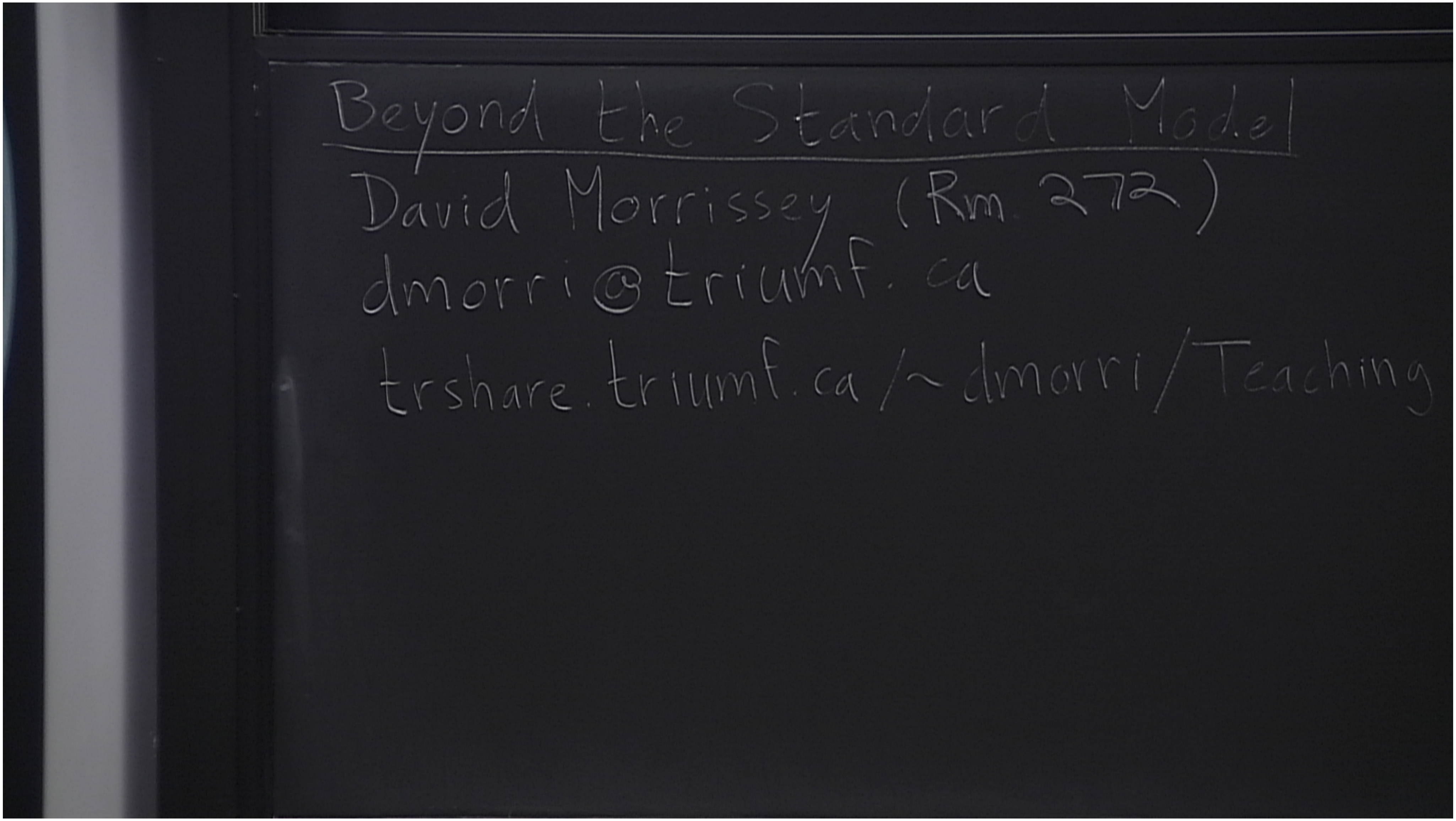
Title: PSI 2015/2016 More/Beyond Standard Model - Lecture 1

Date: Feb 22, 2016 09:00 AM

URL: http://pirsa.org/16020066

Abstract:


Beyond the Standard Model
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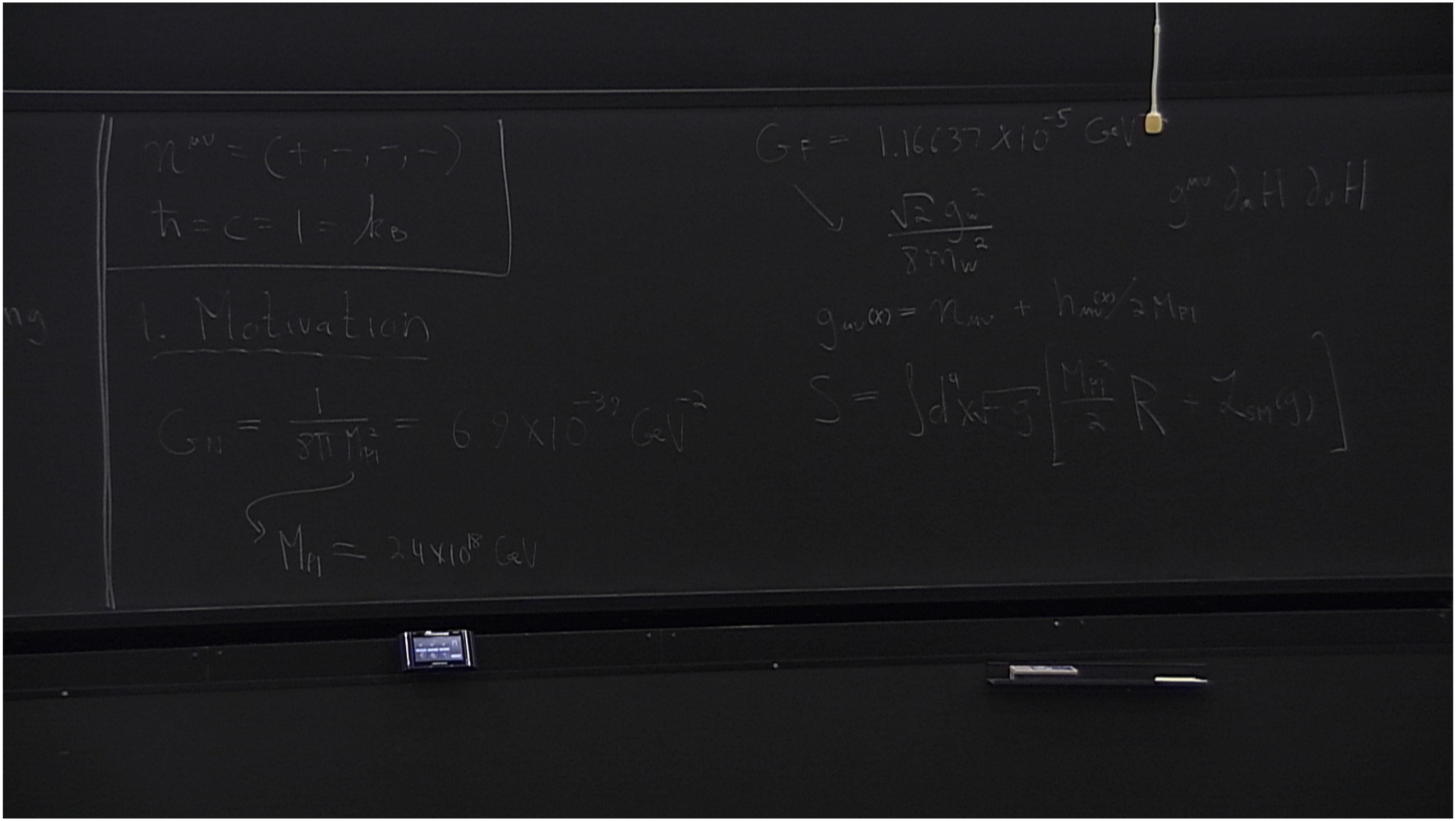
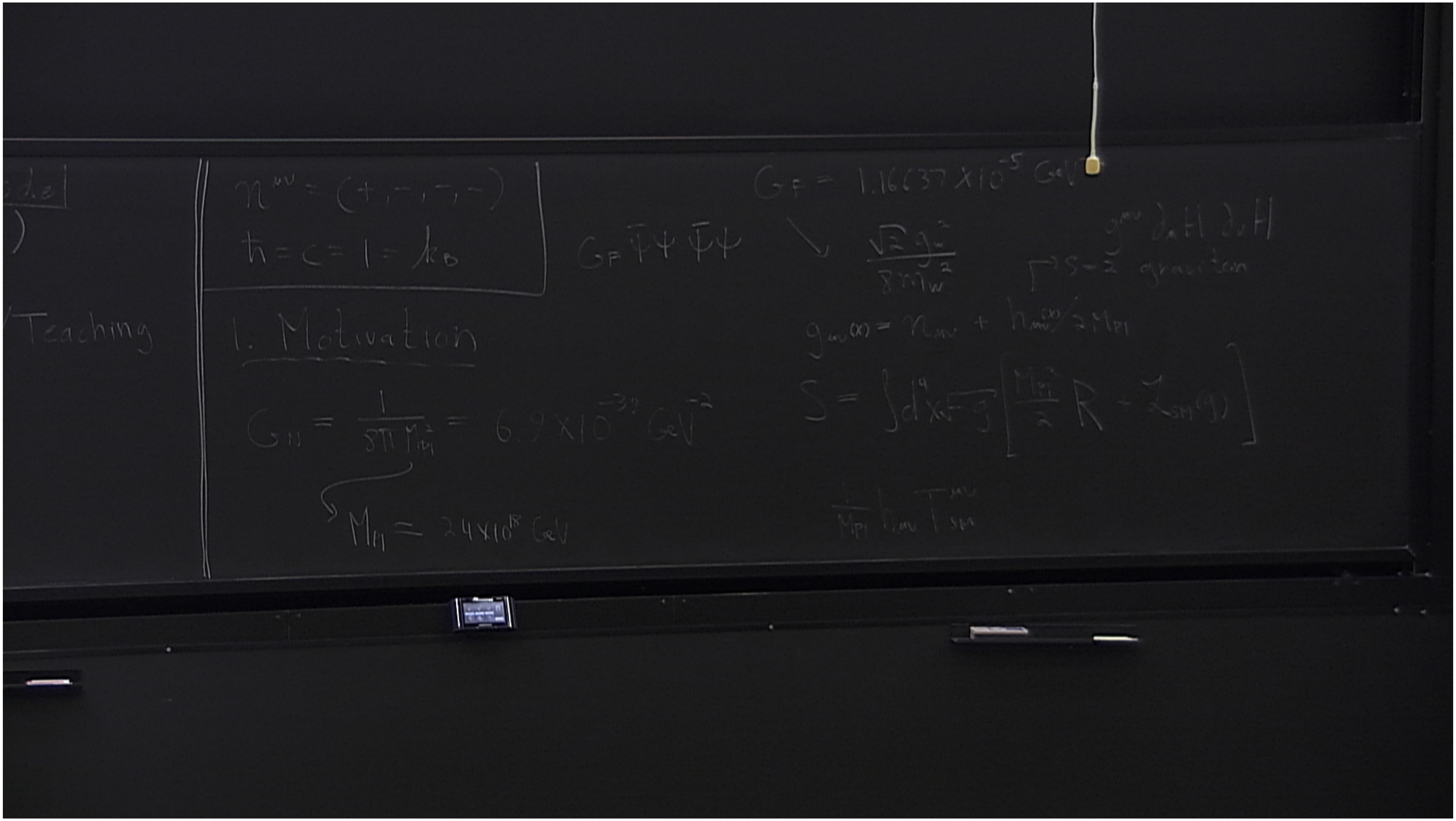
