Title: Math Tutorial - Part 2

Date: Aug 07, 2006 01:00 PM

URL: http://pirsa.org/06080012

Abstract:

Hint 3: $\frac{hG}{c^3}$

1 $\sqrt{\frac{hG}{c^3}}$

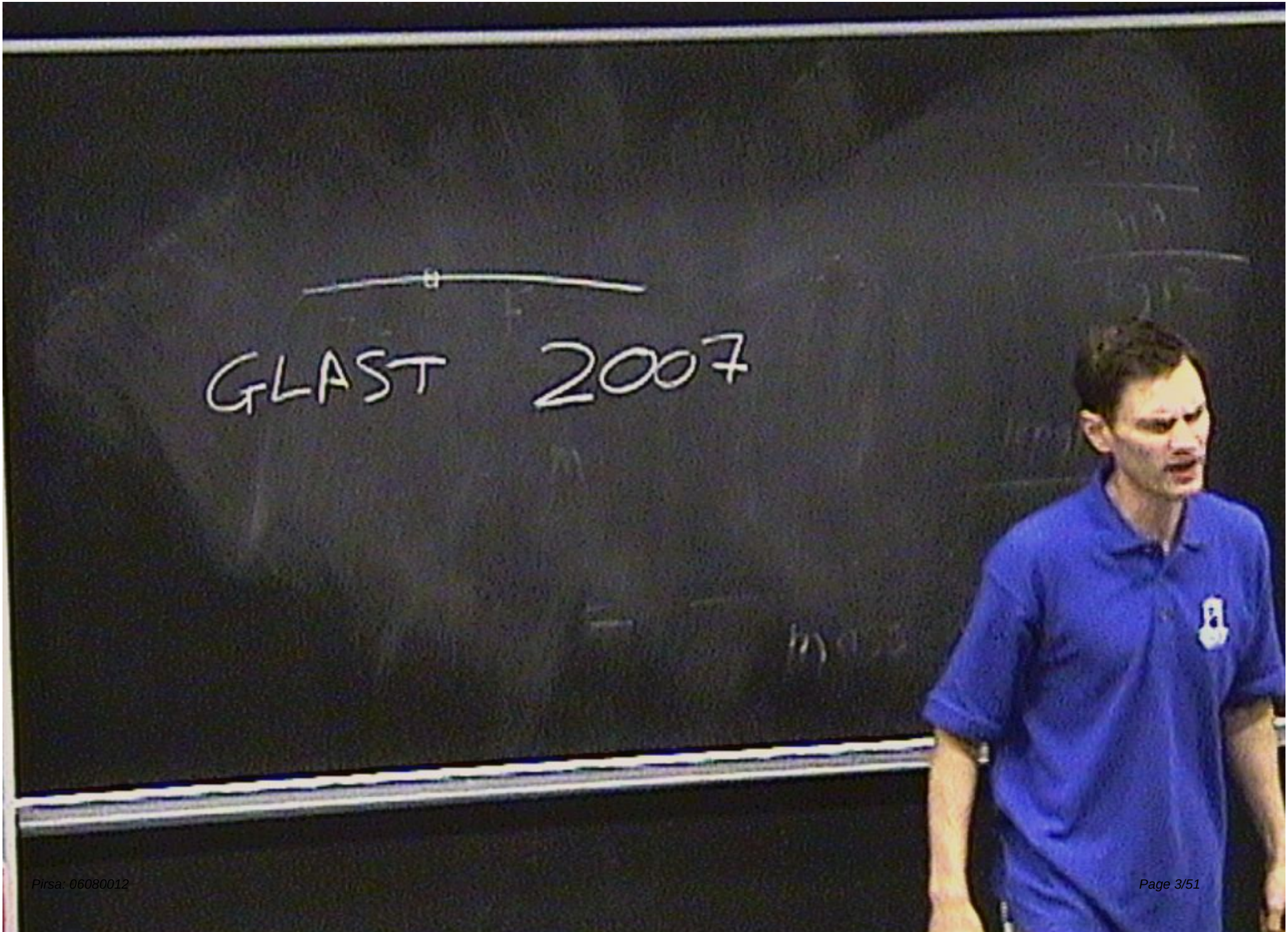
2 $4 \times 10^{-35}\,m = L_P$

$10^{-35}\,m$ Planck length

dimensional analysis

