Title: Informal Chalk and Talk

Date: Aug 12, 2009 01:00 PM

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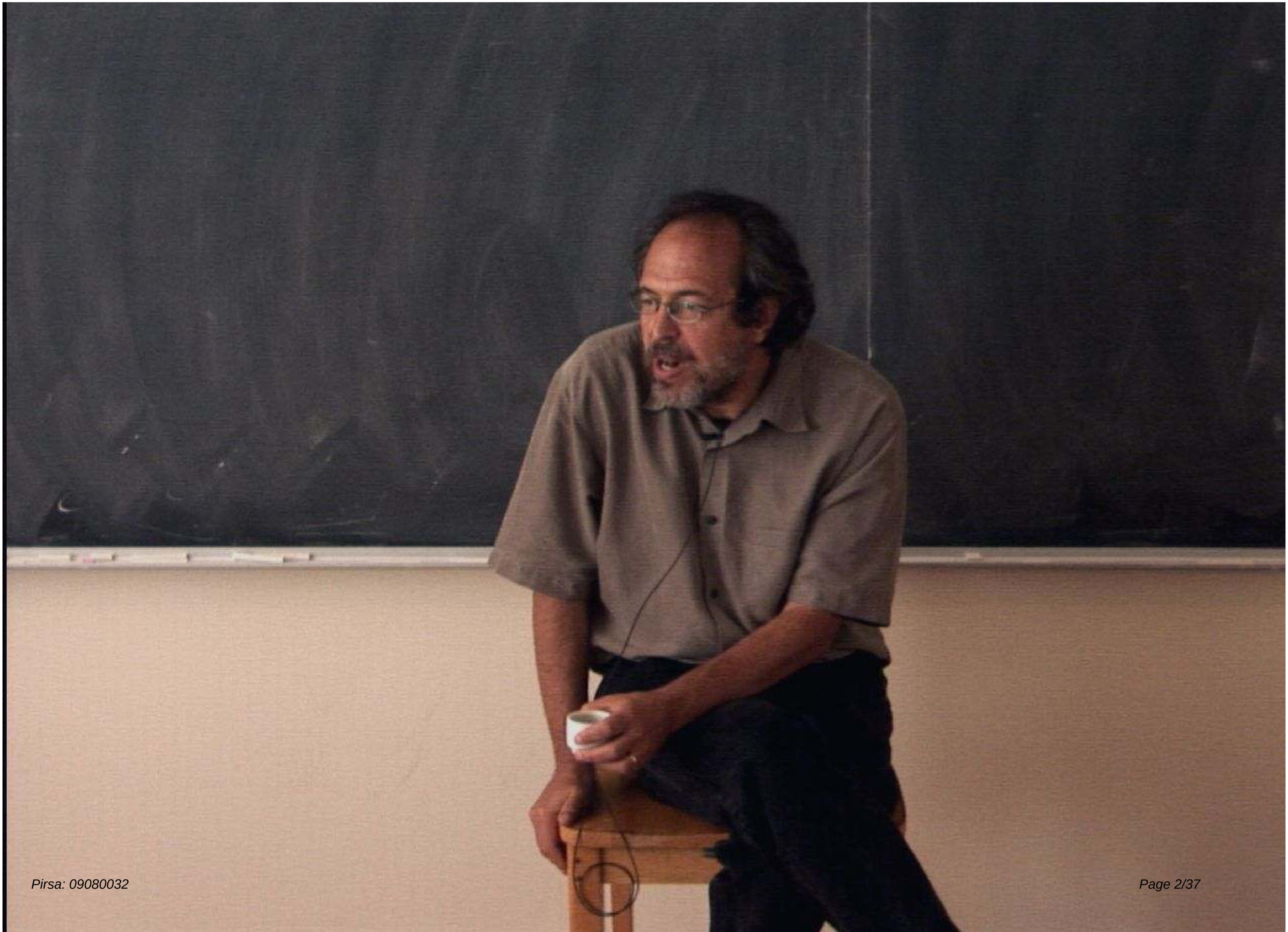
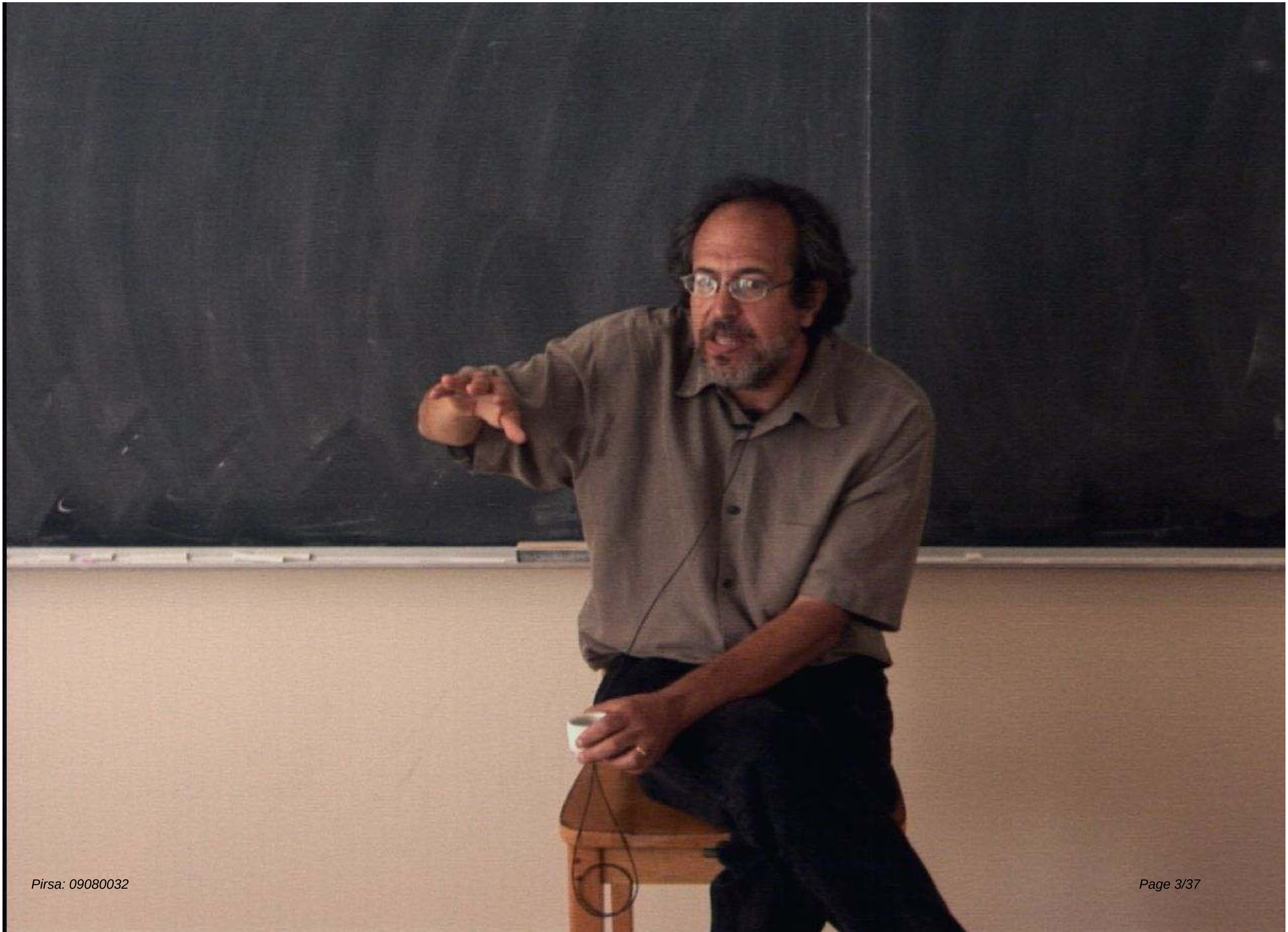
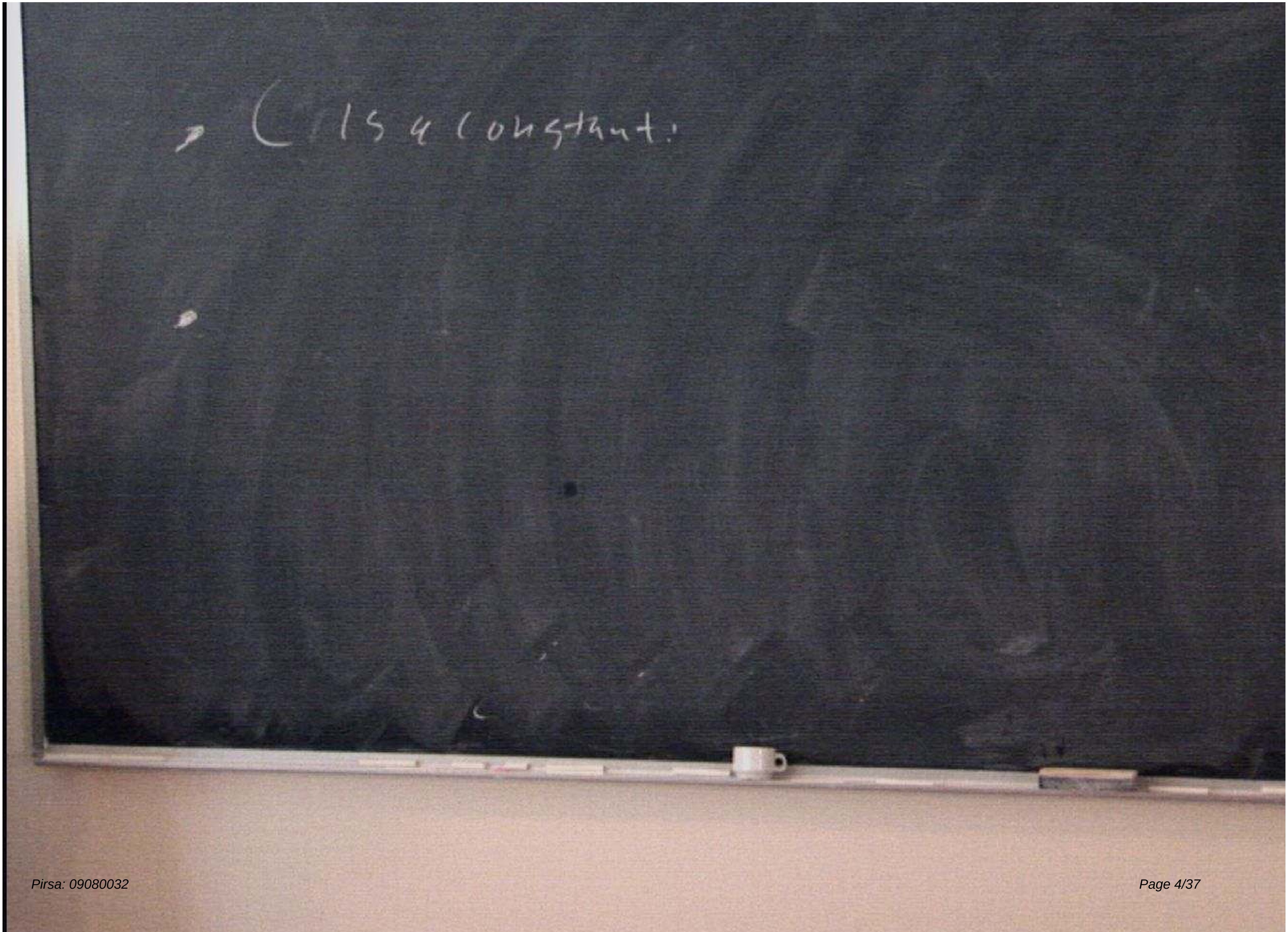
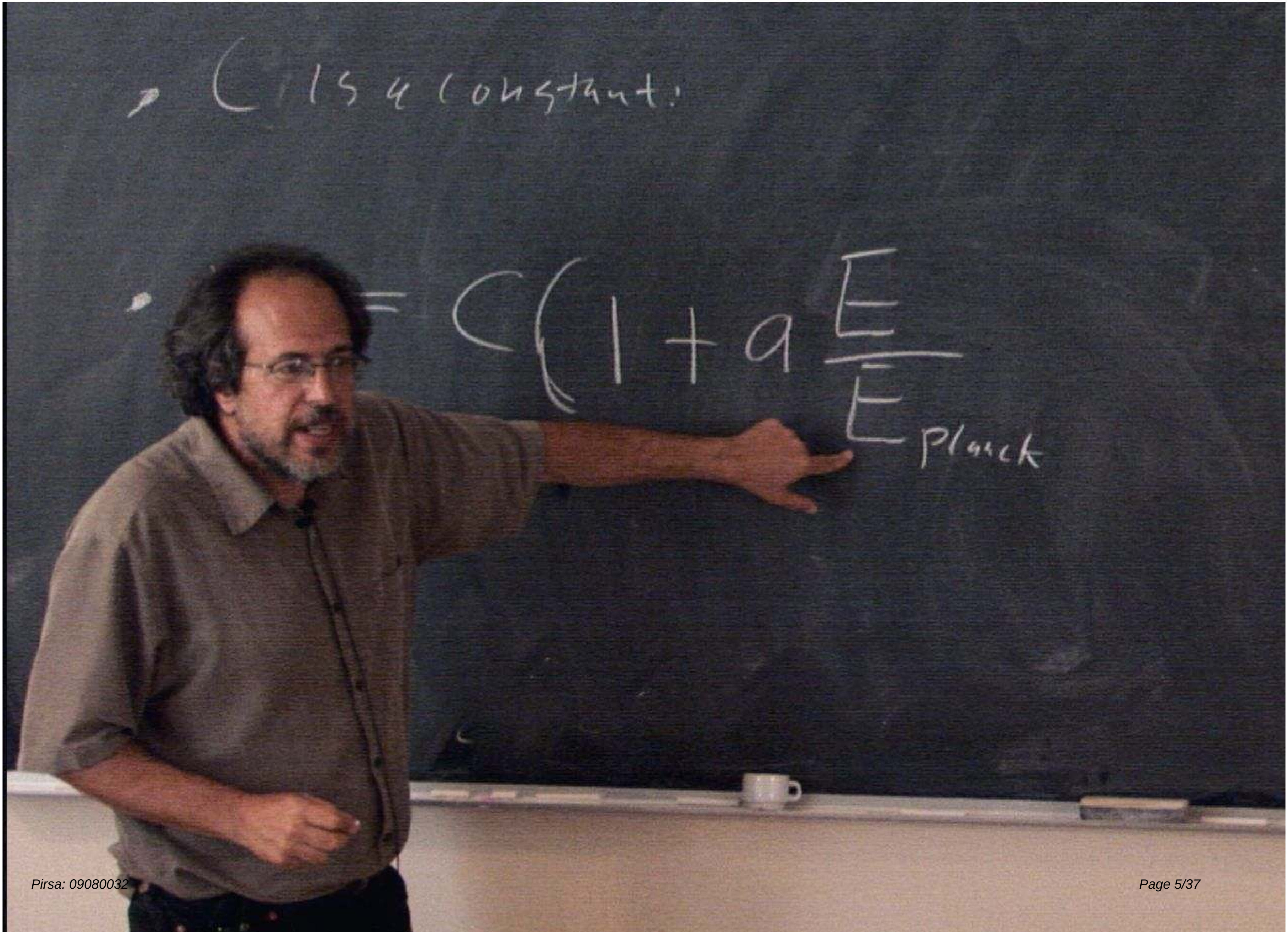
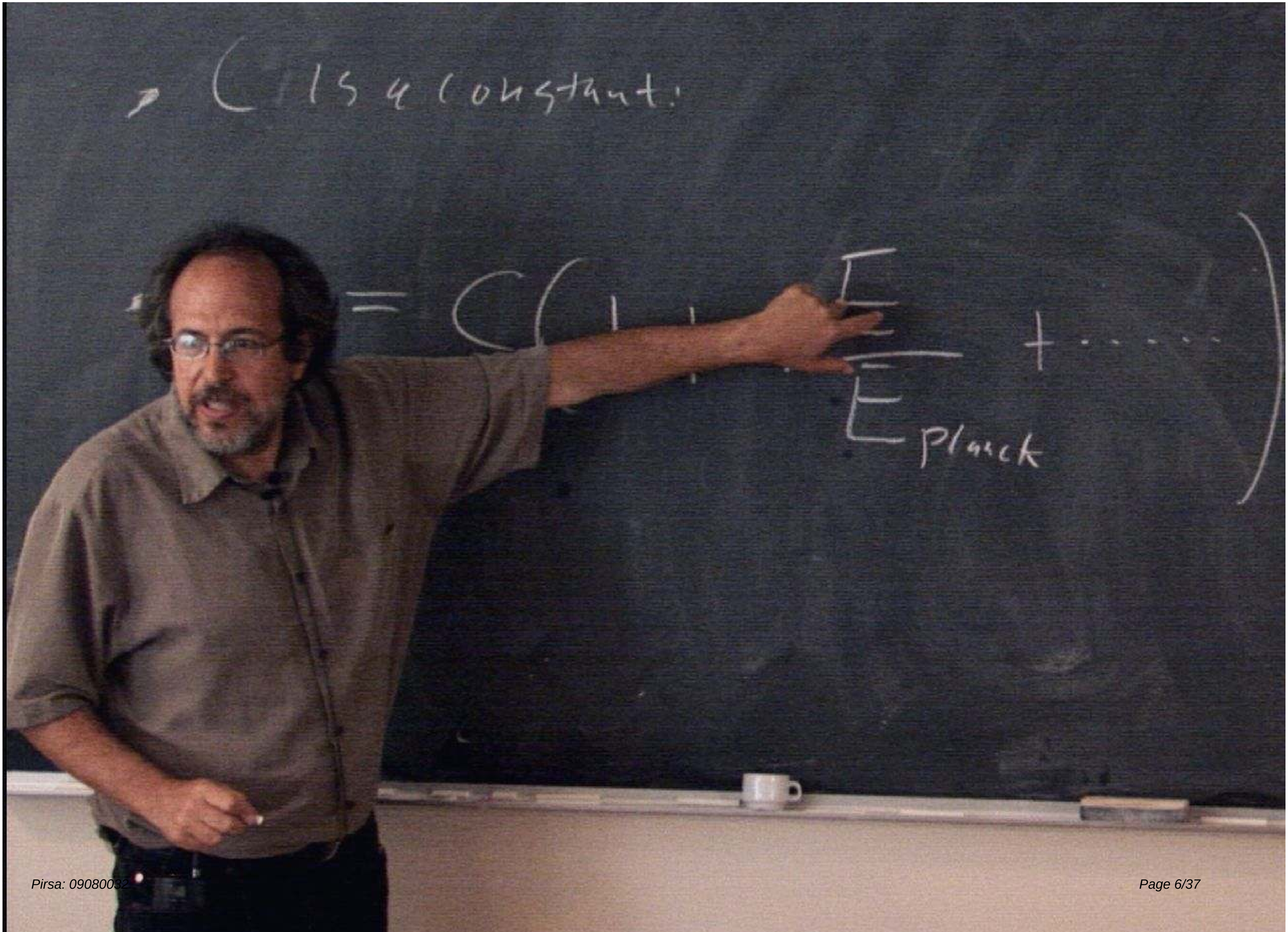
Abstract: Dr. Smolin is a faculty member at Perimeter Institute for Theoretical Physics and author of several books including most recently â€œThe Trouble with Physicsâ€•. He is known for devising several different approaches to quantum gravity, in particular, loop quantum gravity. His research interests include cosmology, elementary particle theory, the foundations of quantum mechanics, and theoretical biology. This information Chalk and Talk will explore in special topics in Quantum Gravity.






