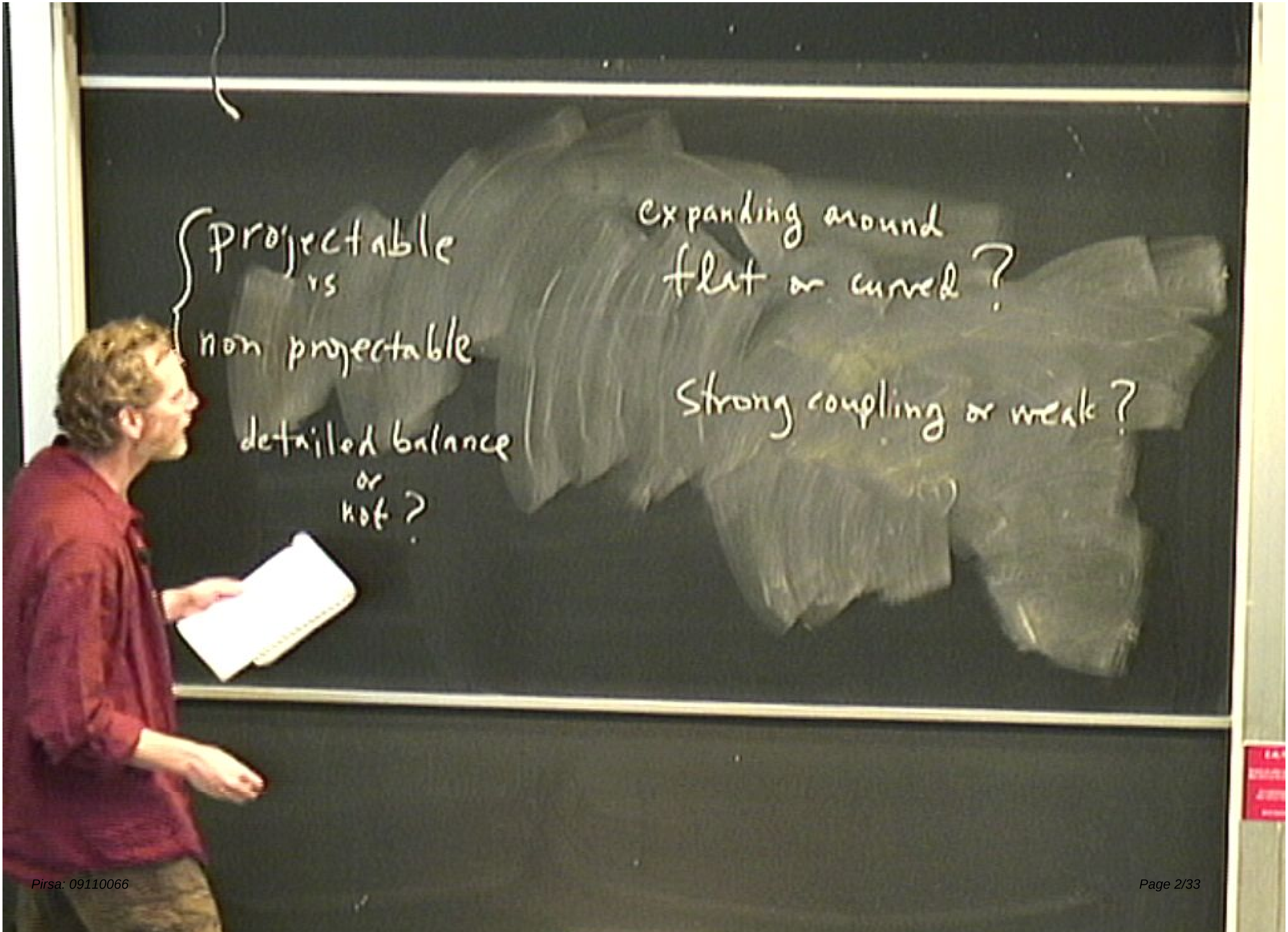
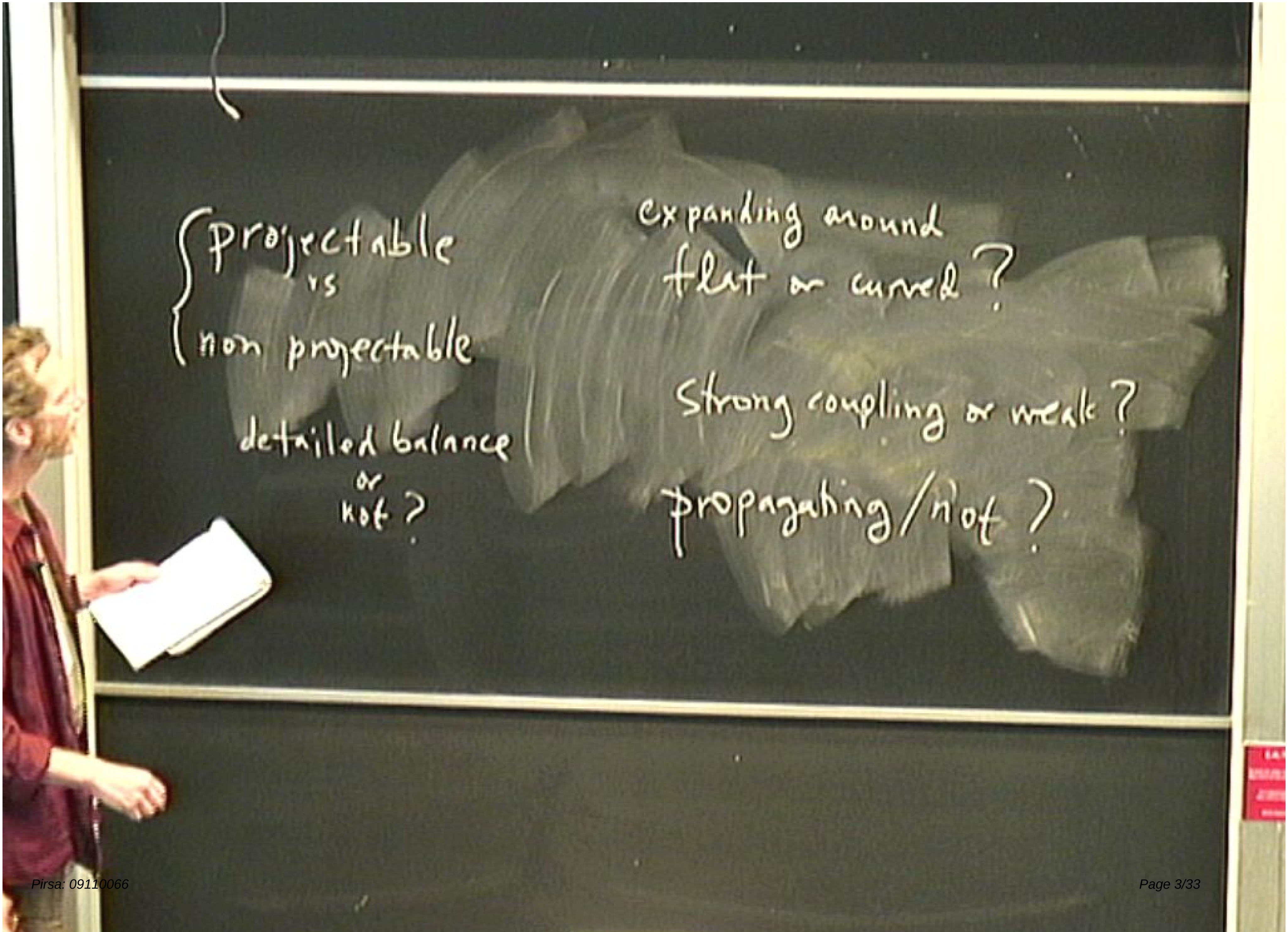
Title: Workshop Summary and Discussion

Date: Nov 10, 2009 03:00 PM

URL: http://pirsa.org/09110066

Abstract:


projectable
vs
non projectable
detailed balance
or
not ?
expanding around
flat or curved ?
Strong coupling or weak ?


projectable
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propagating / not ?