$\frac{hG}{c^3} = \frac{m^4}{s^2}$

$\div 2$ $\sqrt{m^2}$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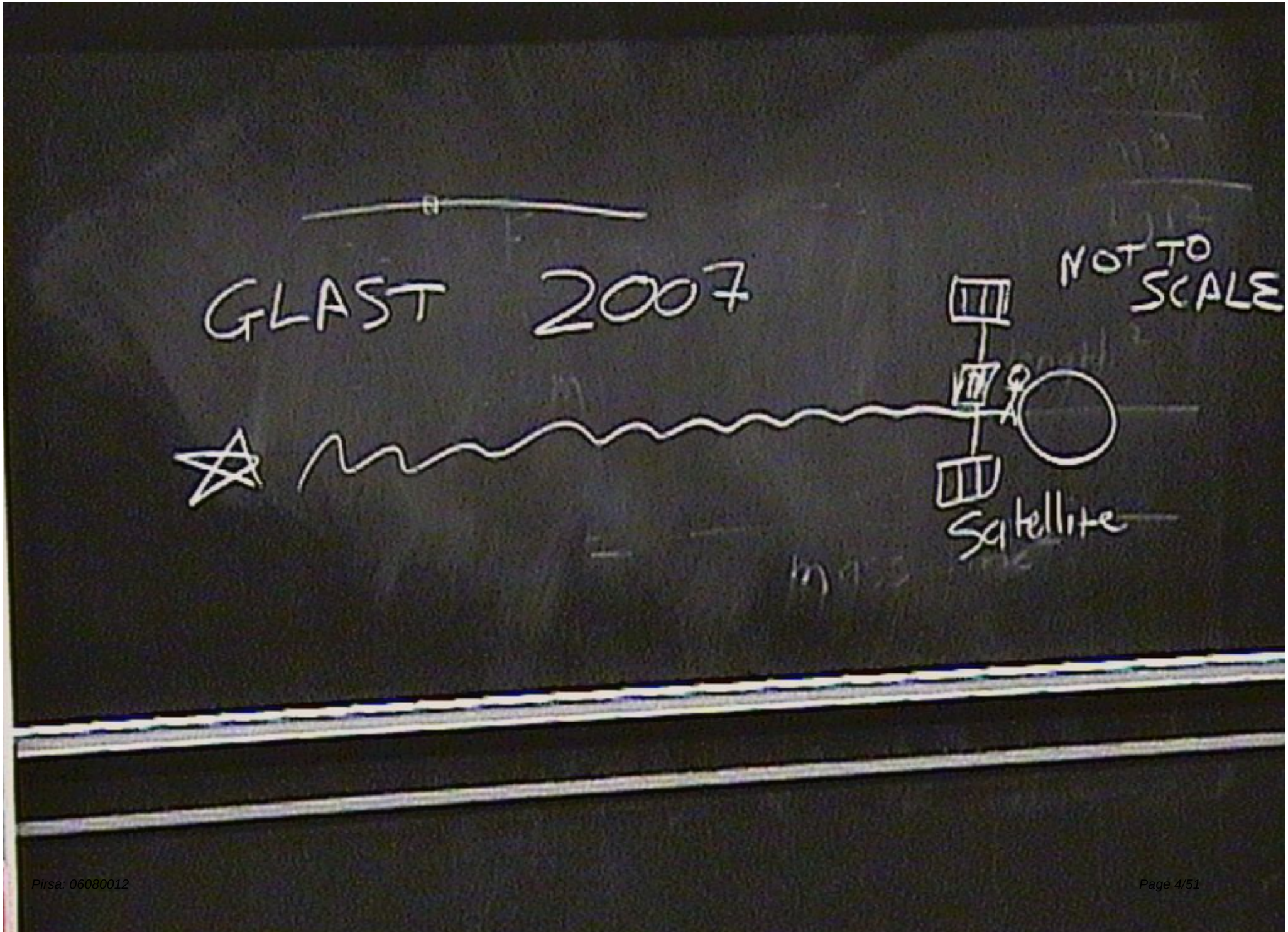
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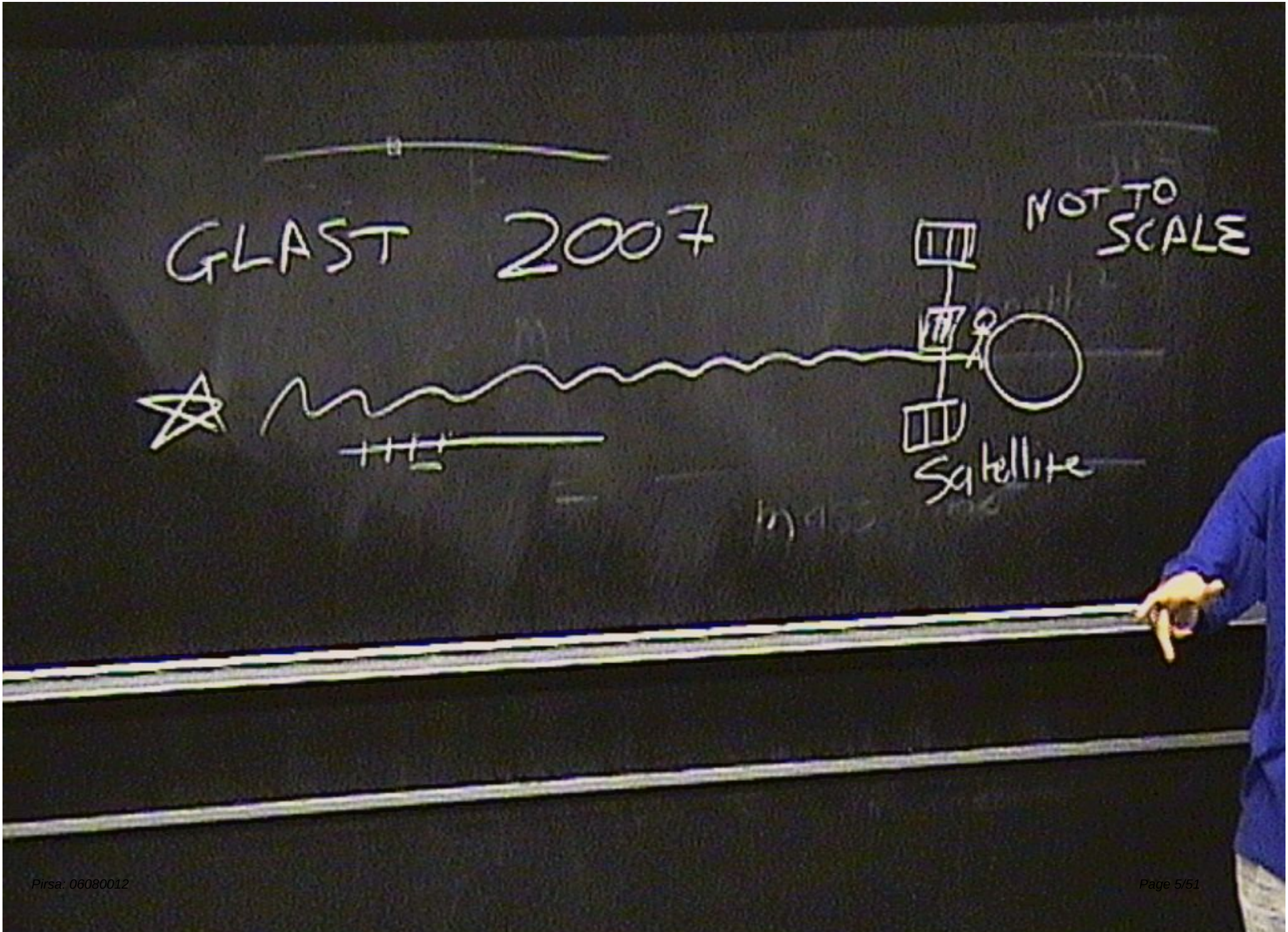
