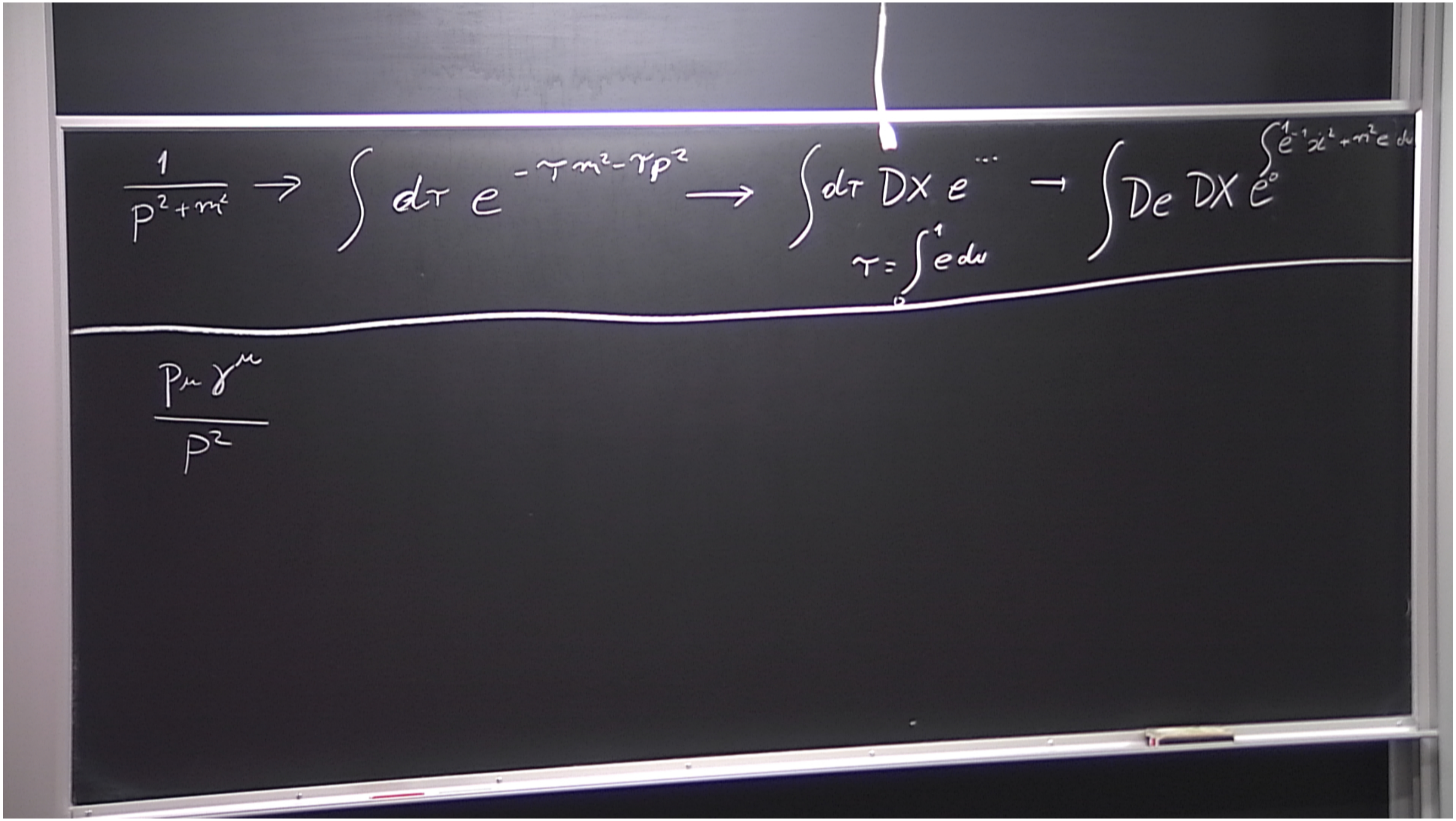
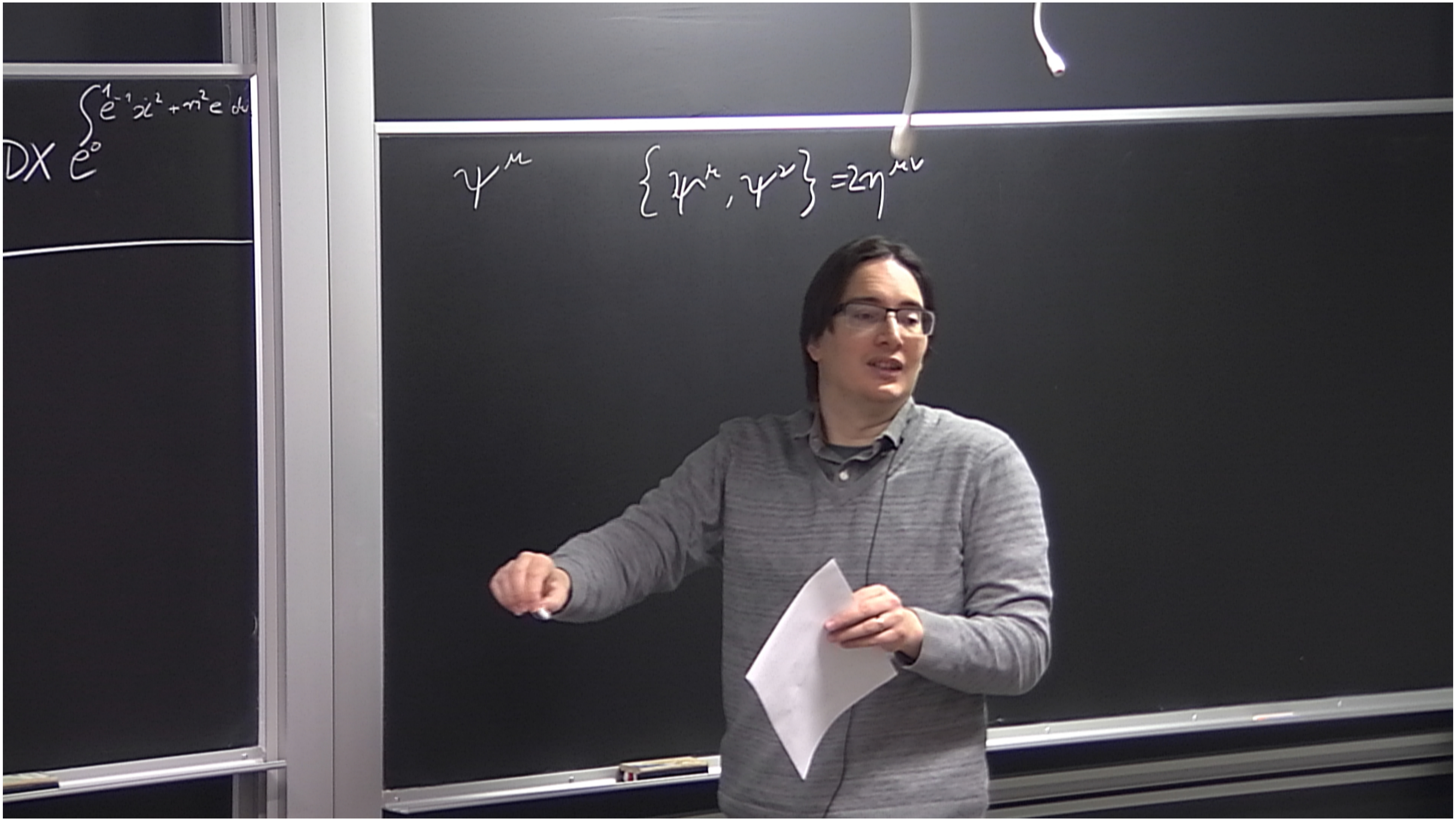
Title: String Theory Review-13

