

Title: The Central Charge of AdS2 Gravity

Date: Nov 12, 2007 11:00 AM

URL: <http://pirsa.org/07110026>

Abstract: TBA

Q G on AdS_3 radius of curv. ℓ

$$[L_n, L_m] = (n-m)L_{m+n} + (m^2 - m)\frac{\ell^2}{12} \delta_{m+n}$$

Q G on AdS_3 radius of curv. ℓ

$$[L_n, L_m] = (n-m)L_{m+n} + (m^2 - n^2) \frac{c}{12} \delta_{m+n}$$

$$c = \frac{3\ell}{2G_3}$$

Q G on AdS_3 radius of curv. ℓ

$$[L_n, L_m] = (n-m)L_{m+n} + (m^2 - m) \frac{c}{12} \delta_{m+n}$$

$$c = \frac{3\ell}{2G_3}$$

Q G on AdS_3 radius of curv. ℓ

$$[L_n, L_m] = (n-m)L_{m+n} + (m^2 - n^2) \frac{c}{12} S_{(m+n)}$$

$$c = \frac{3\ell}{2G_3}$$

$$S = 2\pi\sqrt{\frac{cL_0}{6}}$$

G on AdS_3 radius of curv. ℓ

$$[L_n, L_m] = (n-m)L_{m+n} + (m^2 - n^2) \frac{c}{12} \delta_{m+n}$$

$$c = \frac{3\ell}{3G_3}$$

$$S = 2\pi \sqrt{\frac{cL_0}{6}} \\ = S_{BH}$$

Sim understanding of AdS_2

a) AdS_2 is universal factor in all ~~micro~~ extremal BH

b)

9. in understanding of AdS_2

a) AdS_2 is universal factor in all ~~extremal~~ extremal BH

b)

9. in understanding of AdS_2

a) AdS_2 is universal factor in all ~~near~~ extremal BH

b)

Sim understanding of AdS_2

a) AdS_2 is universal factor in all ~~near~~ extremal BH

b) AdS_2/CFT_1 $CFT_1 \stackrel{?}{=} CQM$

or $CFT_1 = \frac{1}{2} CFT_2 = \text{chiral } CFT_2$

Sim understanding of AdS_2

a) AdS_2 is universal factor in all ~~near~~ extremal BH

b) AdS_2/CFT_1 $\left\{ \begin{array}{l} CFT_1 = CQM \\ \text{or } CFT_1 = \frac{1}{2} CFT_2 = \text{chiral } CFT_2 \end{array} \right.$

Sim understanding of AdS_2

a) AdS_2 is universal factor in all ~~small~~ extremal BH

b) AdS_2/CFT_1 $CFT_1 \stackrel{?}{=} CQM$

→ or $CFT_1 \stackrel{?}{=} \frac{1}{2} CFT_2 = \text{chiral } CFT_2$

c) axiomatic Kerr

Sim understanding of AdS_2 $c=?$

c) AdS_2 in universal factor in all ~~near~~ extremal BH

b) AdS_2/CFT_1 $CFT_1 = CQM$

↳ or $CFT_1 = \frac{1}{2} CFT_2 = \text{chiral } CFT_2$

c) axiomatic Kerr

d)

Sim understanding of AdS_2 $c=?$

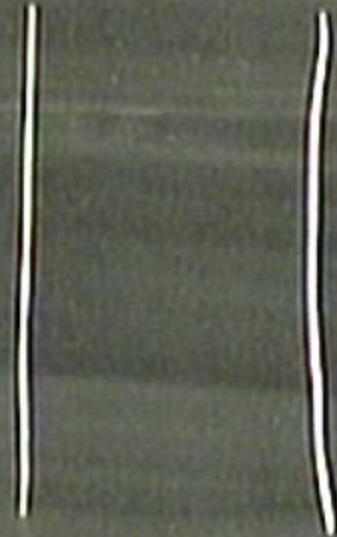
a) AdS_2 is universal factor in all ~~near~~ extremal BH

b) AdS_2/CFT_1 $CFT_1^? = CQM$

or $CFT_1^? = \frac{1}{2} CFT_2 = \text{chiral } CFT_2$

c) axiomatic Kerr

d) $2D \mathcal{G} = 2DCFT$
 $c=0$



Expect

$Ads_3 \xrightarrow{s'}$

~~Ads_3~~



Expect

$$\text{AdS}_3 \xrightarrow{S^1} \text{AdS}_2 + \text{KK electric field}$$

~~AdS³~~

Expect

$AdS_3 \xrightarrow{S^1} AdS_2 + KK \text{ electric field}$

~~AdS^3~~

$$C = \frac{3R}{2G}$$

CFT

$$1/C = ? \dots$$

Hartman

normal BH

schwarz $\neq \tau_2$

?

Hartman

normal BH

Guica

$\chi = \chi_1 \neq \chi_2$

Expect

$$\text{AdS}_3 \xrightarrow{S^1} \text{AdS}_2 + \text{KK electric field}$$

~~\mathbb{Z} AdS³~~

$$C = \frac{3\alpha}{2G} \text{ CFT}$$

$$1/C = ? \dots$$

Quica 5D

D=4 ME gravity

$$ds_4^2 = - \left(1 - \frac{\alpha}{r^2}\right) dt^2 + \frac{dr^2}{\left(1 - \frac{\alpha}{r^2}\right)^2} + r^2 d\Omega_2^2$$

$$= 1, \quad ds^2 \rightarrow \alpha^2 \left(-\frac{dt^2}{G^2} + d\Omega_2^2 \right) \quad A \rightarrow \frac{\alpha dt}{G}$$

Quica 5D

D=4 ME gravity

$$ds_4^2 = -\left(1 - \frac{\chi}{r^2}\right) dt^2 + \frac{dr^2}{\left(1 - \frac{\chi}{r^2}\right)^2} + r^2 d\Omega_2^2$$

$G_N = 1$, $ds^2 \rightarrow \chi^2 \left(-\frac{dt^2}{\chi^2} + \frac{d\chi^2}{\chi^2} + d\Omega_2^2 \right)$

$$\boxed{S_{BH} = \pi \chi^2}$$

$A \rightarrow \chi \frac{d\chi}{\chi}$

Quica 5D

D=4 ME gravity

$$ds_4^2 = - \left(1 - \frac{Q}{r}\right)^2 dt^2 + \frac{dr^2}{\left(1 - \frac{Q}{r}\right)^2} + r^2 d\Omega_2^2$$

$G_N = 1$, $ds_2^2 \rightarrow Q^2 \left(-\frac{dt^2}{G^2} + dG^2 \right)$

$$\boxed{S_{BH} = \pi Q^2}$$

$$\frac{1}{G_N^{(4)}} = 4\pi Q^3$$



Quica 5D

D=4 ME gravity

$$ds_4^2 = - \left(1 - \frac{Q}{r}\right)^2 dt^2 + \frac{dr^2}{\left(1 - \frac{Q}{r}\right)^2} + r^2 d\Omega_2^2$$

$G_N = 1$, $ds_2^2 \rightarrow Q^2 \left(-\frac{dt^2}{G^2} + dG^2 \right)$ ~~ds_2^2~~ $A \rightarrow \frac{Q dt}{G}$

$$\boxed{S_{BH} = \pi Q^2}$$

$$\frac{1}{G_N^{(4)}} = 4\pi Q^3,$$

$$ds_3^2 = \alpha^2 \left(-\frac{dt^2 + d\phi^2}{\alpha} \right) + \left(d\psi + \frac{\alpha dt}{6} \right)^2$$

$$ds^2 = \alpha^2 \left(-\frac{dt^2 + d\phi^2}{\alpha} \right) + \left(d\phi + \frac{g dt}{6} \right)^2$$

$$g \sim g + 4\pi$$

$$g = \frac{g}{\alpha}$$

$$g \sim g + \frac{4\pi}{\alpha}$$

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$$ds^2 = \alpha^2 \left(-\frac{dt^2}{\alpha^2} + d\phi^2 \right) + \left(d\psi + \frac{\alpha dt}{\alpha} \right)^2$$

$$\alpha \sim \alpha + 4\pi$$

$$\psi = \frac{\psi}{\alpha}$$

$$= \alpha^2 \left(\frac{d\phi^2}{\alpha^2} + \frac{dt + d\psi}{\alpha} + d\psi^2 \right) \quad \psi \sim \psi + \frac{4\pi}{\alpha}$$