Satellite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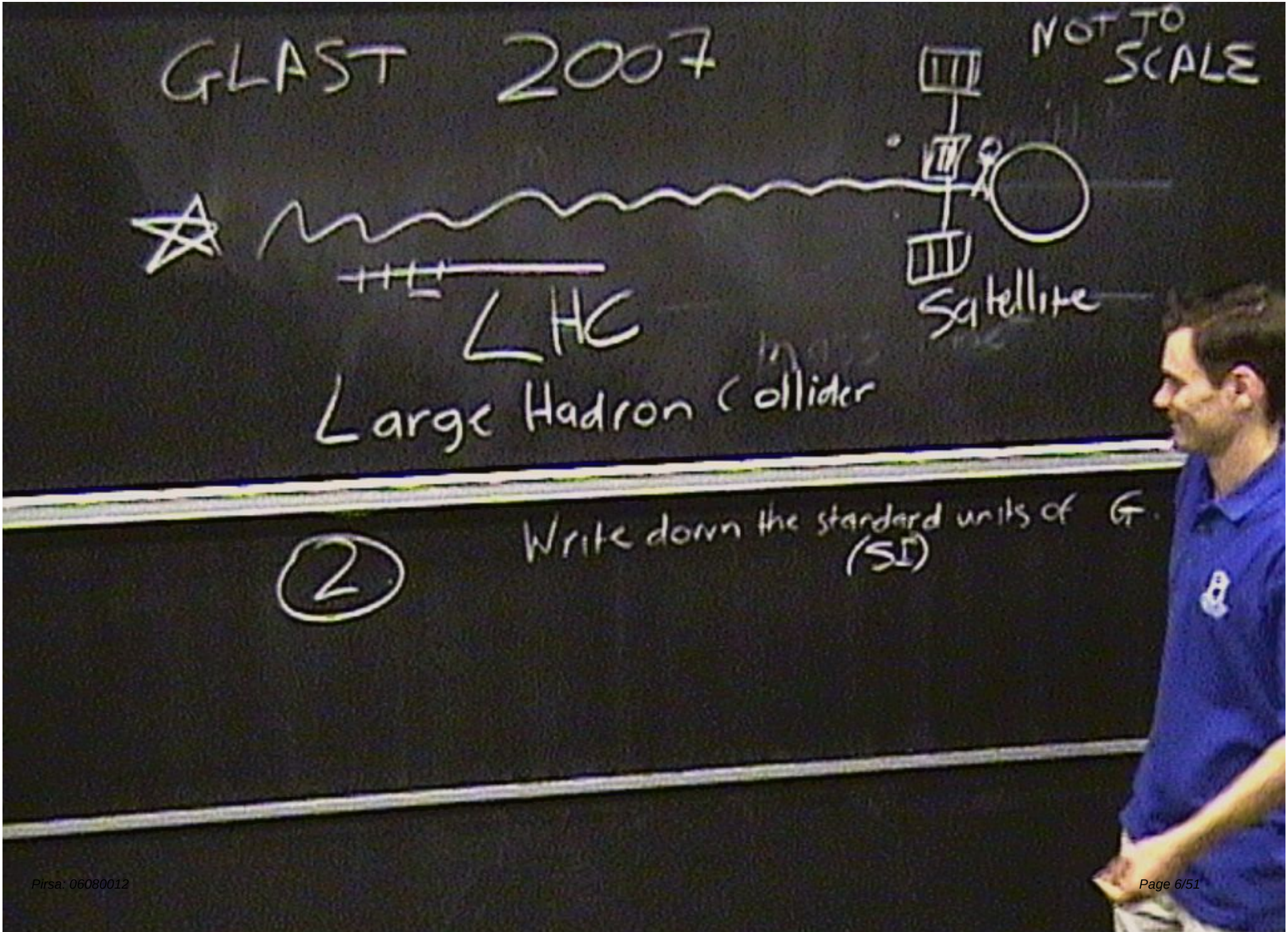
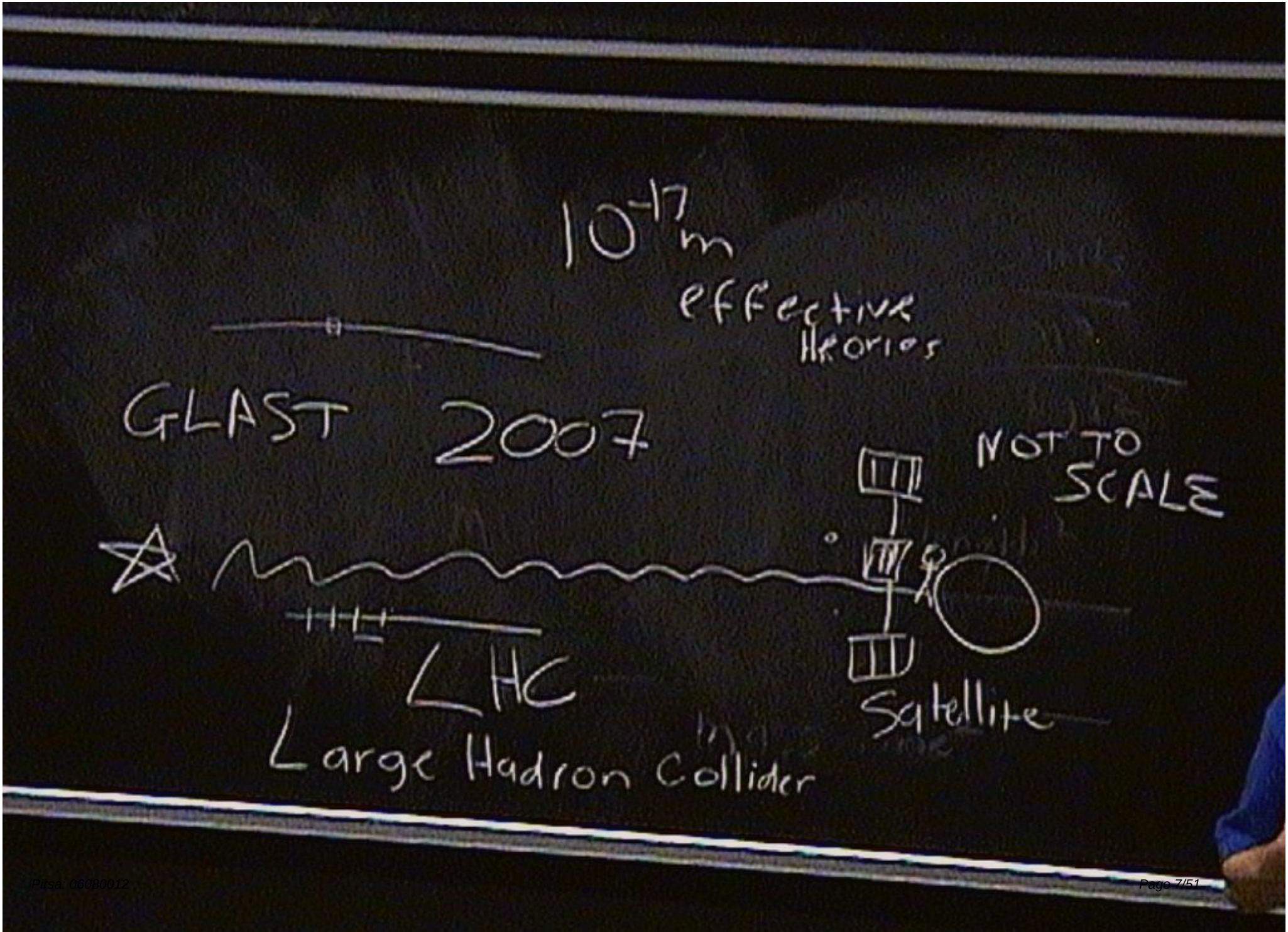
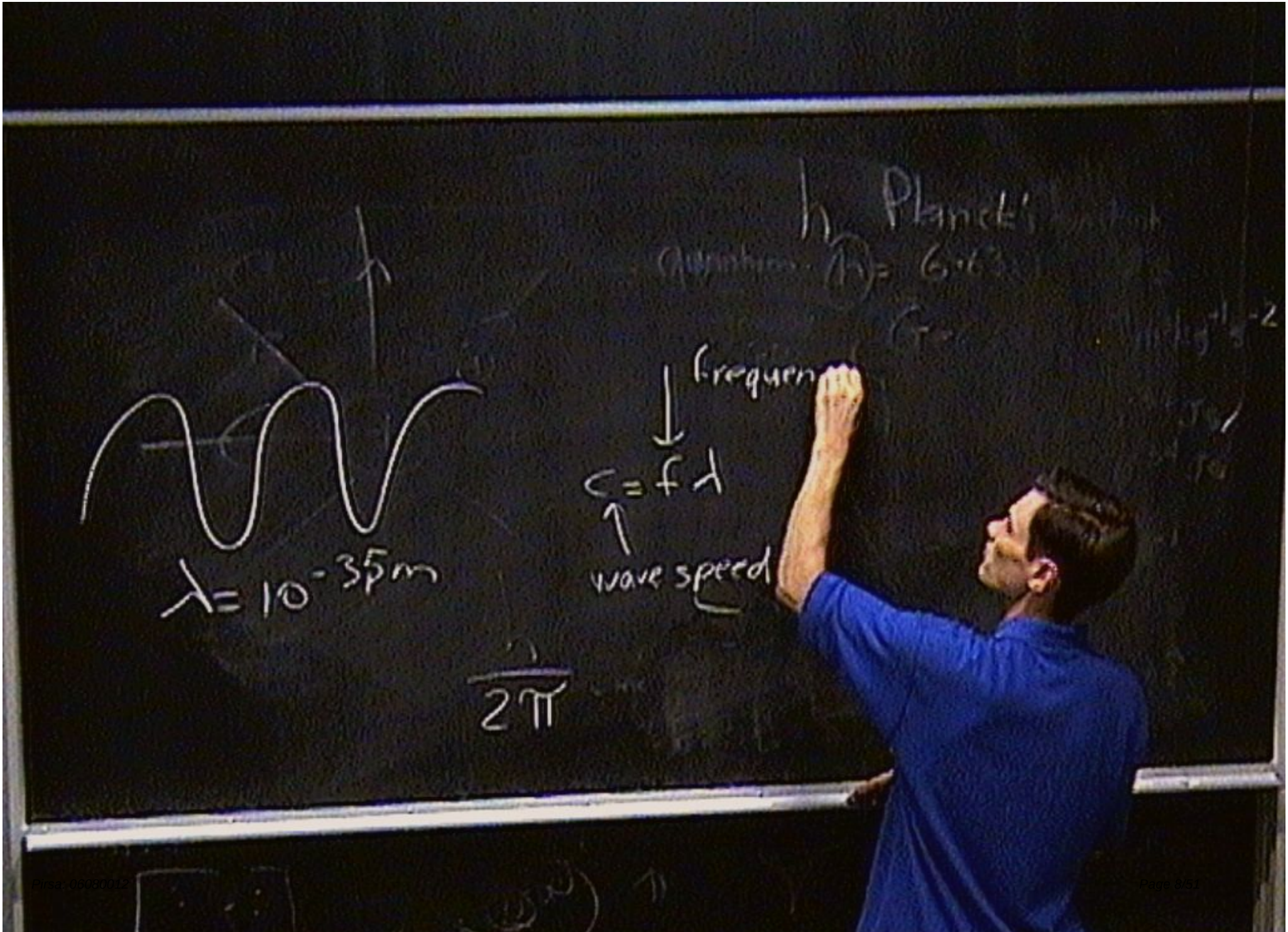
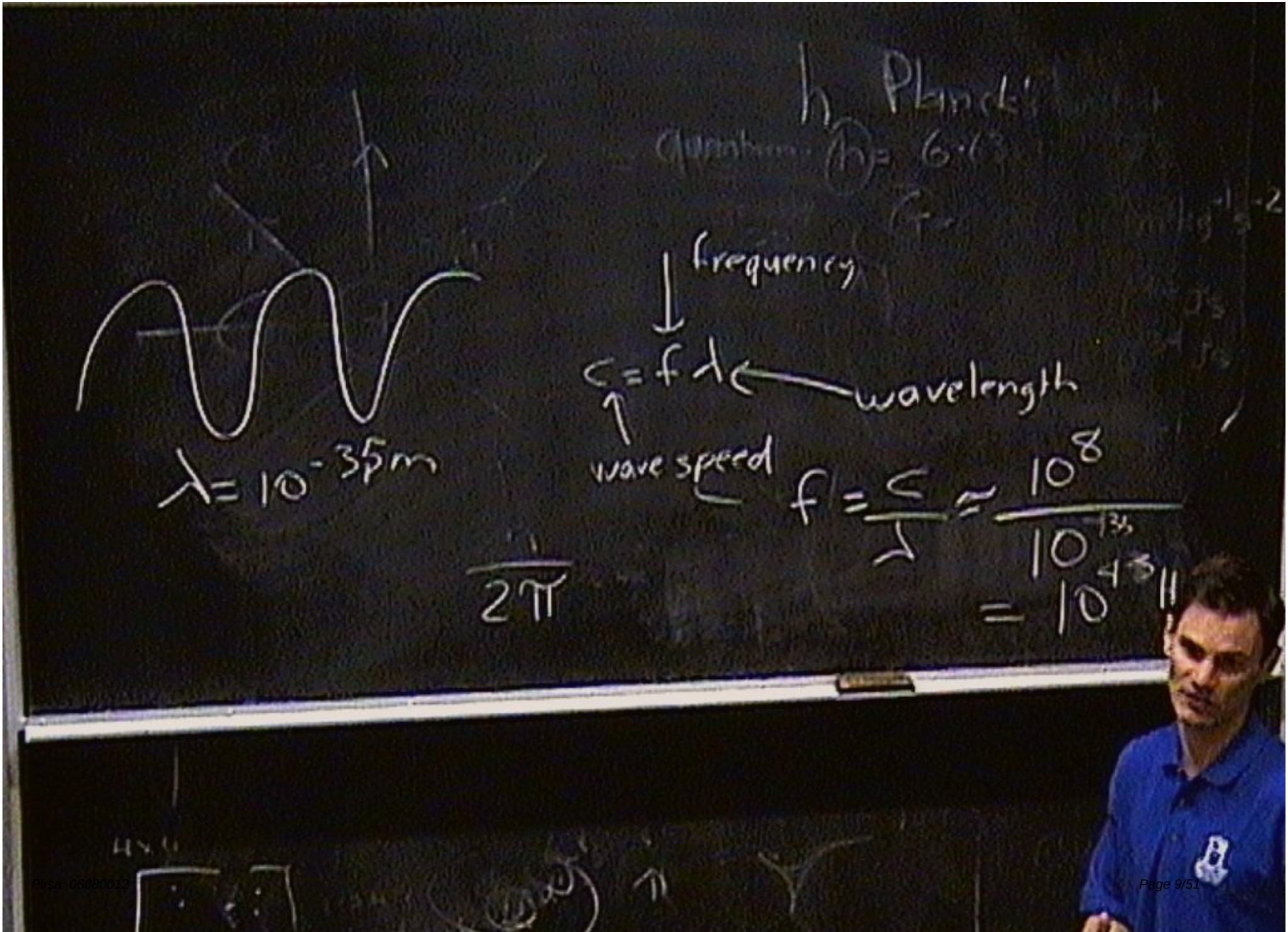
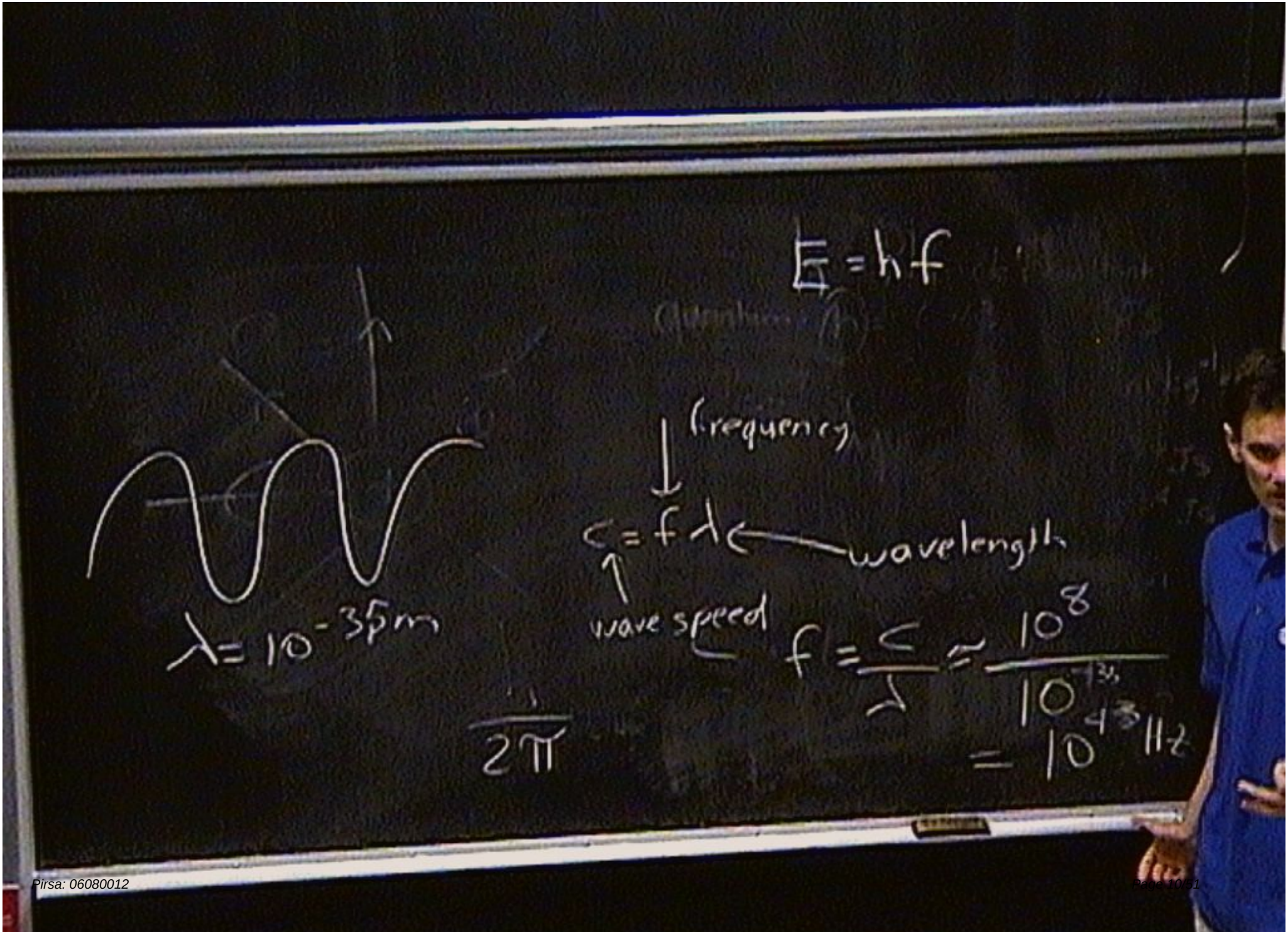
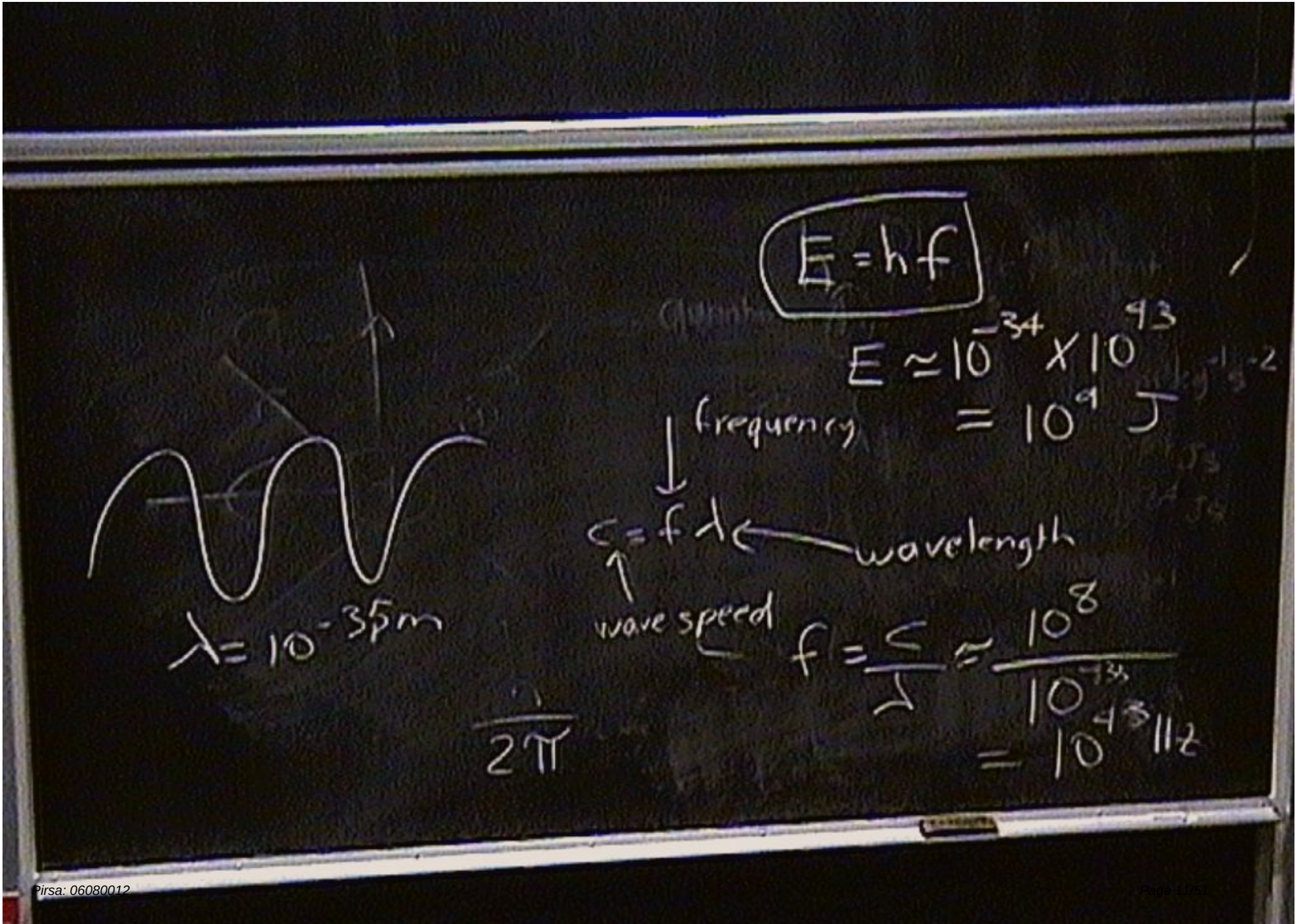