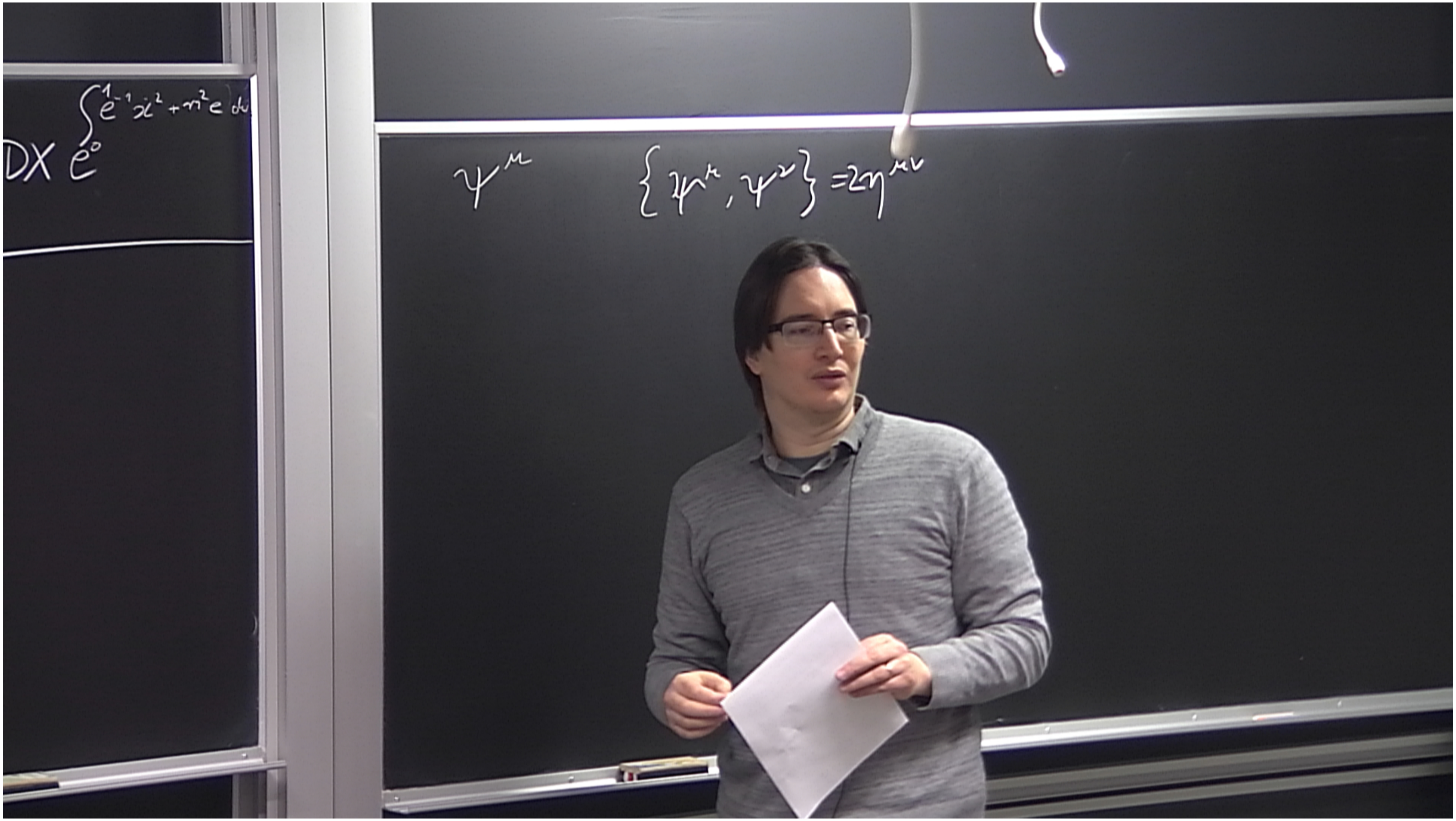
Date: Feb 11, 2015 10:15 AM

URL: http://pirsa.org/15020023

Abstract:


$\frac{1}{p^2+m^2} \rightarrow \int d\tau \, e^{-\tau m^2 - \tau p^2} \longrightarrow \int d\tau \, DX \, e^{\cdots} \rightarrow \int De \, DX \, e^{\int_0^1 e^{-1}\dot{x}^2 + m^2 e \, du}$
$\tau = \int_0^1 e \, du$
$\frac{p_\mu \gamma^\mu}{p^2}$


ψ^μ
{ψ^μ, ψ^ν} = 2η^μν


ψ^μ
$\{\psi^\mu, \psi^\nu\} = 2\eta^{\mu\nu}$

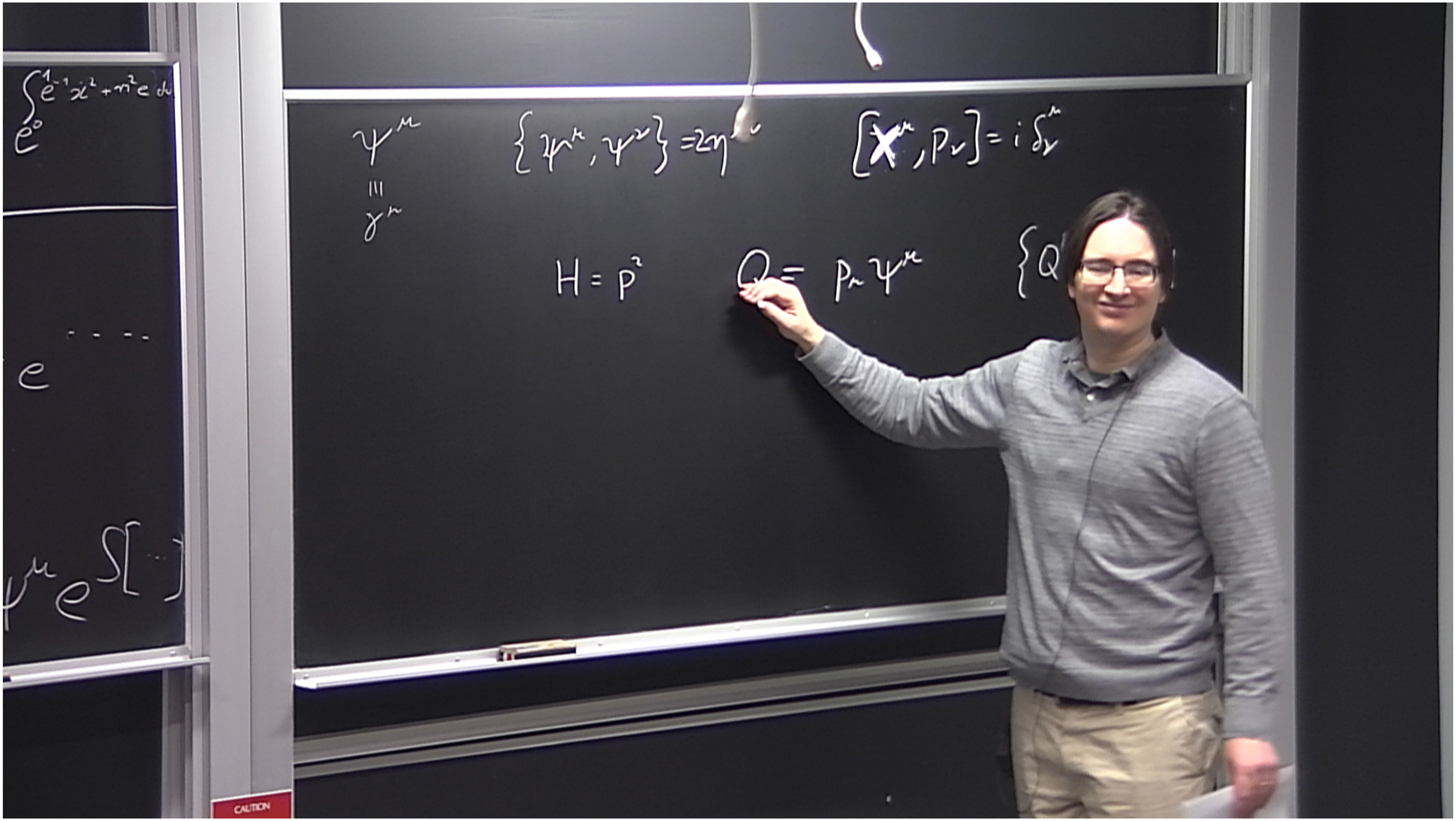
$$\frac{1}{p^2+m^2} \to \int d\tau\, e^{-\tau m^2 - \tau p^2} \longrightarrow \int d\tau\, DX\, e^{\cdots} \to \int \frac{De\, DX}{Diff}\, e^{\int_0^1 e^{-1}\dot{x}^2 + m^2 e\, du}$$

