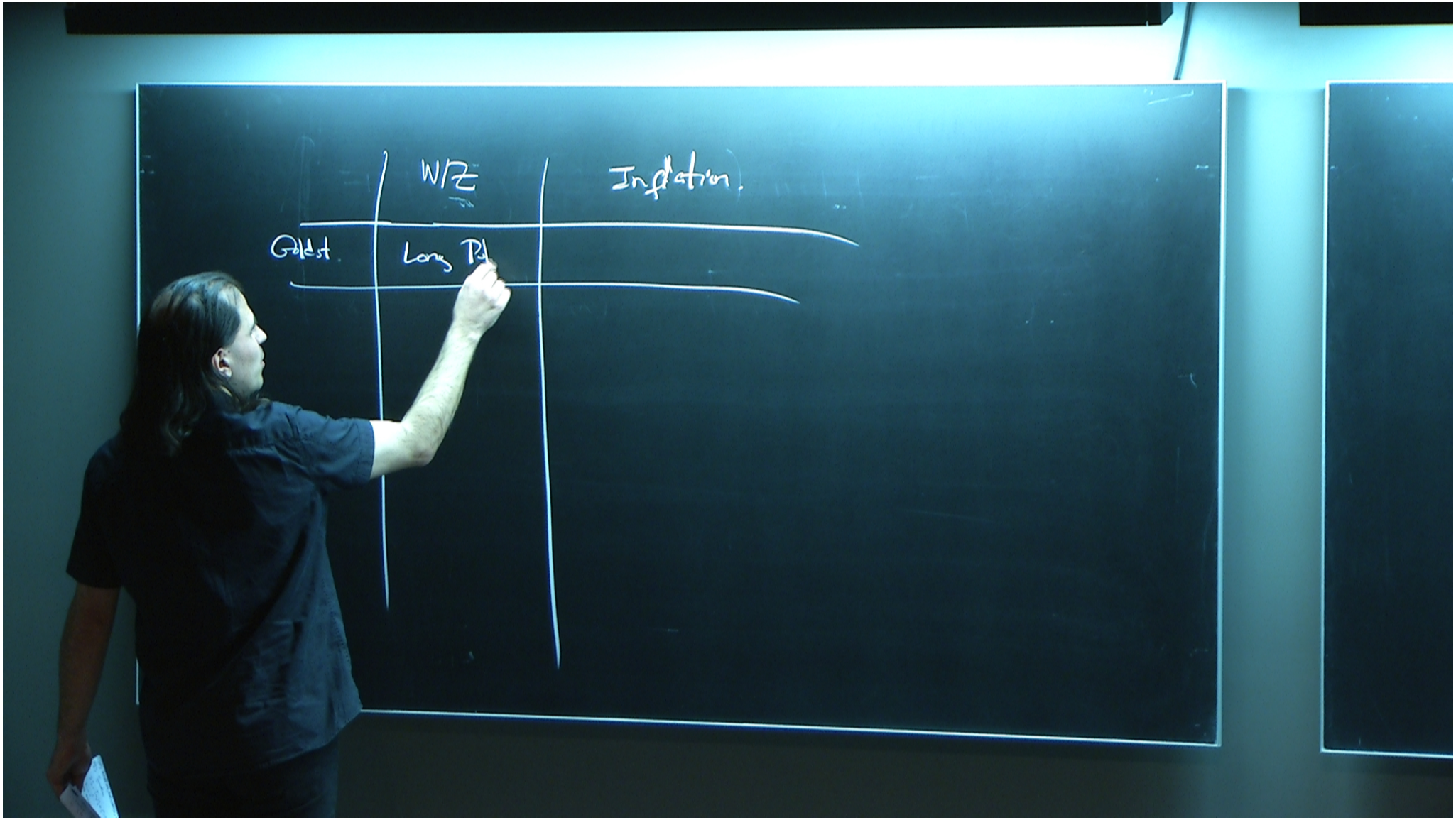
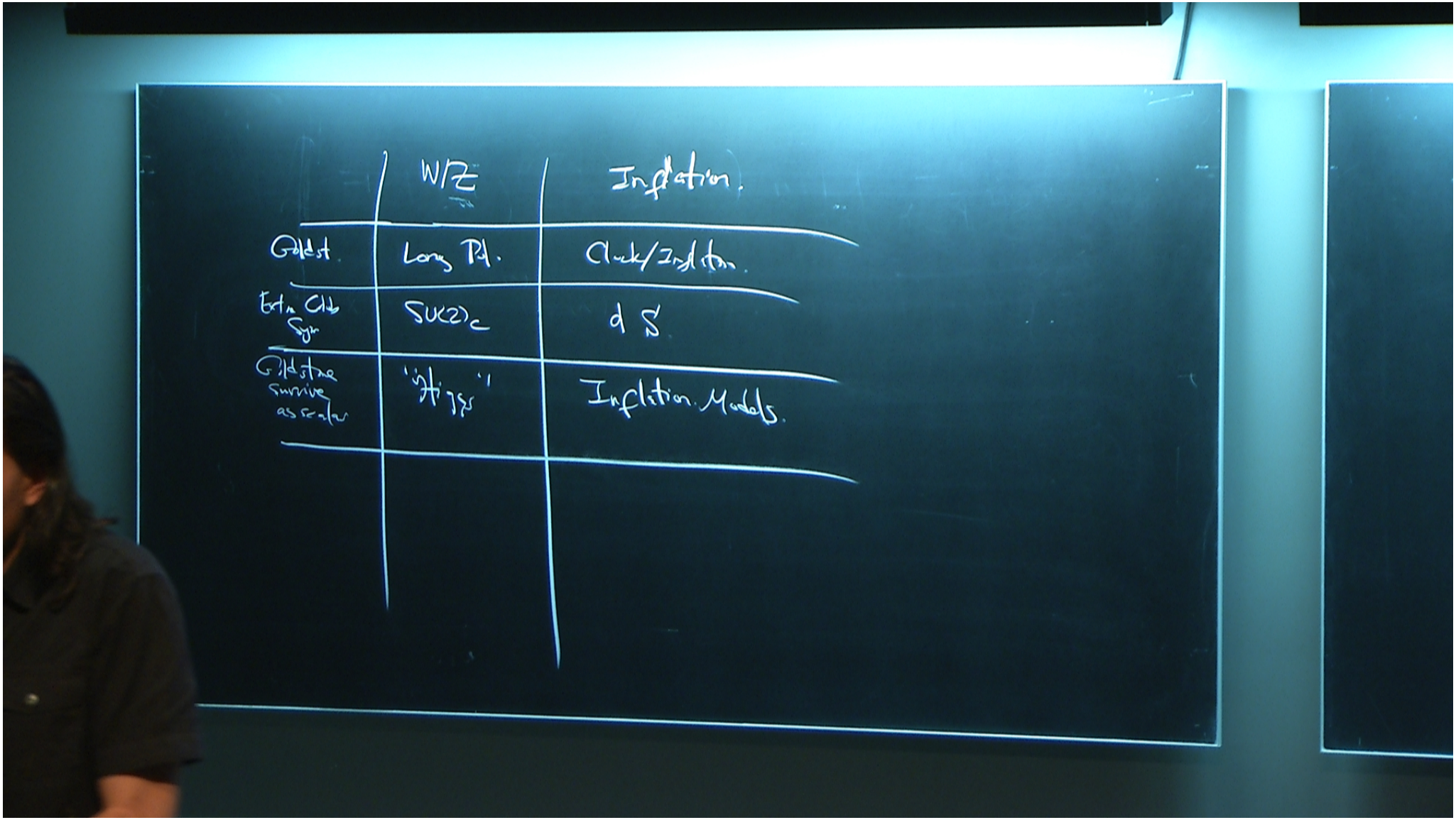
Title: TBA

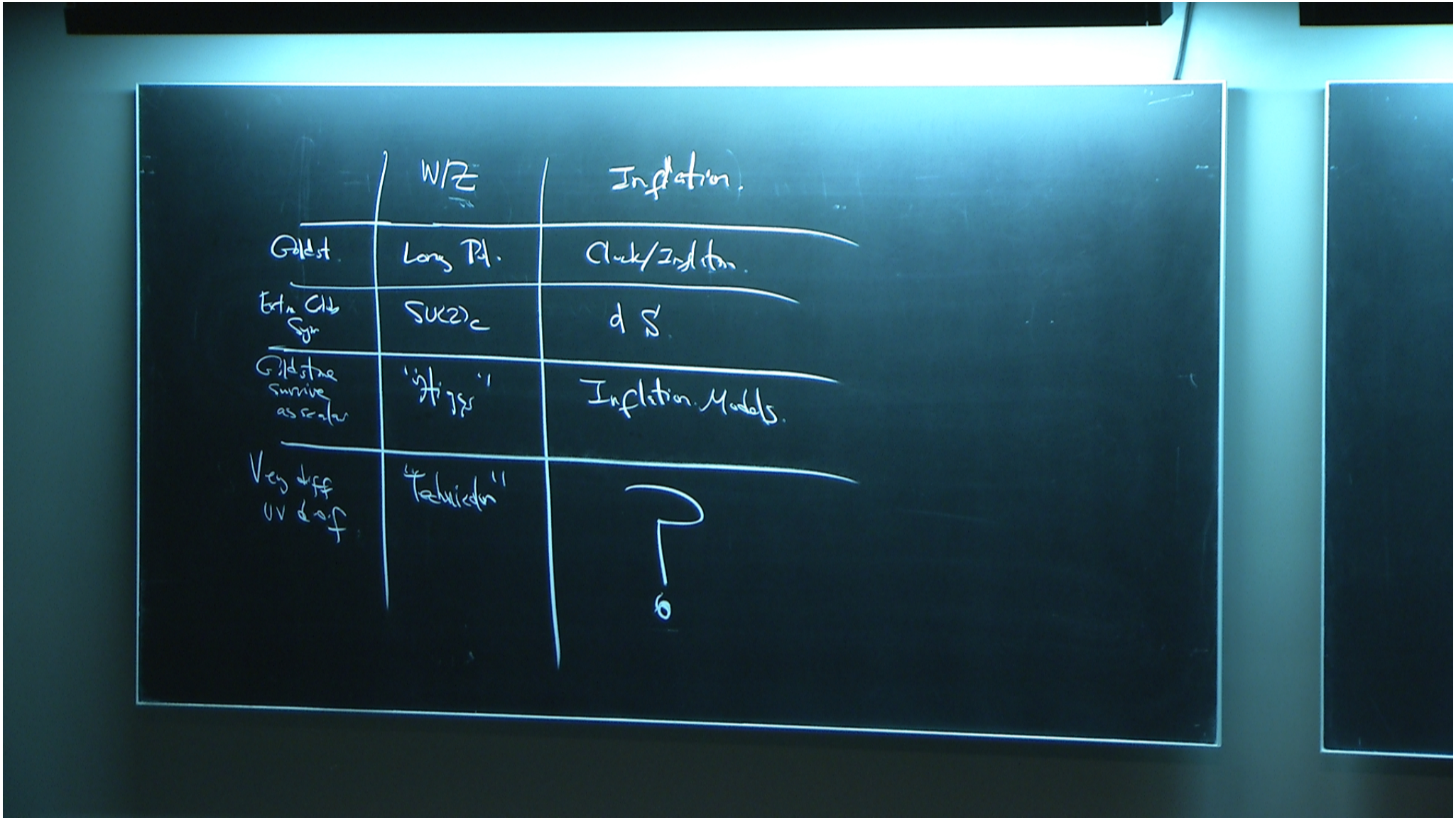
Date: Apr 04, 2014 05:00 PM

URL: http://pirsa.org/14040127

Abstract:

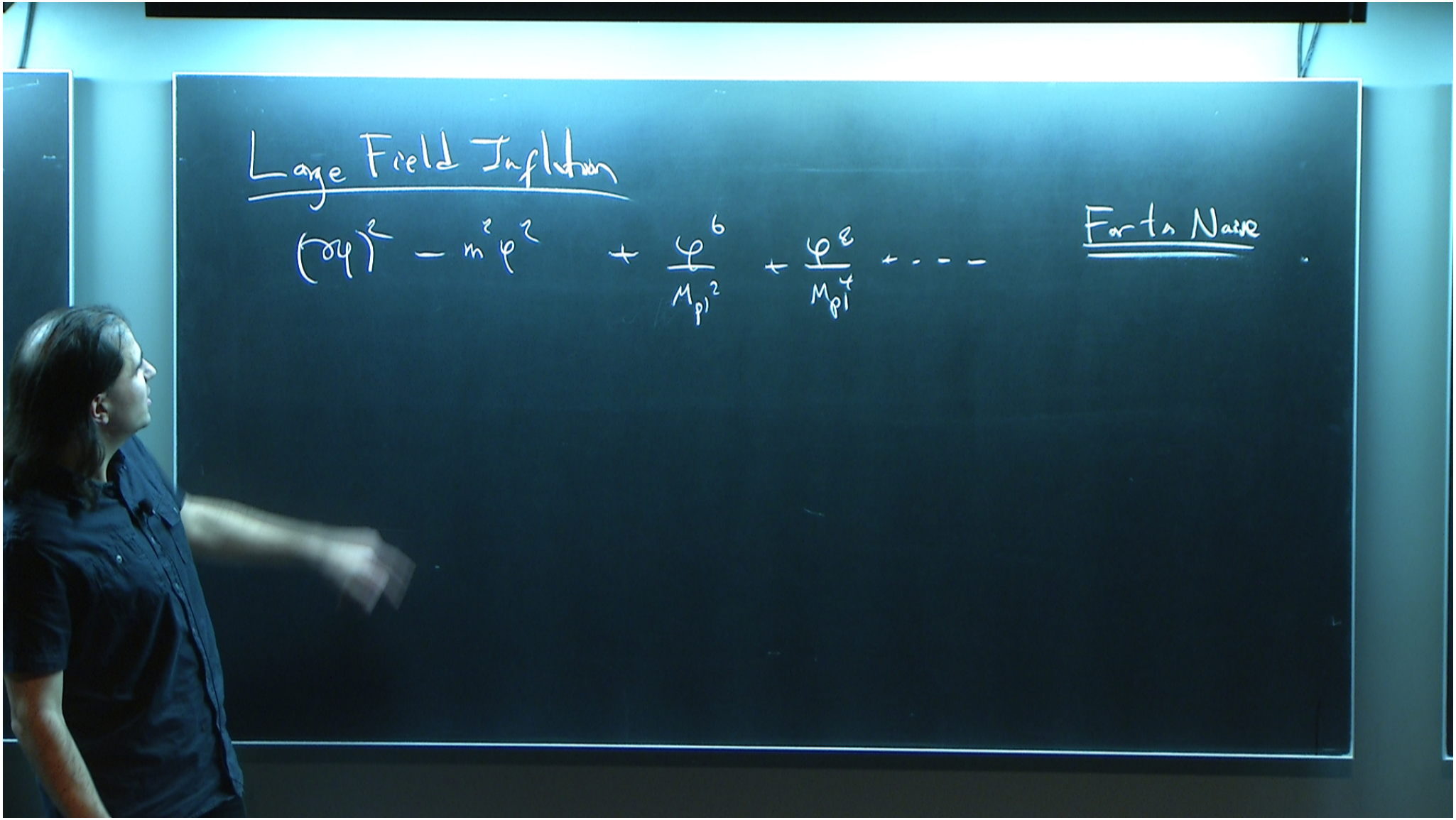

W/Z
Inflation
Gold


W/Z
Inflation.
Goldst.
Long Pl.
Clock/Inflation.
Extra Clb Sym
SUC2)c
d S
Goldstone survive as scalar
'inflaton'
Inflation. Models.


W/Z
Inflation.
Goldst.
Long Pl.
Extra Cl. Sym
SU(2)c
Goldstone survive as scalar
"Higgs"
Inflation. Models.
Very diff UV def
"Technicolor"
?

Large Field Inflation

$$(\partial\varphi)^2 - m^2\varphi^2 + \frac{\varphi^6}{M_{Pl}^2} + \frac{\varphi^8}{M_{Pl}^4} + \cdots$$


Large Field Inflation
$(\partial\varphi)^2 - m^2\varphi^2 + \frac{\varphi^6}{M_{Pl}^2} + \frac{\varphi^8}{M_{Pl}^4} + \cdots$
For the Naive

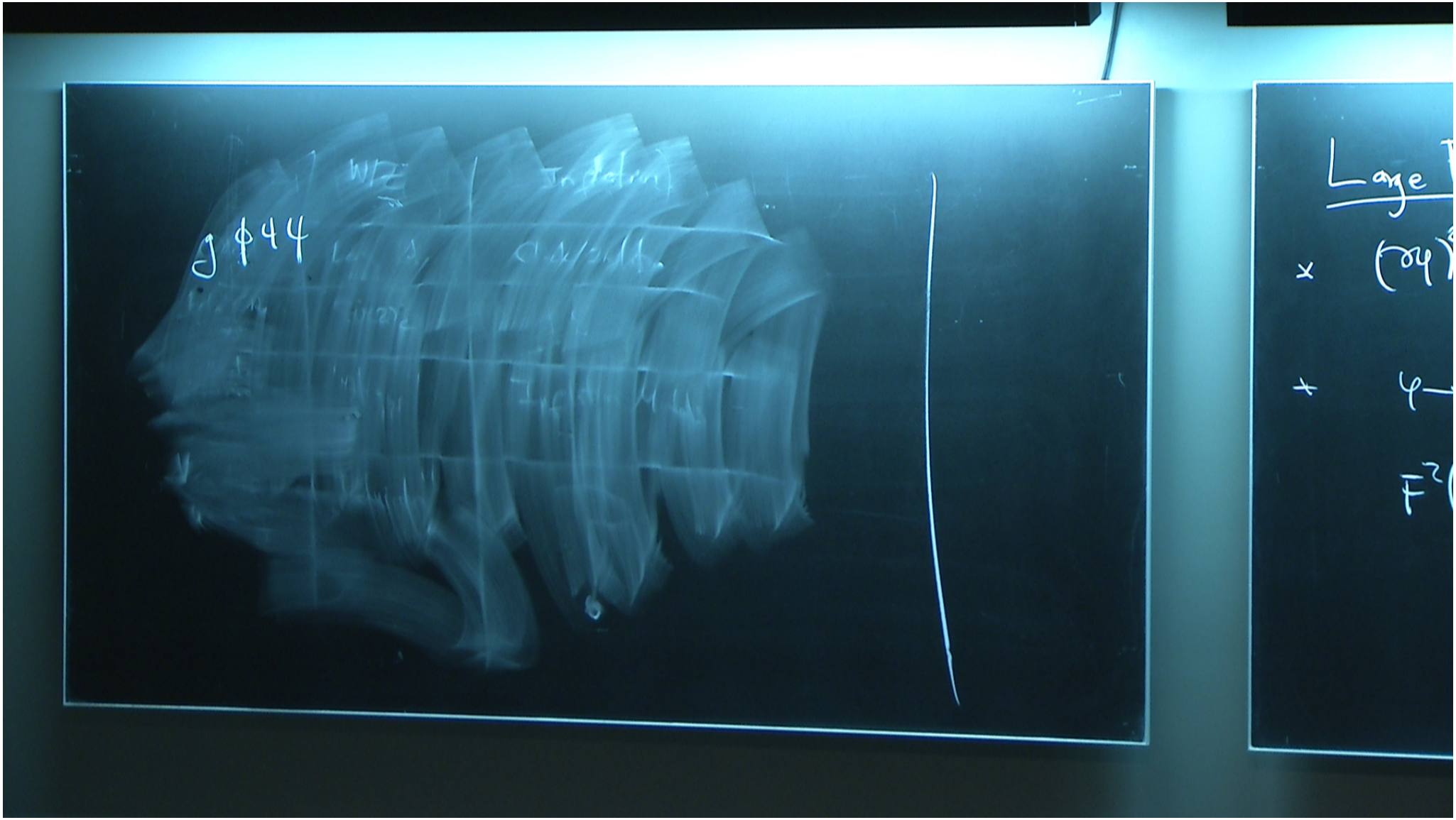
Large Field Inflation

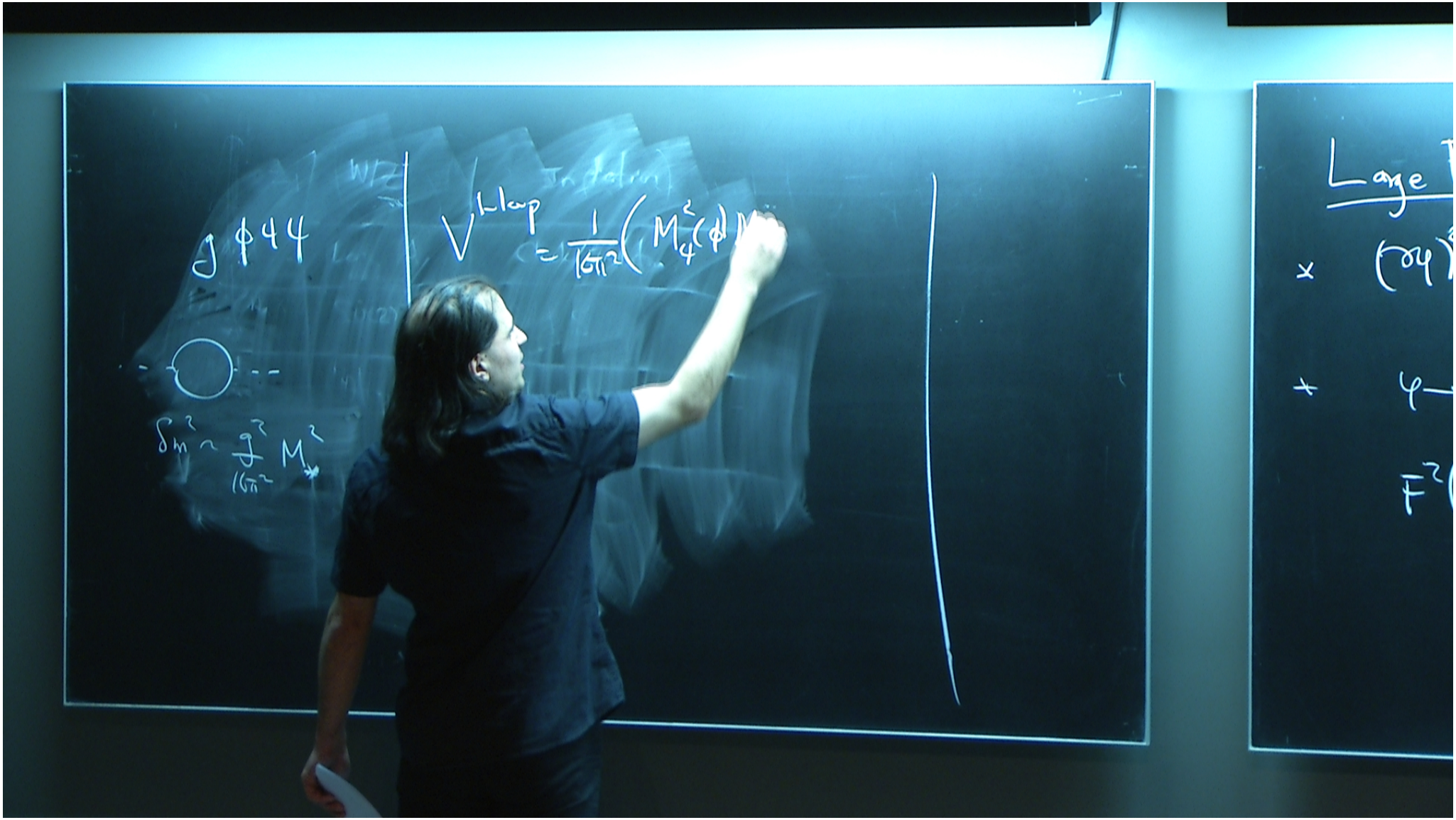
$$\times \quad (\partial\varphi)^2 - m^2\varphi^2 + \frac{\varphi^6}{M_{Pl}^2} + \frac{\varphi^8}{M_{Pl}^4} + \cdots$$