↑
AdS₃

$$ds_3^2 = \alpha^2 \left(-\frac{dt^2}{\alpha^2} + d\phi^2 \right) + \left(d\psi + \frac{\alpha dt}{6} \right)^2$$

$$4 \sim 4 + 4\pi$$

$$4 = \frac{4}{\alpha}$$

$$= \alpha^2 \left(\frac{d\phi^2}{6^2} + \frac{dt + d\psi}{6} + d\psi^2 \right) \quad 4 \sim 4 + \frac{4\pi}{\alpha}$$



Ads₃

$$\frac{1}{G_3} = \frac{1}{G_2 4\pi} = \frac{1}{G_N^3} = \alpha^3$$

$$ds_3^2 = c^2 \left(-\frac{dt^2}{c^2} + dx^2 \right) + \left(dx + \frac{c dt}{c} \right)^2 \quad \text{Sohn=}$$

$$= c^2 \left(\frac{dx^2}{c^2} + \frac{dx + dx}{c} + dx^2 \right) \quad \begin{matrix} 4 \sim 4 + 4\pi \\ 4 = \frac{4}{c} \\ 4 \sim 4 + \frac{4\pi}{c} \end{matrix}$$

$$\frac{1}{c^2} = \frac{1}{c^2 \pi} = \frac{1}{c^2} = c^2 \quad ; c = \frac{3g}{2c_3} = \frac{3c^3}{2}$$

$$ds_3^2 = \alpha^2 \left(-\frac{dt^2 + d\phi^2}{\alpha} \right) + \left(d\psi + \frac{\alpha dt}{6} \right)^2$$

$$= \alpha^2 \left(\frac{d\phi^2}{6^2} + \frac{dt + d\psi}{6} + d\psi^2 \right) \quad \psi \sim \psi + 4\pi$$

$$\psi \sim \psi + 4\pi$$

$$\psi \sim \psi + 4\pi$$

↖

↗

AdS₃

$$\frac{1}{G_3} = \frac{1}{G_2 4\pi} = \frac{1}{G_N^3} = \alpha^3 \quad \mu = \frac{3\theta}{2G_3}$$

$$ds_3^2 = \alpha^2 \left(-\frac{dt^2 + d\phi^2}{\alpha} \right) + \left(d\psi + \frac{q dt}{6} \right)^2$$

$$= \alpha^2 \left(\frac{d\phi^2}{6^2} + \frac{dt + d\psi}{6} + d\psi^2 \right) \quad \begin{matrix} q \sim dt + 4\pi \\ 4 = \frac{q}{\alpha} \end{matrix} \quad \begin{matrix} 4 \sim 4 + \frac{4\pi}{\alpha} \\ \Rightarrow T = \frac{1}{\pi q} \end{matrix}$$

↖

↗

AdS₃

$$\frac{1}{G_3} = \frac{1}{G_2 4\pi} = \frac{1}{G_N^3} = \alpha^3 \quad \#C = \frac{3q}{2G_3} = \frac{3q^3}{2}$$

$$ds_3^2 = \alpha^2 \left(-\frac{dt^2}{\alpha^2} + d\phi^2 \right) + \left(d\psi + \frac{q dt}{6} \right)^2$$

$$S_{\text{eff}} = \frac{c \pi^2 T}{3}$$

$$q \sim 4 + 4\pi$$

$$4 = \frac{q}{\alpha}$$

$$= \alpha^2 \left(\frac{d\phi^2}{6^2} + \frac{d\psi + d\psi}{6} + d\psi^2 \right) \quad q \sim 4 + \frac{4\pi}{\alpha} \Rightarrow T = \frac{1}{\pi \alpha}$$

AdS₃

$$\frac{1}{G_3} = \frac{1}{G_2 4\pi} = \frac{1}{G_N^3} = \alpha^3 \quad c = \frac{39}{26} = \frac{3\alpha^3}{2}$$

$$\frac{c \pi^2 T}{3}$$

$$= \frac{\alpha^3 \pi^2}{\pi \alpha} = \pi \alpha^2$$

$$\frac{4\pi}{\alpha} \Rightarrow T = \frac{1}{\pi \alpha}$$

$$3 \alpha^3$$

$$S = \frac{v}{z}$$

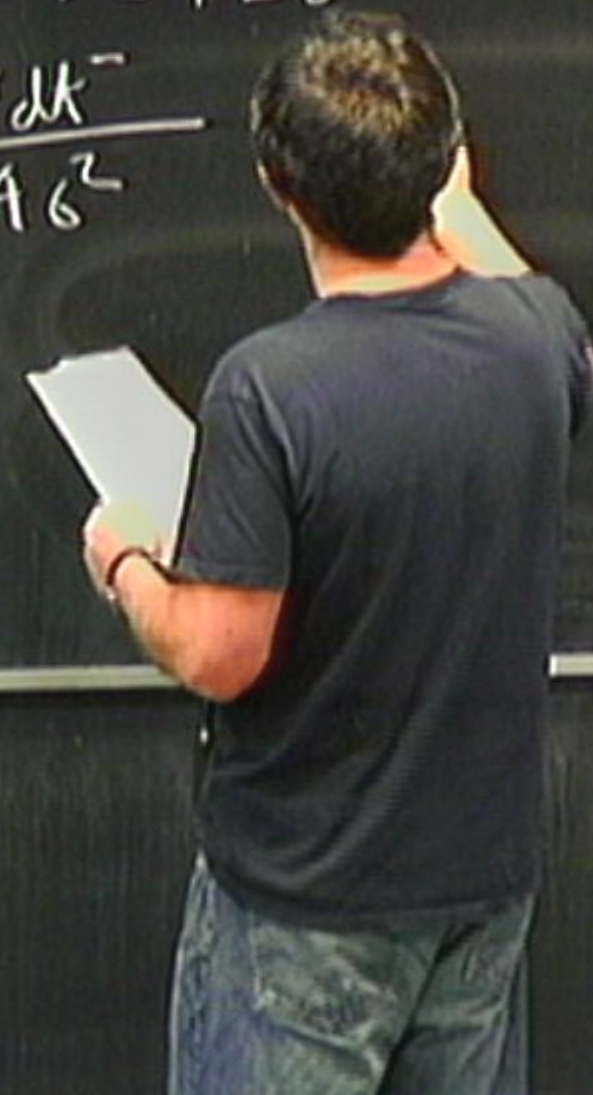
$$S = \frac{h}{z} \int d^2 + e^{-2\phi} \left(R + \frac{z}{g^2} \right)$$

$$S = \frac{K}{z} \left(d^2 + e^{-2q} \left(R + \frac{z}{q^2} \right) - \frac{q^2}{4e} - 3q F^2 \right) + B.T. + G \int e^{-6q} F$$

$$S = \frac{u}{z} \left(d^2 + e^{-2t} \left(R + \frac{z}{d^2} \right) - \frac{d^2}{4} e^{-2t} \left(-\frac{4}{d^2} F^2 \right) + B.T. \right) + C \int e^{-6t} F$$