projectable
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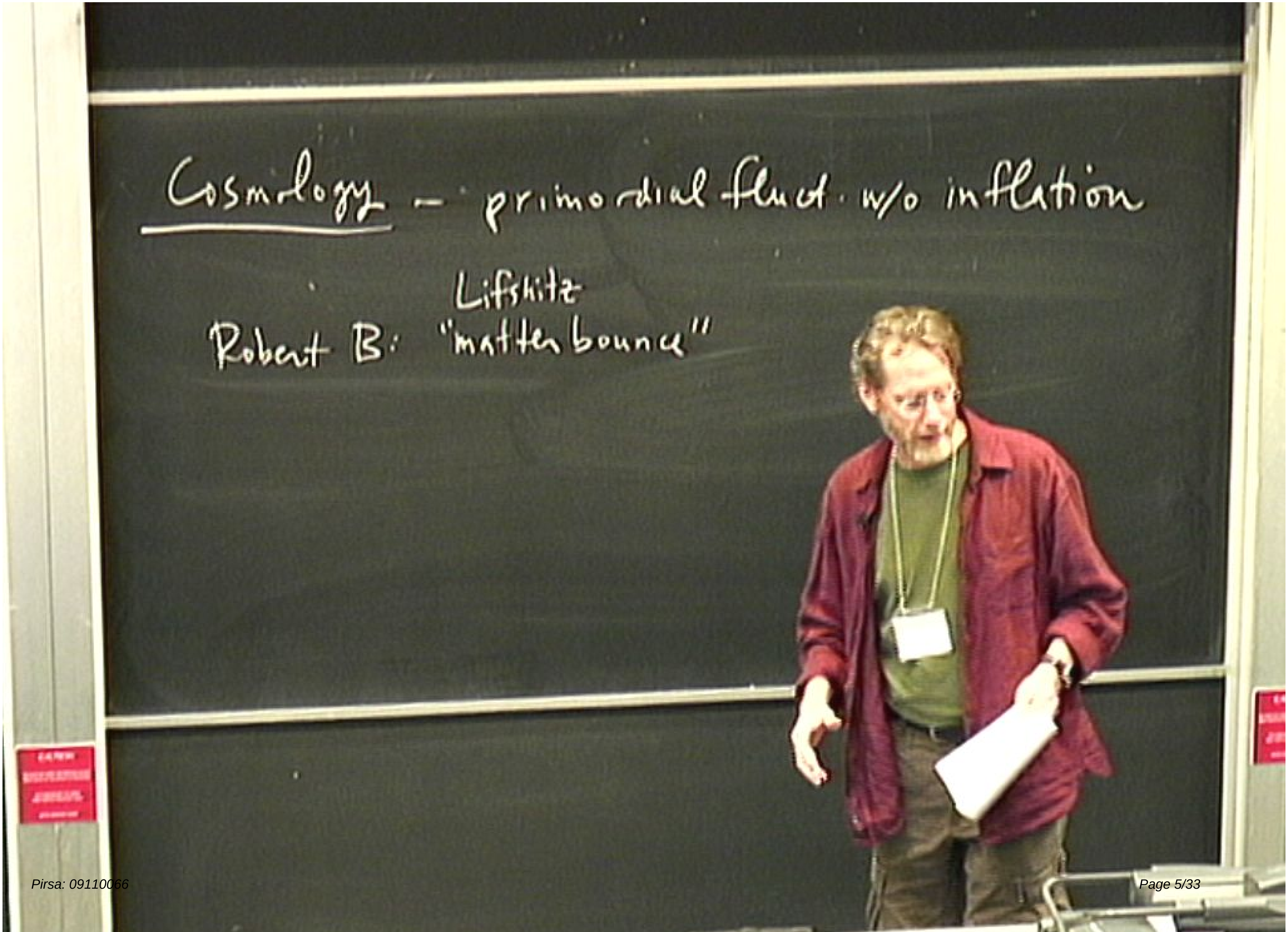
not ?

Strong coupling or weak ?

propagating / not ?

Add $\left(\frac{\partial_i N}{N}\right)^2$ or not ?


Cosmology – primordial fluct. w/o inflation
Lifshitz
Robert B: "matter bounce"

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"by accident" scale inv. if matter dominated

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Shinji M. $\omega^2 \propto k^6$

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scale inv.

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$\mathcal{L}$ scale inv. from $\Phi \to b^{-\left(\frac{3-z}{2}\right)} \Phi$

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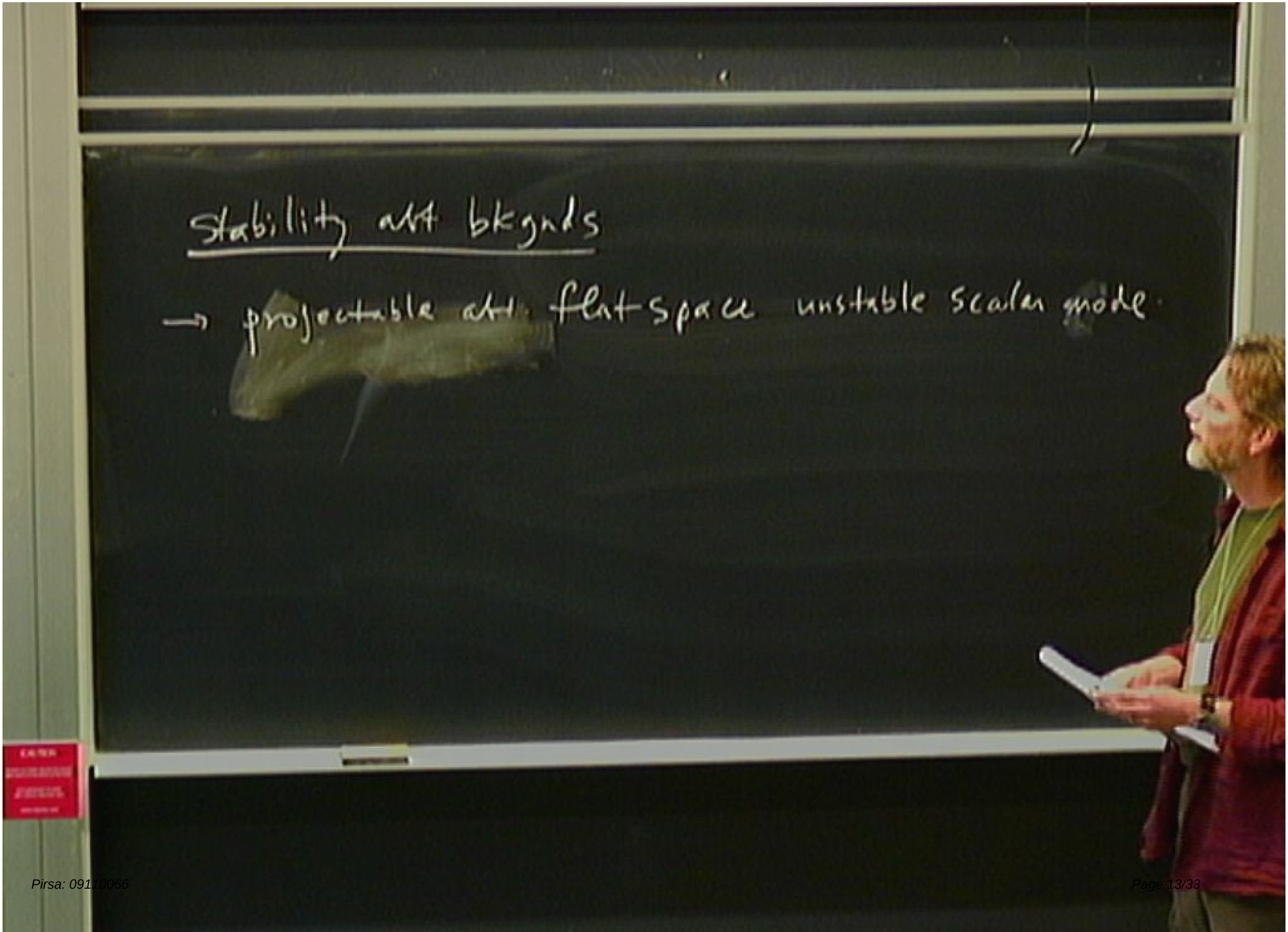
Stability abt bkgnds
→ projectable abt flat-space unstable scalar mode

