Title: Cosmology Theory: Inflation

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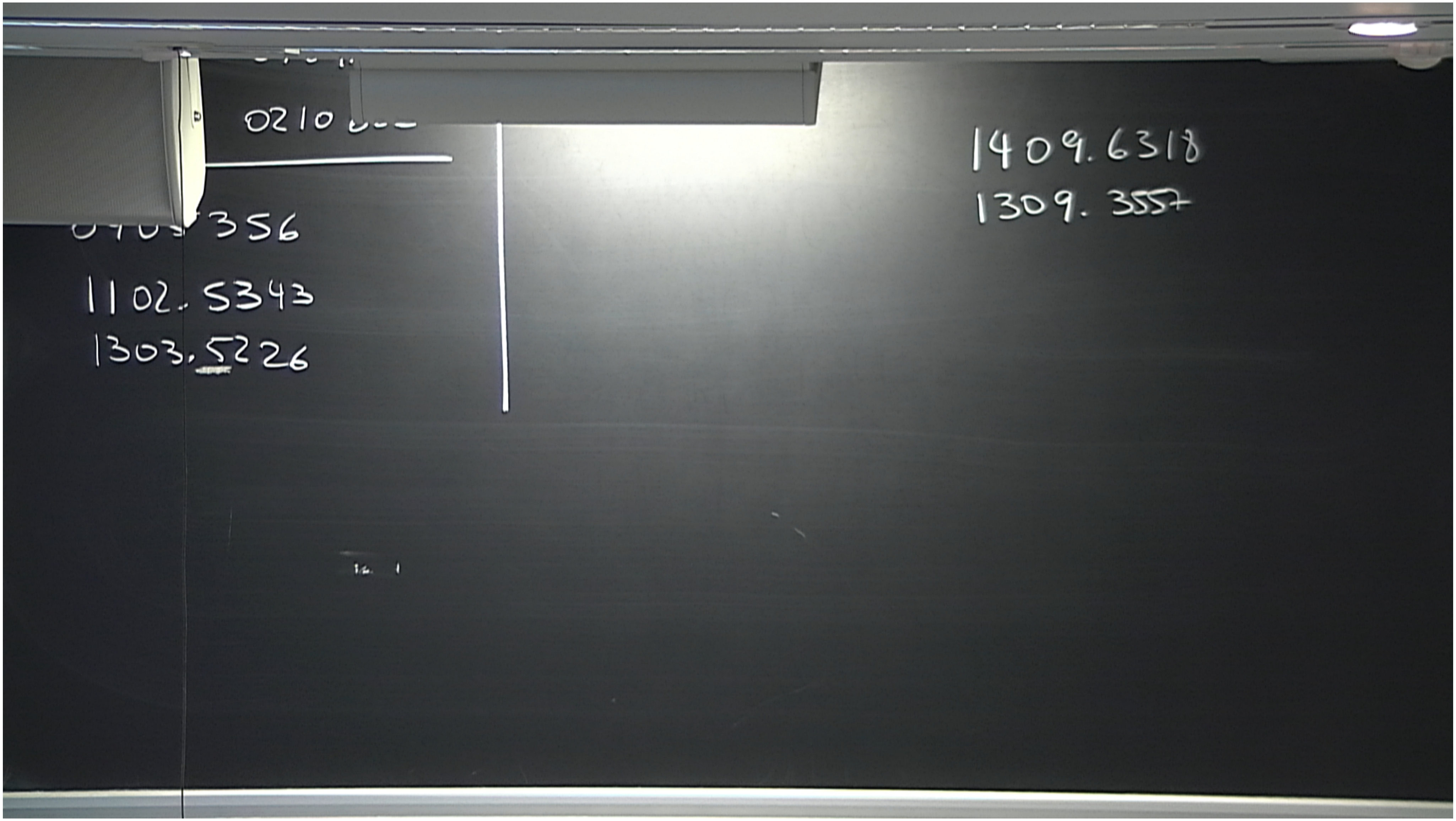
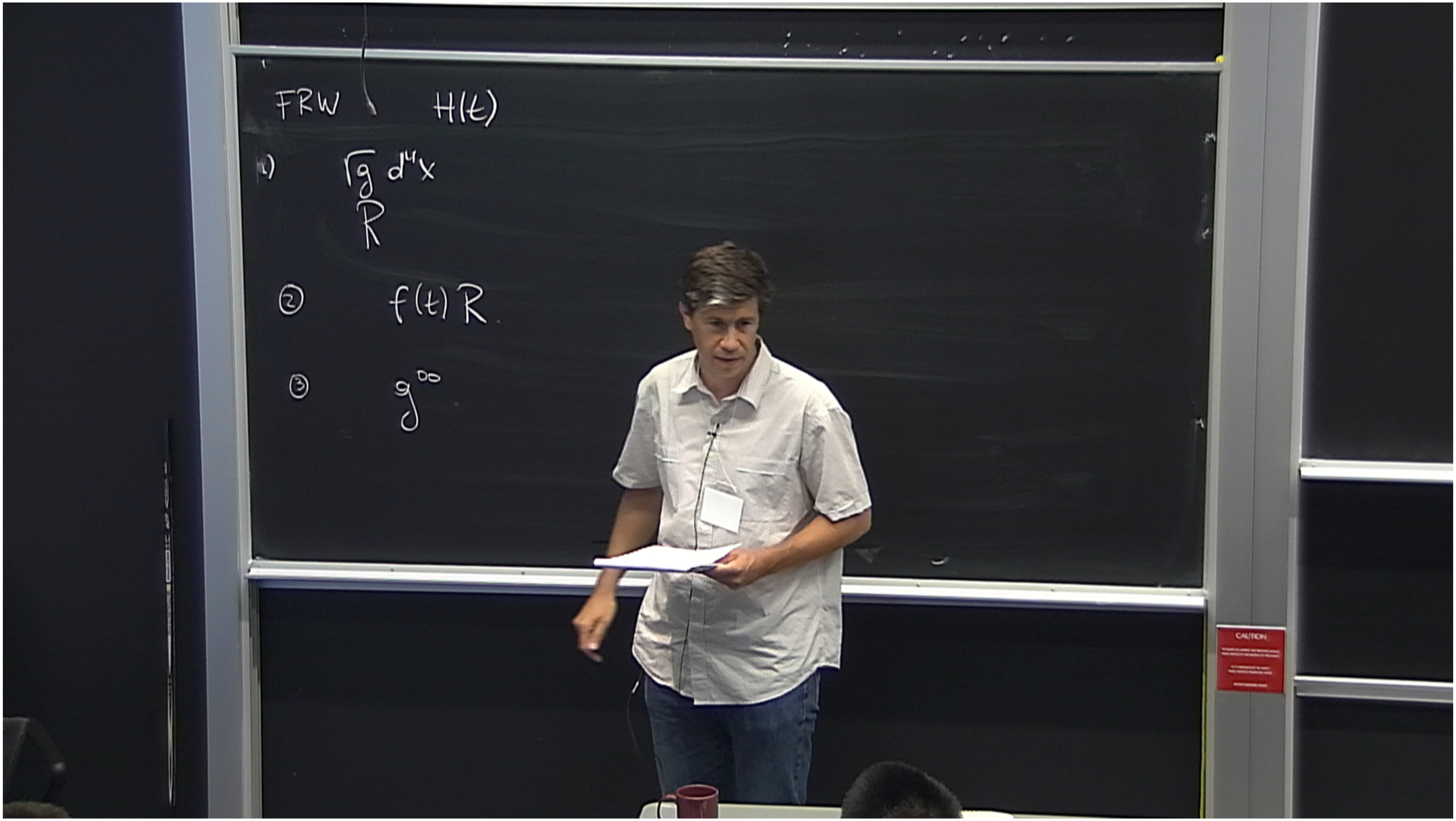
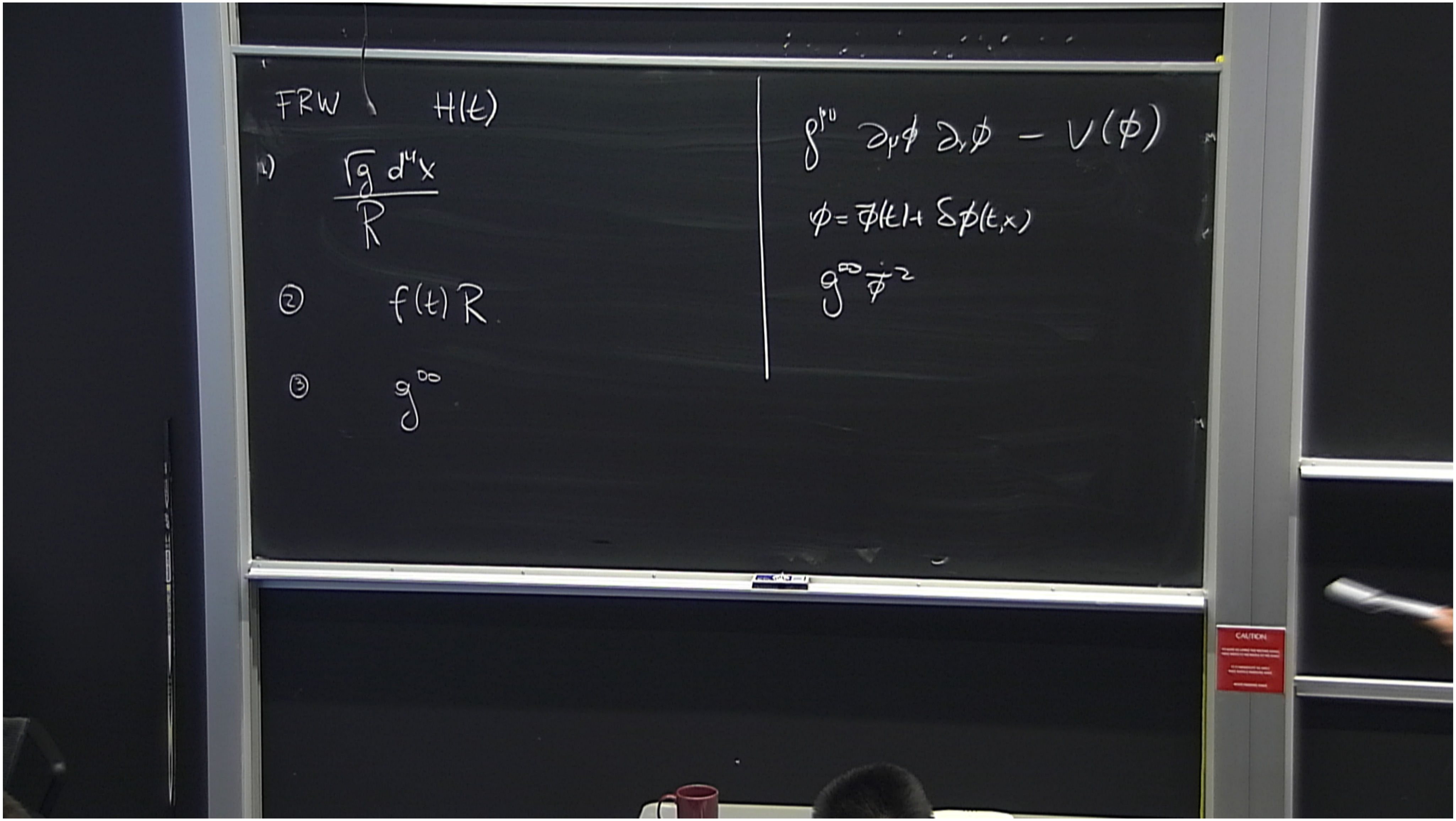
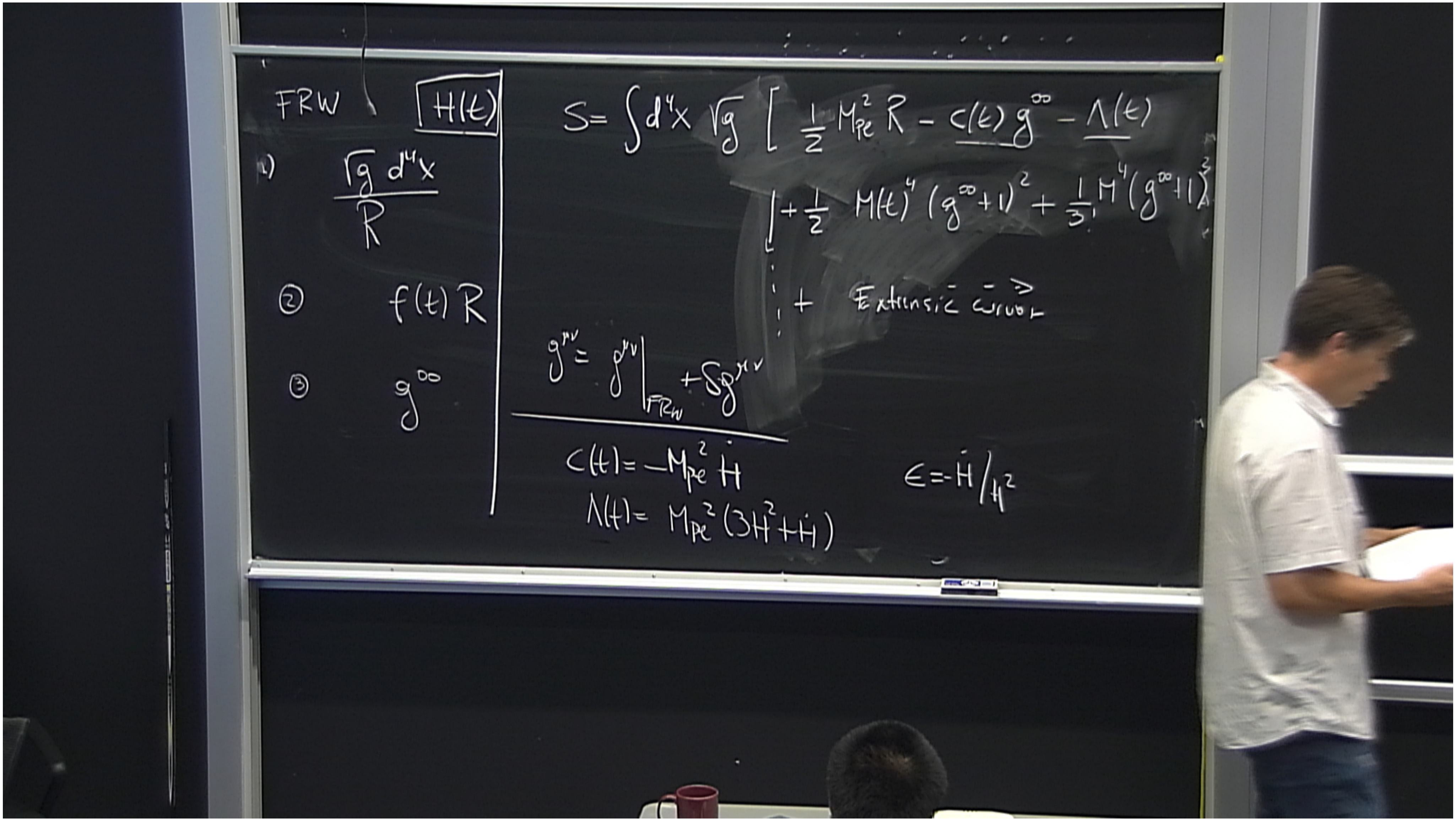
URL: http://pirsa.org/15070030