solution $t' = t \pm 6$

$$ds^2 = -\frac{2dt^+ dt^-}{4b^2}$$



solution

$$t' = t \pm b$$

$$s^2 = -\frac{2dt' dt}{4b^2}$$

$$\bar{t} = \frac{2E}{\rho^2} \epsilon +$$

$$\bar{A} = -\frac{E}{2\rho^2 b}$$

$$e^{2\bar{t}} = E$$

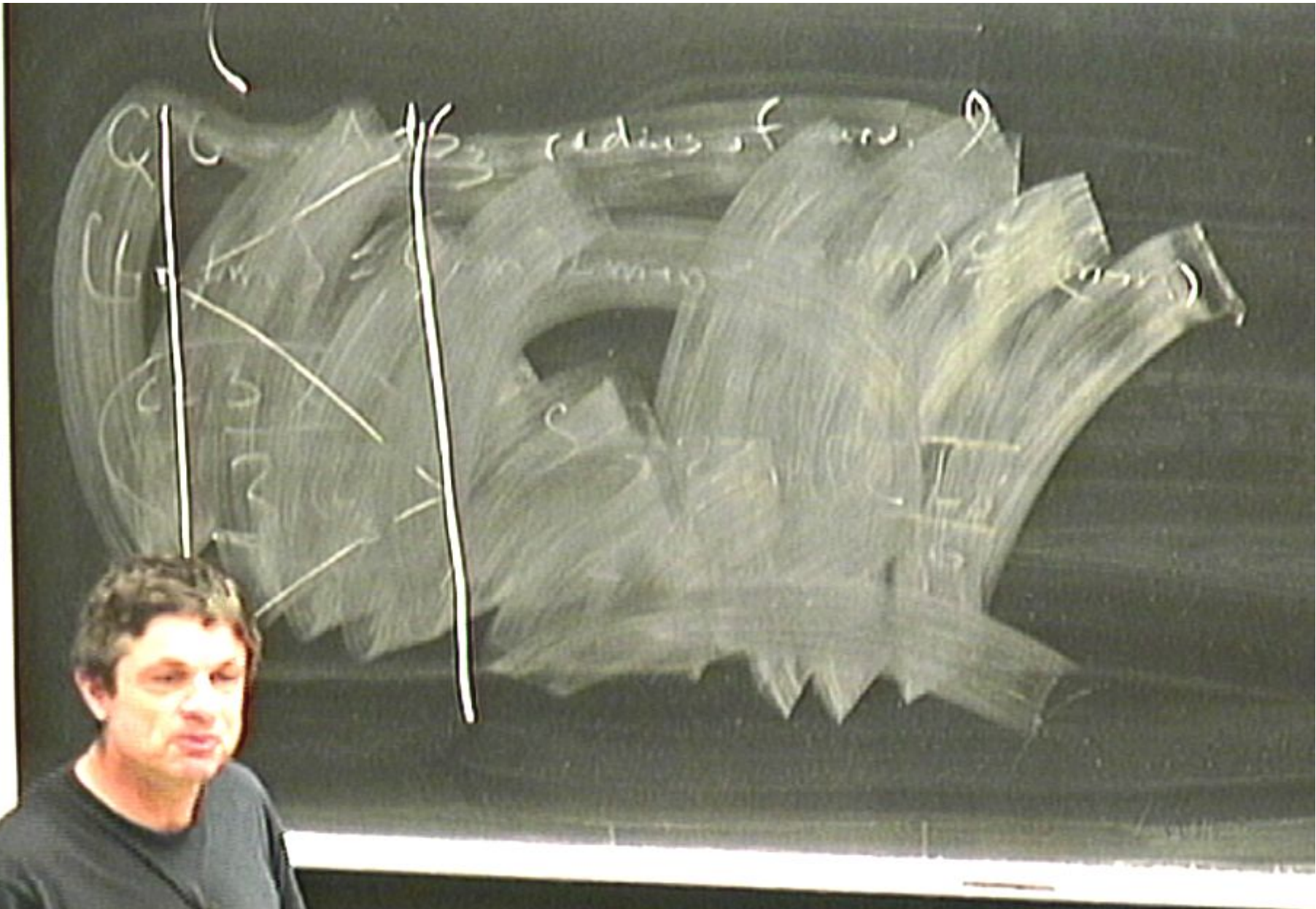
$$S = \frac{\kappa}{2} \int d^2x + e^{-2\phi} \left(R + \frac{2}{g^2} \right) - \frac{g^2}{4} e^{-2\phi} F^2 + \text{B.T.} + \theta \int e^{-6\phi} F$$

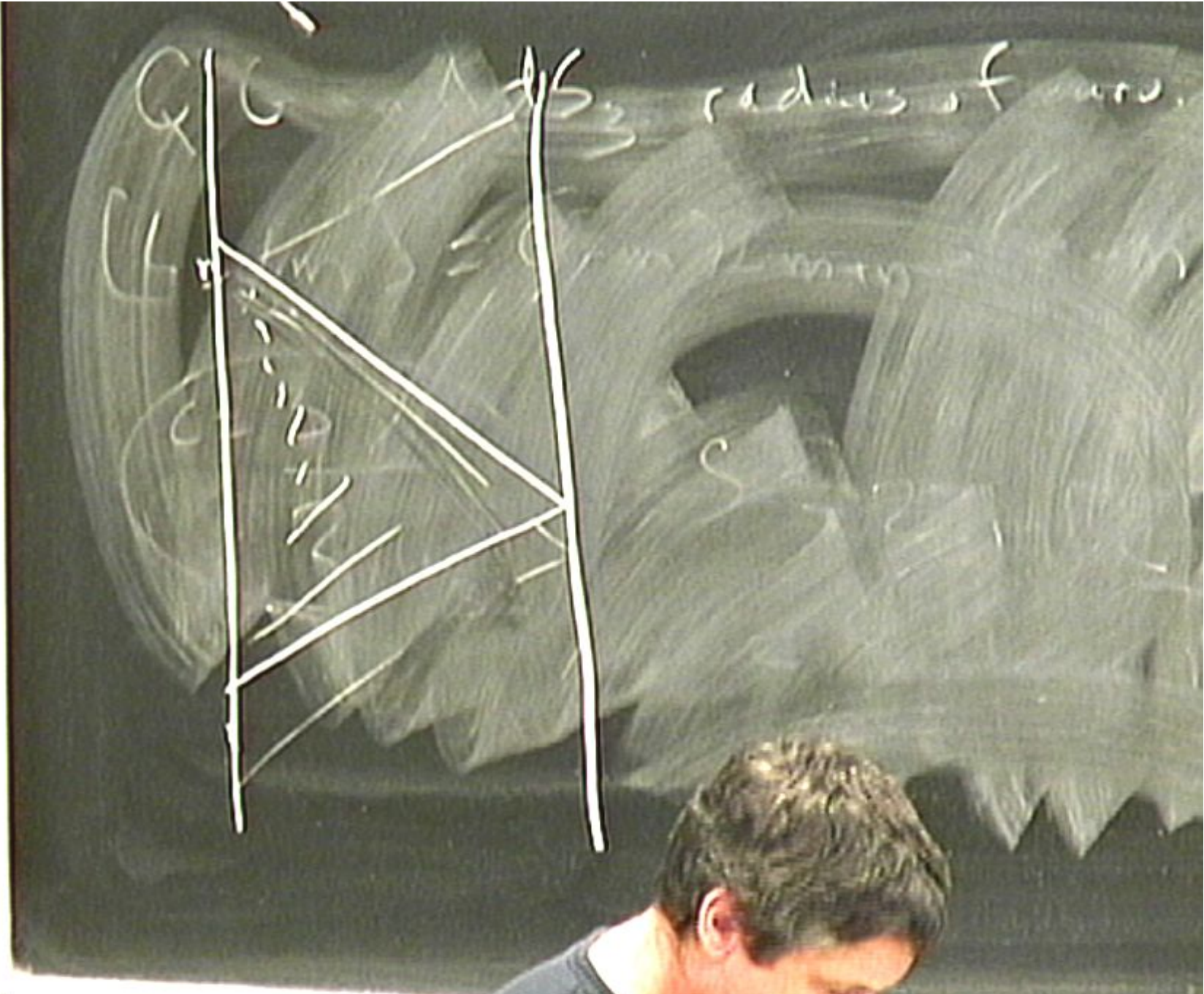
solution $t' = t \pm 6$

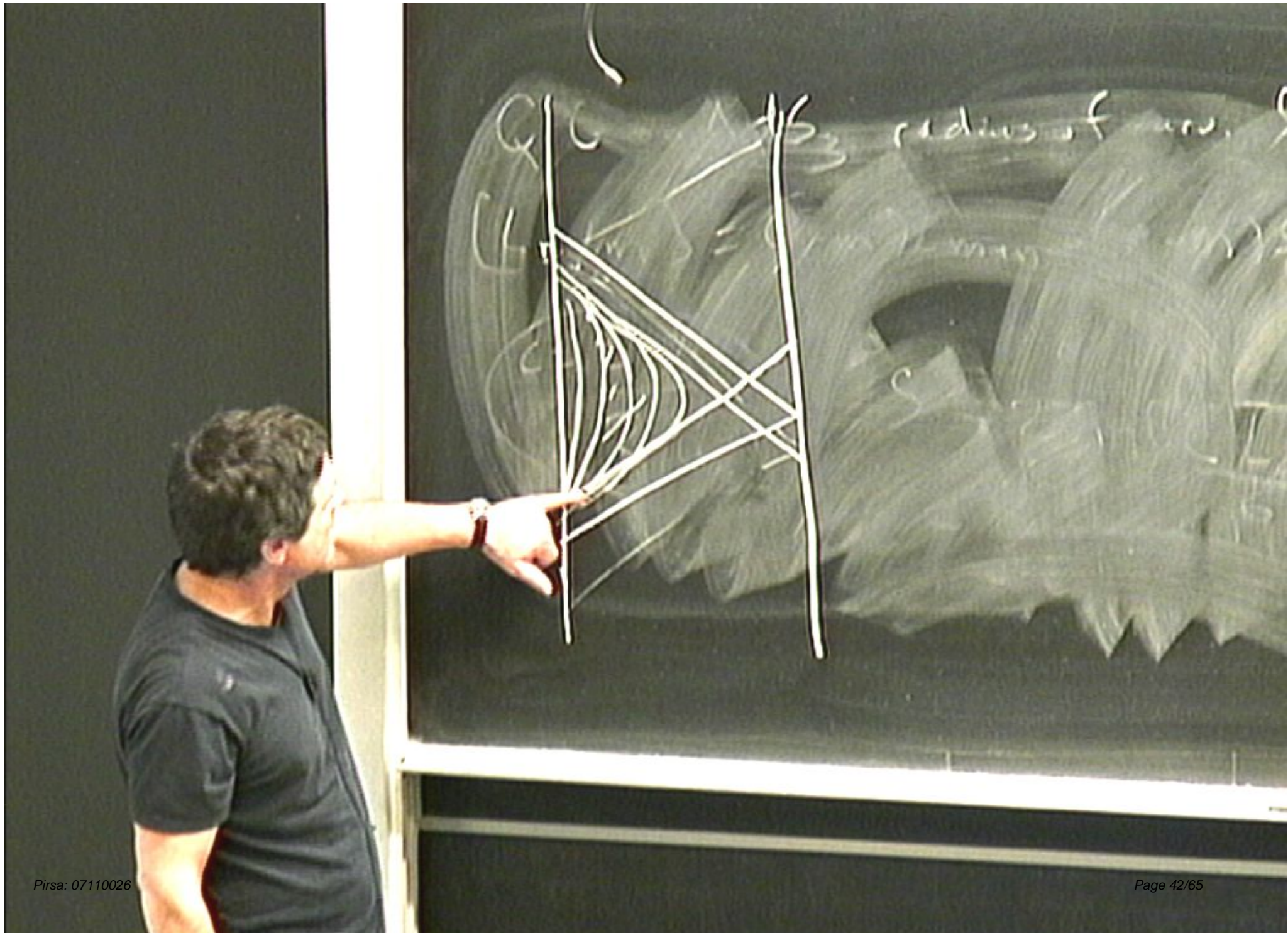
$$d\bar{s}^2 = -\frac{g^2 dt^2 dt'}{4g^2} \quad \bar{F}_{+-} = \frac{2E}{g^2} \epsilon_{+-}$$