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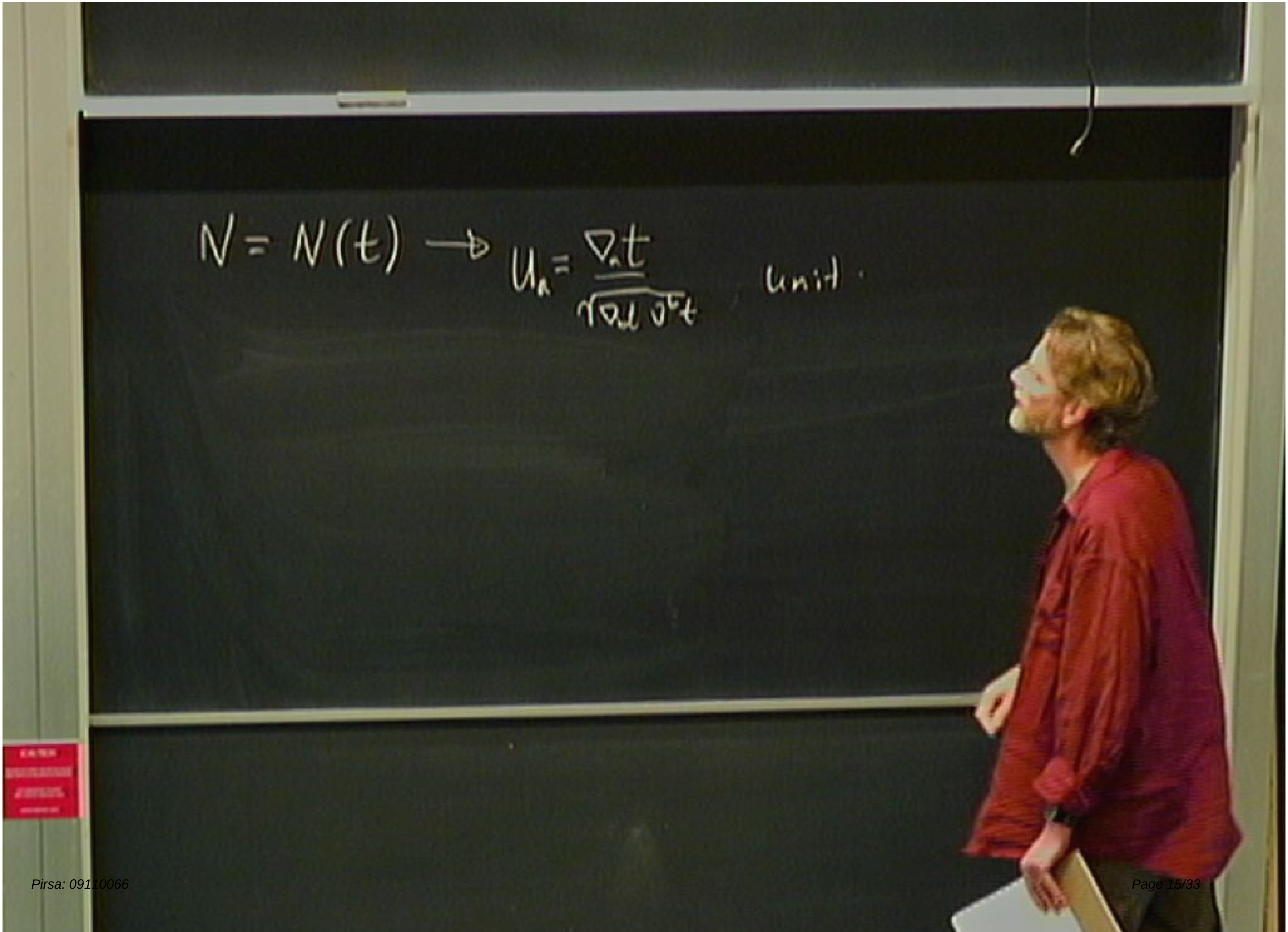
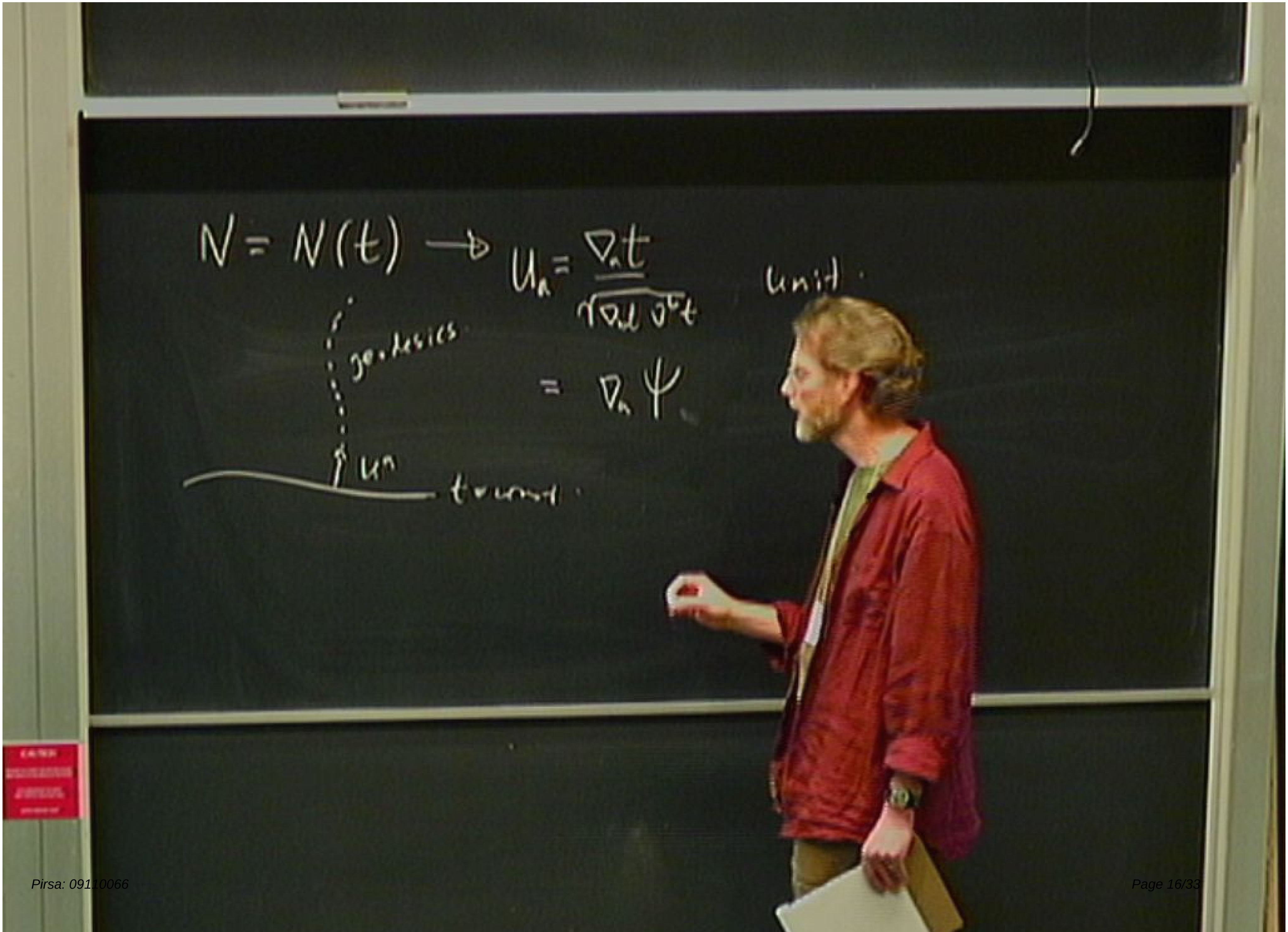
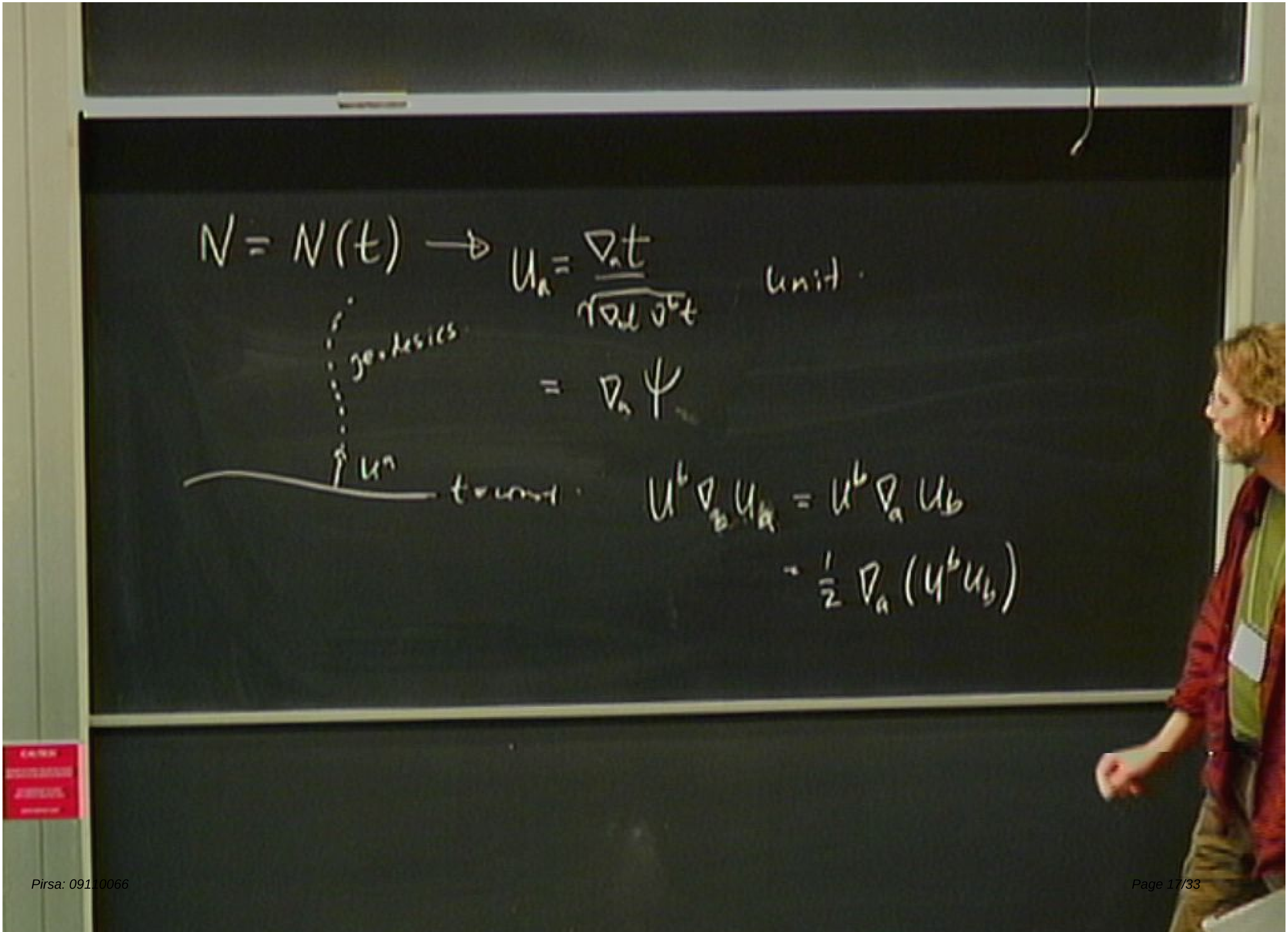
→ add $\left(\frac{\partial_i N}{N}\right)^2$ term. (Diego).


