Title: The Central Charge of AdS2 Gravity

Date: Nov 12, 2007 11:00 AM

URL: http://pirsa.org/07110026

Abstract: TBA

QG on AdS_3 radius of curv. ℓ

$$[L_n, L_m] = (n-m)L_{m+n} + (m^3 - m)\frac{c}{12}\delta(m+n)$$

QG on AdS_3 radius of curv. ℓ

$$[L_n, L_m] = (n-m) L_{m+n} + (m^3 - m) \frac{c}{12} \delta(m+n)$$

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

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$$= S_{BH}$$

S.m understanding of AdS_2

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

b)

§ : m understanding of AdS_2

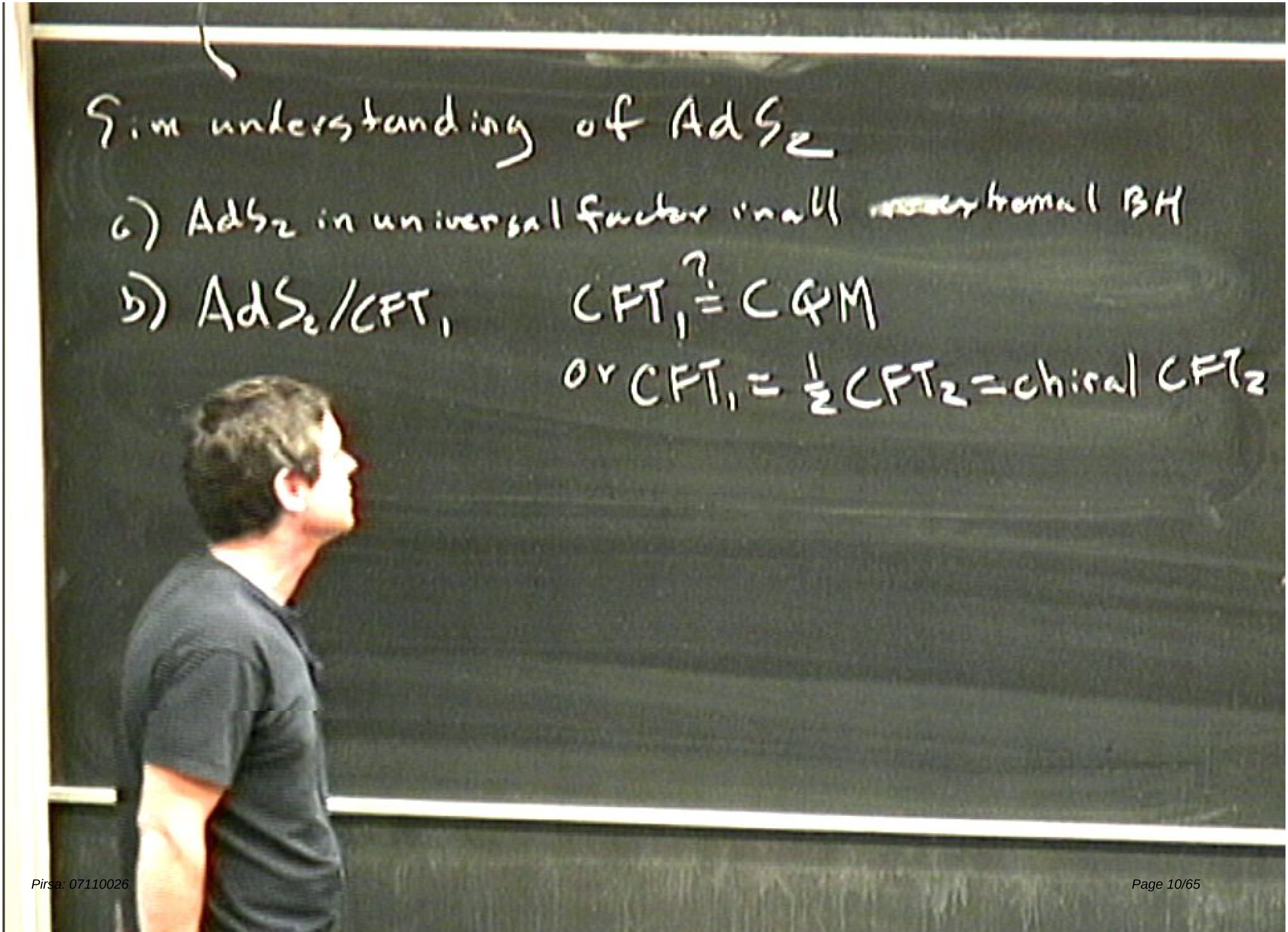
a) AdS_2 is universal factor in all ~~[illegible]~~ extremal BH

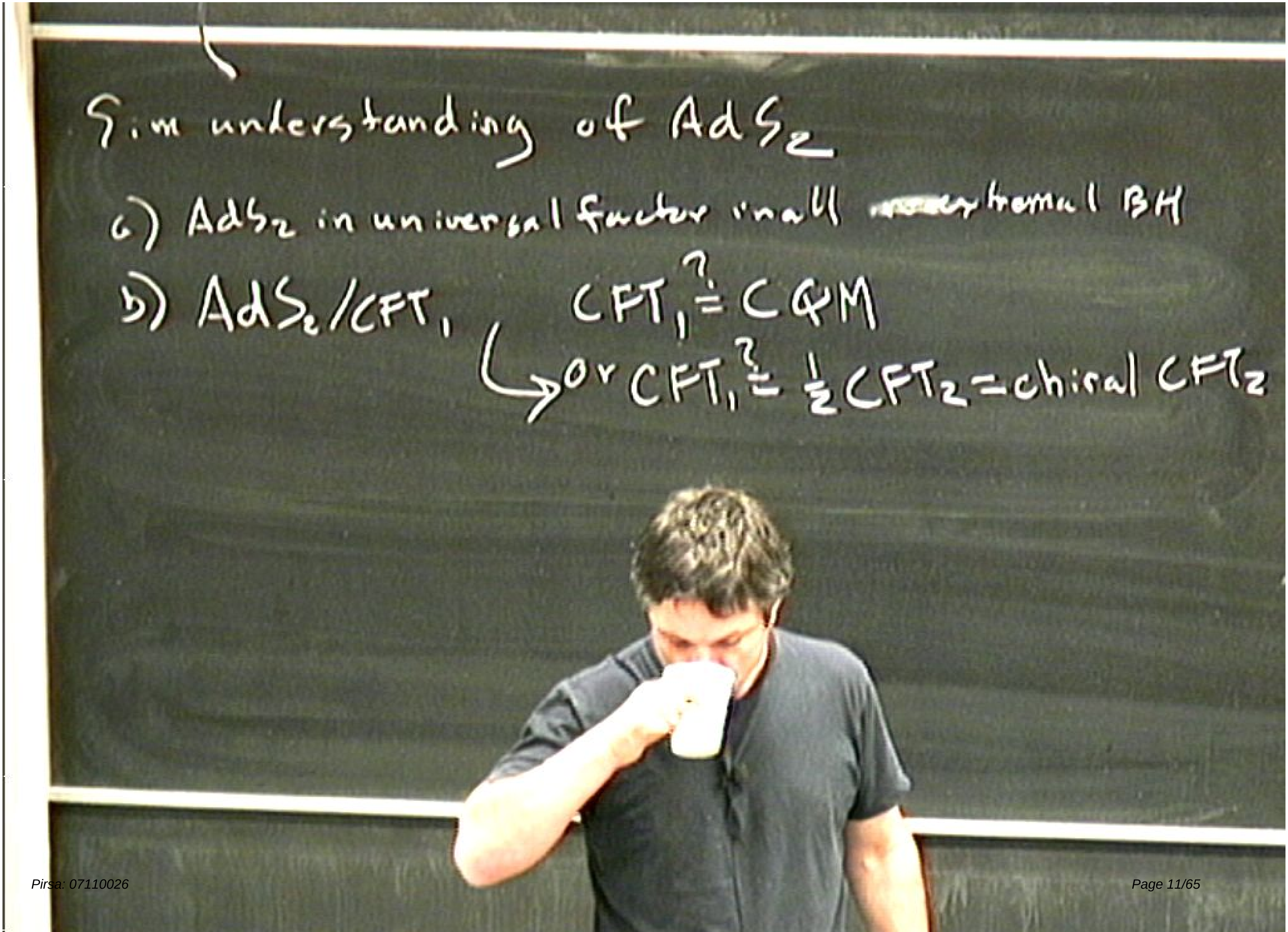
b)

§i.m understanding of AdS_2

a) AdS_2 in universal factor in all extremal BH

b)


§ i.m understanding of AdS2
a) AdS2 in universal factor in all extremal BH
b) AdS2/CFT1
CFT1 ?= CQM
or CFT1 = ½ CFT2 = chiral CFT2


understanding of AdS_2
a) AdS_2 in universal factor in all extremal BH
b) AdS_2/CFT_1 $CFT_1 \overset{?}{=} CQM$
or $CFT_1 \overset{?}{=} \frac{1}{2} CFT_2 =$ chiral CFT_2

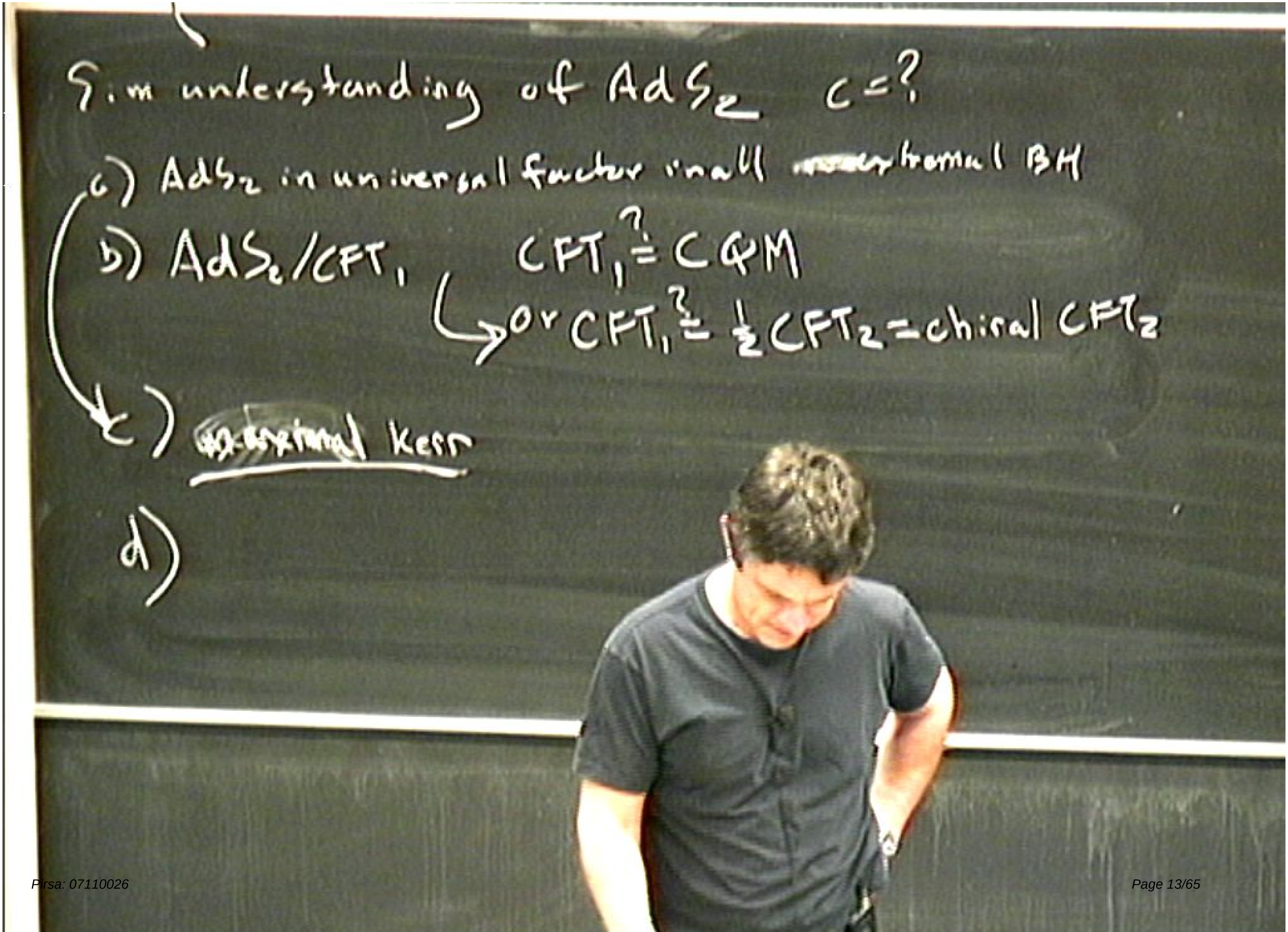
$\S$ i.m understanding of AdS_2

a) AdS_2 in universal factor in all extremal BH

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

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

c) extremal Kerr



S.i.m understanding of AdS2 c=?
a) AdS2 in universal factor in all extremal BH
b) AdS2/CFT1
CFT1 ?= CQM
or CFT1 ?= ½ CFT2 = chiral CFT2
c) extremal Kerr
d)

Q: in understanding of AdS_2 $c=?$

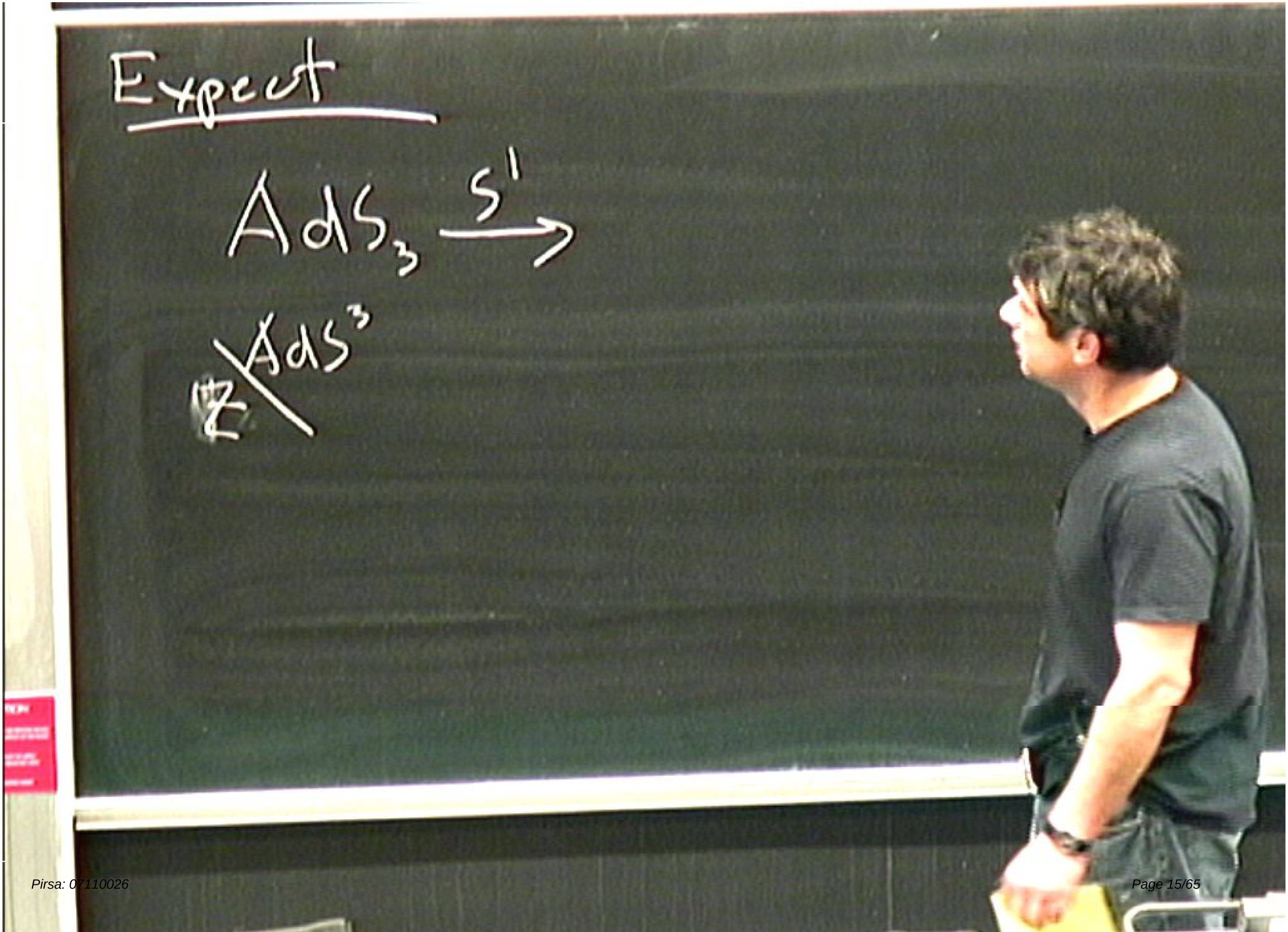
a) AdS_2 in universal factor in all extremal BH