C is a constant:


C is a constant:
= C(1 + a E / E planck


C is a constant!
planck

- C is a constant:

- $$V_\gamma = C\left(1 + a\frac{E}{E_{planck}} + \cdots\cdots\right)$$

$$E_{Pl} = \sqrt{\frac{\hbar}{G c}} \sim$$

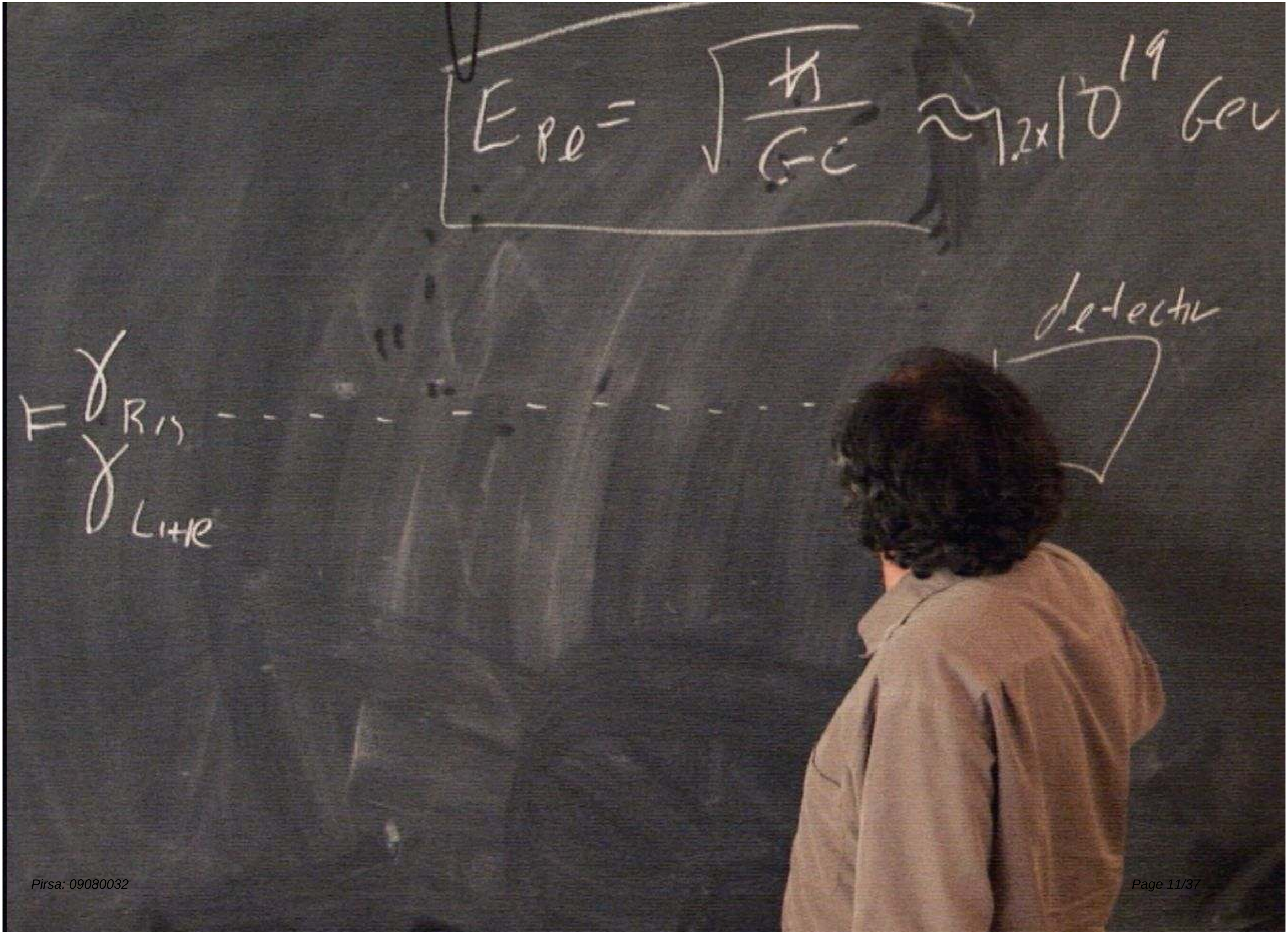
$$E_{Pl} = \sqrt{\frac{\hbar}{Gc}} \approx 1.2 \times 10^{19}\ \text{GeV}$$

s a constant!