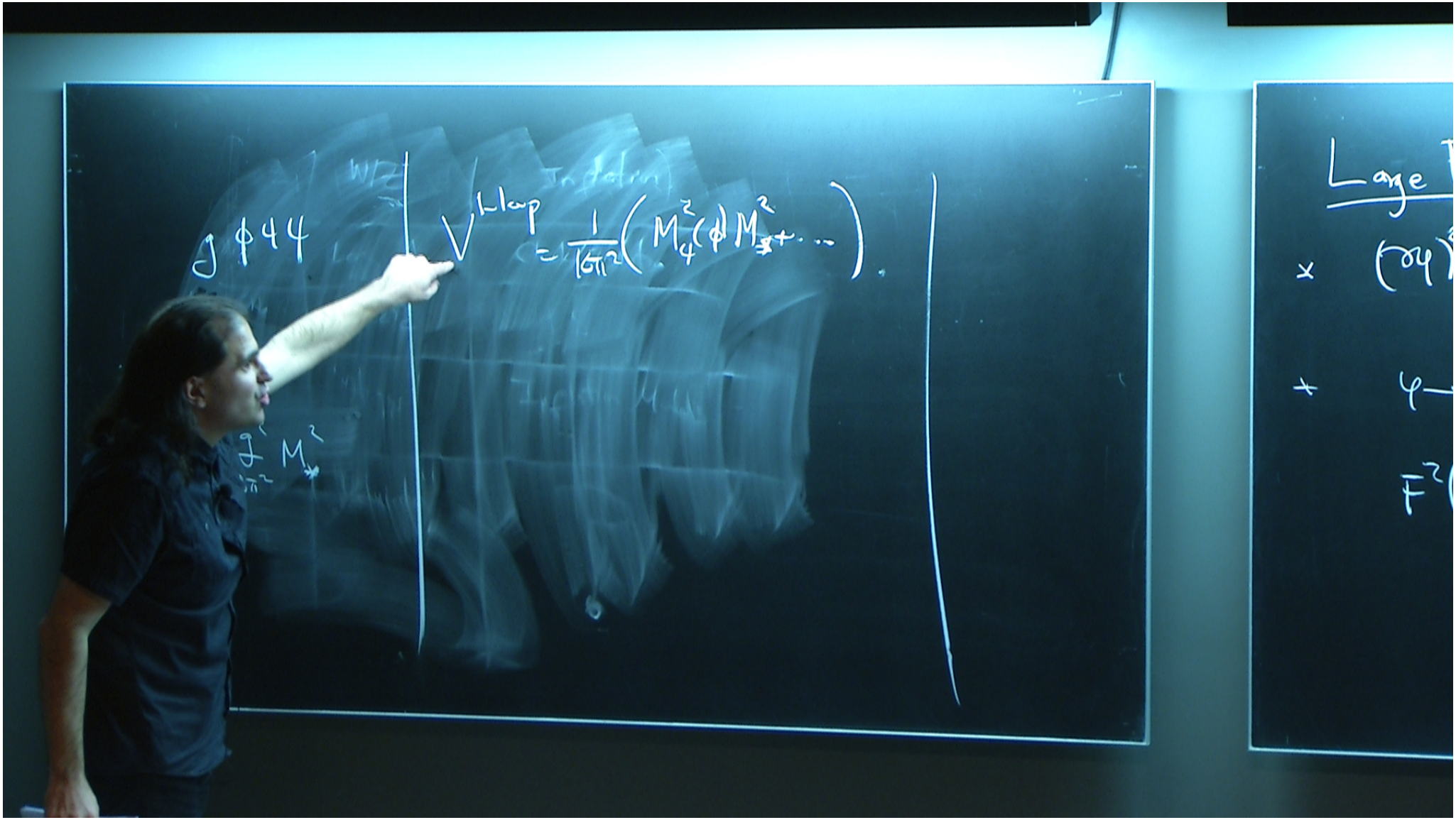
For ts Natve

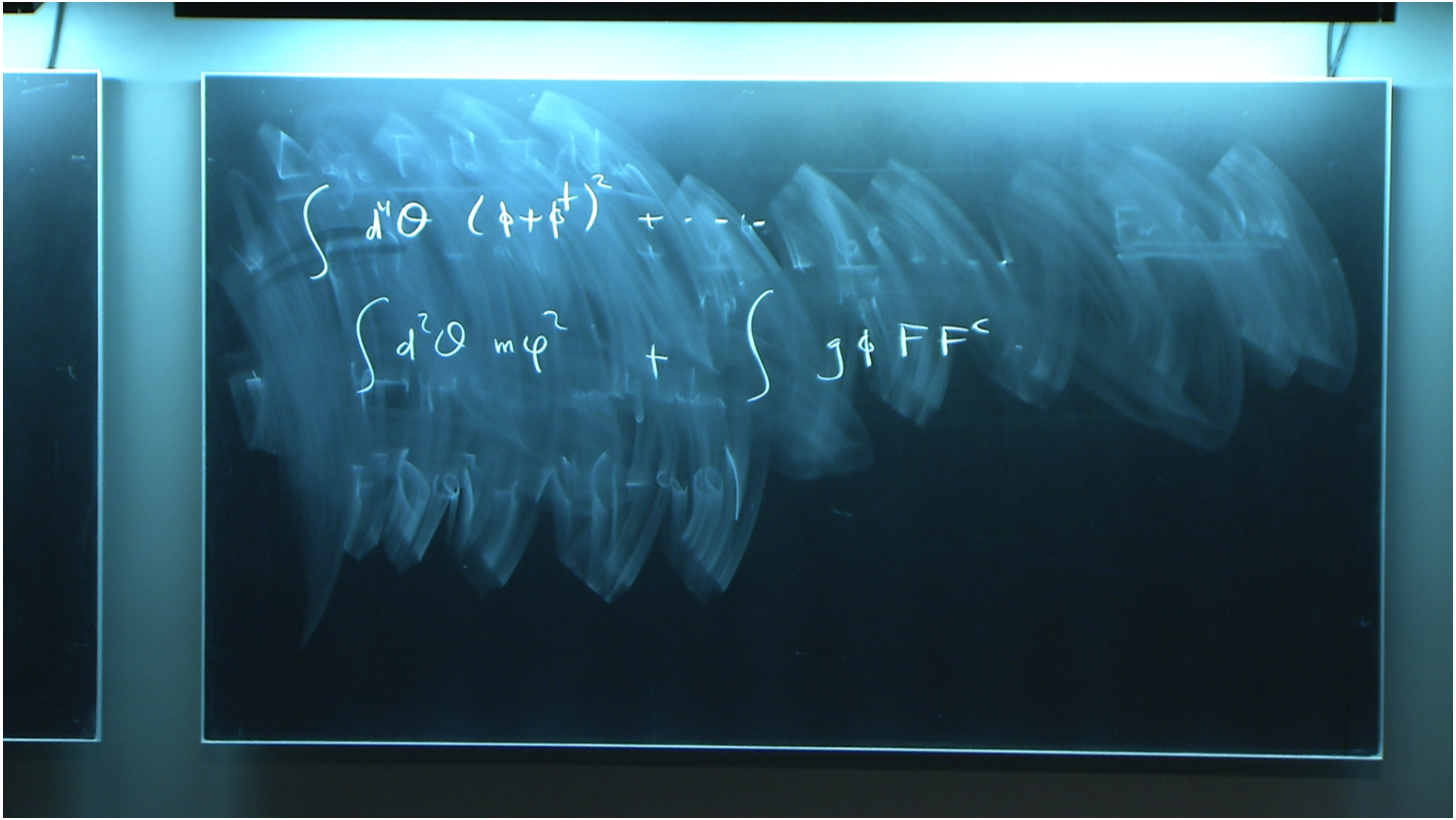
$$+ \quad \varphi \to \varphi + c \quad , \text{ weakly broken.}$$

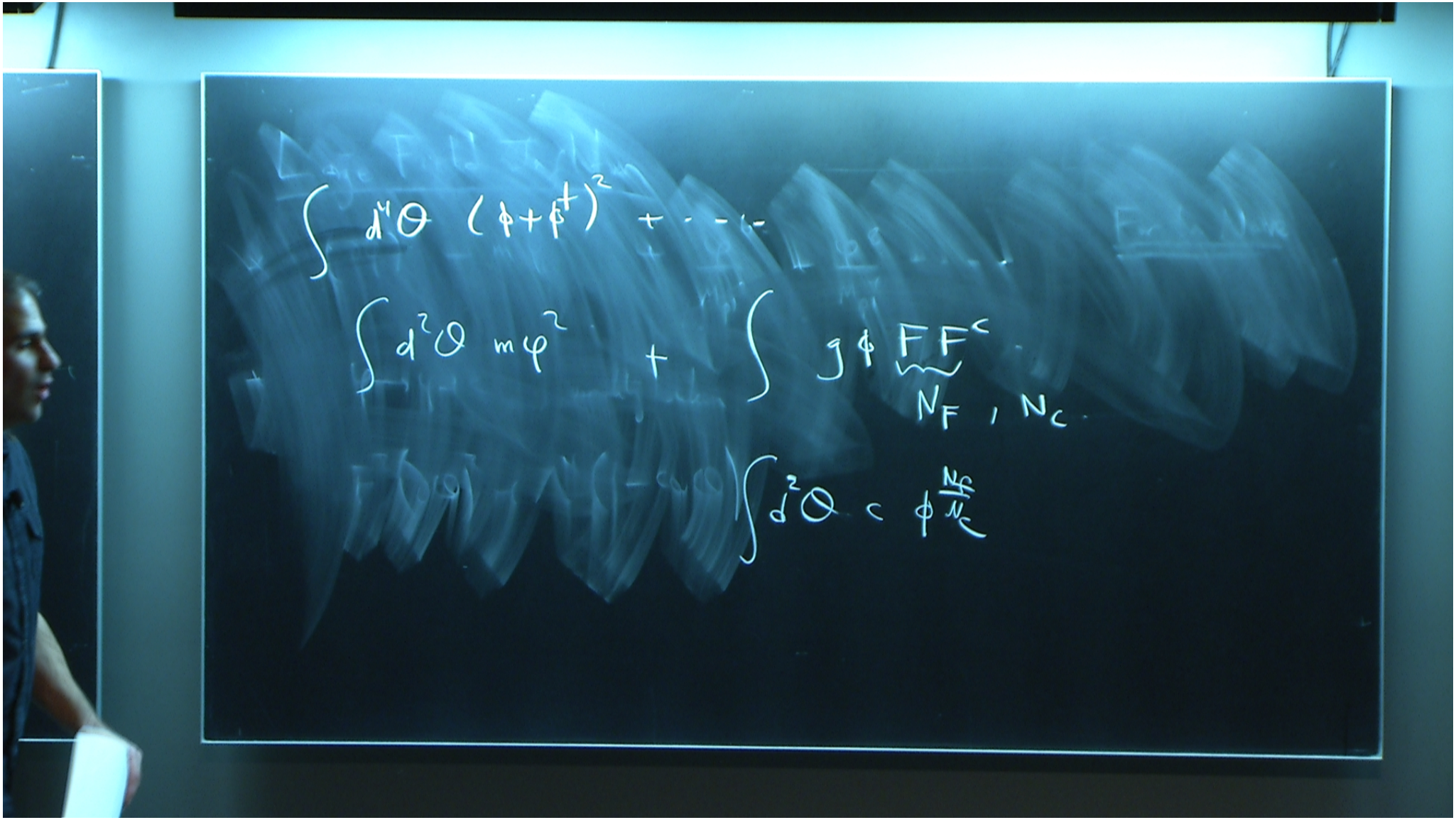
$$F^2(\partial\theta)^2 + \Lambda^4(1-\cos\theta)$$

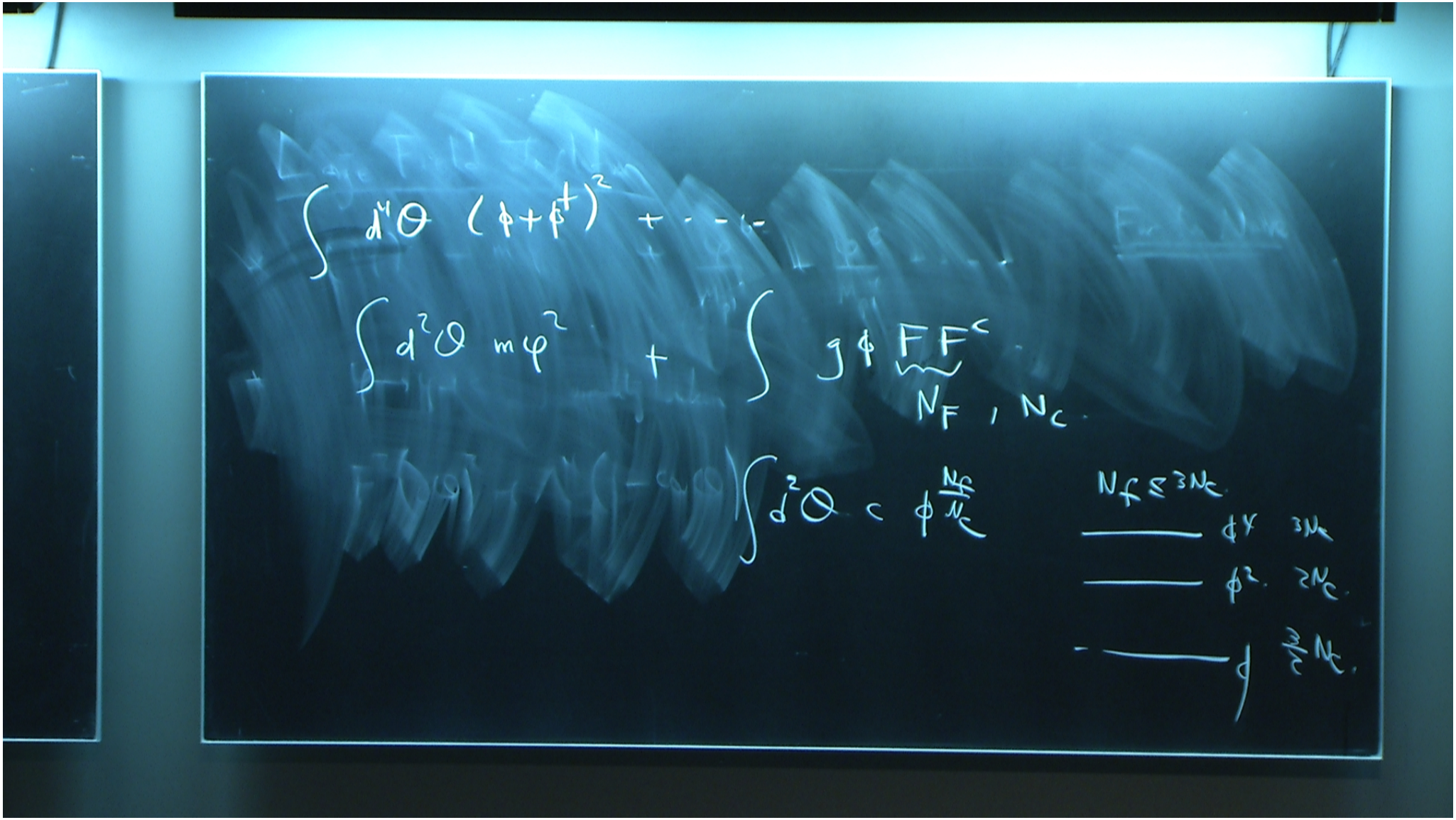

WZ
Lage

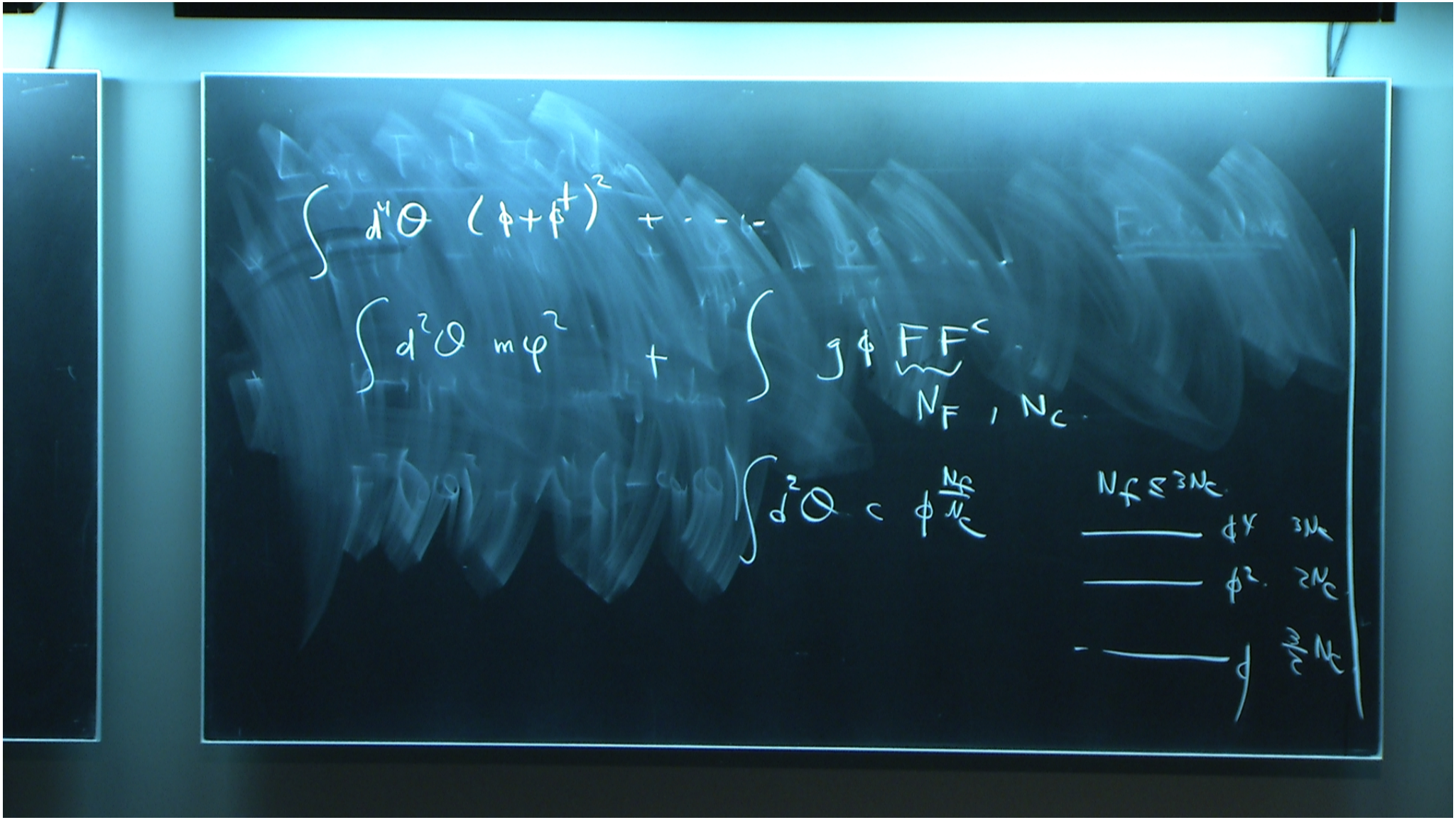

$g\phi^4$
$V^{1\text{-loop}} = \frac{1}{16\pi^2}\left(M_4^2(\phi)\right.$
$\delta m^2 \sim \frac{g^2}{16\pi^2} M^2$
Large
$\times$
$+$

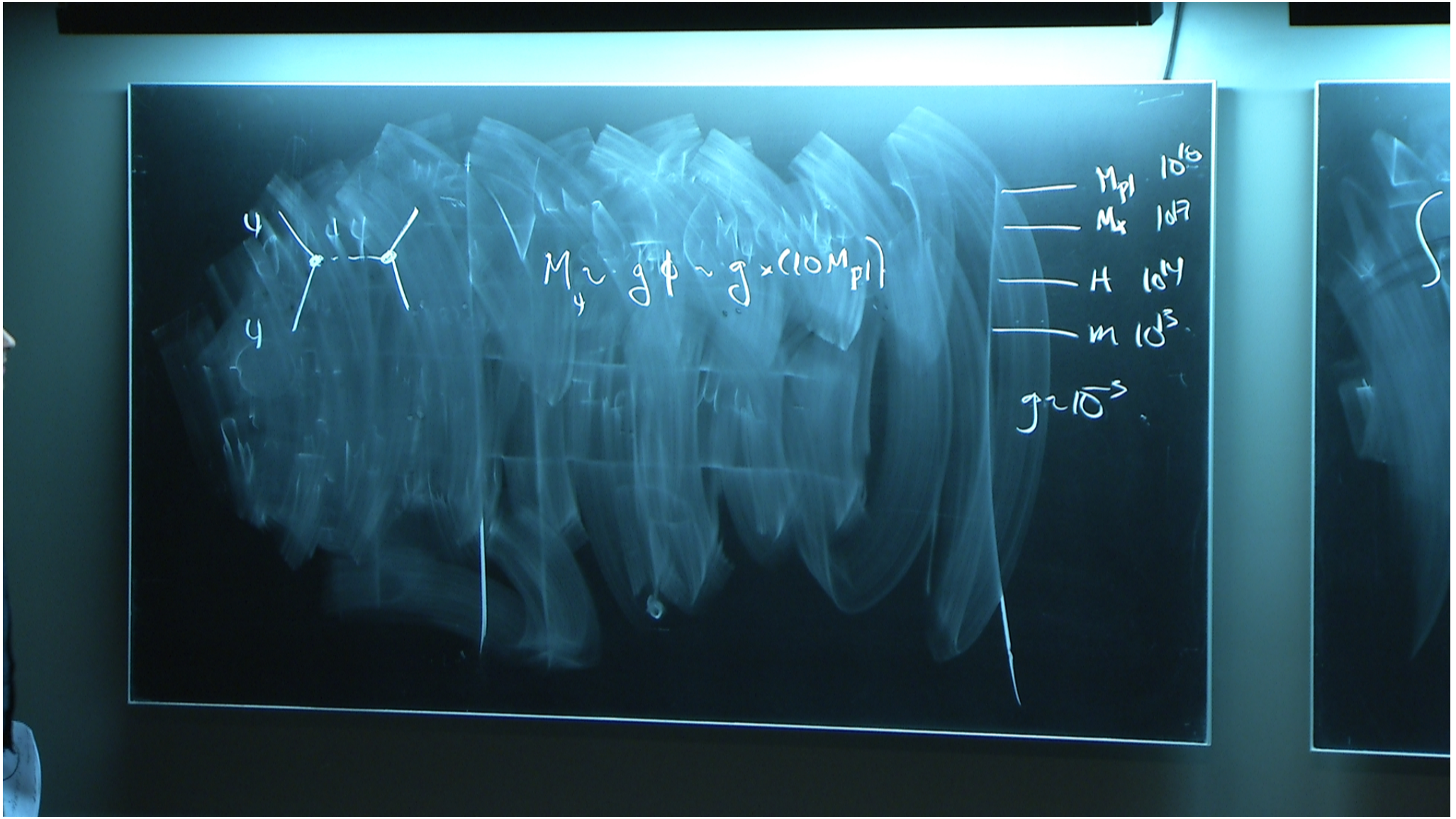

ϕ^4
$V^{1\text{-loop}} = \frac{1}{16\pi^2}\left(M_4^2(\phi) M_3^2 + \cdots\right)$

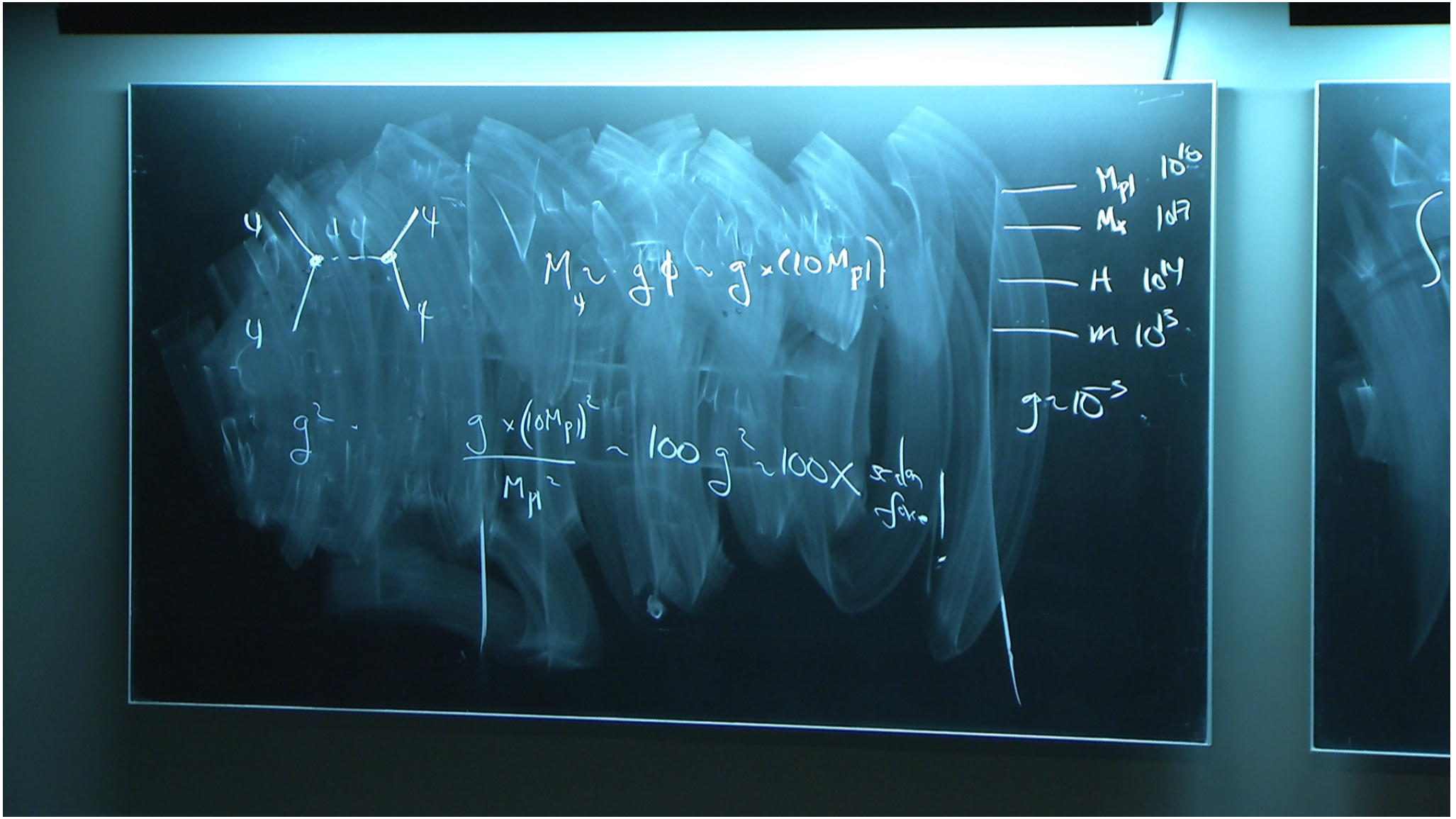

$\int d^4\theta\ (\phi+\phi^\dagger)^2 + \cdots$
$\int d^2\theta\ m\varphi^2 + \int g\phi F F^c$

