{\mu\nu} + \pi_1(\rho) g_{\mu\nu} \hat{T}_a \right)$$

Duff-Liu

$$\hat{T}_{\mu\nu} = \sigma \begin{pmatrix} 1 & & & \\ & -1 & & \\ & & -1 & \\ & & & 0 \end{pmatrix} \delta(\rho) \delta^{(3)}(\vec{r})$$

$$g_{\rho\rho} = \text{det } g_{\mu\nu} = -16\pi G_N \left(2\pi_2(\rho) \hat{T}_{\mu\nu} + \pi_1(\rho) g_{\mu\nu} \hat{T}_a^a \right)$$

$$\pi_1(\rho) = 32\pi G_N \left[a_1 \ln \frac{\rho^2}{\rho_0^2} + b_1 \right]$$

$$2\pi_2 T_{\text{...}} \quad \pi, T_{\text{...}}^{\alpha} / \dots$$

$$\delta g_{ab} = \int_{\text{...}} (2\pi_{ab} - 3\pi_a) \delta \bar{\rho}$$

$2\pi_2 T_{\text{...}} \pi, T_{\text{...}}^{\alpha}$
 $\delta_{\text{...}} \cdot \text{...} (2\pi_2 \pi_1) \delta(\bar{p})$
 $\delta_{\text{...}} = - \frac{1}{\pi} \pi, \delta(\bar{p})$



$$\begin{aligned}
 & 2\pi_\mu T_{\mu\nu}^\alpha \quad \pi, T_{\mu\nu}^\alpha \text{ / } \mu \\
 & \delta g_{\mu\nu} = \int_{\text{vol}} (2\pi_\mu \pi_\nu) \delta \bar{\phi} \rightarrow \frac{6^2 \delta}{2} \\
 & \delta g_{\mu\nu} = -\frac{2}{3} \pi_\mu \delta \bar{\phi} \rightarrow \beta
 \end{aligned}$$

$$\begin{aligned}
 & 2\pi_2 T_{\text{center}} \quad \pi, T_{\text{center}} / \pi \\
 & \delta g_{\text{oh}} = \int_{\text{oh}} (2\pi_2 \pi_1) \delta \delta(\bar{p}) \rightarrow \beta \frac{G^2 \sigma}{2} \\
 & \delta g_{\text{zz}} = - \int \pi_1 \delta \delta(\bar{p}) \rightarrow \beta \frac{G^2 \sigma}{2}
 \end{aligned}$$



$$\begin{aligned}
 & 2\pi_2 T_{\text{...}} \quad \pi, T_{\text{...}} \\
 & \delta g_{00} = \int_{\text{...}} (2\pi_2 \pi_1) \delta \delta(\bar{p}) \rightarrow \frac{G^2 \delta}{2} \\
 & \delta g_{22} = - \frac{2}{\pi} \pi_1 \delta \delta(\bar{p}) \rightarrow \beta \frac{G^2 \delta}{2} \sim \frac{1}{2}
 \end{aligned}$$



$$\begin{aligned}
 & 2\pi_\mu T_{\mu\nu} = \pi_\mu T_{\nu\mu} \\
 & \delta g_{\mu\nu} = \int_{\text{vol}} (2\pi_\mu \pi_\nu) \delta \bar{\rho} \rightarrow \frac{G^2 \bar{\rho}}{2} \\
 & \delta g_{\mu\nu} = - \frac{2}{\beta} \pi_\mu \delta \bar{\rho} \rightarrow \beta \frac{G^2 \bar{\rho}}{2} \sim \frac{1}{2}
 \end{aligned}$$

RSII \leftrightarrow CFT $\forall \Lambda$ coupled grav. te,
 $N^2 \gg 4$

$$H_E = \tan \frac{\phi}{4M^2} \Rightarrow \frac{\phi}{4M^2} = \text{out on } H_E$$
$$\sim H_E \left(1 - \frac{1}{3} (H_E)^2 \right)$$