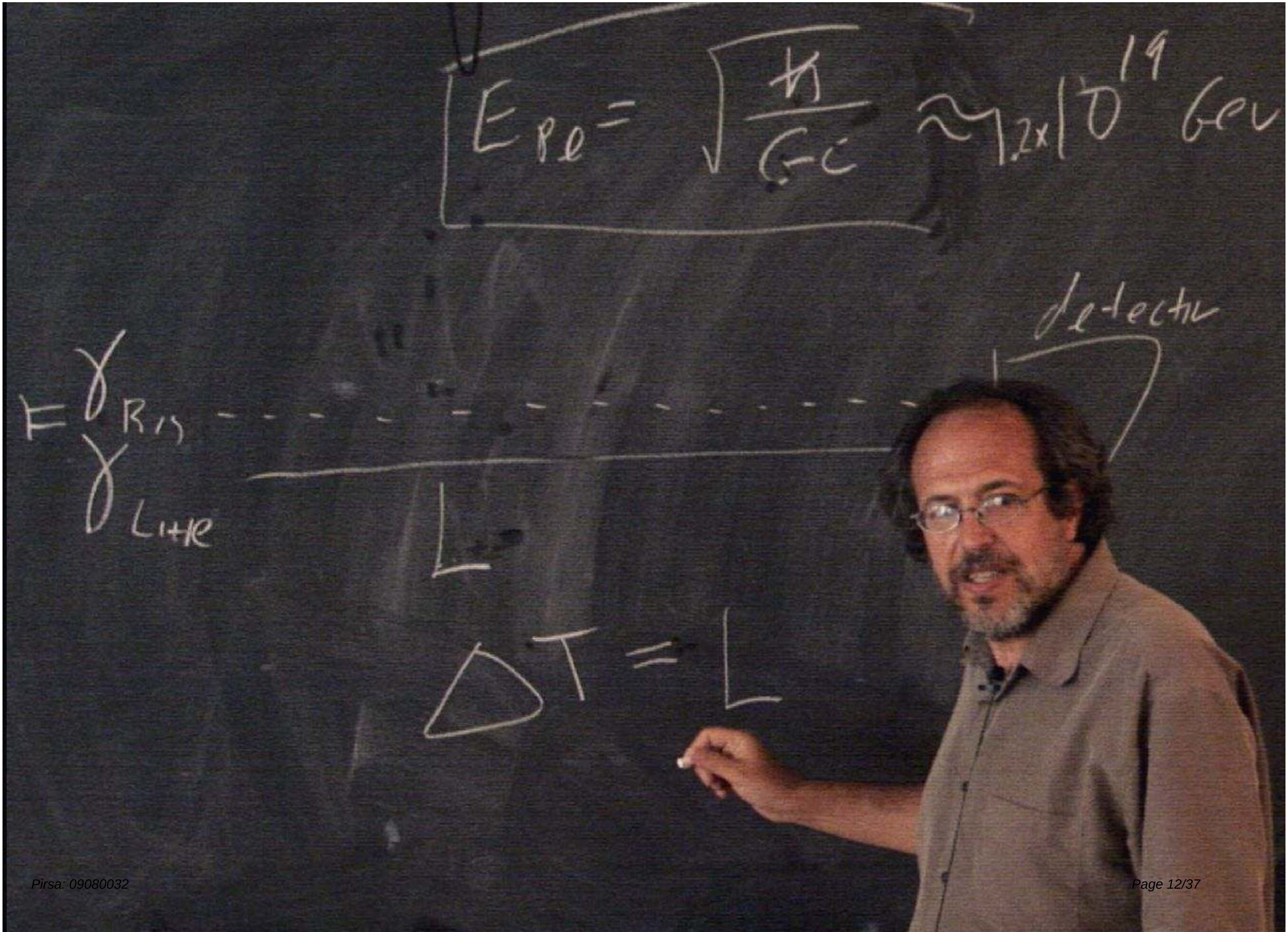
10 GeV

$$= C\left(1 + a\frac{E}{E_{planck}} + \cdots\cdots\right)$$

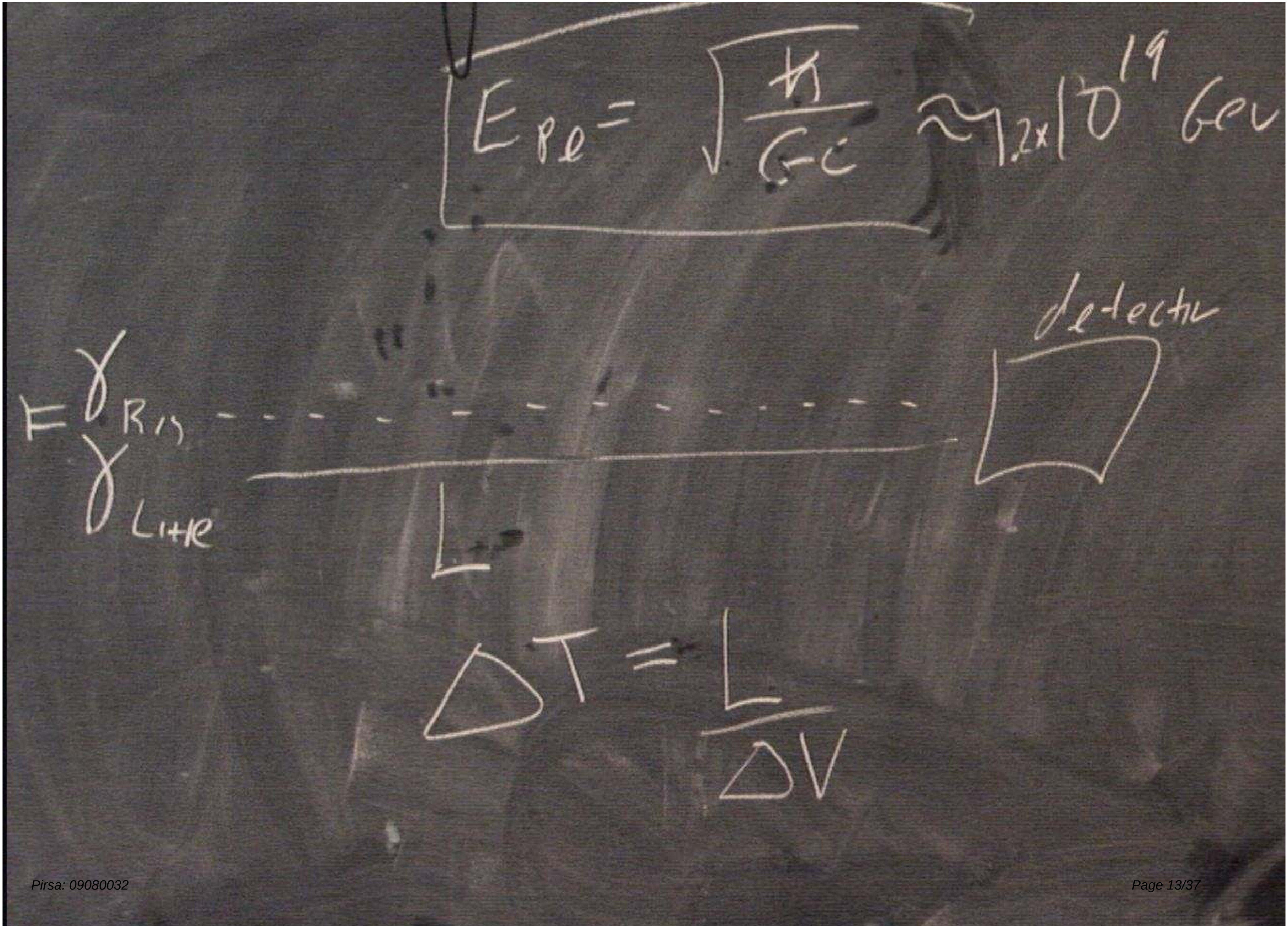
10^{-18}

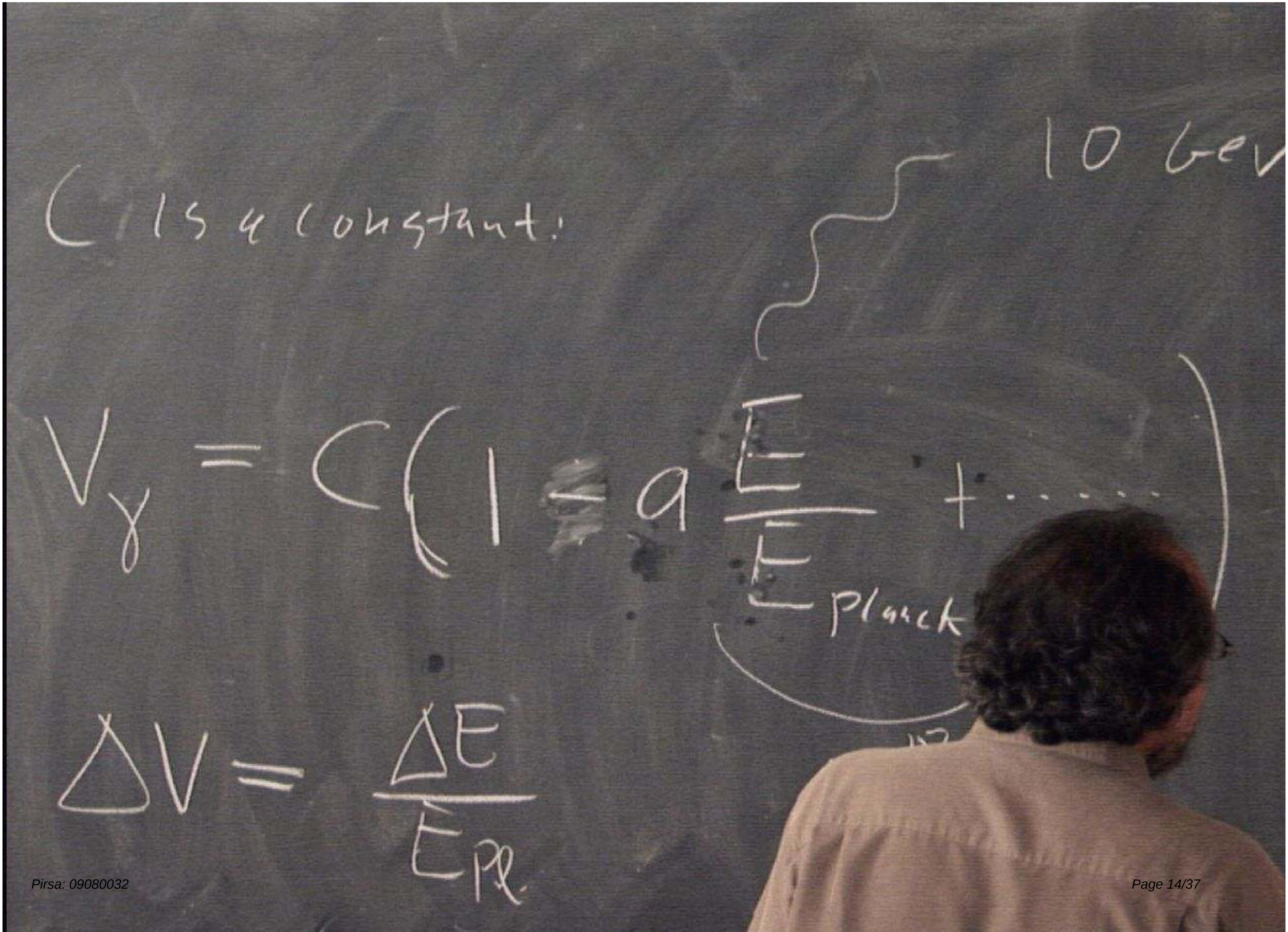


$E_{Pl} = \sqrt{\frac{\hbar}{Gc}} \approx 1.2 \times 10^{19}$ GeV
detector



$E_{Pl} = \sqrt{\frac{\hbar}{Gc}} \approx 1.2\times10^{19}$ GeV
detector
E
γ_{Rig}
γ_{Little}
L
$\Delta T = L$


E_Pl = √(ħ/Gc) ≈ 1.2×10^19 GeV
detector
E γ_Rig
γ_Lite
L
ΔT = L/ΔV


C is a constant!
10 GeV
V_γ = C((1 ± a E/E_planck + ...
ΔV = ΔE/E_Pl.

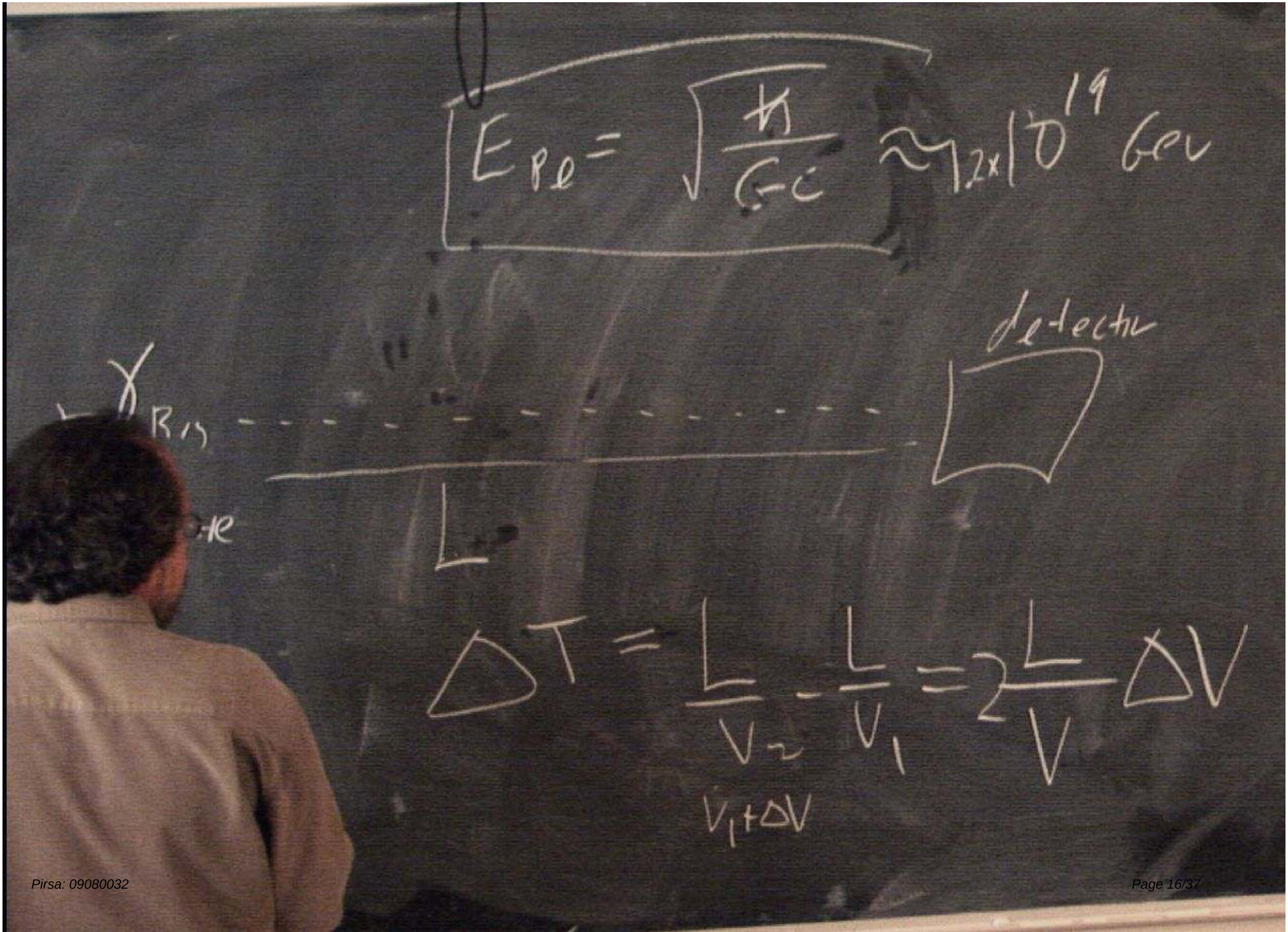
C is a constant!

10 GeV

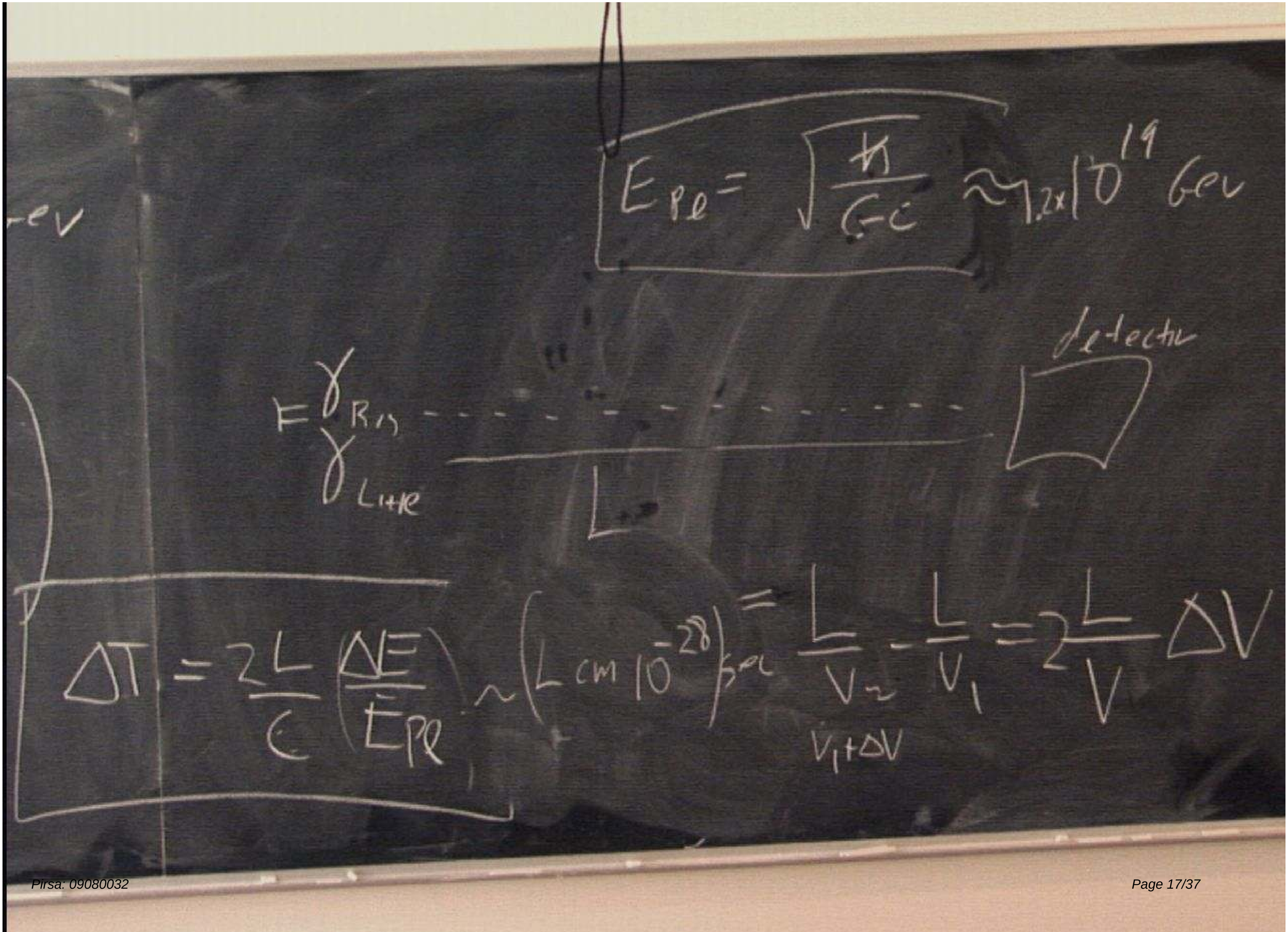
$$V_\gamma = C\left(1 + a\frac{E}{E_{planck}} + \dots\dots\right)$$