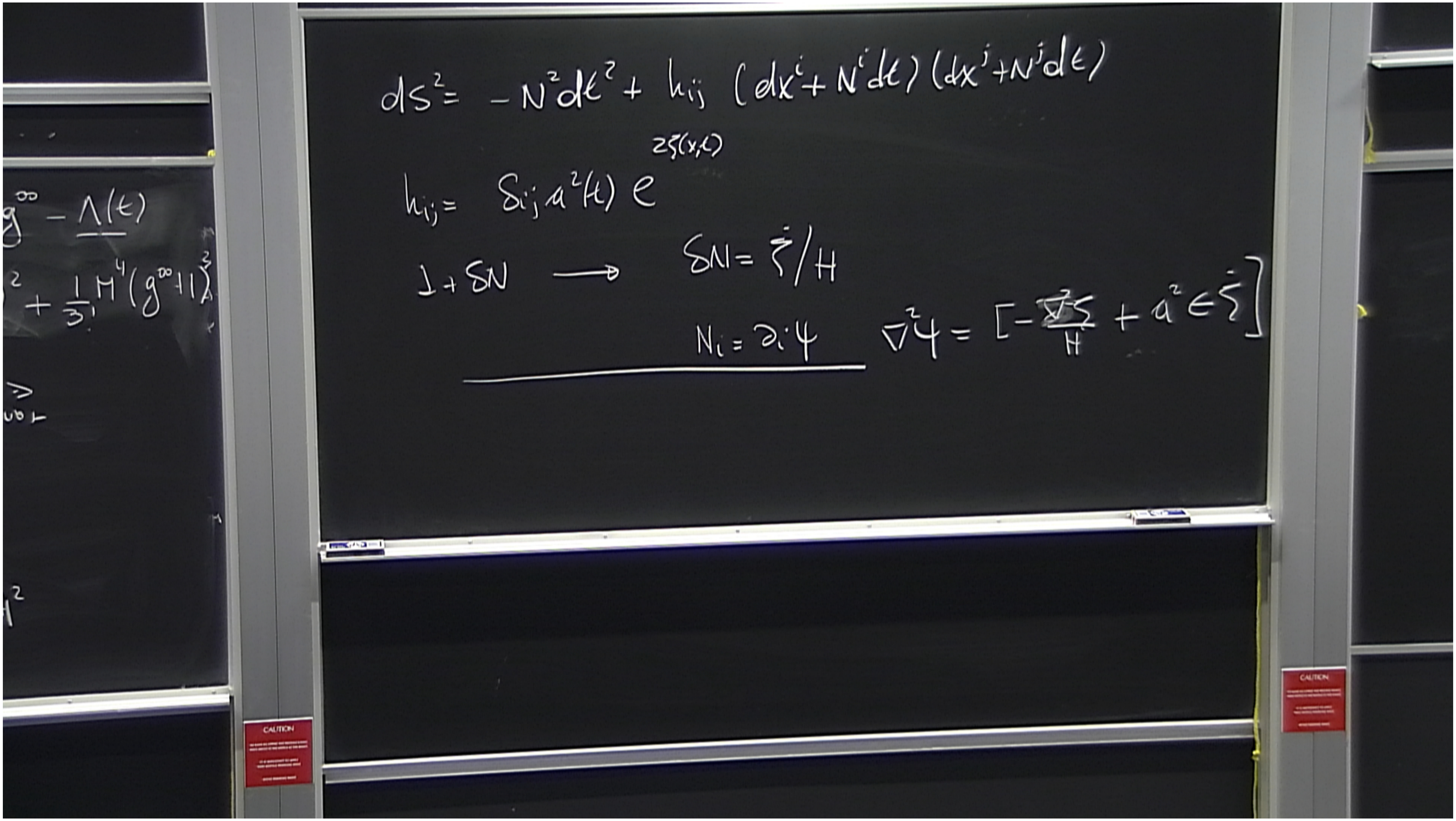
Abstract:

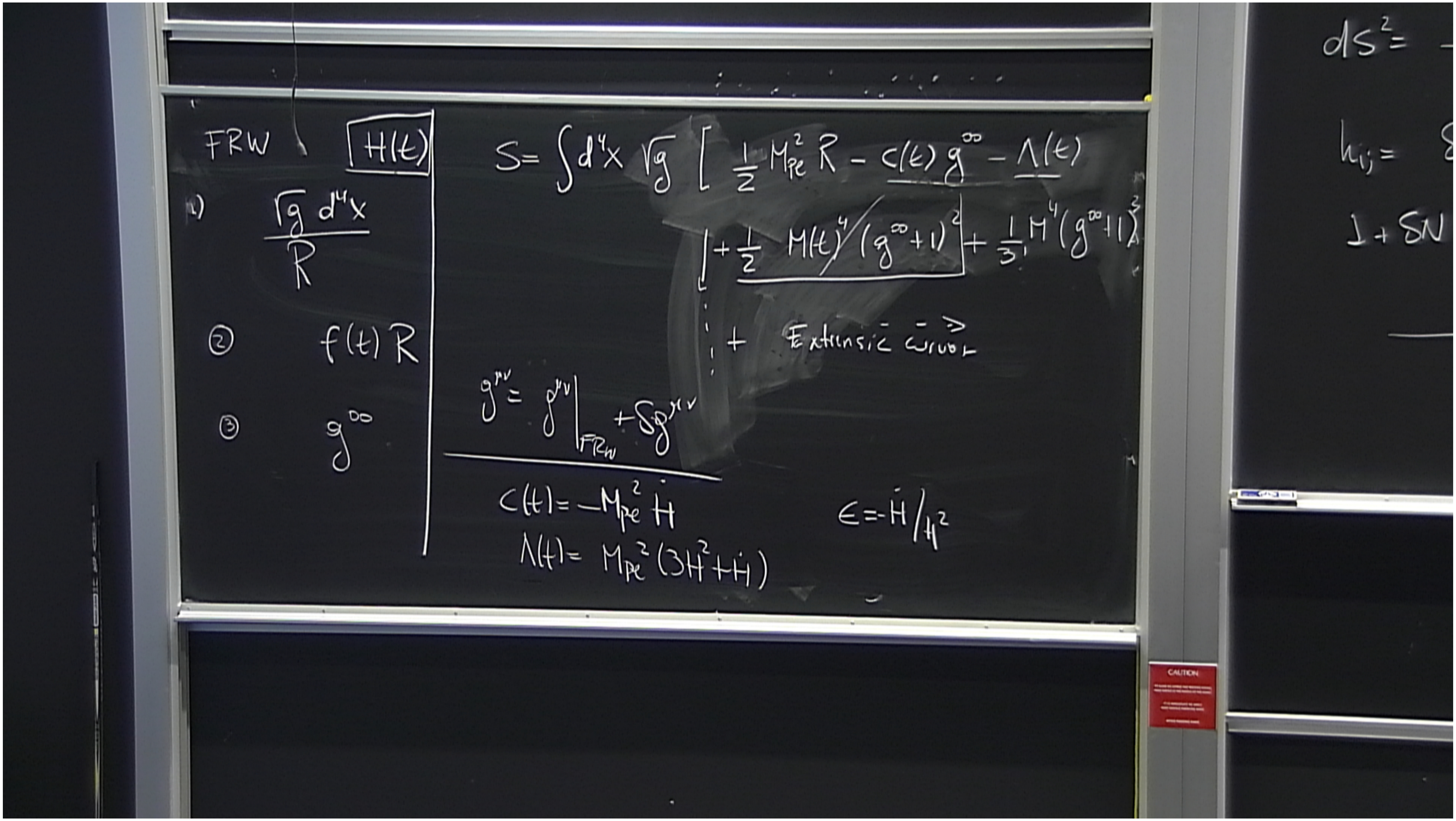

1102.5343
1303.5226
1409.6318
1309.3557

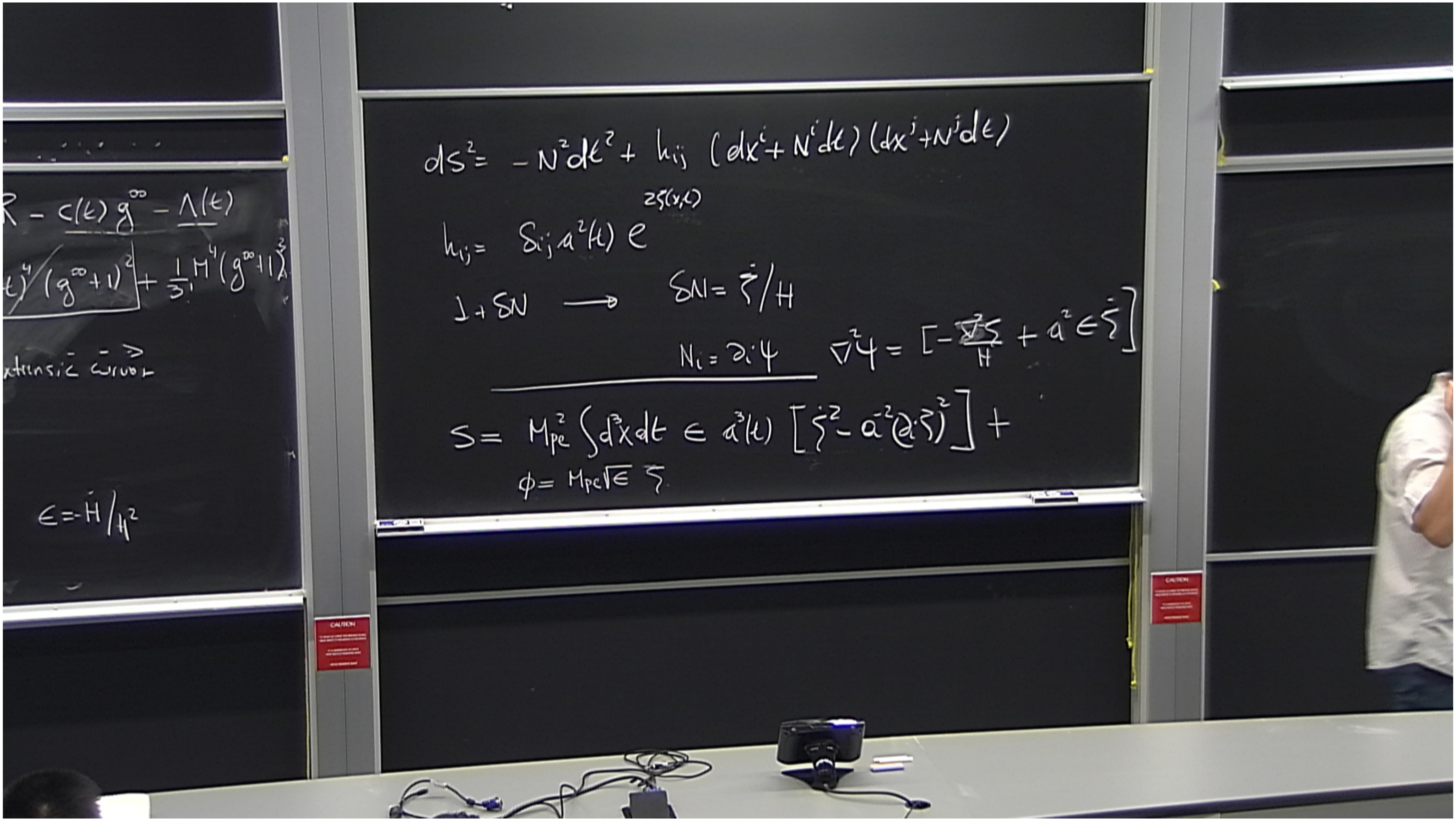

FRW H(t)
1) √g d^4x
R
② f(t) R
③ g^00

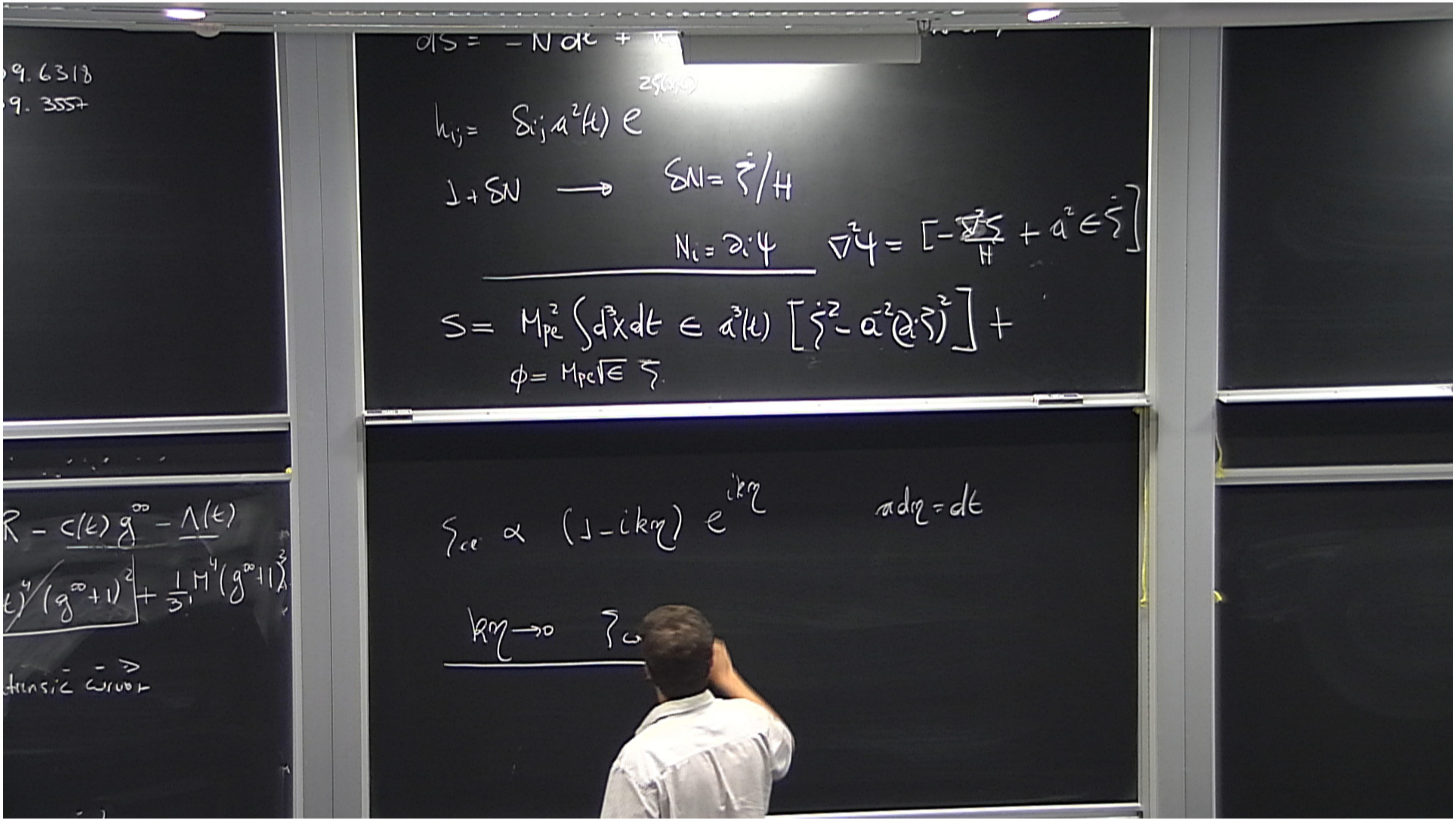

FRW H(t)
1) $\frac{\sqrt{g}\, d^4x}{R}$
② $f(t) R$
③ g^{00}
$g^{\mu\nu} \partial_\mu \phi \partial_\nu \phi - V(\phi)$