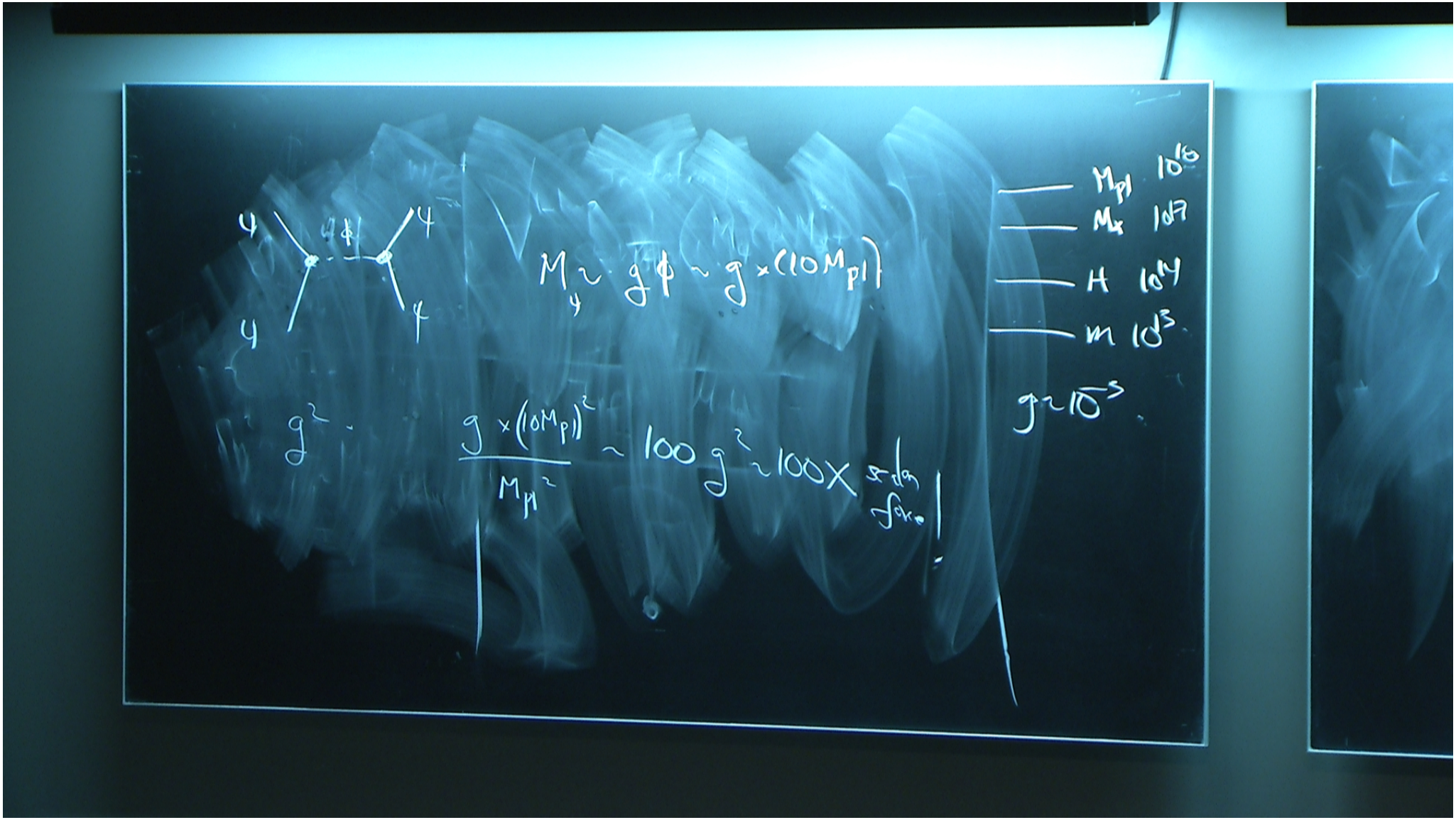

$\int d^4\theta \ (\phi+\phi^\dagger)^2 + \cdots$
$\int d^2\theta \ m\varphi^2 + \int g\phi F F^c$
$N_F \, , N_c$
$\int d^2\theta \ c \ \phi^{\frac{N_f}{N_c}}$

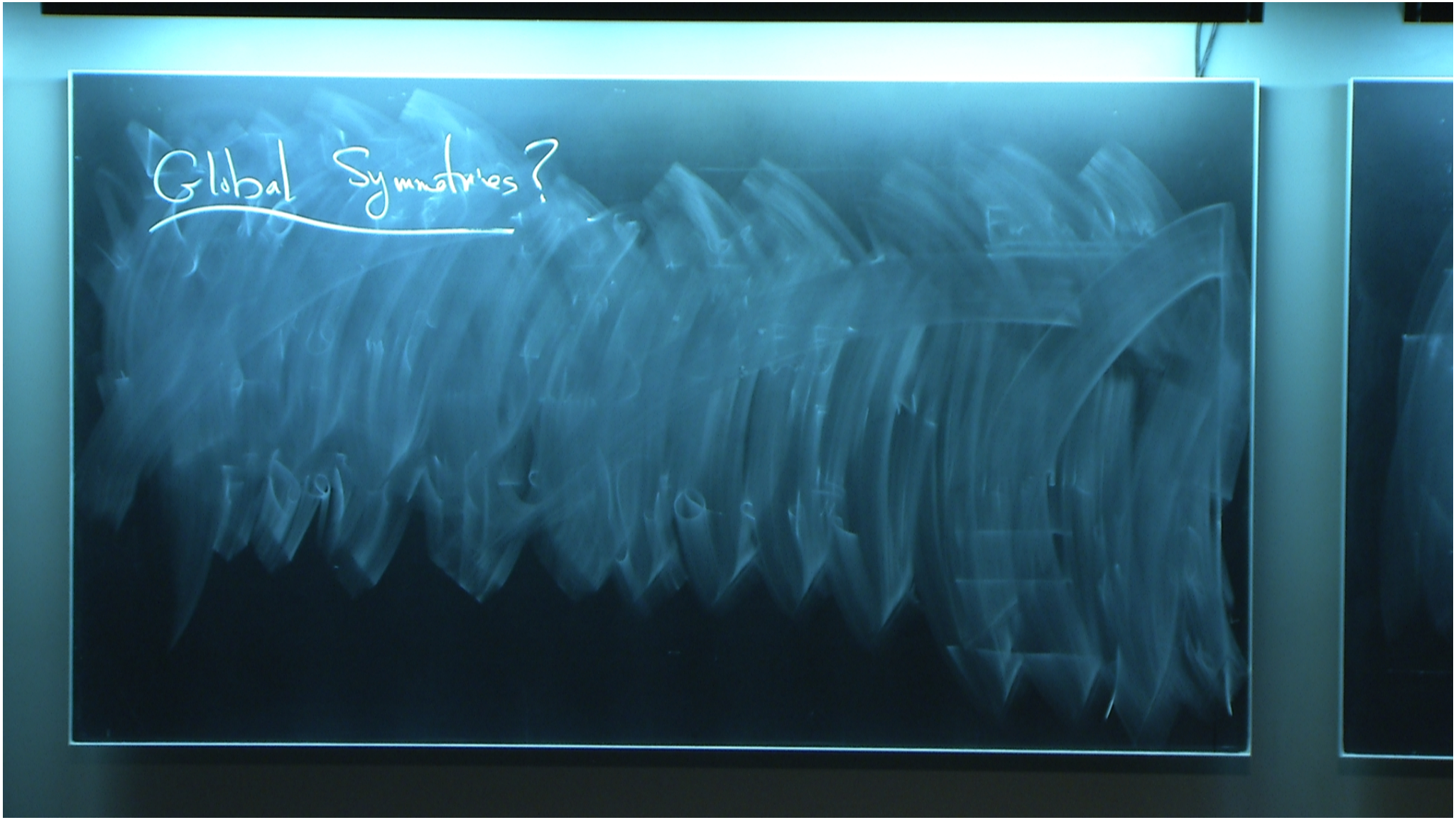

$\int d^4\theta\ (\phi+\phi^\dagger)^2$ + . . .
$\int d^2\theta\ m\varphi^2$ + $\int g\phi F F^c$
N_F , N_c
$\int d^2\theta\ c\ \phi^{\frac{N_f}{N_c}}$
$N_f \geq 3N_c$
ϕ^4 $3N_c$
ϕ^2 $2N_c$
ϕ $\frac{3}{2}N_c$

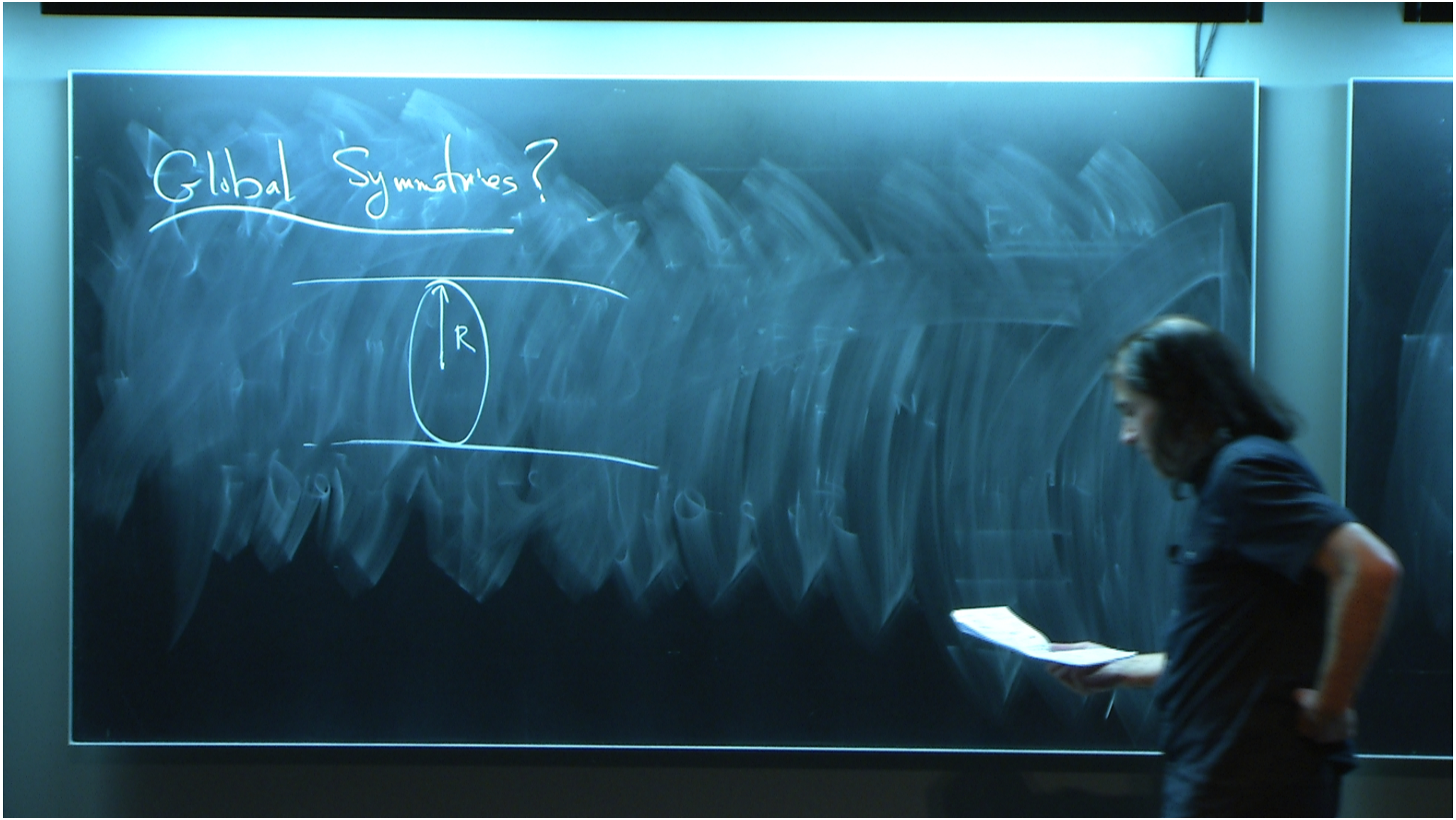

$\int d^4\theta\ (\phi+\phi^\dagger)^2 + \cdots$
$\int d^2\theta\ m\varphi^2 + \int g\phi F F^c$
N_F, N_c
$\int d^2\theta\ c\,\phi^{\frac{N_f}{N_c}}$
$N_f \geq 3N_c$
ϕ^{3N_c}
ϕ^{2N_c}
$\phi^{\frac{3}{2}N_c}$

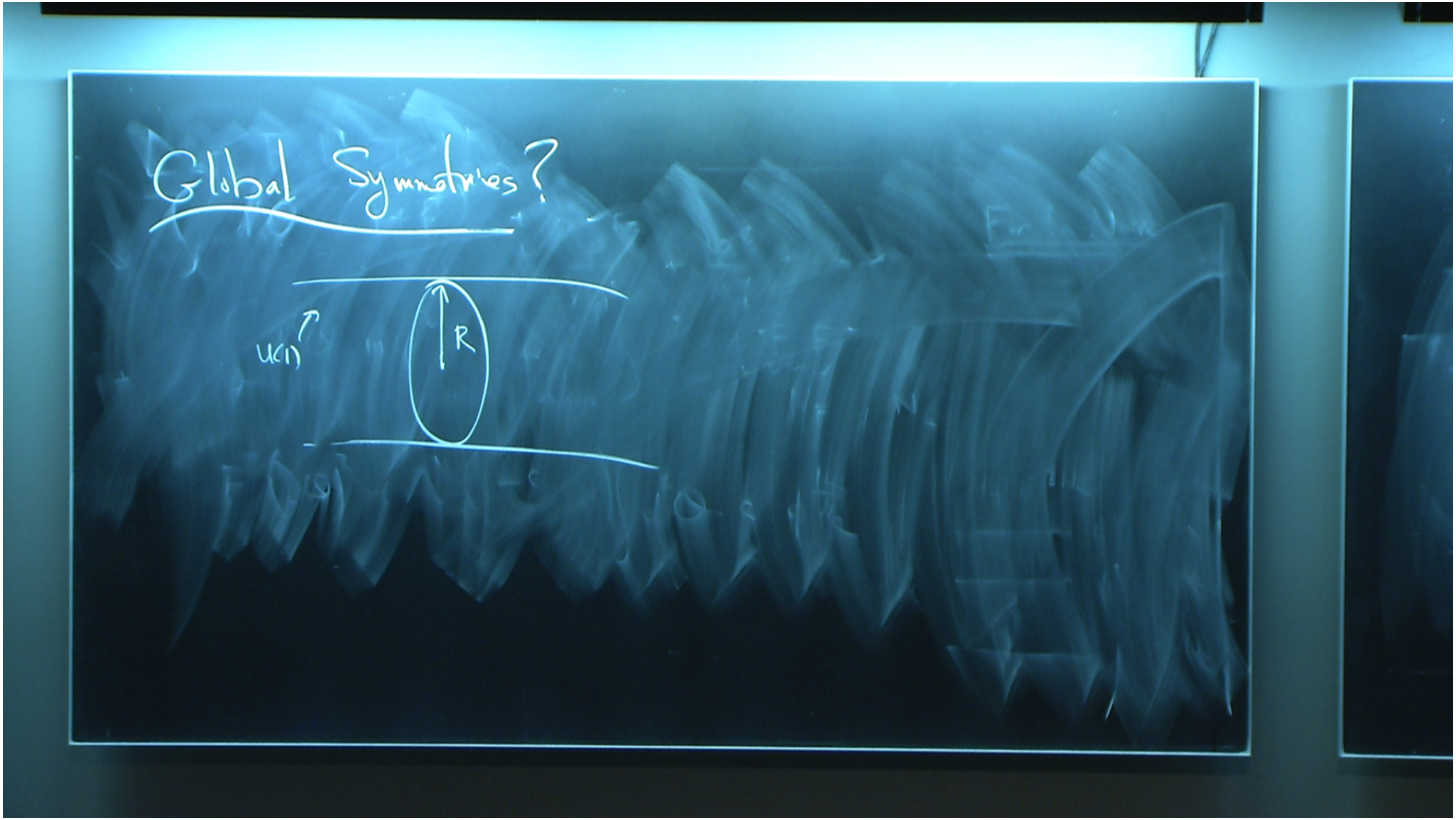

$M_\psi \sim g\phi \sim g \times (10 M_{Pl})$
M_{Pl} 10^{16}
M_X 10^{17}
H 10^{14}
m 10^{13}
$g \sim 10^{-3}$

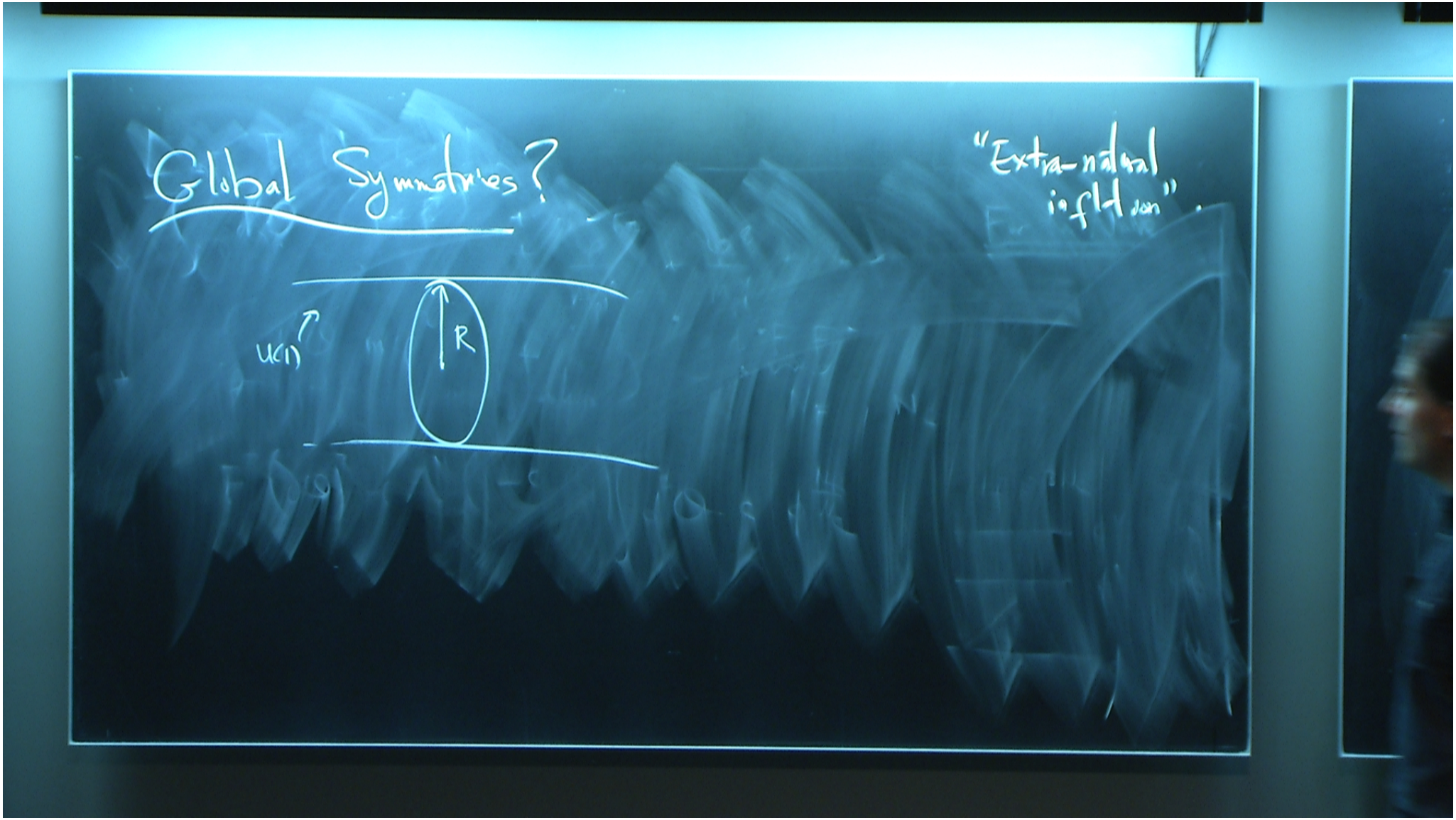

$M_\psi \sim g\phi \sim g \times (10 M_{Pl})$
$g^2 \cdot \frac{g \times (10 M_{Pl})^2}{M_{Pl}^2} \sim 100\, g^2 \sim 100 \times$ strong force!
M_{Pl} 10^{19}
M_X 10^{17}
H 10^{14}
m 10^{3}
$g \sim 10^{-3}$

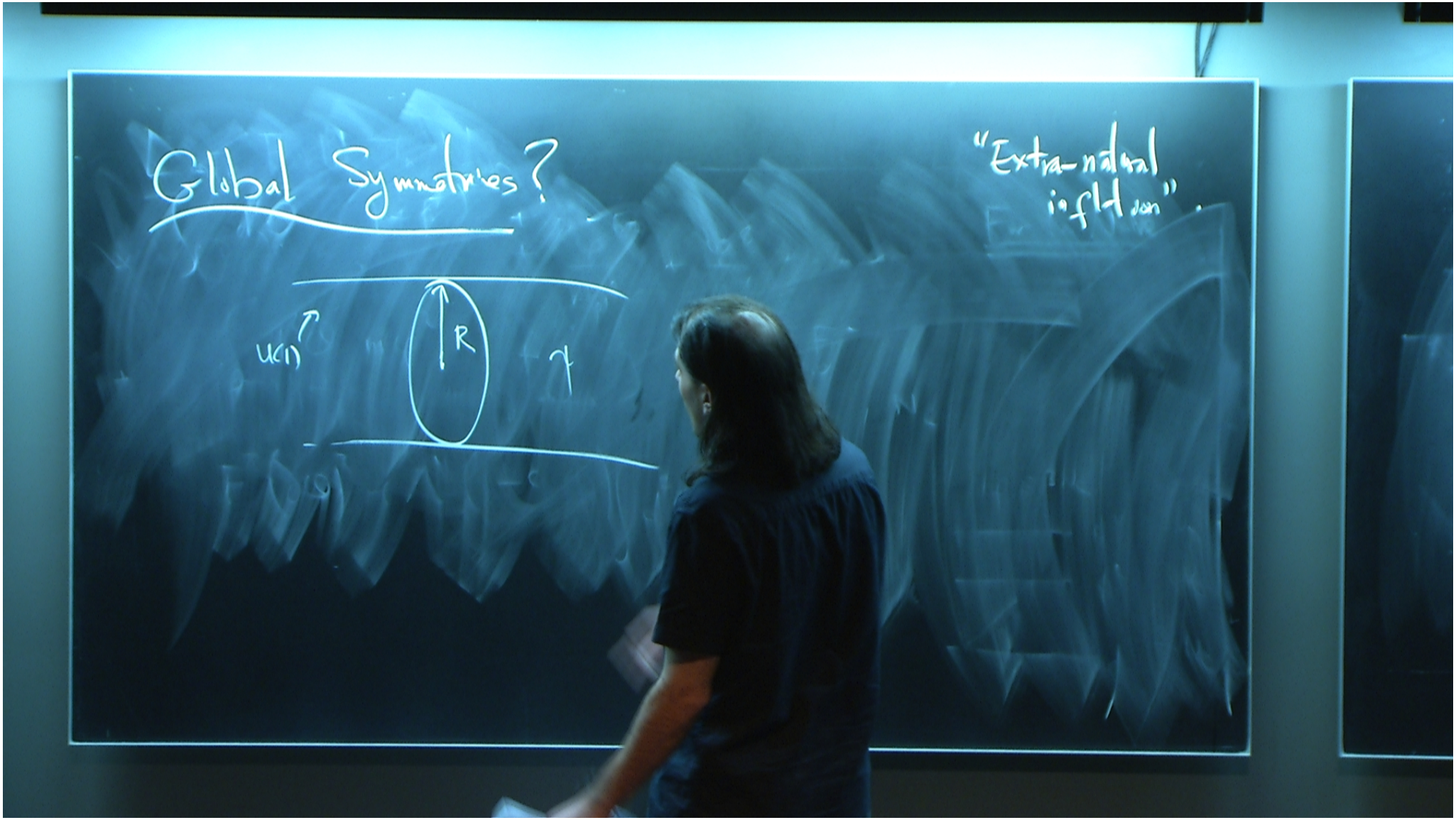

$M_\chi \sim g\phi \sim g \times (10 M_{pl})$
$\frac{g^2 \times (10 M_{pl})^2}{M_{pl}^2} \sim 100\, g^2 \sim 100 \times$
M_{pl} 10^{18}
M_* 10^{17}
H 10^{14}
m 10^{3}
$g \sim 10^{-3}$

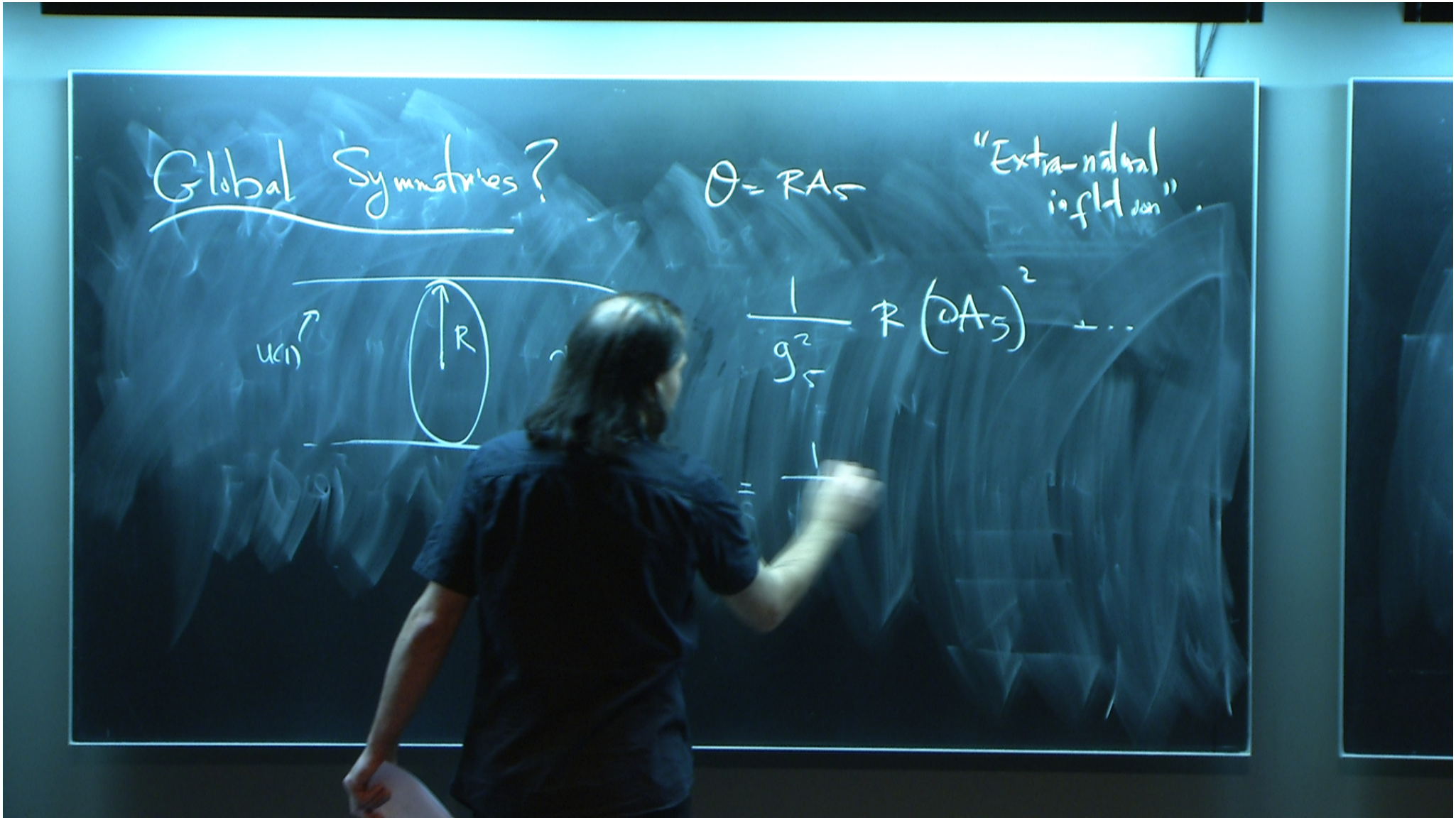

Global Symmetries?