$$\Delta V = \frac{\Delta E}{E_{Pl}}$$

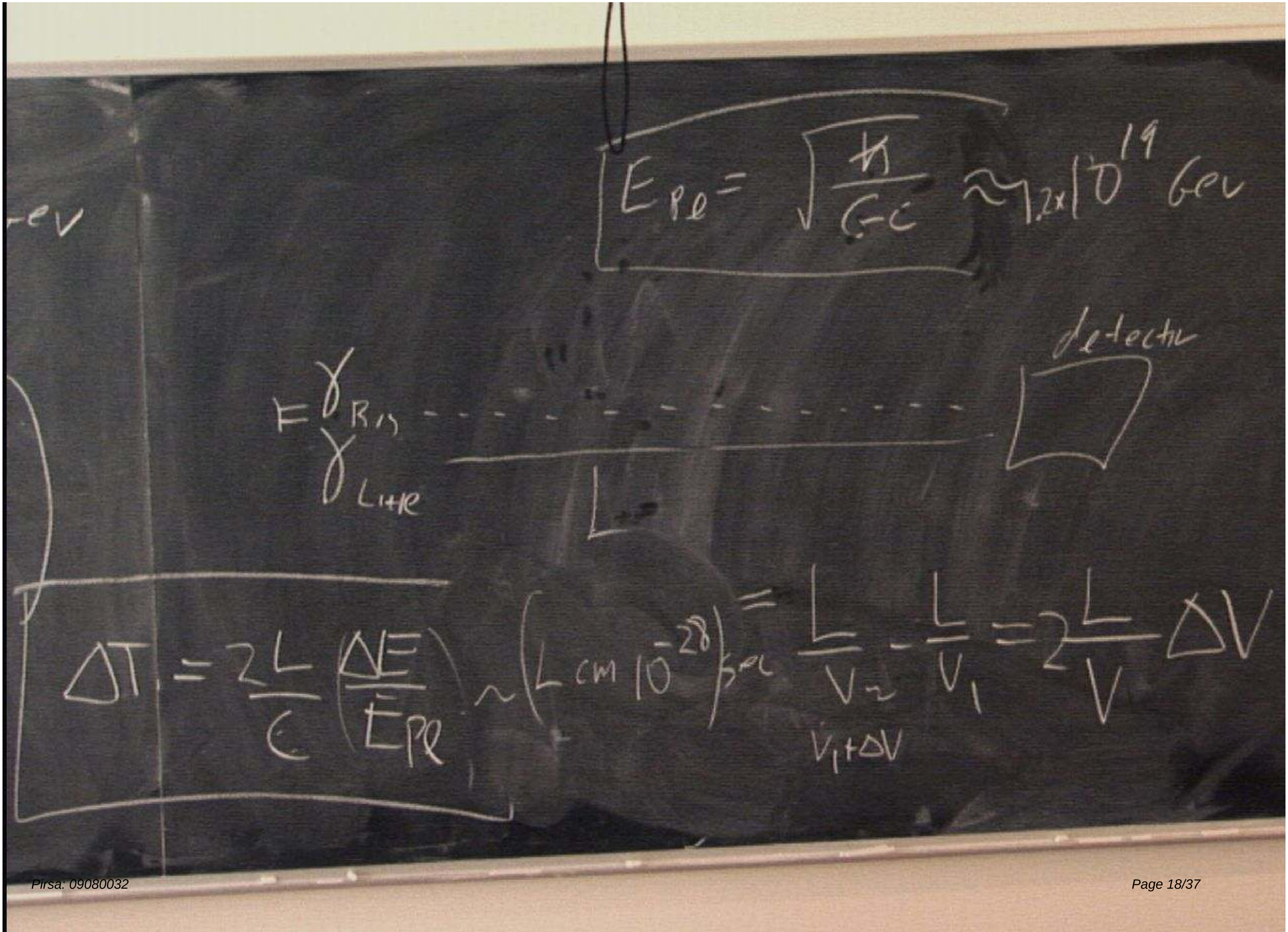
10^{-18}

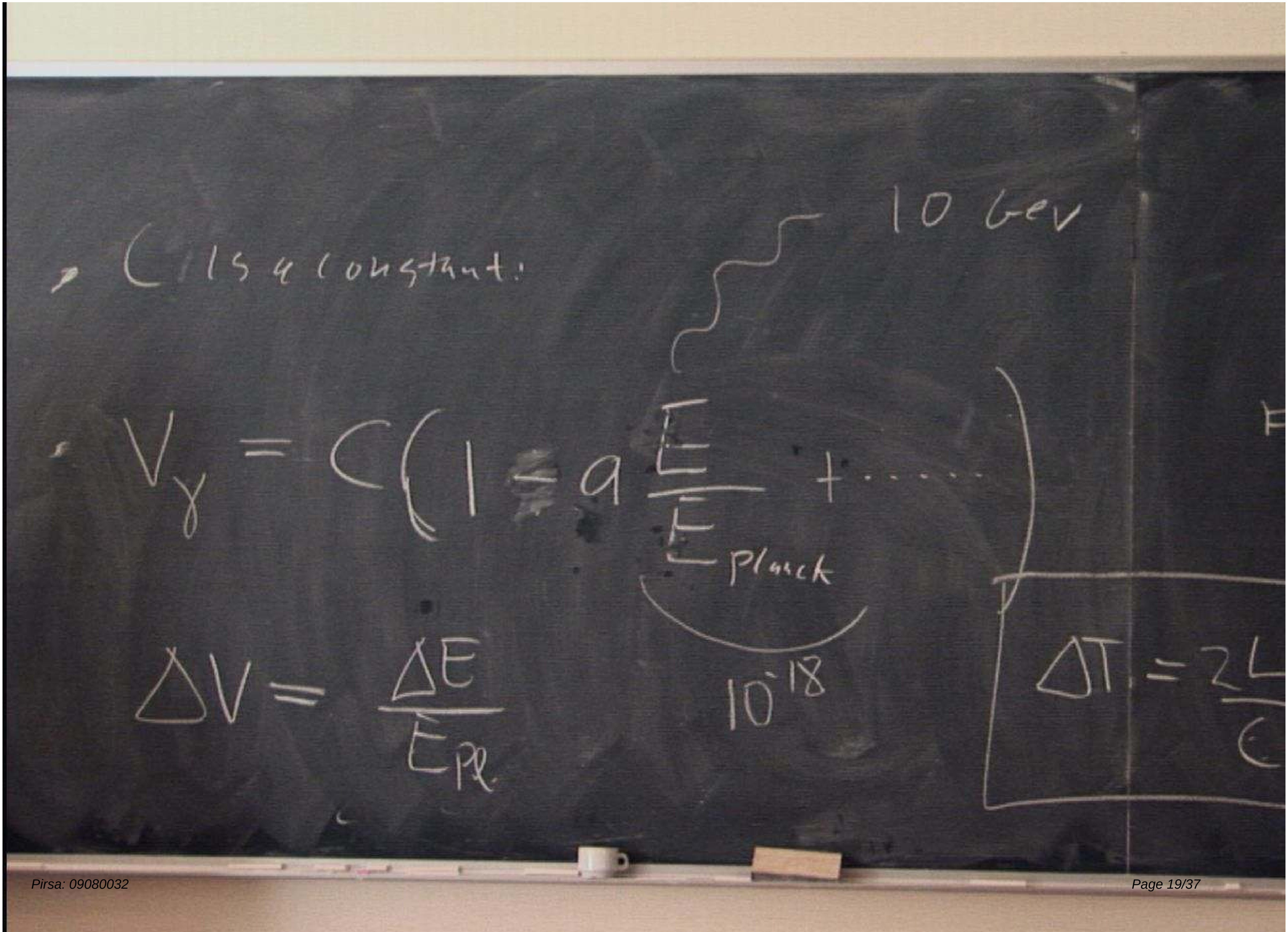


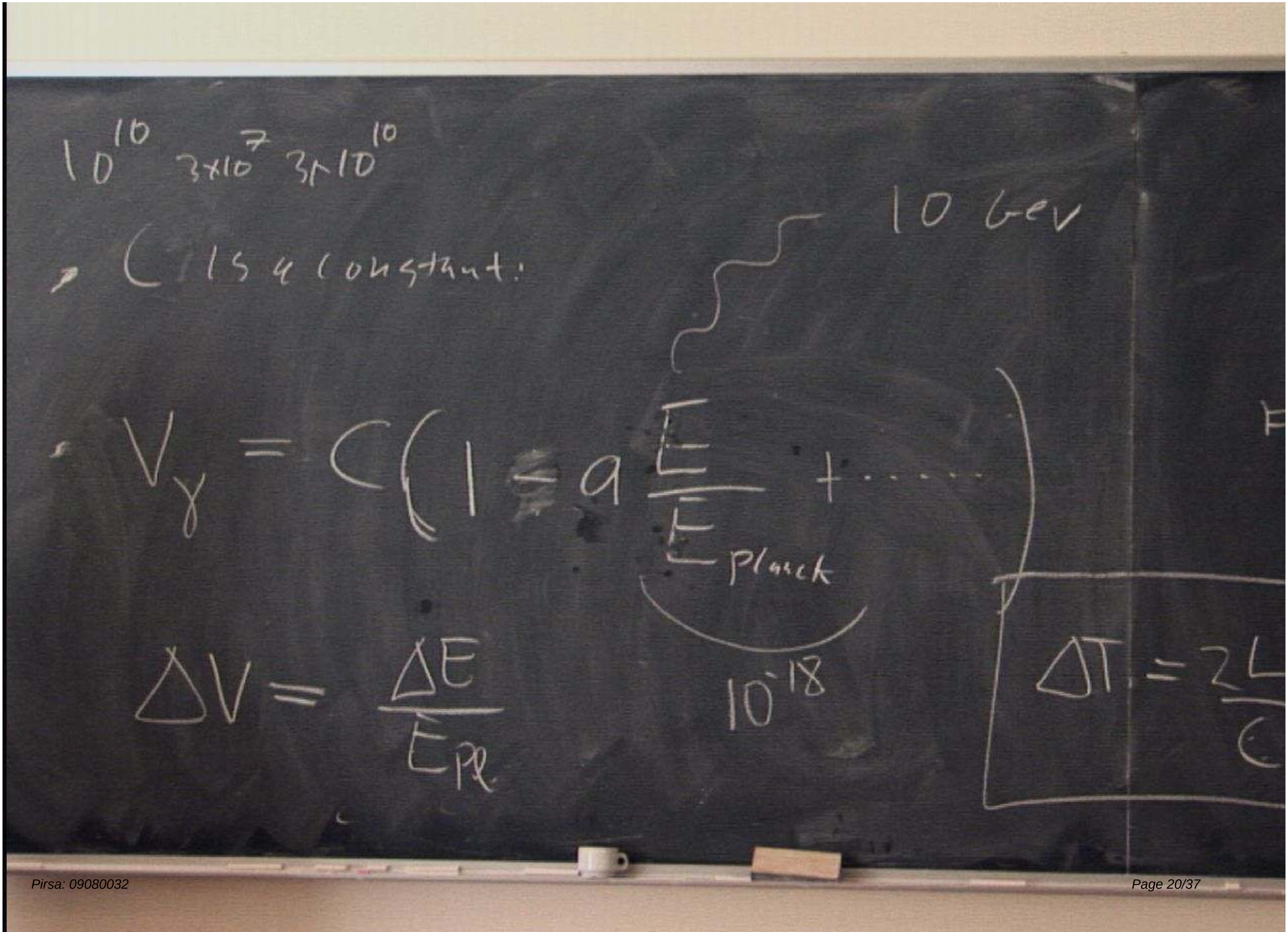
E_Pl = √(ħ/Gc) ~ 1.2×10^19 GeV
detector
L
ΔT = L/V_2 − L/V_1 = L/V² ΔV
V_1+ΔV

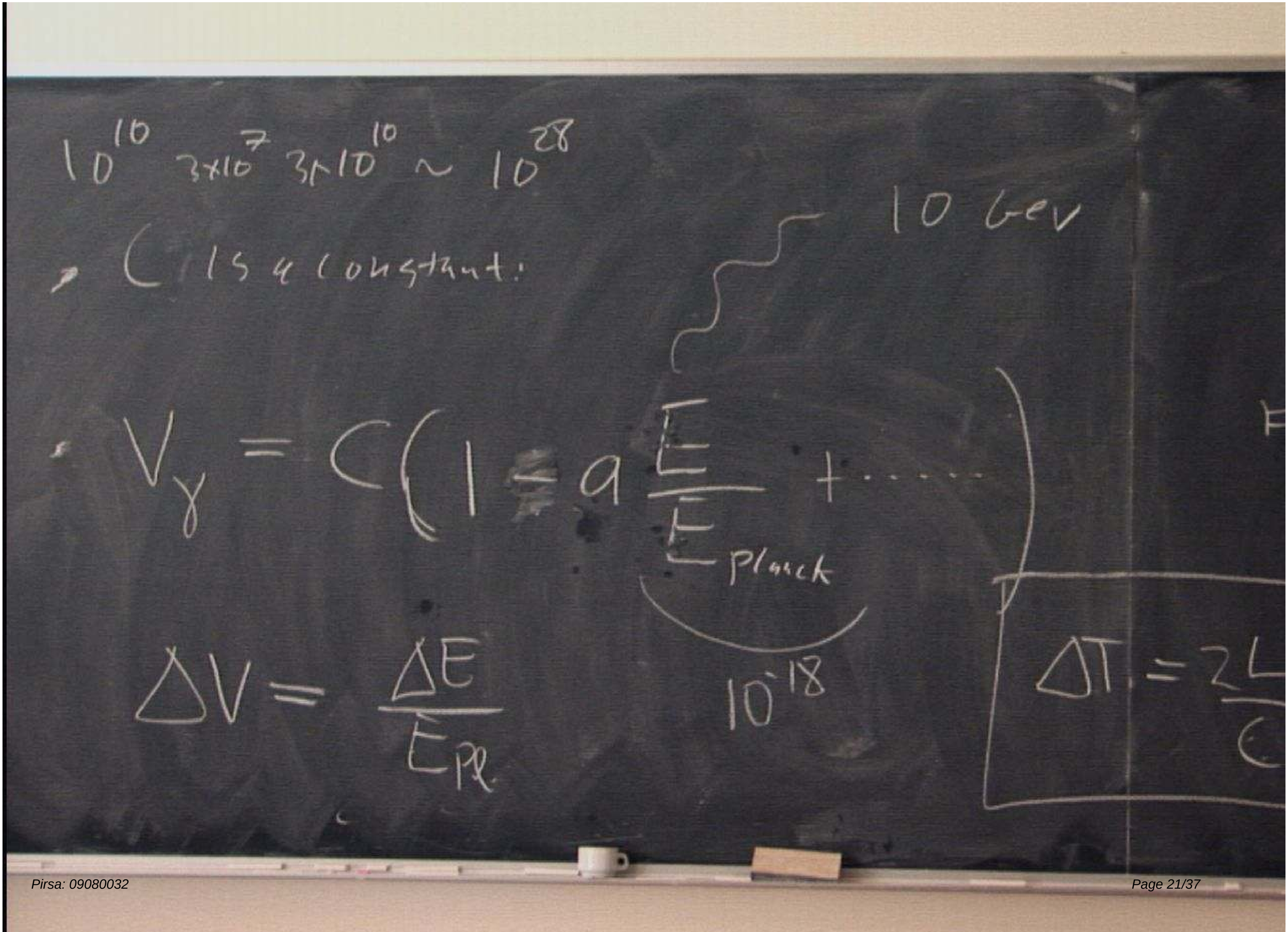


$E_{Pl} = \sqrt{\frac{\hbar}{Gc}} \approx 1.2 \times 10^{19}$ GeV
detector
E
γ_{Little}
L
$\Delta T = \frac{2L}{c}\left(\frac{\Delta E}{E_{Pl}}\right) \sim \left(L\,\mathrm{cm}\,10^{-28}\right)$ sec $= \frac{L}{V_2} - \frac{L}{V_1} = 2\frac{L}{V}\Delta V$
$V_1 + \Delta V$

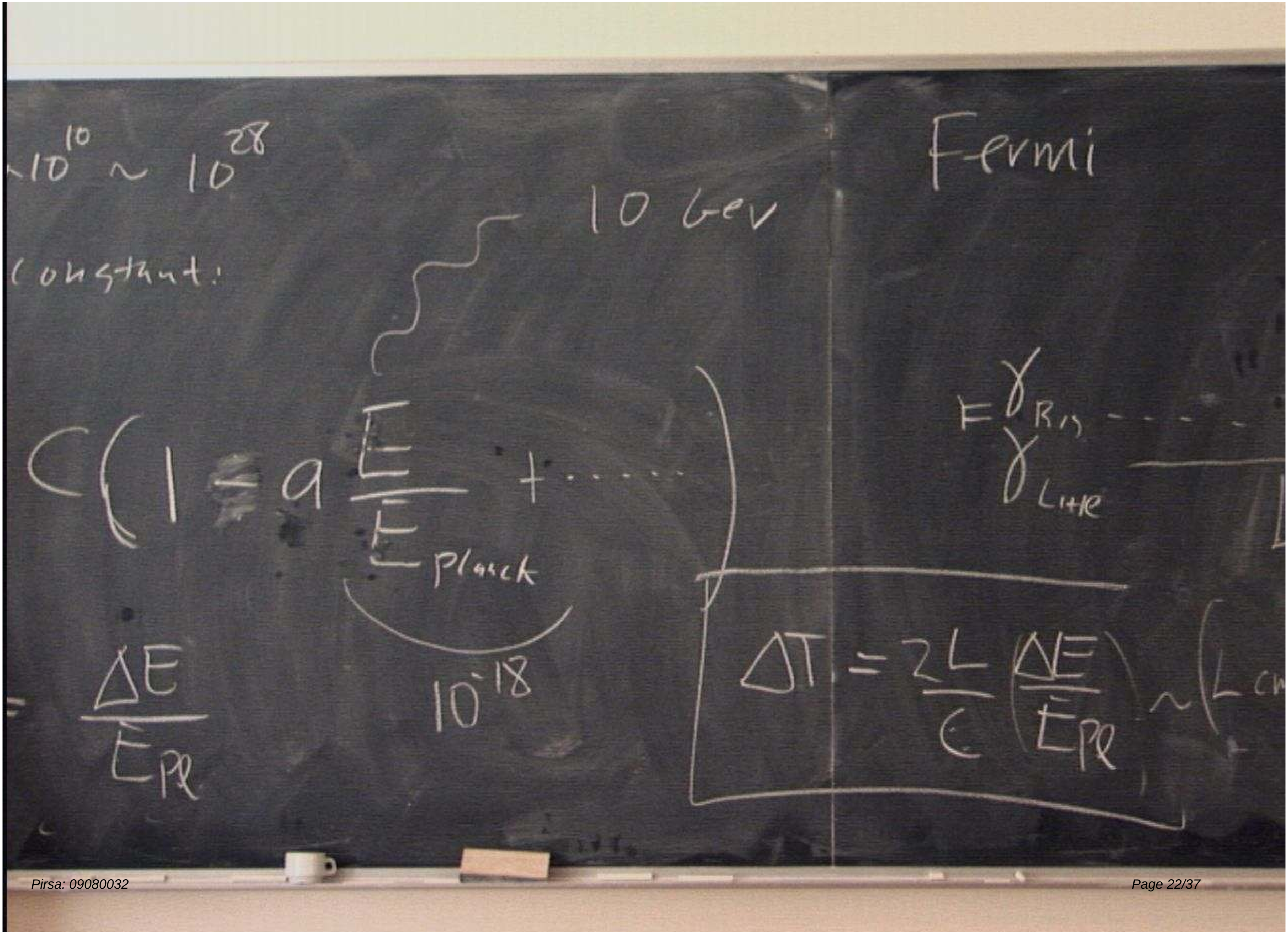

eV
E_Pl = √(ħ/Gc) ≃ 1.2×10^19 GeV
detector
E
γ_Rig
γ_Lite
L
ΔT = 2L/c (ΔE/E_Pl) ~ (L cm 10^-28) sec = L/V_2 − L/V_1 = 2 L/V ΔV
V_1+ΔV