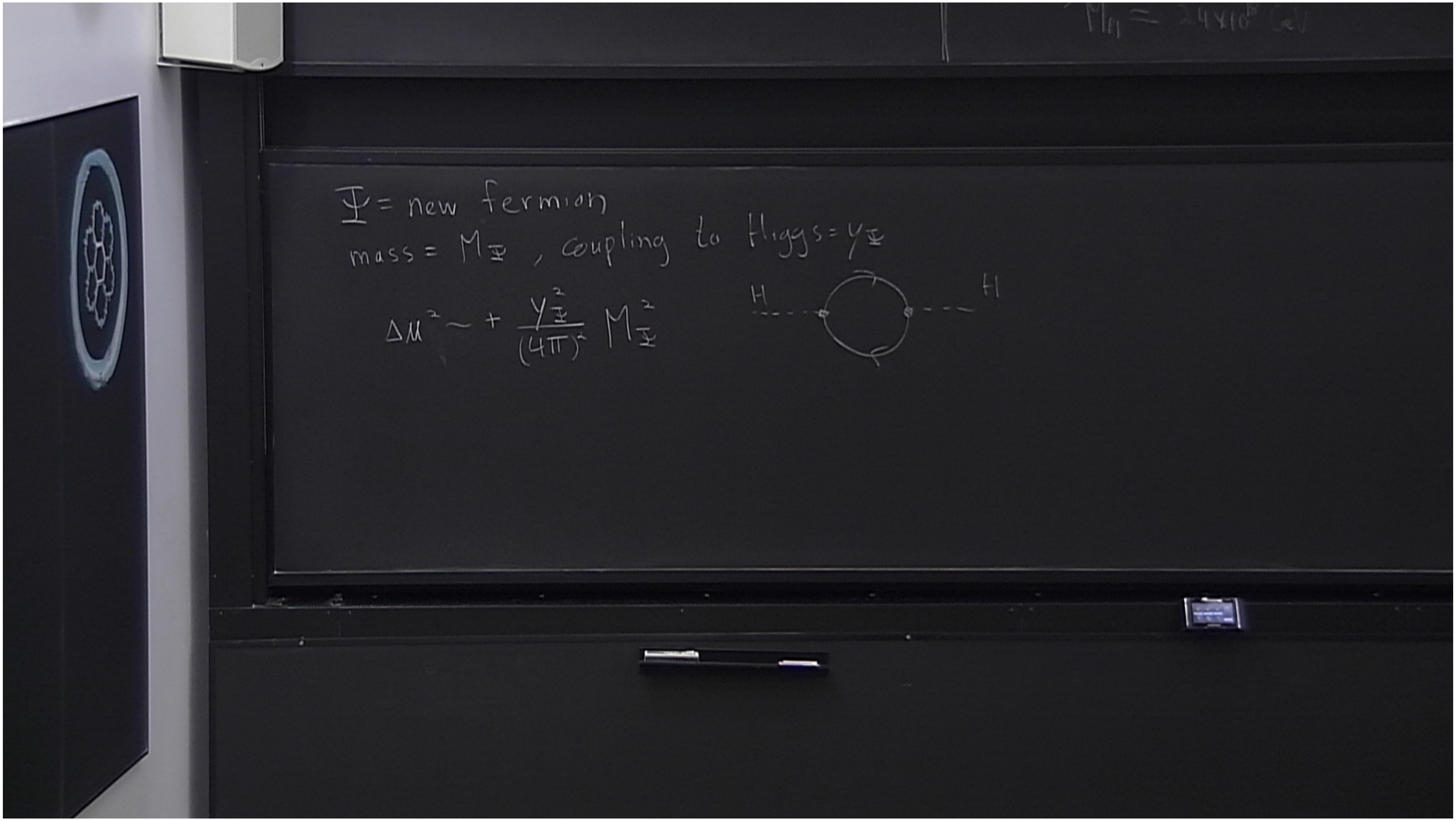
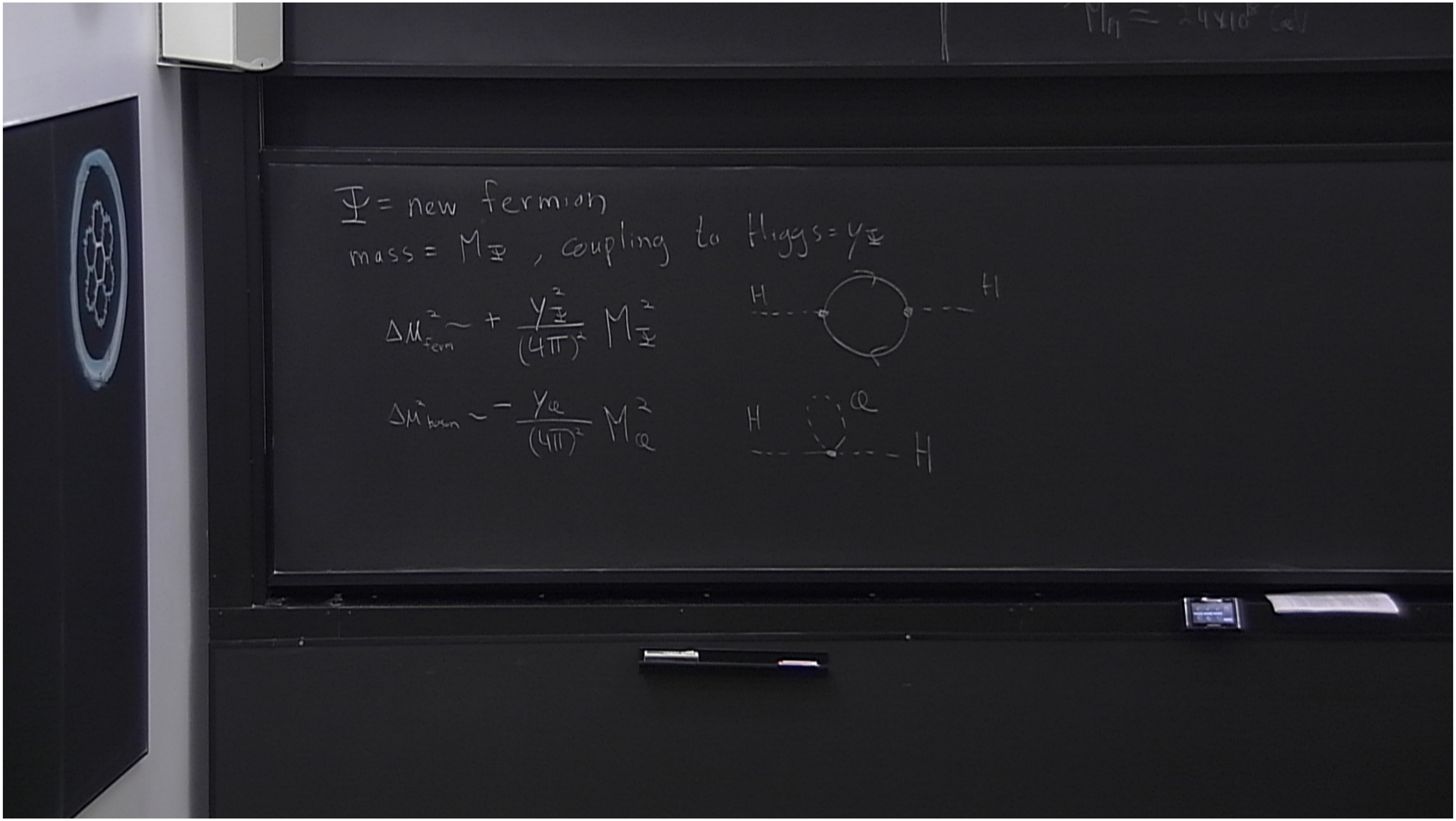