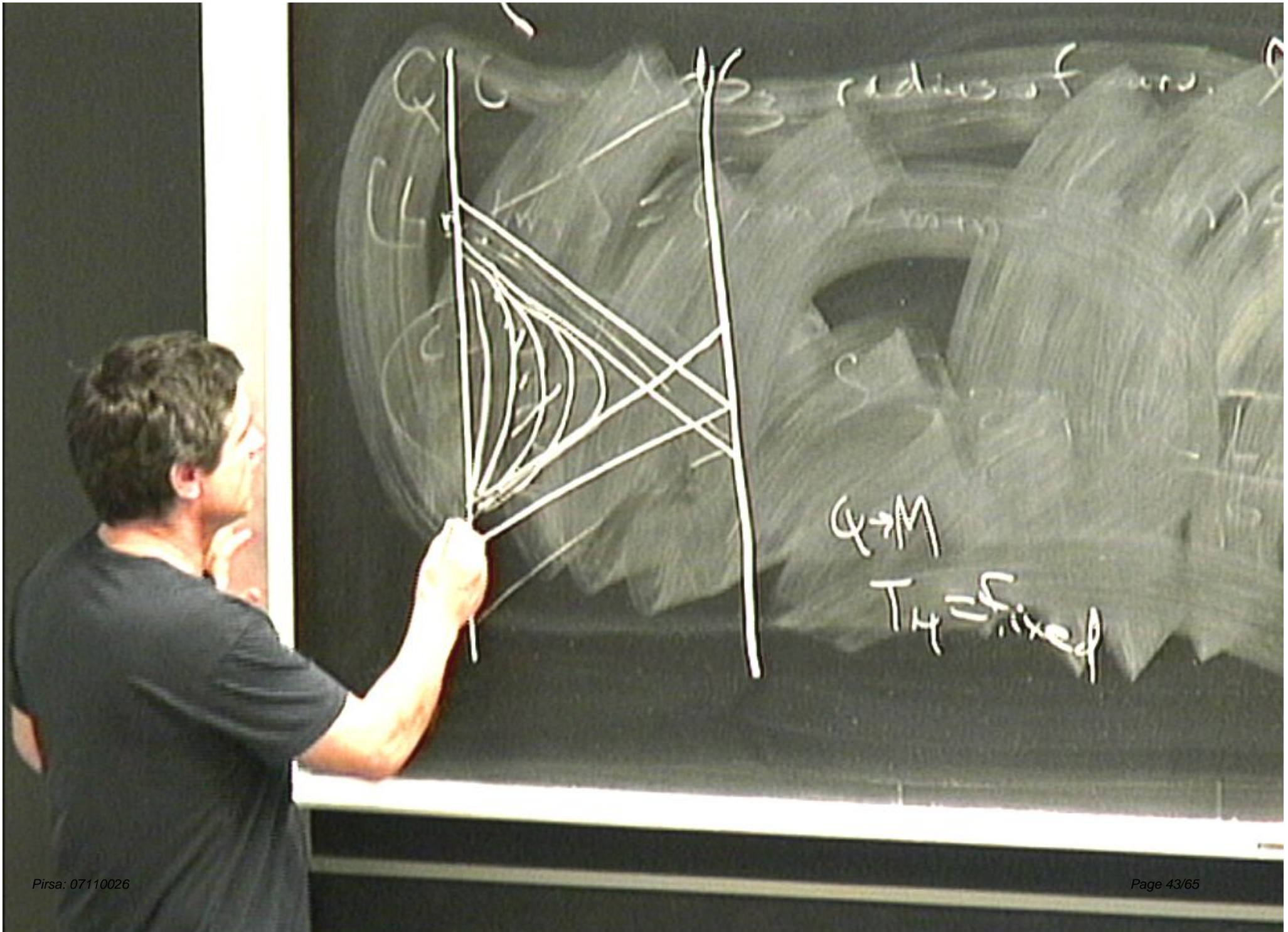
$$\bar{A}_- = -\frac{E}{2g^2 \alpha} \quad e^{2\bar{\phi}} = E$$