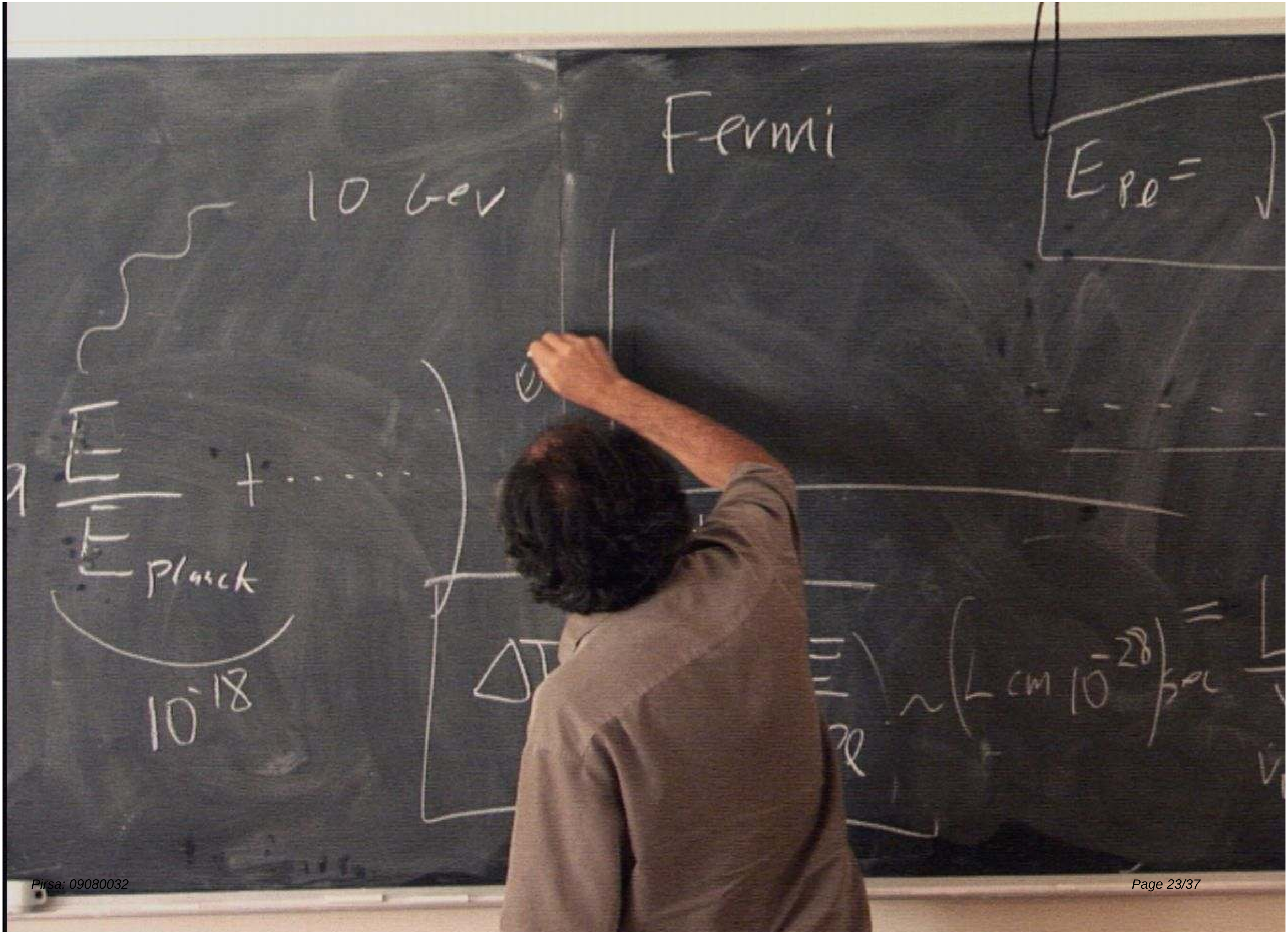

C is a constant:
10 GeV
$V_\gamma = C(1 - a \frac{E}{E_{planck}} + \ldots)$
$\Delta V = \frac{\Delta E}{E_{Pl}}$
10^{-18}
$\Delta T = 2$

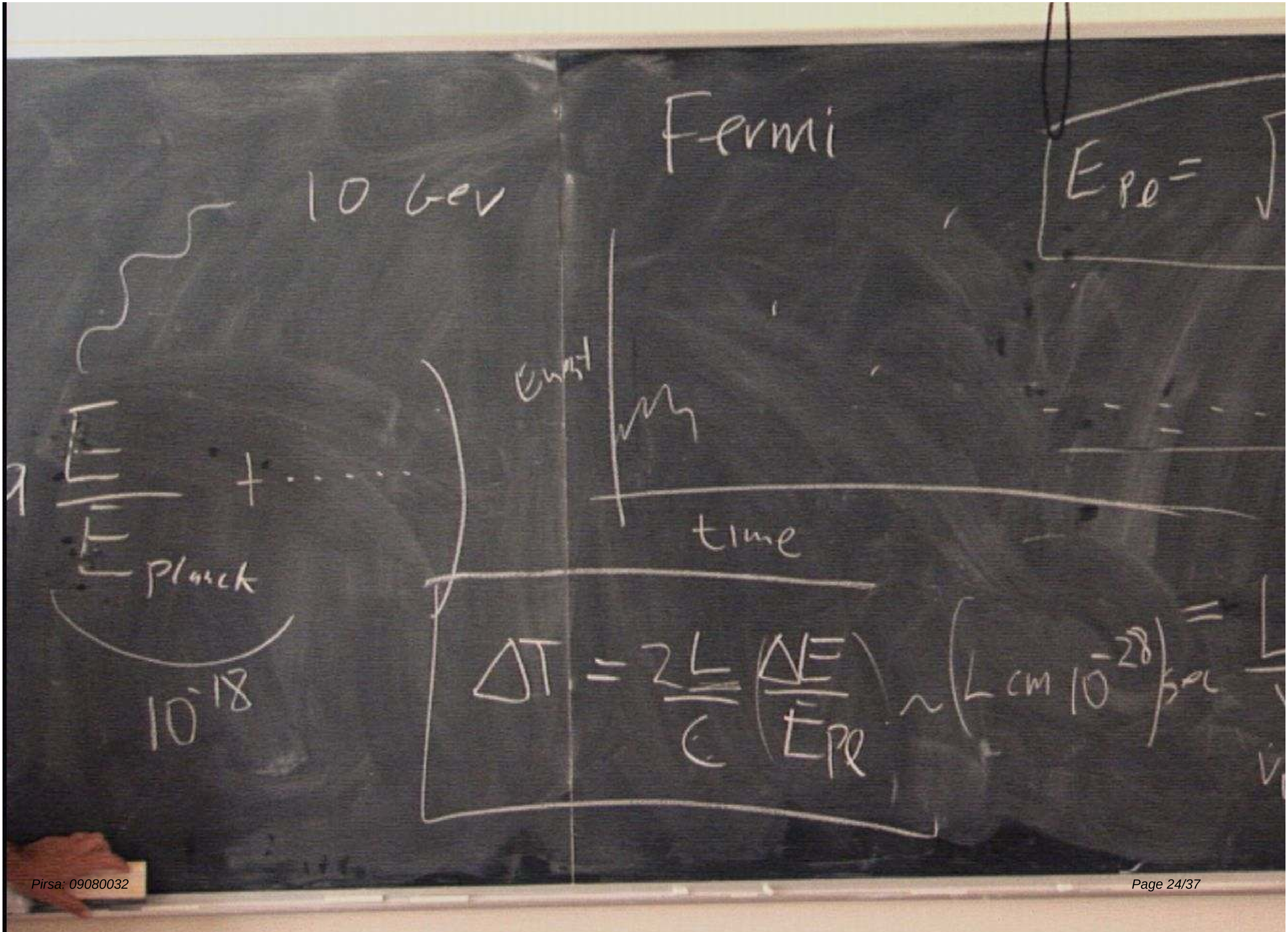

10^{10} 3×10^{7} 3×10^{10}
10 GeV
C is a constant:
$V_\gamma = C\left(1 - a\frac{E}{E_{planck}} + \ldots\right)$
10^{-18}
$\Delta V = \frac{\Delta E}{E_{Pl}}$

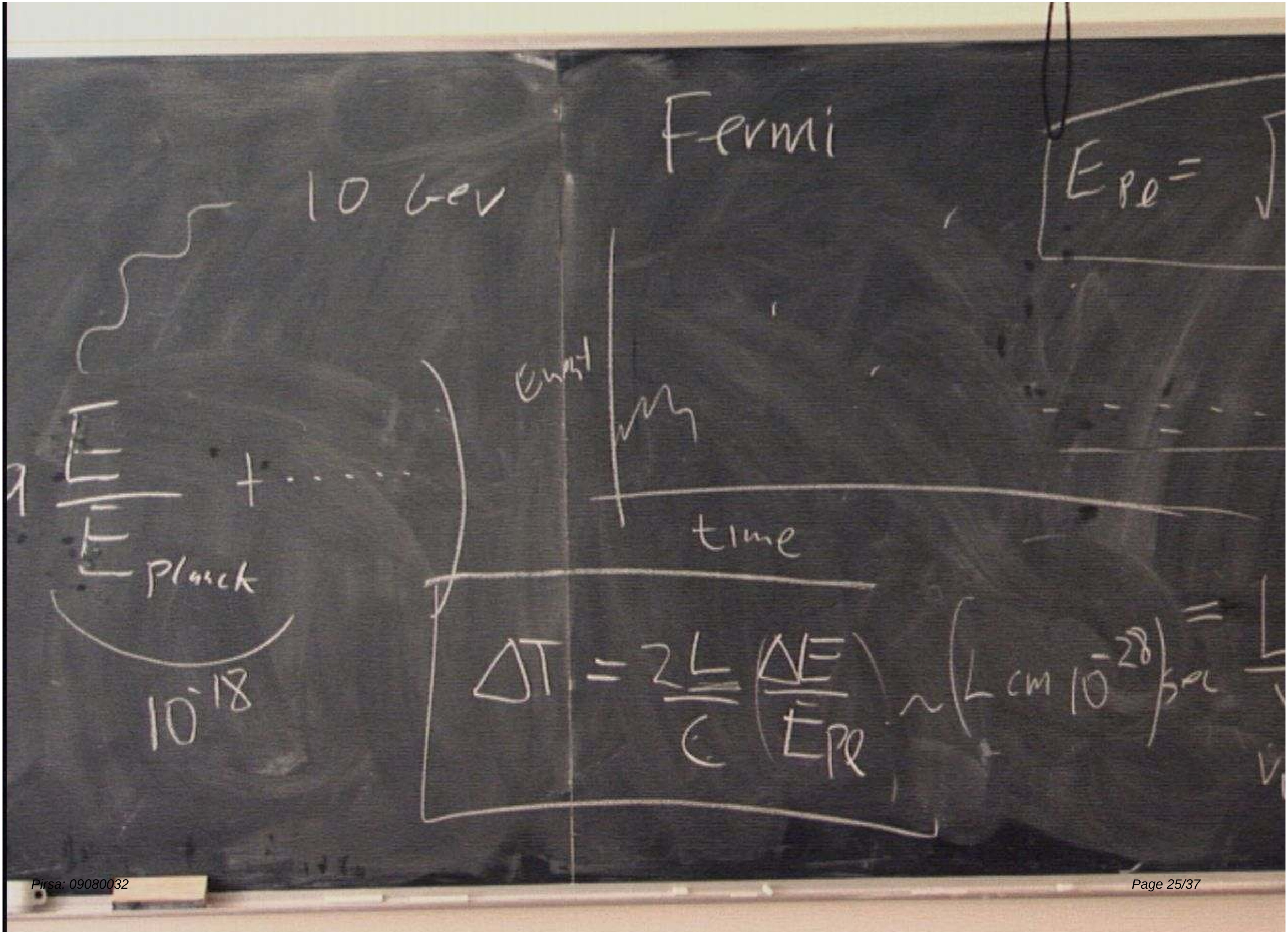


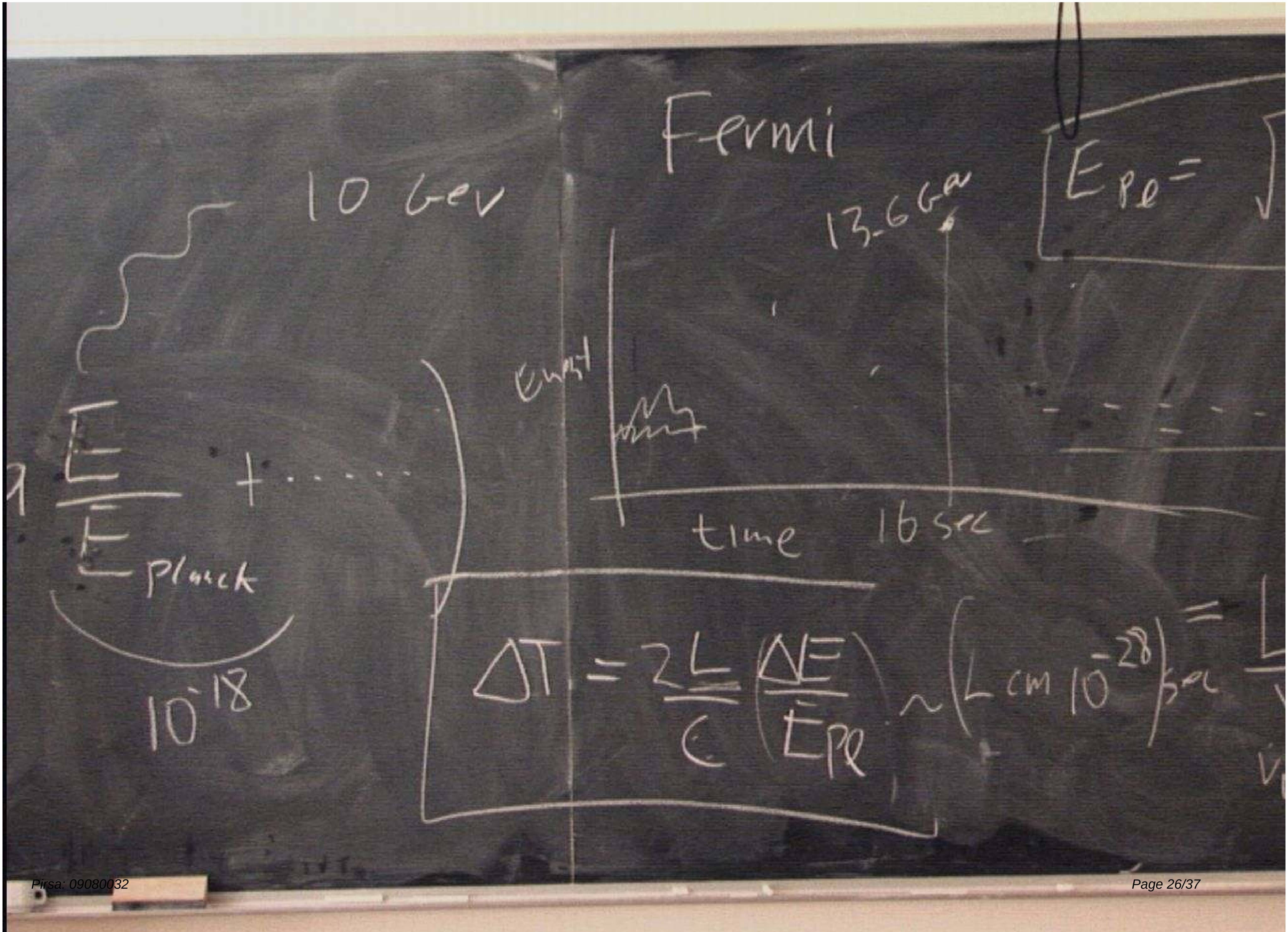
10^10 3x10^7 3x10^10 ~ 10^28
c is a constant:
V_γ = c(1 ± a E/E_planck + ...)
10 GeV
ΔV = ΔE/E_Pl
10^-18
ΔT = 2L