GLAST 2007
NOT TO SCALE
Satellite
LHC
Large Hadron Collider
2
Write down the standard units of G.
(SI)

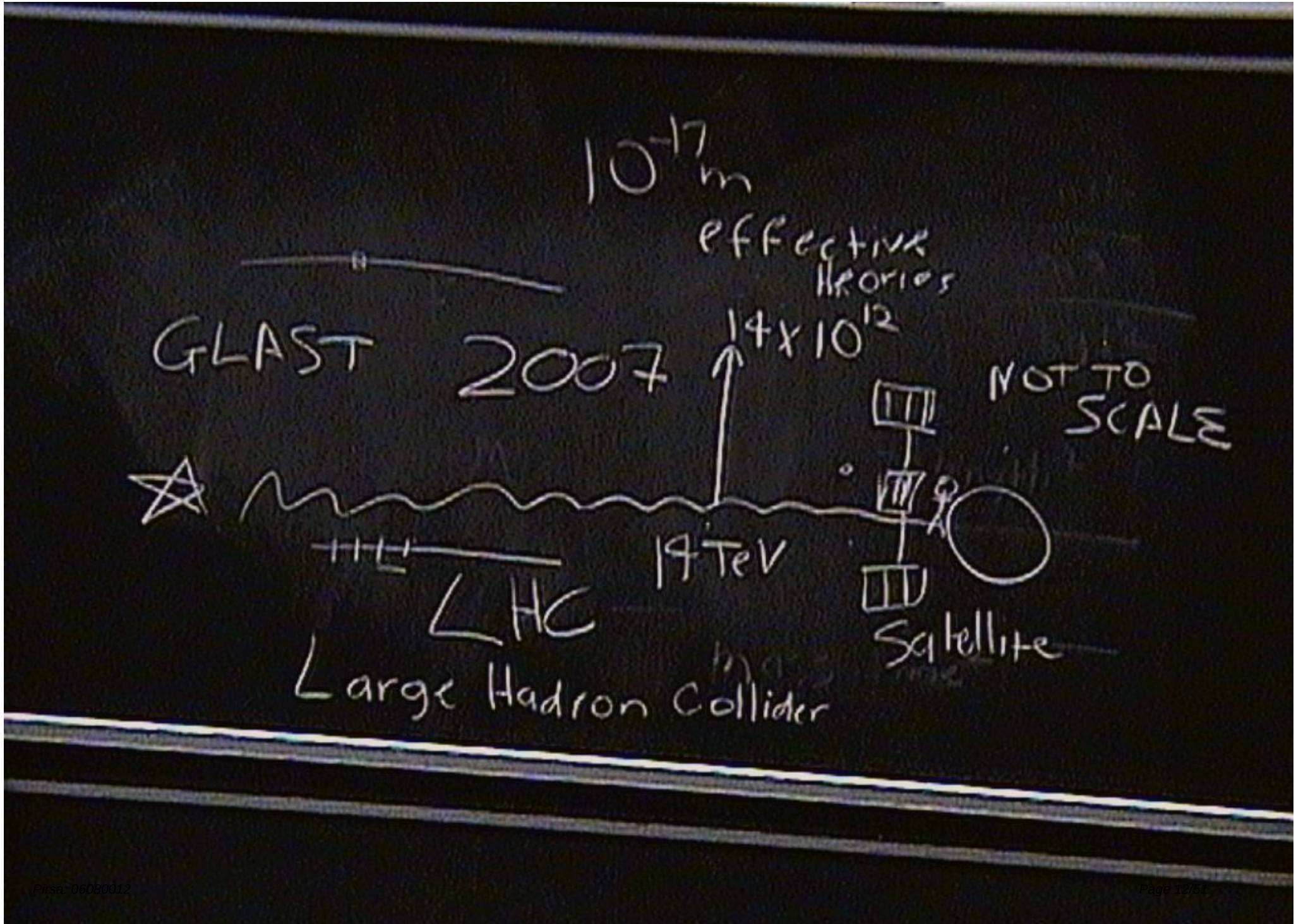

10^{-17} m
effective theories
GLAST 2007
NOT TO SCALE
LHC
Large Hadron Collider
Satellite

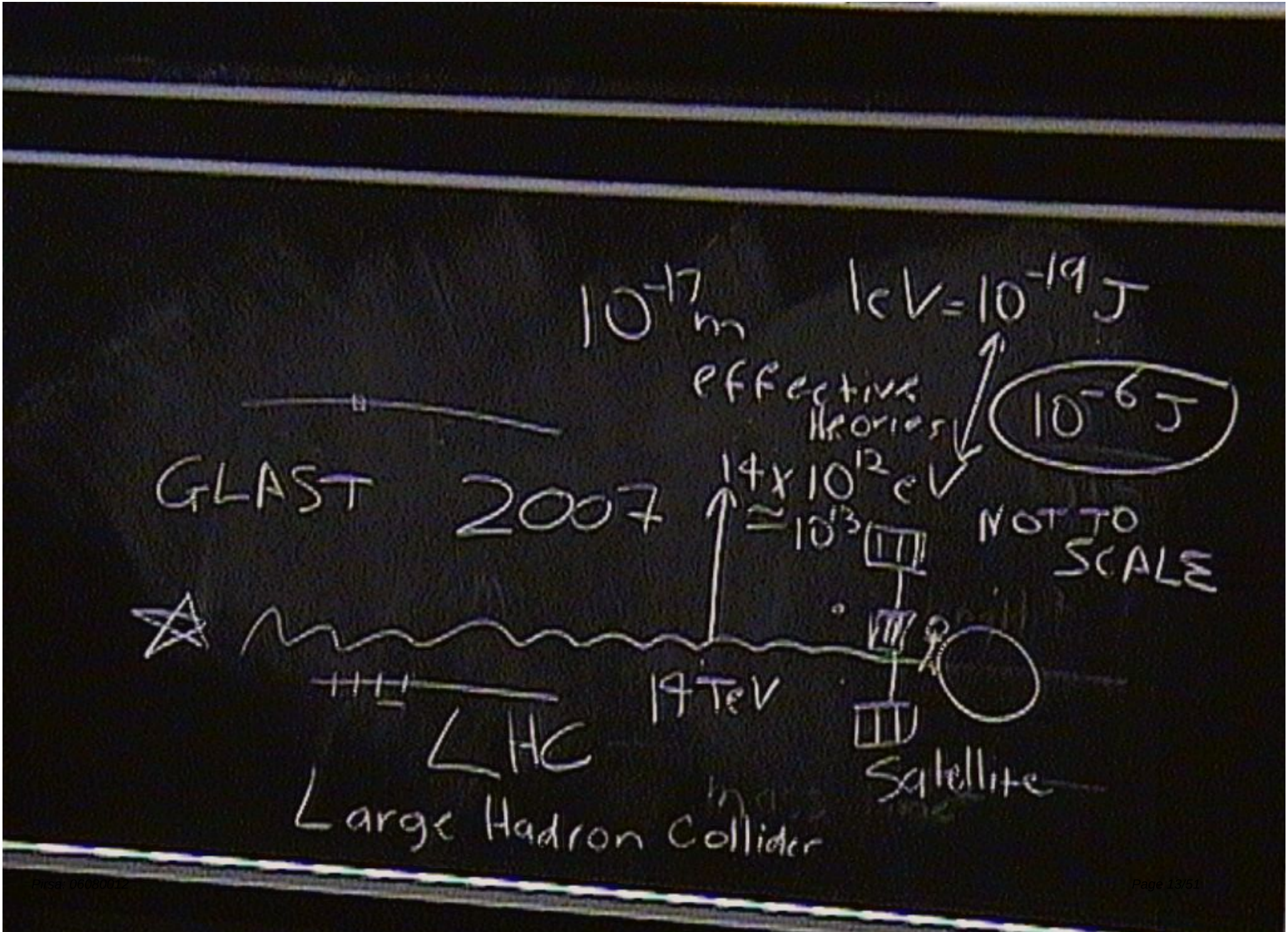

h Planck's
frequen
c = f λ
wave speed
λ = 10^-35 m
1
2π

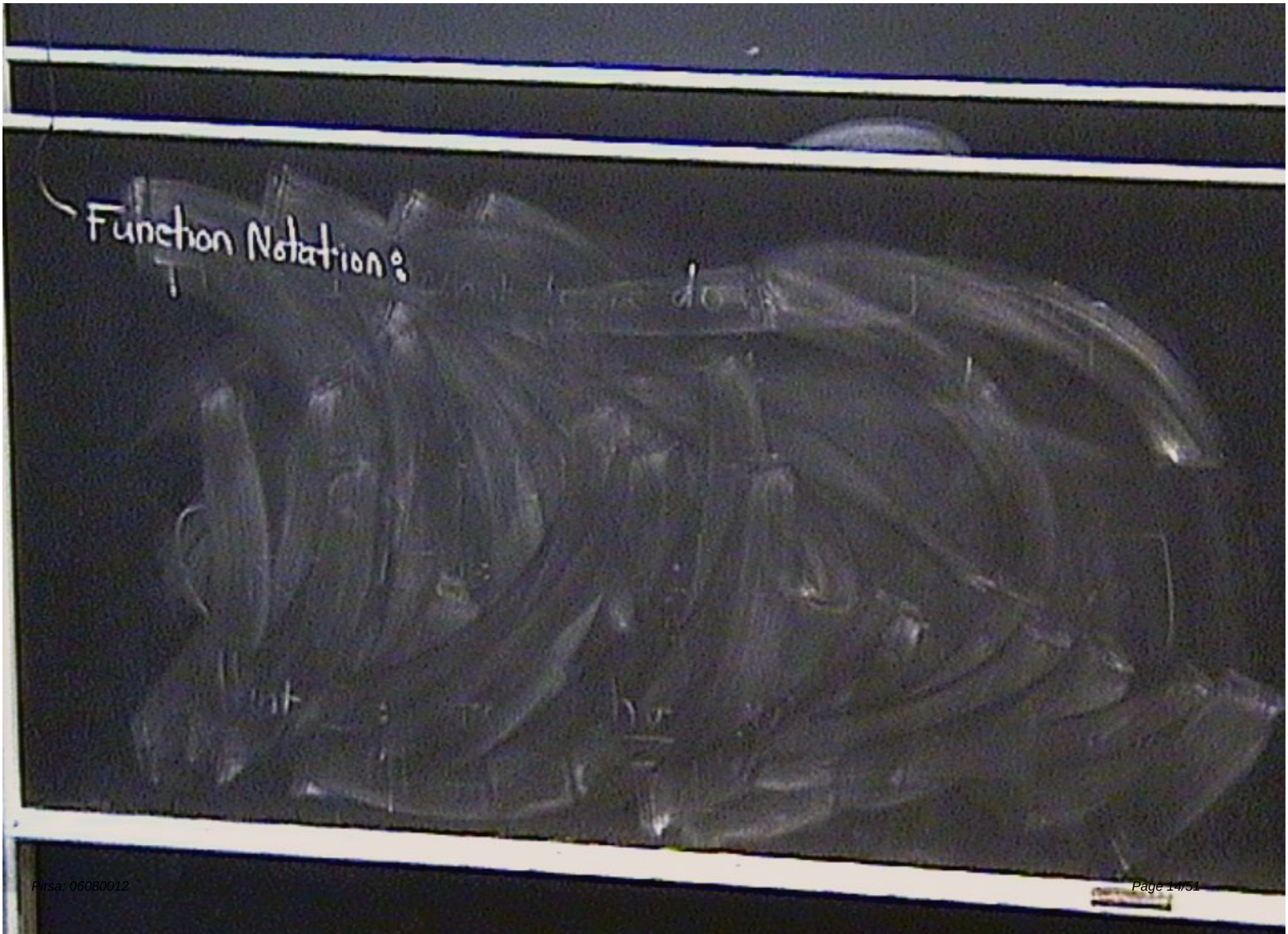

h Planck's
quantum (h) = 6.6
frequency
c = f λ
wavelength
wave speed
λ = 10^-35 m
f = c/λ ≈ 10^8 / 10^-35
= 10^43
1/2π


E = hf
frequency
c = f λ
wavelength
wave speed
λ = 10^-35 m
f = c/λ ≈ 10^8 / 10^-35
= 10^43 Hz
1/2π