\updownarrow
 \emptyset

$$\begin{aligned}
 & 2\pi, T_{\text{...}} \quad \pi, T_{\text{...}} \\
 & \delta g_{01} = \gamma_{01} (2\pi_{01} - 3\pi_{10}) \delta \bar{\rho} \rightarrow \frac{6^2 \delta}{2} \\
 & \delta g_{22} = -\frac{2}{\beta} \pi_{22} \delta \bar{\rho} \rightarrow \beta \frac{6^2 \delta}{2} \sim \frac{1}{2}
 \end{aligned}$$



$$J \sim -4 \frac{R''}{R'} - 4 \frac{D' R''}{R'}$$

$$g \sim -4 \frac{R'}{R^2} + 4 \frac{R' R''}{R^3}$$

$$\Delta = \frac{4}{3} \frac{H_1}{H_2^2} \quad \frac{1}{H_2^2} = 8 \pi G K_1 = \frac{k_1}{M_{pl}^2}$$

$$g \sim -4 \frac{R^0}{R^1} + 4 \frac{R^{12} R^{11}}{R^1}$$

$$\Delta = \frac{4}{3} \frac{H^1}{H^2}$$

$$- \frac{1}{3} (He)^2$$

$$\frac{1}{H^2} \cdot B_n G K_1 = \frac{k_1}{H^2}$$



$$g \sim -4 \frac{R''}{R'} + 4 \frac{D' R''}{R'}$$

$$\Delta = \frac{4}{3} \frac{H'}{H} - \frac{1}{12} B_n G K_1 = \frac{k_1}{M_{42}}$$

$$-\frac{1}{3} (H_2)$$



$$Q = E_{(1)} + I_{(1)}$$

$$g \sim -4 \frac{R'}{R^2} + 4 \frac{R'' R'}{R^3}$$

$$\Delta = \frac{4}{3} \frac{H'}{H^2}$$

$$-\frac{1}{3} (H\epsilon)^2$$

$$\frac{1}{H^2} \cdot 8\pi G K_1 = \frac{k_1}{M_{pl}^2}$$

$$\left[\frac{1}{3} - \frac{1}{3} \right]$$

$$Q = E_{(1)} + \frac{I}{(1)}$$

$$g \sim -4 \frac{R^0}{R^1} \cdot 4 \frac{R^{12} R''}{R^1}$$

$$\Delta = \frac{4}{3} \frac{H^1}{H^2}$$

$$-\frac{1}{3} (He)^2$$

$$\frac{1}{H^2} \cdot B_n G K_1 = \frac{k_1}{H^2}$$

$$\left[\frac{1}{3} - \frac{1}{3} \right]$$

$$Q = E_{41} + \frac{1}{3}$$

$$g \sim -4 \frac{R^0}{R^1} + 4 \frac{R'^0 R''}{R^1}$$

$$\Delta = \frac{4}{3} \frac{H^1}{H^2}$$

$$-\frac{1}{3} (He)^2$$

$$\frac{1}{H^2} \cdot B_n G K_1 = \frac{k_1}{H^2}$$



$$Q = E_{(1)} + \cancel{F_{(1)}}$$

RSI \longleftrightarrow CFT w/ Λ coupled gravity
 $N^2 \ll 4$

$$H_E = \tan \frac{G}{4M^2} \rightarrow \frac{G}{4M^2} = \text{outgoing } H_E$$
$$H_E \ll 1 \quad \sim H_E \left(1 - \frac{1}{3} (c_H \eta^2)\right)$$