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

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

c) extremal Kerr

d) $2D\ QG = 2D\ CFT$
$c=0$


Expect
$AdS_3 \xrightarrow{S^1}$
$\mathbb{Z} / AdS^3$

<u>Expect</u>

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

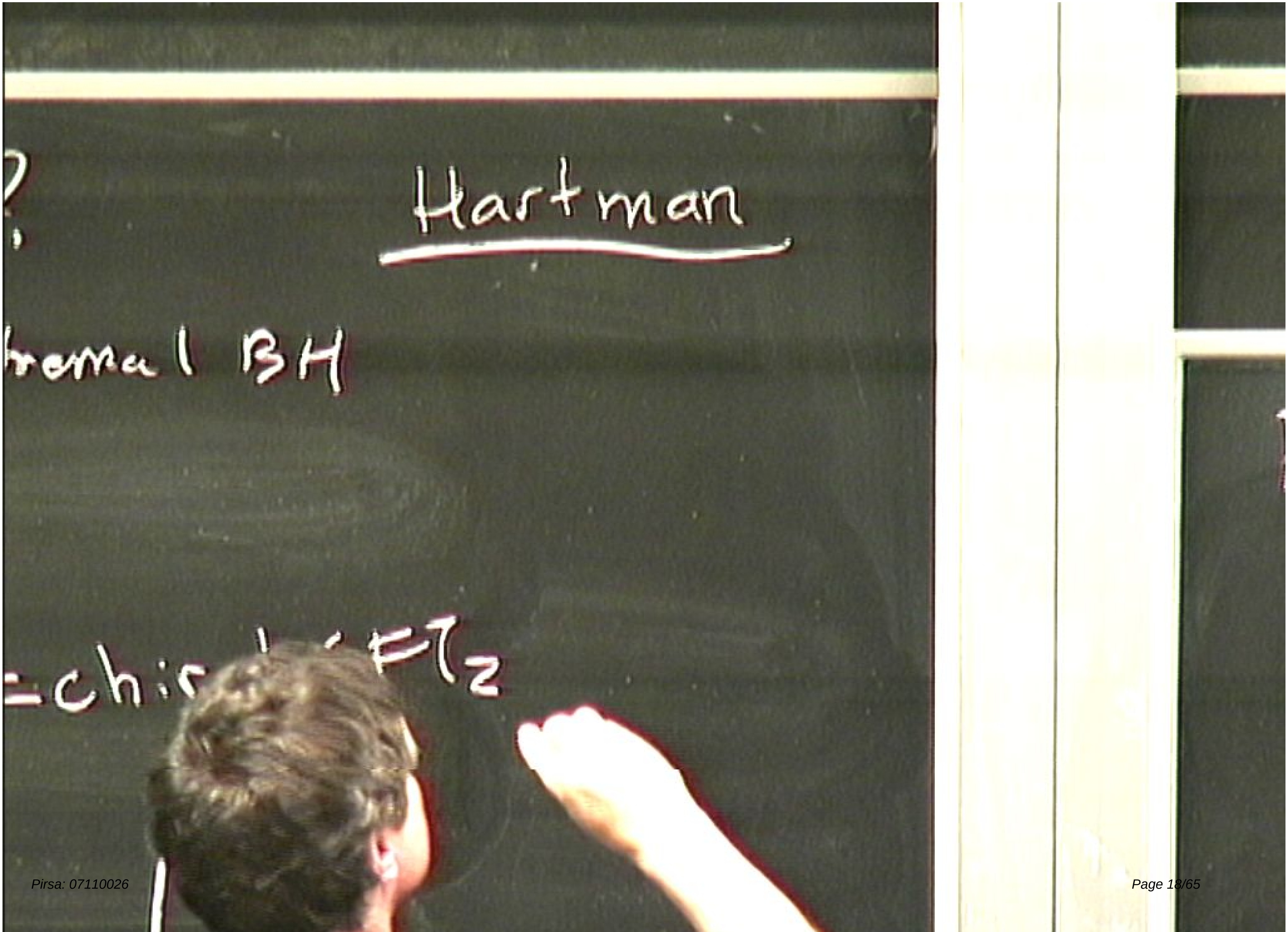
$$\mathbb{Z}\backslash AdS^3$$

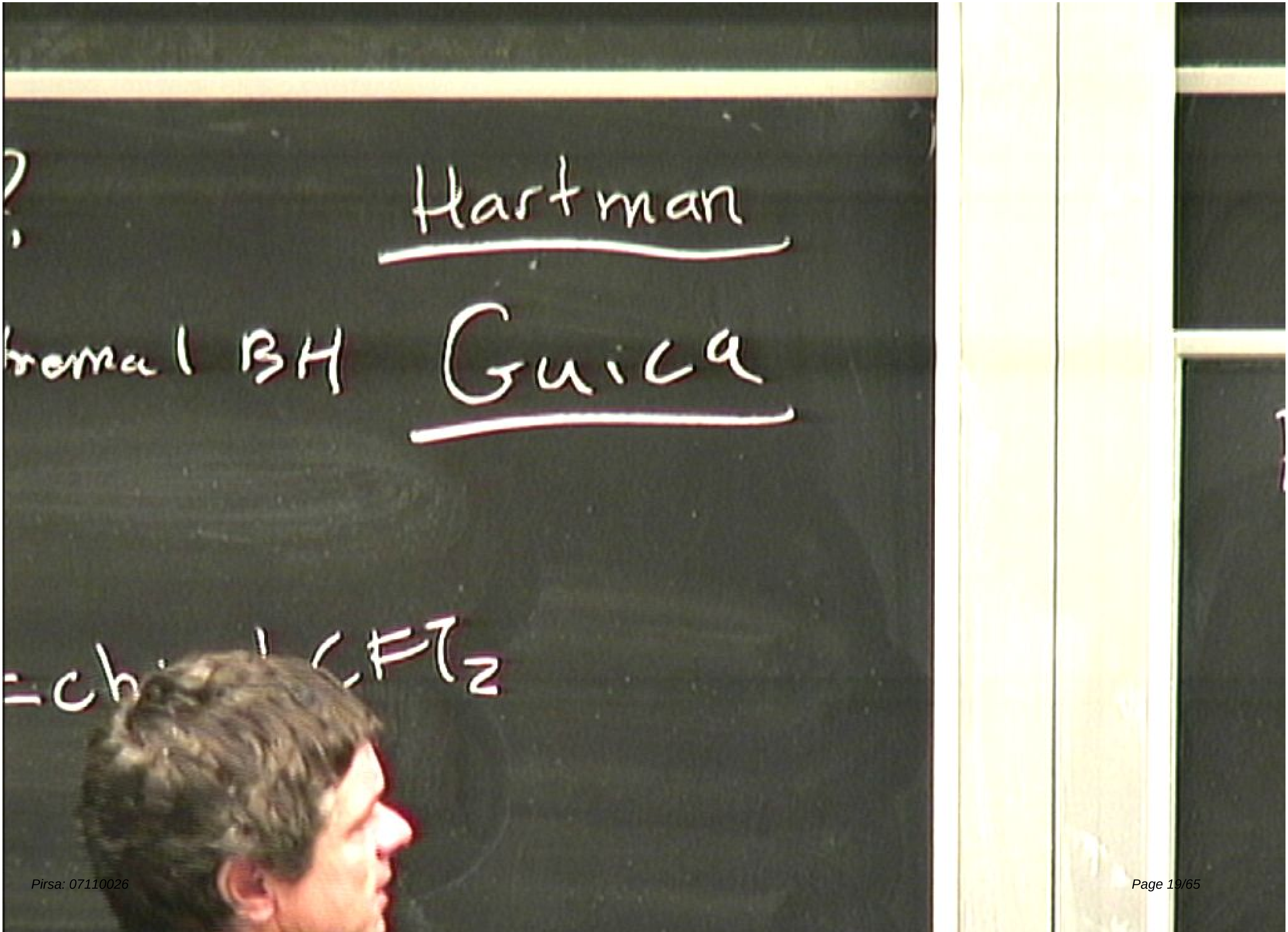
Expect

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

$\cancel{AdS^3}$

$c = \frac{3\ell}{2G}$ CFT $\longrightarrow$ $c = ?$ ...


Hartman
BH


Hartman
BH
Guica

Expect

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

$\cancel{\mathbb{Z}\ AdS^3}$

$c = \frac{3\ell}{2G}$ CFT $\longrightarrow$ $\cancel{c} = \ ?$ . . .

Guica 5D

D=4 ME gravity

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

$=1$, $ds^2 \to Q^2\left(-\frac{dt^2+d\sigma^2}{\sigma^2} + d\Omega_2^2\right)$ $A \to \frac{Q\,dt}{\sigma}$

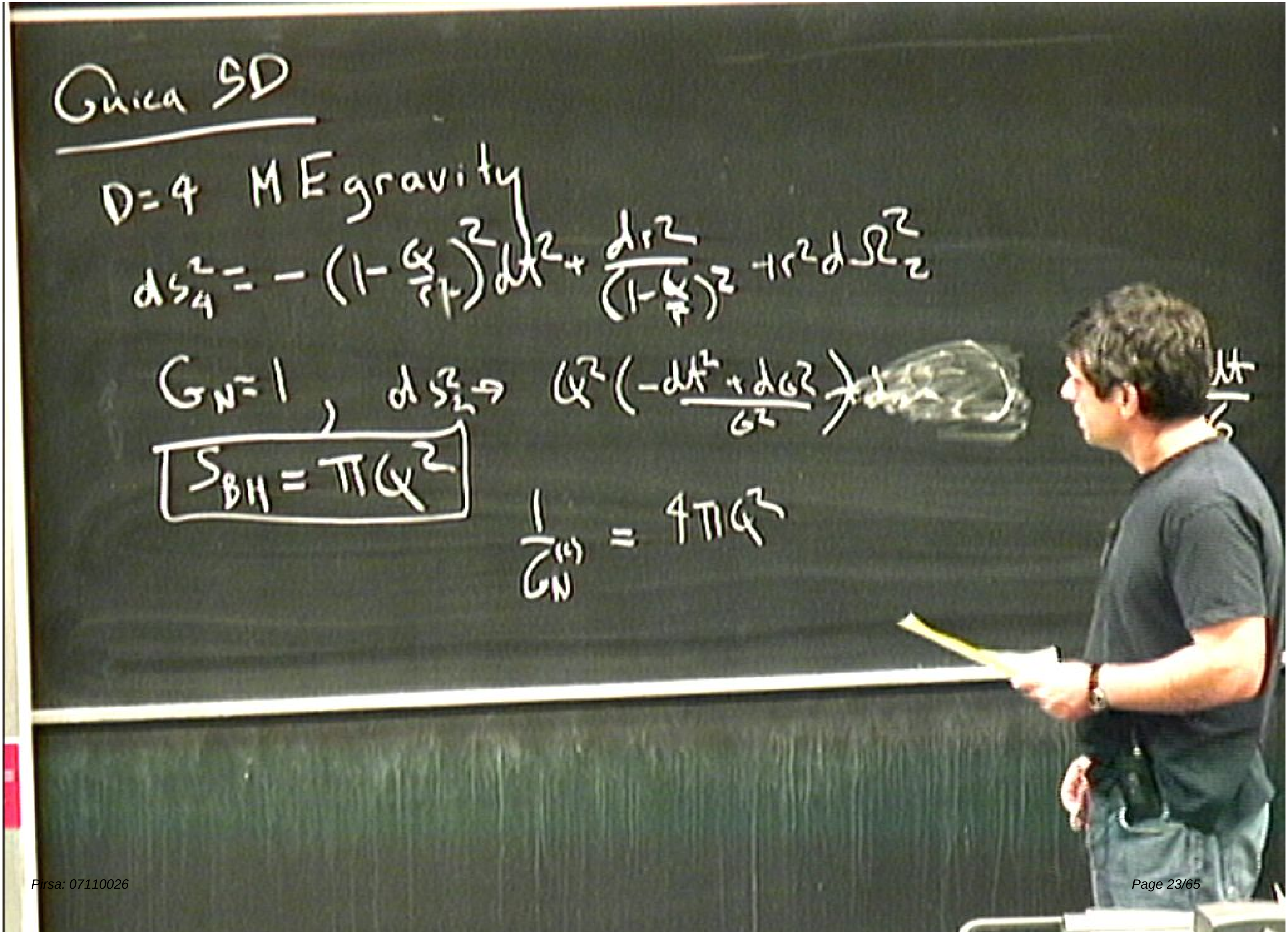
Guica SD

D=4 ME gravity

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

$G_N = 1$, $ds^2 \to Q^2\left(\frac{-dt^2 + d\sigma^2}{\sigma^2} + d\Omega_2^2\right)$ $\qquad A \to \frac{Q\,dt}{\sigma}$

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


Guica 5D
D=4 ME gravity
$ds_4^2 = -\left(1-\frac{Q}{r}\right)^2 dt^2 + \frac{dr^2}{\left(1-\frac{Q}{r}\right)^2} + r^2 d\Omega_2^2$
$G_N=1$, $ds_2^2 \to Q^2\left(-dt^2 + \frac{d\sigma^2}{\sigma^2}\right)$
$\boxed{S_{BH} = \pi Q^2}$
$\frac{1}{G_N^{(2)}} = 4\pi Q^2$

Gaiotto 5D

D=4 ME gravity

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

$G_N = 1$, $\quad ds_2^2 \to Q^2\left(\frac{-dt^2 + d\sigma^2}{\sigma^2}\right)$ $\quad A \to \frac{Q\,dt}{\sigma}$

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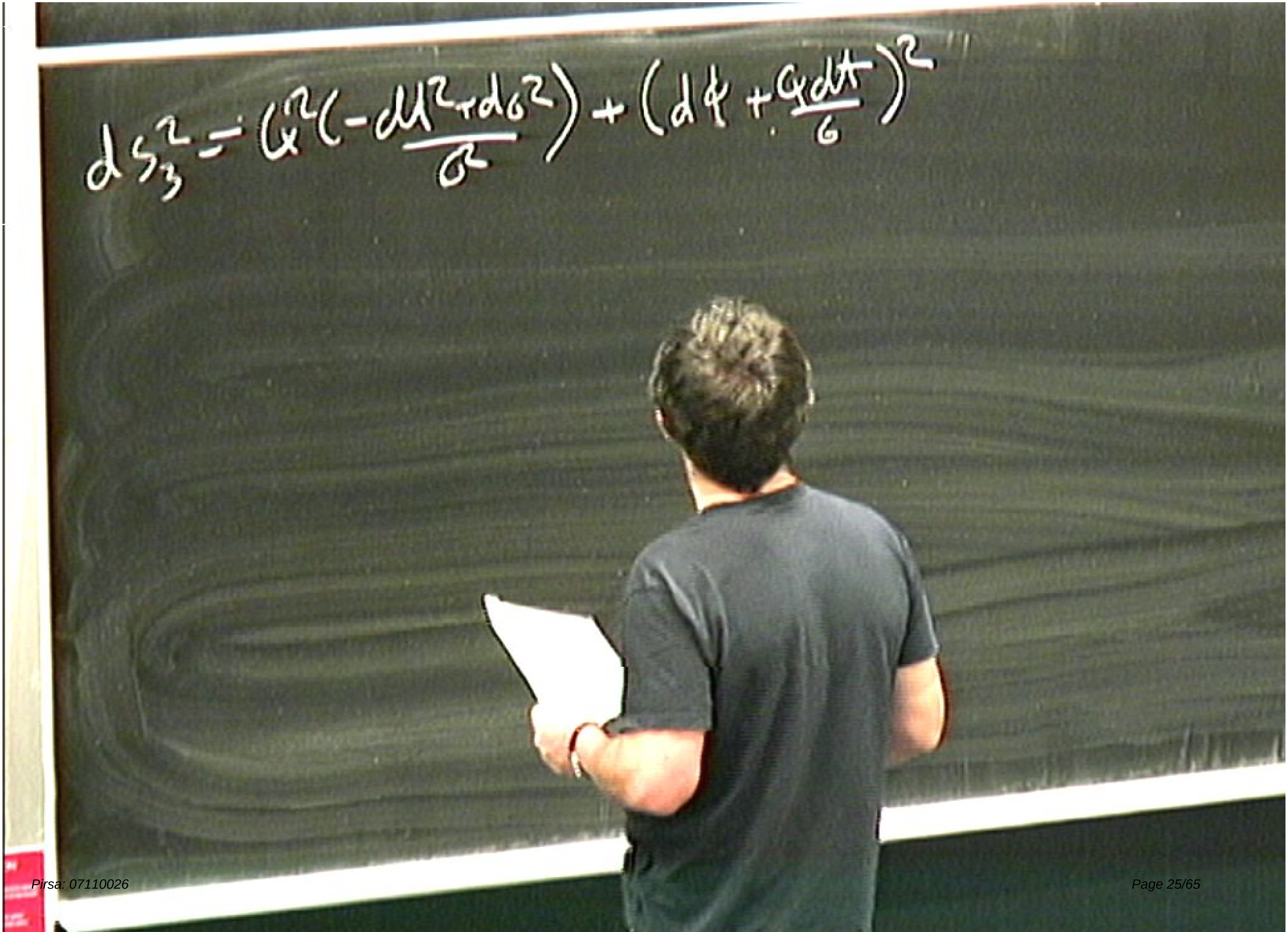
$ds_3^2 = \ell^2\left(\frac{-dt^2+d\sigma^2}{\sigma^2}\right)+\left(d\phi+\frac{q\,dt}{\sigma}\right)^2$

$$ds_3^2 = Q^2\left(\frac{-dt^2+d\sigma^2}{\sigma^2}\right) + \left(d\phi + \frac{q\,dt}{\sigma}\right)^2$$