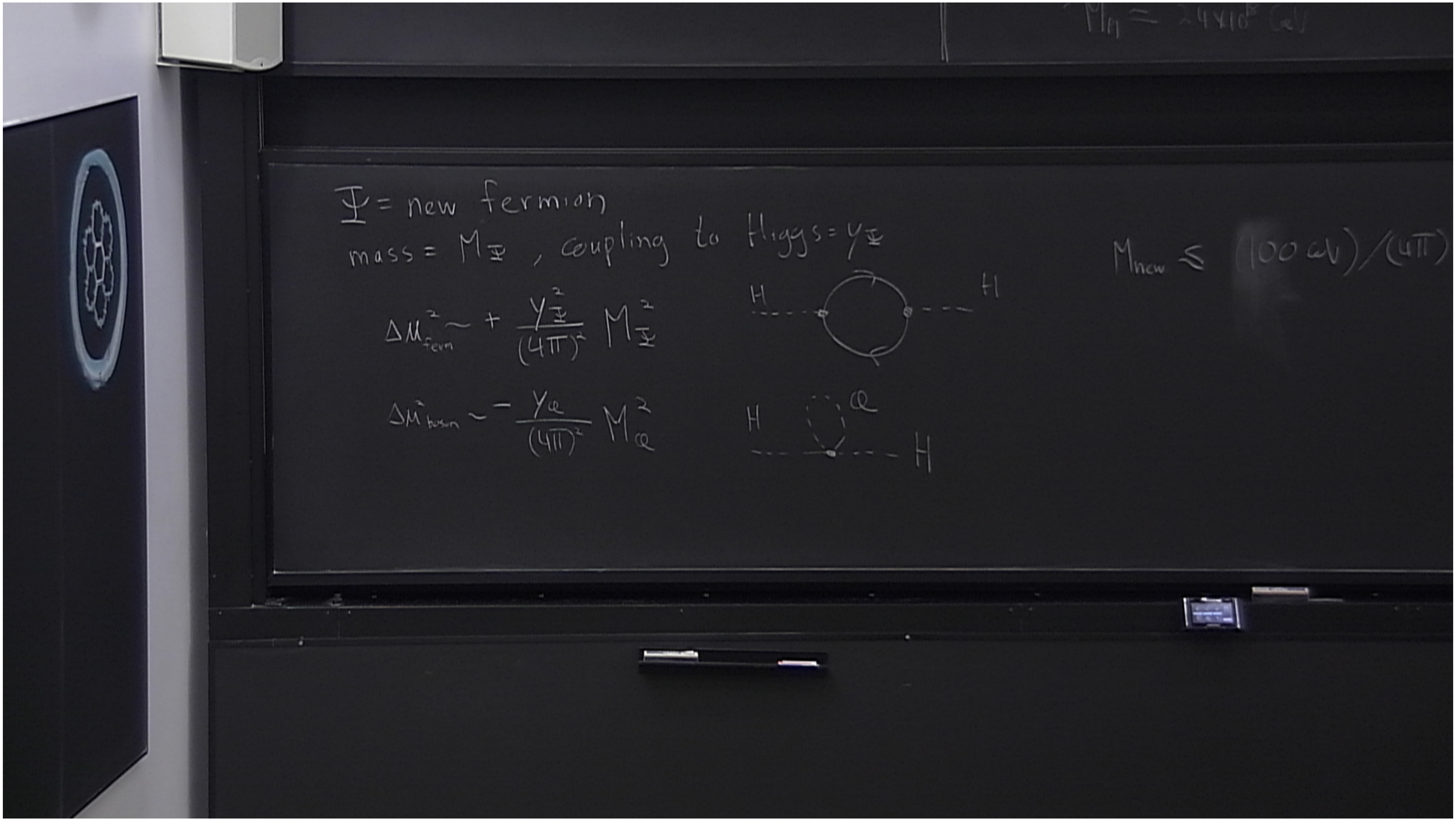
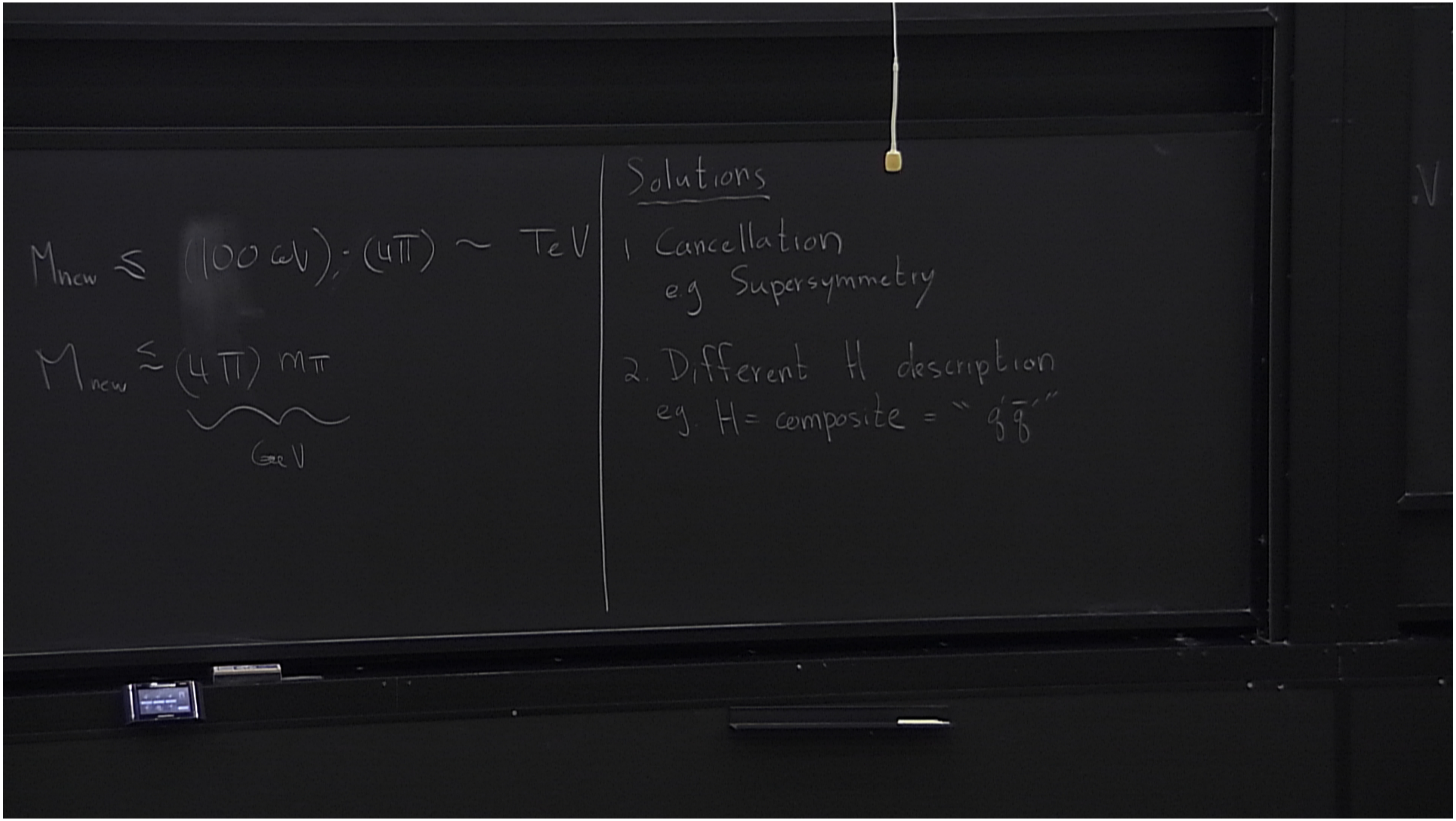