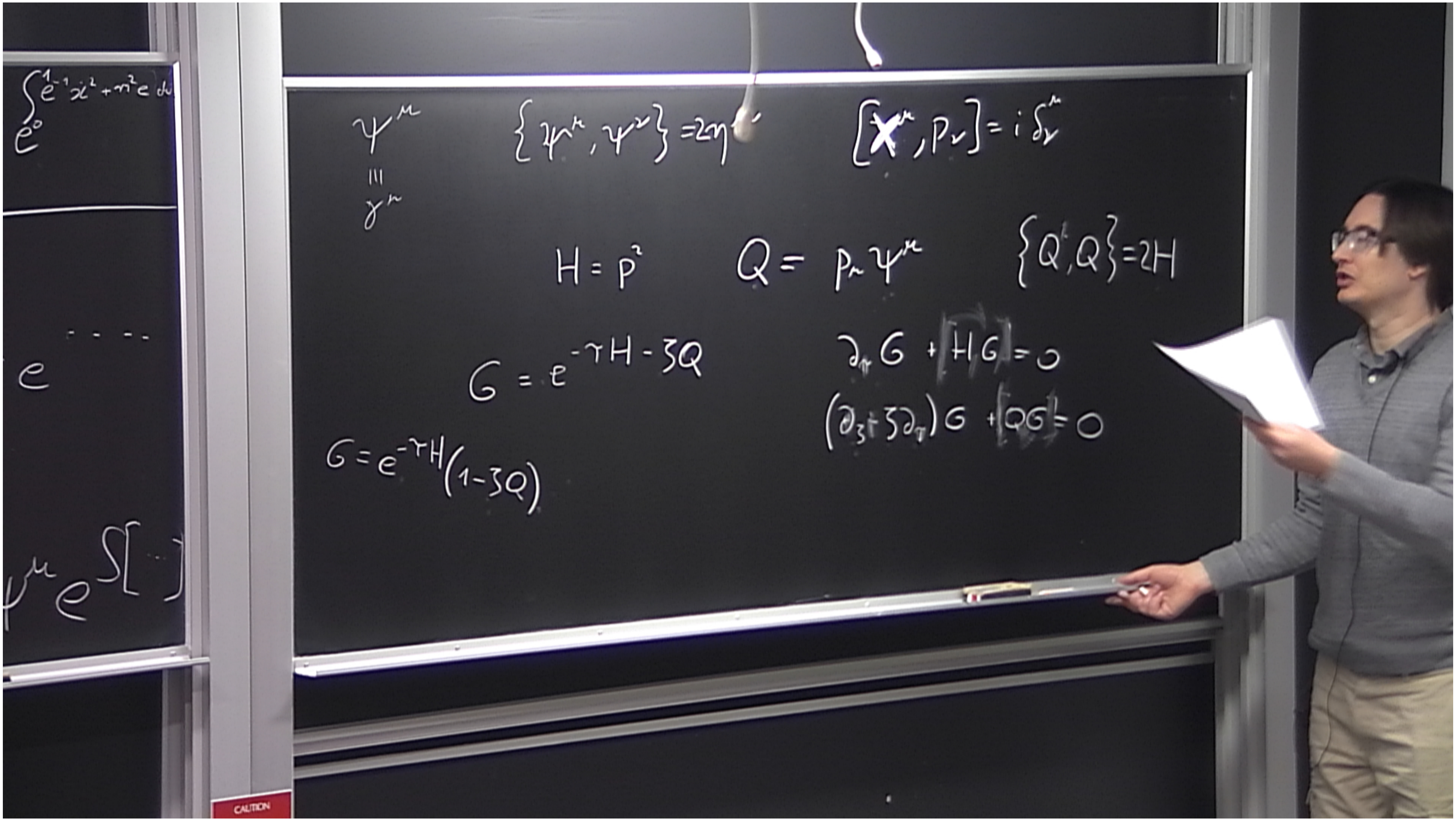
$$\tau = \int_0^1 e\, du$$

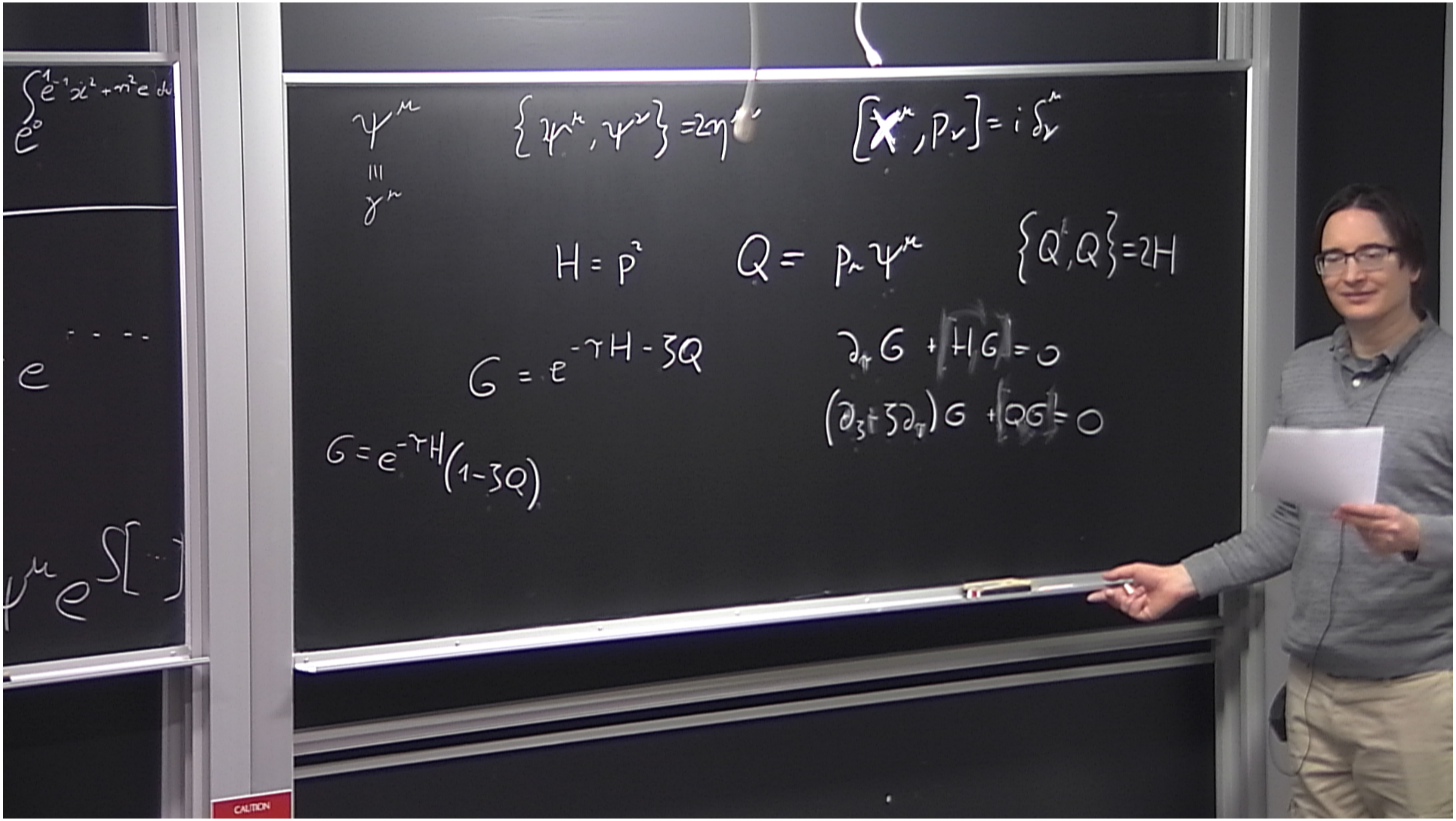
$$\frac{p_\mu \gamma^\mu}{p^2} \to \int d\tau\, d\zeta\, e^{-\tau p^2 - \zeta p_\mu \gamma^\mu} \Rightarrow \int d\tau\, d\zeta\, DX^\mu D\psi^\mu\, e^{\cdots\cdots}$$