Global Symmetries?
R


Global Symmetries?
U(1)
R


Global Symmetries?
"Extra-natural inflation"
U(1)
R

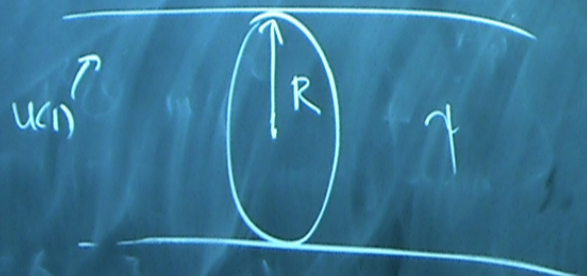

Global Symmetries?
"Extra-natural inflation"
U(1)
R


Global Symmetries?
θ = RA5
"Extra-natural inflation"
U(1)
R
1/g5^2 R (∂A5)^2 + ...
=

Global Symmetries?

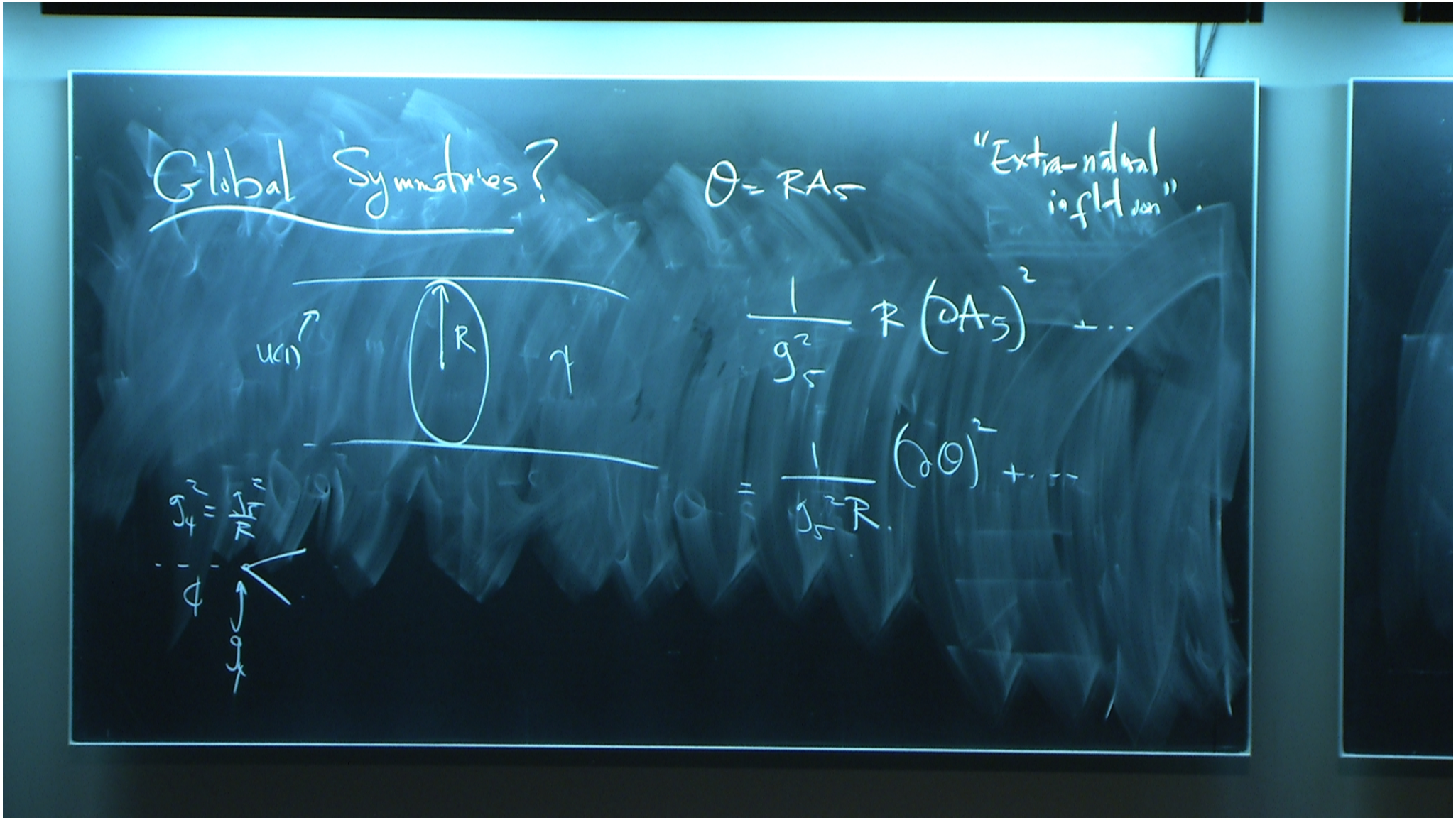
$\theta = R A_5$

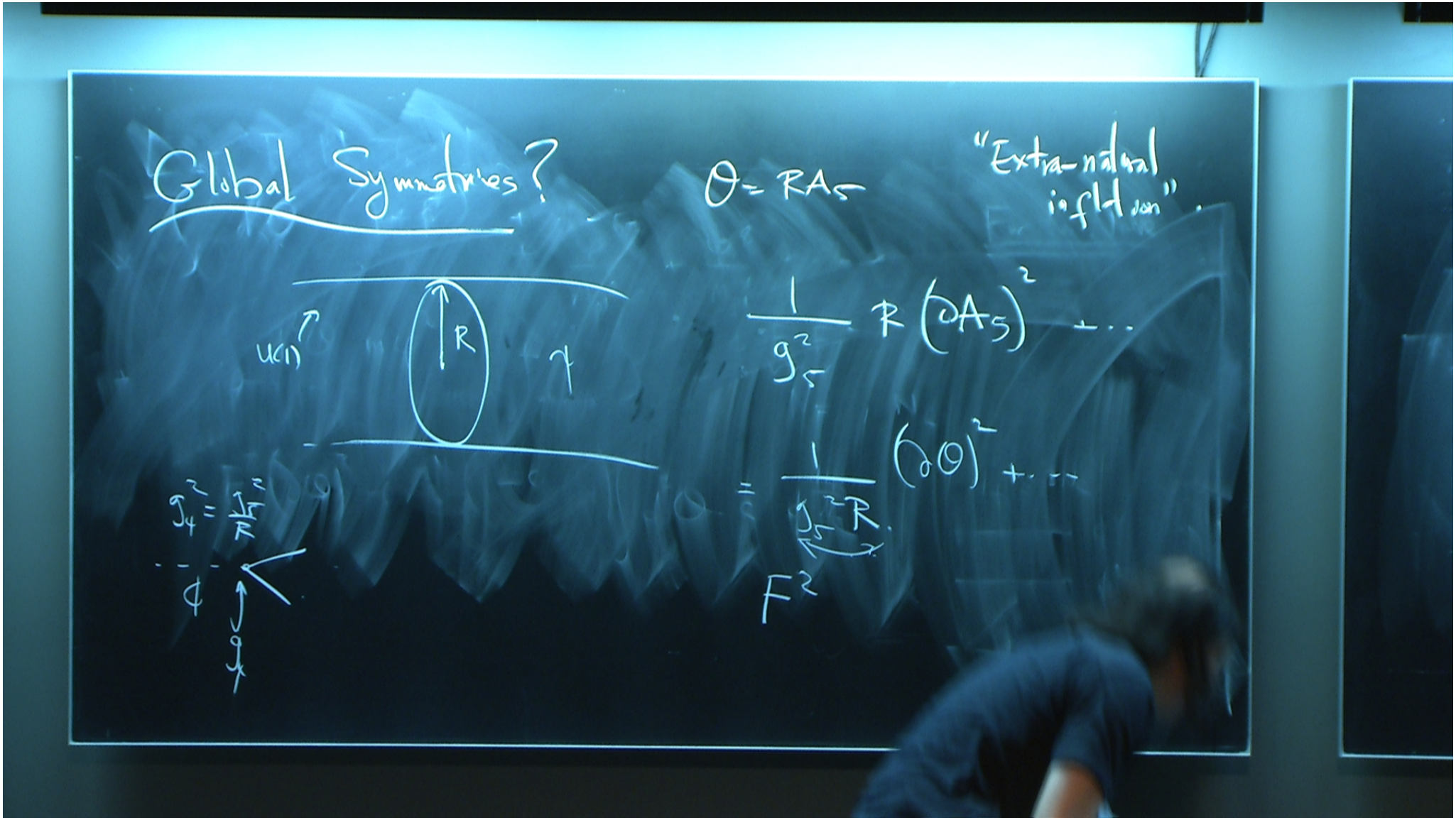
"Extra-natural inflation".

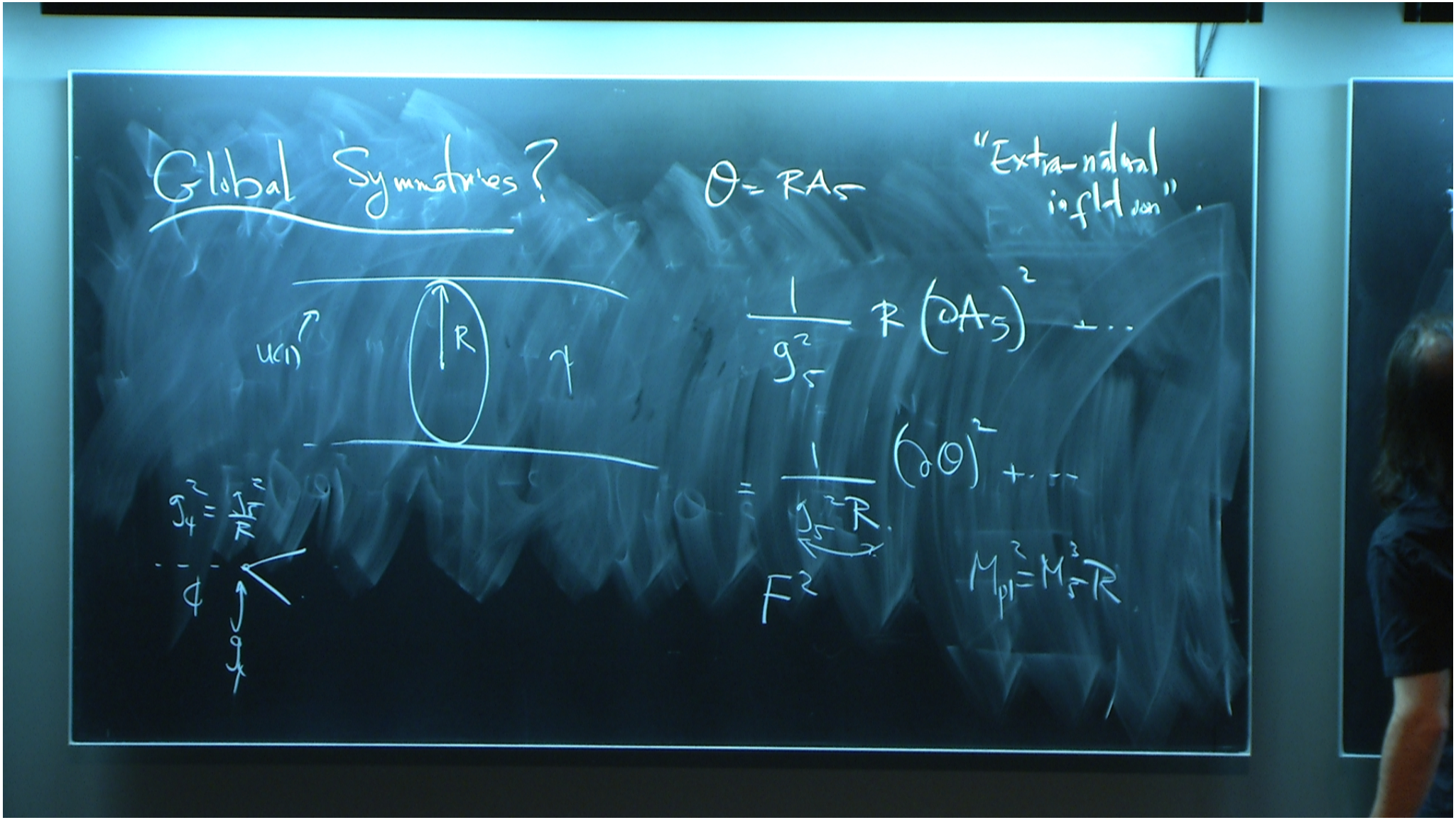


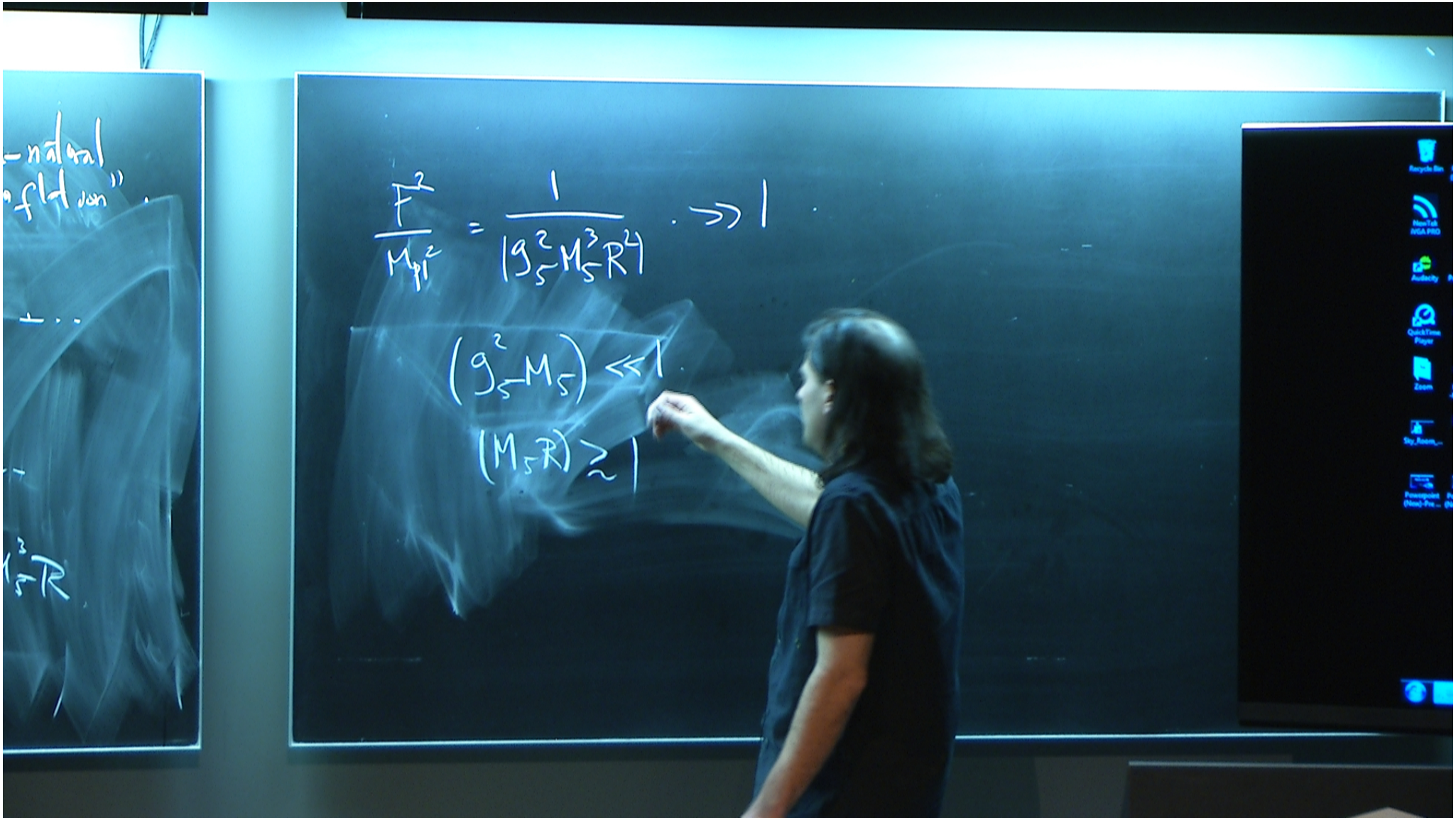
$$\frac{1}{g_5^2} R (\partial A_5)^2 + \dots$$

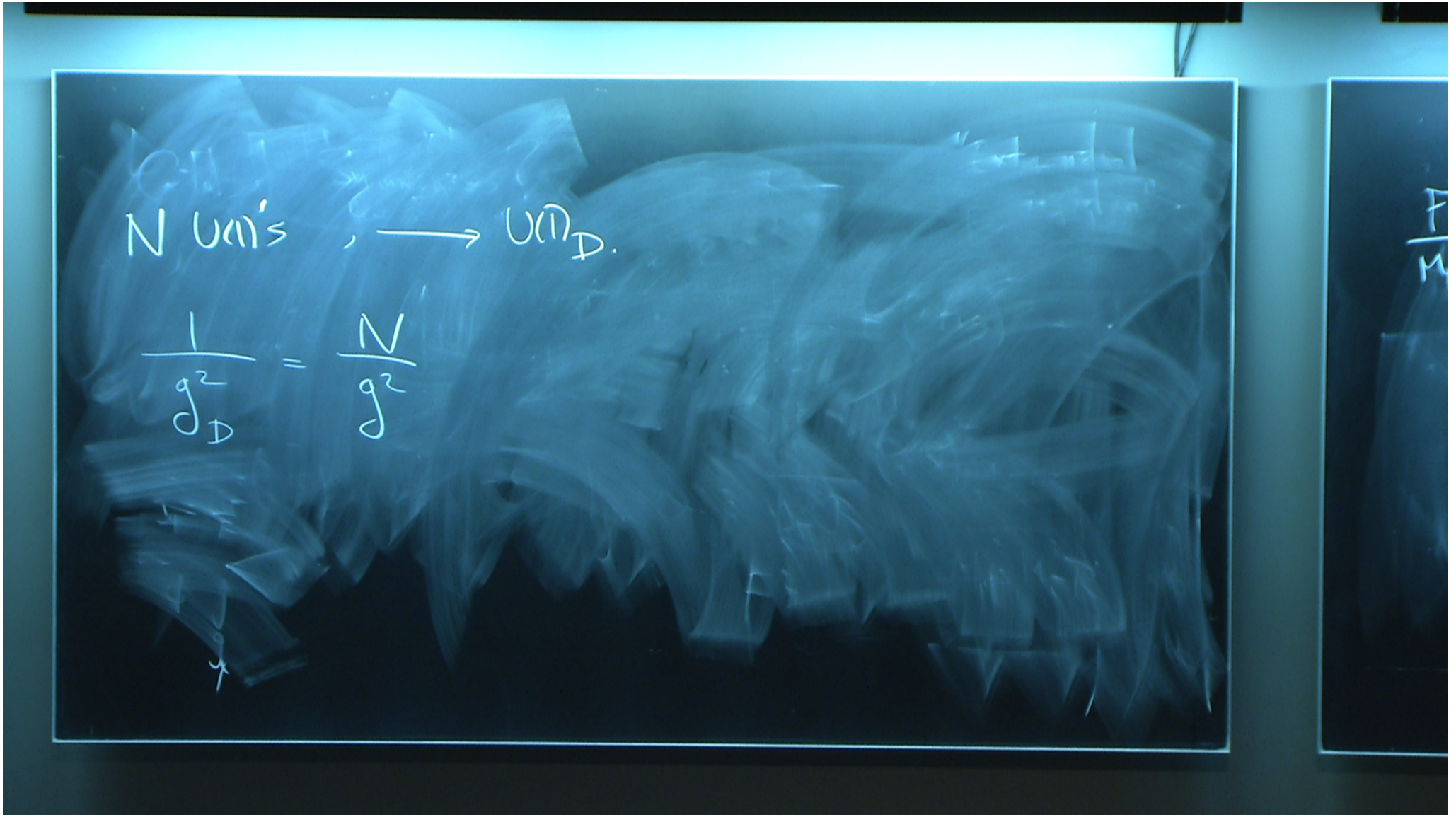
$$= \frac{1}{g_5^2 R} (\partial \theta)^2 + \dots$$

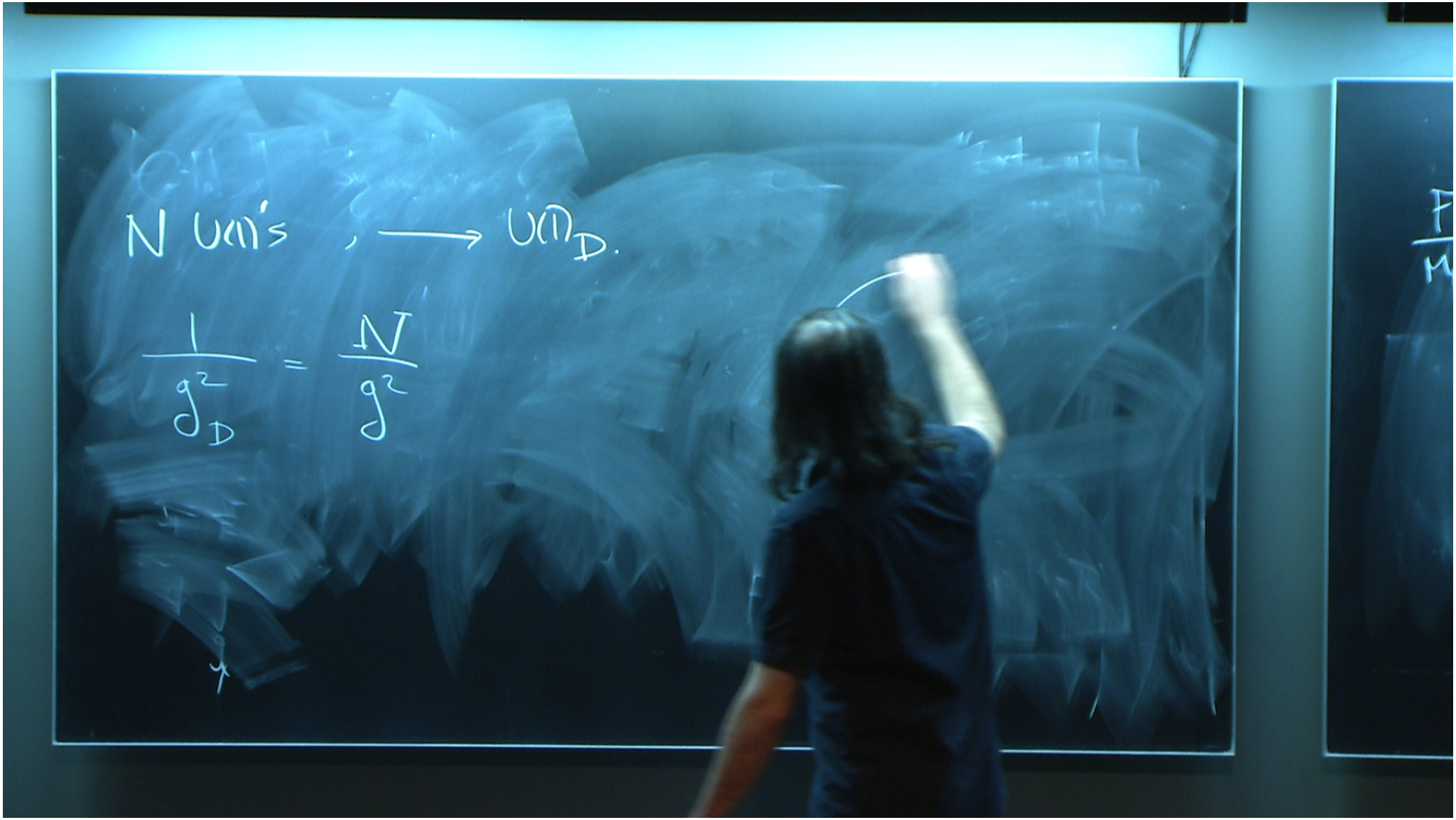

Global Symmetries?
$\theta = R A_5$
"Extra-natural inflation"
U(1)
R
$\frac{1}{g_5^2} R (\partial A_5)^2 + \ldots$
$= \frac{1}{g_5^2 R} (\partial \theta)^2 + \ldots$
$g_4^2 = \frac{g_5^2}{R}$
ϕ
$\frac{g}{f}$


Global Symmetries?
θ = RA5
"Extra-natural inflation"
U(1)
R
q
$\frac{1}{g_5^2} R (\partial A_5)^2 + \ldots$
$= \frac{1}{g_5^2 R} (\partial\theta)^2 + \ldots$
F^2
$g_4^2 = \frac{g_5^2}{R}$
Φ
q_χ


Global Symmetries?
$\theta = R A_5$
"Extra-natural inflation"
U(1)
R
$\frac{1}{g_5^2} R (\partial A_5)^2 + \ldots$
$= \frac{1}{g_5^2 R} (\partial \theta)^2 + \ldots$
F^2
$M_{pl}^2 = M_5^3 R$
$g_4^2 = \frac{g_5^2}{R}$
ϕ
g_4

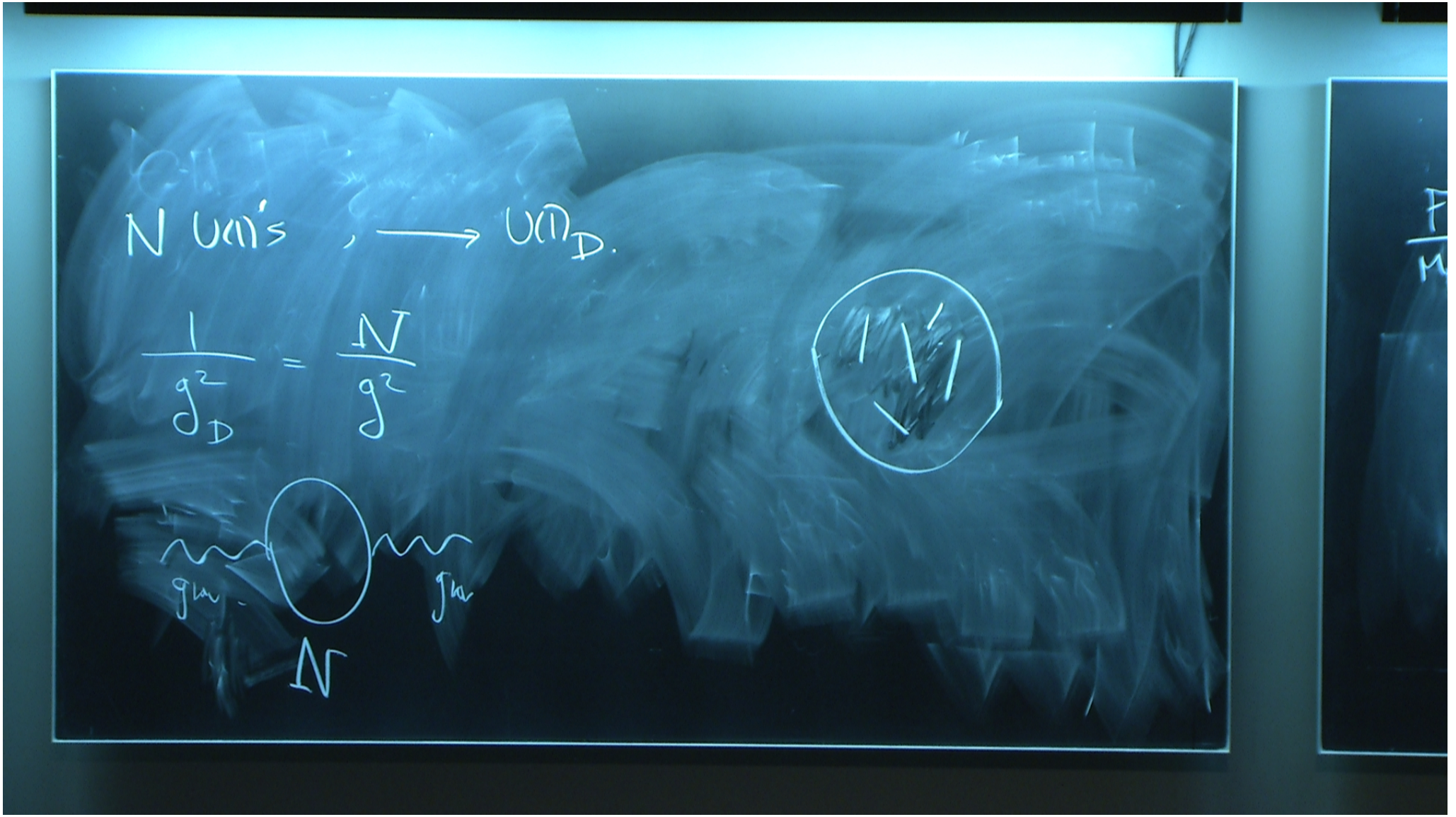

$\frac{F^2}{M_{Pl}^2} = \frac{1}{g_5^2 M_5^3 R^2} \gg 1$
$(g_5^2 M_5) \ll 1$
$(M_5 R) \gtrsim 1$


N U(1)'s , ⟶ U(1)_D.
1/g_D^2 = N/g^2


N U(1)'s , ⟶ U(1)_D.
1/g_D^2 = N/g^2

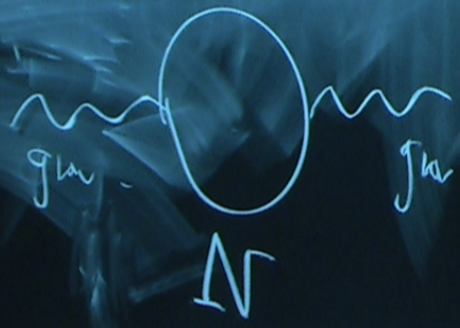
N U(1)'s , $\longrightarrow$ $U(1)_D$.

$$\frac{1}{g_D^2} = \frac{N}{g^2}$$


N U(1)'s , ⟶ U(1)_D.
1/g_D^2 = N/g^2
g_μν
g_μν
N

N U(1)'s , $\longrightarrow$ $U(1)_D$.