$\phi = \bar{\phi}(t) + \delta\phi(t,x)$
$g^{00} \dot{\bar{\phi}}^2$

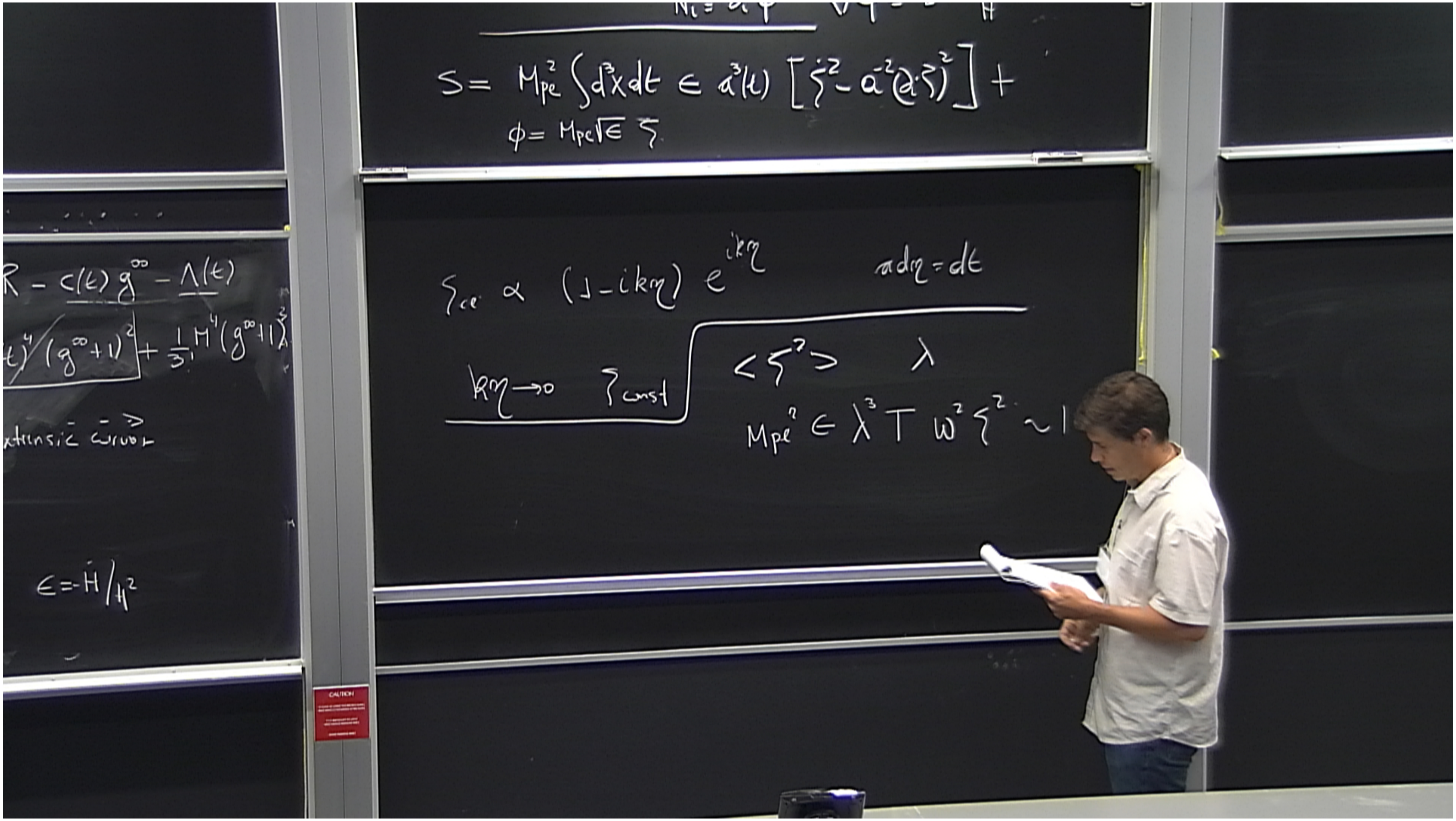

FRW
H(t)
1) √g d⁴x / R
② f(t) R
③ g⁰⁰
S = ∫d⁴x √g [½ M_Pl² R − c(t) g⁰⁰ − Λ(t)
+ ½ M(t)⁴ (g⁰⁰+1)² + ⅓ M⁴ (g⁰⁰+1)³
+ Extrinsic curvature
g^μν = g^μν|_FRW + δg^μν
c(t) = −M_Pl² Ḣ
Λ(t) = M_Pl² (3H² + Ḣ)
ε = −Ḣ/H²