η^{μν} = (+,−,−,−)
ħ = c = 1 = k_B
1. Motivation
G_N = 1/(8π M_Pl^2) = 6.9 × 10^{−39} GeV^{−2}
M_Pl = 2.4 × 10^18 GeV
G_F = 1.16637 × 10^{−5} GeV^{−2}
√2 g_w^2 / 8 m_w^2
g^{μν} ∂_μ H ∂_ν H
g_{μν}(x) = η_{μν} + h_{μν}(x)/2M_Pl
S = ∫d^4x √−g [M_Pl^2/2 R + L_SM(g)]

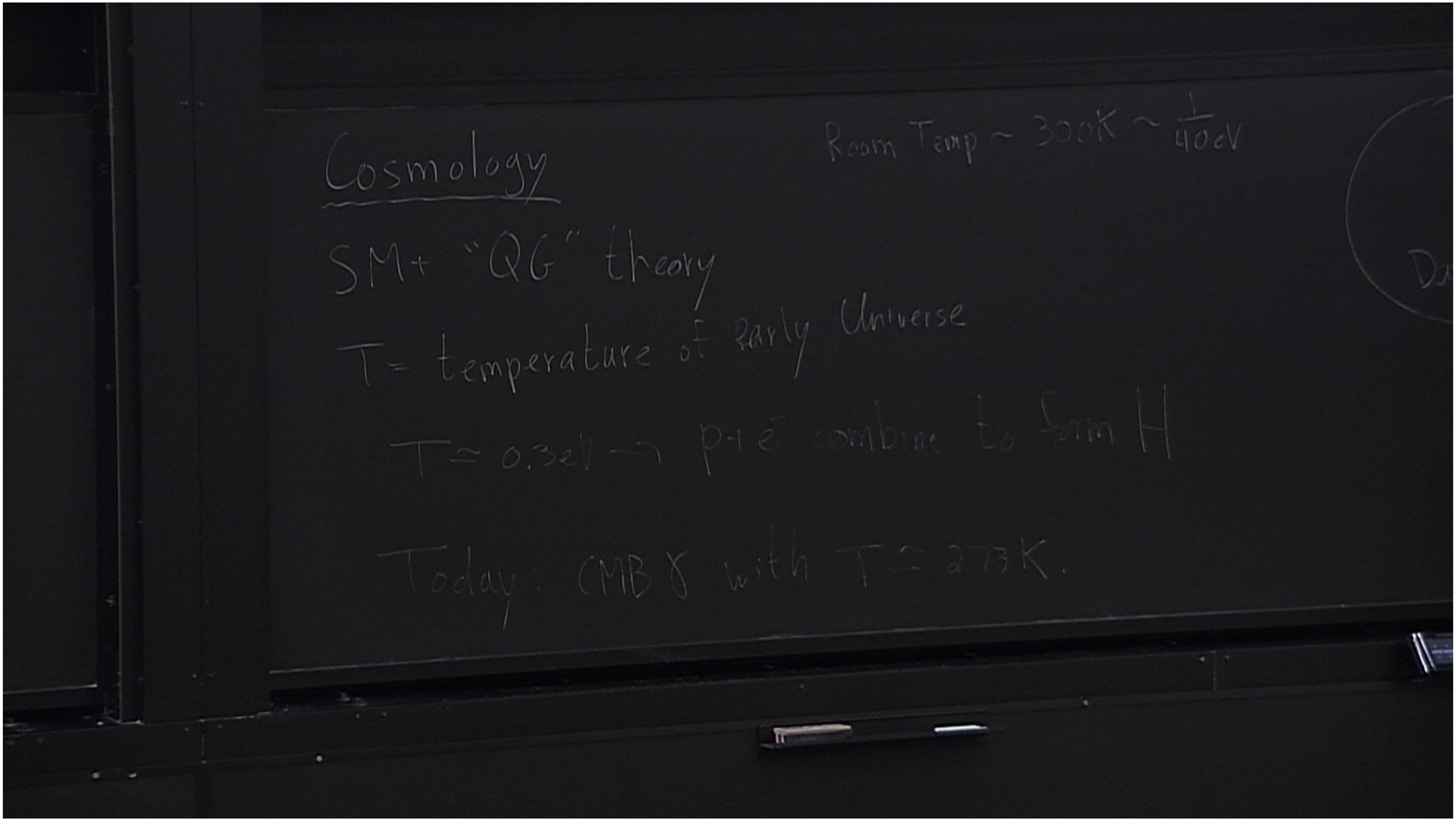

η^μν = (+,−,−,−)
ħ = c = 1 = k_B
Teaching
1. Motivation
G_N = 1/8π M_Pl^2 = 6.9×10^-39 GeV^-2
M_Pl = 2.4×10^18 GeV
G_F ψ̄ψ ψ̄ψ
G_F = 1.16637×10^-5 GeV^-2
√2 g_w^2 / 8 m_W^2
g^μν ∂_μ H ∂_ν H
S=2 graviton
g_μν(x) = η_μν + h_μν(x)/2M_Pl
S = ∫d^4x √-g [M_Pl^2/2 R + L_SM(g)]
1/M_Pl h_μν T_SM^μν