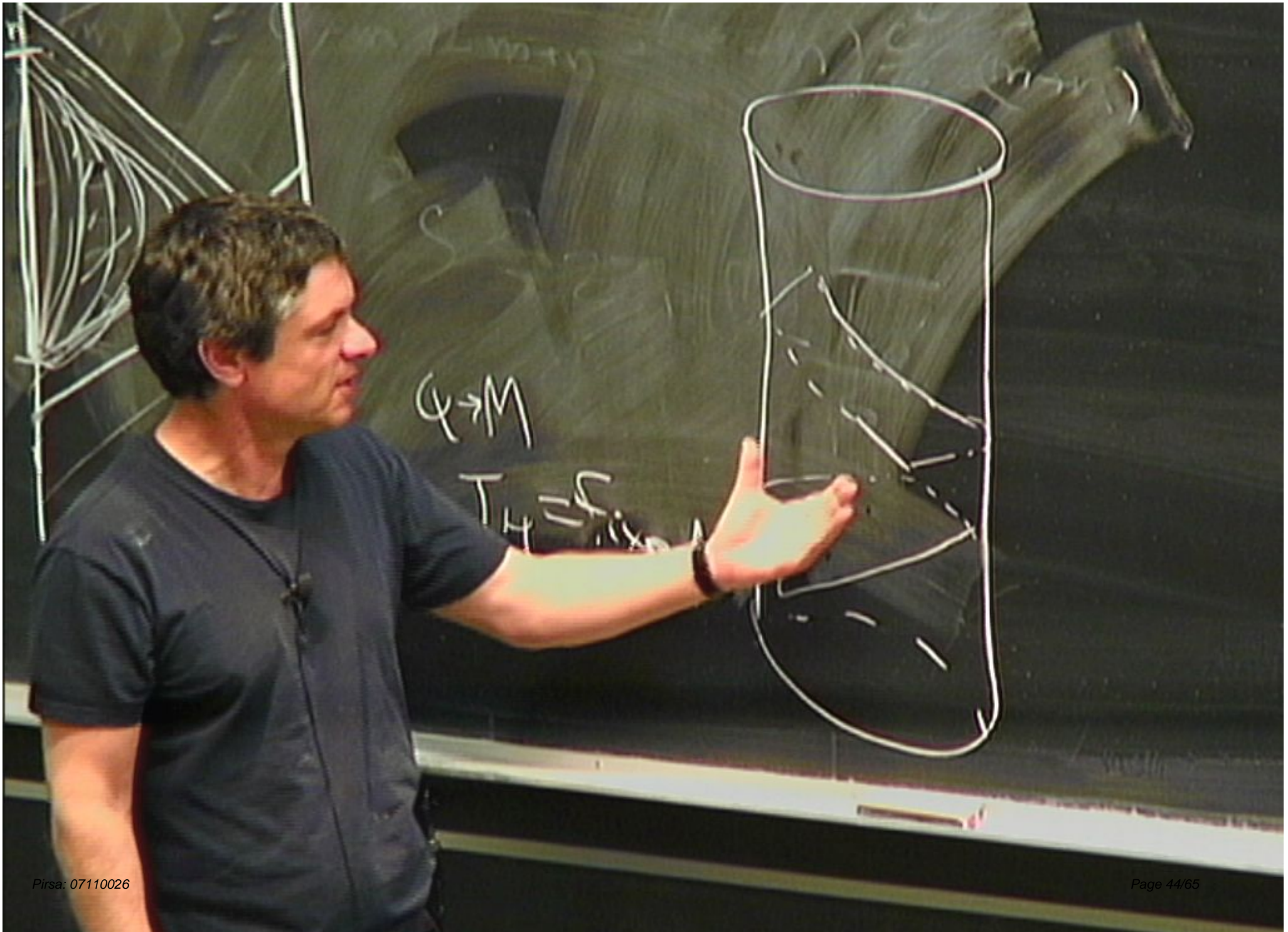


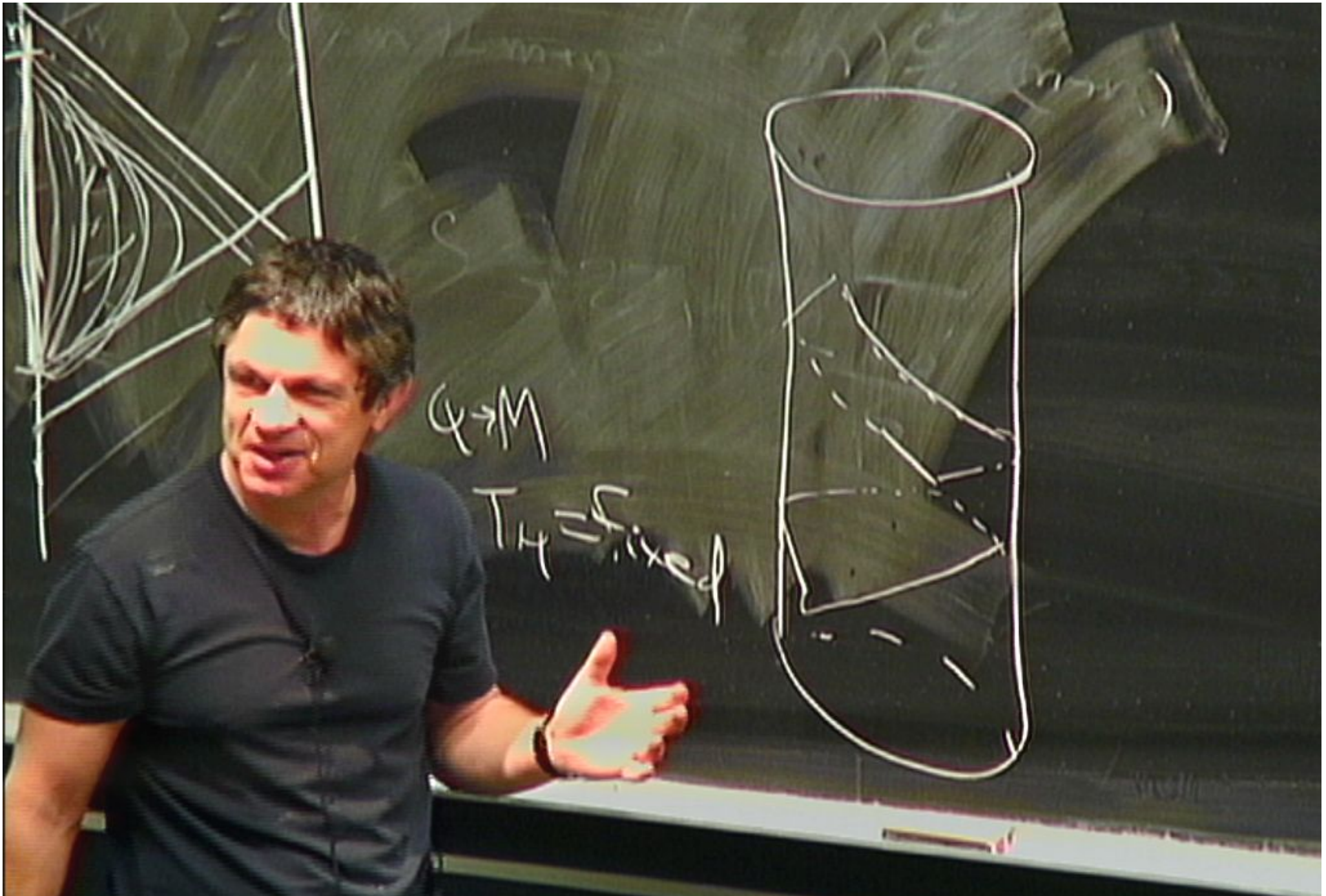






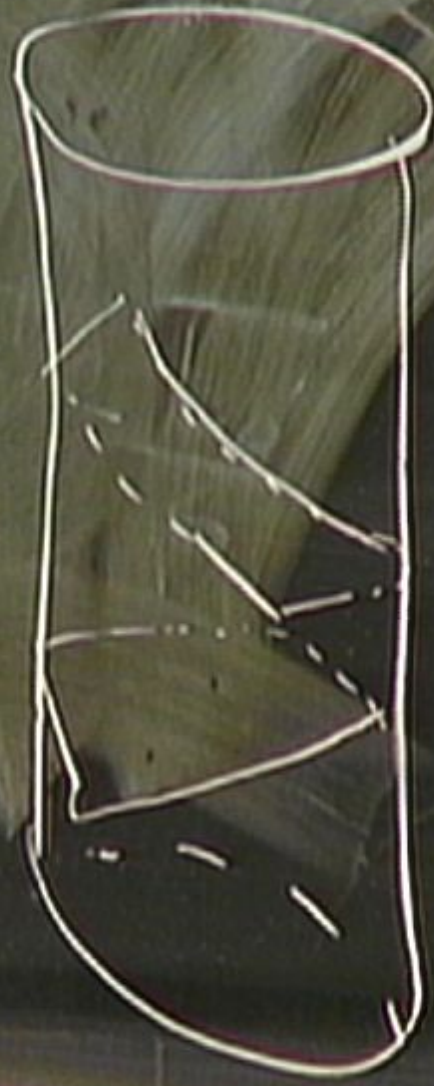


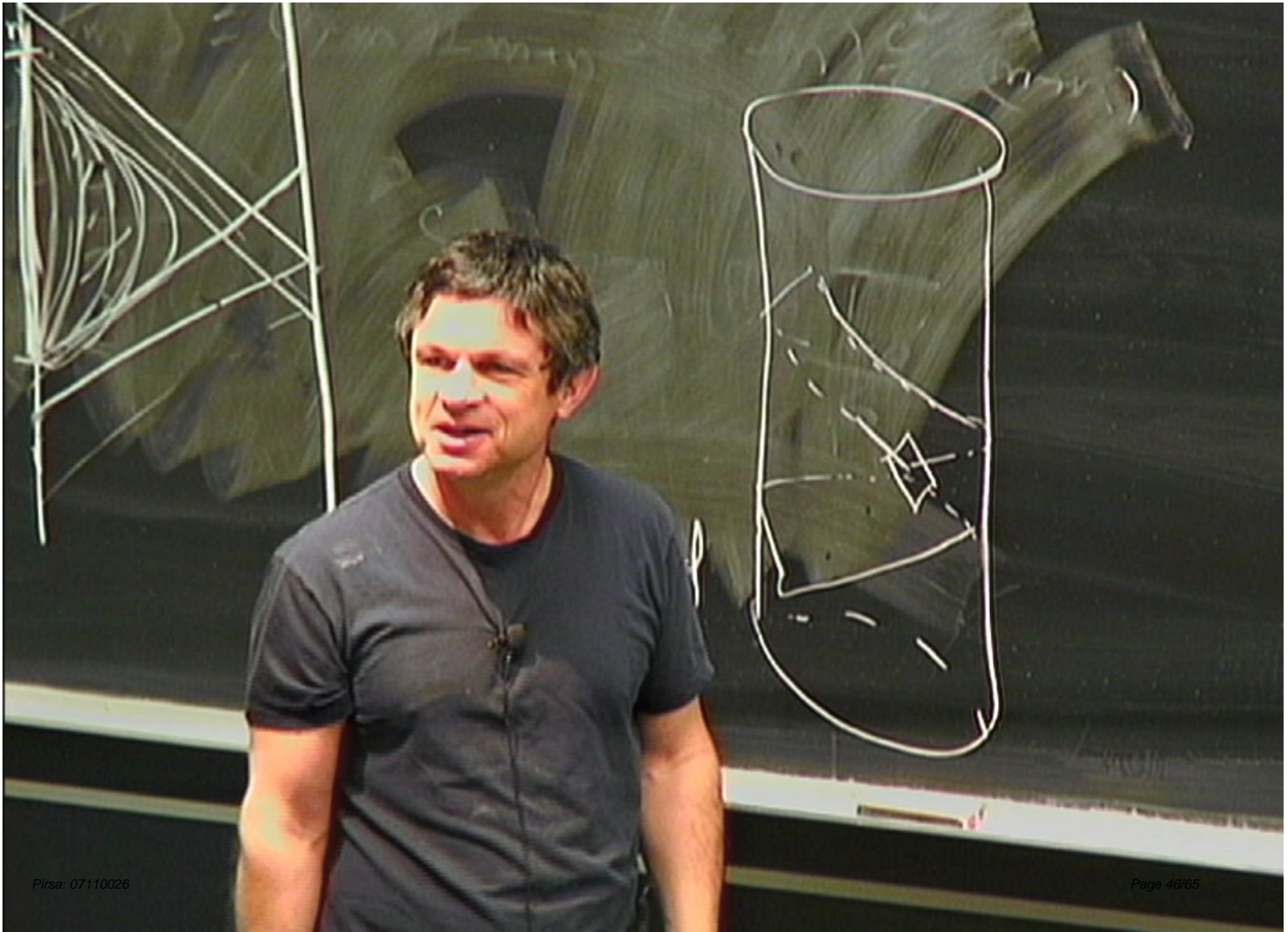