$N = N(t) \longrightarrow u_a = \frac{\nabla_a t}{\sqrt{\nabla_a t \, \nabla^a t}}$
unit


N = N(t) → u_a = ∇_a t / √(∇_a t ∇^a t)
unit
geodesics
= ∇_a ψ
u^a
t = const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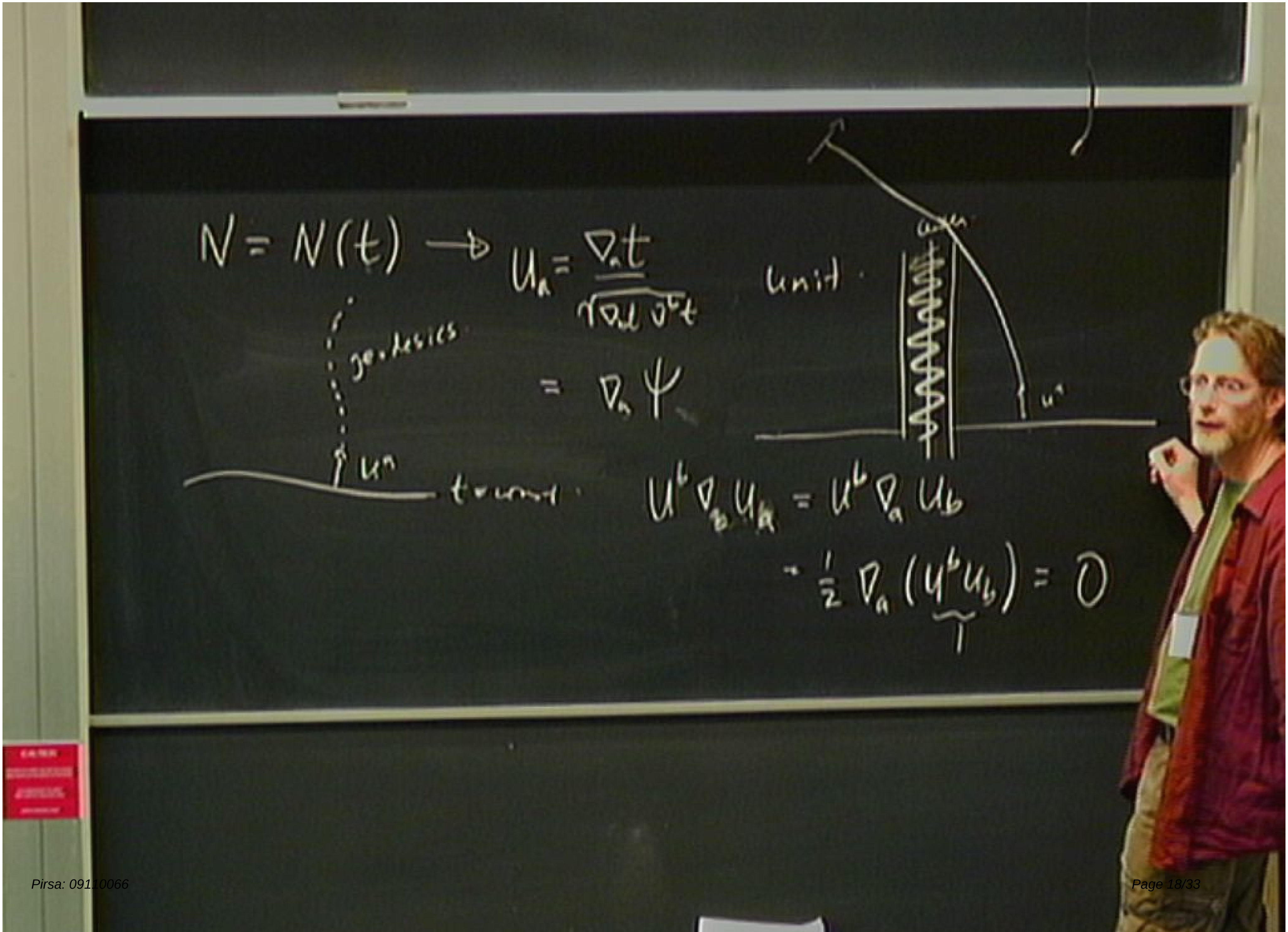
$= \nabla_a \psi$
u^a
$t = \text{const}$
$u^b \nabla_b u_a = u^b \nabla_a u_b$
$= \frac{1}{2} \nabla_a (u^b u_b)$