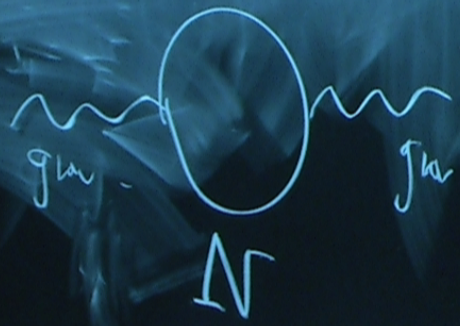
$$\frac{1}{g_D^2} = \frac{N}{g^2}$$



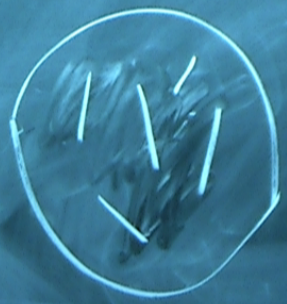
$\delta M_{Pl}^2 \sim N \Lambda_{UV}^2$

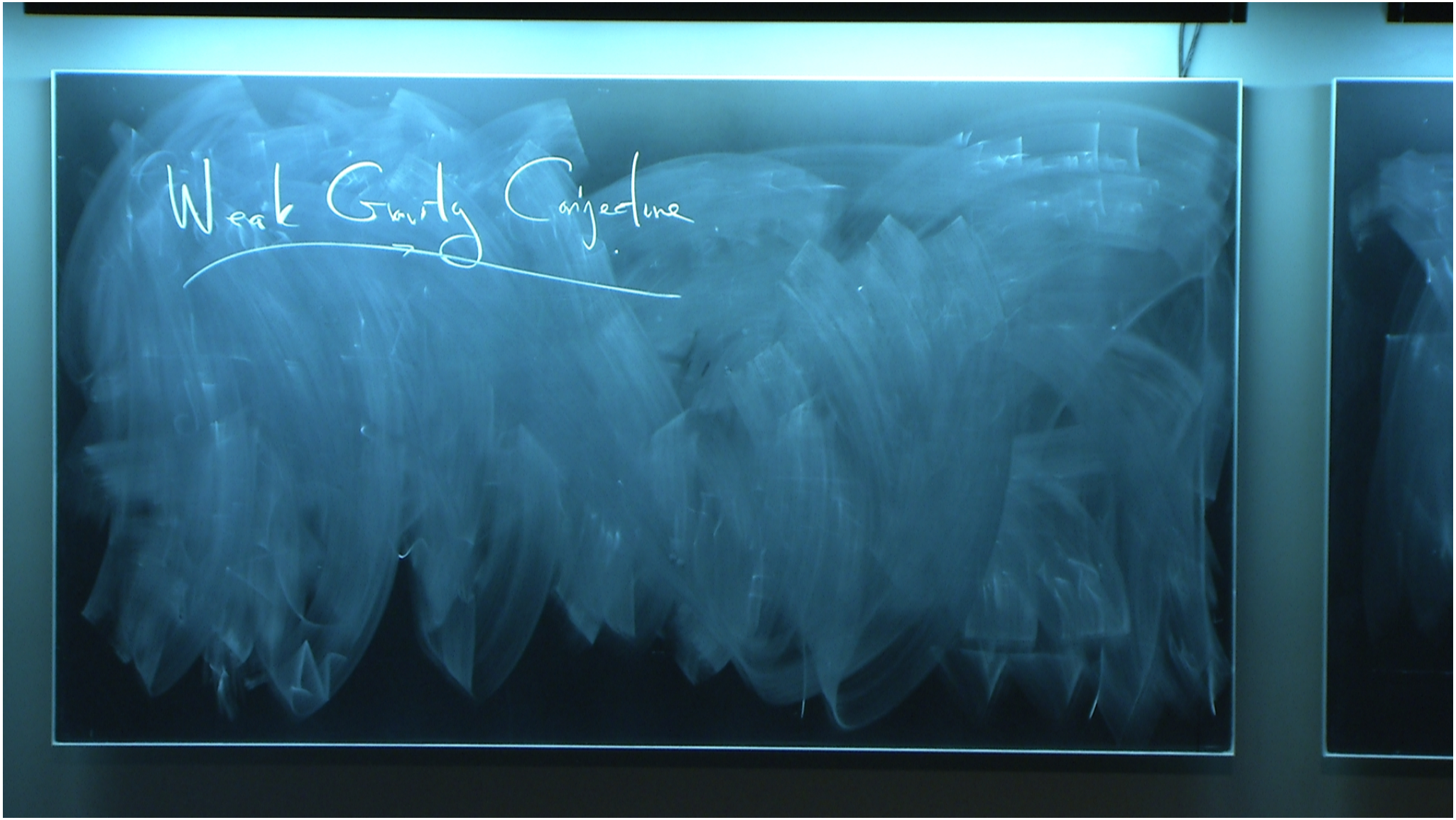
N U(1)'s , $\longrightarrow$ $U(1)_D$.