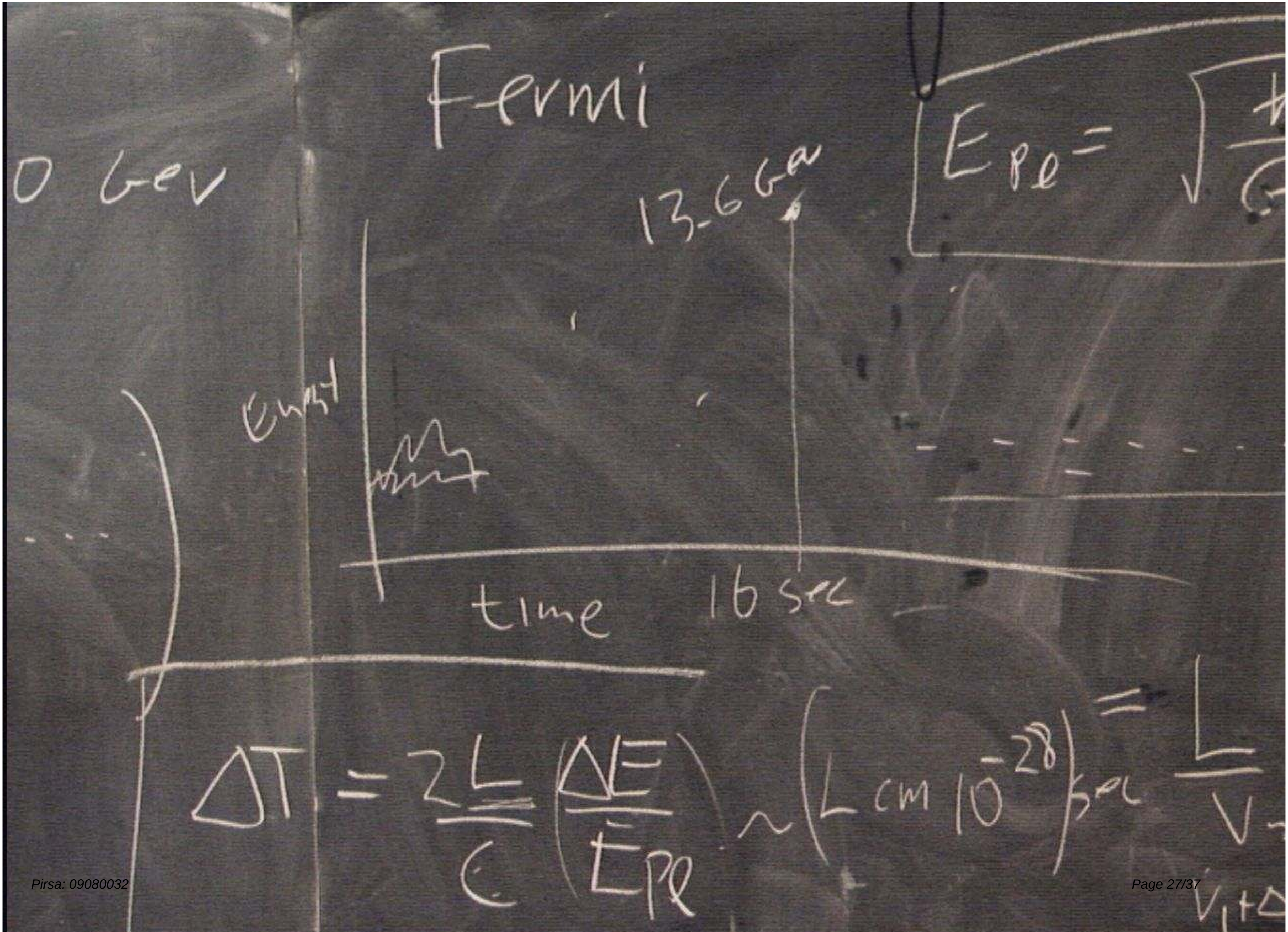

10^10 ~ 10^28
constant:
10 GeV
Fermi
C(1 a E/E_planck + ...)
ΔE/E_Pl
10^-18
ΔT = 2L/c (ΔE/E_Pl)

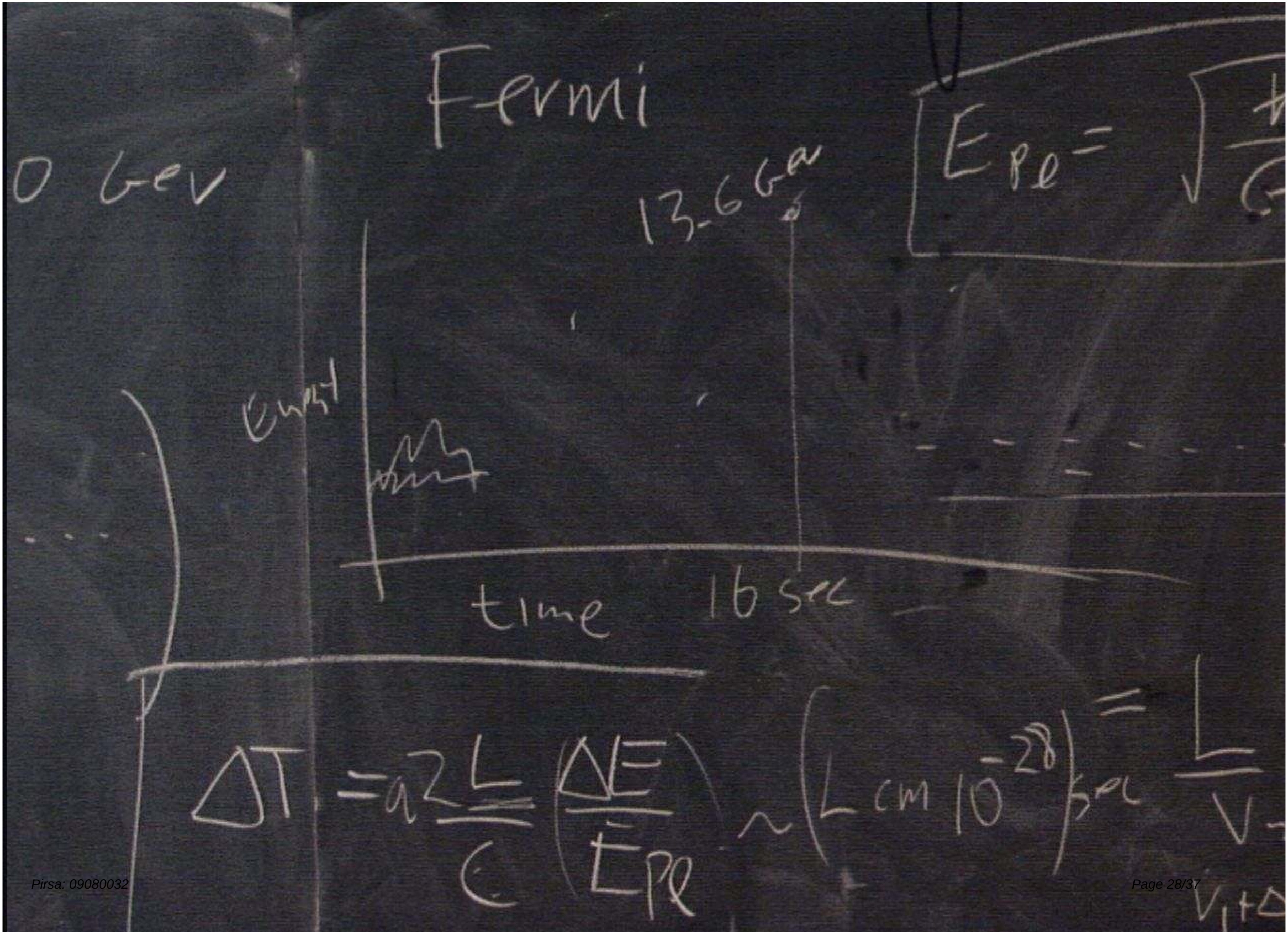

Fermi
10 Gev
planck
10-18

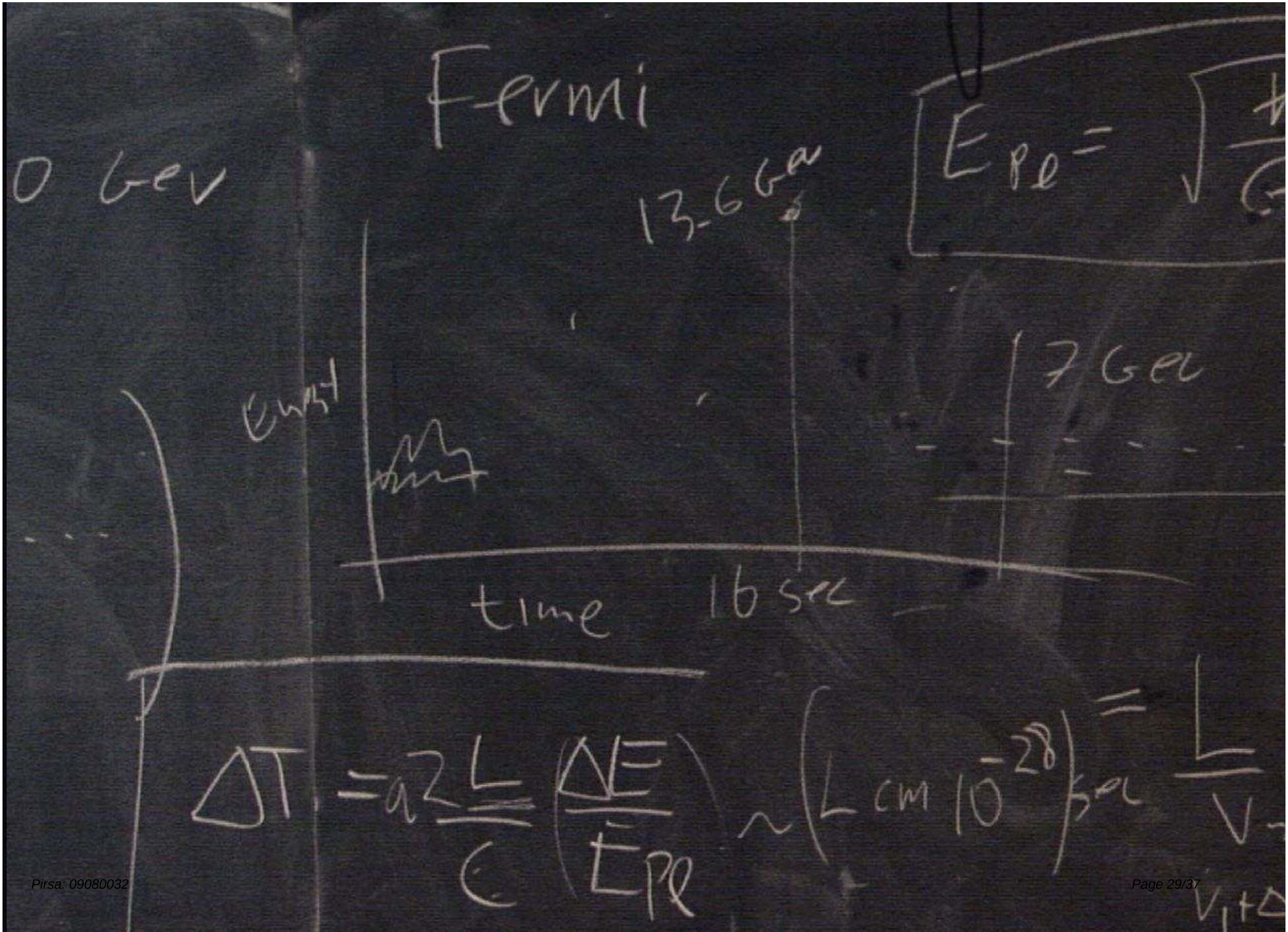

10 GeV
Fermi
E_pl =
Energy
time
E planck
10^-18
ΔT = 2L/c (ΔE/E_pl) ~ (L cm 10^-28) sec

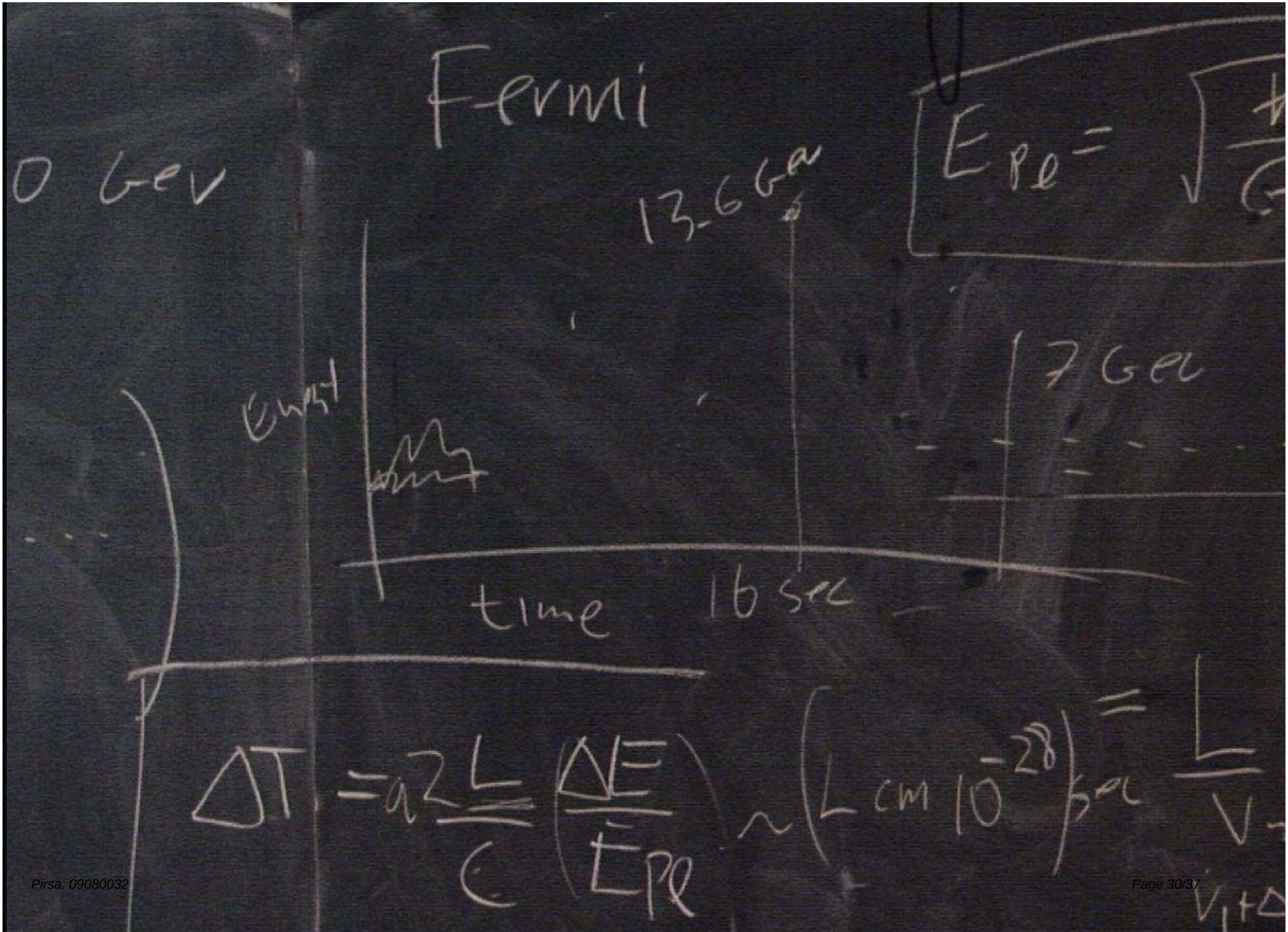

10 GeV
Fermi
$E_{Pl} = \sqrt{}$
Energy
time
$\frac{E}{E_{planck}} + \dots$
10^{-18}
$\Delta T = \frac{2L}{c}\left(\frac{\Delta E}{E_{Pl}}\right) \sim \left(L\,cm\,10^{-28}\right) sec$