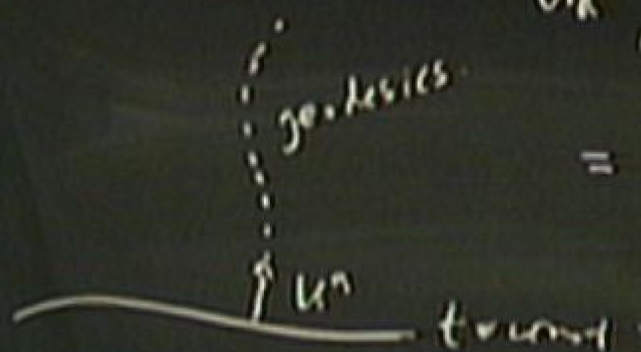


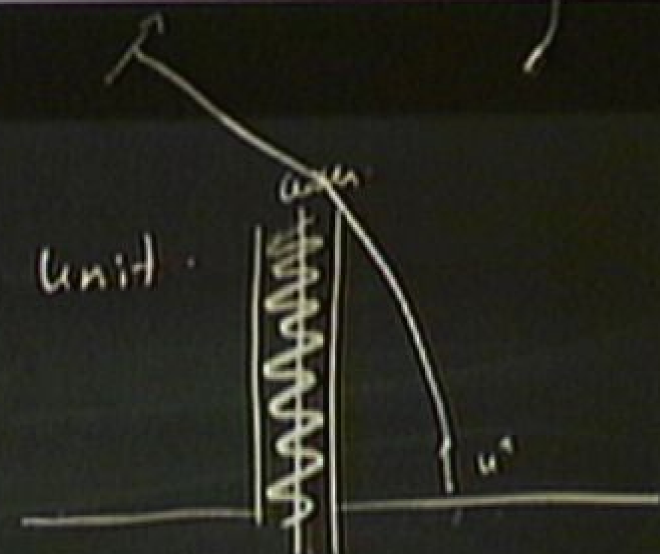
N = N(t) → u_a = ∇_a t / √(∇_a t ∇^a t)
= ∇_a ψ
geodesics
u^a
t = const.
unit
u^b ∇_b u_a = u^b ∇_a u_b
= ½ ∇_a (u^b u_b) = 0

$$N = N(t) \longrightarrow u_a = \frac{\nabla_a t}{\sqrt{\nabla_d t\, \nabla^d t}}$$

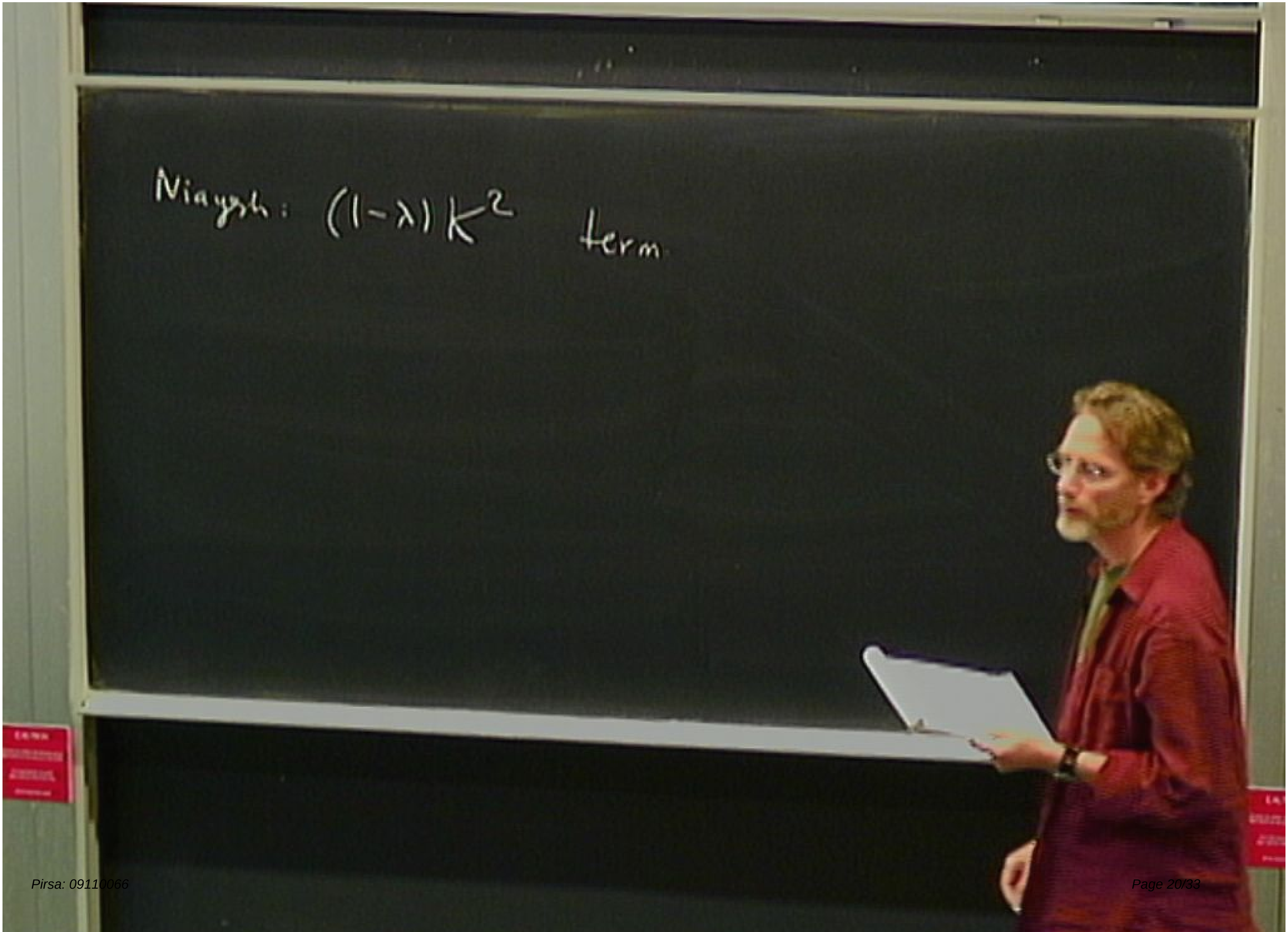
$$= \nabla_a \psi$$

unit.





$$u^b \nabla_b u_a = u^b \nabla_a u_b = \frac{1}{2} \nabla_a (\underbrace{u^b u_b}_{1}) = 0$$