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

$$\psi = \frac{\phi}{Q}$$

$$\psi \sim \psi + \frac{4\pi}{Q}$$

$$=$$

$$ds_3^2 = \ell^2\left(\frac{-dt^2 + d\sigma^2}{\sigma^2}\right) + \left(d\phi + \frac{q\,dt}{\sigma}\right)^2$$

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

$$\psi = \frac{\phi}{\ell}$$

$$= \ell^2\left(\frac{d\sigma^2}{\sigma^2} + \frac{dt\,d\psi}{\sigma} + d\psi^2\right) \qquad \psi \sim \psi + \frac{4\pi}{\ell}$$

$\uparrow$

AdS_3

$$ds_3^2 = Q^2\left(\frac{-dt^2 + d\sigma^2}{\sigma^2}\right) + \left(d\phi + \frac{Q\,dt}{\sigma}\right)^2$$

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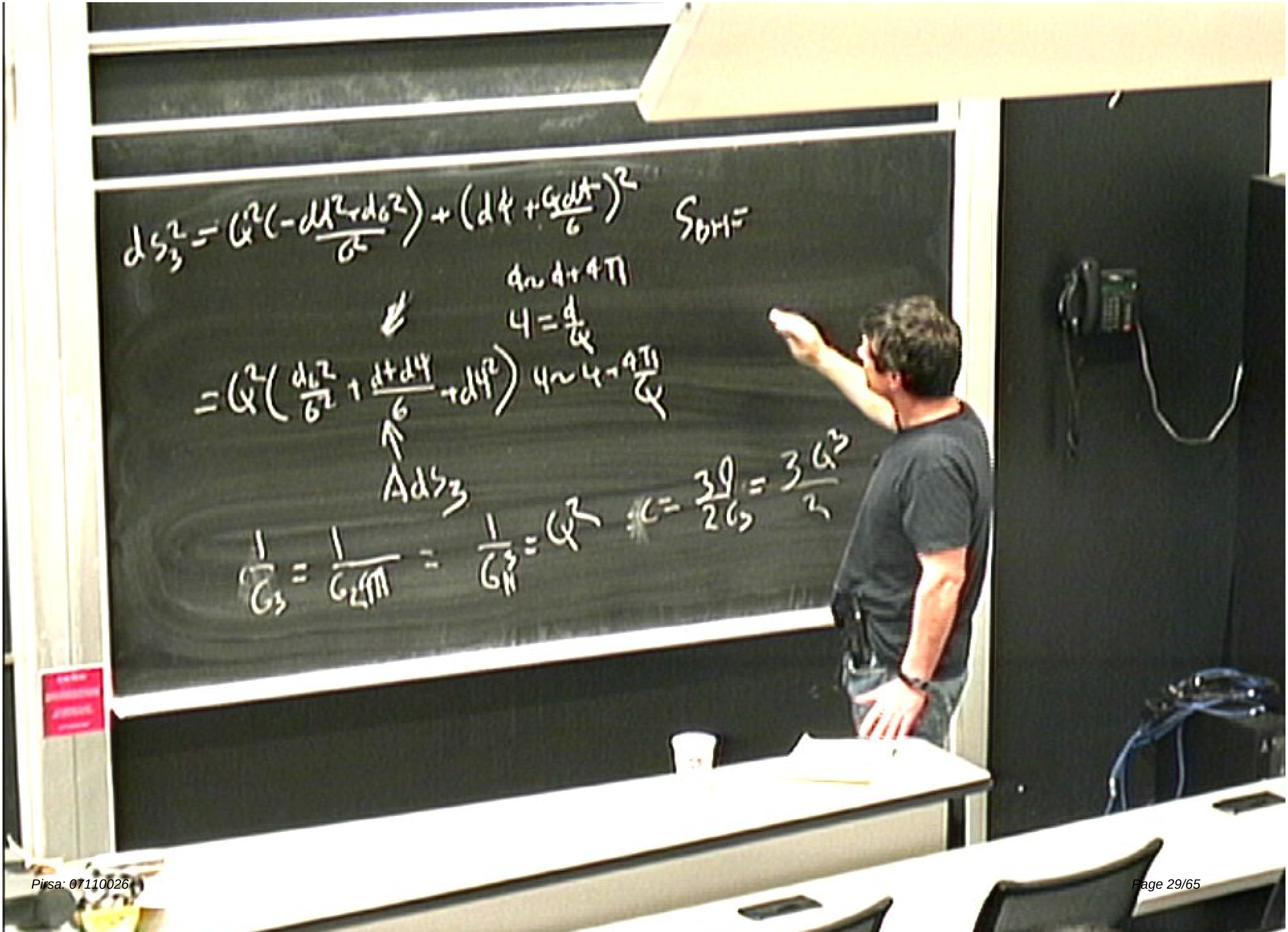
AdS_3

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



S_BH =
AdS_3

$$ds_3^2 = Q^2\left(\frac{-dt^2+d\sigma^2}{\sigma^2}\right) + \left(d\phi + \frac{Q\,dt}{\sigma}\right)^2$$

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AdS_3

$$\frac{1}{G_3} = \frac{1}{G_2 4\pi} = \frac{1}{G_N^3} = Q^3 \qquad c = \frac{3\ell}{2G_3} =$$

$$ds_3^2 = Q^2\left(\frac{-dt^2+d\sigma^2}{\sigma^2}\right) + \left(d\phi + \frac{Q\,dt}{\sigma}\right)^2$$

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

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$$= Q^2\left(\frac{d\sigma^2}{\sigma^2} + \frac{dt\,d\psi}{\sigma} + d\psi^2\right) \qquad \psi \sim \psi + \frac{4\pi}{Q} \Rightarrow T = \frac{1}{\pi Q}$$

$$\uparrow$$

AdS_3

$$\frac{1}{G_3} = \frac{1}{G_4 4\pi} = \frac{1}{G_N^3} = Q^3 \qquad c = \frac{3\ell}{2G_3} = \frac{3Q^3}{2}$$

$$ds_3^2 = Q^2\left(\frac{-dt^2+d\sigma^2}{\sigma^2}\right) + \left(d\phi + \frac{Q\,dt}{\sigma}\right)^2$$

$$S_{BH} = \frac{c\,\pi^2 T}{3}$$

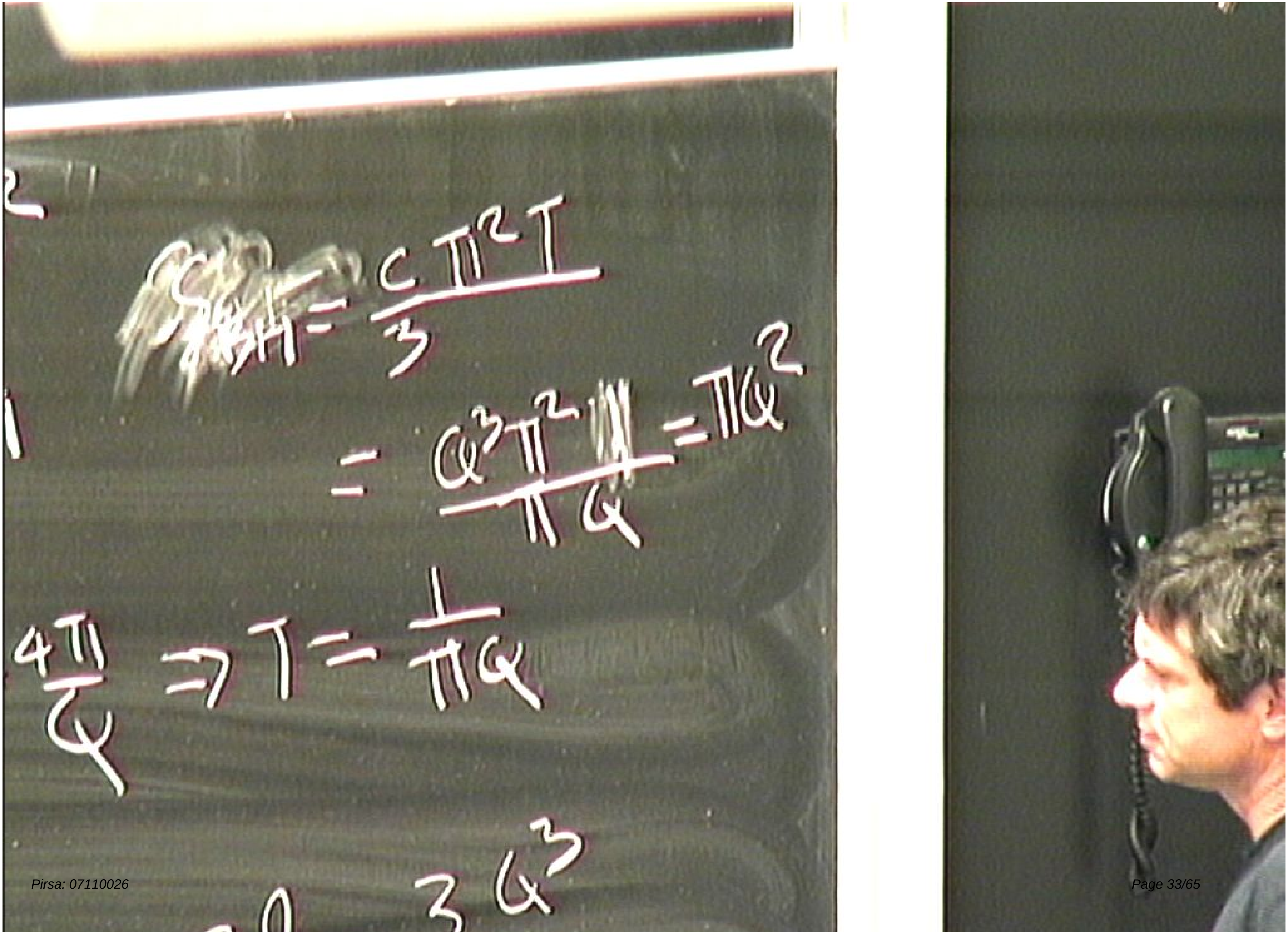
$$\phi \sim \phi + 4\pi$$

$$\psi = \frac{\phi}{Q}$$

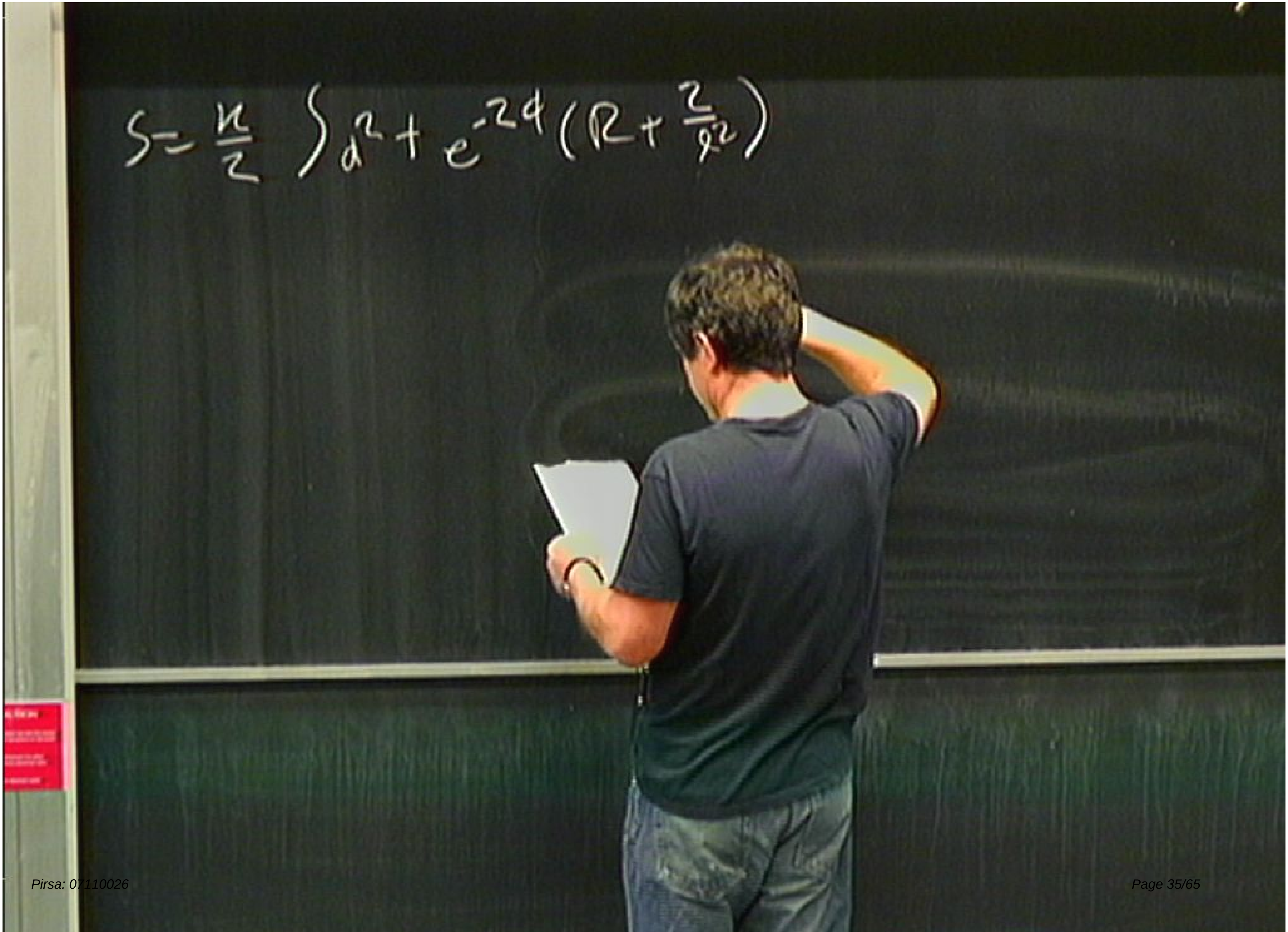
$$= Q^2\left(\frac{d\sigma^2}{\sigma^2} + \frac{dt\,d\psi}{\sigma} + d\psi^2\right) \qquad \psi \sim \psi + \frac{4\pi}{Q} \Rightarrow T = \frac{1}{\pi Q}$$