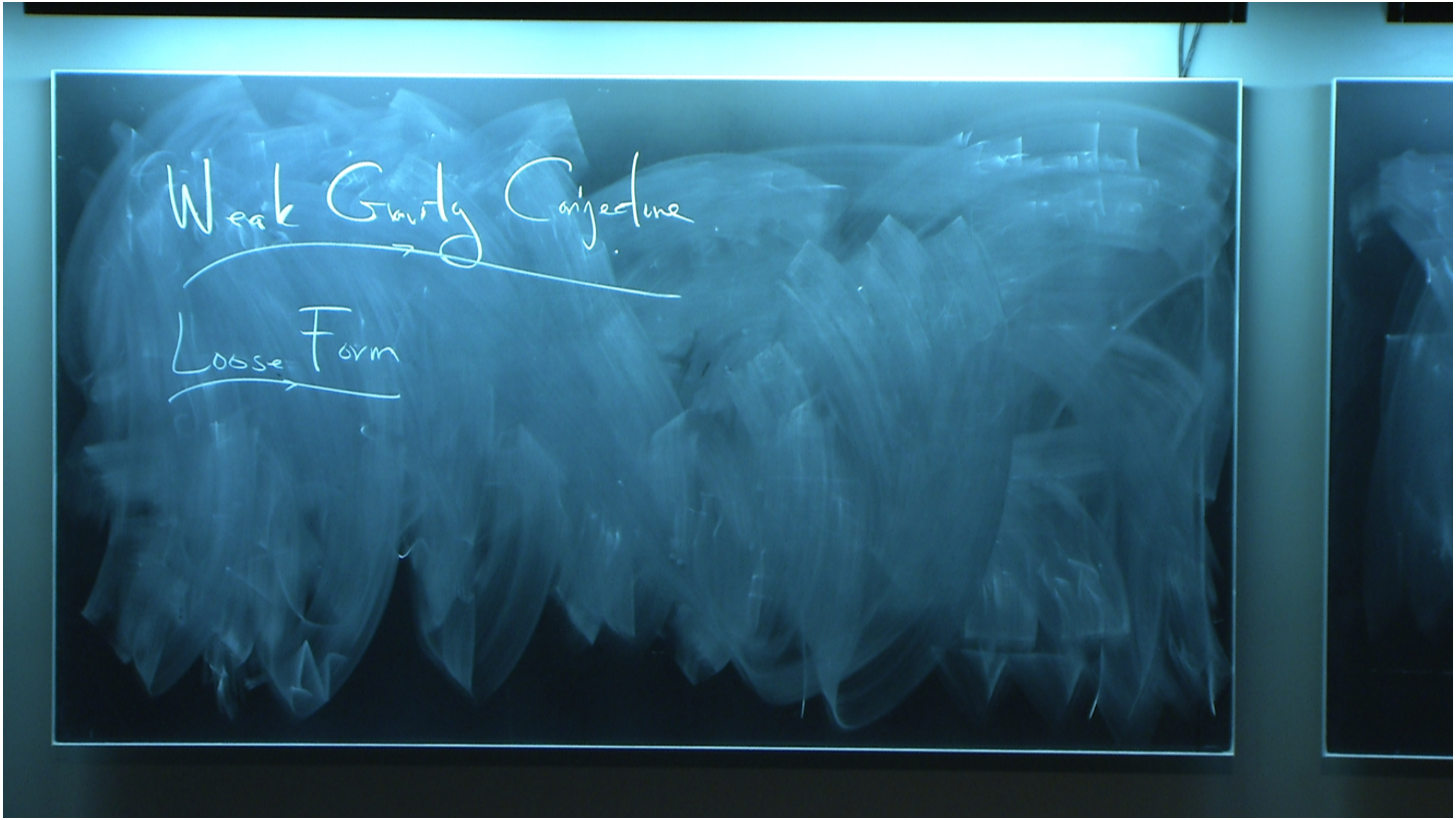
$$\frac{1}{g_D^2} = \frac{N}{g^2}$$

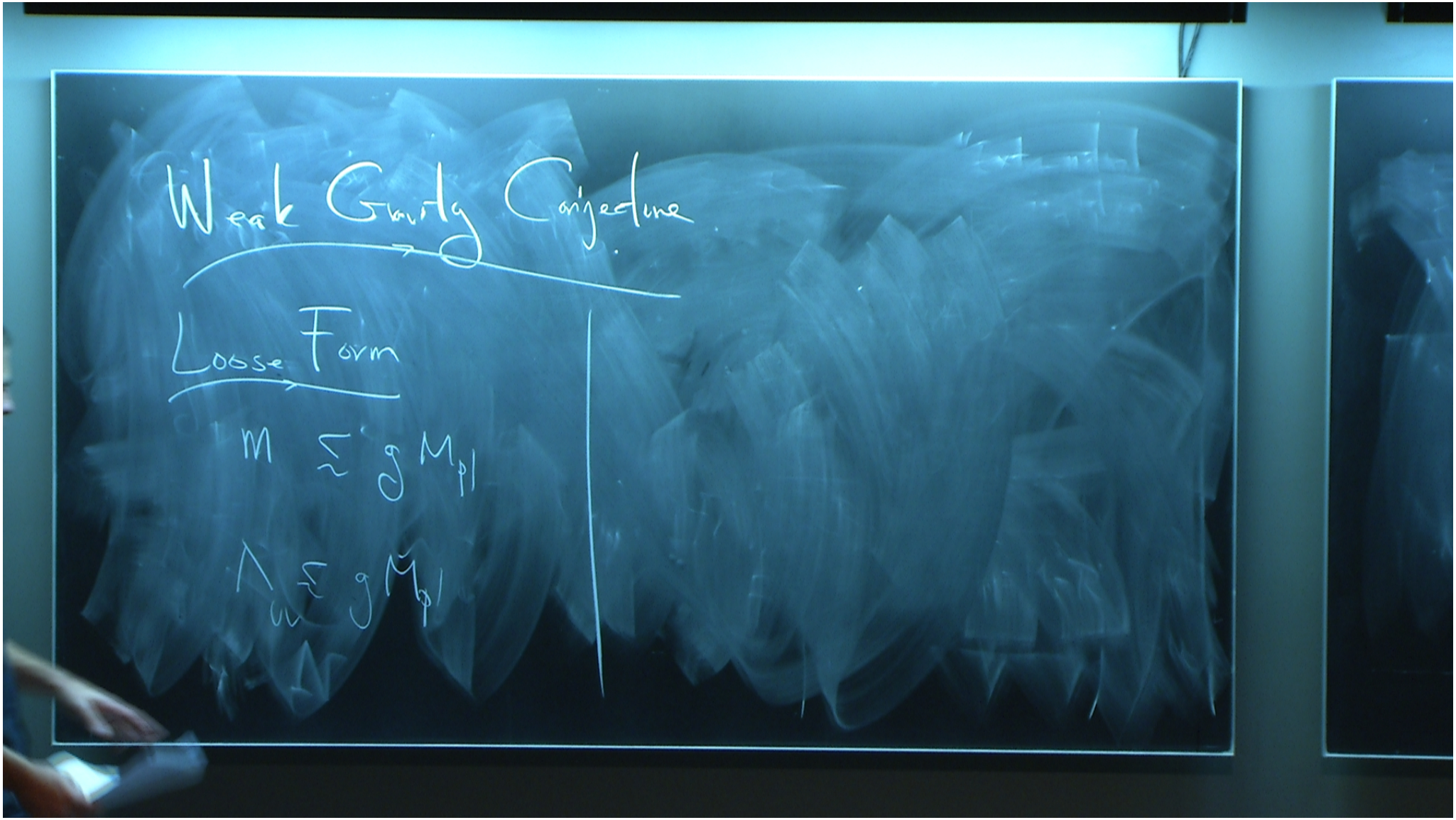


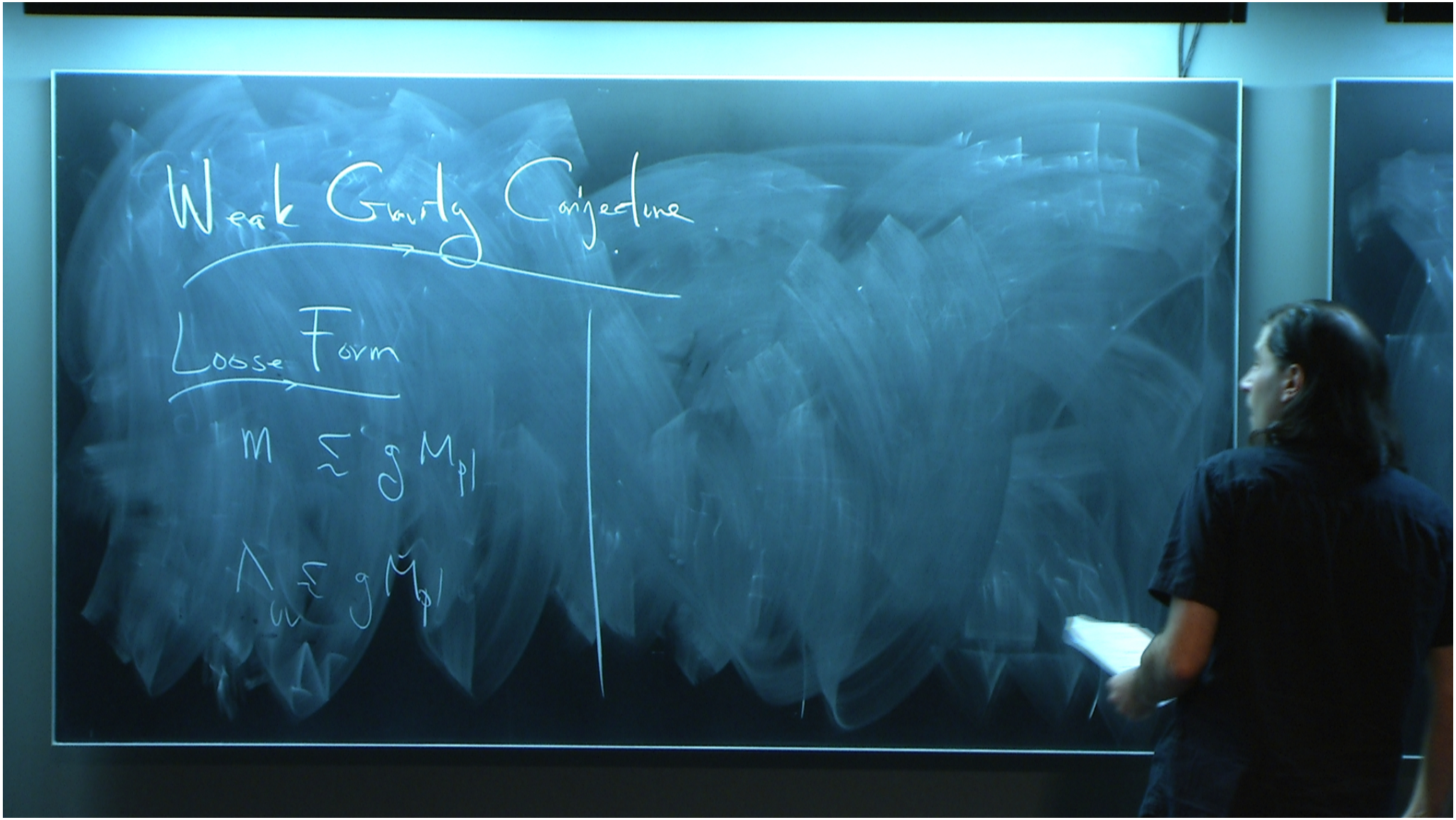
$\delta M_{Pl}^2 \sim N \Lambda_{UV}^2$

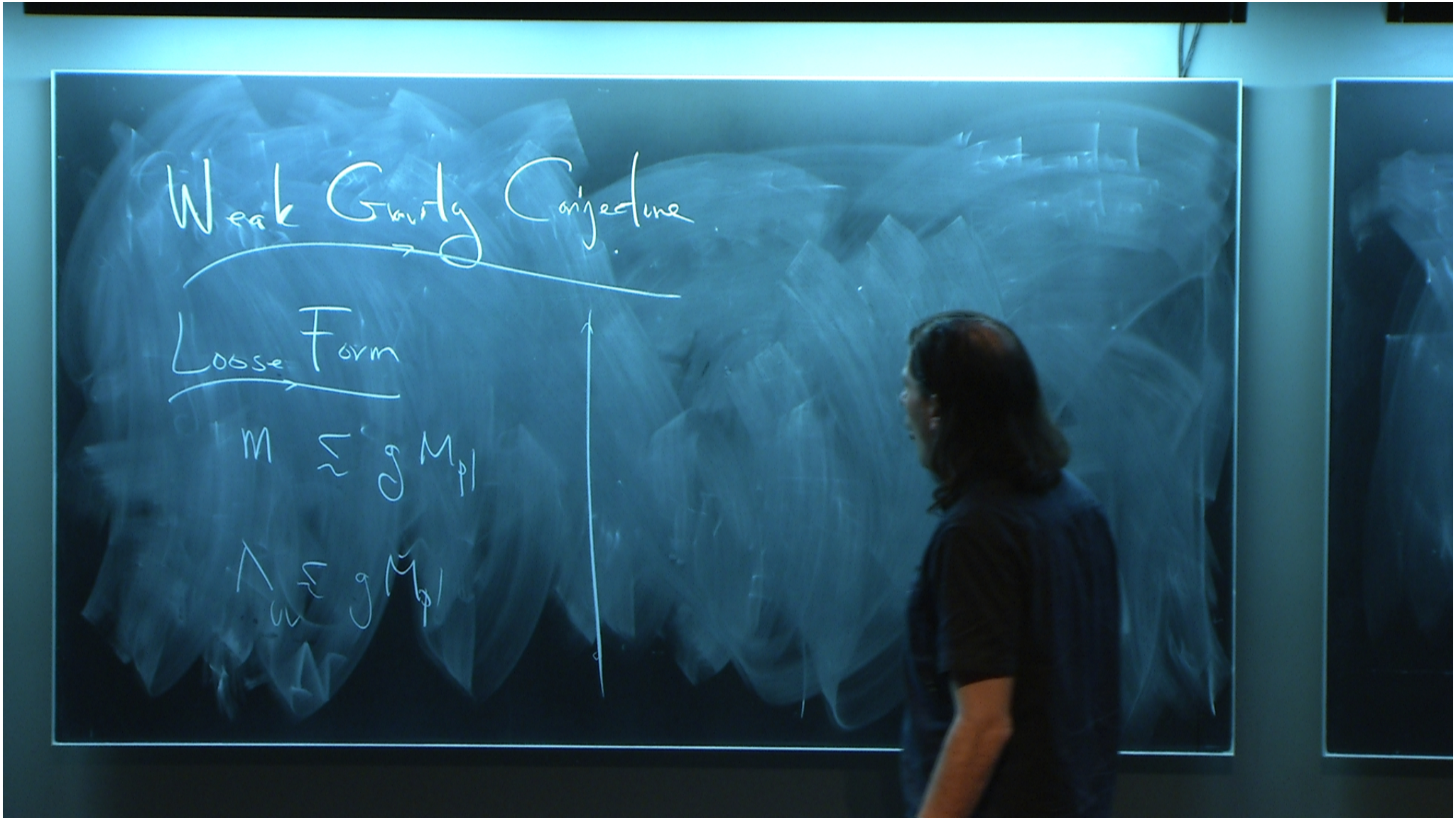


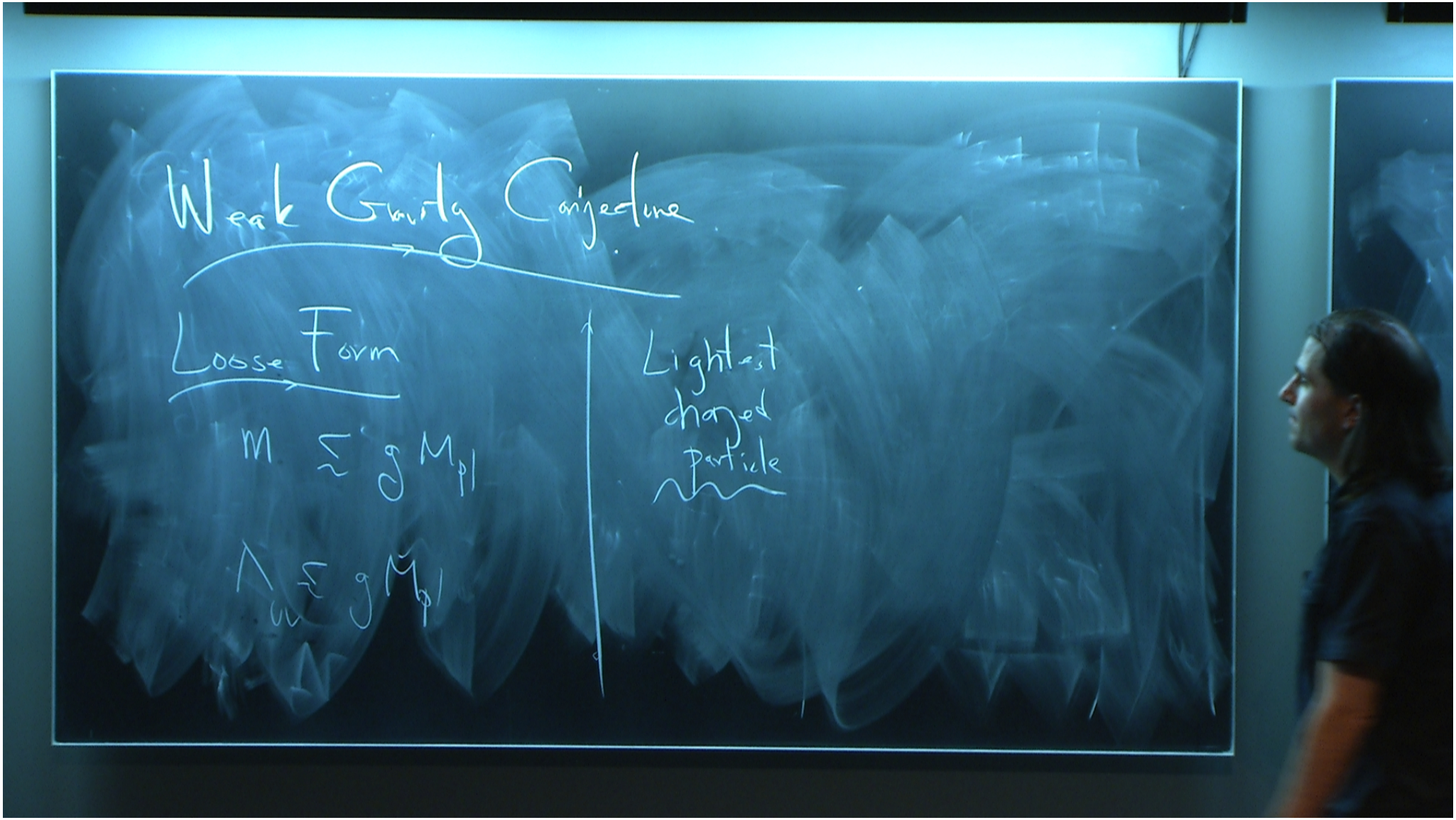

Weak Gravity Conjecture

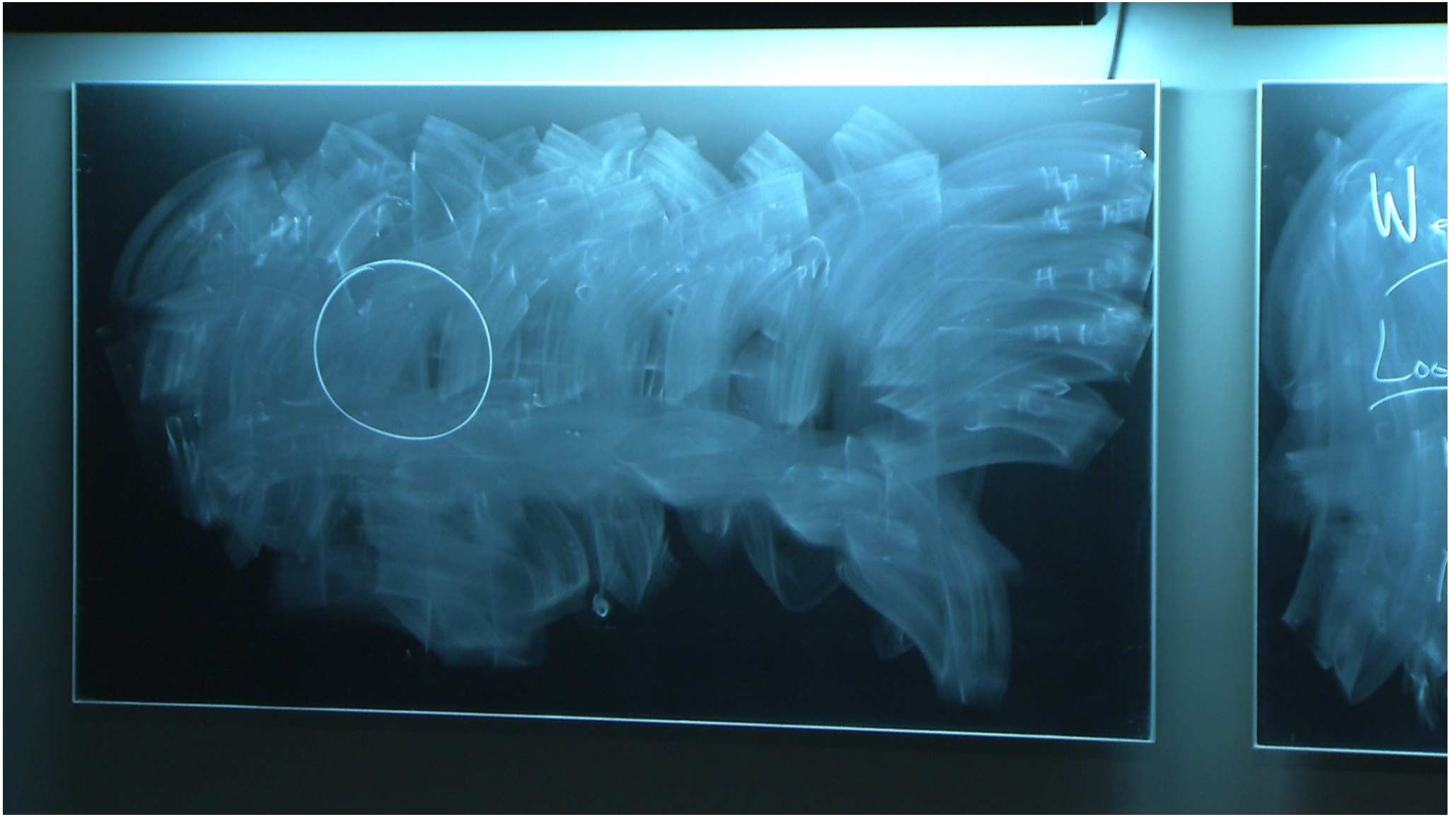

Weak Gravity Conjecture
Loose Form

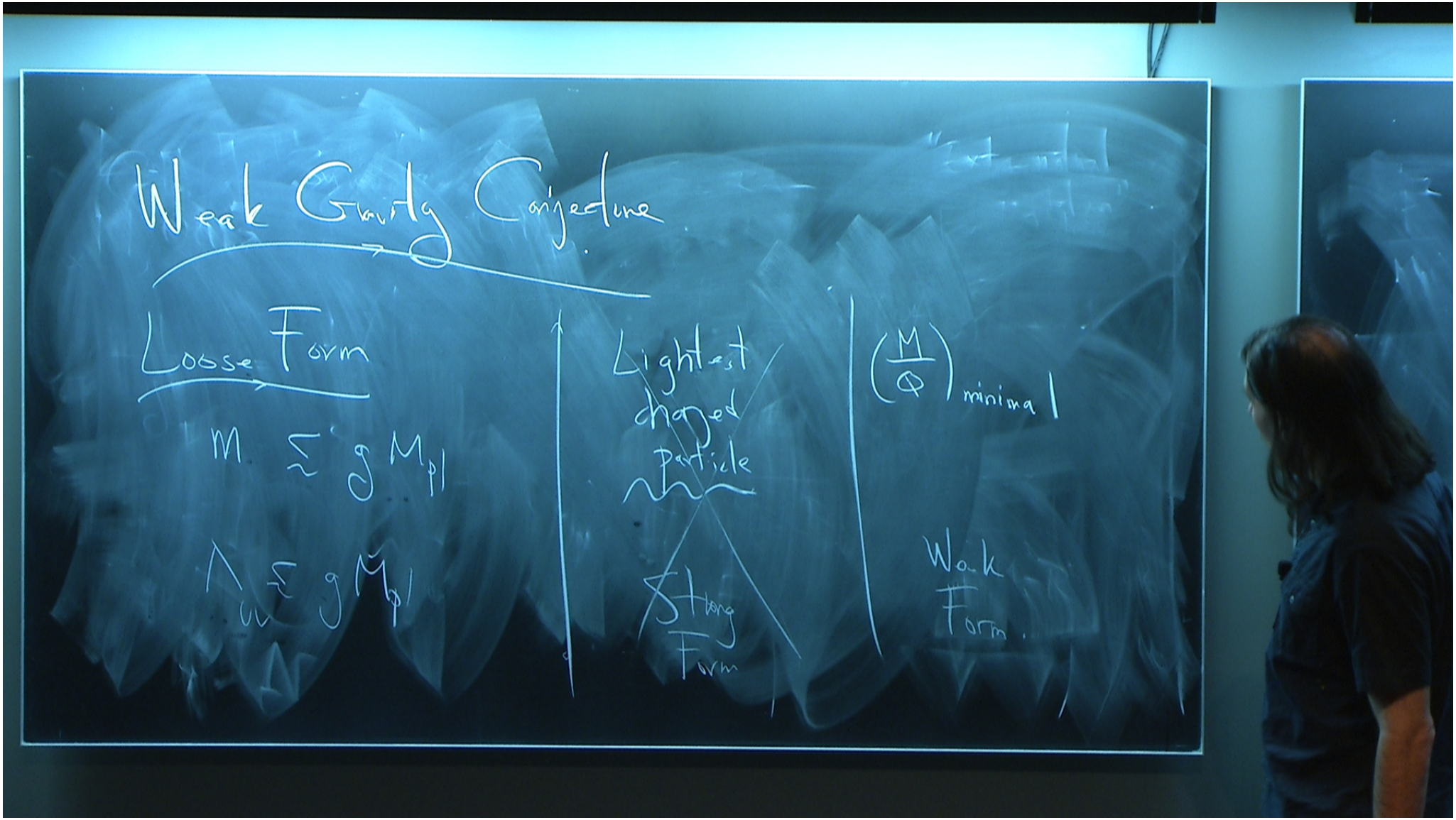

Weak Gravity Conjecture
Loose Form
$m \lesssim g M_{pl}$
$\Lambda \lesssim g M_{pl}$

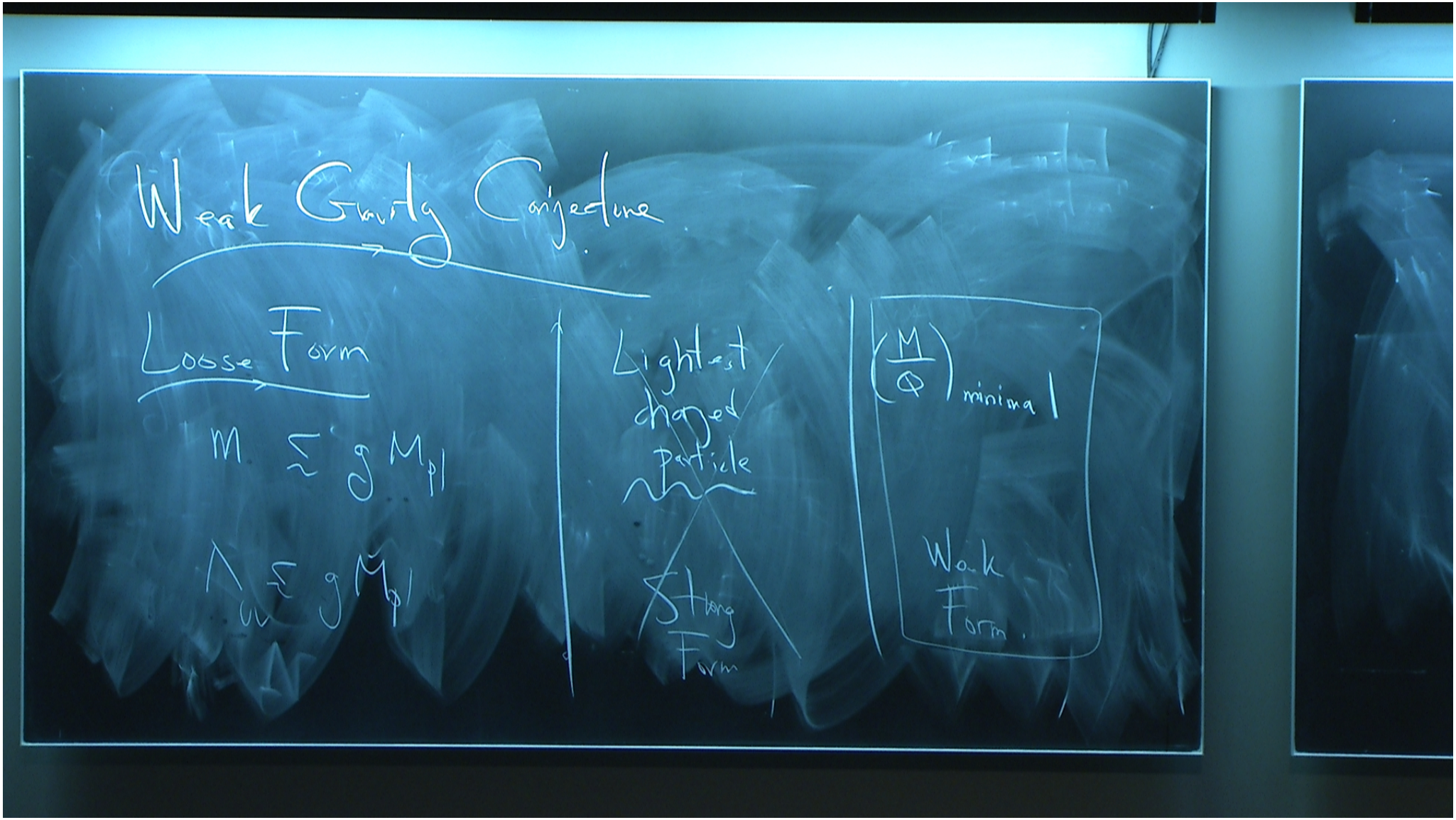

Weak Gravity Conjecture
Loose Form
$m \lesssim g M_{pl}$
$\Lambda \lesssim g M_{pl}$

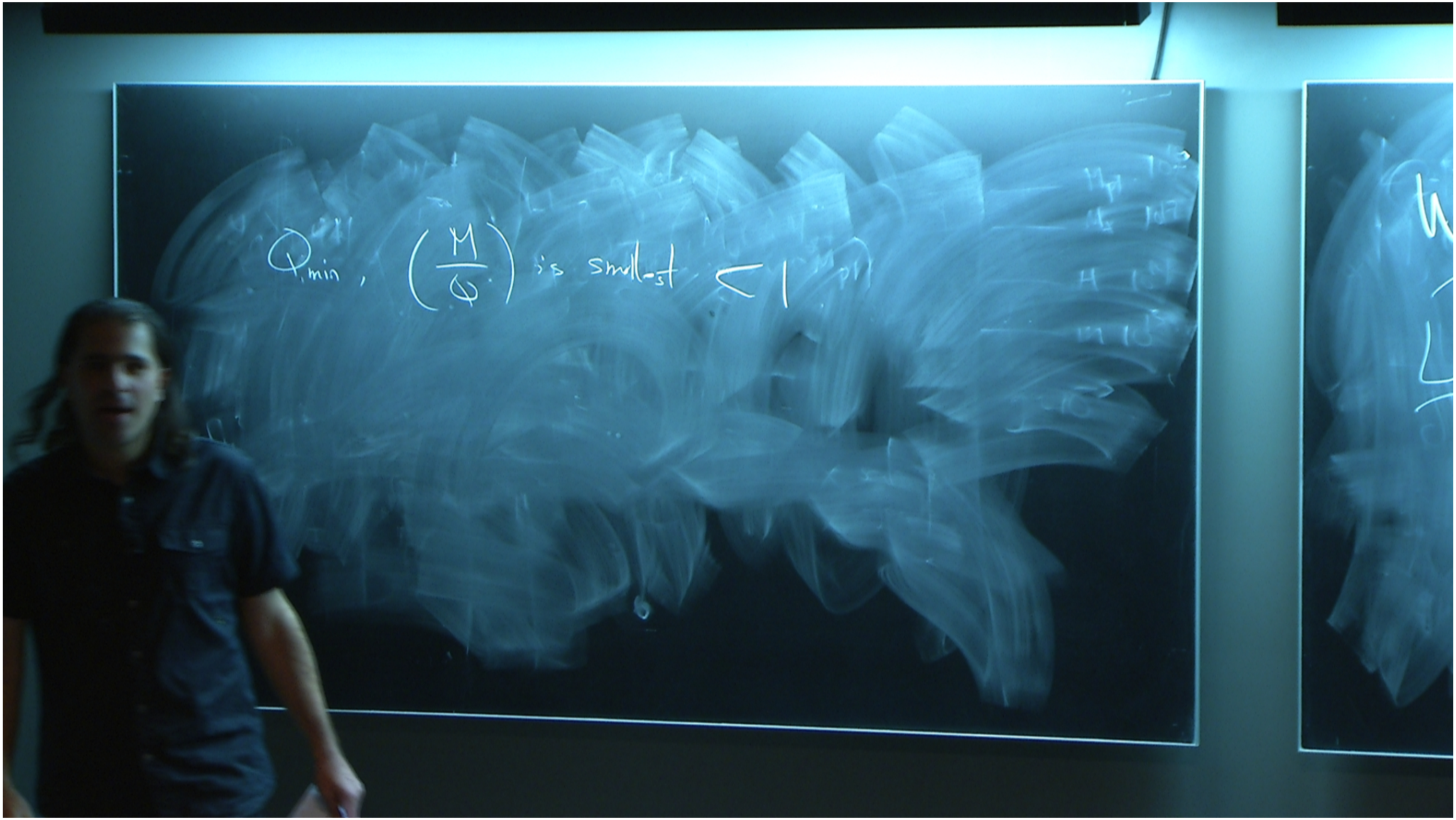

Weak Gravity Conjecture
Loose Form
$m \lesssim g M_{pl}$
$\Lambda_{uv} \lesssim g M_{pl}$

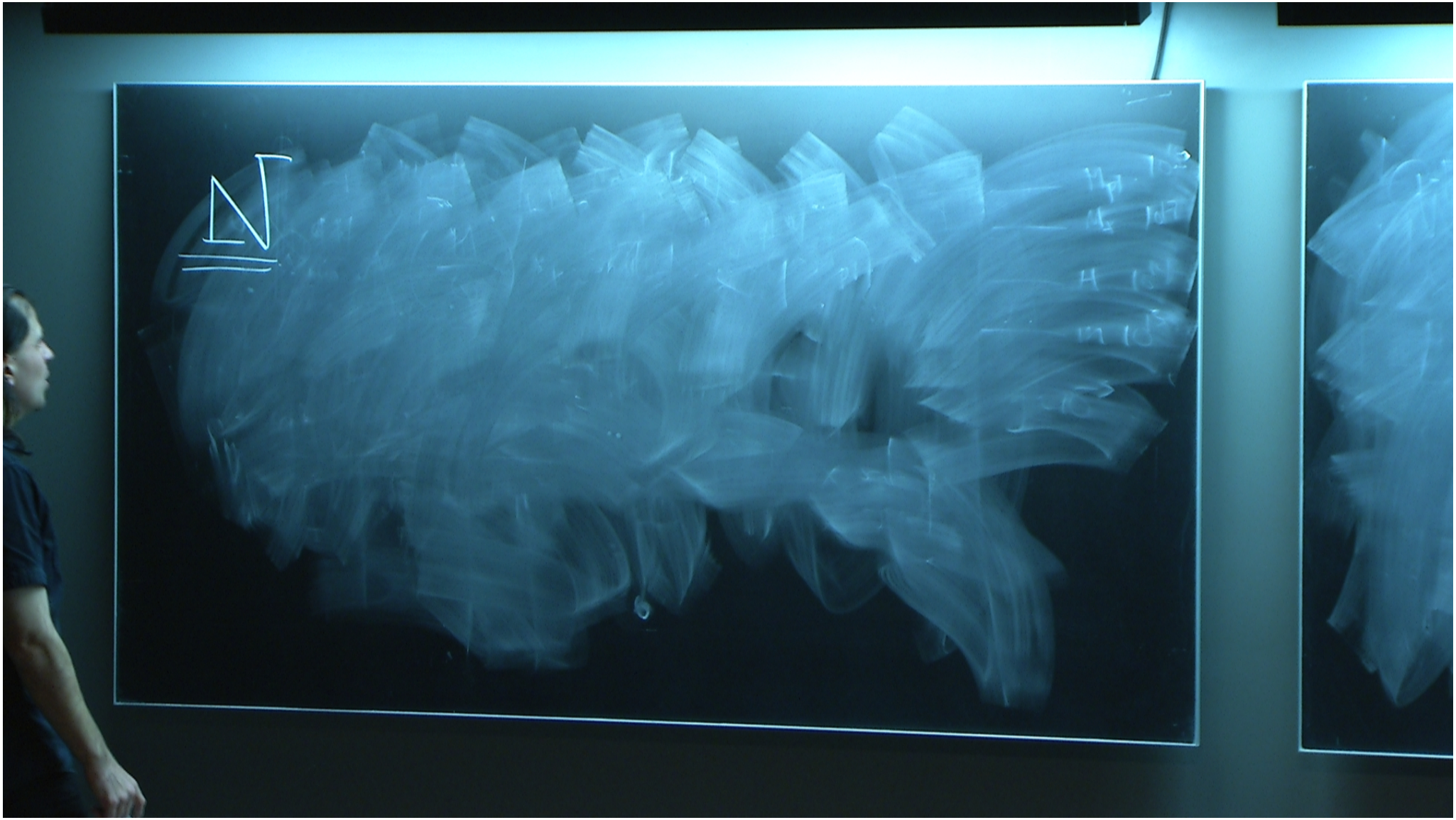

Weak Gravity Conjecture
Loose Form
$m \lesssim g M_{pl}$
$\Lambda \lesssim g M_{pl}$
Lightest charged particle

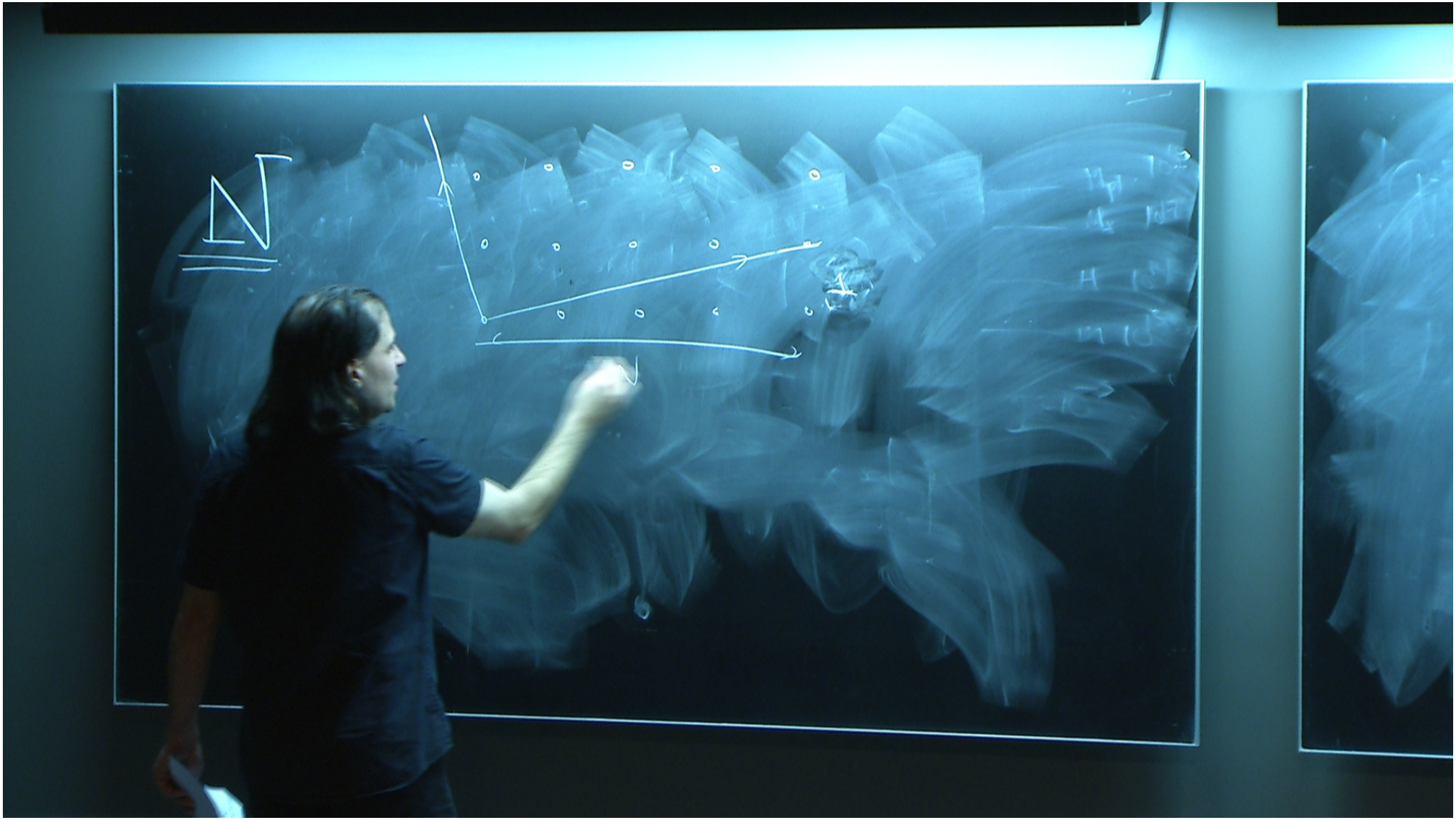


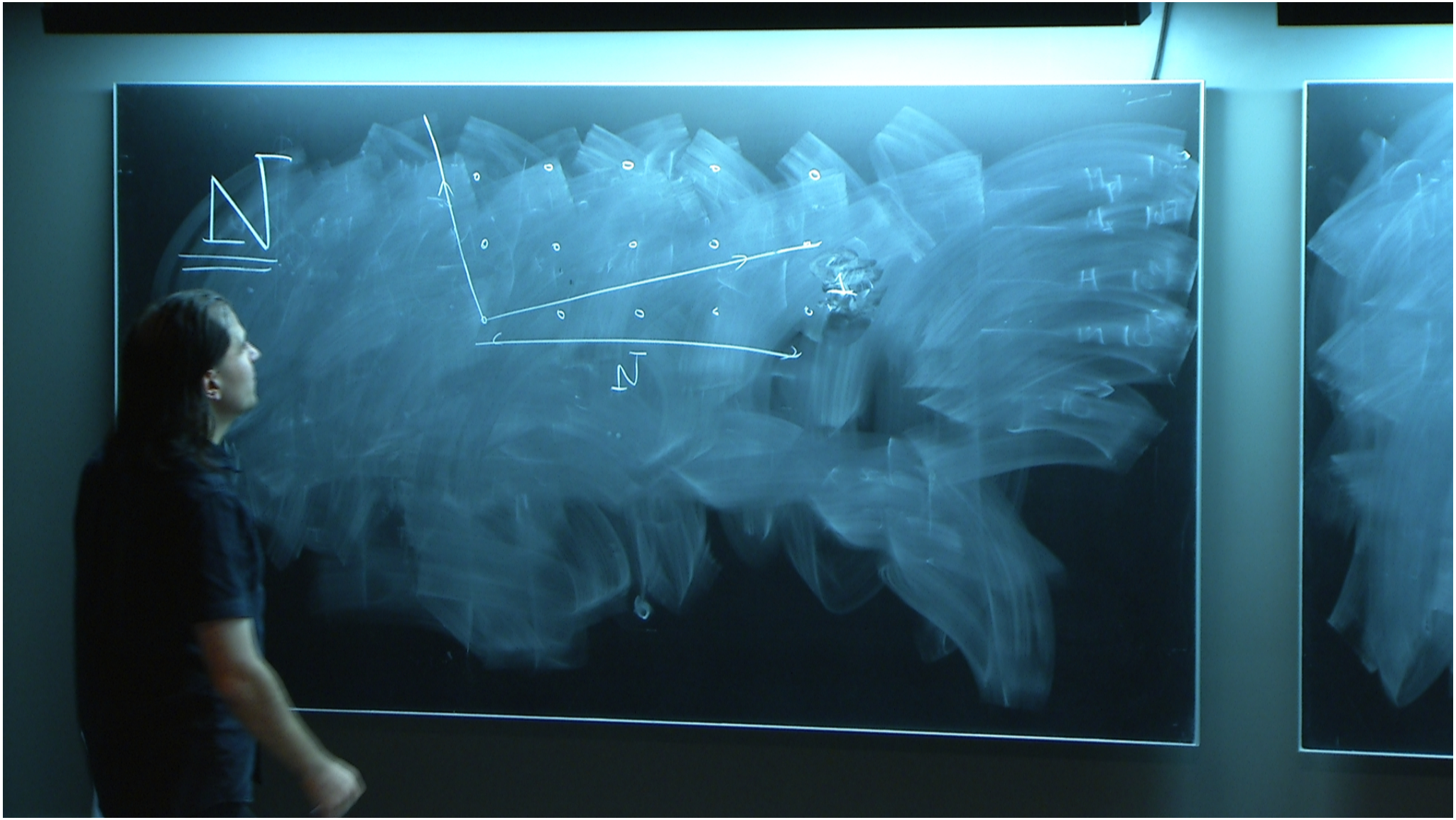

Weak Gravity Conjecture
Loose Form
$m \lesssim g M_{pl}$
$\Lambda \lesssim g M_{pl}$
Lightest charged Particle
Strong Form
$\left(\frac{M}{Q}\right)_{minimal}$
Weak Form