Niayesh: $(1-\lambda) K^2$ term

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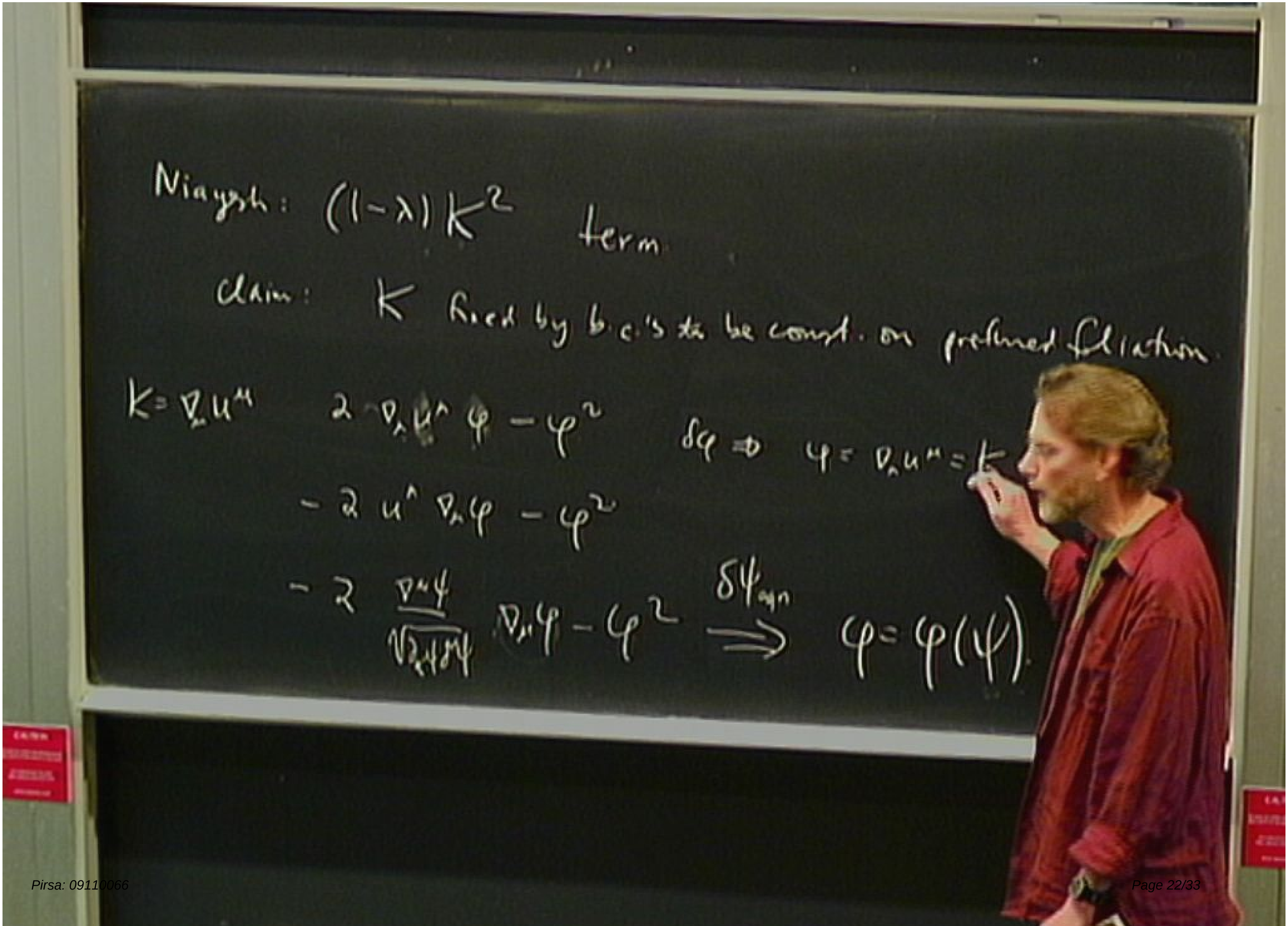
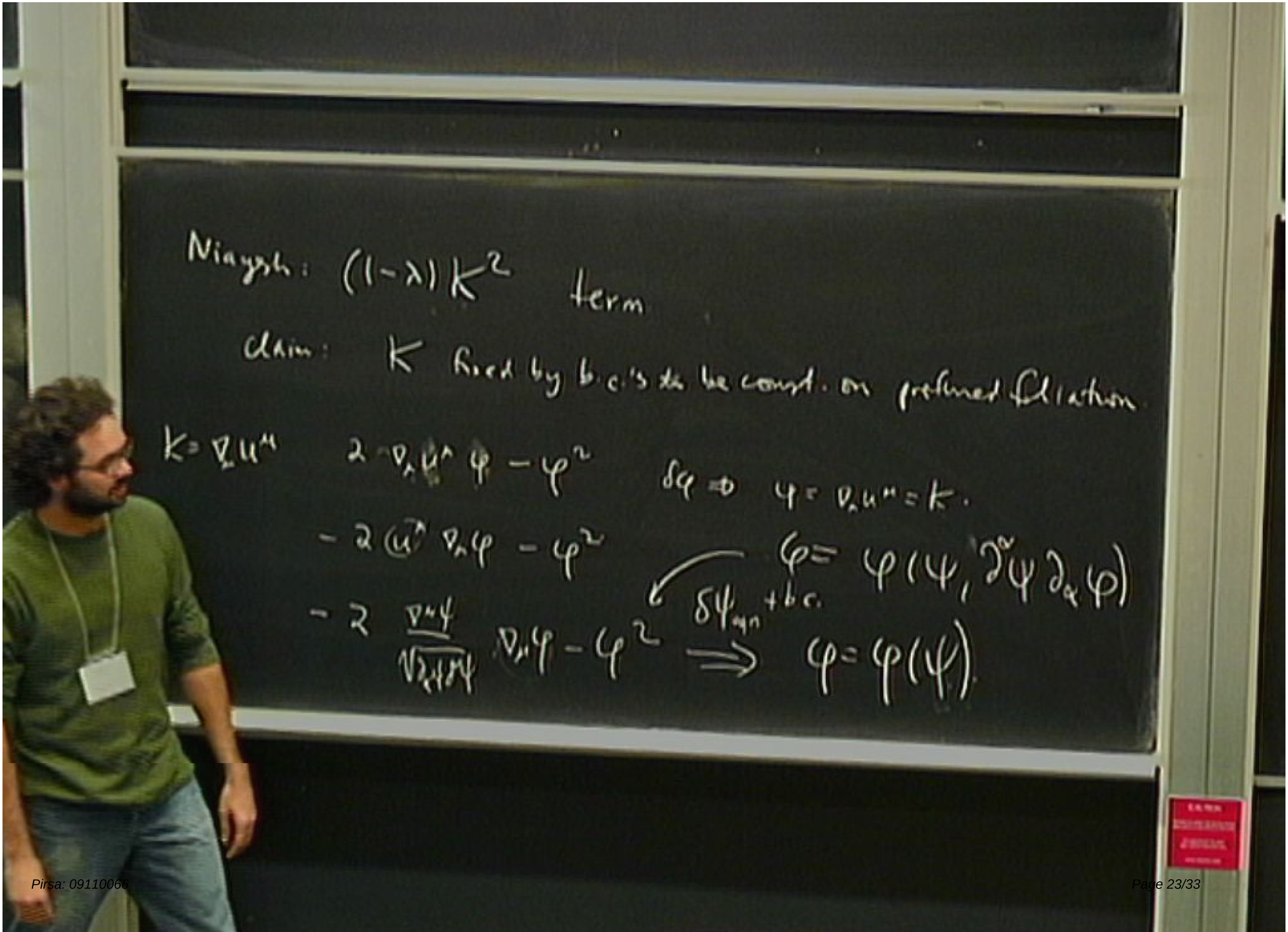
Claim: K fixed by b.c.'s to be const. on preferred foliation.

$K = \nabla_\mu u^\mu$ $\qquad 2\nabla_\mu u^\mu \varphi - \varphi^2$ $\qquad \delta\varphi \Rightarrow \varphi = \nabla_\mu u^\mu = K.$

$$-2u^\mu \nabla_\mu \varphi - \varphi^2$$

$$-2\frac{\nabla^\mu \varphi}{\sqrt{\nabla_\alpha \varphi \nabla^\alpha \varphi}} \nabla_\mu \varphi - \varphi^2$$


Niayesh: $(1-\lambda) K^2$ term
Claim: K fixed by b.c.'s to be const. on preferred foliation
$K = \nabla_\mu u^\mu$
$2 \nabla_\mu u^\mu \varphi - \varphi^2$
$\delta\varphi \Rightarrow \varphi = \nabla_\mu u^\mu = K$
$-2 u^\mu \nabla_\mu \varphi - \varphi^2$
$-2 \frac{\nabla^\mu \psi}{\sqrt{\nabla_\nu \psi \nabla^\nu \psi}} \nabla_\mu \varphi - \varphi^2 \xrightarrow{\delta\psi_{eqn}} \varphi = \varphi(\psi)$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Claim: K fixed by b.c.'s to be const. on preferred foliation
$K = \nabla_\mu u^\mu$
$2\nabla_\mu u^\mu \varphi - \varphi^2$
$\delta\varphi \Rightarrow \varphi = \nabla_\mu u^\mu = K$.
$-2u^\mu \nabla_\mu \varphi - \varphi^2$
$\varphi = \varphi(\psi, \partial^\alpha\psi\,\partial_\alpha\varphi)$
$-2\frac{\nabla^\mu\psi}{\sqrt{\nabla_\alpha\psi\nabla^\alpha\psi}}\nabla_\mu\varphi - \varphi^2$
$\delta\psi_{eqn}$ + b.c.
$\Longrightarrow \varphi = \varphi(\psi)$