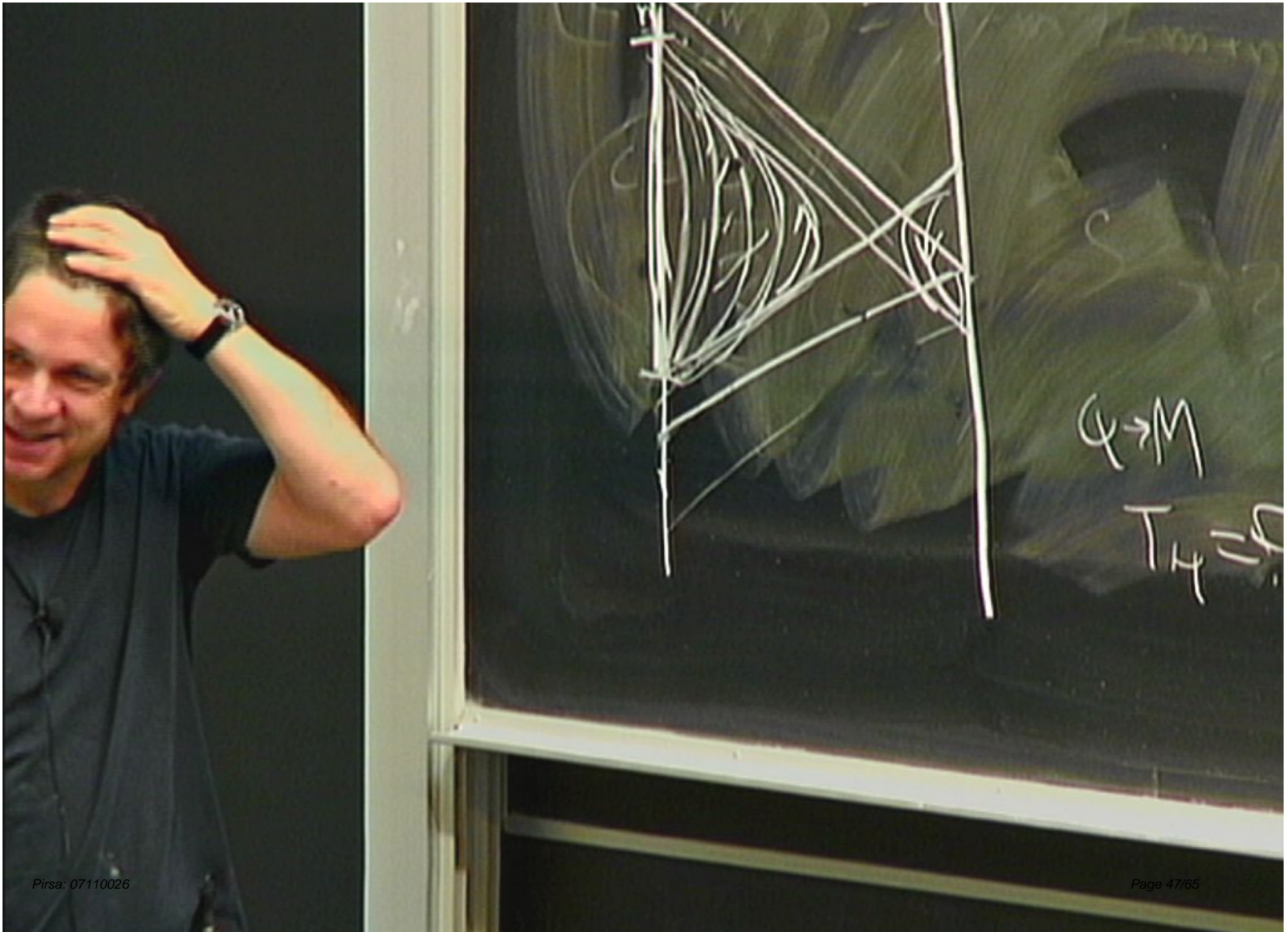


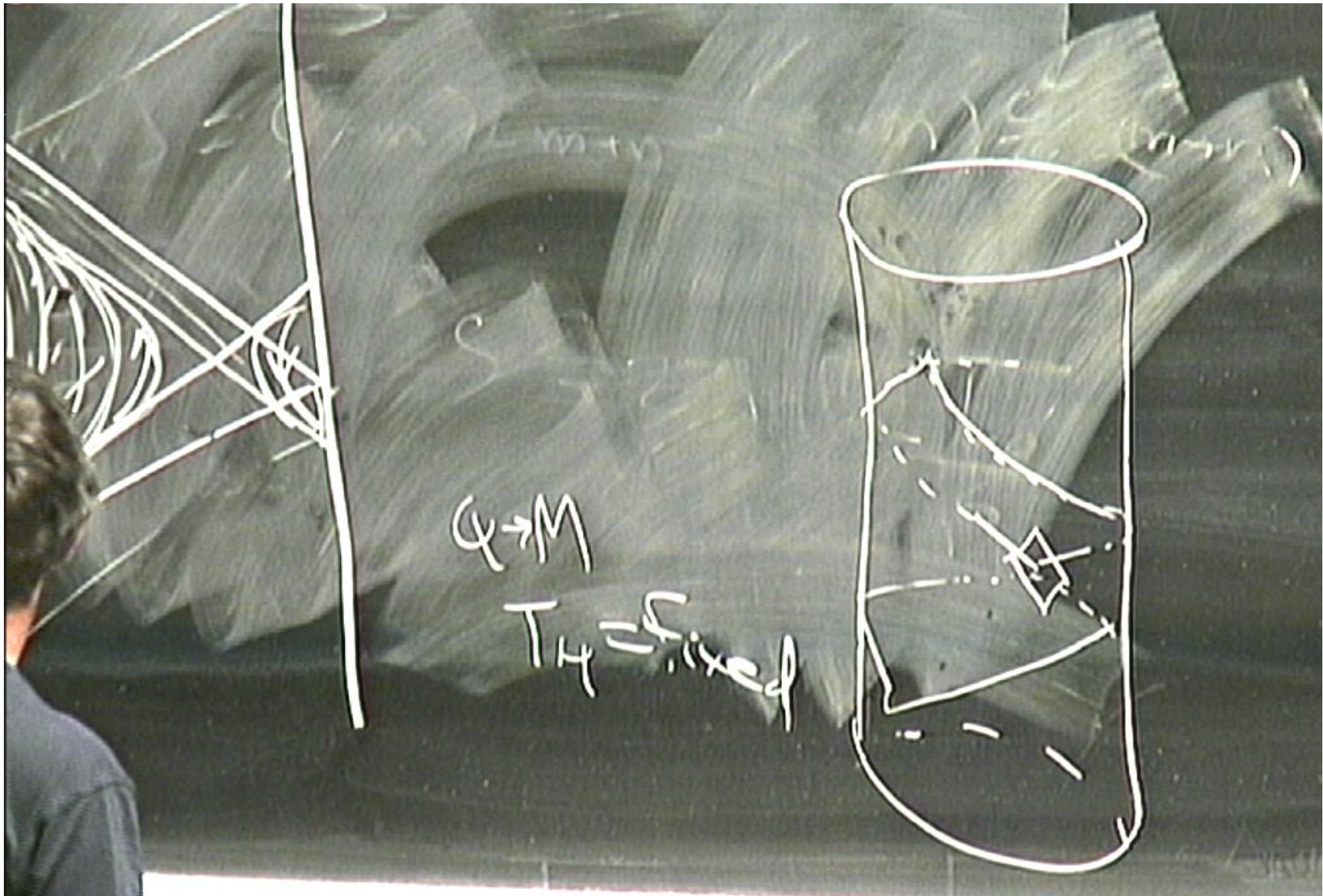
$Q \rightarrow M$

$T_H = \text{Fixed}$



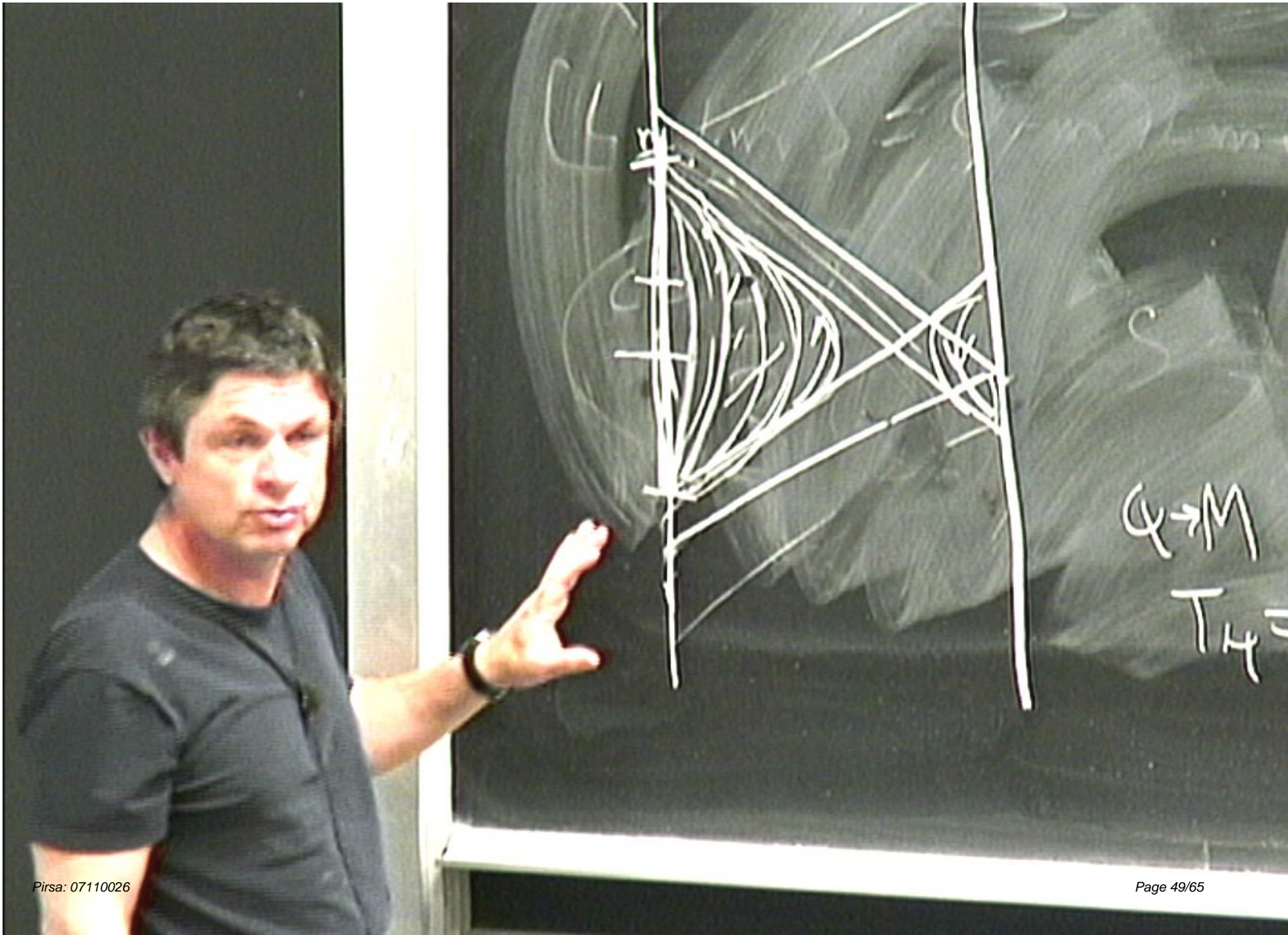






$\Phi \rightarrow M$

$T_H \text{ fixed}$



D=4 ME gravity

$$ds_4^2 = - \left(1 - \frac{G}{r}\right)^2 dt^2 + \frac{dr^2}{\left(1 - \frac{G}{r}\right)^2} + r^2 d\Omega_2^2$$