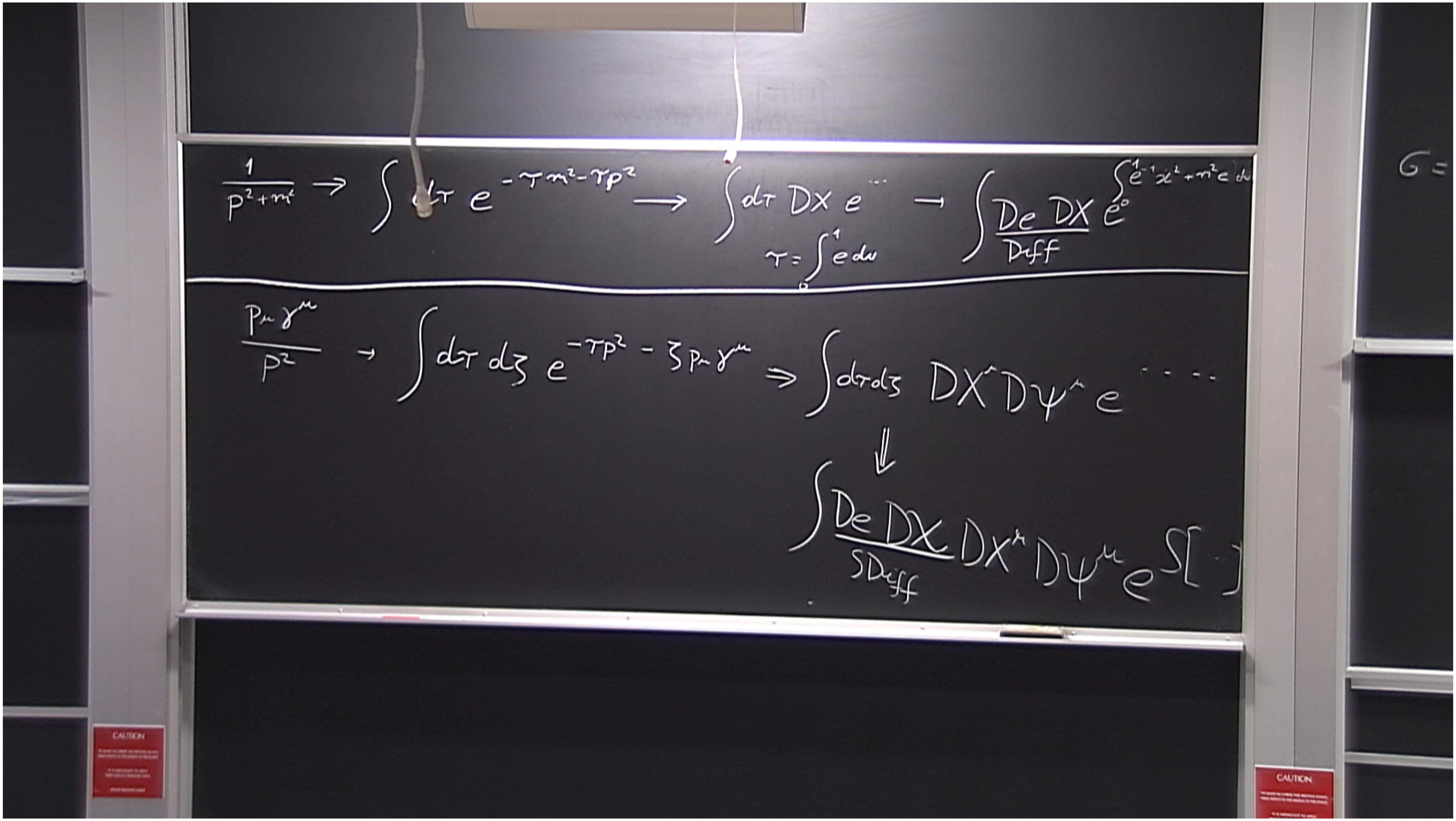
$$\Downarrow$$

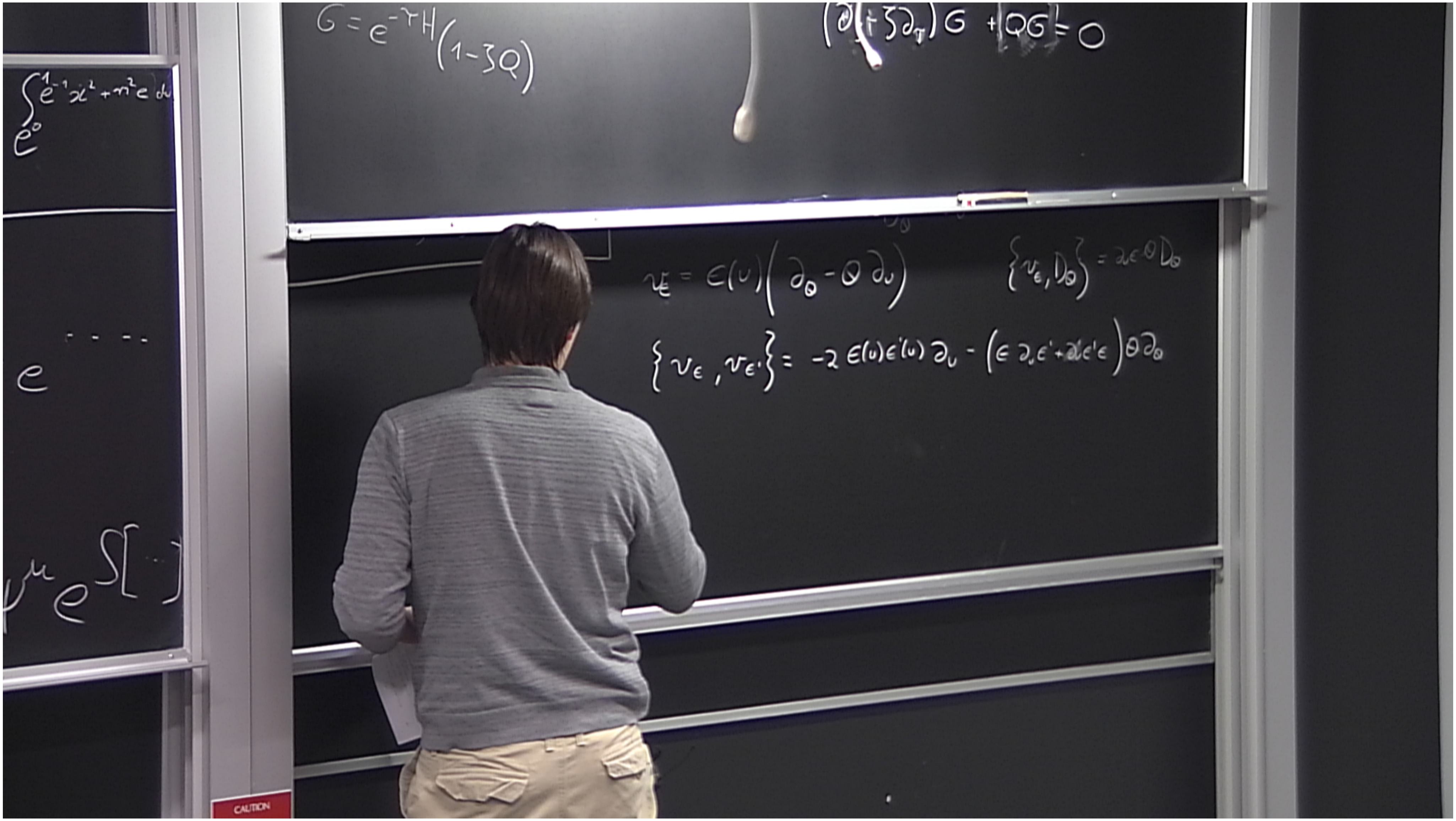
$$\int \frac{De\, DX}{SDiff}\, DX^\mu D\psi^\mu\, e^{S[\cdot\cdot]}$$