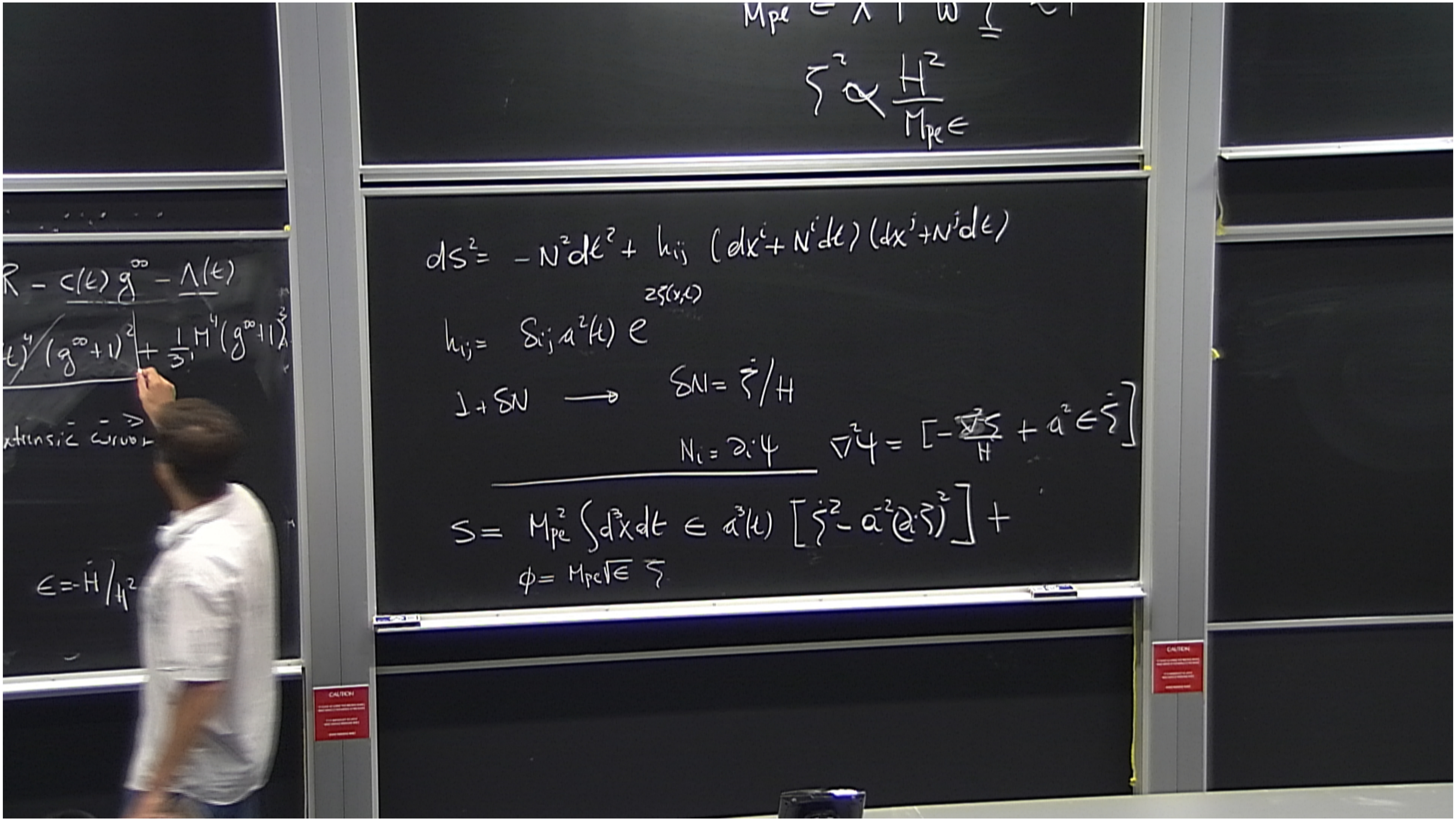

$ds^2 = -N^2 dt^2 + h_{ij}(dx^i + N^i dt)(dx^j + N^j dt)$
$h_{ij} = \delta_{ij} a^2(t) e^{2\zeta(x,t)}$
$1 + \delta N \longrightarrow \delta N = \dot{\zeta}/H$
$N_i = \partial_i \psi$
$\nabla^2 \psi = [-\frac{\nabla^2 \zeta}{H} + a^2 \epsilon \dot{\zeta}]$
$g^{00} - \Lambda(t)$
$+ \frac{1}{3!} M^4 (g^{00}+1)^3$

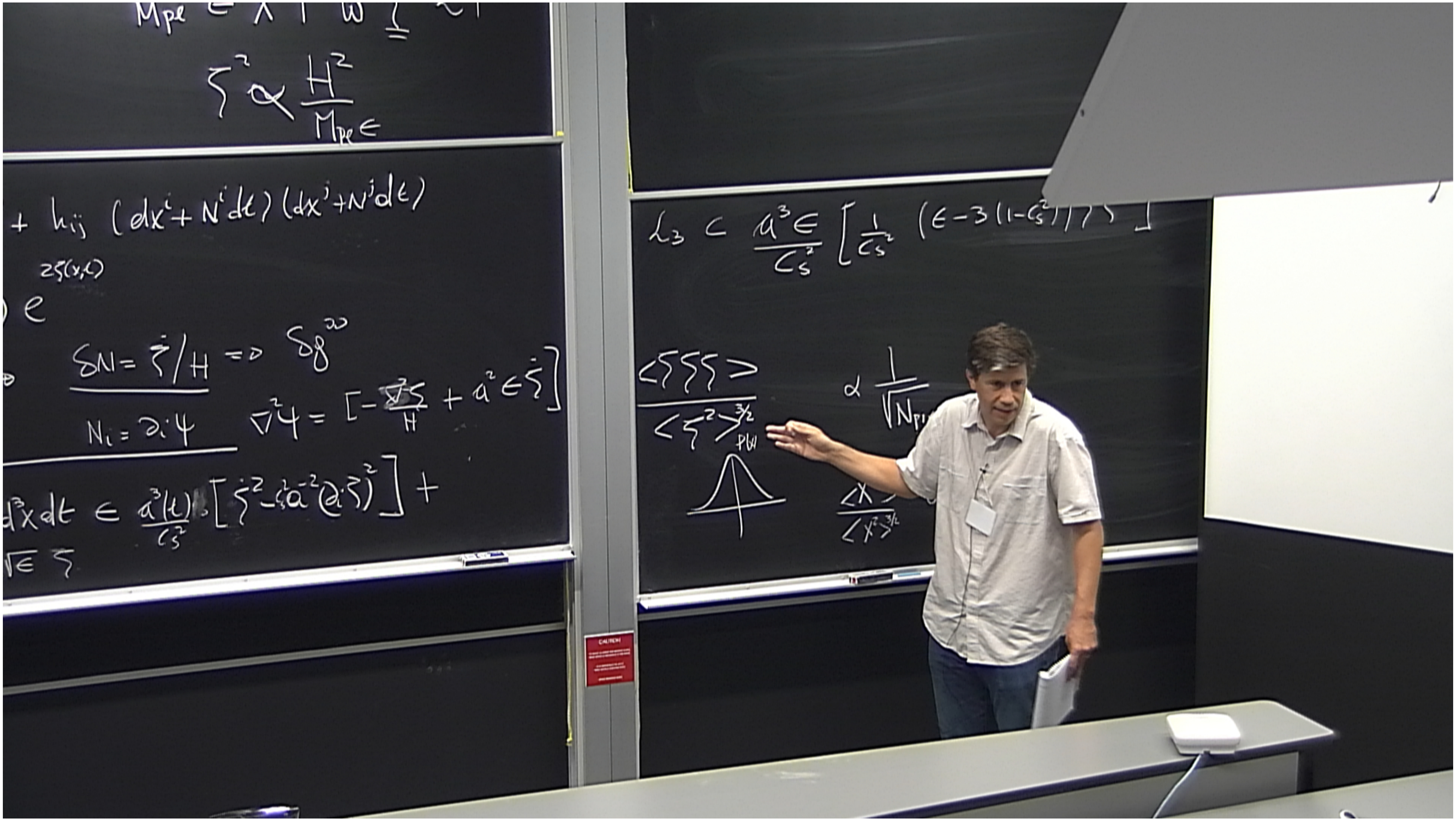

FRW
H(t)
1) √g d⁴x
R
2 f(t) R
3 g⁰⁰
S = ∫d⁴x √g [½ M_Pl² R − c(t) g⁰⁰ − Λ(t)
+ ½ M(t)⁴ (g⁰⁰+1)² + ⅓ M⁴ (g⁰⁰+1)³
+ Extrinsic curvature
g^μν = g^μν|_FRW + δg^μν
c(t) = −M_Pl² Ḣ
Λ(t) = M_Pl² (3H² + Ḣ)
ε = −Ḣ/H²
ds² =
h_ij =
1 + δN