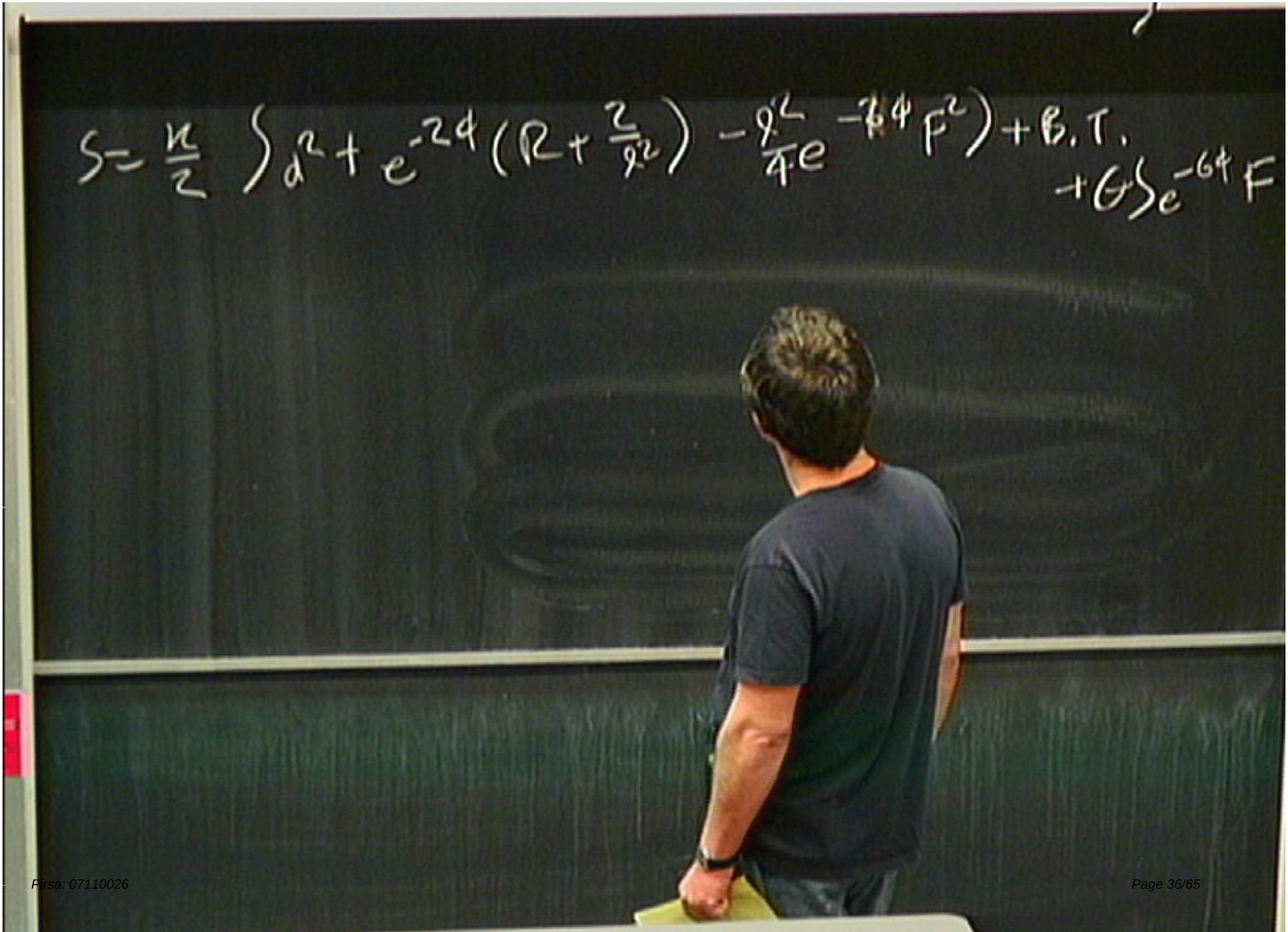
AdS_3

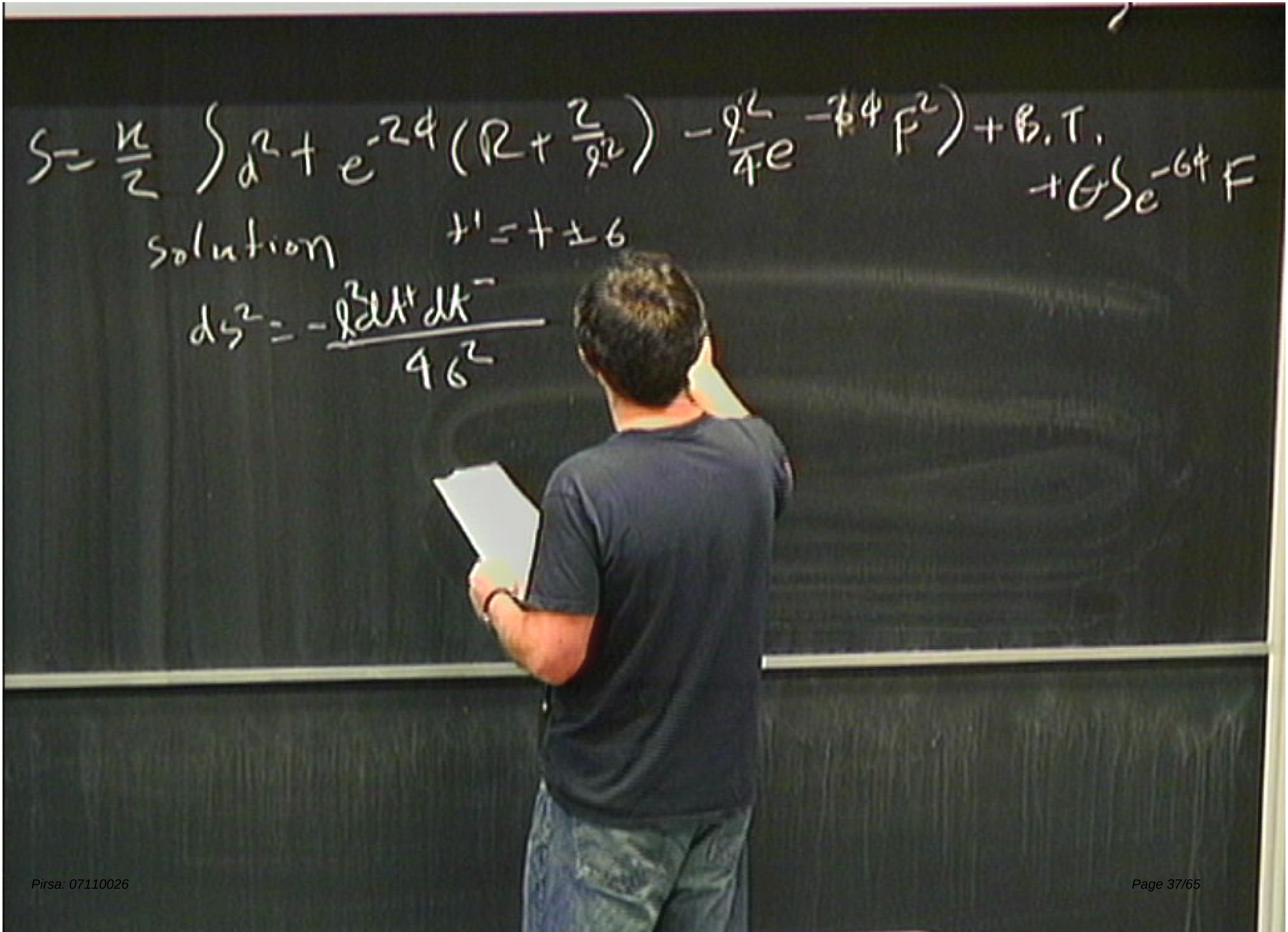
$$\frac{1}{G_3} = \frac{1}{G_2 4\pi} = \frac{1}{G_N^3} = Q^3 \qquad c = \frac{3\ell}{2G_3} = \frac{3Q^3}{2}$$


$S_{BH} = \frac{c\pi^2 T}{3}$
$= \frac{Q^3\pi^2}{\pi Q} = \pi Q^2$
$\frac{4\pi}{Q} \Rightarrow T = \frac{1}{\pi Q}$
$3Q^3$

$S = \frac{n}{2}$ }


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


+ B. T.