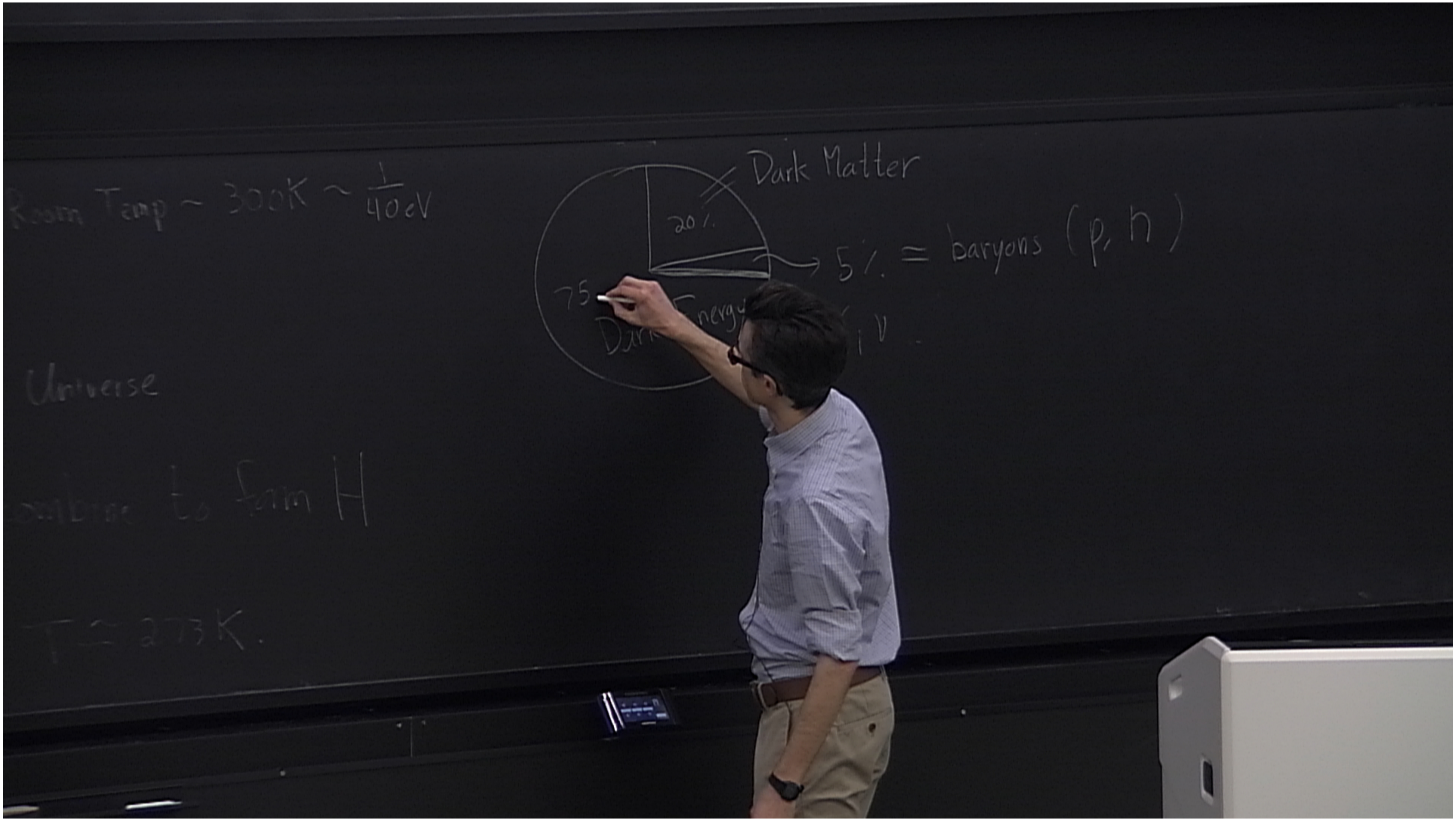

Ψ = new fermion
mass = M_Ψ , coupling to Higgs = y_Ψ
ΔM² ~ + y_Ψ² / (4π)² M_Ψ²
H
H

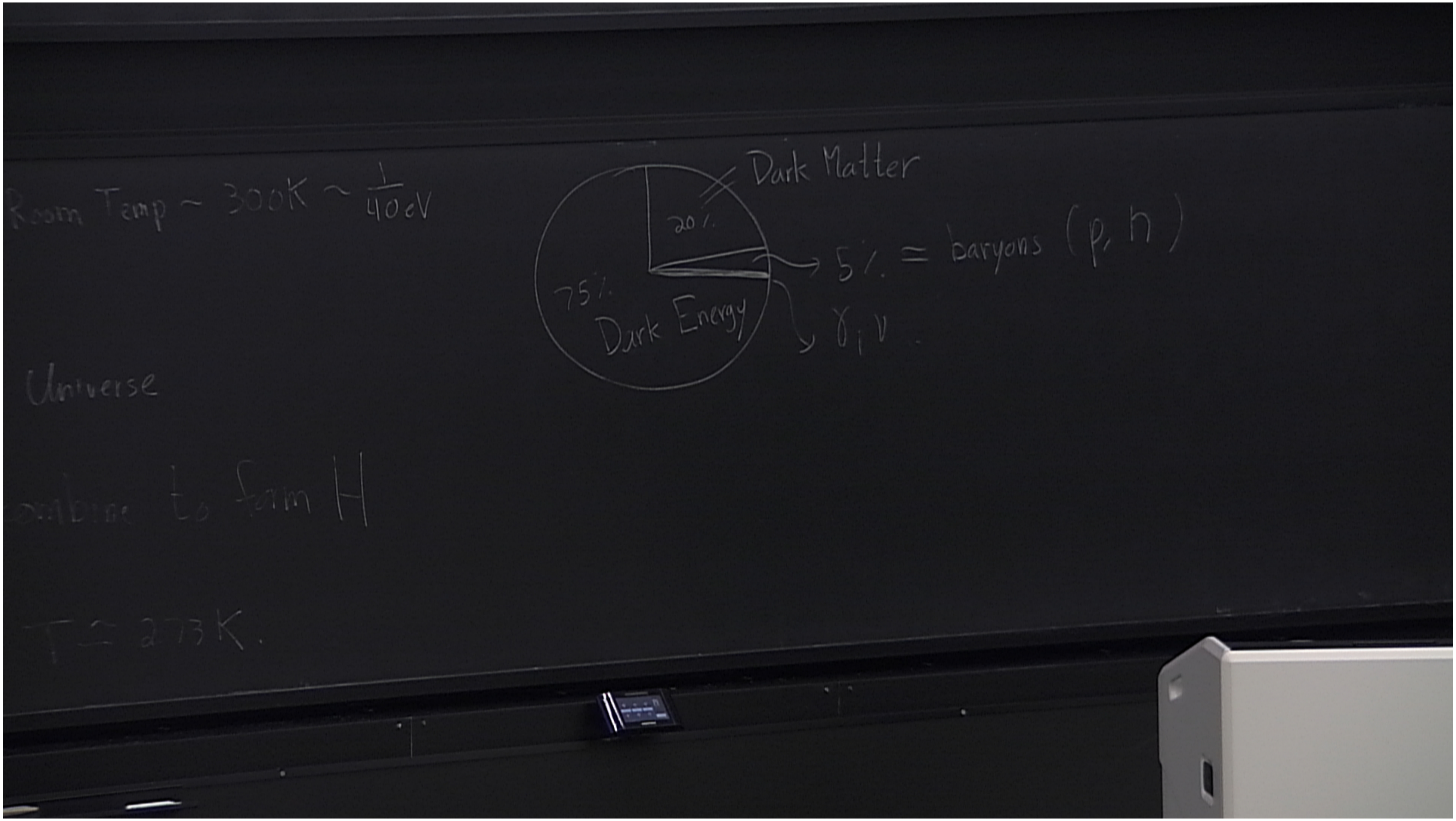

Ψ = new fermion
mass = M_Ψ , coupling to Higgs = y_Ψ
$\Delta M^2_{ferm} \sim + \frac{y_\Psi^2}{(4\pi)^2} M_\Psi^2$
$\Delta M^2_{boson} \sim - \frac{y_\phi}{(4\pi)^2} M_\phi^2$
H
H
H
H