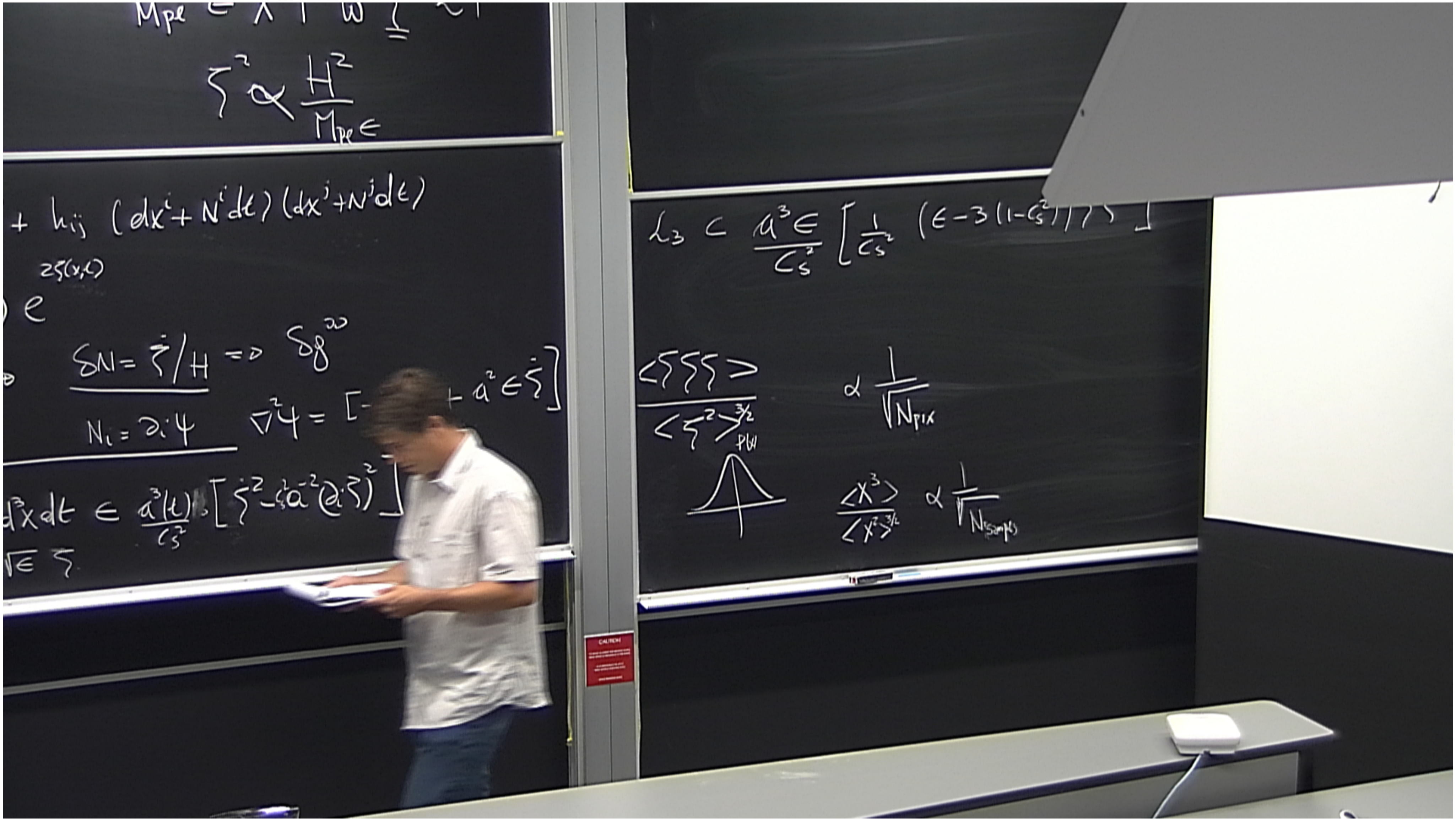

ds² = −N²dt² + hᵢⱼ (dxⁱ + Nⁱdt)(dxʲ + Nʲdt)
hᵢⱼ = δᵢⱼ a²(t) e^{2ζ(x,t)}
1 + δN → δN = ζ̇/H
Nᵢ = ∂ᵢψ
∇²ψ = [−∇²ζ/H + a²ε ζ̇]
S = M_pl² ∫d³x dt ε a³(t) [ζ̇² − a⁻²(∂ᵢζ)²] +
φ = M_pl√ε ζ
ε = −Ḣ/H²
extrinsic curvature


9.6318
9.3557
$h_{ij} = \delta_{ij} a^2(t)\, e^{2\zeta}$
$1 + \delta N \longrightarrow \delta N = \dot{\zeta}/H$
$N_i = \partial_i \psi \quad \nabla^2 \psi = [-\frac{\nabla^2\zeta}{H} + a^2 \epsilon \dot{\zeta}]$
$S = M_{pl}^2 \int d^3x\, dt\, \epsilon\, a^3(t) [\dot{\zeta}^2 - a^{-2}(\partial_i\zeta)^2] +$
$\phi = M_{pl}\sqrt{\epsilon}\, \zeta$
$\zeta_{cl} \propto (1 - ik\eta)\, e^{ik\eta}$
$a\, d\eta = dt$
$k\eta \to 0$
$R - c(t) g^{00} - \Lambda(t)$
extrinsic curvature

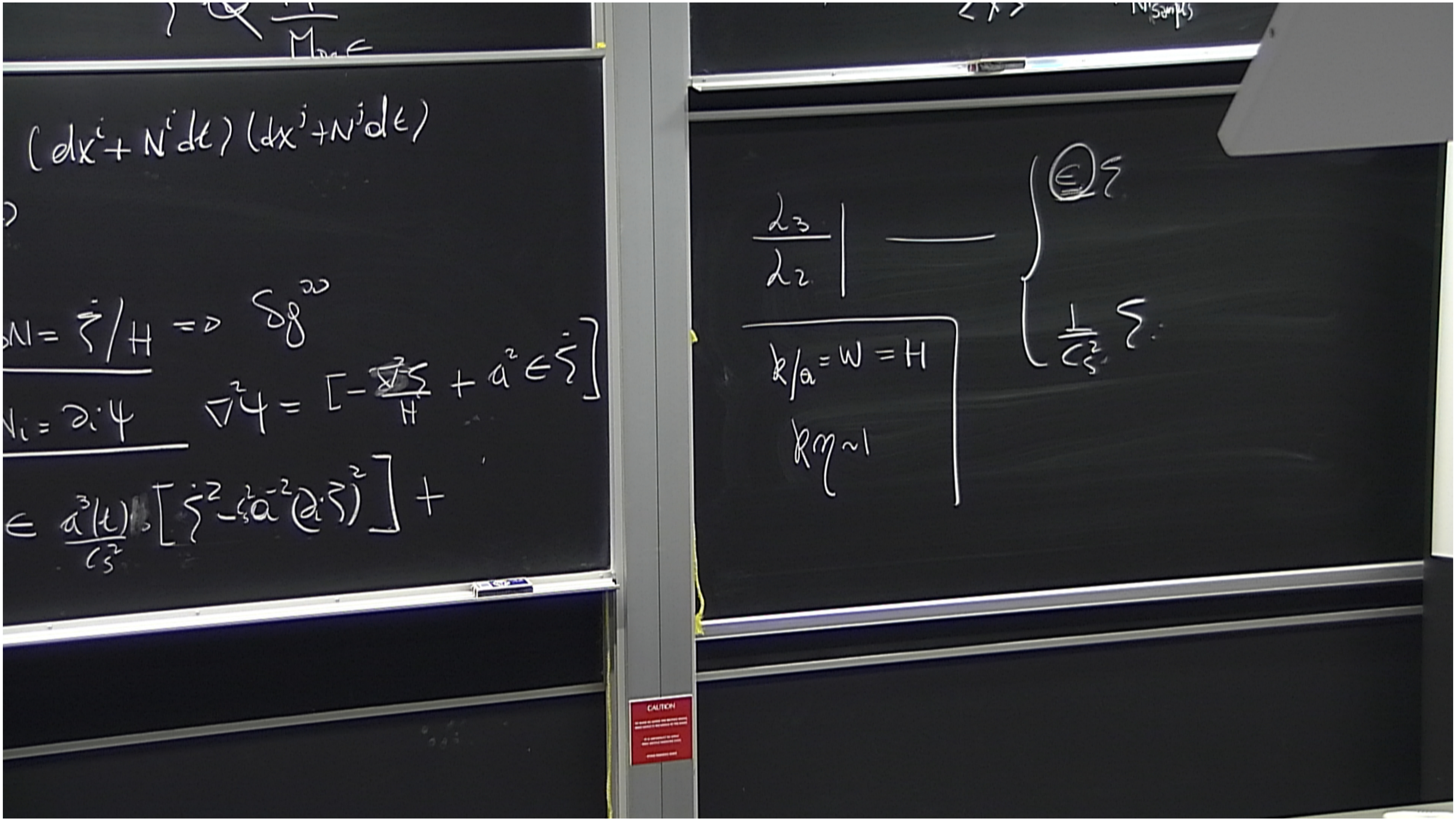

S= Mpe² ∫d³x dt ε a³(t) [ζ̇² − a⁻²(∂ζ)²] +
φ= Mpe√ε ζ
ζcl ∝ (1 − ikη) e^ikη
a dη = dt
kη → 0 ζconst
<ζ²> λ
Mpe² ε λ³ T ω² ζ² ~ 1
ε = −Ḣ/H²