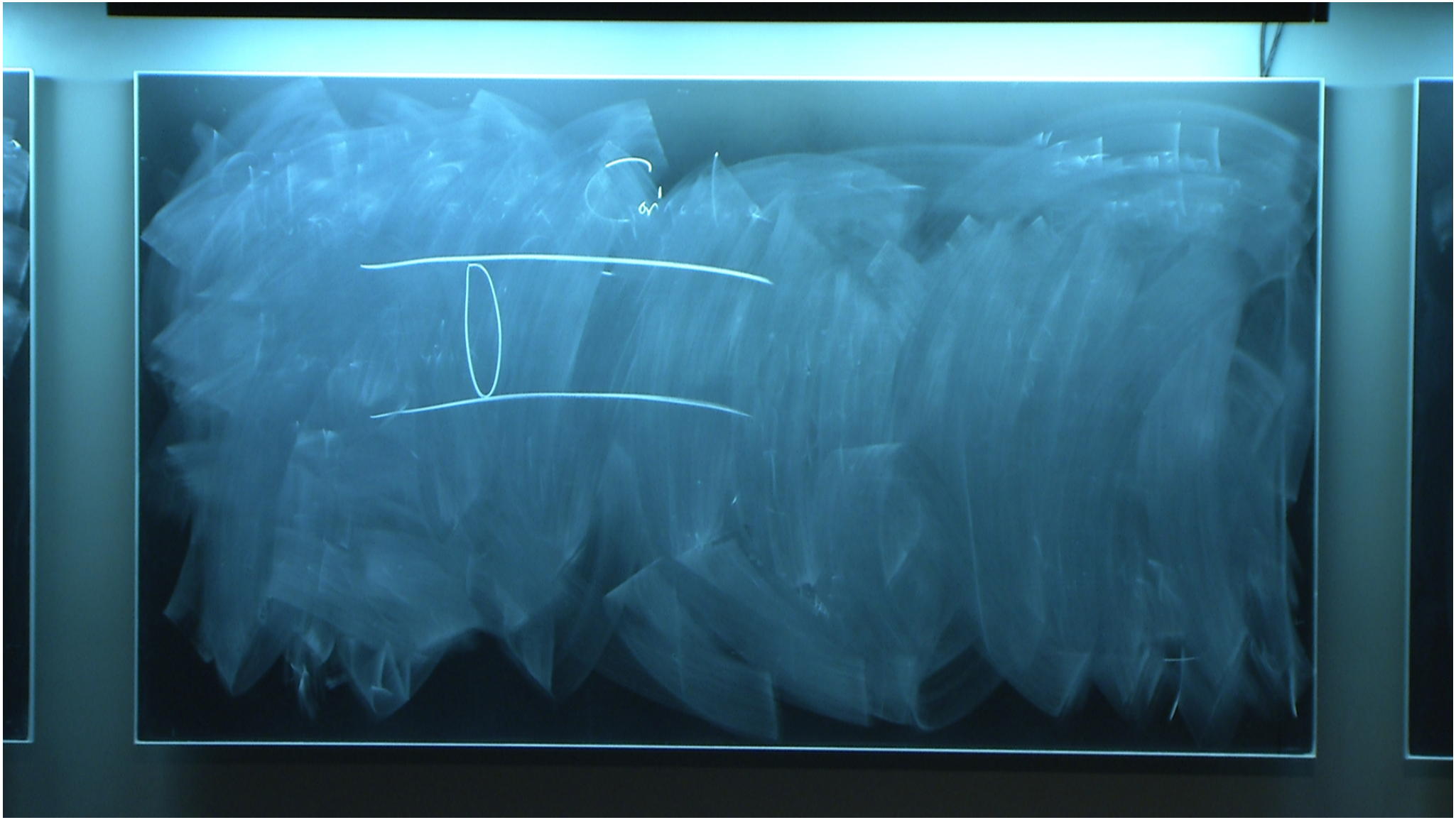

Weak Gravity Conjecture
Loose Form
$m \lesssim g M_{pl}$
$\Lambda \lesssim g M_{pl}$
Lightest charged Particle
Strong Form
$\left(\frac{M}{Q}\right)_{minimal}$
Weak Form.