$E = hf$
$E \approx 10^{-34} \times 10^{43}$
$= 10^{9}$ J
frequency
$c = f\lambda$
wavelength
wave speed
$\lambda = 10^{-35}$m
$f = \frac{c}{\lambda} \approx \frac{10^{8}}{10^{-35}}$
$= 10^{43}$ Hz
$\frac{1}{2\pi}$


10^{-17} m
effective theories
GLAST
2007
14×10^{12}
NOT TO SCALE
19 TeV
LHC
Large Hadron Collider
Satellite

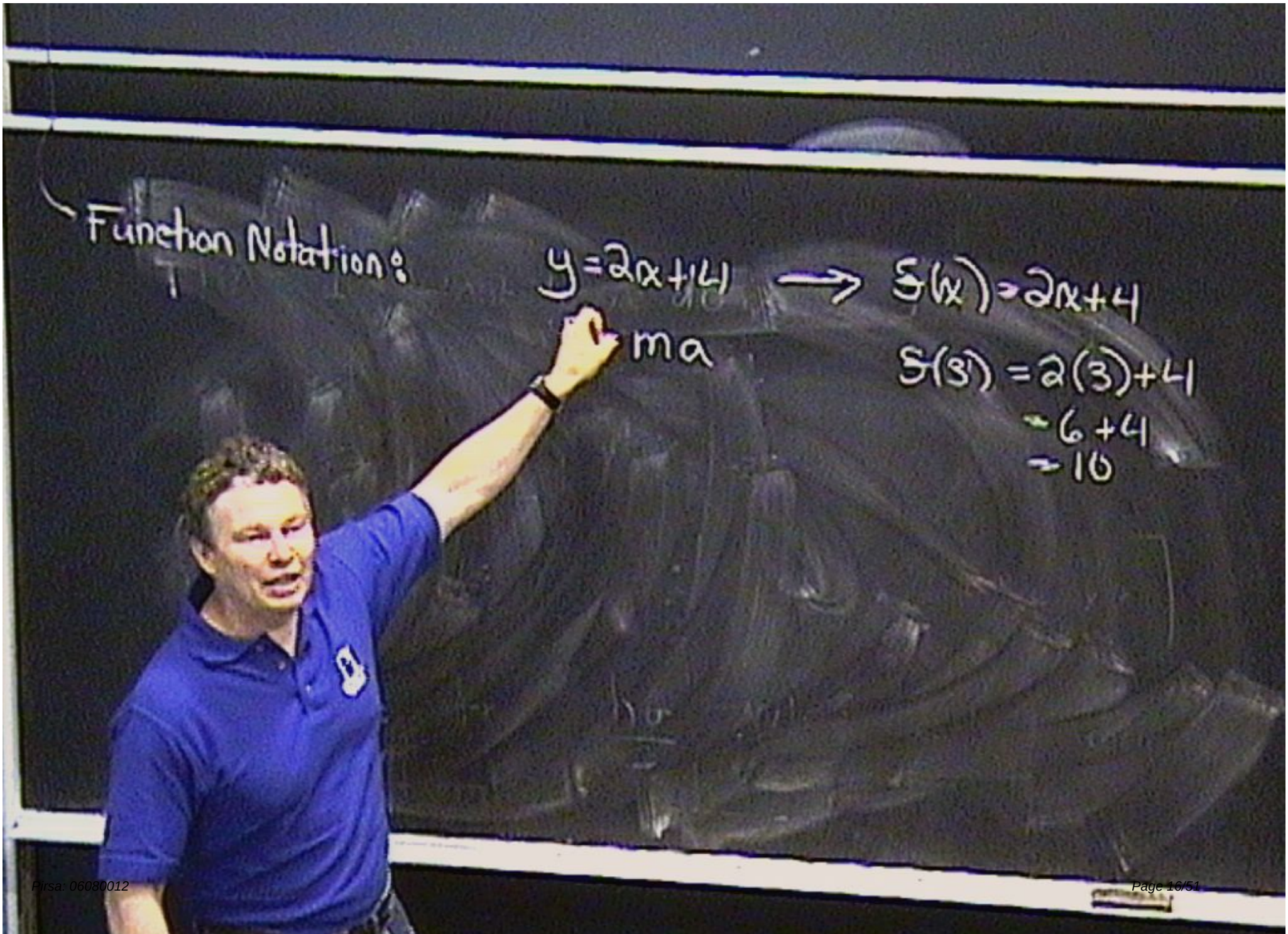

10^{-17} m
1eV = 10^{-19} J
effective
10^{-6} J
GLAST
2007
14×10^{12} eV
$\simeq 10^{13}$
NOT TO
SCALE
19 TeV
LHC
Satellite
Large Hadron Collider


Function Notation:

Function Notation:

$y = 2x + 4$

$F = ma$


Function Notation:
y = 2x + 4
ma
f(x) = 2x + 4
f(3) = 2(3) + 4
= 6 + 4
= 10

Function Notation:

$y = 2x + 4 \longrightarrow f(x) = 2x + 4$

$F = ma$

$f(3) = 2(3) + 4$

$= 6 + 4$

$= 10$

Function Notation:

$y = 2x + 4$ → $f(x) = 2x + 4$

$F = ma$

$f(3) = 2(3) + 4$

$= 6 + 4$

$= 10$

$f(x) = 2x^2 + x - 1$

$f(3) =$

$f(\pi) =$

$f($

Function Notation:

$y = 2x + 4$ → $f(x) = 2x + 4$

$F = ma$

$f(3) = 2(3) + 4$

$= 6 + 4$

$= 10$

f

F

f $f(x) = 2x^2 + x - 1$

$f(3) =$

$f(\pi) =$

$f(a^2) =$

$f(3x^2 - 1) =$

$f(x) = 2x + 4 \longrightarrow f(x) = 2x + 4$

$F = ma$

$f(3) = 2(3) + 4$

$= 6 + 4$

$= 10$

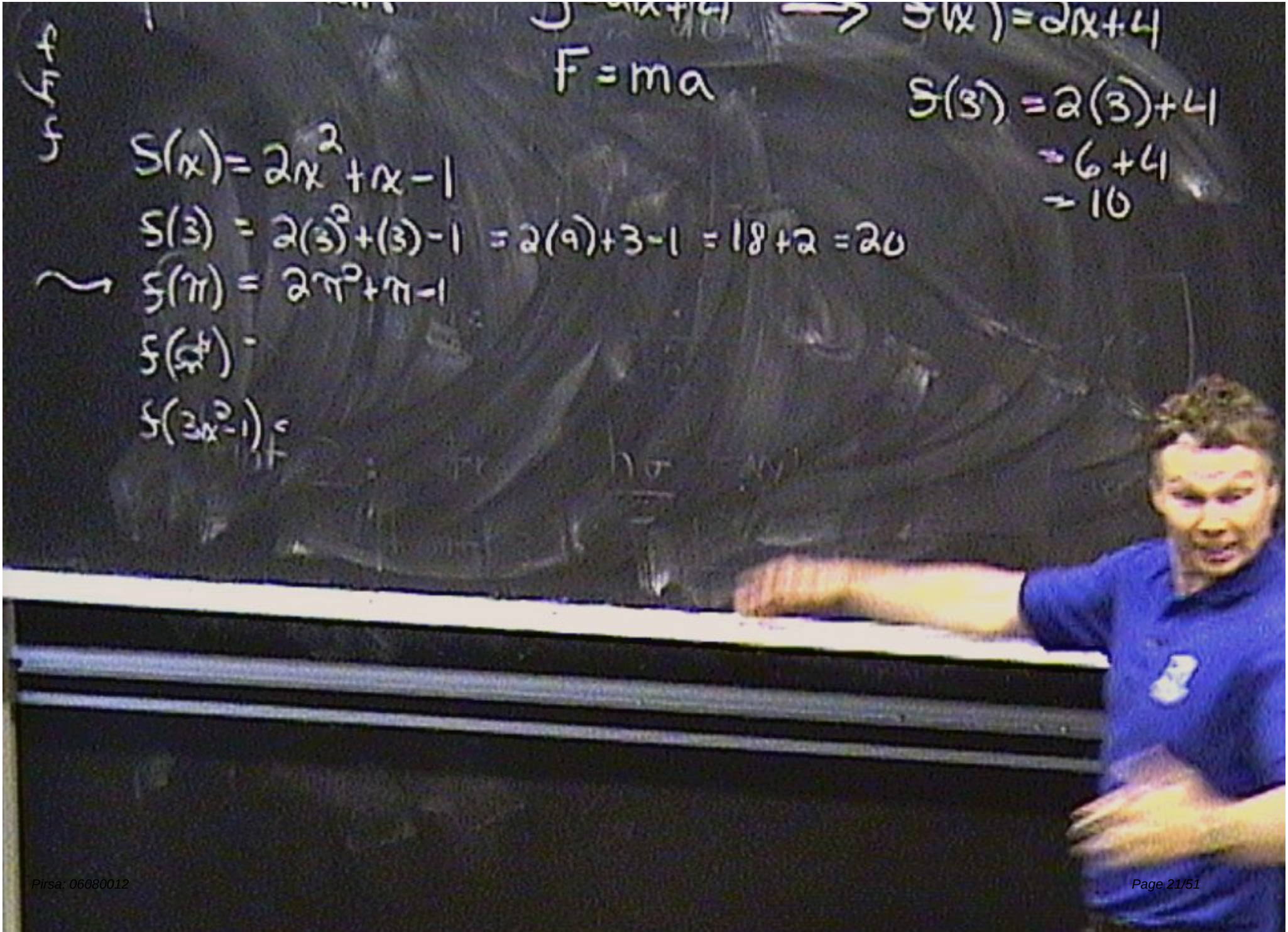
$S(x) = 2x^2 + x - 1$

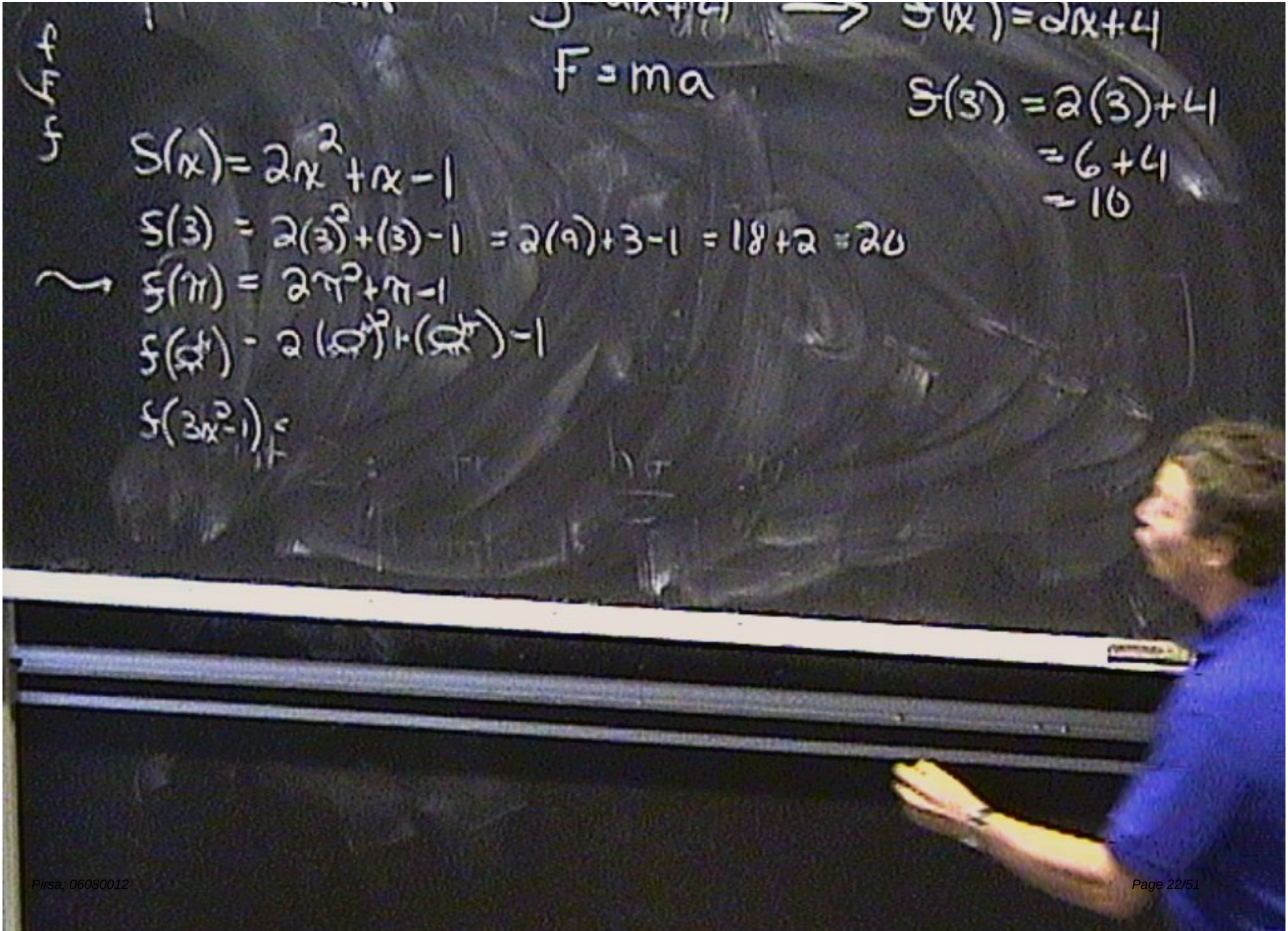
$S(3) = 2(3)^2 + (3) - 1 = 2(9) + 3 - 1 = 18 + 2 = 20$