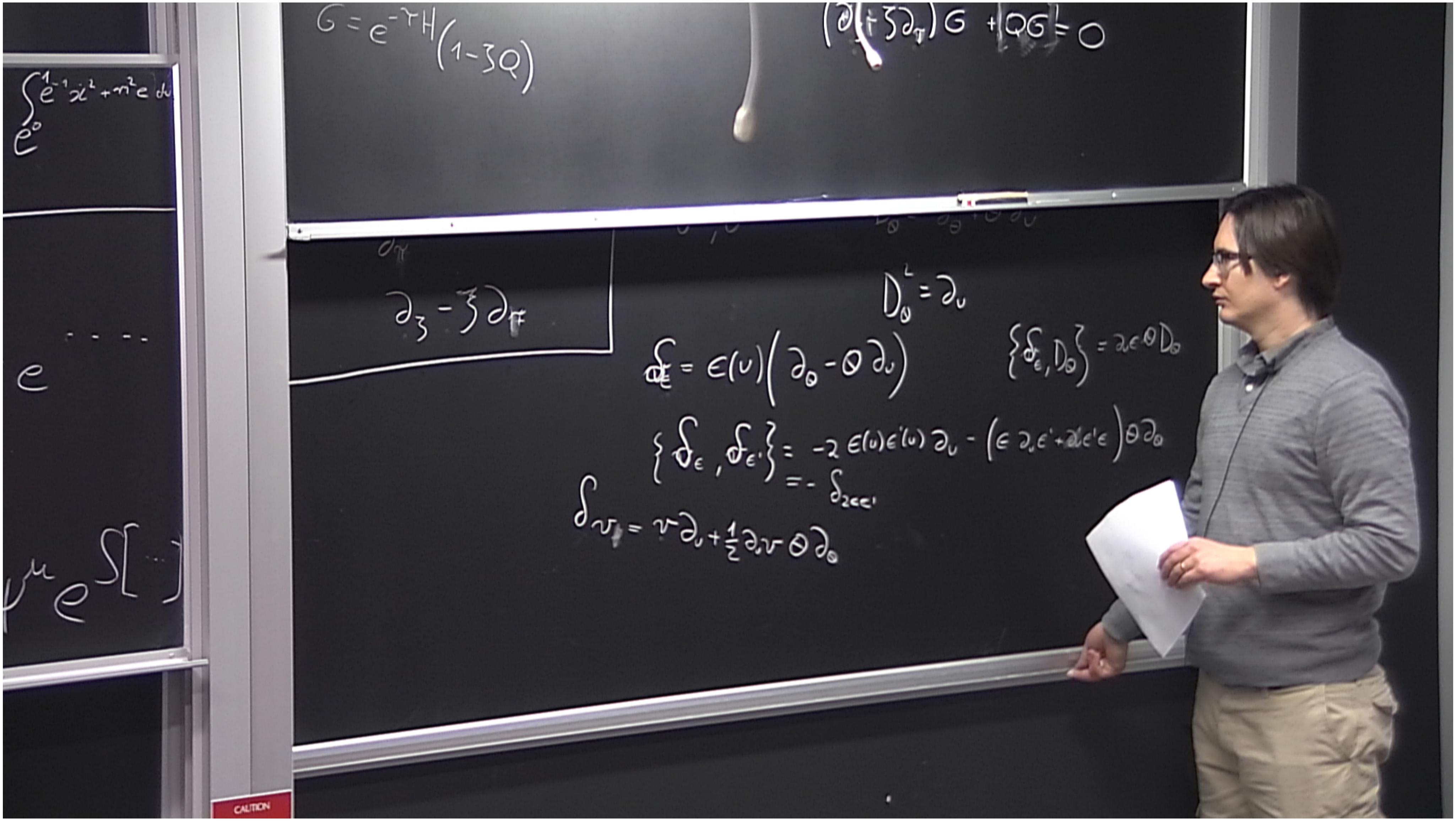

ψ^μ
{ψ^μ, ψ^ν} = 2η
[X^μ, P_ν] = i δ_ν^μ
H = p²
Q = p_μ ψ^μ
CAUTION

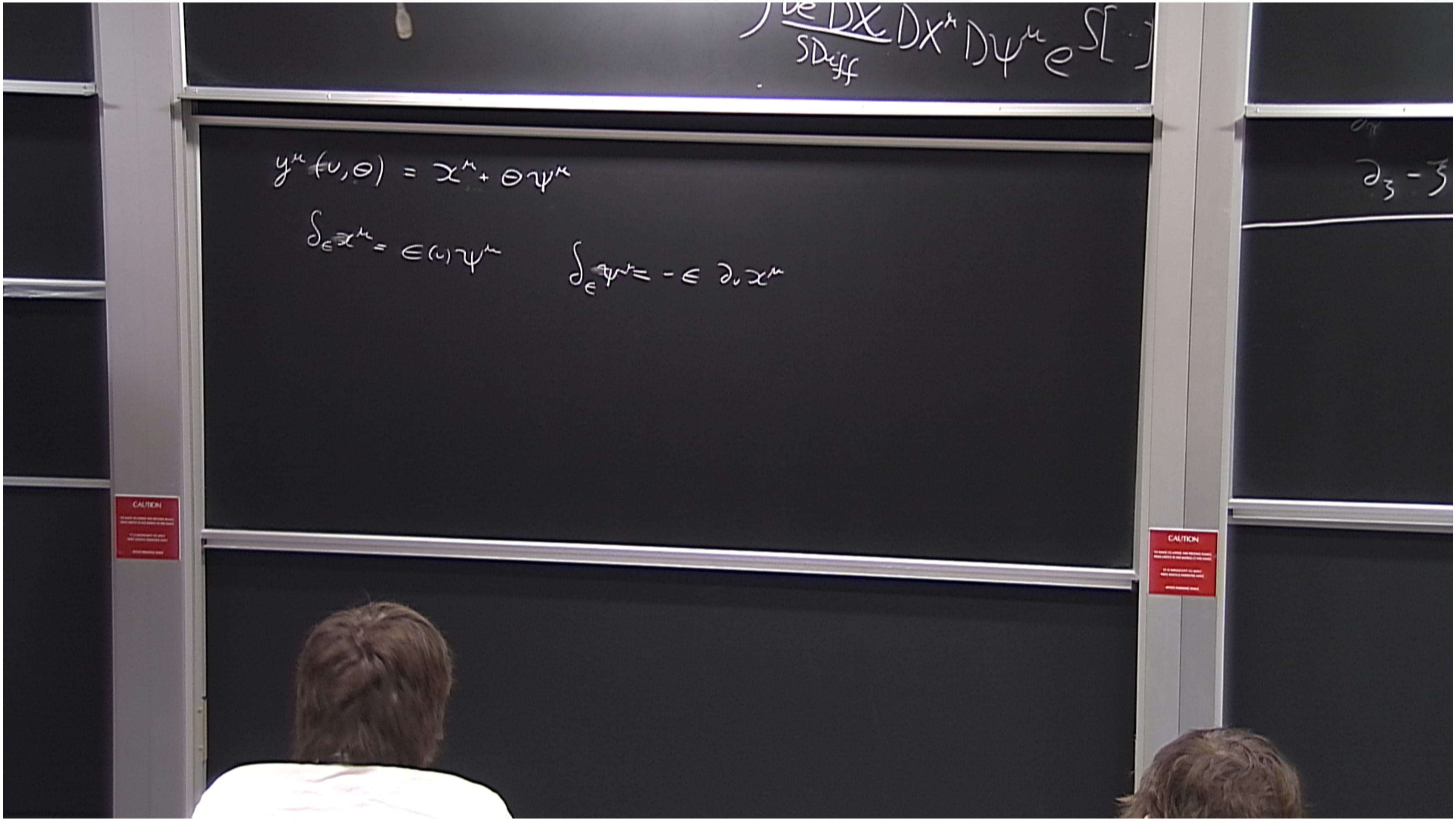

$\psi^\mu \equiv \gamma^\mu$
$\{\psi^\mu, \psi^\nu\} = 2\eta$
$[x^\mu, p_\nu] = i\delta^\mu_\nu$
$H = p^2$
$Q = p_\mu \psi^\mu$
$\{Q, Q\} = 2H$
$G = e^{-\tau H - \zeta Q}$
$\partial_\tau G + [H, G] = 0$
$(\partial_\zeta + \zeta\partial_\tau) G + [Q, G] = 0$
$G = e^{-\tau H}(1 - \zeta Q)$
CAUTION

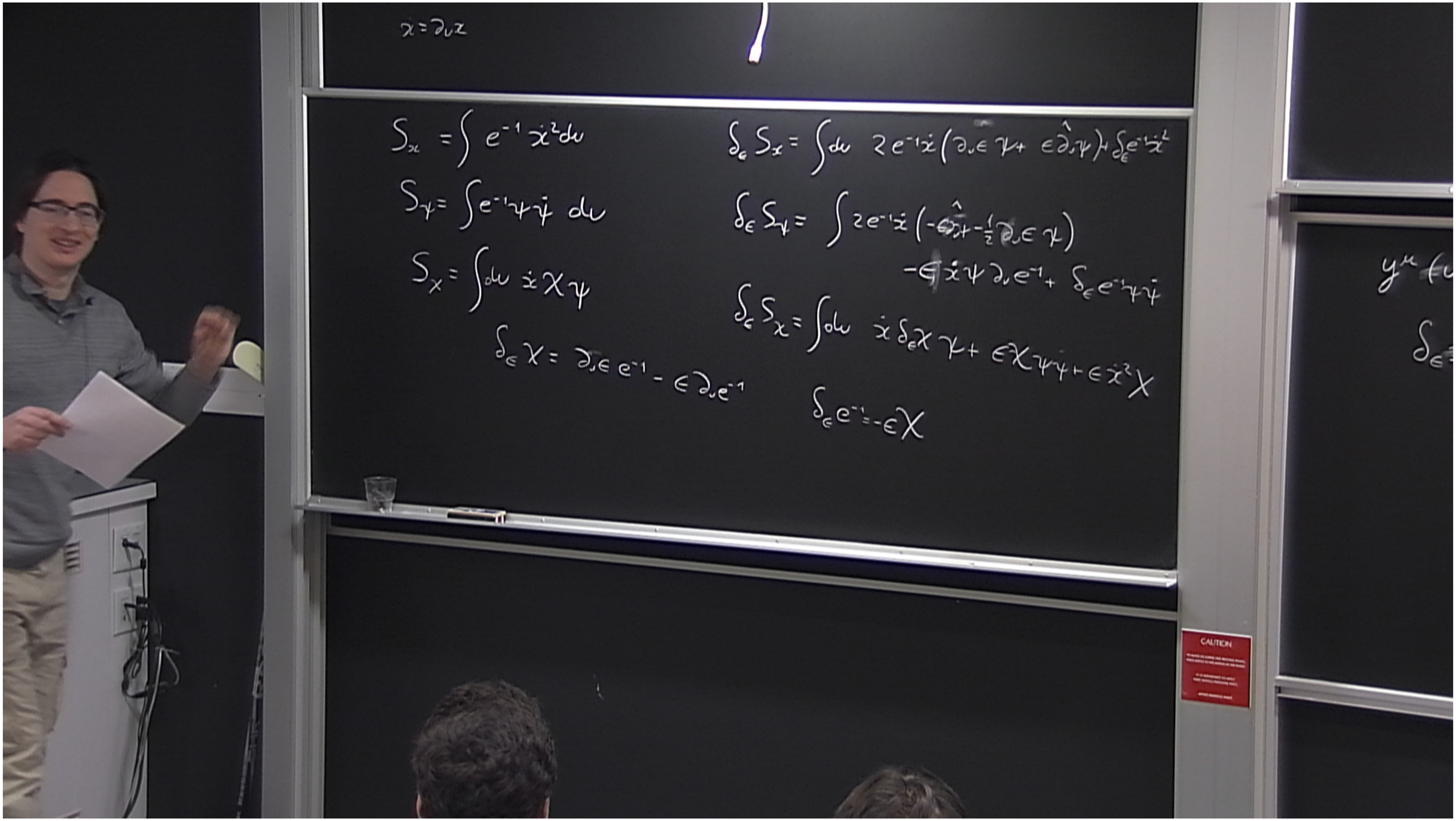

ψ^μ
{ψ^μ, ψ^ν} = 2η
[X^μ, P_ν] = i δ_ν^μ
H = p²
Q = p_μ ψ^μ
{Q, Q} = 2H
G = e^{-τH - ζQ}
∂_τ G + HG = 0
(∂_ζ + ζ∂_τ) G + QG = 0
G = e^{-τH}(1 - ζQ)