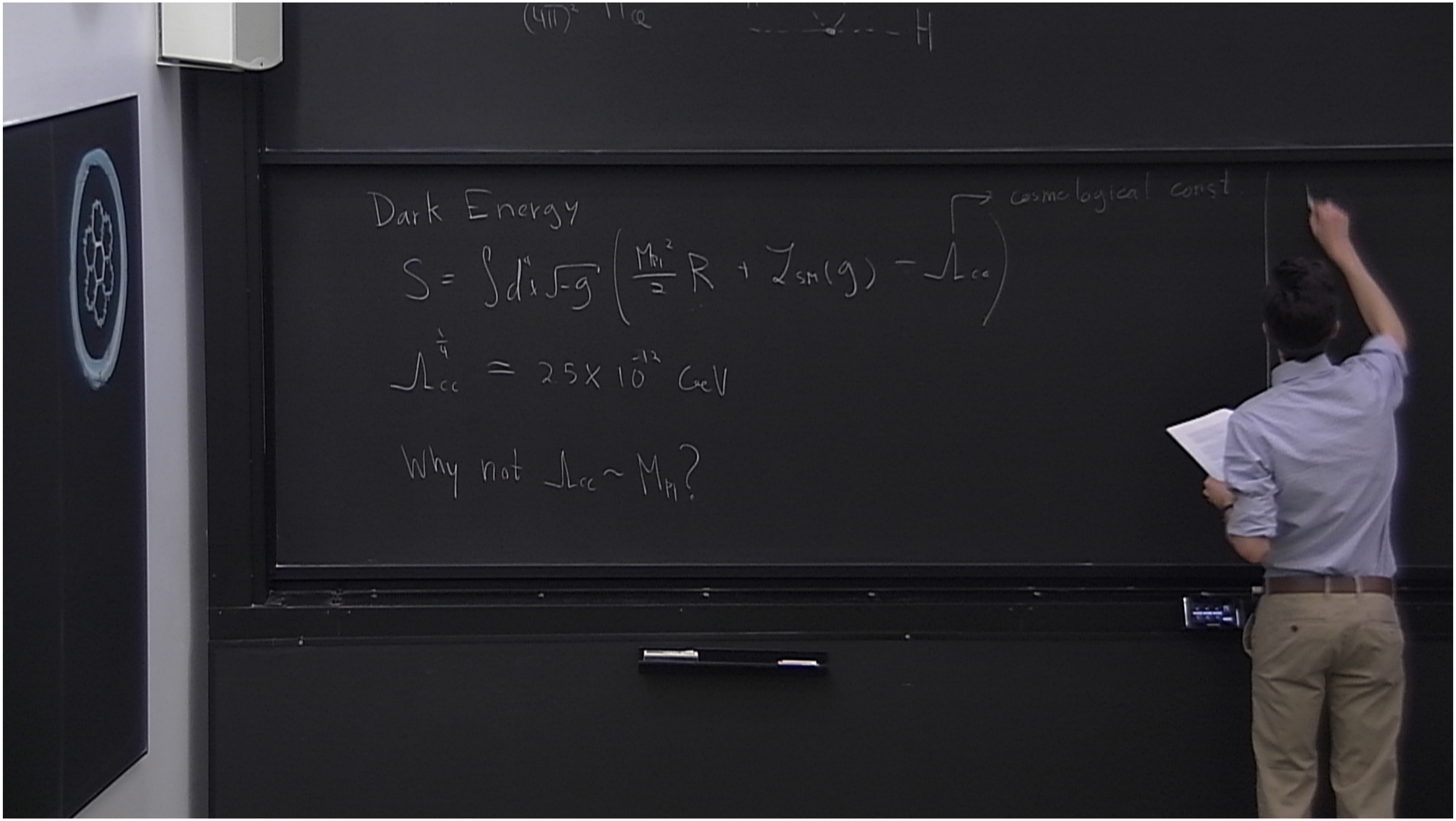

Ψ = new fermion
mass = M_Ψ , coupling to Higgs = y_Ψ
ΔM²_ferm ~ + y_Ψ²/(4π)² M_Ψ²
ΔM²_boson ~ − y_φ/(4π)² M_φ²
H
H
φ
M_new ≲ (100 GeV)/(4π)


M_new ≲ (100 GeV) · (4π) ~ TeV
M_new ≲ (4π) mπ
GeV
Solutions
1 Cancellation
e.g Supersymmetry
2. Different H description
eg. H = composite = "q q̄"


Cosmology
Room Temp ~ 300K ~ 1/40 eV
SM+ "QG" theory
T = temperature of early Universe
T ≃ 0.3eV → p+e⁻ combine to form H
Today: CMB γ with T ≃ 2.73K.


Room Temp ~ 300K ~ 1/40eV
Dark Matter
20%
5% = baryons (p, n)
75
Dark Energy
Universe
combine to form H
T ≃ 273K.


Room Temp ~ 300K ~ 1/40eV
Dark Matter
20%
75%
Dark Energy
5% = baryons (p, n)
γ, ν
Universe
to form H
T ≃ 273K.


Dark Energy
cosmological const.
S = ∫d⁴x √-g (M_Pl²/2 R + L_SM(g) − Λ_cc)
Λ_cc^(1/4) = 2.5 × 10^-12 GeV
Why not Λ_cc ~ M_Pl?