Stability -- projectable case

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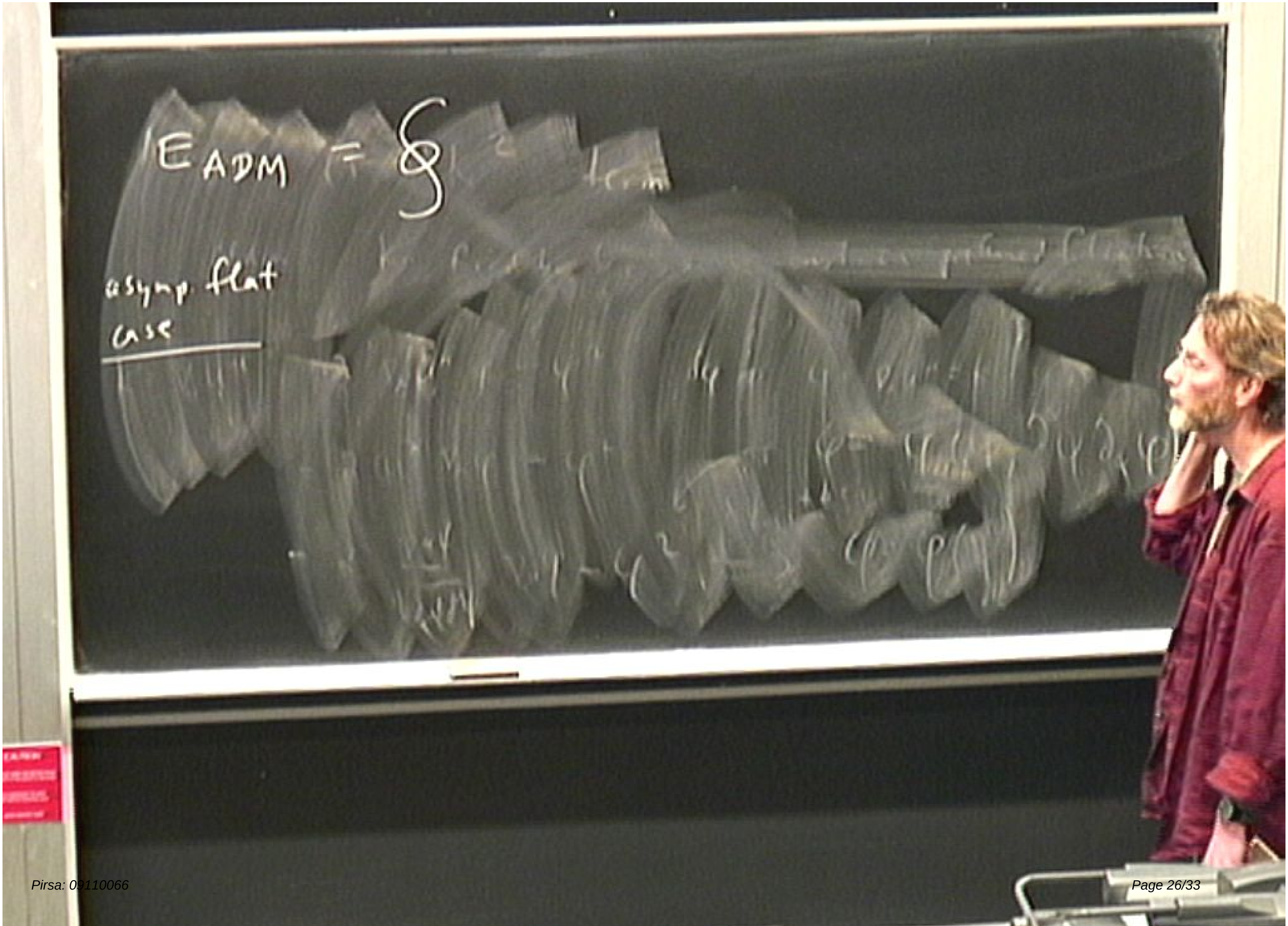
Scalar constraint dropped, preferred time

$\longrightarrow$ true hamiltonian   no "problem of time".


E ADM = ∮
asymp. flat
case

$$E_{ADM} = \oint = \int_{\Sigma} \left\{ \left(\Theta_{0\mu} - T_{0\mu} \right) + j_{\mu} \right\} d\Sigma^{\mu}$$

asymp. flat case

$$E_{ADM} = \oint = \int_{\Sigma} \left\{ \left(\Theta_{0\mu} - T_{0\mu} \right) + j_\mu \right\} \underbrace{d\Sigma^\mu}_{n^\mu d^3\Sigma}$$

asymp. flat case

$j_\mu n^\mu \geq 0$

can be arranged

(Witten)

$$E_{ADM} = \oint = \int_{\Sigma} \left\{ \underbrace{(G_{0\mu} - T_{0\mu})}_{T^{\mu\nu}} + j_\mu \right\} \underbrace{d\Sigma^\mu}_{n^\mu d^3\Sigma}$$

asymp. flat case

$$T_{0\mu} = \rho^{\mu\nu} u_0 u_\mu$$

$j_\mu n^\mu \geq 0$ can be arranged (Witten)

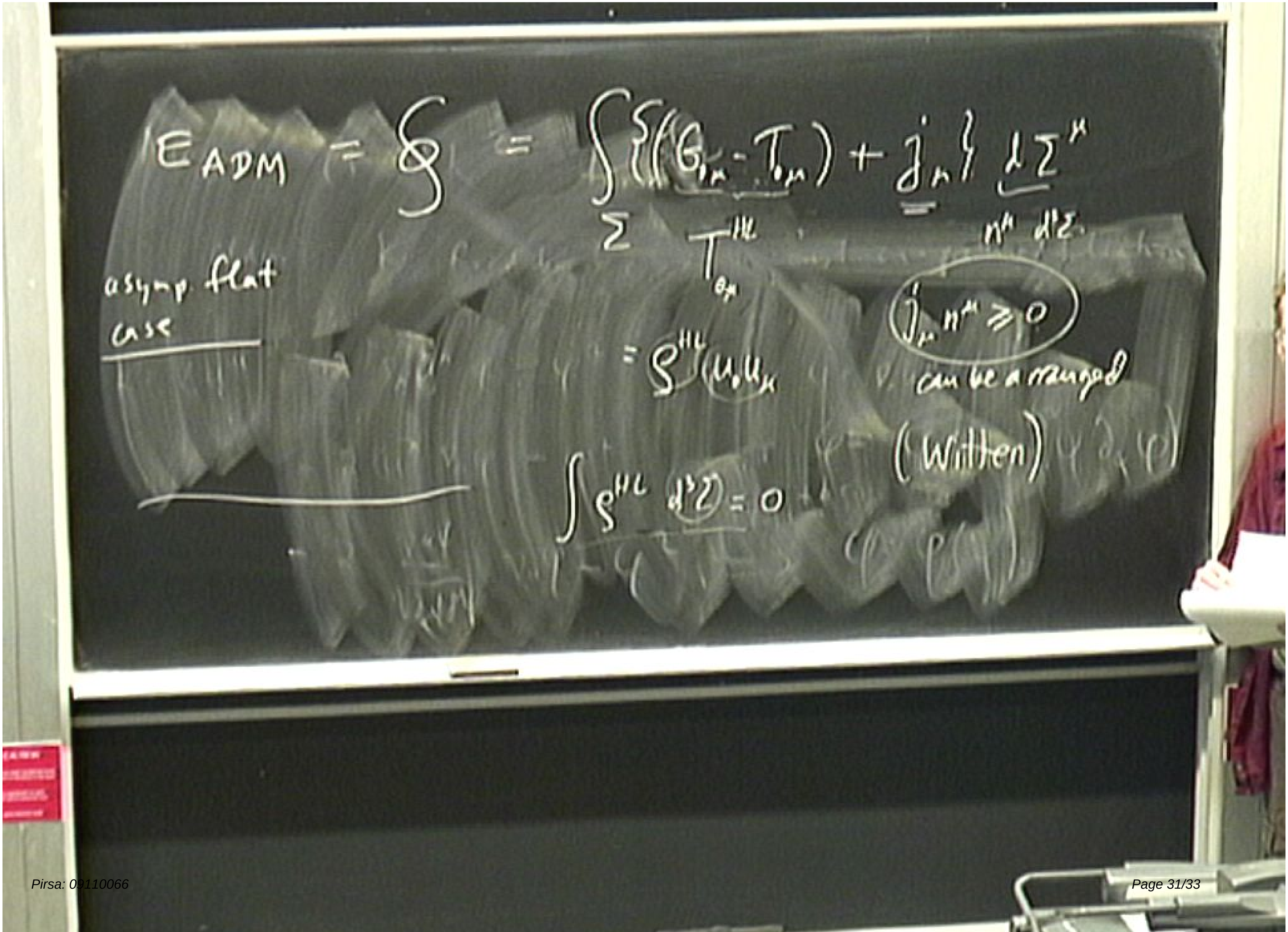
$$E_{ADM} = \oint = \int_{\Sigma} \{ (\underbrace{G_{0\mu} - T_{0\mu}}_{T^{HL}_{0\mu}}) + j_\mu \} \underbrace{d\Sigma^\mu}_{n^\mu d^3\Sigma}$$