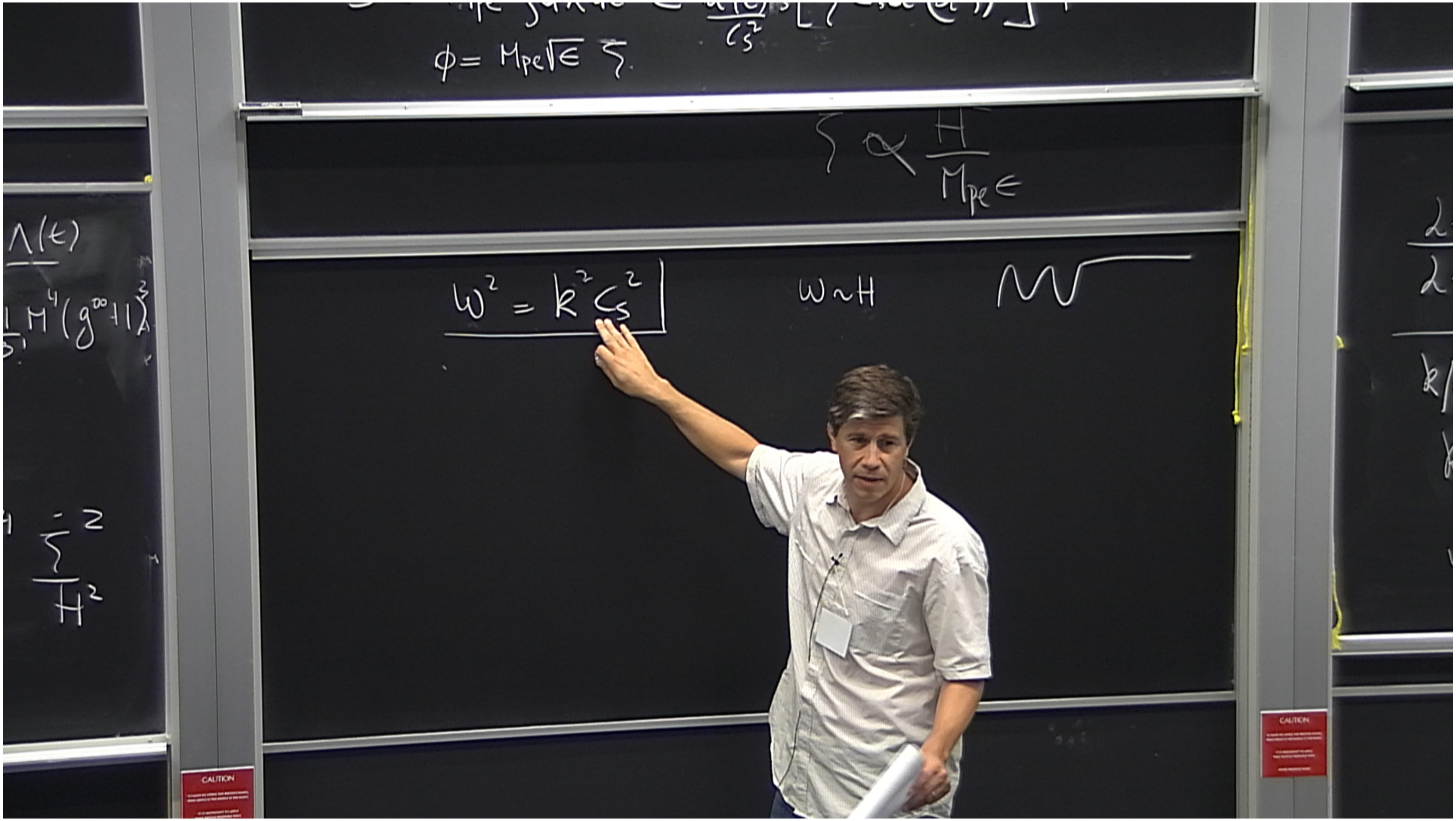

$\zeta^2 \propto \frac{H^2}{M_{pl}\epsilon}$
$ds^2 = -N^2 dt^2 + h_{ij}(dx^i + N^i dt)(dx^j + N^j dt)$
$h_{ij} = \delta_{ij} a^2(t) e^{2\zeta(x,t)}$
$1 + \delta N \longrightarrow \delta N = \dot{\zeta}/H$
$N_i = \partial_i \psi$
$\nabla^2 \psi = [-\frac{\nabla^2 \zeta}{H} + a^2 \epsilon \dot{\zeta}]$
$S = M_{pl}^2 \int d^3x\, dt\, \epsilon\, a^3(t) [\dot{\zeta}^2 - a^{-2}(\partial_i \zeta)^2] +$
$\phi = M_{pl}\sqrt{\epsilon}\, \zeta$
$\epsilon = -\dot{H}/H^2$
$R - c(t) g^{00} - \Lambda(t)$