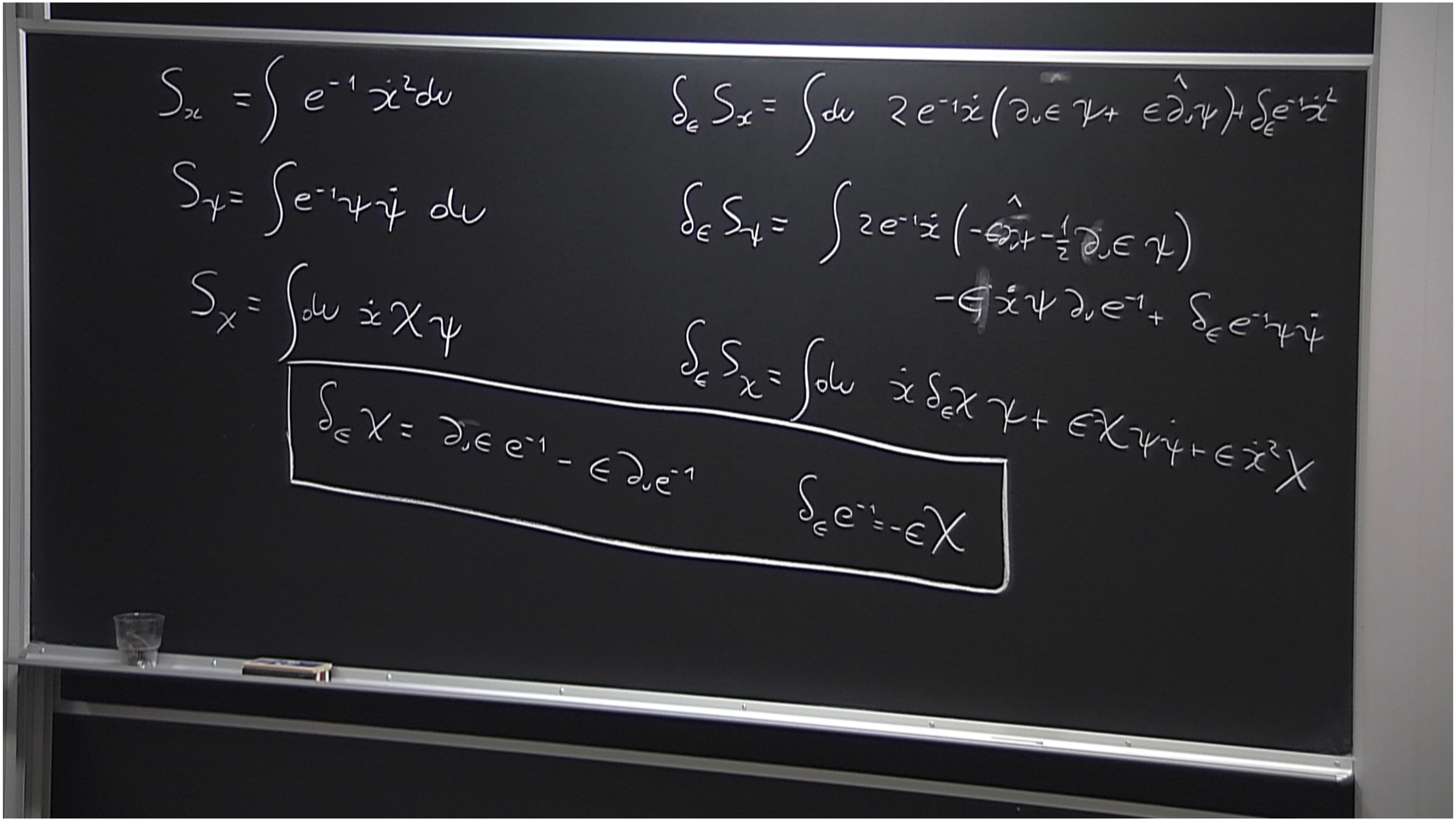

1/(p^2+m^2) → ∫dτ e^{-τm^2-τp^2} → ∫dτ DX e^{...} → ∫ De DX / Diff e^{∫_0^1 e^{-1} ẋ^2 + m^2 e du}
τ = ∫_0^1 e du
p_μ γ^μ / p^2 → ∫dτ dζ e^{-τp^2 - ζ p_μ γ^μ} ⇒ ∫dτ dζ DX^μ Dψ^μ e^{....}
∫ De DX / SDiff DX^μ Dψ^μ e^{S[ ]}
G =

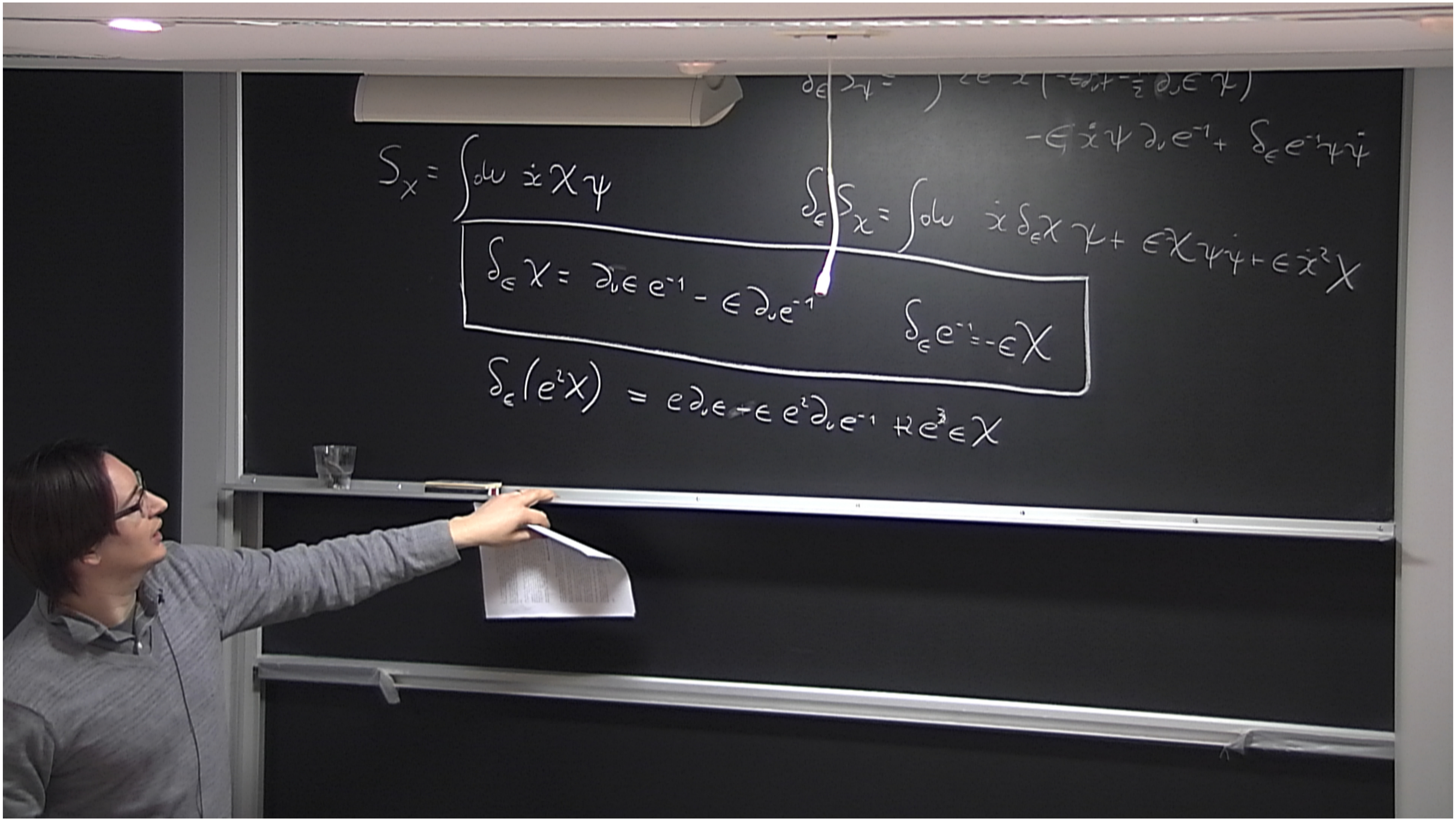


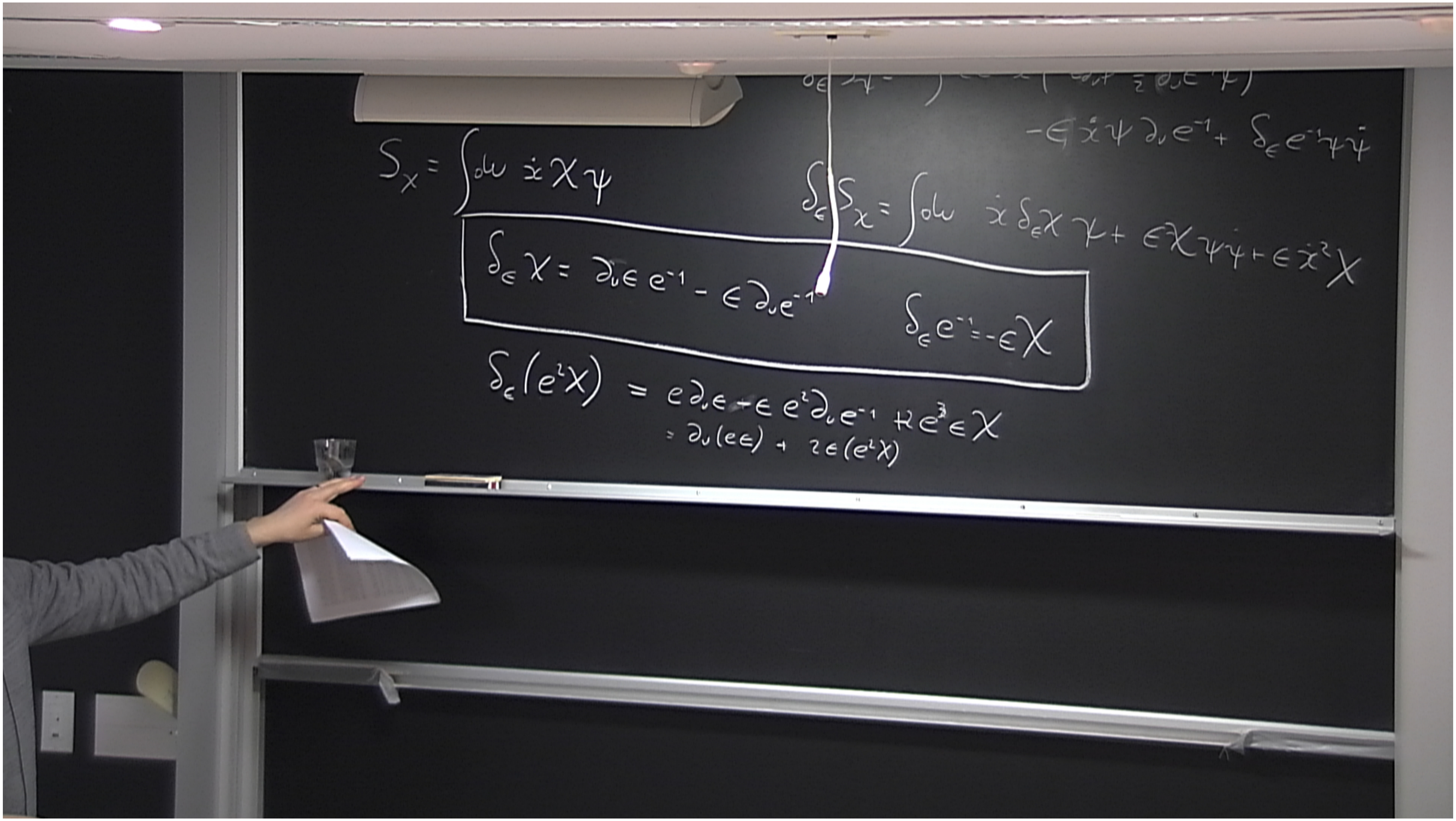

G = e^{-τH}(1-ζQ)
D_θ^2 = ∂_u
{δ_ε, δ_ε'} = -2 ε(u)ε'(u) ∂_u - (ε ∂_u ε' + ∂_u ε' ε) θ ∂_θ
CAUTION