$G \rightarrow 4^2 \left(\frac{-dt^2 + dG^2}{G^2} \right)$

$\boxed{4^2}$

$$\frac{1}{G_N^{(4)}} = 4\pi G^3, \quad d$$

Quica 51

$$dS = -e^{2\phi} dt^+ dt^-$$

$$\partial_+ A_- + \partial_- A_+ = 0$$

$$\Rightarrow A_{\pm} = \pm \partial_{\pm} \eta$$

$$dS = -e^2 \rho dt^+ dt^-$$

$$\partial_+ A_- + \partial_- A_+ = 0$$

$$\Rightarrow A_{\pm} = \pm \partial_{\pm} \eta$$

Gauge symmetry

$$\delta A_{\pm} = \pm \partial_{\pm} \theta$$

$$G = \theta(t^+) + \theta(t^-)$$

conf. diffeom
 $\xi^+(t^+), \xi^-(t^-)$

ca. 51

$$dS = -e^2 \rho dt^+ dt^-$$

$$\partial_+ A_- + \partial_- A_+ = 0$$

$$\Rightarrow A_{\pm} = \pm \partial_{\pm} \eta$$

Gauge symmetry

$$\delta A_{\pm} = \pm \partial_{\pm} \theta$$

$$\theta = \theta(t^+) + \theta(t^-)$$

conf. diffeom

$$\xi^+(t^+), \xi^-(t^-)$$

Namely

$$\xi^+(t^+) = \xi^-(t^-)$$

Area \rightarrow 1D

$$ds^2 = -e^{2\varphi} dt^+ dt^-$$

$$\partial_+ A_- + \partial_- A_+ = 0$$

$$\Rightarrow A_{\pm} = \pm \partial_{\pm} \eta$$

Gauge symmetry

$$\delta A_{\pm} = \partial_{\pm} \theta$$

$$\theta = \theta(t^+) + \theta(t^-)$$

conf. diffeom

$$\xi^+(t^+), \xi^-(t^-)$$

Naively

$$\xi^+(t^+) = \xi^-(t^-)$$

$$T_{--}, T_{++}, A \rightarrow G_{\text{light}}$$

$$T_{--} T_{++} \sim \frac{0}{(z-w)^4}$$

Area 5D

$$dS^2 = -e^{2\varphi} dt^+ dt^-$$

$$\partial_+ A_- + \partial_- A_+ = 0$$

$$\Rightarrow A_{\pm} = \pm \partial_{\pm} \eta$$

Gauge symmetry

$$\delta A_{\pm} = \partial_{\pm} \theta$$

$$\theta = \theta(t^+) + \theta(t^-)$$

conf. diffeom

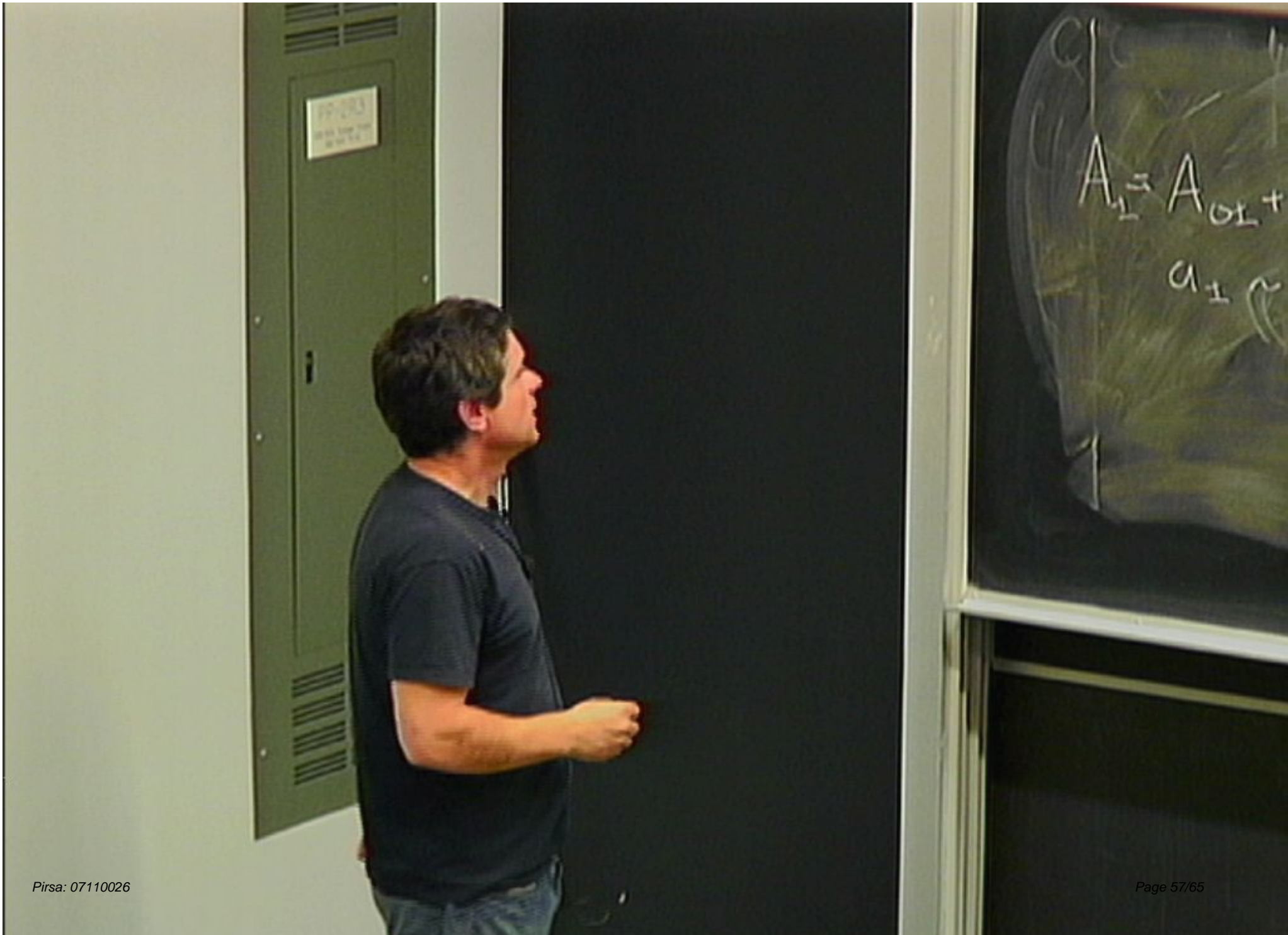
$$z^+(t^+), z^-(t^-)$$

Naively

$$z^+(t^+) = z^-(t^-)$$

$$T_{--}, T_{++}, A \rightarrow G dt$$

$$T_{--} T_{++} \sim \frac{0}{(z-w)^4}$$



radius of cur.

$$A_{\pm} = A_{0\pm} + a_{\pm}$$

$$a_{\pm} \sim O(\epsilon)$$

$$A_{\pm 1} = A_0 \pm a_{\pm 1}$$

$$a_{\pm 1} \sim O(\epsilon)$$

$$\mathcal{L} A_{\pm 1} \sim$$

$$A_{\perp} = A_{0\perp} + a_{\perp}$$

$$a_{\perp} \sim \mathcal{O}(G)$$

$$\partial_{\perp}^2 A_{\perp} \sim \frac{E}{2} \partial_{\perp}^2 \xi^{-}$$

radius of ...

$$A_{\pm} = A_{0\pm} + a_{\pm}$$

$$a_{\pm} \sim O(\epsilon)$$

$$\partial_{\pm} A_{\pm} \sim \frac{F}{2} \partial_{\pm} S^{-}$$

$$\Theta(+^{-}) = \frac{F}{2} \partial_{-} S^{-}, \quad \Theta(+^{-}) = -\frac{F}{2} \partial_{-} S^{-}$$

diagram of ...

$$\begin{array}{c} \uparrow \\ \text{---} \text{---} \text{---} \text{---} \text{---} \\ \uparrow \\ \text{---} \end{array} + \frac{E}{2} \omega - \delta -$$

$$\begin{array}{c} \uparrow \\ \text{++} \text{---} \text{++} \text{---} \\ \uparrow \\ \text{---} \end{array} - \frac{E}{2} \omega + \delta +$$

6)

2 5 -

$$A_{\pm} = A_{0\pm} + a_{\pm}$$

$$a_{\pm} \sim O(\epsilon)$$

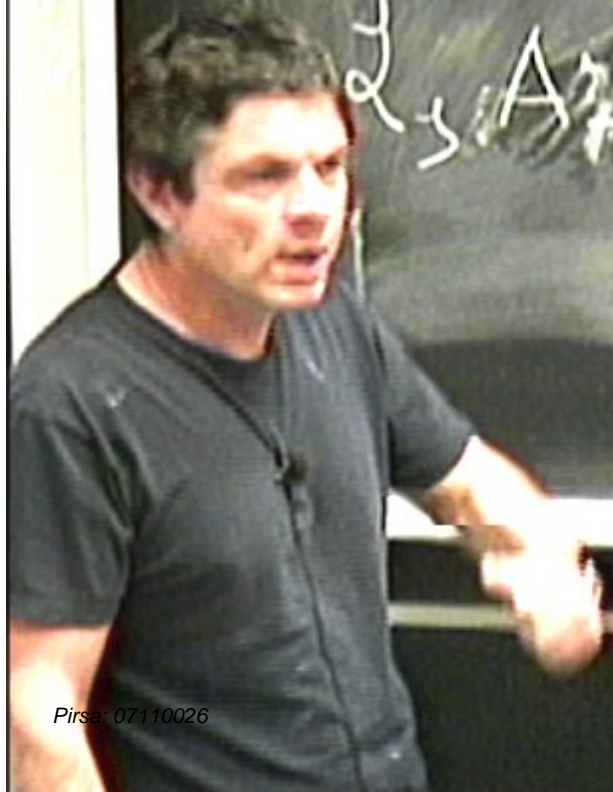
$$A_{\pm} \sim \frac{E}{2} \omega_{\pm} \mathcal{S}^{\pm}$$

$$\Theta(+^{\pm}) = \frac{E}{2} \omega_{\pm} \mathcal{S}^{\pm}, \quad \Theta(-^{\pm}) = -\frac{E}{2} \omega_{\pm} \mathcal{S}^{\pm}$$

$$T_{--} = T_{++} + \frac{E}{2} \omega_{-} \mathcal{S}^{-}$$

$$T_{++} = T_{--} - \frac{E}{2} \omega_{+} \mathcal{S}^{+}$$

radius of ...



$$A_{\pm} = A_{0\pm} + a_{\pm}$$

$$a_{\pm} \sim \mathcal{O}(\epsilon)$$

$$A_{\pm} \sim \frac{E}{2} \omega_{\pm}^{-1}$$

$$\Theta(\pm) = \frac{E}{2} \omega_{\pm}^{-1}, \quad \Theta(\mp) = -\frac{E}{2} \omega_{\mp}^{-1}$$

radius of ...

$$T_{--} = T_{++} + \frac{E}{2} \omega_{-}$$

$$T_{+-} = T_{-+} - \frac{E}{2} \omega_{+}$$

radius of ...

$$A_{\pm} = A_{0\pm} + a_{\pm}$$

$$a_{\pm} \sim O(\epsilon)$$

$$A_{\pm} \sim \frac{E}{2} \omega_{\pm} \zeta^{-1}$$

$$\Theta(+^{\pm}) = \frac{E}{2} \omega_{\pm} \zeta^{-1}, \quad \Theta(-^{\pm}) = -\frac{E}{2} \omega_{\pm} \zeta^{-1}$$

$$T_{--} = T_{++} + \frac{E}{2} \omega_{-} \zeta^{-1}$$

$$T_{++} = T_{--} - \frac{E}{2} \omega_{+} \zeta^{-1}$$