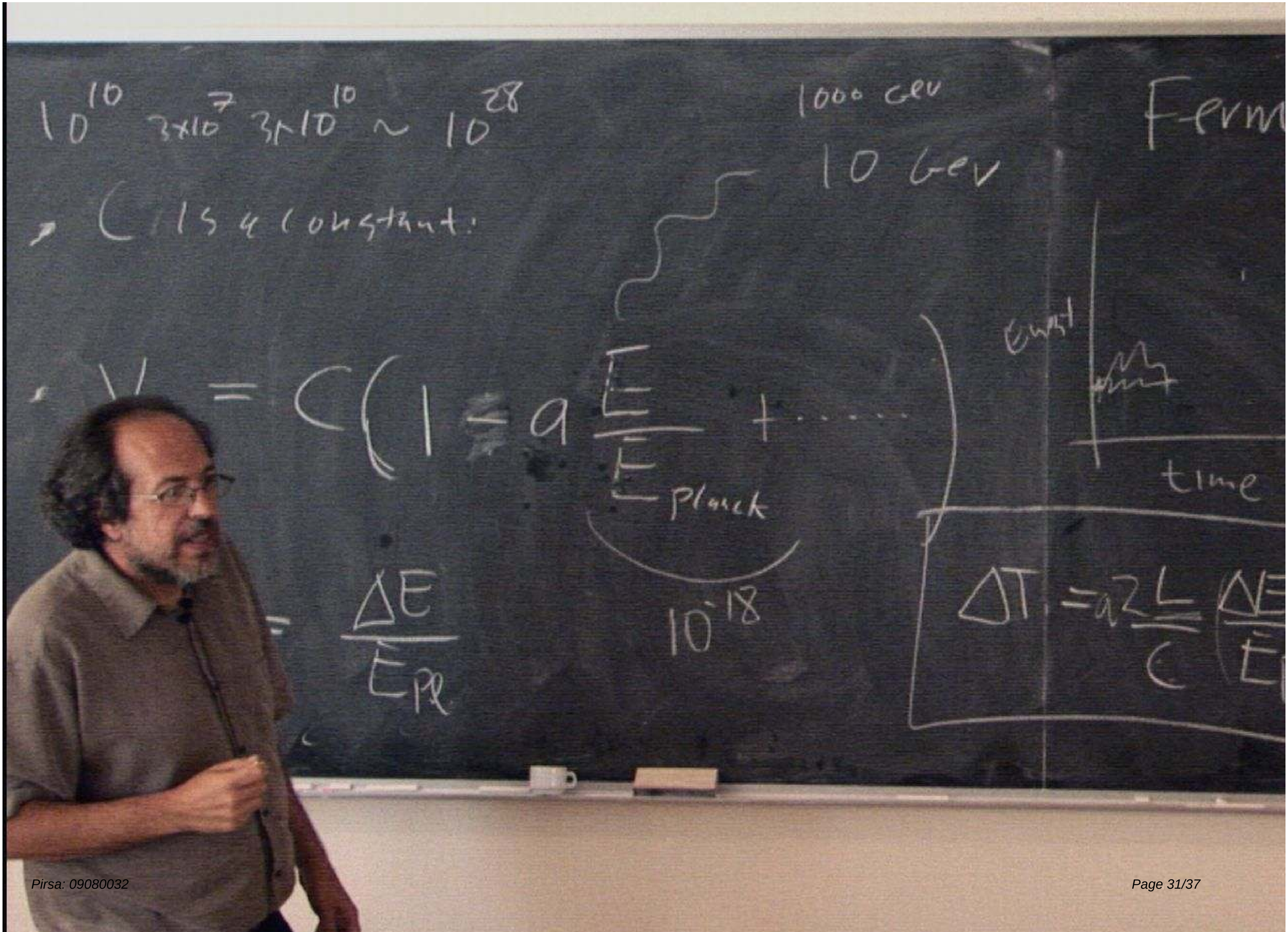

Fermi
10 GeV
13.6 GeV
time
16 sec
planck
10^{-18}
$E_{Pl} =$
$\Delta T = \frac{2L}{c}\left(\frac{\Delta E}{E_{Pl}}\right) \sim \left(L\,\mathrm{cm}\,10^{-28}\right)\mathrm{sec}$

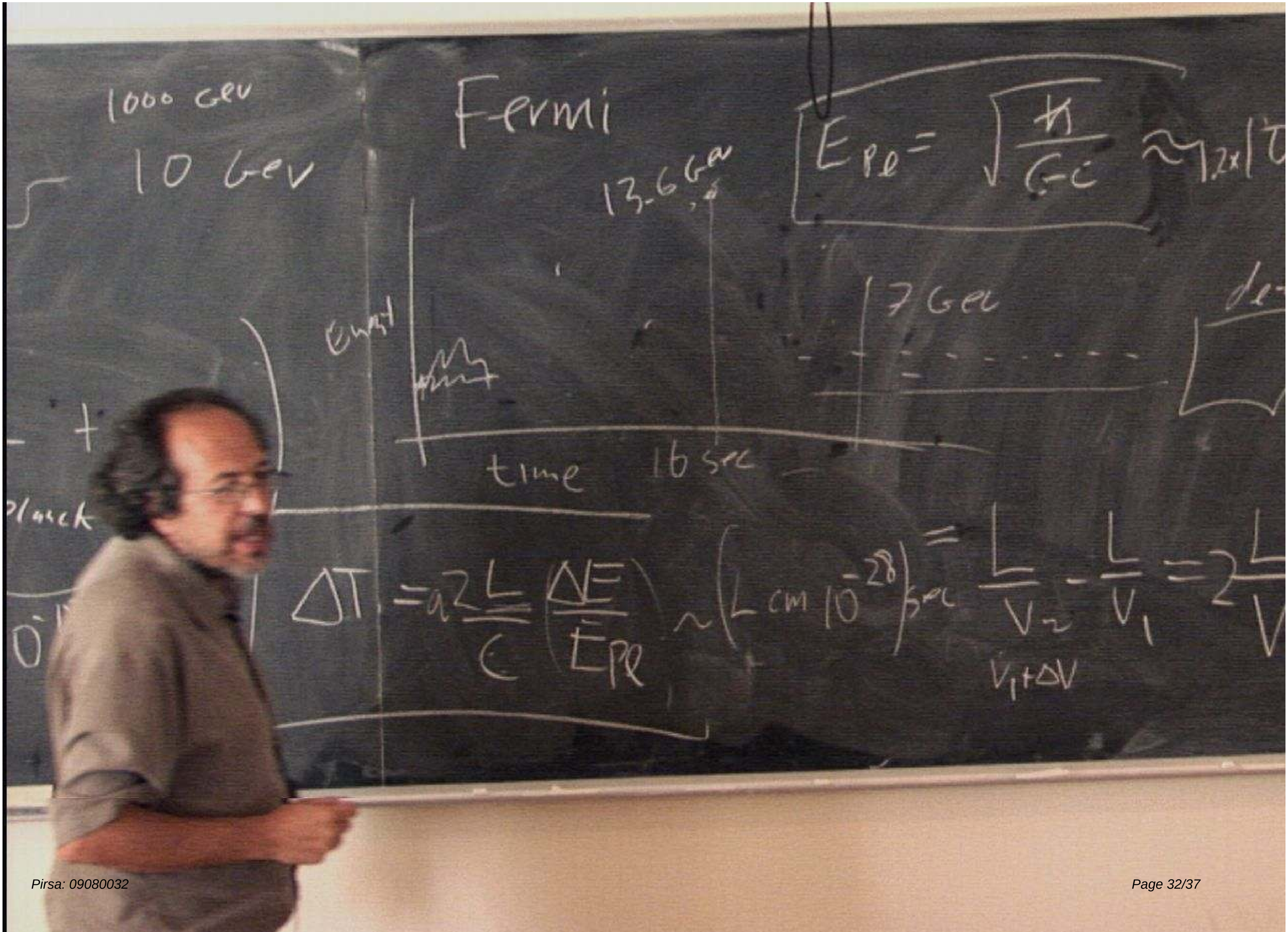

Fermi
0 GeV
13.6 GeV
time
16 sec
ΔT = 2L/c (ΔE/E_Pl) ~ (L cm 10^-28) sec

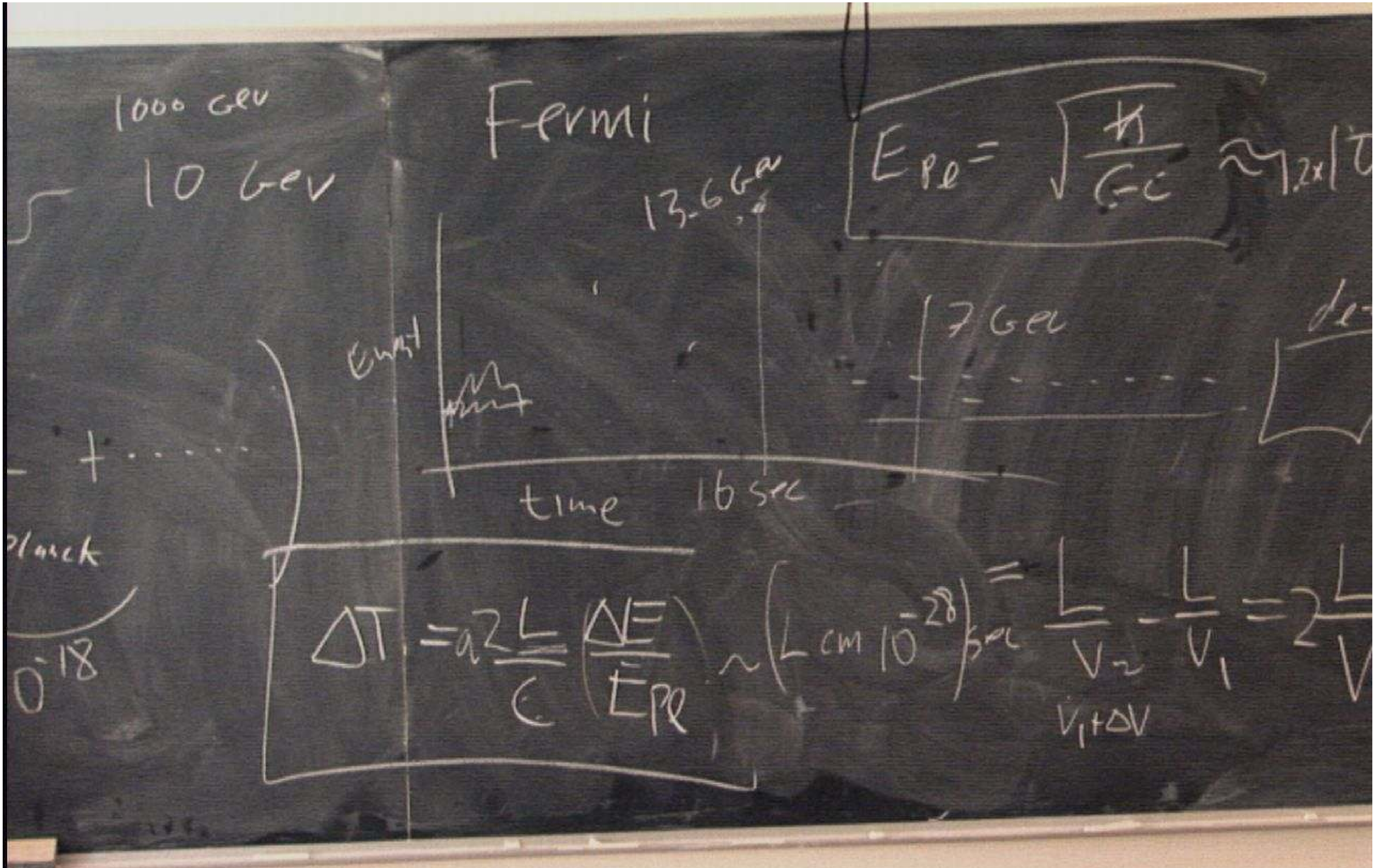

Fermi
0 GeV
13.6 GeV
Energy
time
16 sec
$E_{Pl} = \sqrt{\quad}$
$\Delta T = a2 \frac{L}{c} \left(\frac{\Delta E}{E_{Pl}}\right) \sim (L\,cm\,10^{-28})\,sec = \frac{L}{V}$