$\frac{\mathcal{D}X}{SDiff} DX^\mu D\psi^\mu e^{S[\cdot]}$
$y^\mu(\upsilon,\theta) = x^\mu + \theta\psi^\mu$
$\delta_\epsilon x^\mu = \epsilon(\upsilon)\psi^\mu$
$\delta_\epsilon \psi^\mu = -\epsilon\, \partial_\upsilon x^\mu$
CAUTION
CAUTION

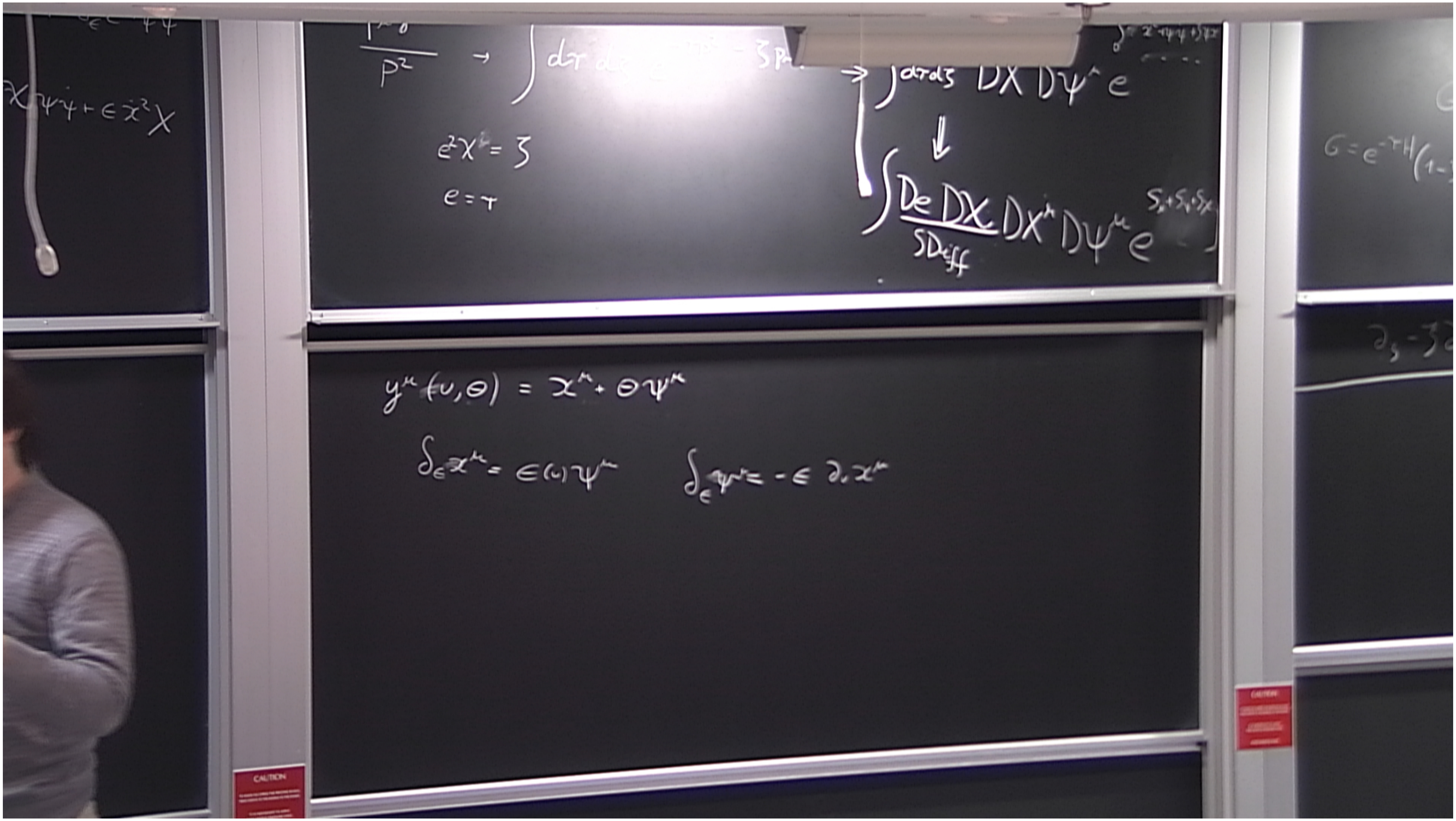

$S_x = \int e^{-1} \dot{x}^2 du$
$S_\psi = \int e^{-1} \psi \dot{\psi} \, du$
$S_\chi = \int du \, \dot{x} \chi \psi$
$\delta_\epsilon e^{-1} = -\epsilon \chi$

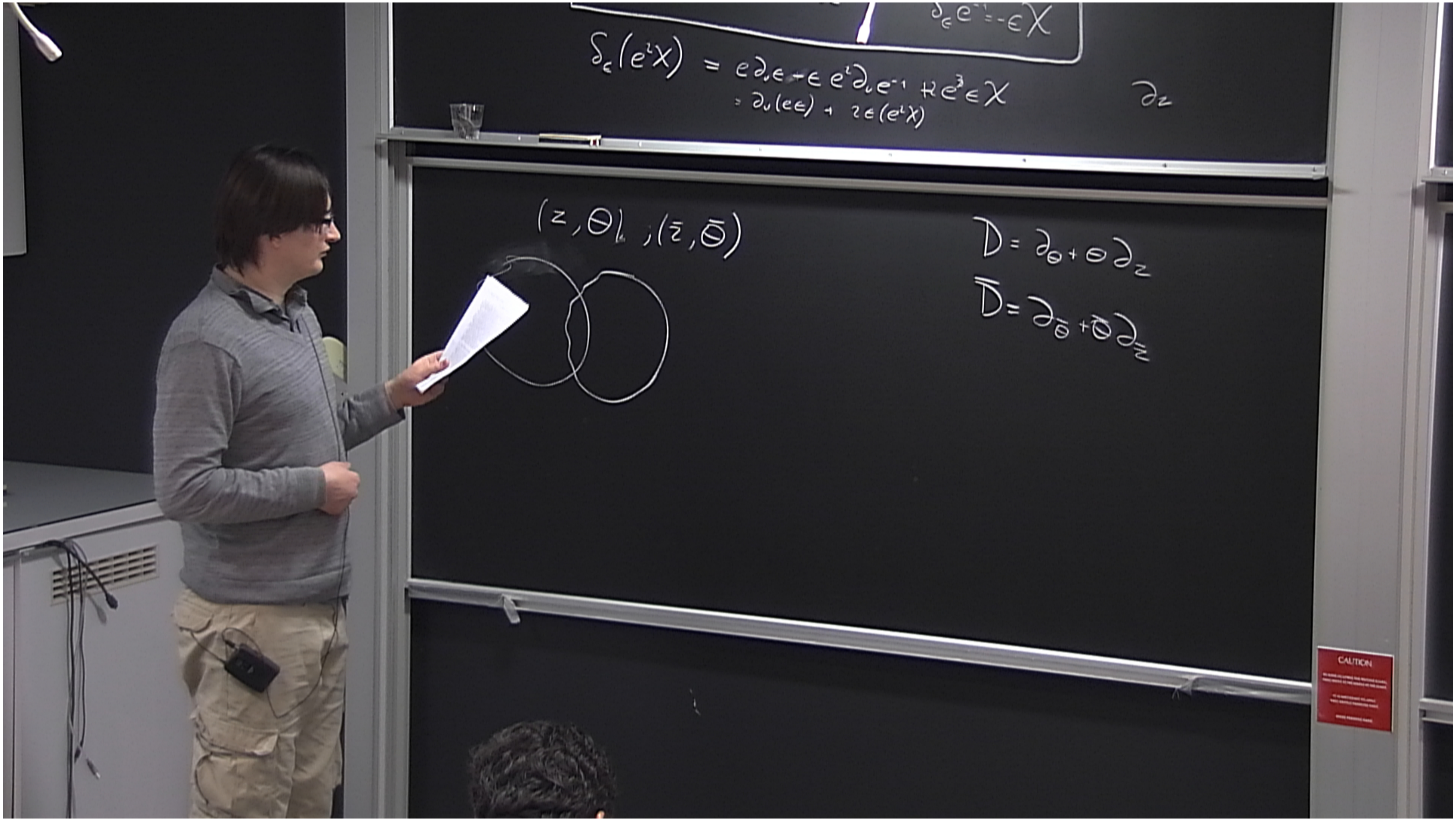

$S_x = \int e^{-1} \dot{x}^2 du$
$S_\psi = \int e^{-1} \psi \dot{\psi} \, du$
$S_\chi = \int du \, \dot{x} \chi \psi$
$\delta_\epsilon \chi = \partial_u \epsilon \, e^{-1} - \epsilon \partial_u e^{-1}$
$\delta_\epsilon e^{-1} = -\epsilon \chi$
$\delta_\epsilon S_x = \int du \; 2 e^{-1} \dot{x} (\partial_u \epsilon \psi + \epsilon \partial_u \psi) + \delta_\epsilon e^{-1} \dot{x}^2$
$\delta_\epsilon S_\psi = \int 2 e^{-1} \dot{x} (-\epsilon \partial_u \psi - \frac{1}{2} \partial_u \epsilon \psi)$
$- \epsilon \dot{x} \psi \partial_u e^{-1} + \delta_\epsilon e^{-1} \psi \dot{\psi}$
$\delta_\epsilon S_\chi = \int du \; \dot{x} \delta_\epsilon \chi \psi + \epsilon \chi \psi \dot{\psi} + \epsilon \dot{x}^2 \chi$