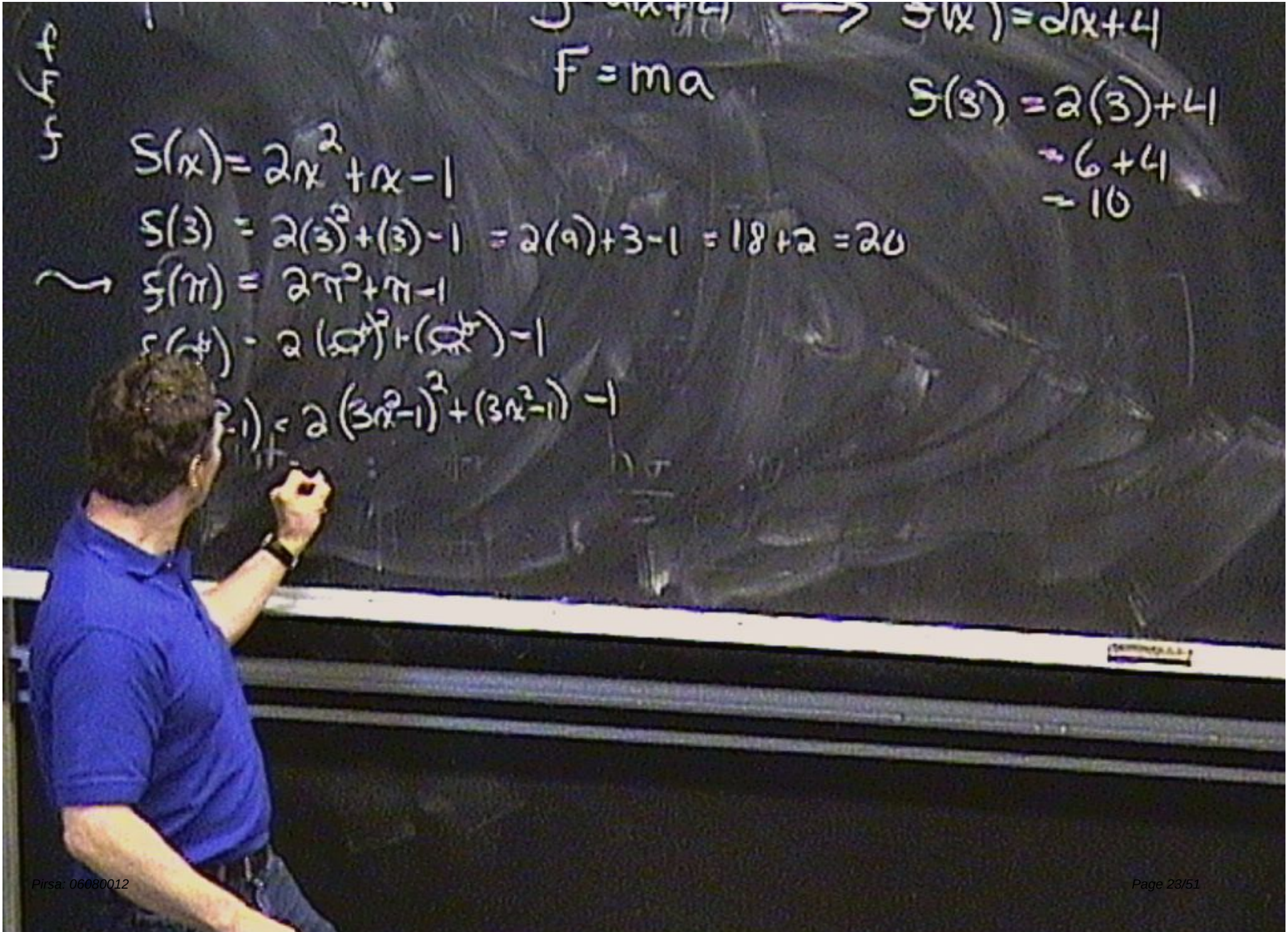
$\rightsquigarrow S(\pi) =$

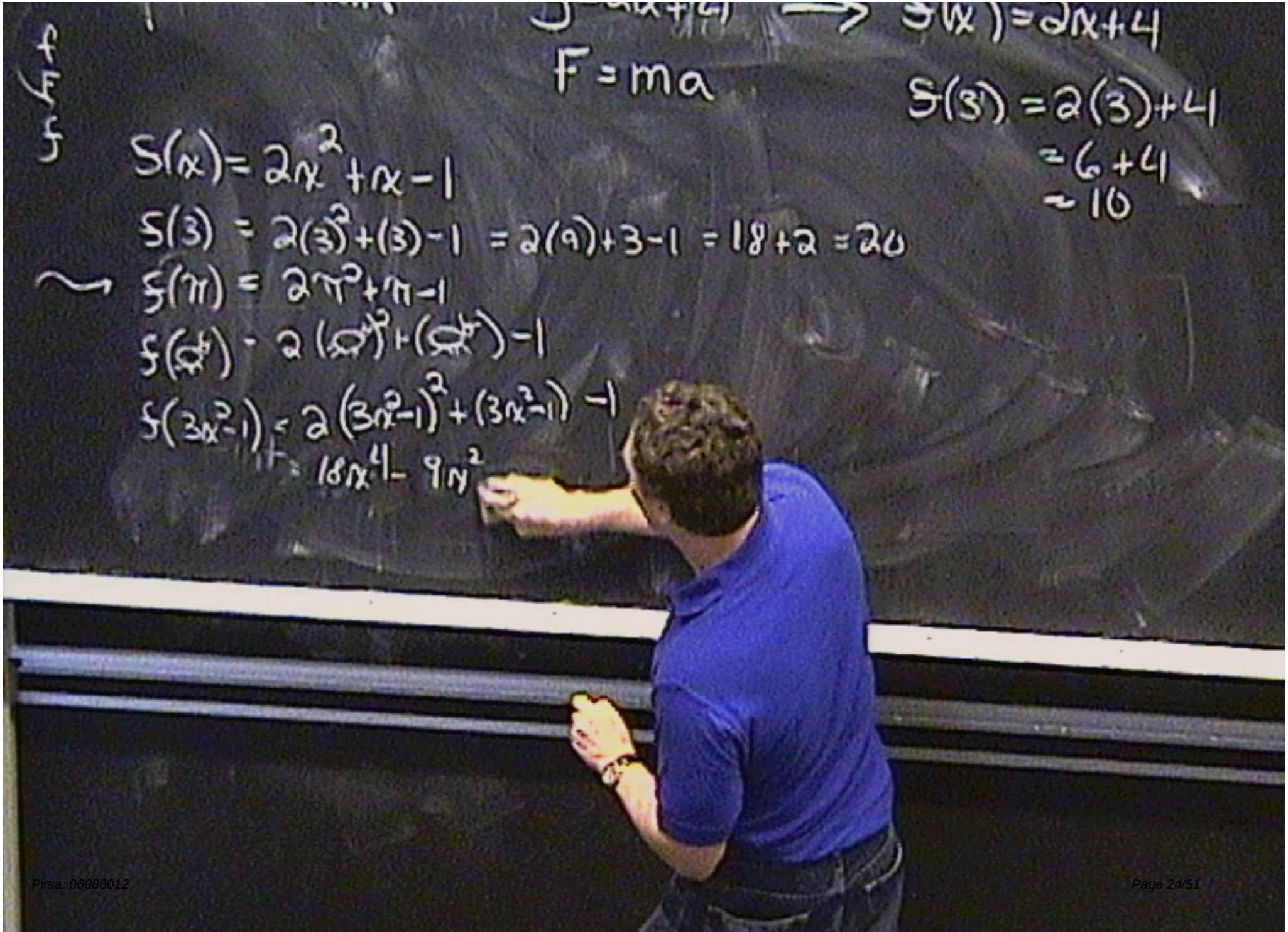
$S(x^4) =$

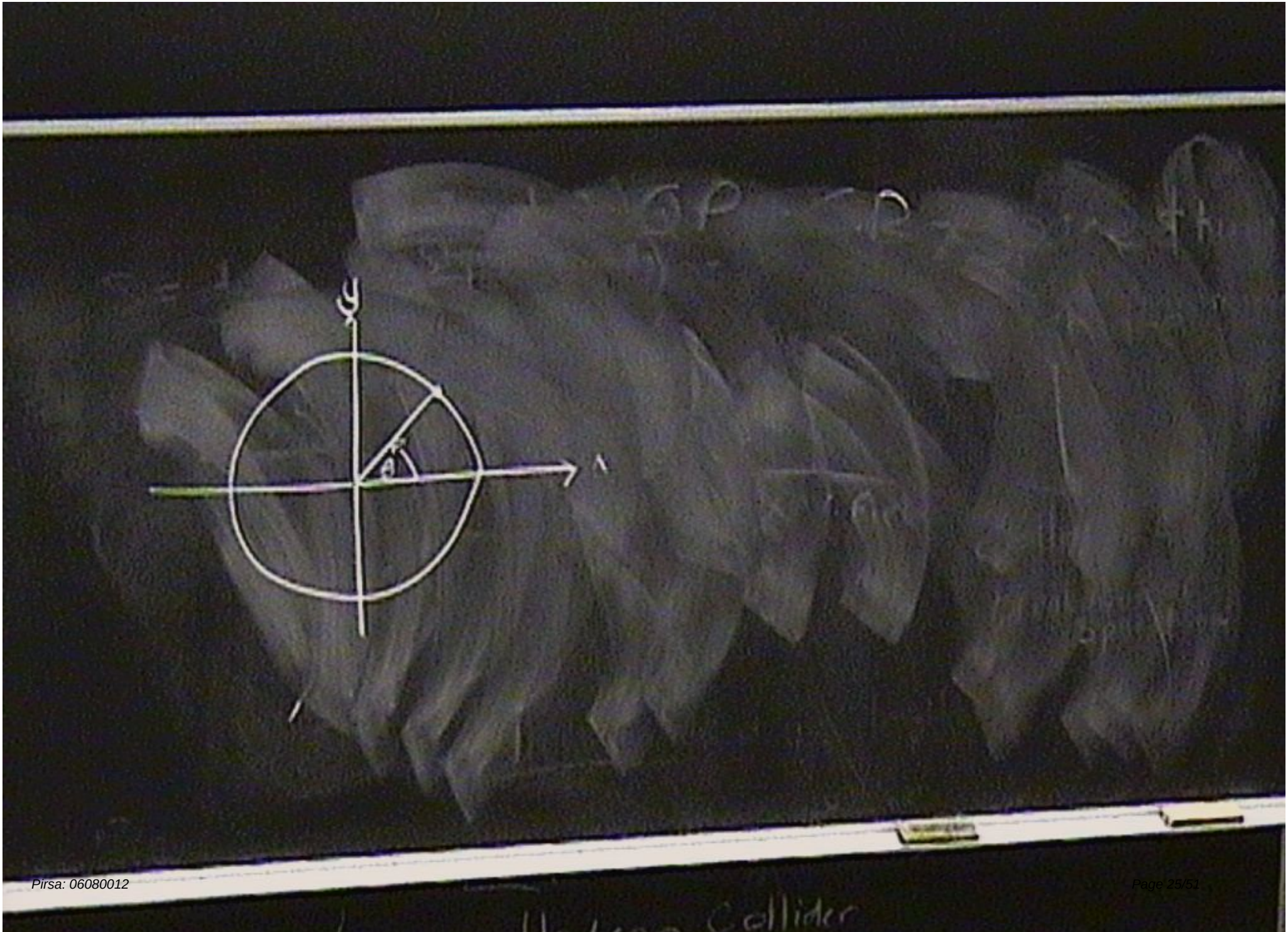
$S(3x^2 - 1) =$

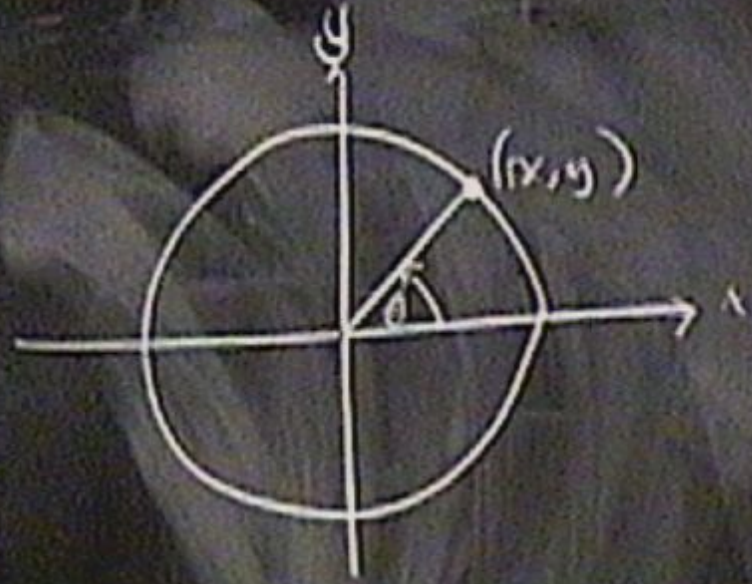

F = ma
S(x) = 2x^2 + x - 1
S(3) = 2(3)^2 + (3) - 1 = 2(9) + 3 - 1 = 18 + 2 = 20
S(π) = 2π^2 + π - 1
S(3x^2 - 1)
S(x) = 2x + 4
S(3) = 2(3) + 4
= 6 + 4
= 10