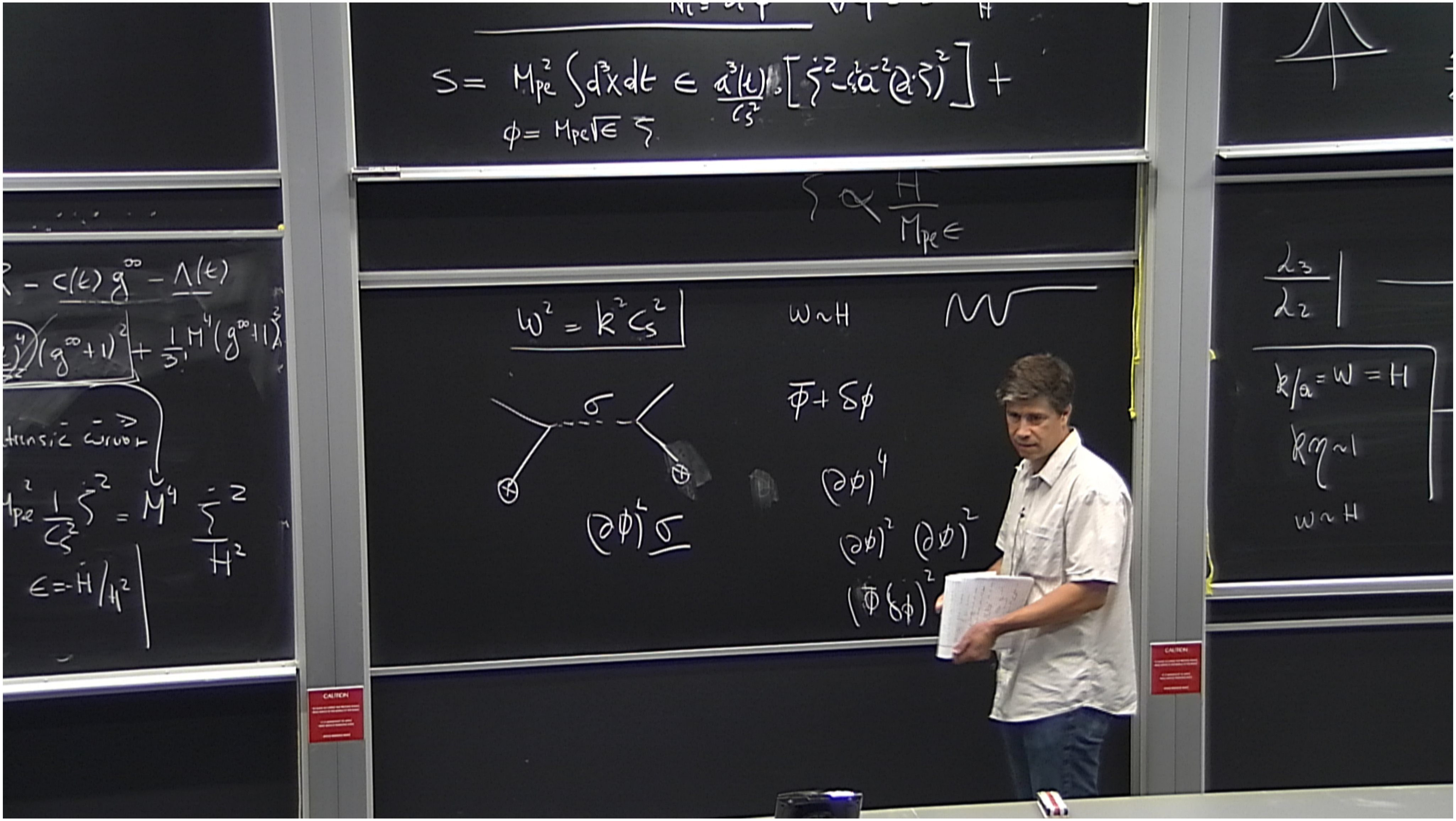


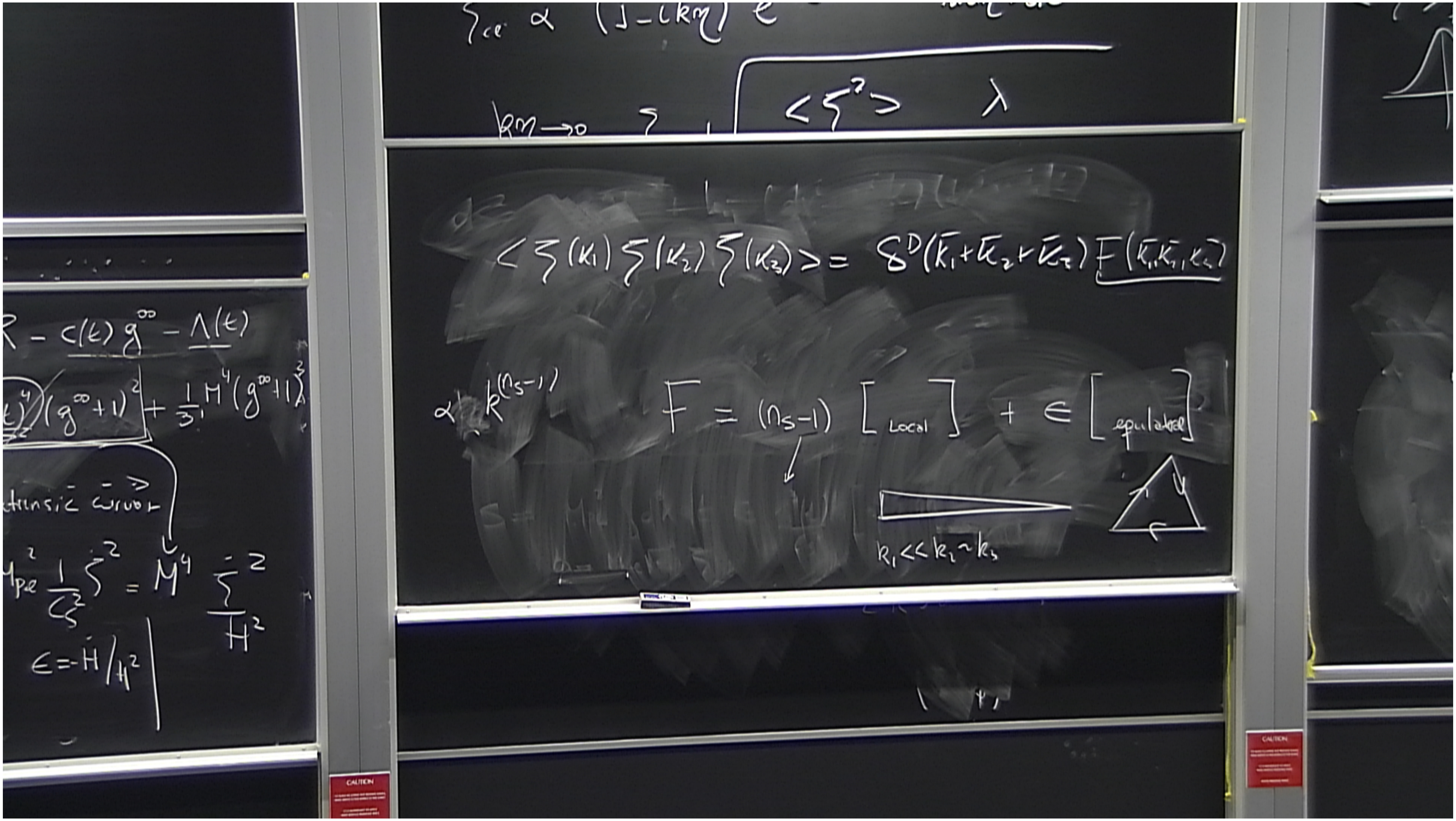
ζ² ∝ H²/(M_pl ε)
+ h_ij (dx^i + N^i dt)(dx^j + N^j dt)
δN = ζ̇/H ⇒ δg^00
N_i = ∂_i ψ
∇²ψ = [
+ a² ε ζ̇]
d³x dt ε a³(t)/c_s² [ζ̇² − c_s² a⁻² (∂_i ζ)²]
√ε ζ
L_3 ⊂ a³ε/c_s² [1/c_s² (ε − 3(1 − c_s²)) ζ̇³]
<ζζζ> / <ζ²>^{3/2} ∝ 1/√N_pix
<x³> / <x²>^{3/2} ∝ 1/√N_samples


$(dx^i + N^i dt)(dx^j + N^j dt)$
$N = \dot{\zeta}/H \Rightarrow \delta g^{00}$
$N_i = \partial_i \psi$
$\nabla^2 \psi = [-\frac{\nabla^2 \zeta}{H} + a^2 \epsilon \dot{\zeta}]$
$\epsilon \frac{a^3(t)}{c_s^2} [\dot{\zeta}^2 - c_s^2 a^{-2} (\partial_i \zeta)^2] +$
$\frac{\lambda_3}{\lambda_2}$
$\epsilon \zeta$
$\frac{1}{c_s^2} \zeta$
$k/a = W = H$
$k\eta \sim 1$

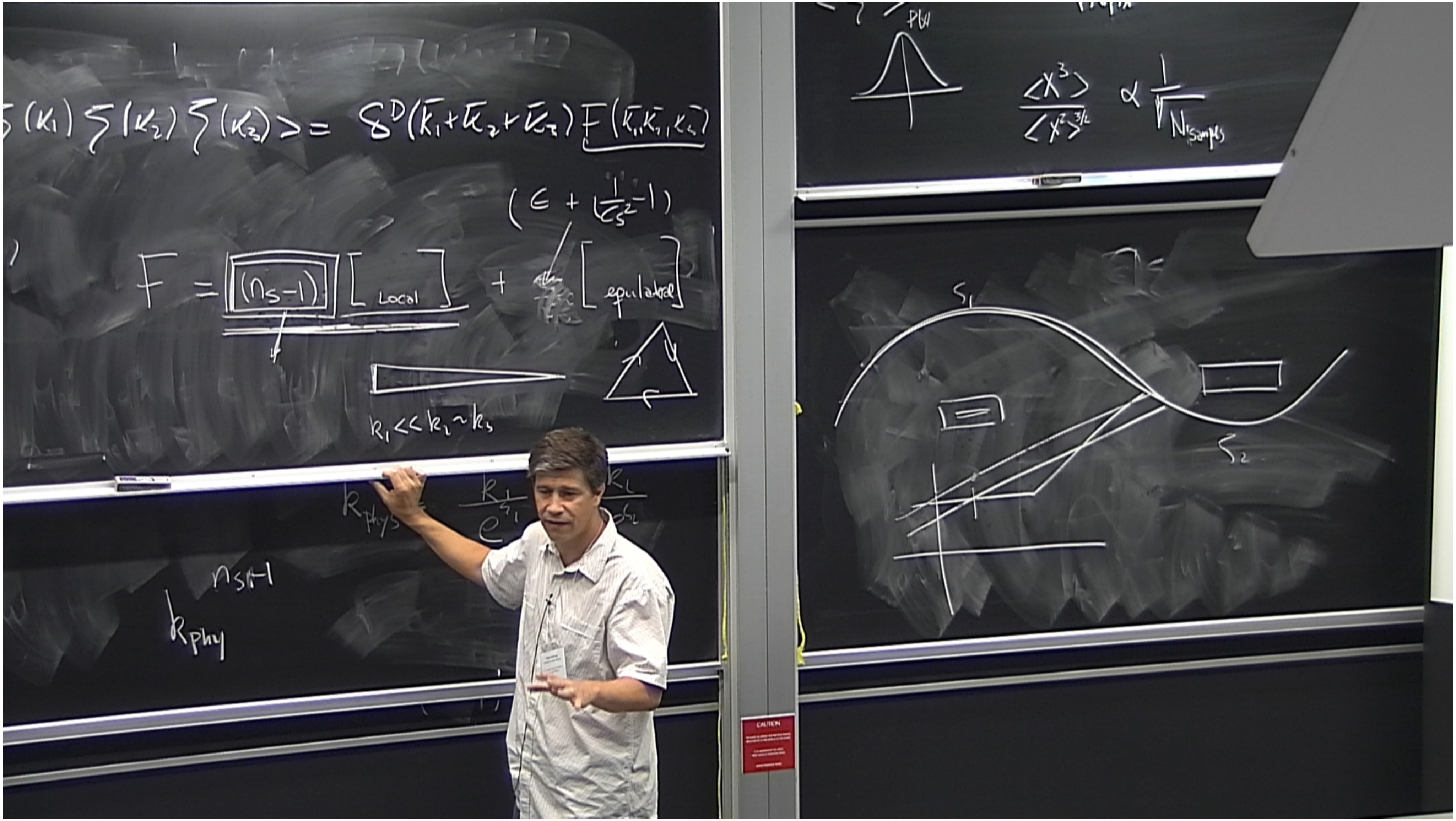


φ = Mpe √ε ζ
ζ ∝ H / Mpe ε
ω² = k² cs²
ω ~ H
CAUTION
CAUTION


$S = M_{pl}^2 \int d^3x\, dt\, \epsilon \frac{a^3(t)}{c_s^2} [\dot{\zeta}^2 - c_s^2 a^{-2} (\partial_i \zeta)^2] +$
$\phi = M_{pl}\sqrt{\epsilon}\, \zeta$
$\zeta \propto \frac{H}{M_{pl}\epsilon}$
$\omega^2 = k^2 c_s^2$
$\omega \sim H$
$\bar{\Phi} + \delta\phi$
$(\partial\phi)^4$
$(\partial\phi)^2 (\partial\phi)^2$
$(\bar{\Phi}\,\delta\phi)^2$
$(\partial\phi)^2 \sigma$
σ
$\frac{\lambda_3}{\lambda_2}$
$k/a = \omega = H$
$k\eta \sim 1$
$\omega \sim H$
$\epsilon = -\dot{H}/H^2$



<ζ(k1) ζ(k2) ζ(k3)> = δ^D(k1+k2+k3) F(k1,k2,k3)
F = (ns-1) [Local] + ∈ [equilateral]
k1 << k2 ~ k3
∝ k^(ns-1)
<ζ²>
λ
∈ = -Ḣ/H²


Local
CAUTION


Local
equilateral
Nsamples
nphy