\downarrow
 \mathcal{O}

RSII \longleftrightarrow CFT w/ Λ coupled gravity,
 $N^2 \gg 4$

$$\underline{HE} = \tan \frac{\mathcal{G}}{4M^2} \rightarrow \frac{\mathcal{G}}{4M^2} = \text{order HE}$$

$$HE \ll 1$$

$$\sim HE \left(1 - \frac{1}{3} (HE)^2 \right)$$

$$\frac{\mathcal{G}}{4M^2} = +1 \left(1 + (HE)^2 + (HE)^4 + \dots \right)$$

$$2\pi_2 T_{\mu\nu} + \pi, T_{\mu\nu} \gamma_{\mu\nu}$$

$$\delta g_{ab} = \gamma_{ab} (2\pi_{\mu\nu} \delta x^\mu) \delta x^\nu \rightarrow \frac{G^2 \delta}{2}$$

$$\delta g_{\mu\nu} = -\frac{2}{\gamma} \pi, \delta x^\mu \delta x^\nu \rightarrow \beta \frac{G^2 \delta}{2} \sim \frac{1}{2}$$

$$\sigma = \frac{R^{411}}{M_{pl}^{2n-2}}$$

$$2\pi_\mu T_{\mu\nu} = \pi_\mu T_{\nu\alpha} \gamma_{\alpha\mu}$$

$$\delta g_{ab} = \gamma_{ab} (2\pi_\mu \delta x^\mu) \delta \delta(\bar{p}) \rightarrow \frac{G^2 \delta}{2}$$

$$\delta g_{22} = -\frac{2}{\gamma} \pi_\mu \delta \delta(\bar{p}) \rightarrow \beta \frac{G^2 \delta}{2} \sim \frac{1}{2}$$

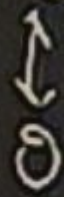
$$\sigma = \frac{R^{m+1}}{M_{pl}^{2m-2}} \sim (H/e)^{m+1}$$

RSII \longleftrightarrow CFT v/\wedge coupled grav. $N^2 \gg 4$

$$\text{HE} = \tan \frac{\mathcal{G}}{4M^2} \rightarrow \frac{\mathcal{G}}{4M^2} = \text{out HE}$$

$$\text{HE} \leftarrow \sim \text{HE} \left(1 - \frac{1}{3} (\text{HE})^2 \right)$$

$$\frac{\mathcal{G}}{4M^2} = +1(1, \dots)$$



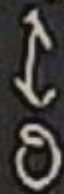
RSII \leftrightarrow CFT v/\wedge uncoupled gravity,
 $N^2 \gg 4$

$$\underline{HE} = \tan \frac{\zeta}{4M^2} \rightarrow \frac{\zeta}{4M^2} = \text{out-in HE}$$

$$HE \ll 1$$

$$\sim HE \left(1 - \frac{1}{3} (HE)^2 \right)$$

$$\frac{\zeta}{4M^2} = +1 \left(1 + (HE)^2 + (HE)^4 + \dots \right)$$



$$2\pi_2 \text{ ...}$$

$$Q_{\mu\nu, \alpha\beta, \gamma\delta} \delta g_{ab} = \gamma_{ab} (2\pi_{ab} - 3\pi_{ab}) \delta \delta(\bar{p}) \rightarrow \frac{1}{2}$$

$$\delta g_{\alpha\beta} = -\frac{2\pi_{\alpha\beta} \delta \delta(\bar{p})}{\dots} \rightarrow \beta \frac{G^2 \delta}{2} \sim \frac{1}{2}$$

$$\sigma = \frac{R^{m+1}}{M_{pl}^{2m-2}} \sim (H e^{\frac{2}{m+1}})^{m+1}$$

$$-(R) \cdot 2 = \frac{R^2}{e^2} - \frac{R^2}{R^2}$$

217_2 $\delta g_{ab} = \gamma_{ab} (2\pi_{ab} - 3\pi_{,a}) \delta \delta(\bar{\rho}) \rightarrow \frac{1}{2} \frac{G^2 \delta}{2} \sim \frac{1}{2}$
 $\delta g_{ab} = -\frac{2}{3} \pi_{,a} \delta \delta(\bar{\rho})$