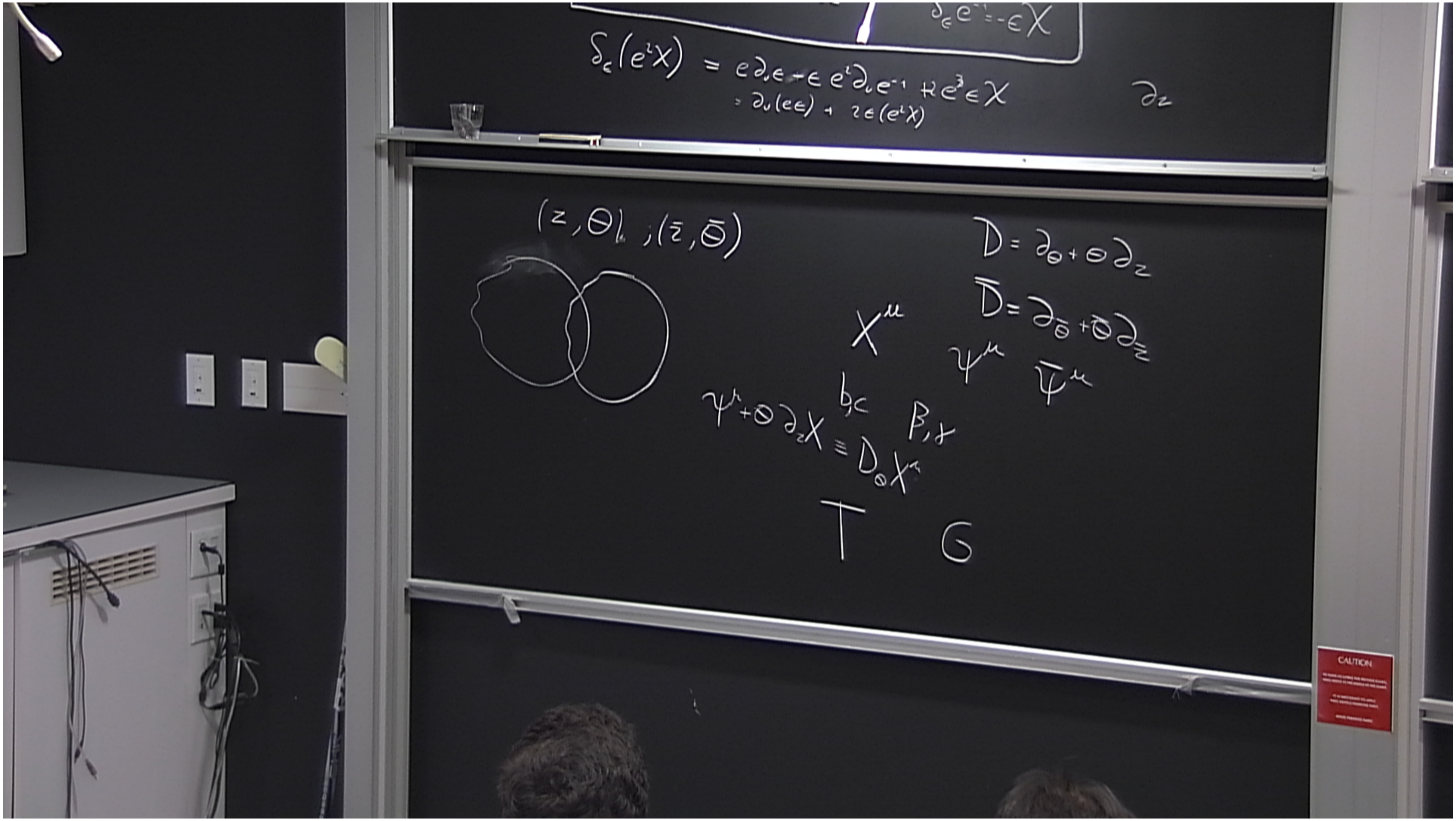




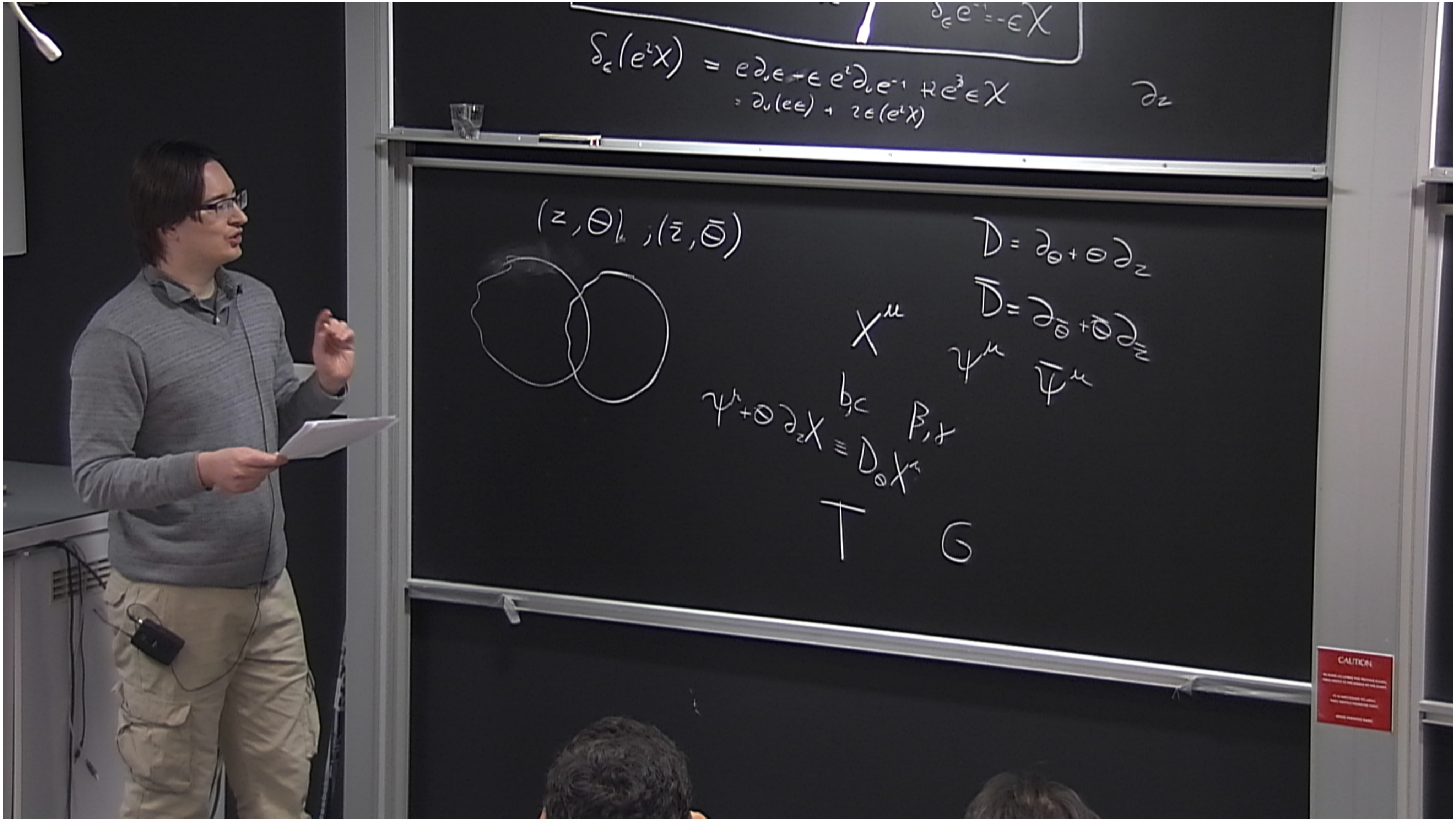
$-\epsilon \dot{x} \psi \partial_v e^{-1} + \delta_\epsilon e^{-1} \psi \dot{\psi}$
$S_\chi = \int dw \, \dot{x} \chi \psi$
$\delta_\epsilon S_\chi = \int dw \, \dot{x} \delta_\epsilon \chi \psi + \epsilon \chi \psi \dot{\psi} + \epsilon \dot{x}^2 \chi$
$\delta_\epsilon \chi = \partial_v \epsilon \, e^{-1} - \epsilon \partial_v e^{-1}$
$\delta_\epsilon e^{-1} = -\epsilon \chi$
$\delta_\epsilon (e^2 \chi) = e \partial_v \epsilon - \epsilon e^2 \partial_v e^{-1} + 2 e^3 \epsilon \chi$
$= \partial_v (e \epsilon) + 2 \epsilon (e^2 \chi)$


e²χ^μ = ζ
e = τ
y^μ(υ,θ) = x^μ + θψ^μ
δ_ε x^μ = ε(υ)ψ^μ
δ_ε ψ^μ = -ε ∂_υ x^μ





(z, θ) ; (z̄, θ̄)
D = ∂θ + θ∂z
D̄ = ∂θ̄ + θ̄∂z̄
Xμ
ψμ
ψ̄μ
b, c
β, γ
T
G


$\delta_\epsilon e^{-1} = -\epsilon \chi$
$\delta_\epsilon(e^2\chi) = e\partial_v\epsilon + \epsilon e^2\partial_v e^{-1} + 2e^3\epsilon\chi$
$= \partial_v(e\epsilon) + 2\epsilon(e^2\chi)$
∂_z
$(z,\theta), (\bar z,\bar\theta)$
$D = \partial_\theta + \theta\partial_z$
$\bar D = \partial_{\bar\theta} + \bar\theta\partial_{\bar z}$
X^μ
ψ^μ
$\bar\psi^\mu$
b, c
β, γ
$\psi^\mu + \theta\partial_z X \equiv D_\theta X^\mu$
T
G
CAUTION