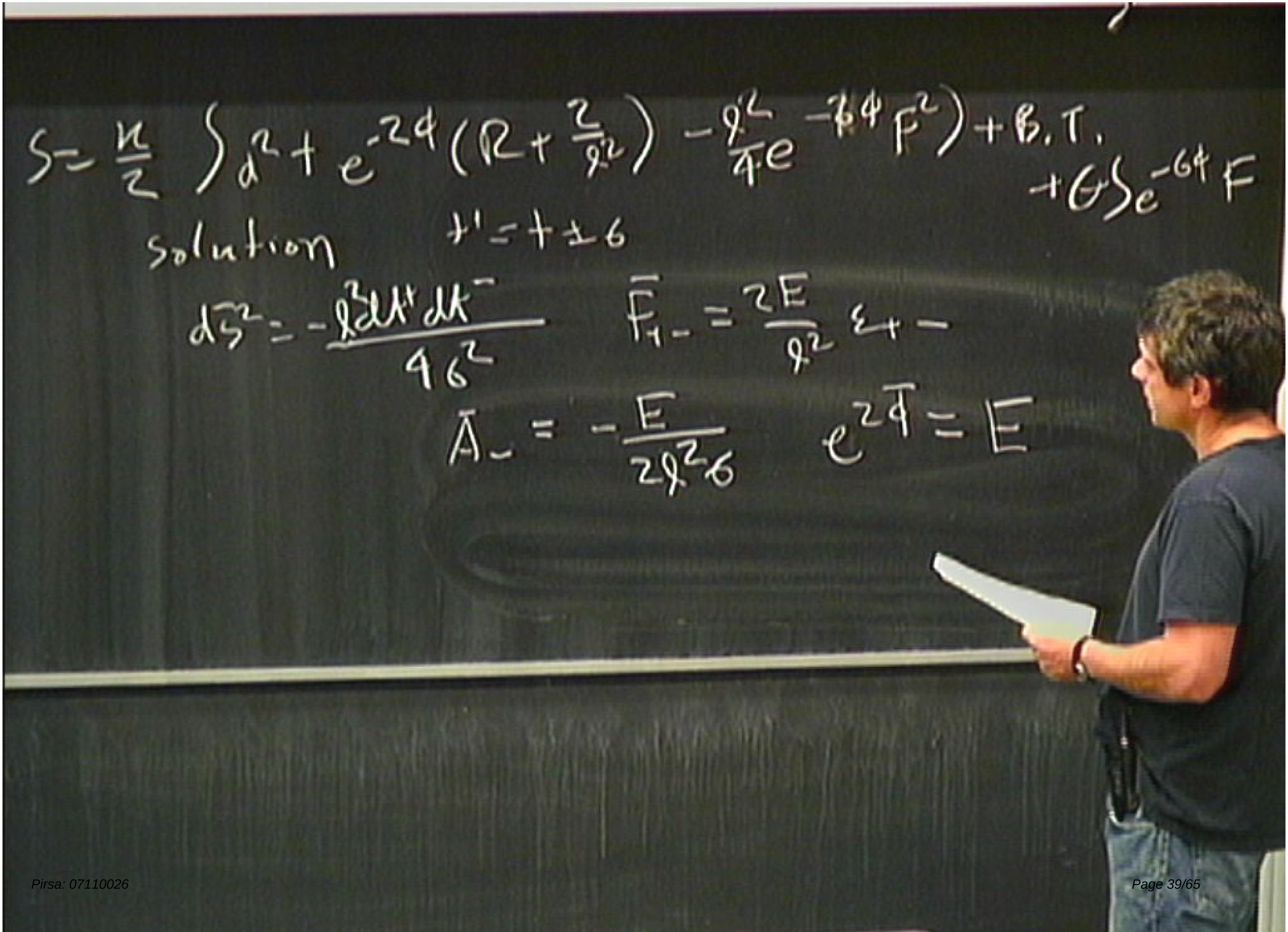

+ B. T.
solution

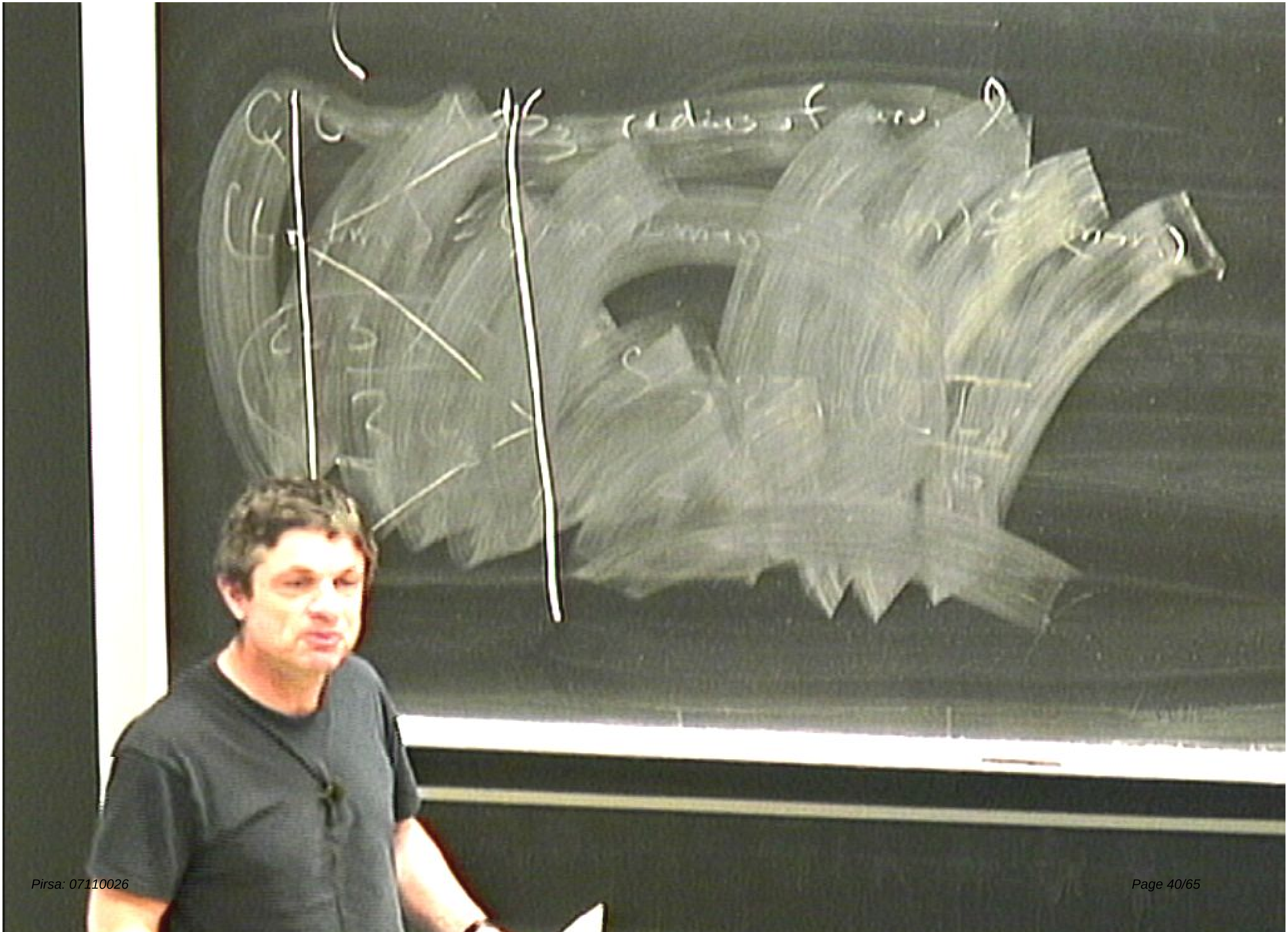
$) d^2 + e$

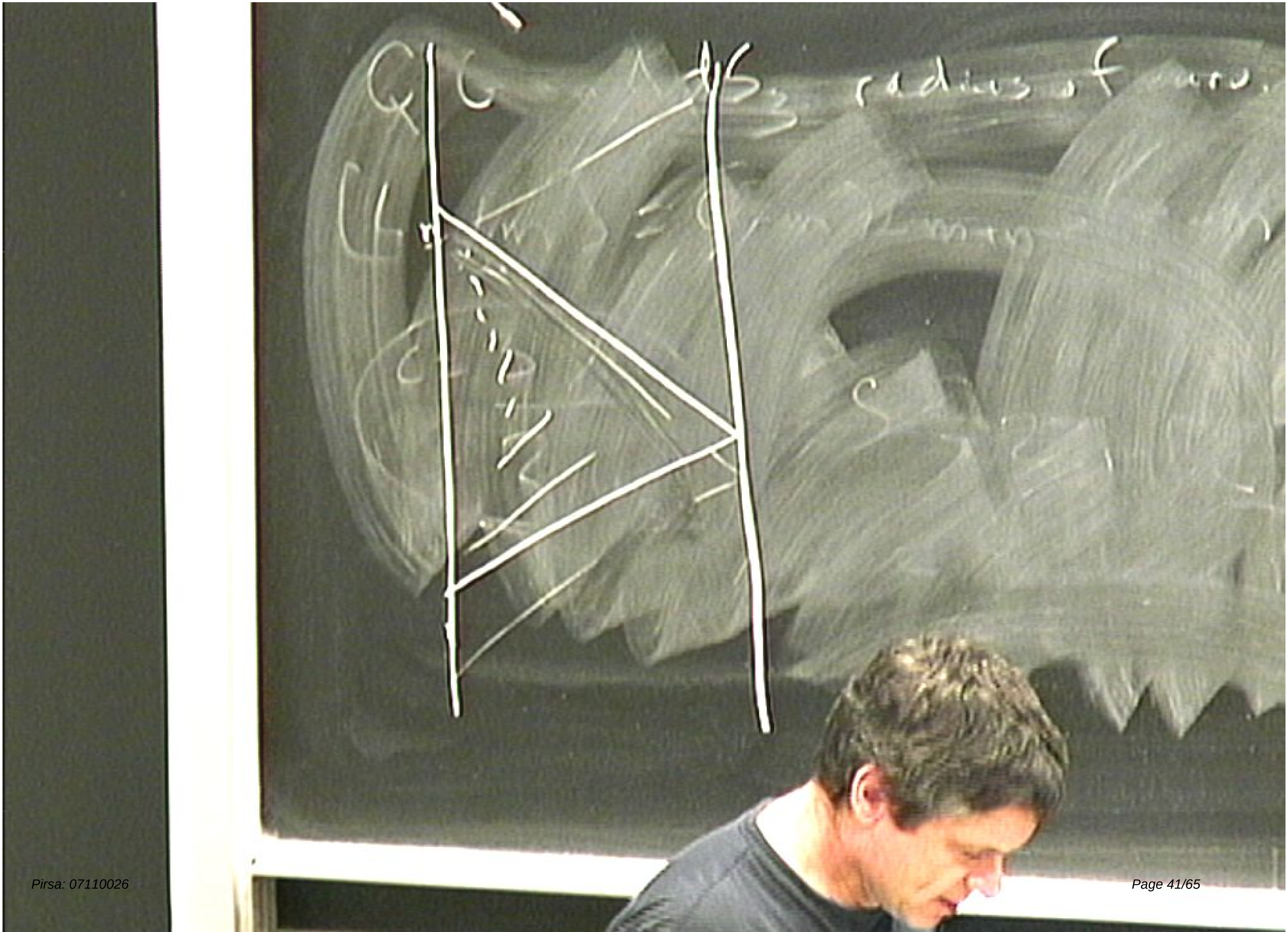
...lution $\quad t' = t \pm 6$

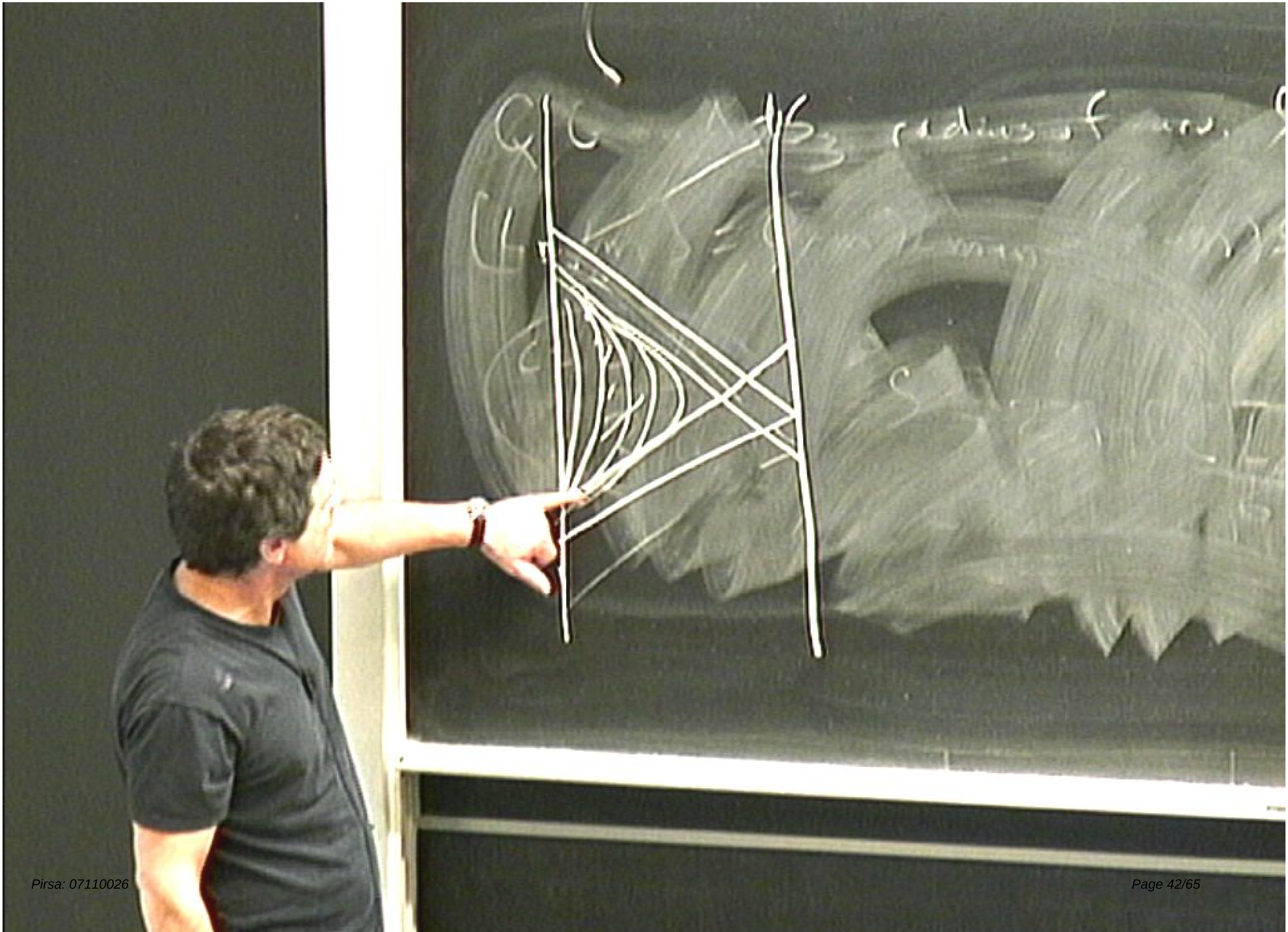
$$d\bar{s}^2 = -\frac{\ell^3 dt^+ dt^-}{4 6^2} \qquad \bar{F}_{+-} = \frac{2E}{\ell^2}\, \varepsilon_{+-}$$

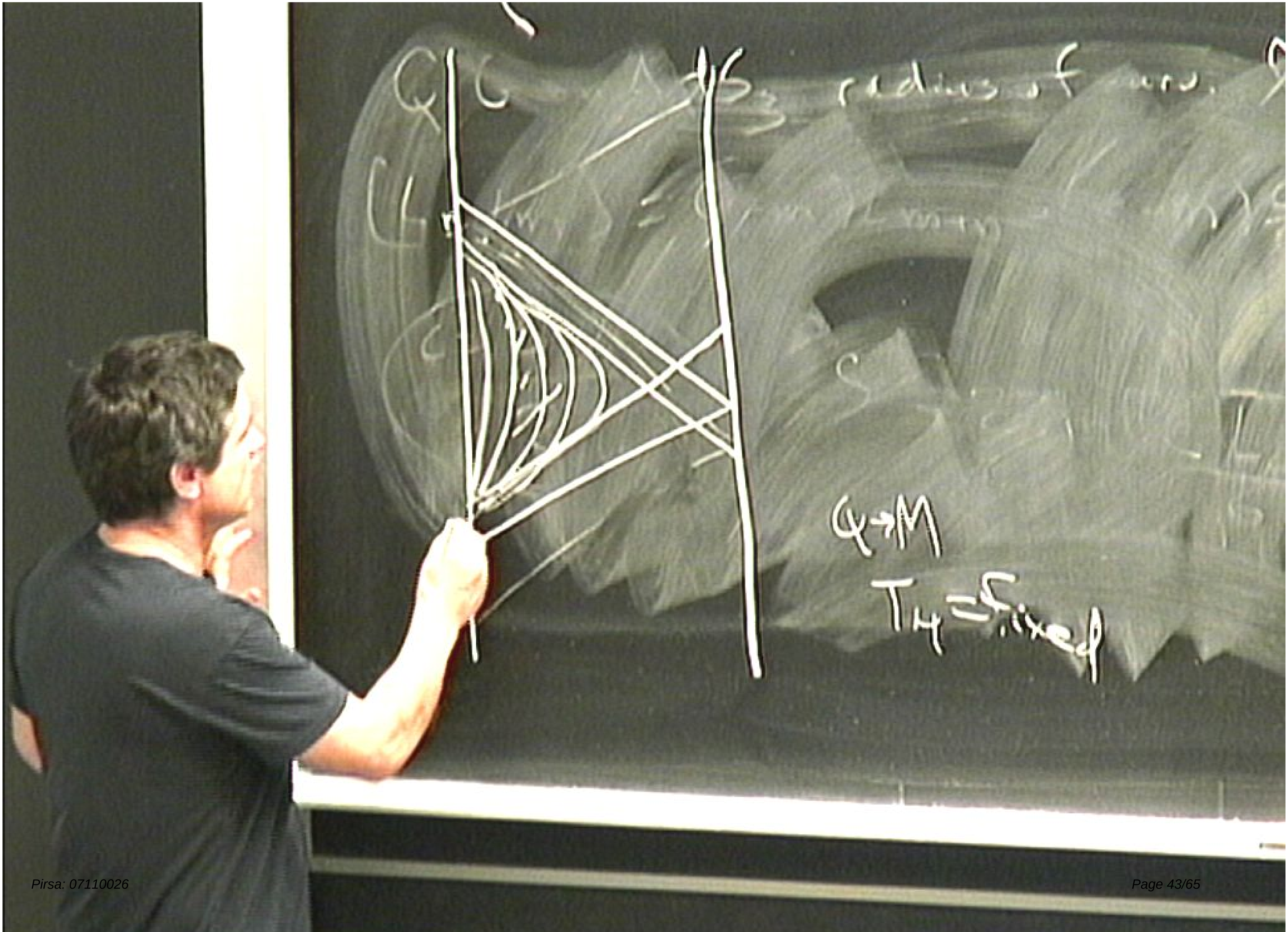
$$\bar{A}_- = -\frac{E}{2\ell^2 6} \qquad e^{2\bar{\Phi}} = E$$

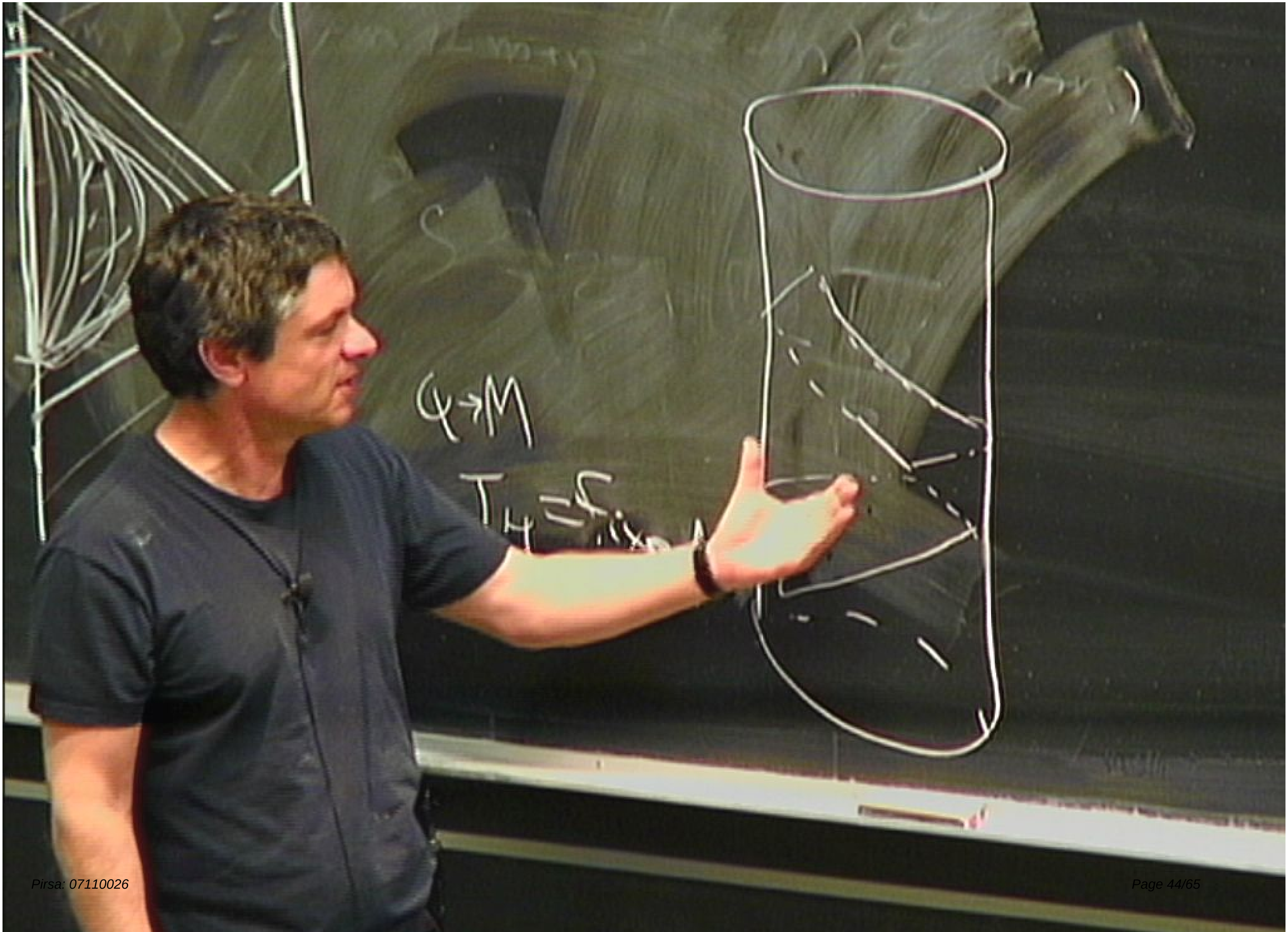

$S = -\frac{\kappa}{2} \int d^2x\, e^{-2\phi}\left(R + \frac{2}{\ell^2}\right) - \frac{\ell^2}{4} e^{-6\phi} F^2\Big) + B.T.$
$+ \theta \int e^{-6\phi} F$
solution $x' = x \pm \sigma$
$d\bar{s}^2 = -\frac{\ell^2 dx^+ dx^-}{4\sigma^2}$
$\bar{F}_{+-} = \frac{2E}{\ell^2} \epsilon_{+-}$
$\bar{A}_- = -\frac{E}{2\ell^2\sigma}$
$e^{2\bar{\phi}} = E$