$$\mathcal{D} = \frac{R^{(m+1)}}{M_{pl}^{2m-2}} \sim (H e^{\frac{2}{m+1}})$$

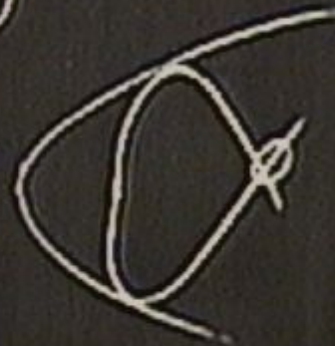
$$-(R) \cdot 1 = \frac{R^2}{e^2} = \frac{R^2}{M_{pl}^2}$$



$21 \frac{1}{2}$
 $\delta g_{ab} = \eta_{ab} (2\pi_{ab} - 3\pi_{ab}) \delta \bar{\rho} \rightarrow \frac{10}{2}$
 $\delta g_{33} = -\frac{3}{1} \pi_{ab} \delta \bar{\rho} \rightarrow \beta \frac{G^2 \delta}{2} \sim \frac{1}{2}$

$$\mathcal{D} = \frac{R^{4n+1}}{M_{pl}^{2n-2}} \sim (H e)^{2(n+1)}$$

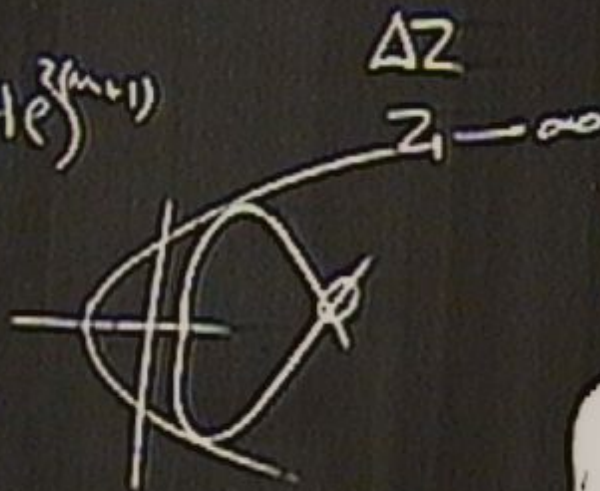
$$-(R) \cdot 1 = \frac{R^2}{e^2} - \frac{R^2}{R^2}$$



$21 \frac{1}{2}$
 $\delta g_{00} = \eta_{00} (2\pi \omega - 3\pi_1) \delta \delta(\bar{p}) \rightarrow \frac{1}{2}$
 $\delta g_{zz} = -\frac{3}{2} \pi_1 \delta \delta(\bar{p}) \rightarrow \beta \frac{G^2 \delta}{2} \sim \frac{1}{2}$

$$\mathcal{D} = \frac{R^{m+1}}{M_{pl}^{2m-2}} \sim (H e^{\frac{2}{m+1} \Delta z})$$

$$-(R) \cdot 1 = \frac{R^2}{e^2} - \frac{R^2}{R^2}$$



$$21 \frac{1}{2} \text{ } \dots$$

$$0, \frac{1}{2}, 1, 2 \quad \delta g_{ab} = \eta_{ab} (2n_{a-1} - 3n_a) \delta \delta(\bar{\rho}) \rightarrow \frac{1}{2}$$

$$\delta g_{33} = - \frac{2}{3} n_3 \delta \delta(\bar{\rho}) \rightarrow \beta \frac{G^2 \delta}{2} \sim \frac{1}{2}$$

$$\mathcal{D} = \frac{R^{4n+1}}{M_{pl}^{2n-2}} \sim (H e^{\frac{2}{M_{pl}} \phi})^{2(n+1)}$$

$$-(R) \cdot 1 = \frac{R^2}{e^2} - \frac{R^2}{R^2}$$