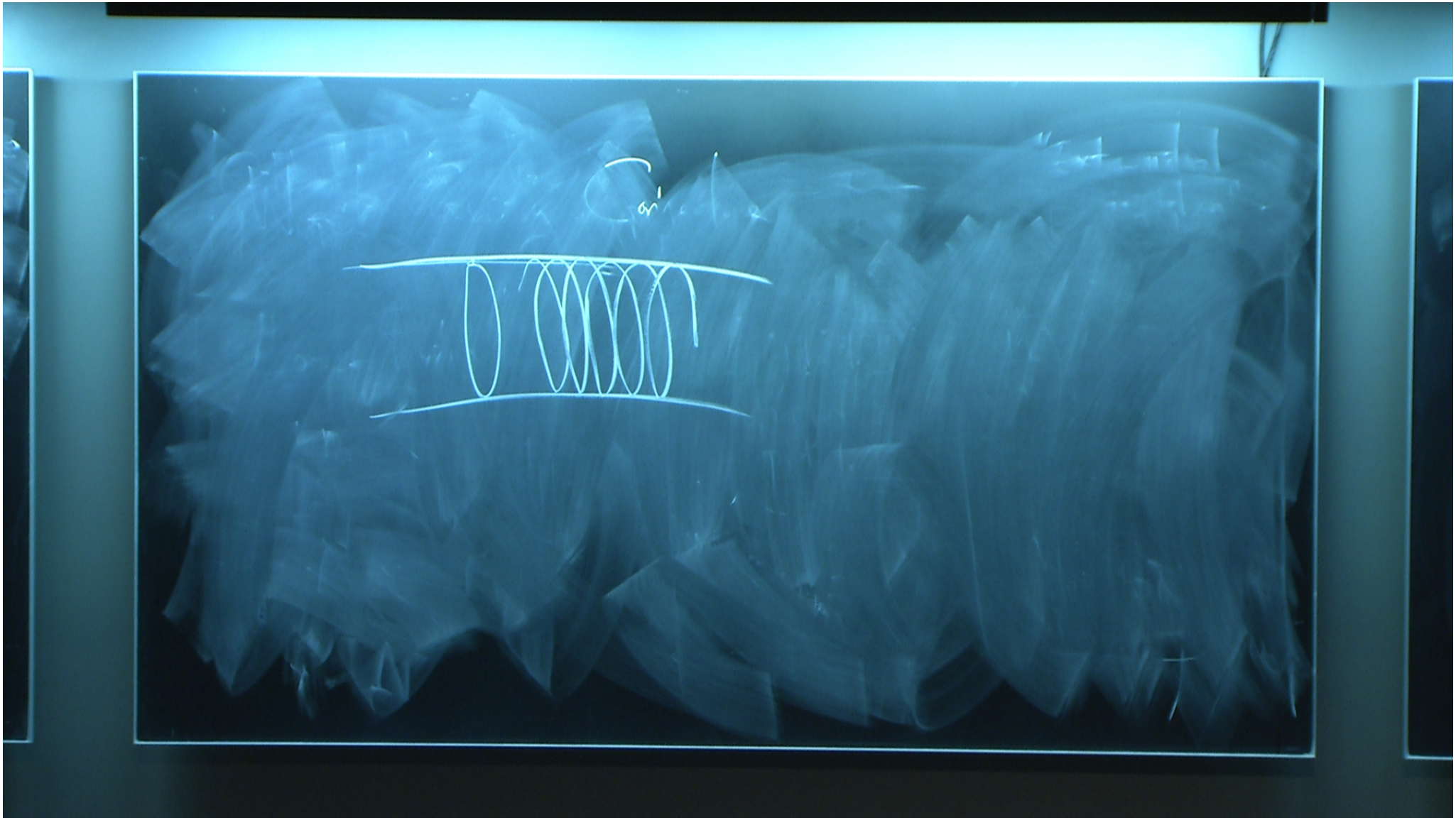

Q_{min}, $\left(\frac{M}{Q}\right)$ is smallest < 1

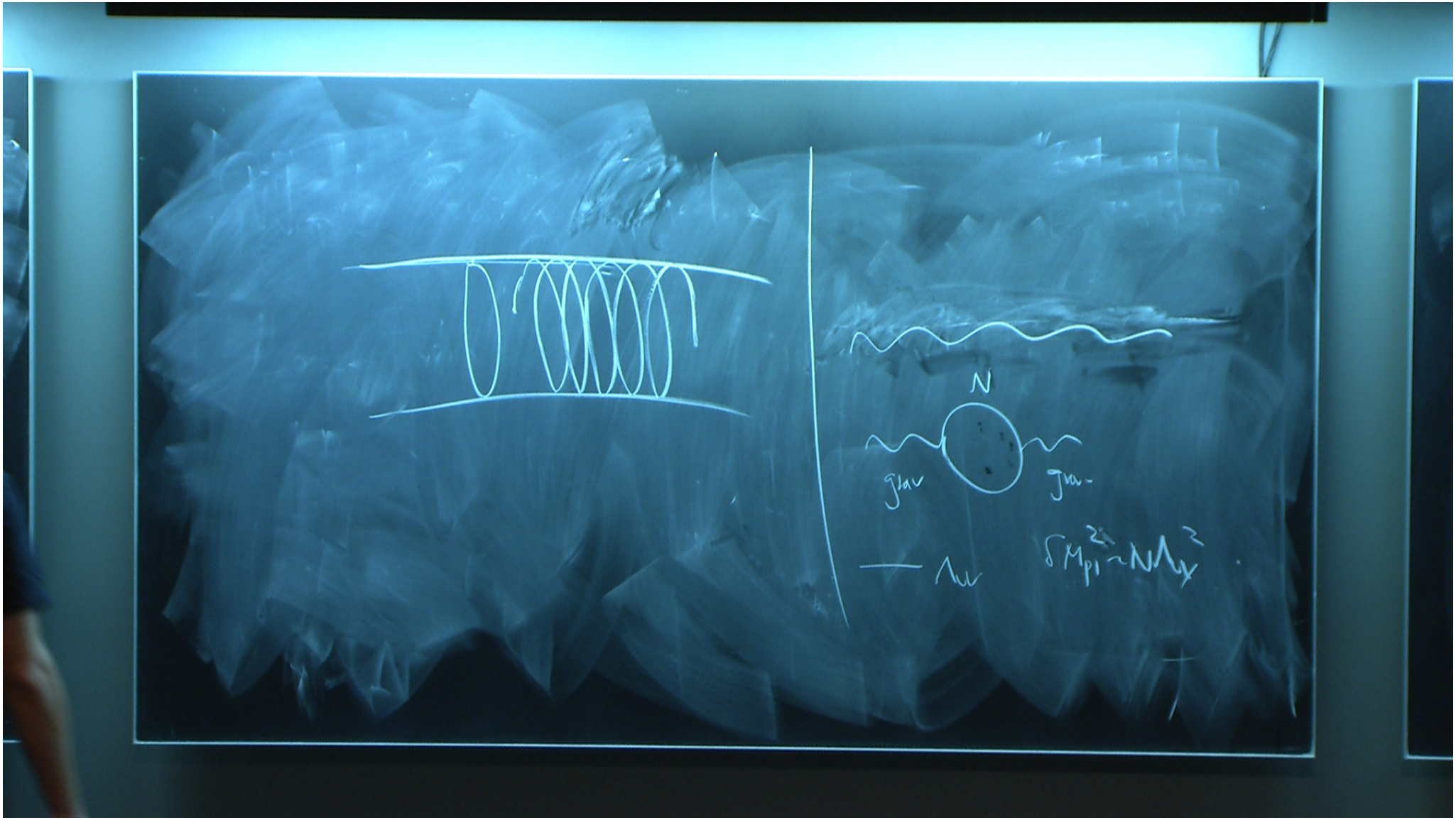


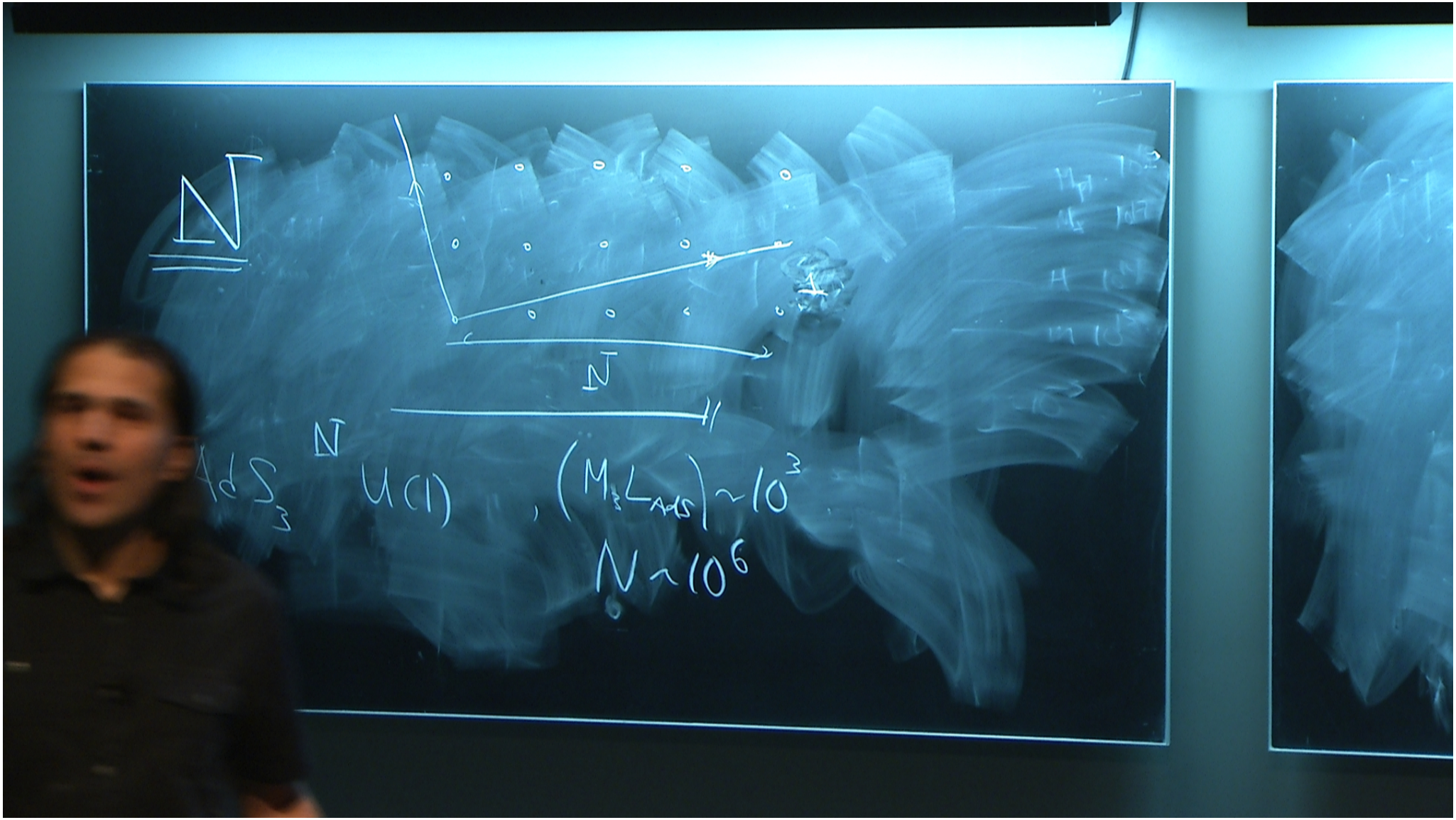


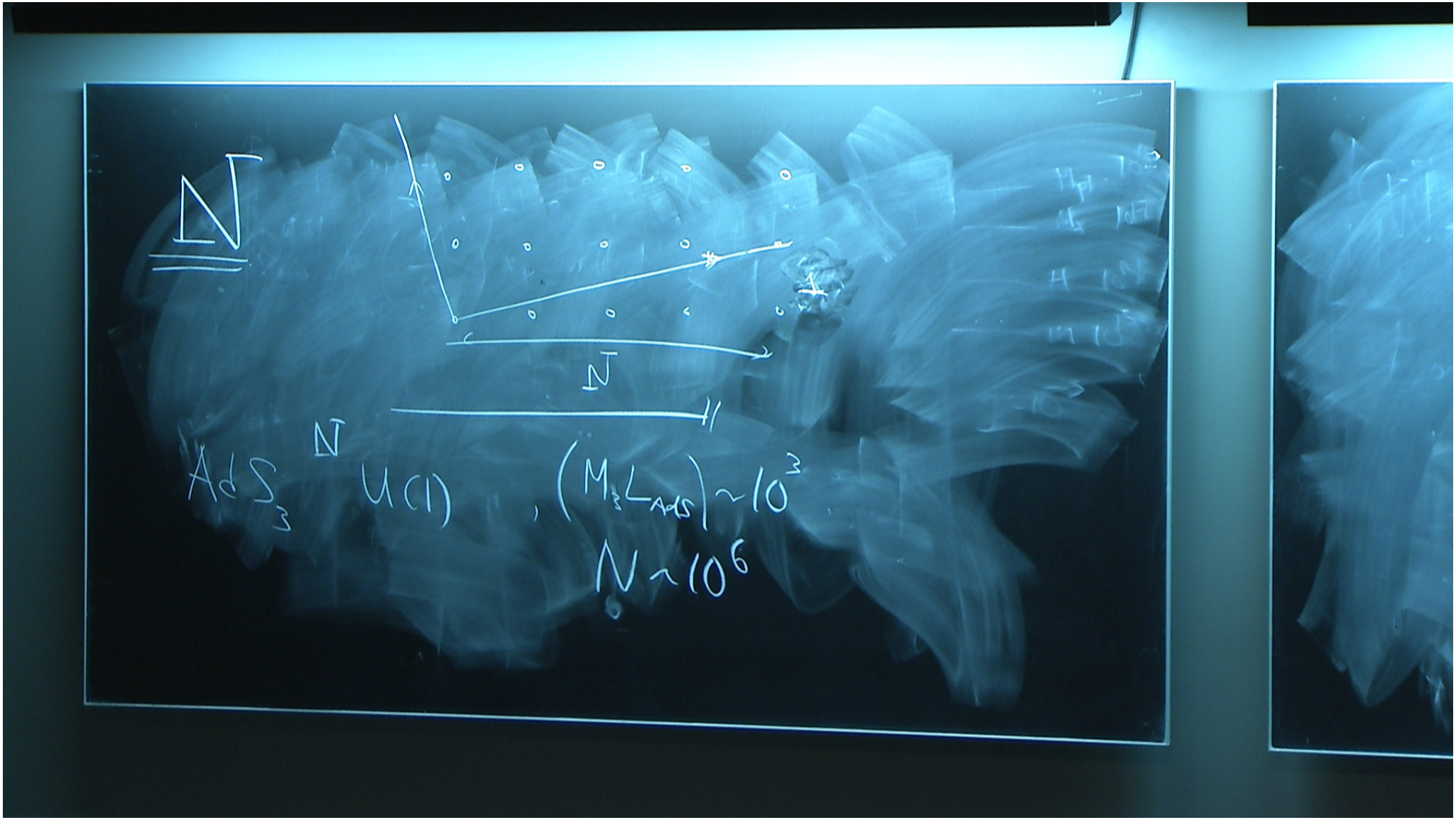


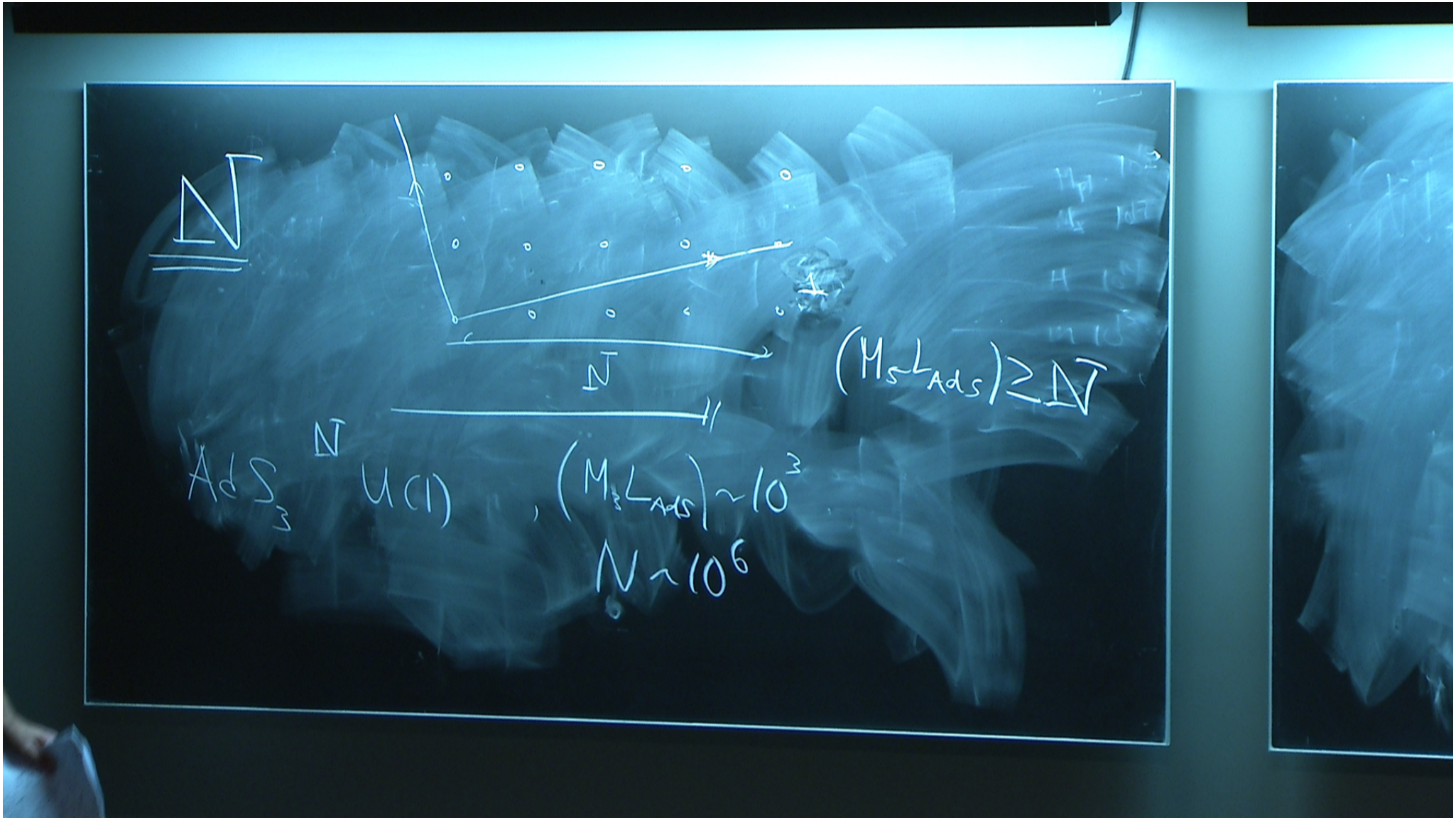


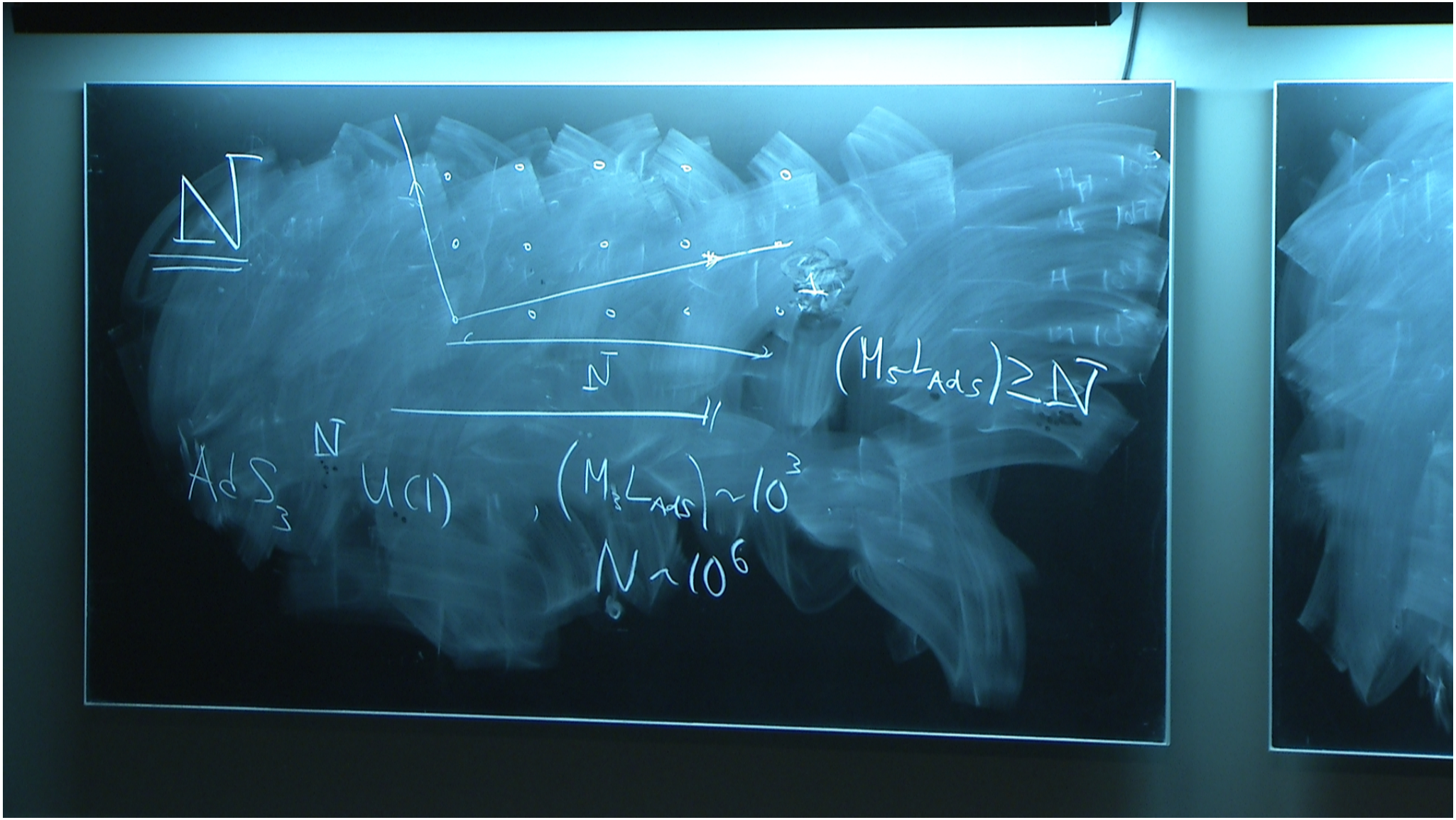


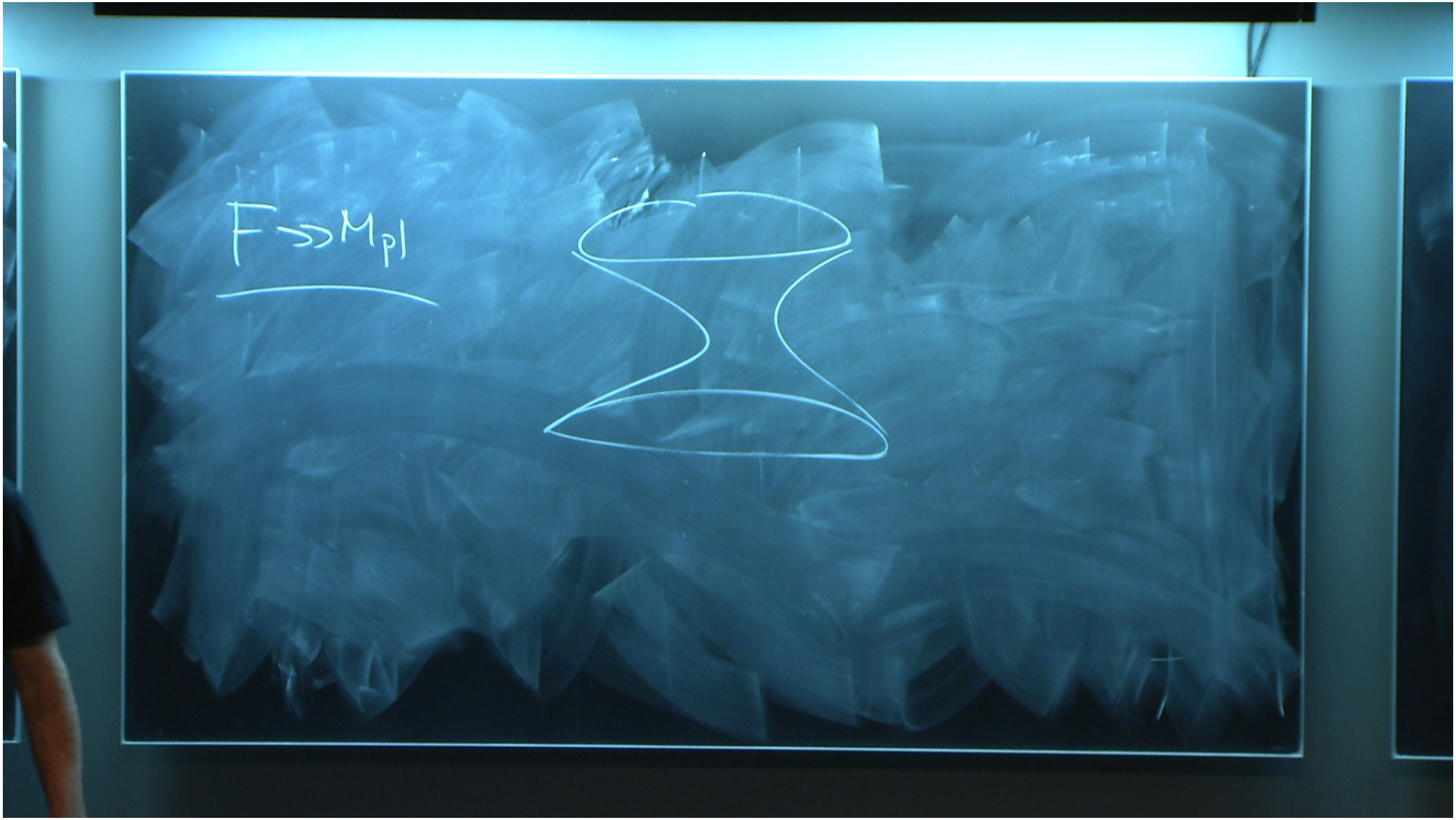

N
$g_{\mu\nu}$
$g_{\mu\nu}$
$\delta M_{Pl}^2 \sim N\Lambda_X^2$
Λ_{UV}

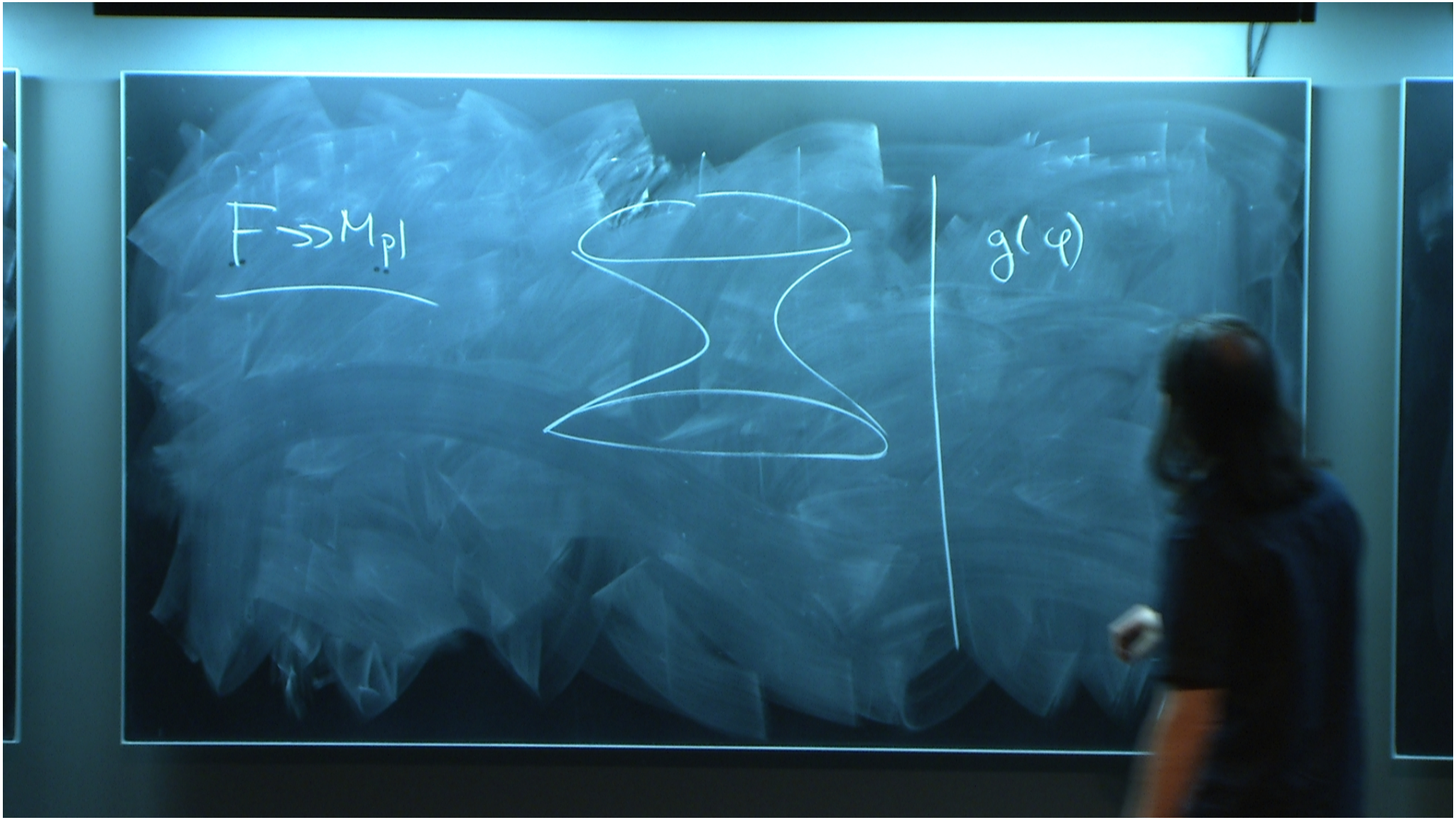

N
N
N
AdS_3
U(1)
$(M_3 L_{AdS}) \sim 10^3$
$N \sim 10^6$

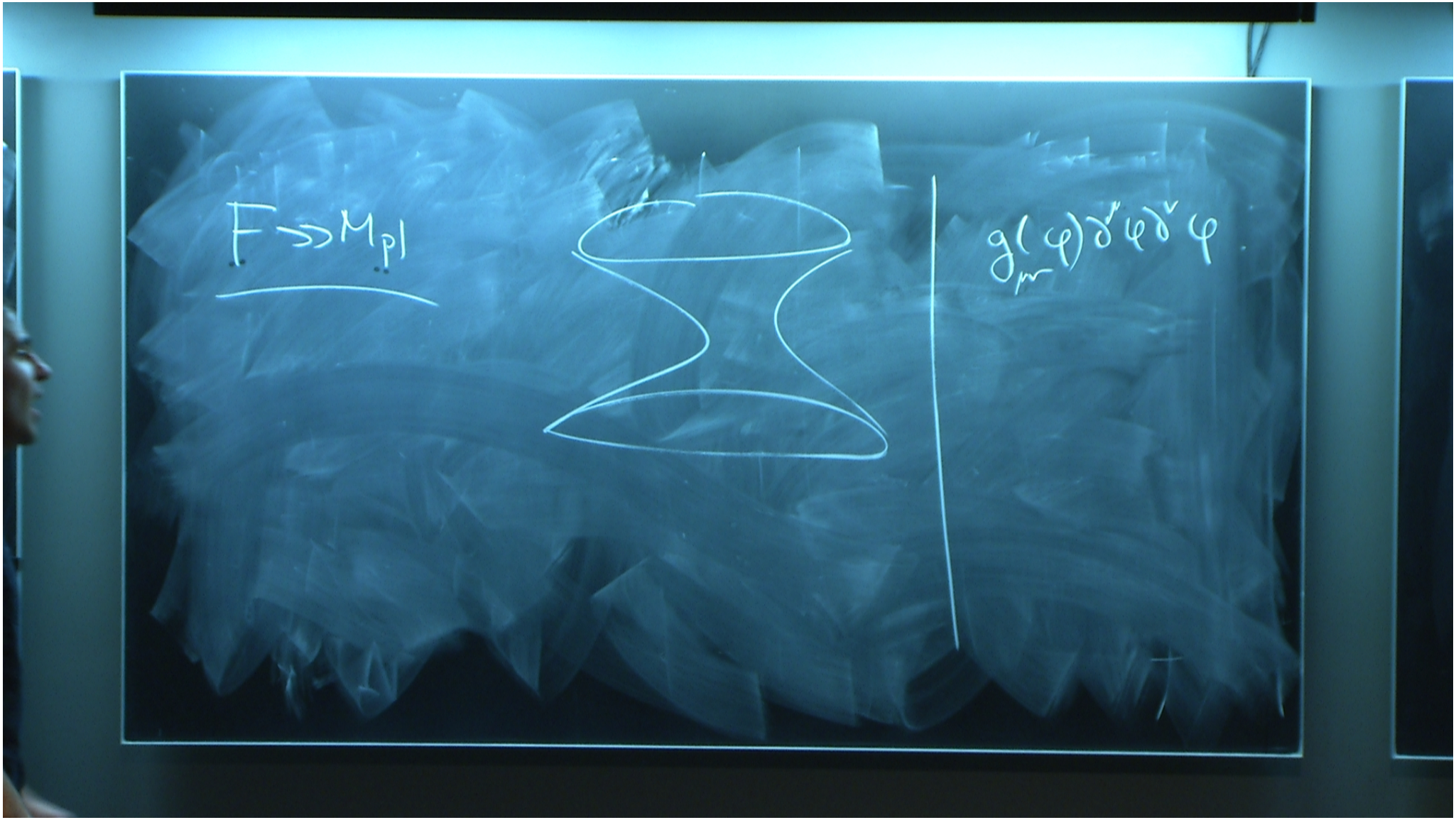

N
N
N
AdS_3
U(1)
$(M_3 L_{AdS}) \sim 10^3$
$N \sim 10^6$

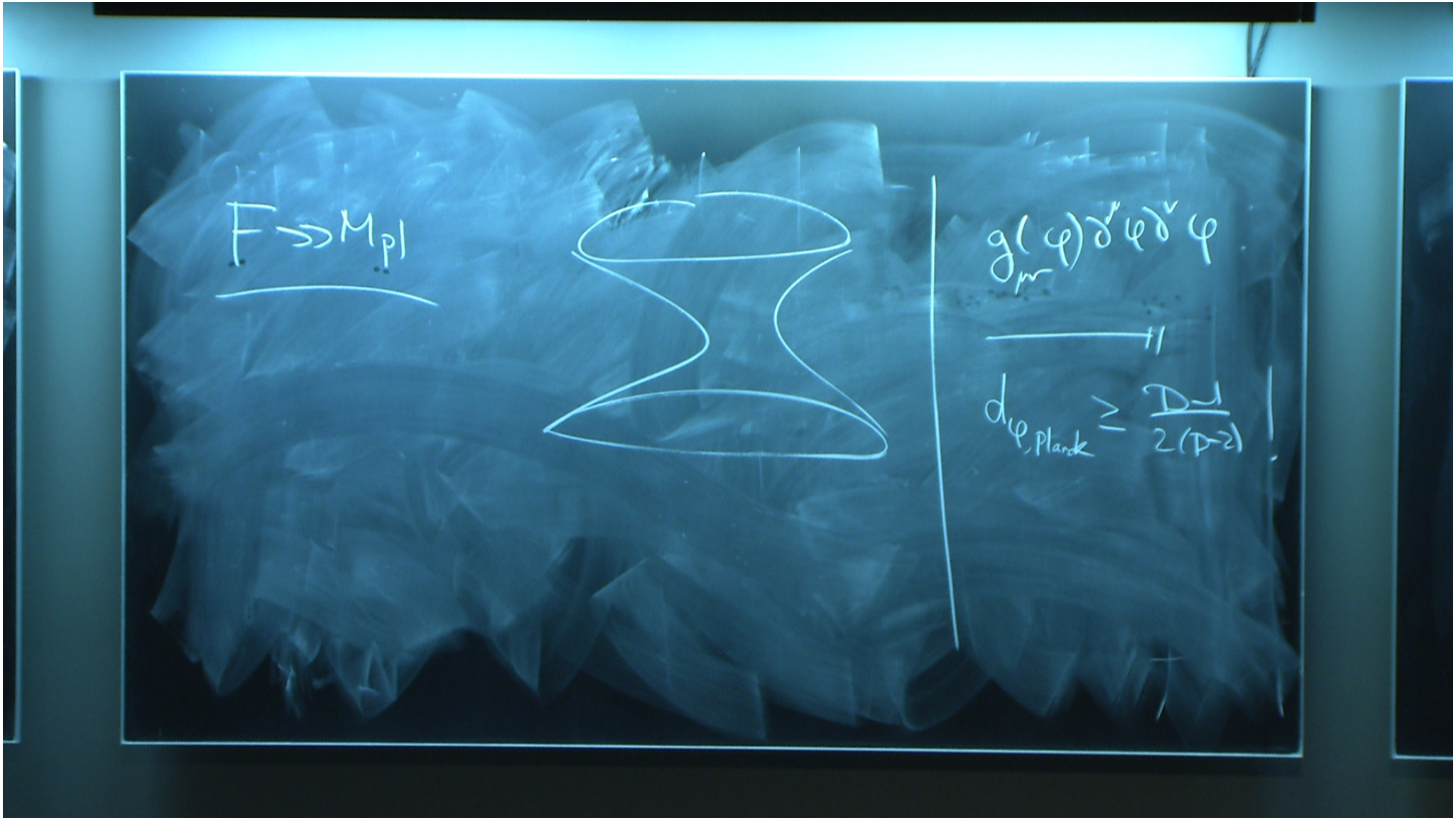

N
N
$(M_5 L_{AdS}) \geq N$
AdS_3
N
U(1)
$(M_5 L_{AdS}) \sim 10^3$
$N \sim 10^6$

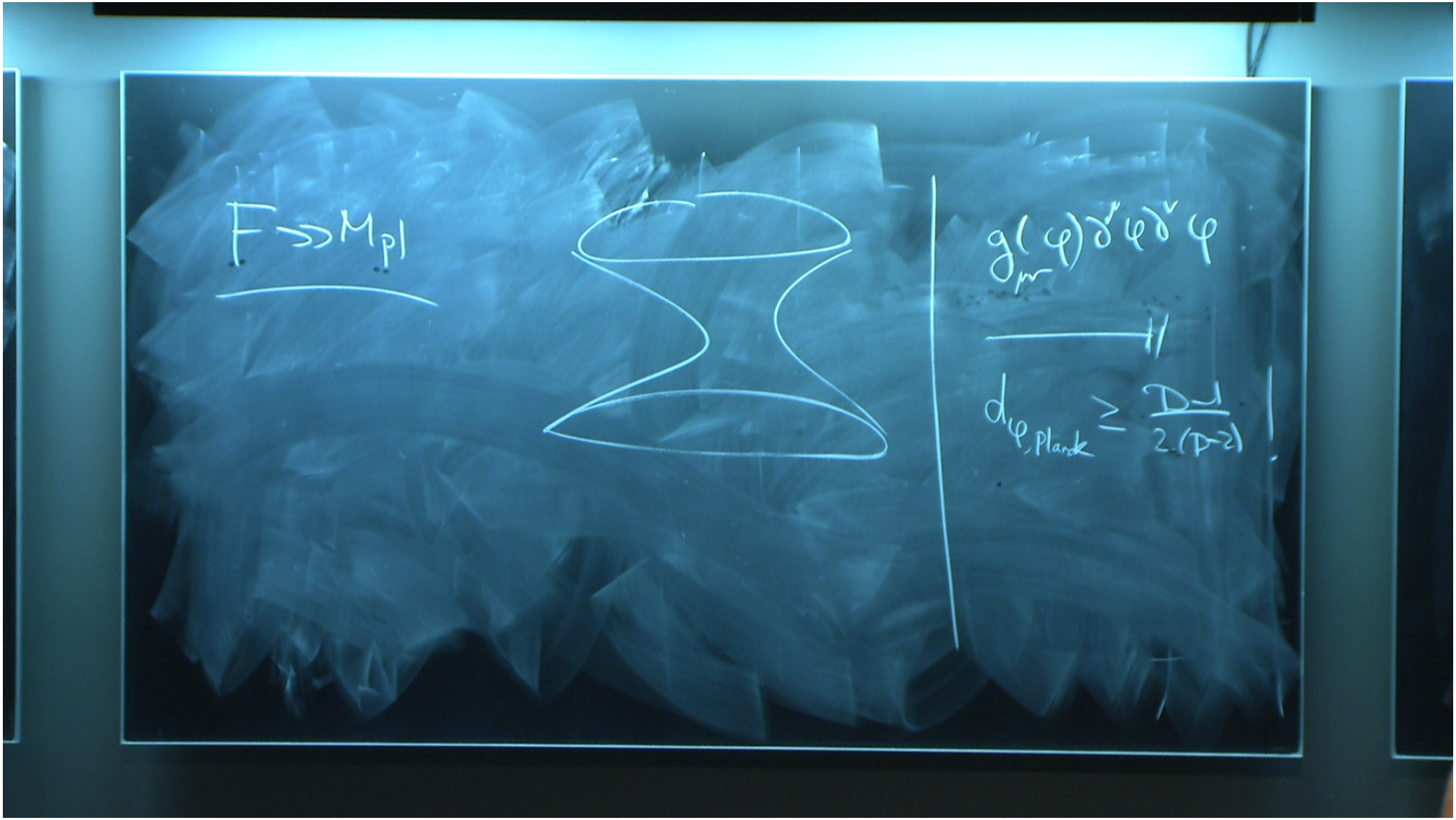

N
N
$(M_s L_{AdS}) \geq N$
AdS_3
U(1)
$(M_3 L_{AdS}) \sim 10^3$
$N \sim 10^6$

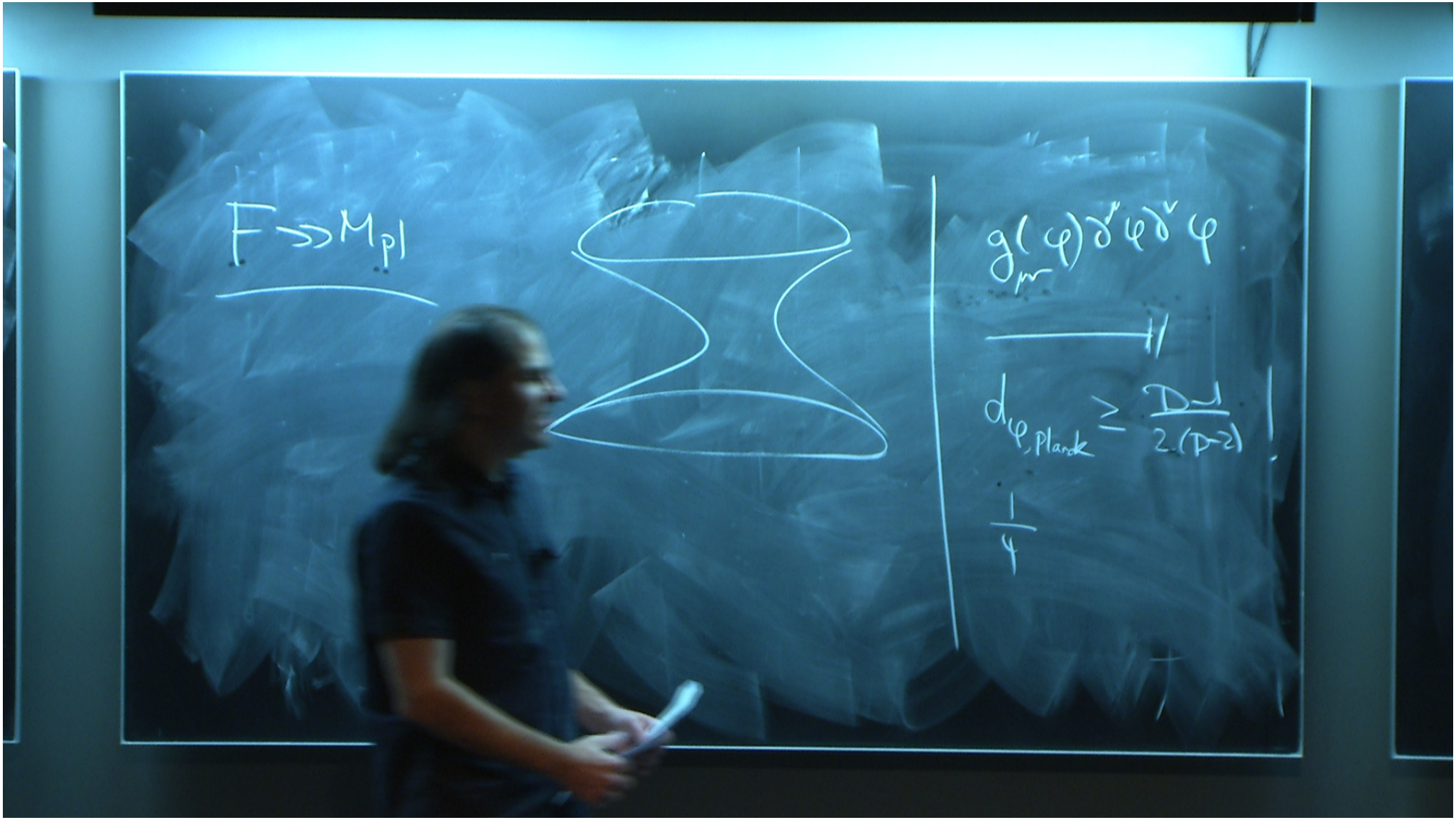

F >> M_pl


F >> M_pl
g(φ)


F >> M_pl
g(φ) ∂_μ φ ∂^ν φ


F >> M_pl
g_μν(φ) ∂^μ φ ∂^ν φ
d_φ,Planck ≥ (D−1) / 2(D−2) !


F >> M_pl
g_μν(φ) ∂^μ φ ∂^ν φ
d_φ,Planck ≥ (D−1) / 2(D−2)


F >> M_pl
g(φ) ∂φ ∂φ
d_φ,Planck ≥ (D−1) / 2(D−2)
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