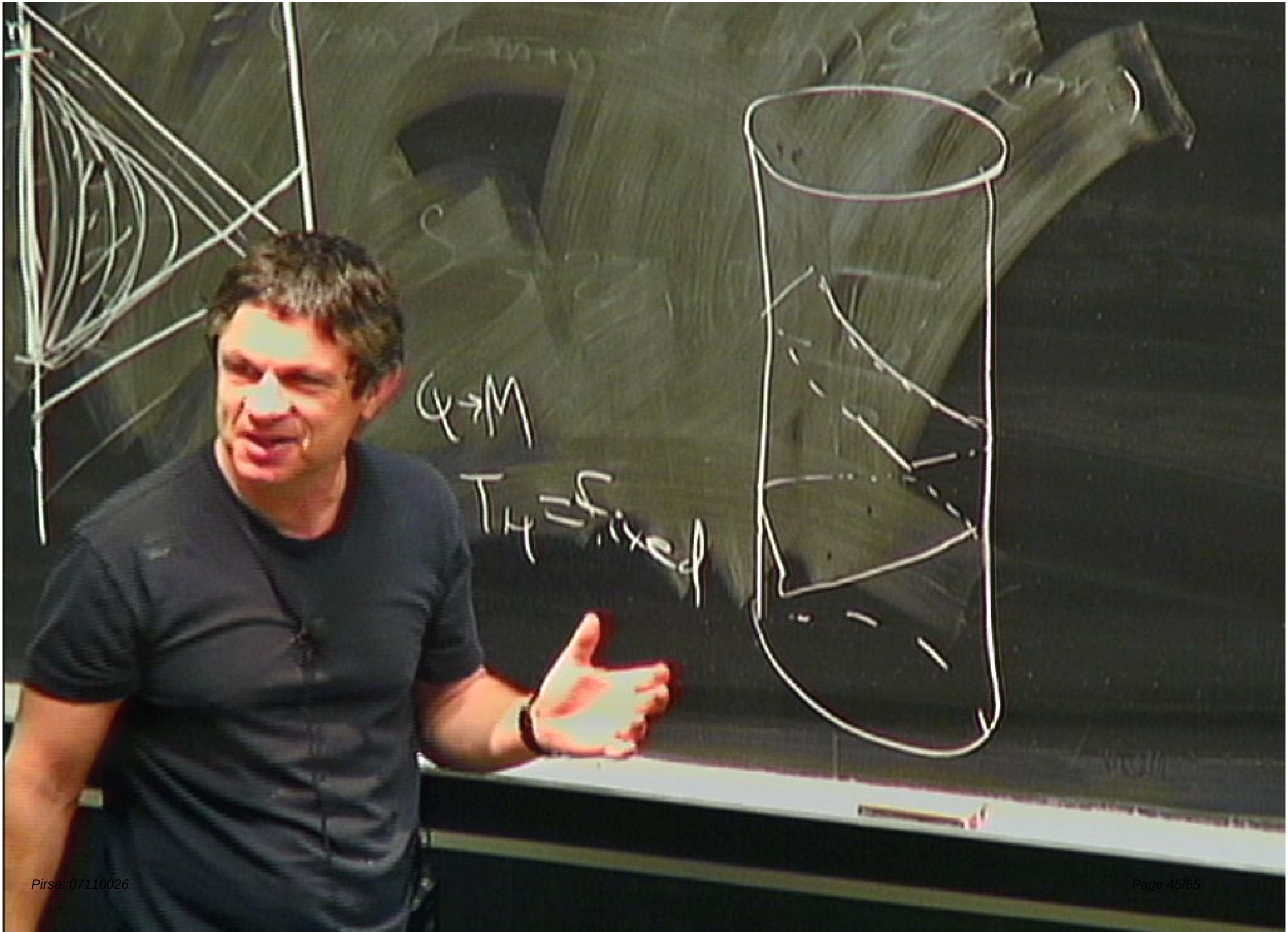




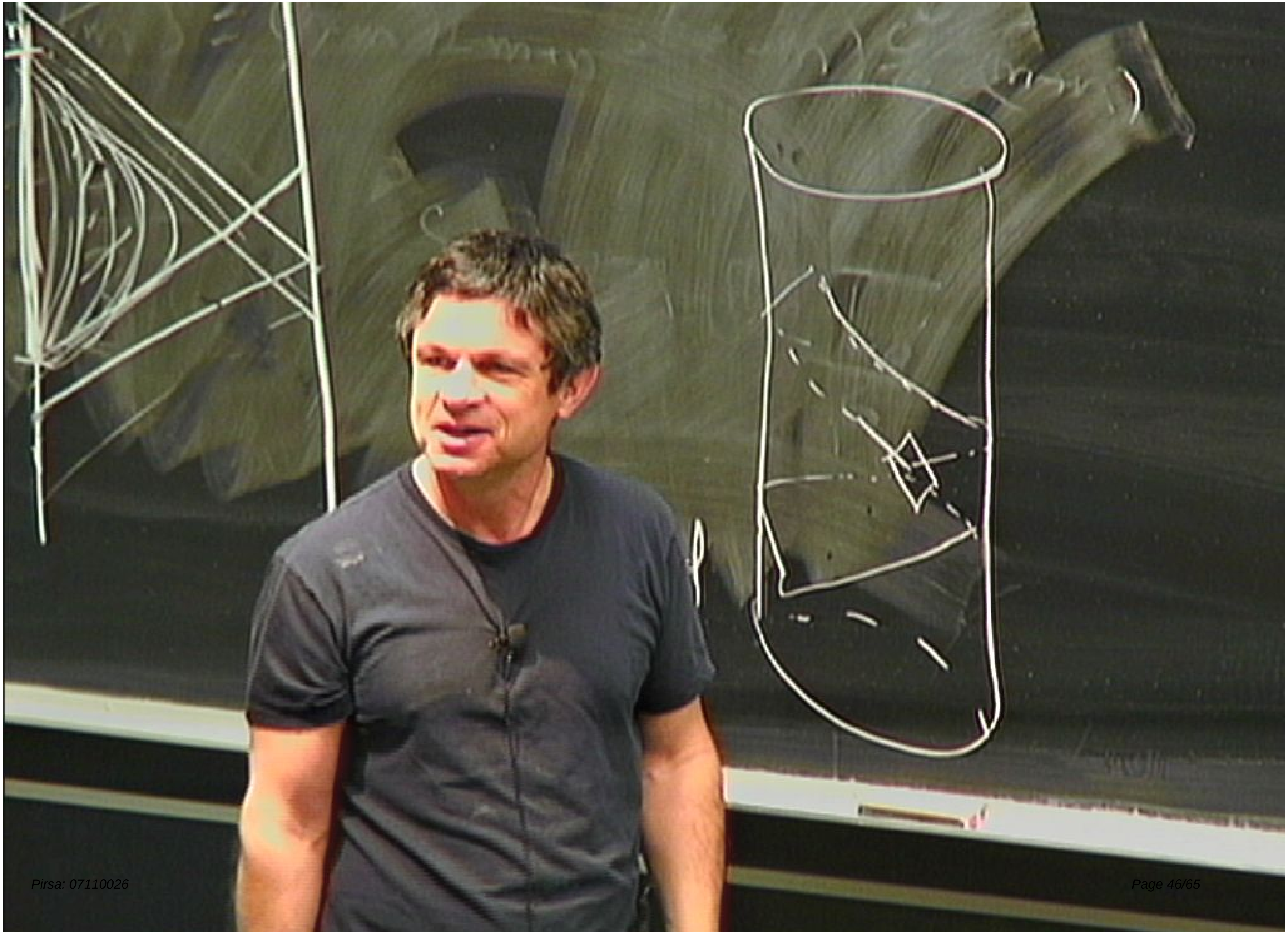


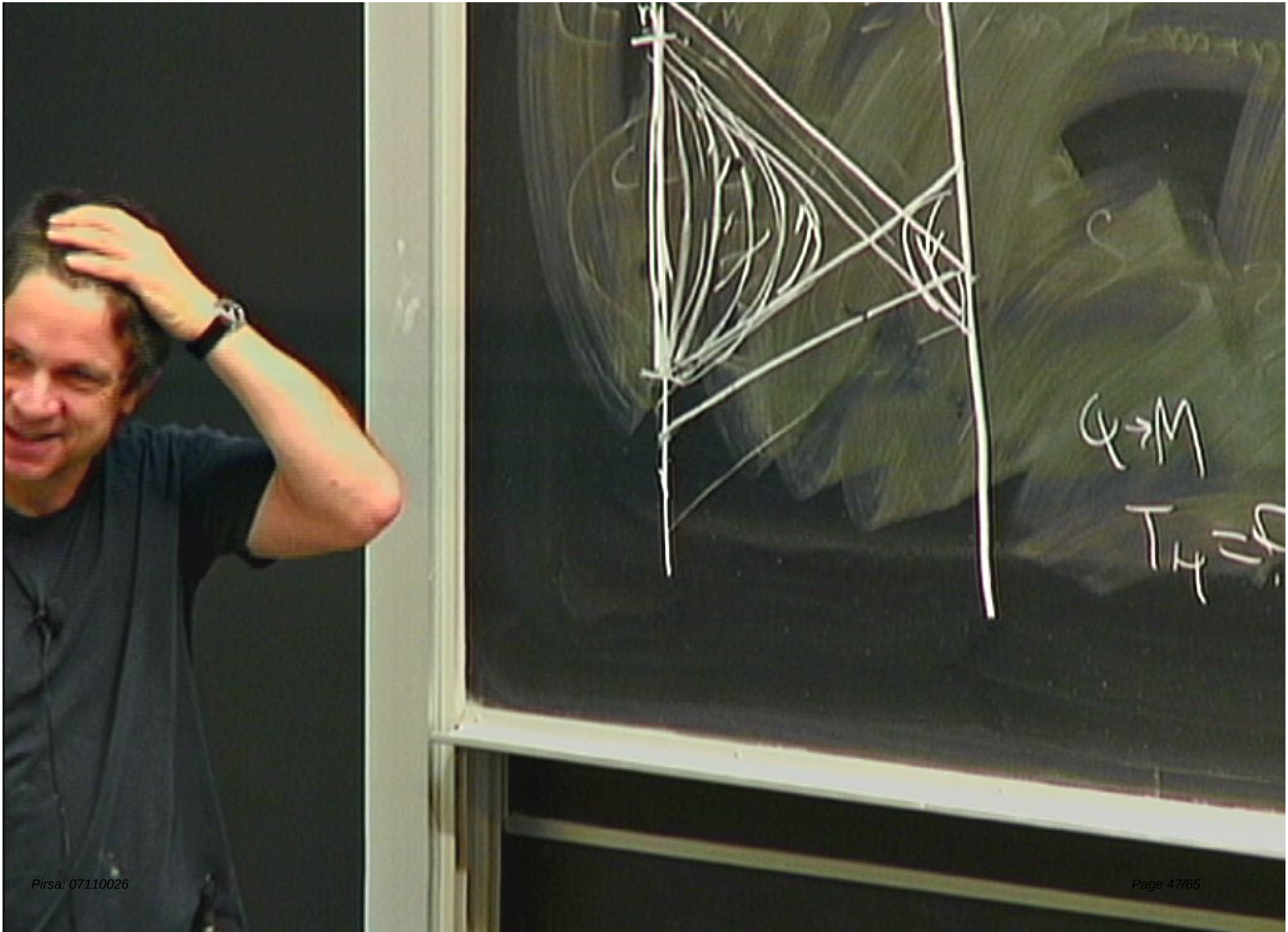

Q→M
T_H = fixed

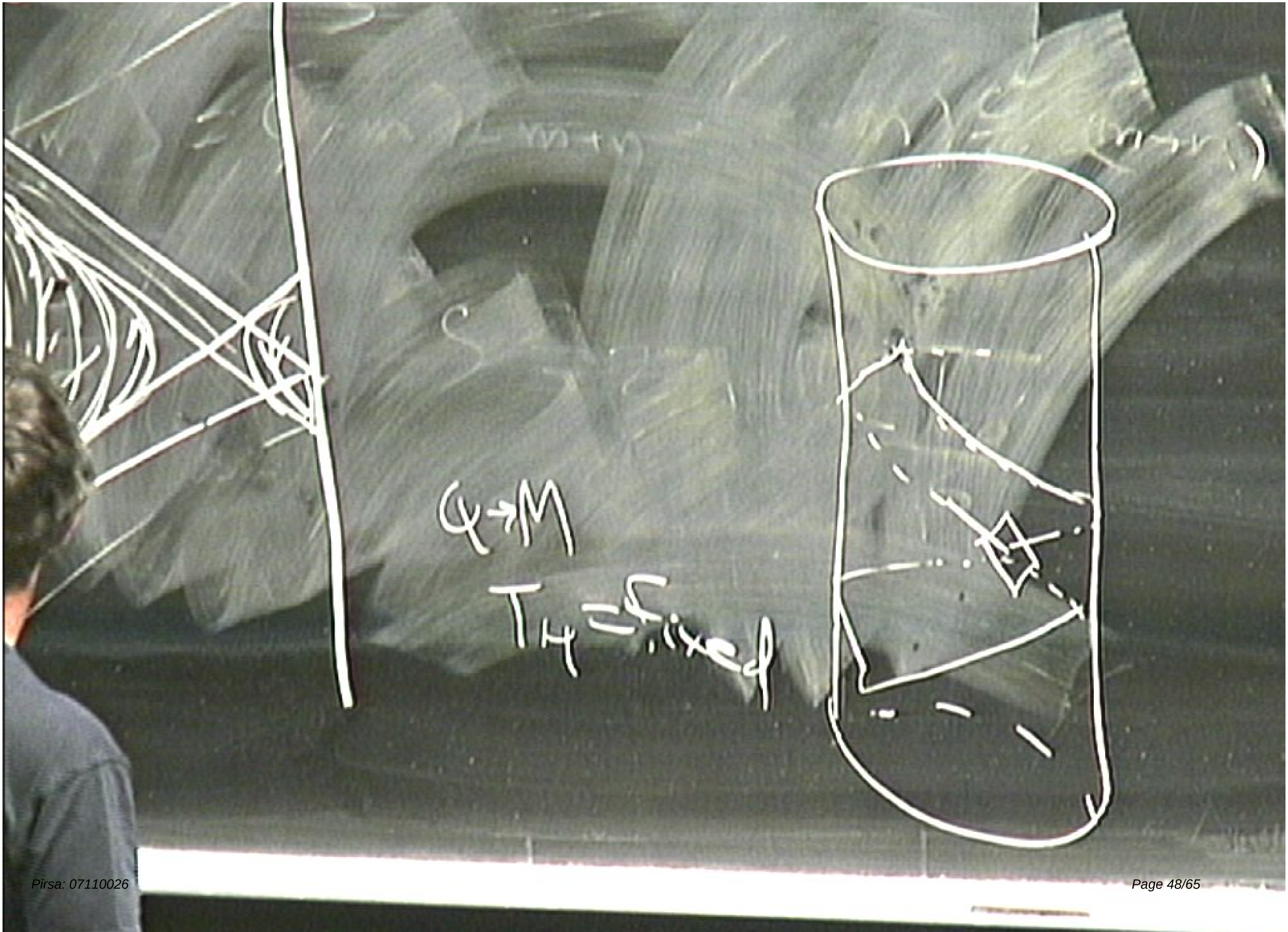


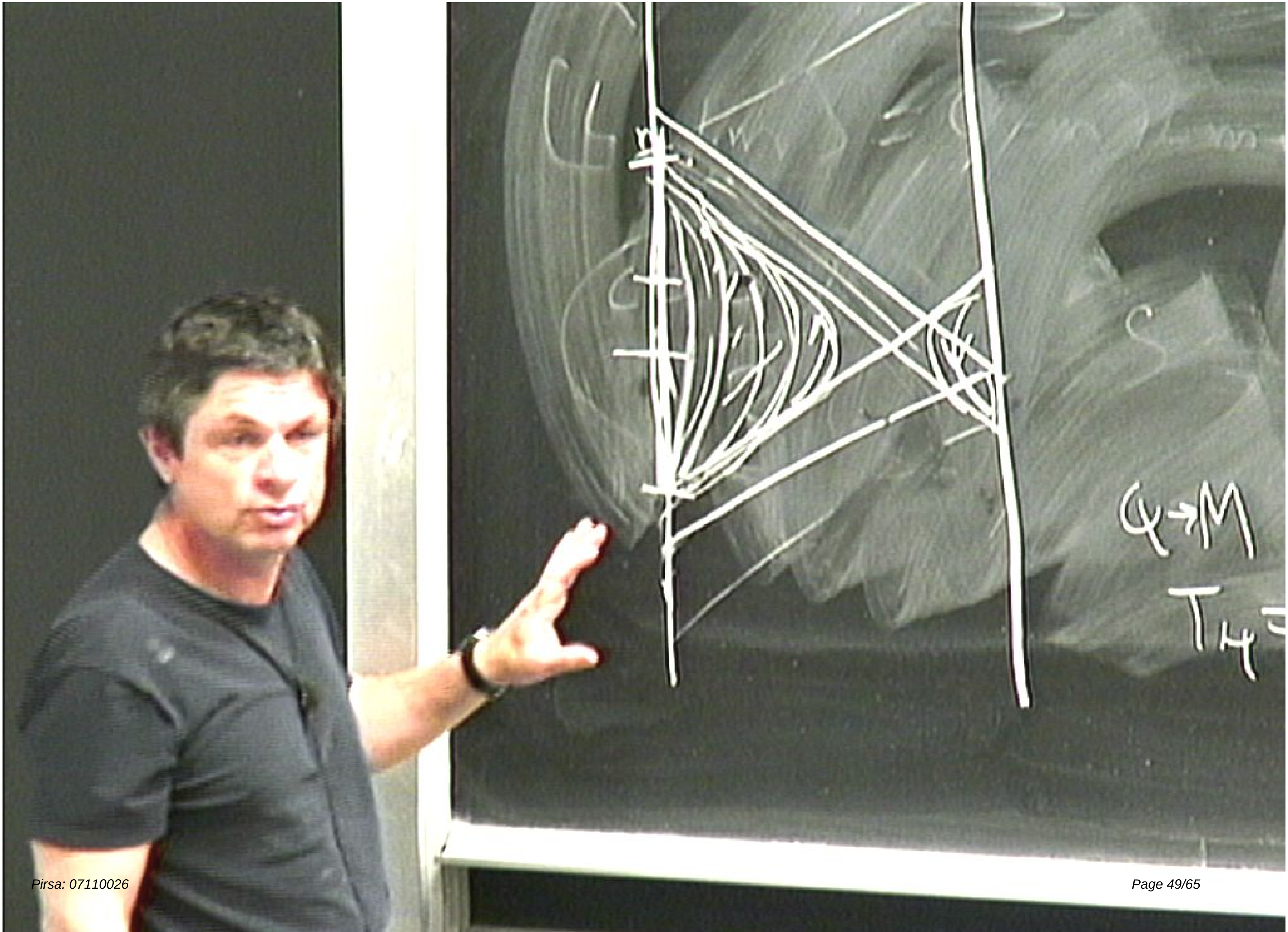