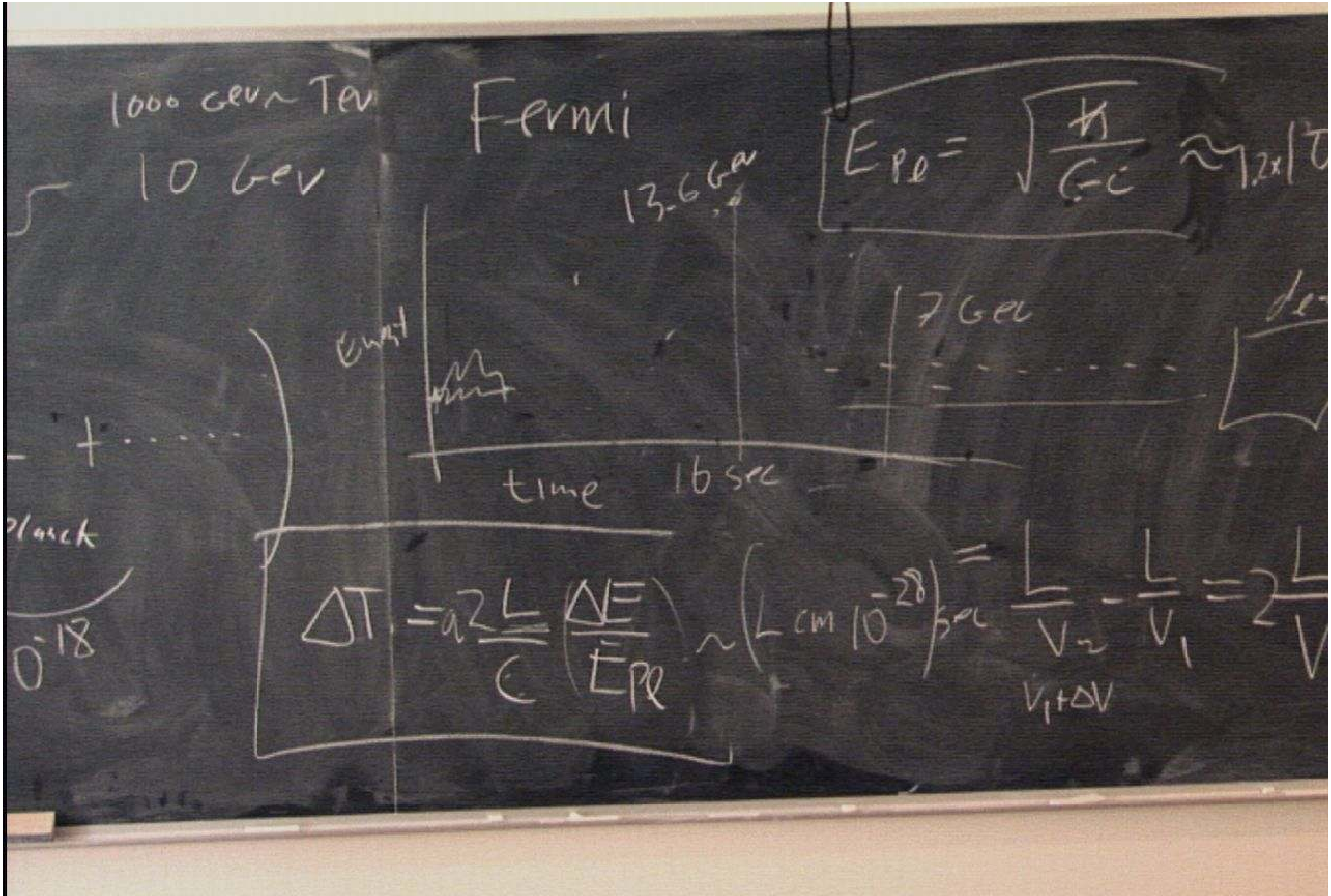

Fermi
0 GeV
13.6 GeV
Energy
time
16 sec
7 GeV
ΔT = a2 L/c (ΔE/E_Pl) ~ (L cm 10^-28) sec

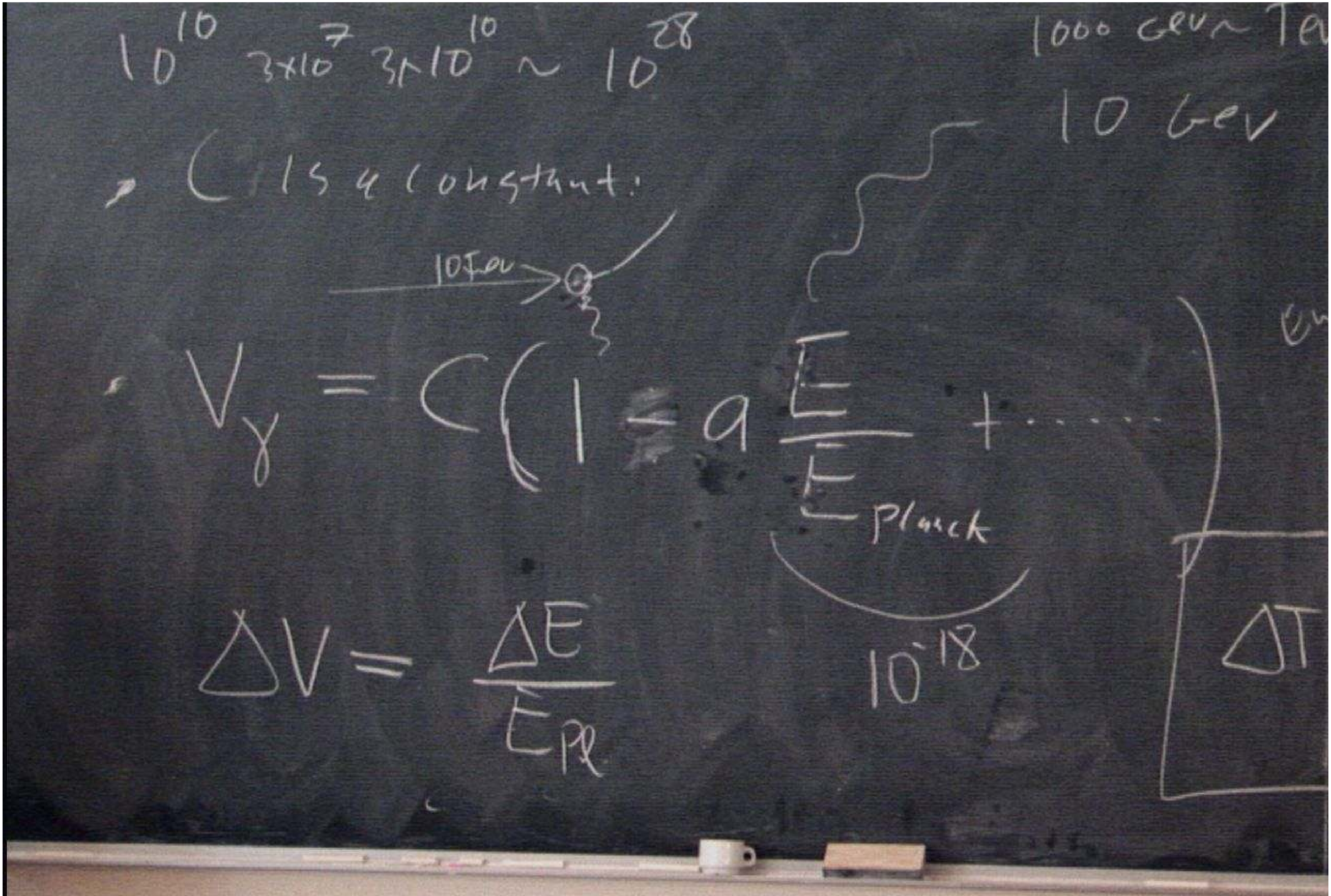

Fermi
0 GeV
13.6 GeV
7 GeV
time
16 sec
$E_{pl} = \sqrt{\ldots}$
$\Delta T = a 2 \frac{L}{c} \left(\frac{\Delta E}{E_{pl}}\right) \sim \left(L\,cm\,10^{-28}\right) sec = \frac{L}{V}$

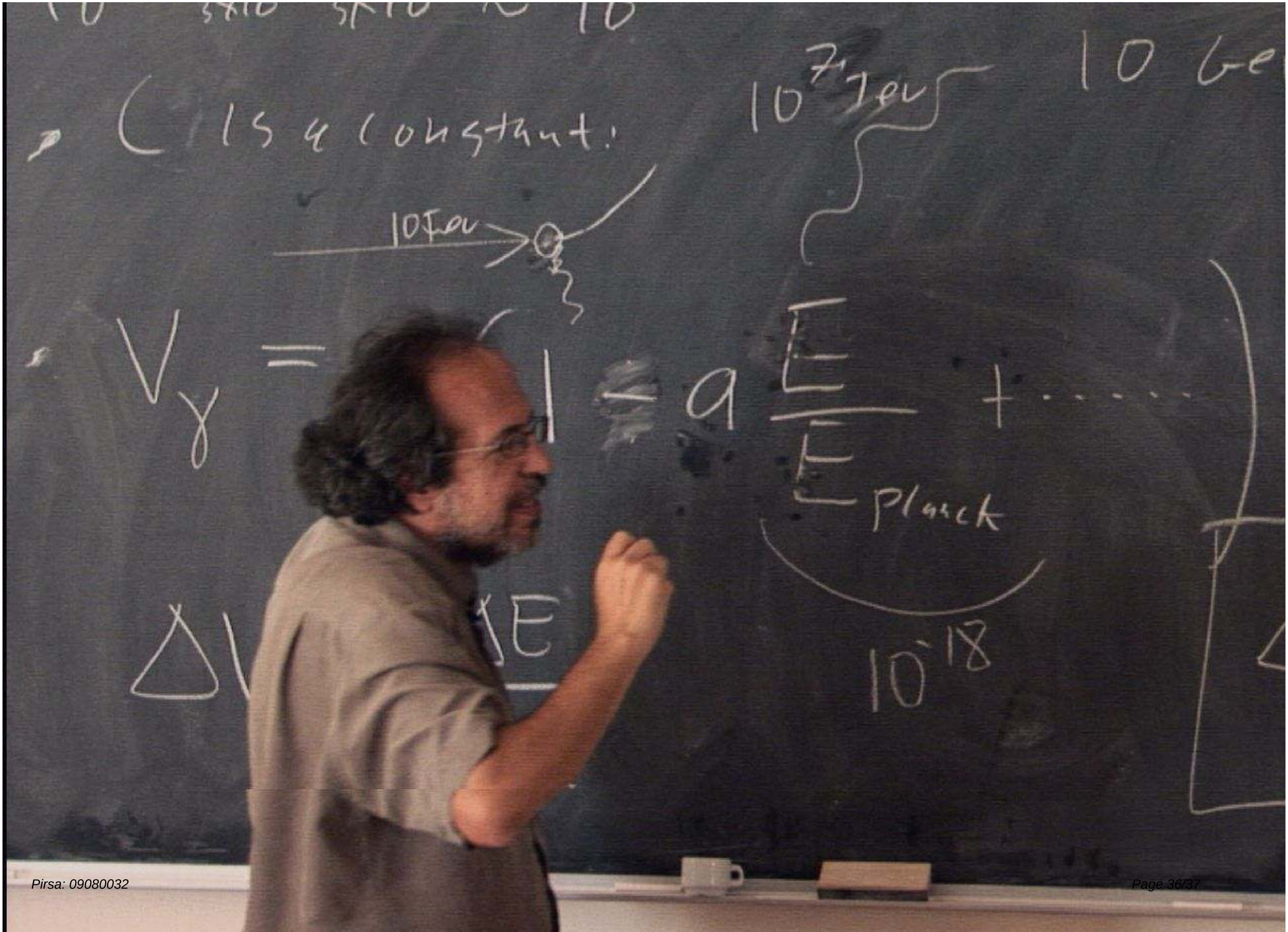

1000 GeV
10 GeV
C is a constant:
Ferm
Energy
time
Planck
10^{-18}

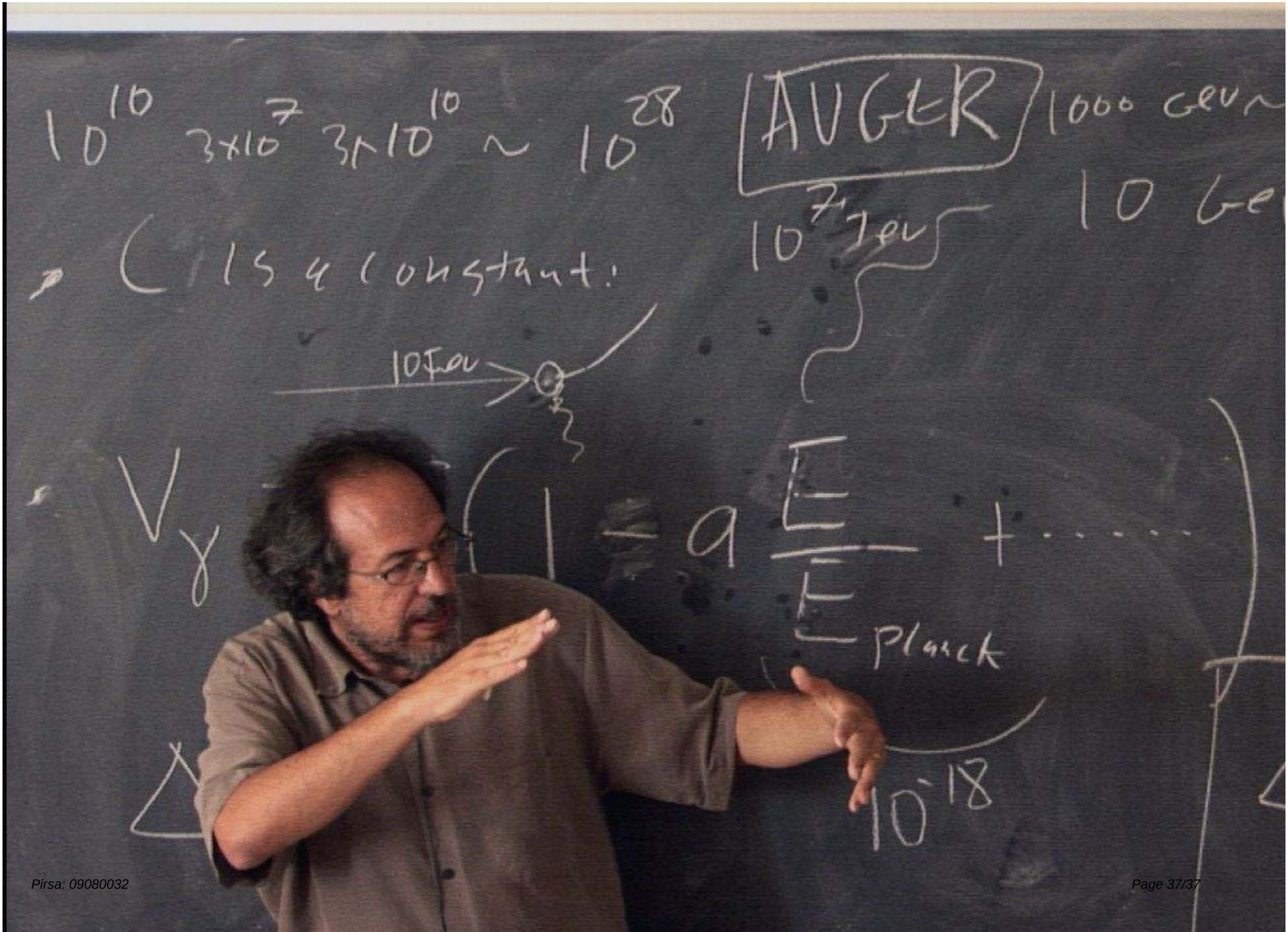

1000 GeV
10 GeV
Fermi
13.6 GeV
Energy
time
16 sec
7 GeV
Planck
V1+ΔV


1000 GeV
10 GeV
Fermi
13.6 GeV
E_Pl = √(ħ/Gc) ≈ 1.2×10
7 GeV
Emit
time
16 sec
Planck
10^-18
ΔT = a2 L/c (ΔE/E_Pl) ~ (L cm 10^-28) sec
= L/V_2 - L/V_1 = 2 L/V
V_1+ΔV


1000 GeV ~ TeV
10 GeV
Fermi
E_Pl = √(ħ / Gc)
13.6 GeV
7 GeV
time
16 sec
Planck
ΔT = a 2 L/c (ΔE / E_Pl) ~ (L cm 10^-28) sec
= L/V_2 - L/V_1 = 2 L/V
V_1 + ΔV


10^10 3x10^7 3x10^10 ~ 10^28
1000 GeV ~ TeV
10 GeV
C is a constant!
10 TeV
V_γ = C(1 - a E/E_planck + ...)
10^-18
ΔV = ΔE/E_Pl
ΔT


C is a constant!
10 GeV
Planck
10^{-18}


10^10 3x10^7 3x10^10 ~ 10^28
AUGER
1000 GeV
10 GeV
10^7 TeV
c is a constant!
10 TeV
V_γ = c (1 - a E / E_planck + ...)
10^-18