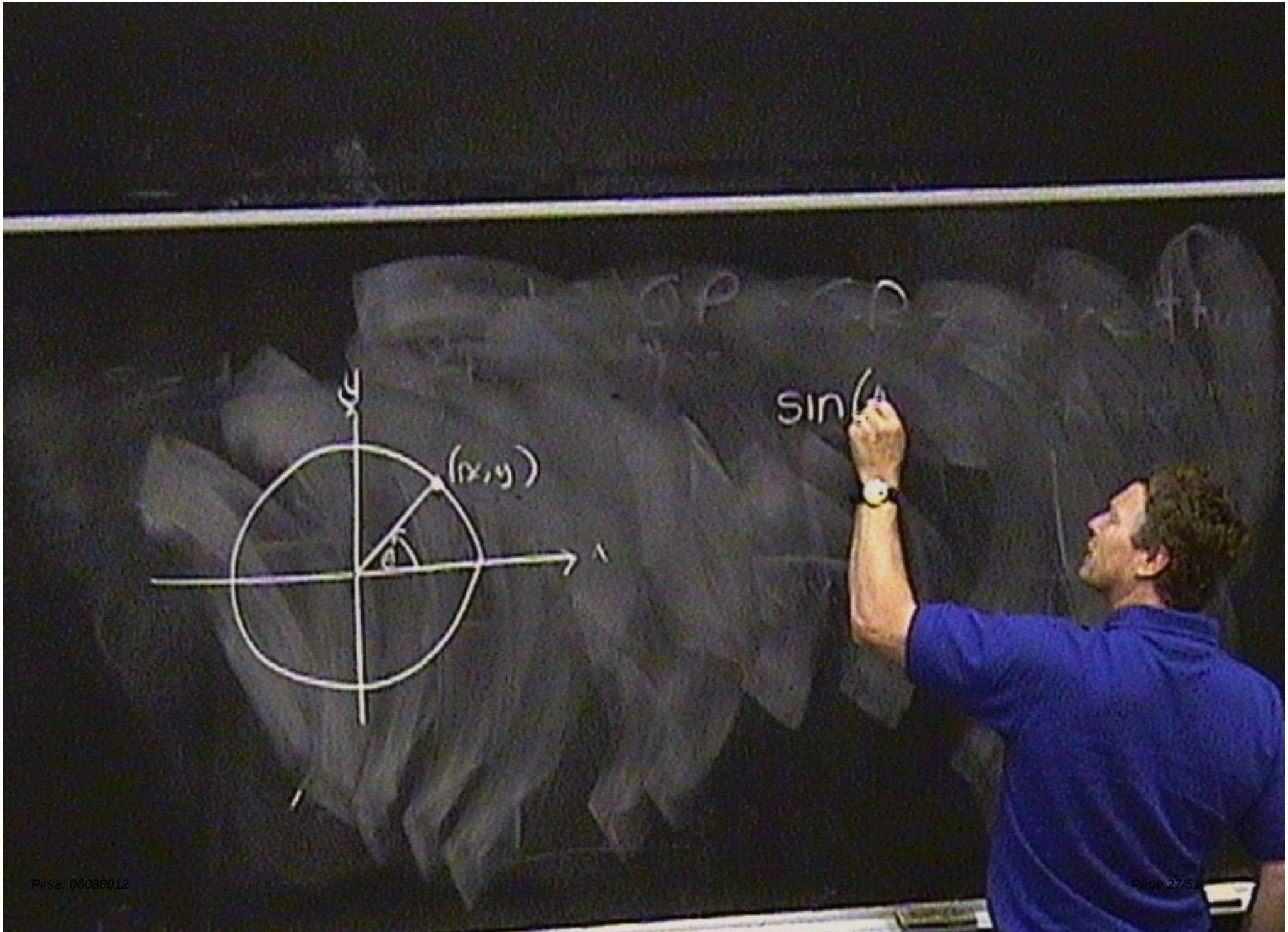

F = ma
S(x) = 2x^2 + x - 1
S(3) = 2(3)^2 + (3) - 1 = 2(9) + 3 - 1 = 18 + 2 = 20
S(π) = 2π^2 + π - 1
S(3x^2 - 1)
S(x) = 2x + 4
S(3) = 2(3) + 4
= 6 + 4
= 10

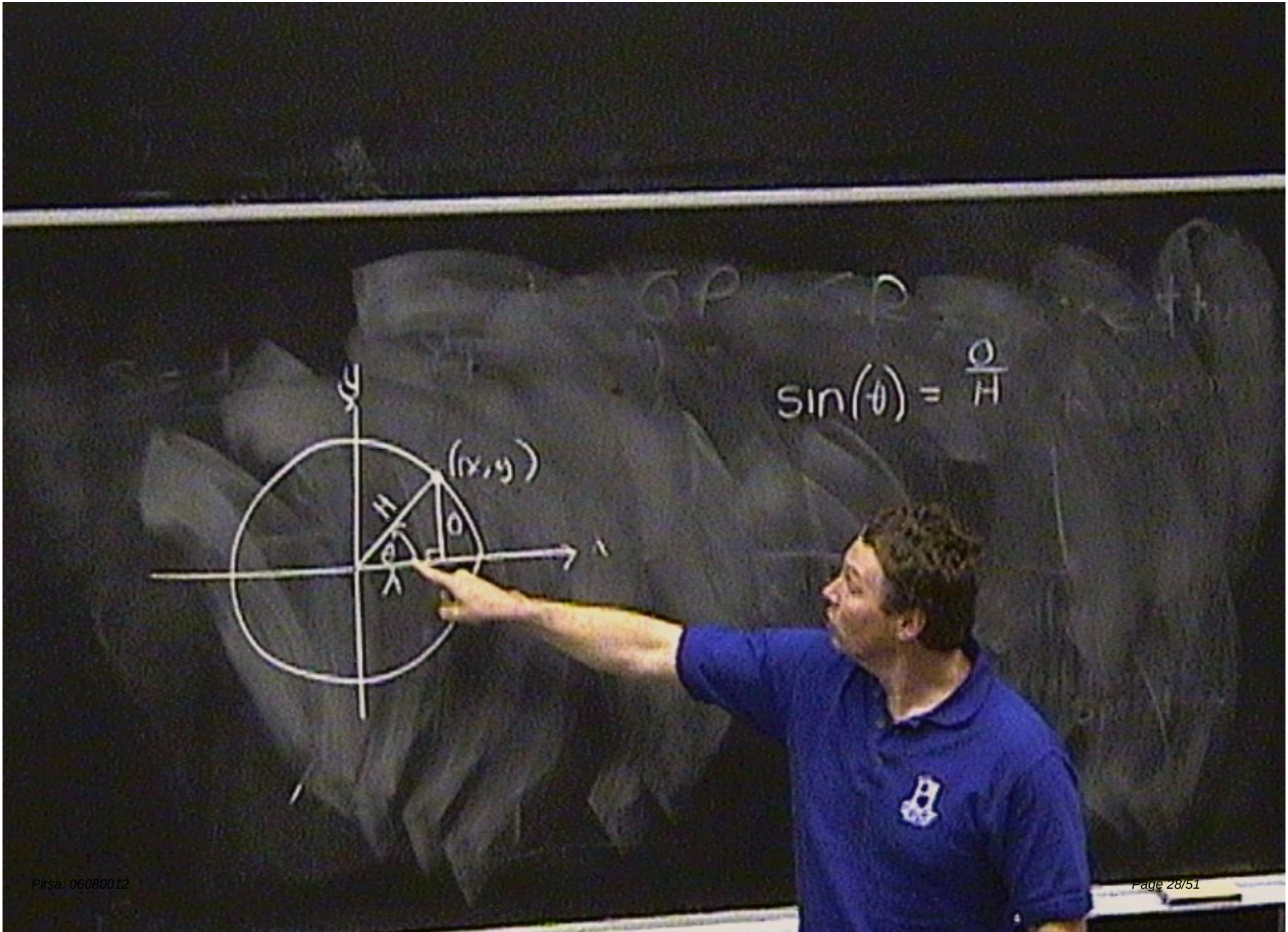

F = ma
S(x) = 2x + 4
S(3) = 2(3) + 4
= 6 + 4
= 10
S(x) = 2x² + x − 1
S(3) = 2(3)² + (3) − 1 = 2(9) + 3 − 1 = 18 + 2 = 20
S(π) = 2π² + π − 1