Q→M
T_H = fixed

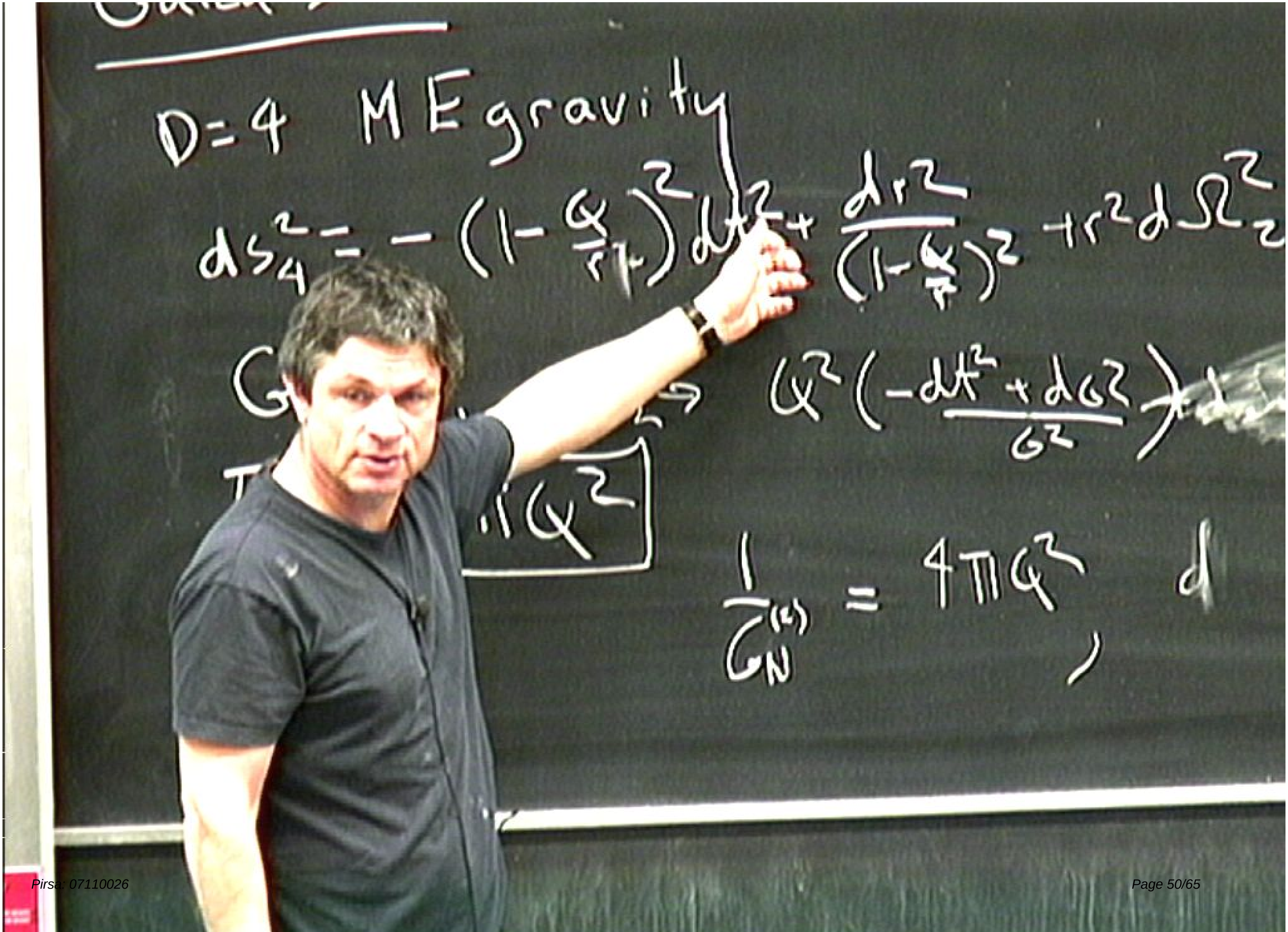


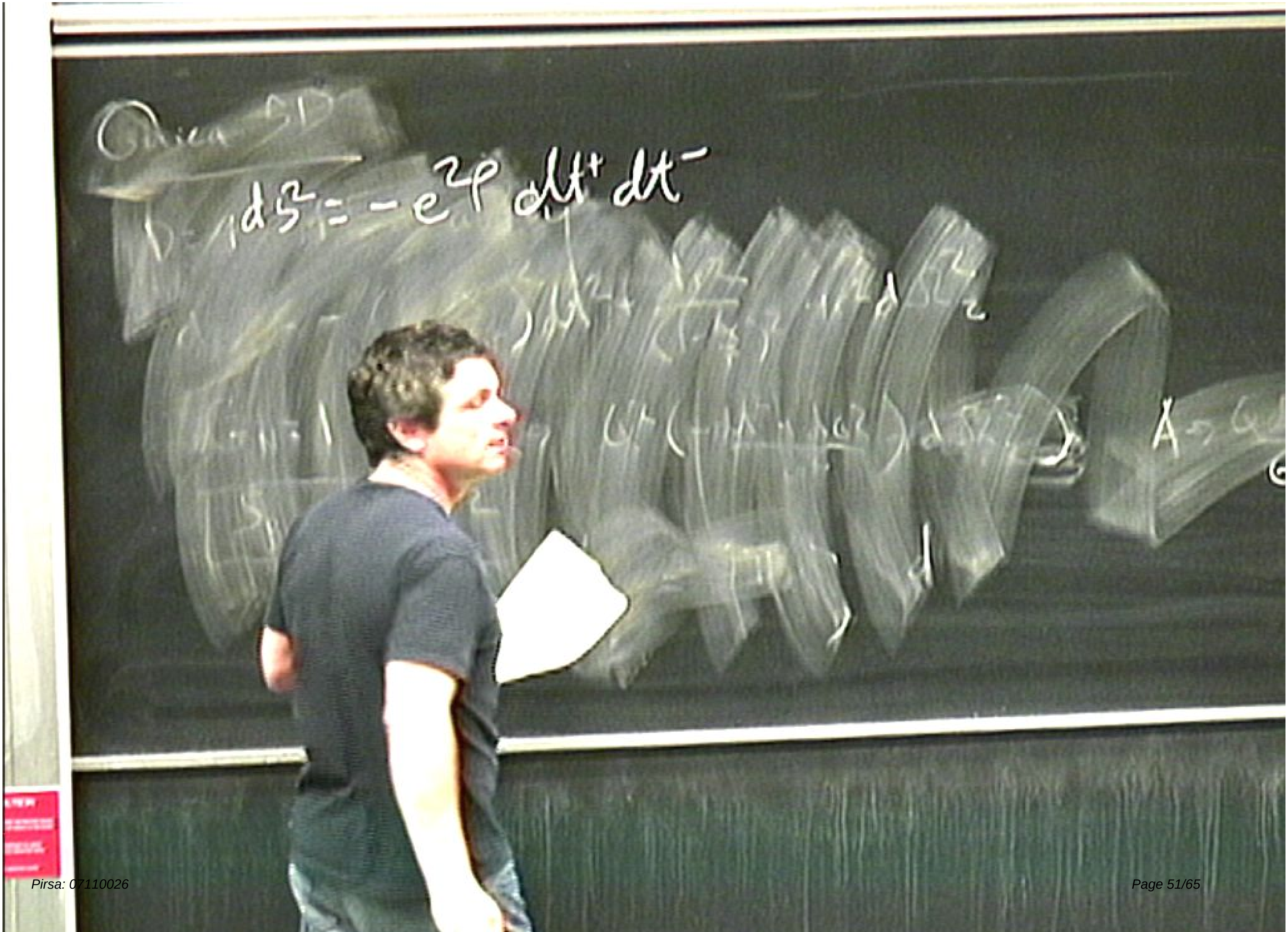

Q→M


Q→M
T_H = fixed



Q→M


D=4 ME gravity
ds²₄ = −(1−Q/r)² dt² + dr²/(1−Q/r)² + r² dΩ²₂
Q²(−dt² + dσ²/σ²)
1/G_N^(2) = 4πQ²