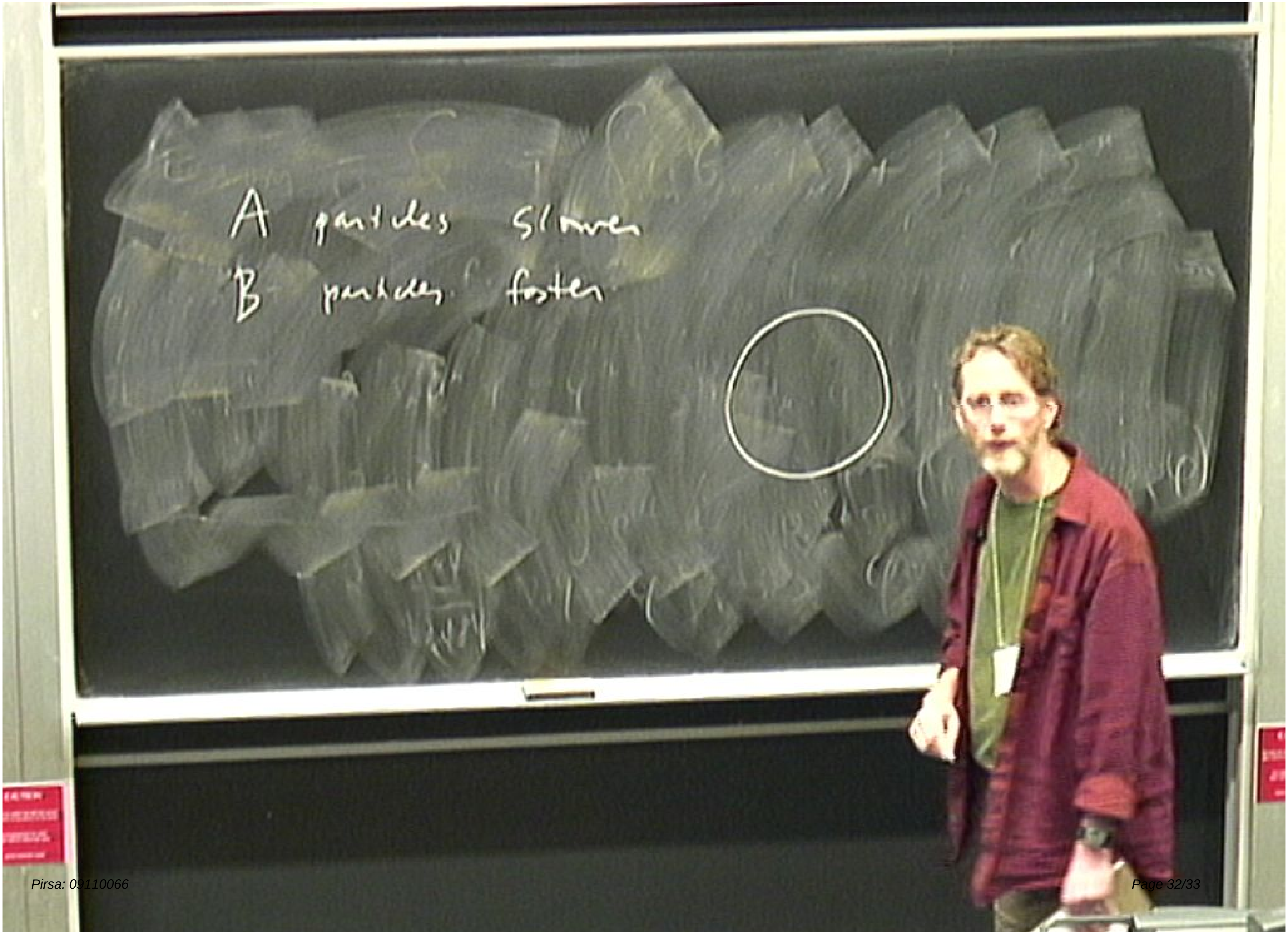
asymp flat case

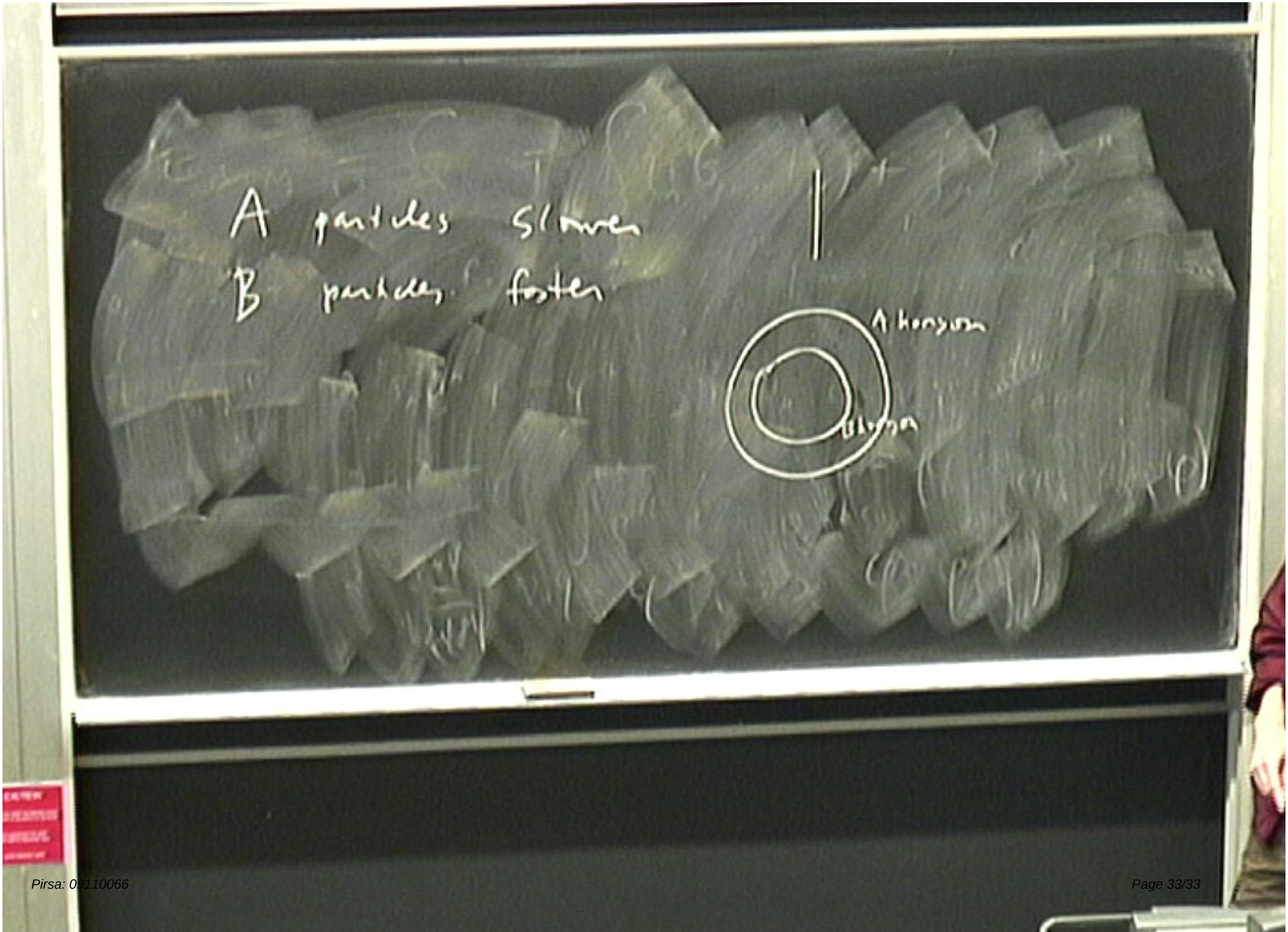
$$= \rho^{HL} u_0 u_\mu$$

$j_\mu n^\mu \geq 0$ can be arranged (Witten)

$$\int \rho^{HL} d^3\Sigma$$


E_ADM = ∮ = ∫_Σ {(Θ_0μ − T_0μ) + j_μ} dΣ^μ
n^μ d^3Σ
asymp. flat case
T^μν_θμ
= ρ^μν u_0 u_μ
j_μ n^μ ≥ 0
can be arranged
(Witten)
∫ ρ^μν d^3Σ = 0


A particles slower
B particles faster


A particles slower
B particles faster
A horizon
B horizon