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

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

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

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

conf. diffeom

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

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

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

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

Gauge symmetry

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

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

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

conf. diff com

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

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

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

Naively

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

Gauge symmetry

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

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Gauge symmetry

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conf. diffeom

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

Naively

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

$$T_{--},\ J_+ + A$$

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

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

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

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

Gauge symmetry

$$\delta A_\pm = \pm\partial_\pm \Theta$$

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

conf. diffeom

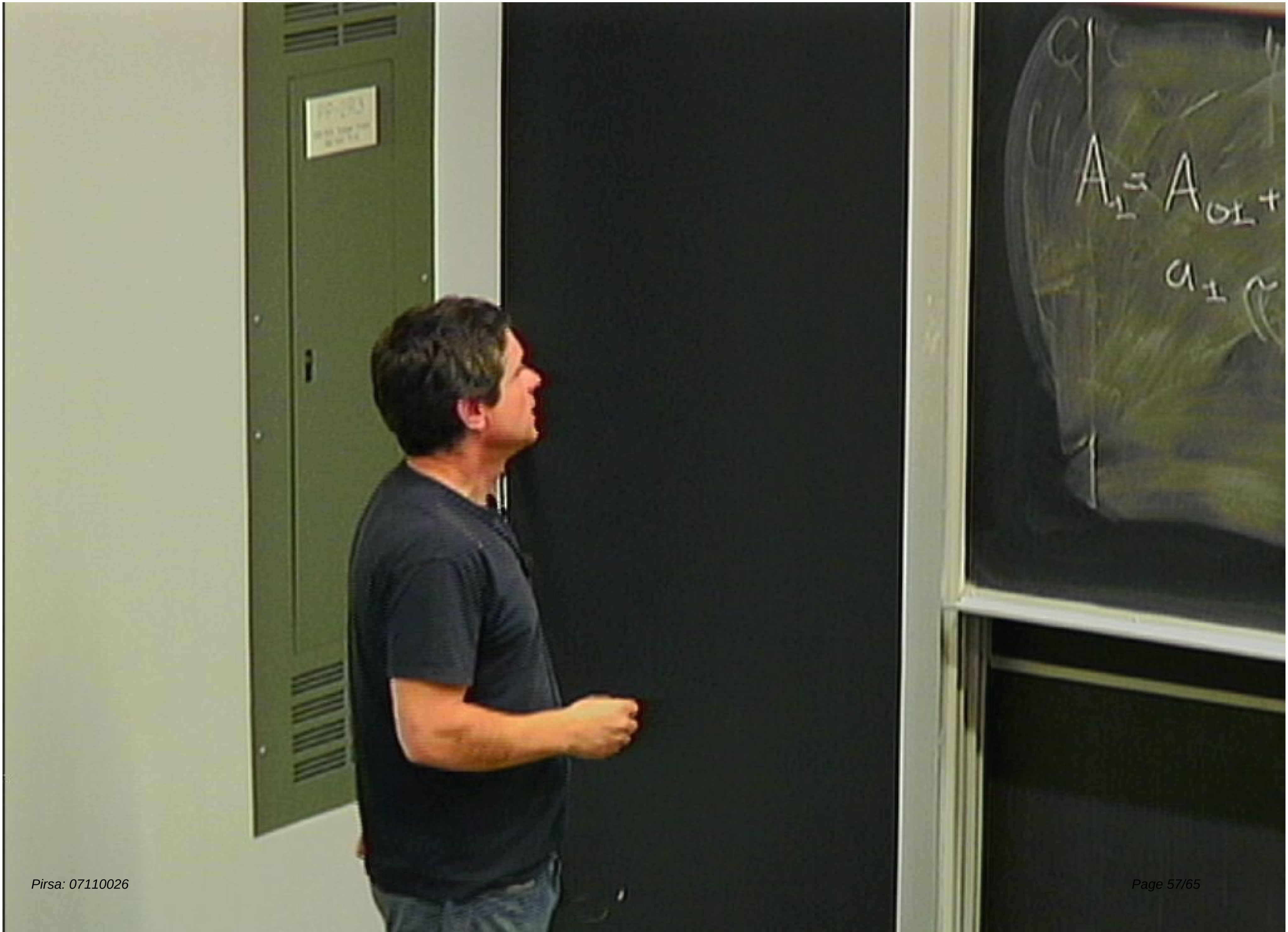
$$\xi^+(t^+),\ \xi^-(t^-)$$

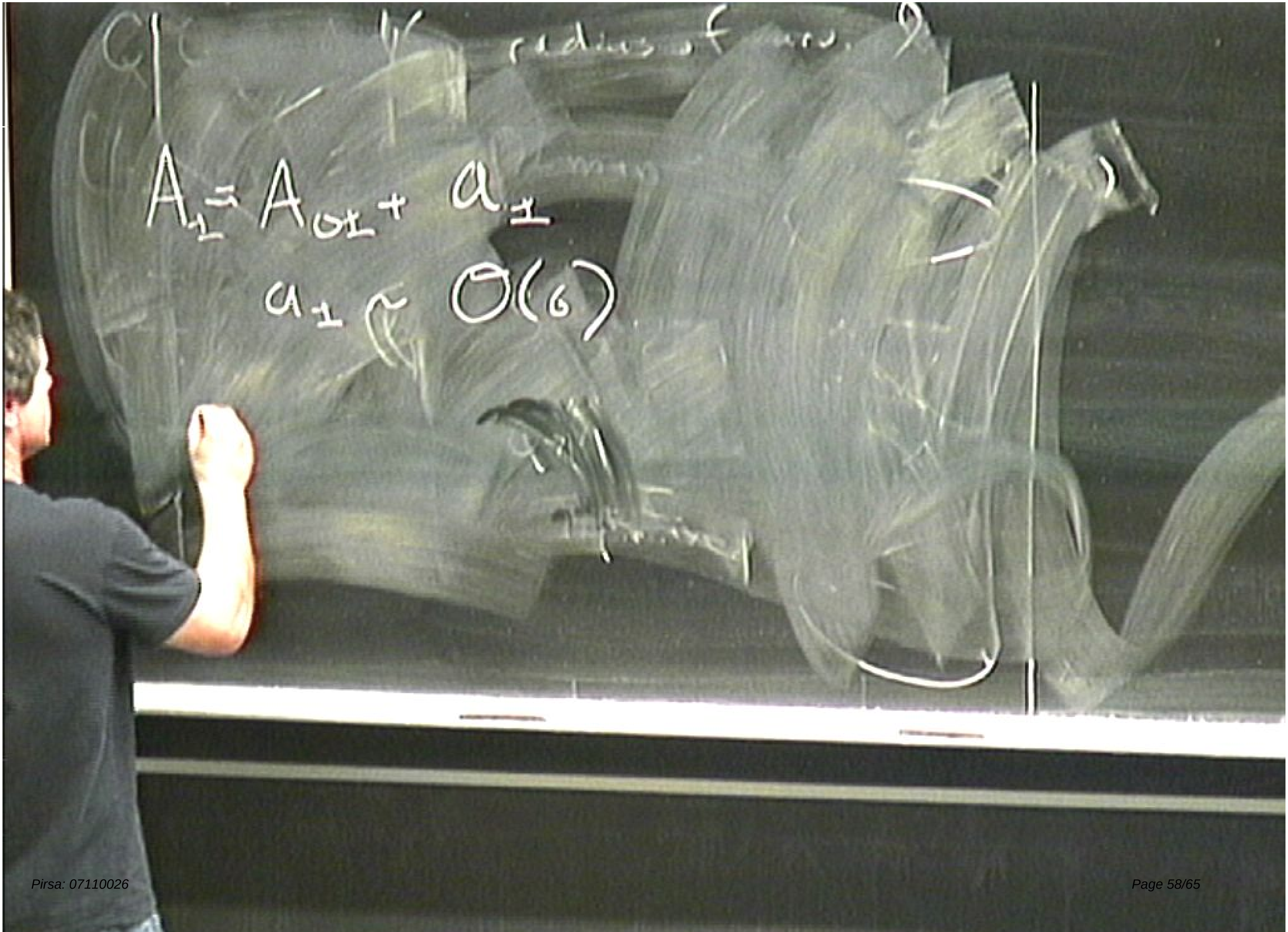
Naively

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

$$T_{--},\ J_-,\ A$$

$$T_{--}\,T_{--} \sim \frac{c}{(z-w)^4}$$

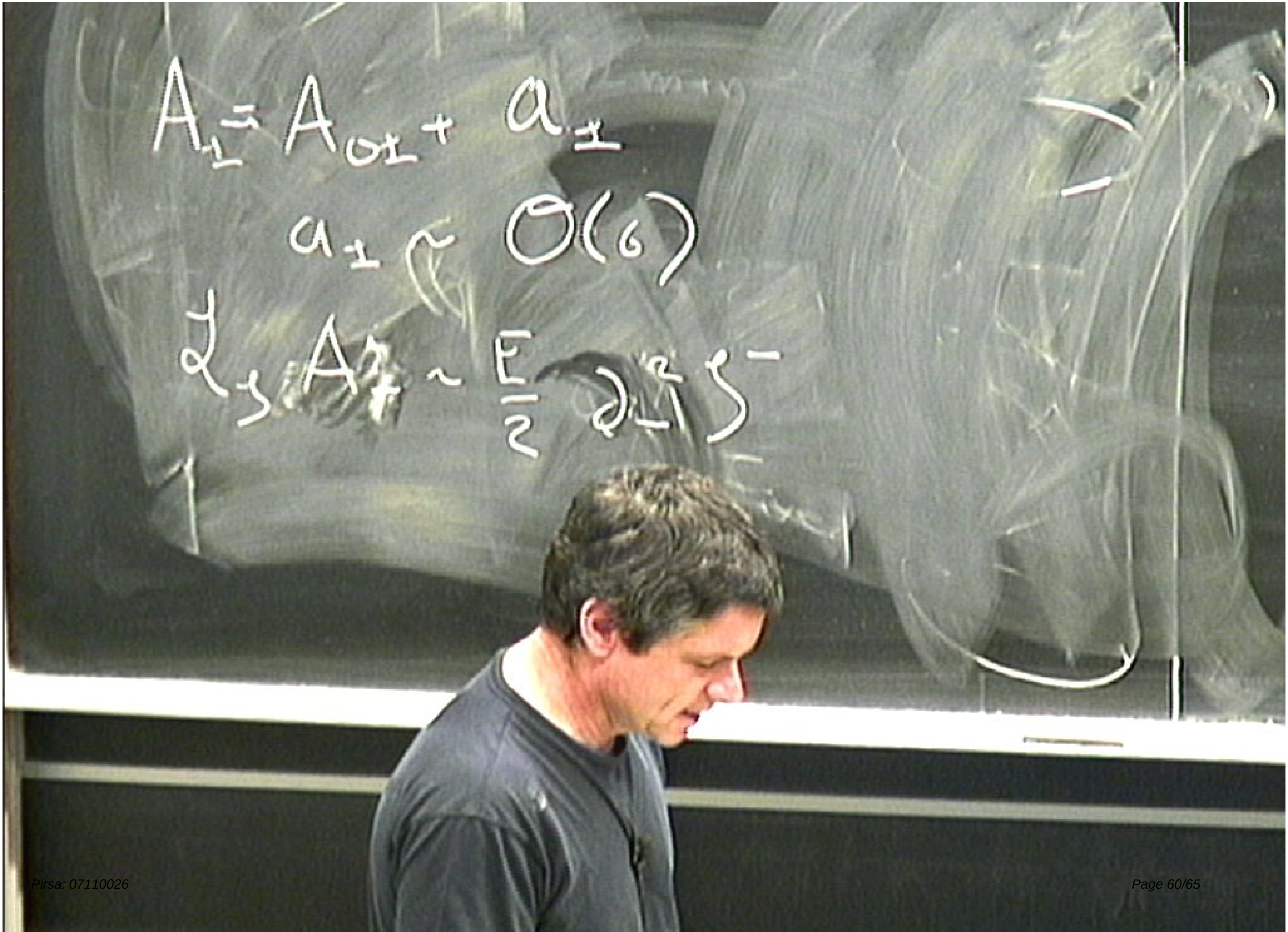

$A_1 = A_{01} +$
a_1


$A_1 = A_{01} + a_1$
$a_1 \sim O(\epsilon)$

$$A_1 = A_{01} + a_1$$

$$a_1 \sim O(6)$$

$$\mathcal{L}_3 \, A_1 \sim$$

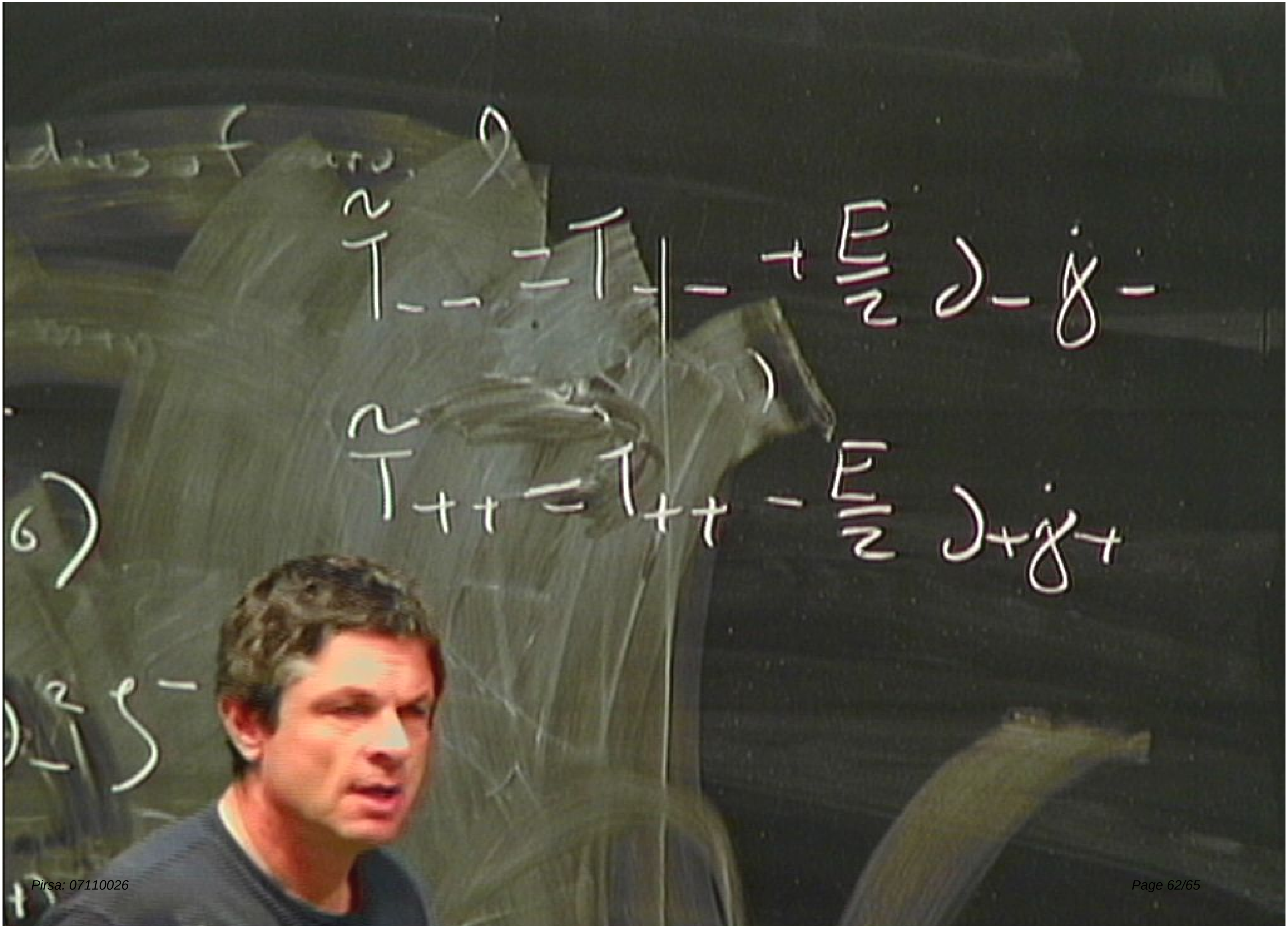

$A_1 = A_{01} + a_1$
$a_1 \sim O(\epsilon)$

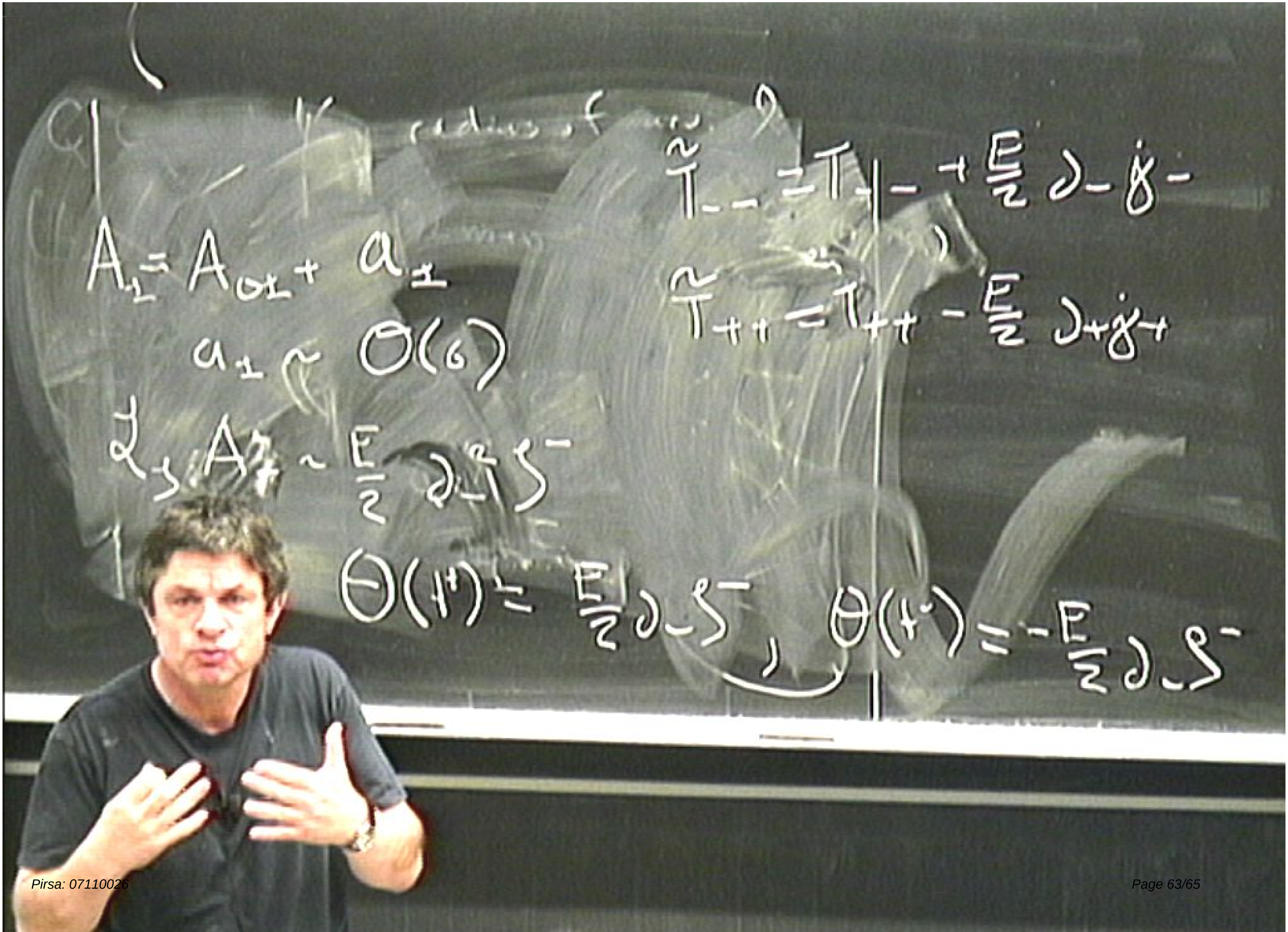
$$A_1 = A_{01} + a_1$$

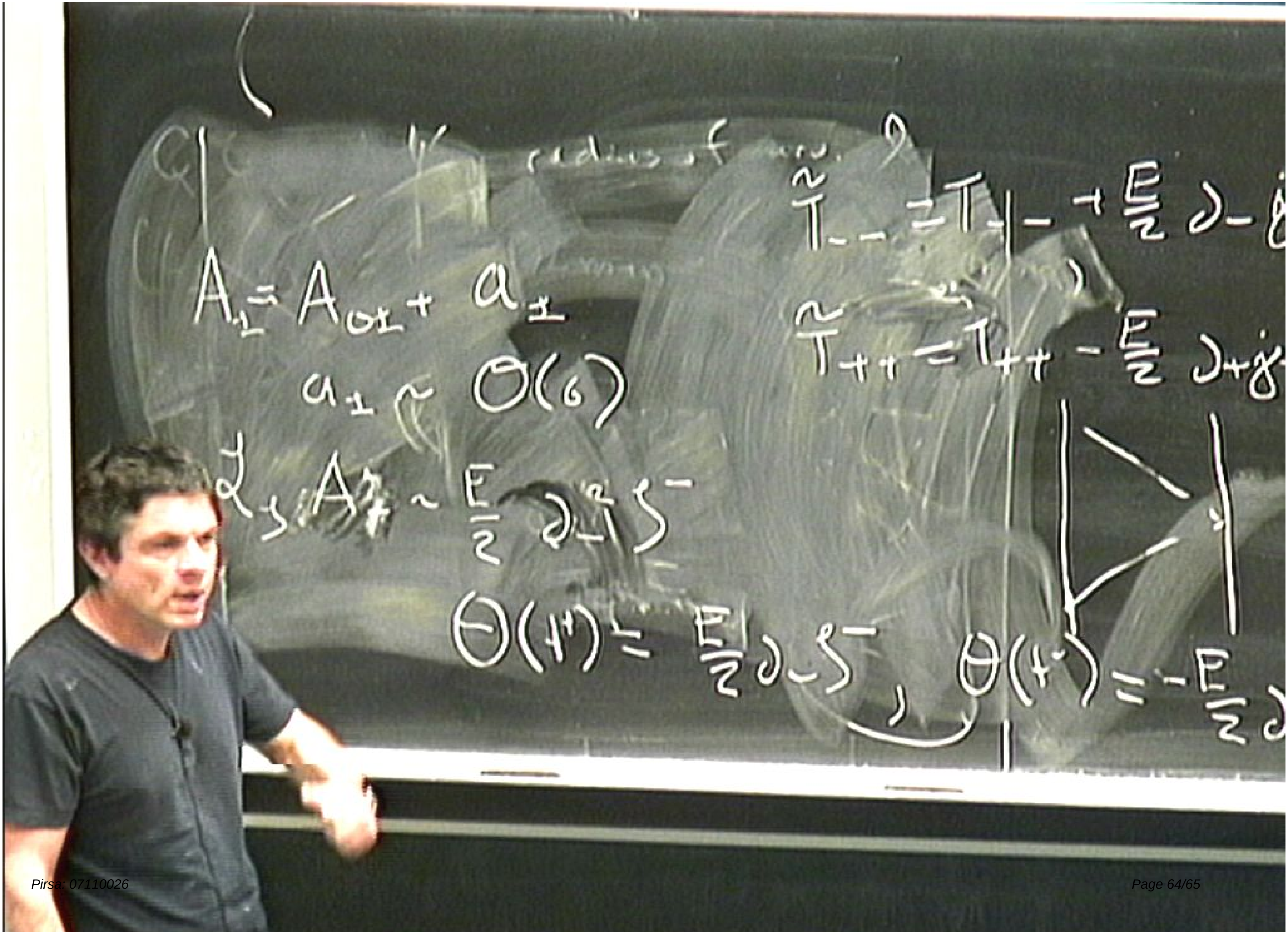
$$a_1 \sim O(\epsilon)$$

$$\mathcal{L}_3 A_1 \sim \frac{E}{2}\partial_-^2 \varsigma^-$$

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


$\tilde{T}_{--} = T_{--} + \frac{E}{2} \partial_- \dot{\gamma}_-$
$\tilde{T}_{++} = T_{++} - \frac{E}{2} \partial_+ \dot{\gamma}_+$


$A_1 = A_{01} + a_1$
$a_1 \sim O(\epsilon)$
$\tilde{T}_{--} = T_{--} + \frac{E}{2} \partial_- \dot{g}_-$
$\tilde{T}_{++} = T_{++} - \frac{E}{2} \partial_+ \dot{g}_+$
$\Theta(t^+) = \frac{E}{2} \partial_- \rho^-$, $\Theta(t^-) = -\frac{E}{2} \partial_- \rho^-$


A₁ = A₀₁ + a₁
a₁ ~ O(ε)
T̃₊₊ = T₊₊ − E/2 ∂₊
T̃₋₋ = T₋₋ + E/2 ∂₋
Θ(+) = E/2 ∂₋ ξ⁻
Θ(+) = −E/2

$$\tilde{T}_{--} = T_{--} + \frac{E}{2}\partial_- \dot{g}_-$$

$$\tilde{T}_{++} = T_{++} - \frac{E}{2}\partial_+ \dot{g}_+$$

$$A_1 = A_{01} + a_1$$

$$a_1 \sim O(\epsilon)$$

$$\mathcal{L}_3 A \sim \frac{E}{2}\partial_-^2 \zeta^-$$

$$\Theta(t^+) = \frac{E}{2}\partial_- \zeta^- \,, \quad \Theta(t^-) = -\frac{E}{2}\partial_- \zeta^-$$