F = ma
S(x) = 2x² + x − 1
S(3) = 2(3)² + (3) − 1 = 2(9) + 3 − 1 = 18 + 2 = 20
S(π) = 2π² + π − 1
S(x²) = 2(x²)² + (x²) − 1
S(3x² − 1) = 2(3x² − 1)² + (3x² − 1) − 1
= 18x⁴ − 9x²
S(x) = 2x + 4
S(3) = 2(3) + 4
= 6 + 4
= 10


y
x
θ


y
(x,y)
θ
x

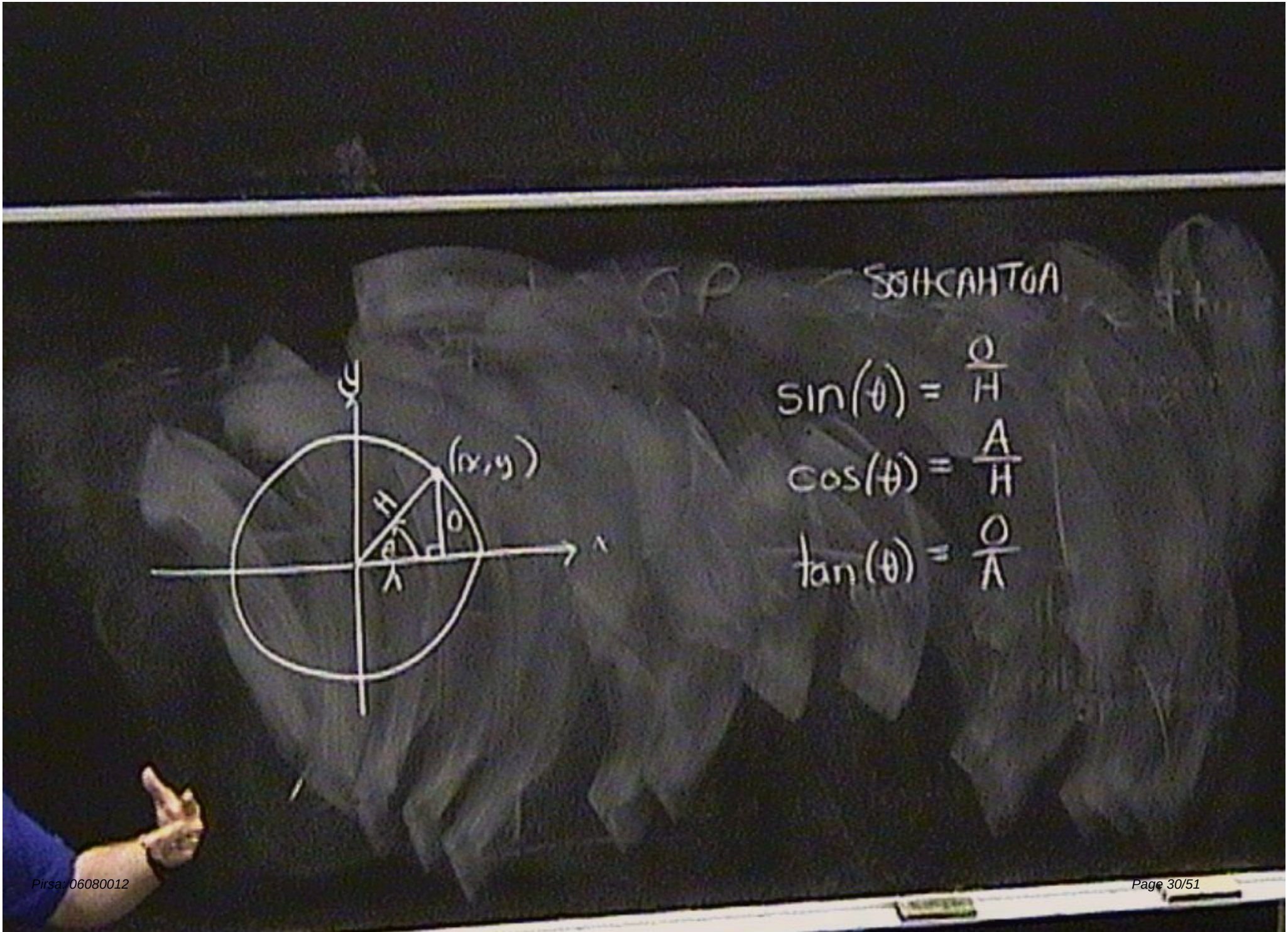

y
(x,y)
θ
x
sin(

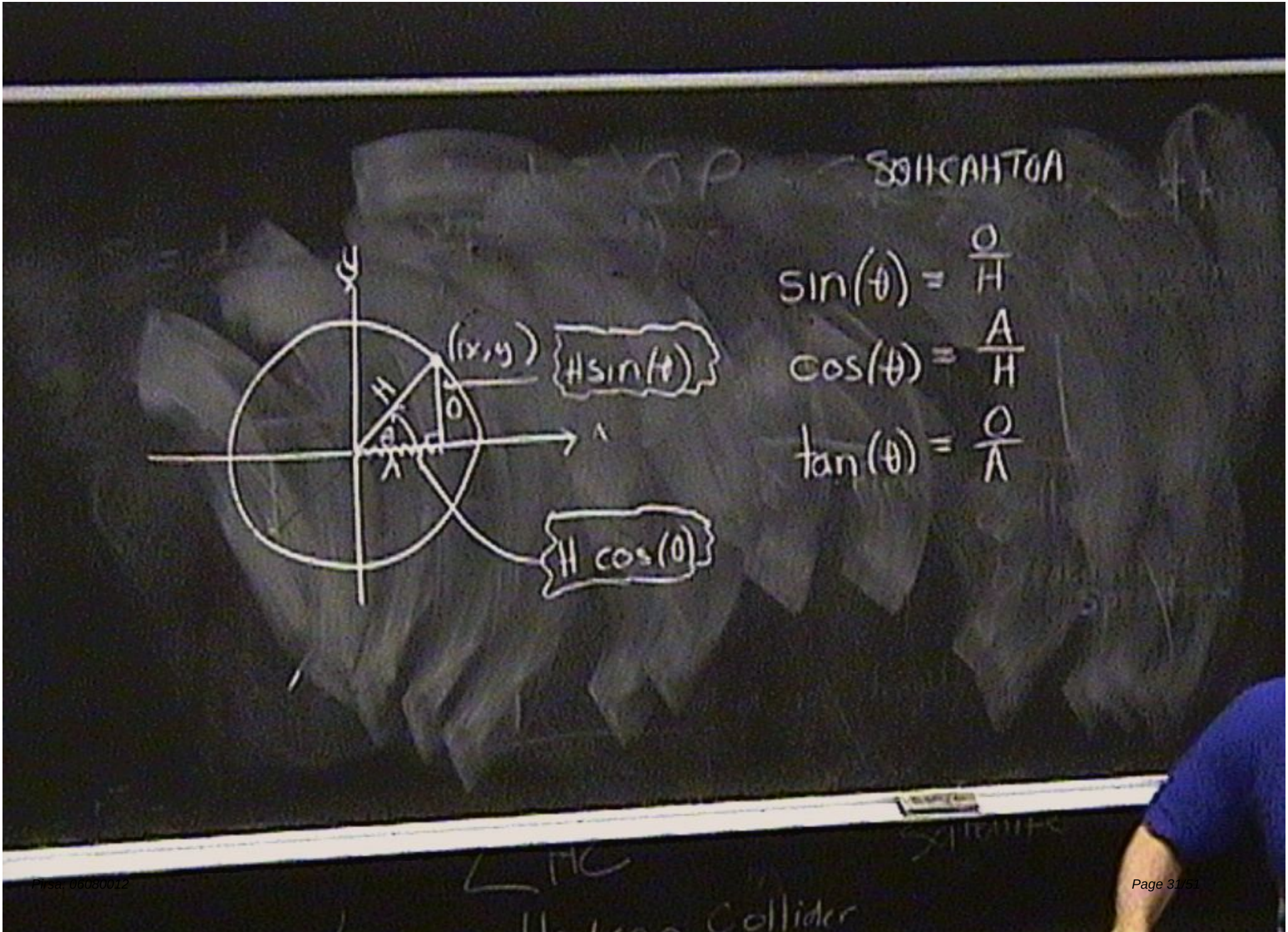

Sin(θ) = O/H
y
(x,y)
H
O
θ
x

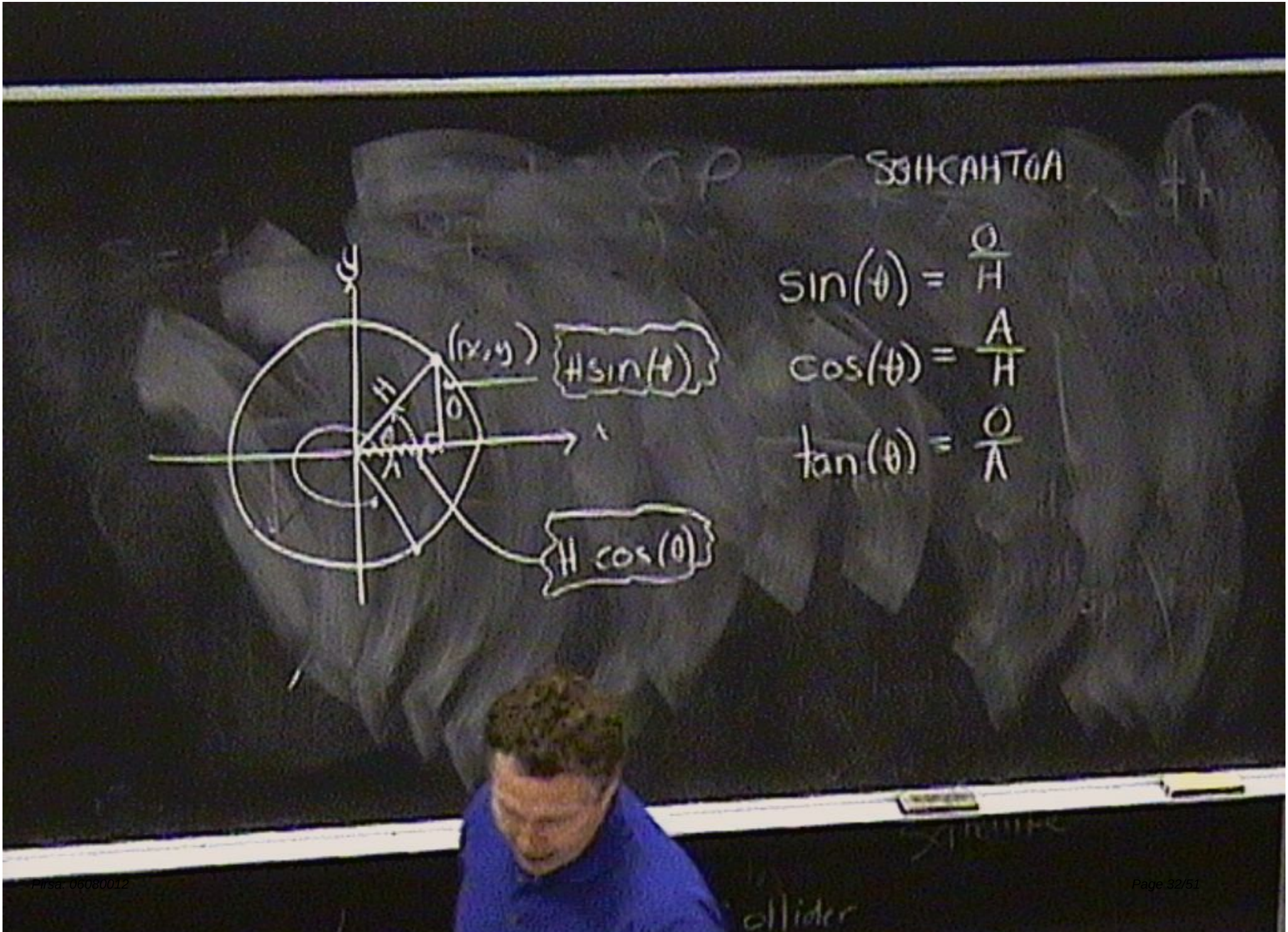
$$\sin(\theta) = \frac{O}{H}$$

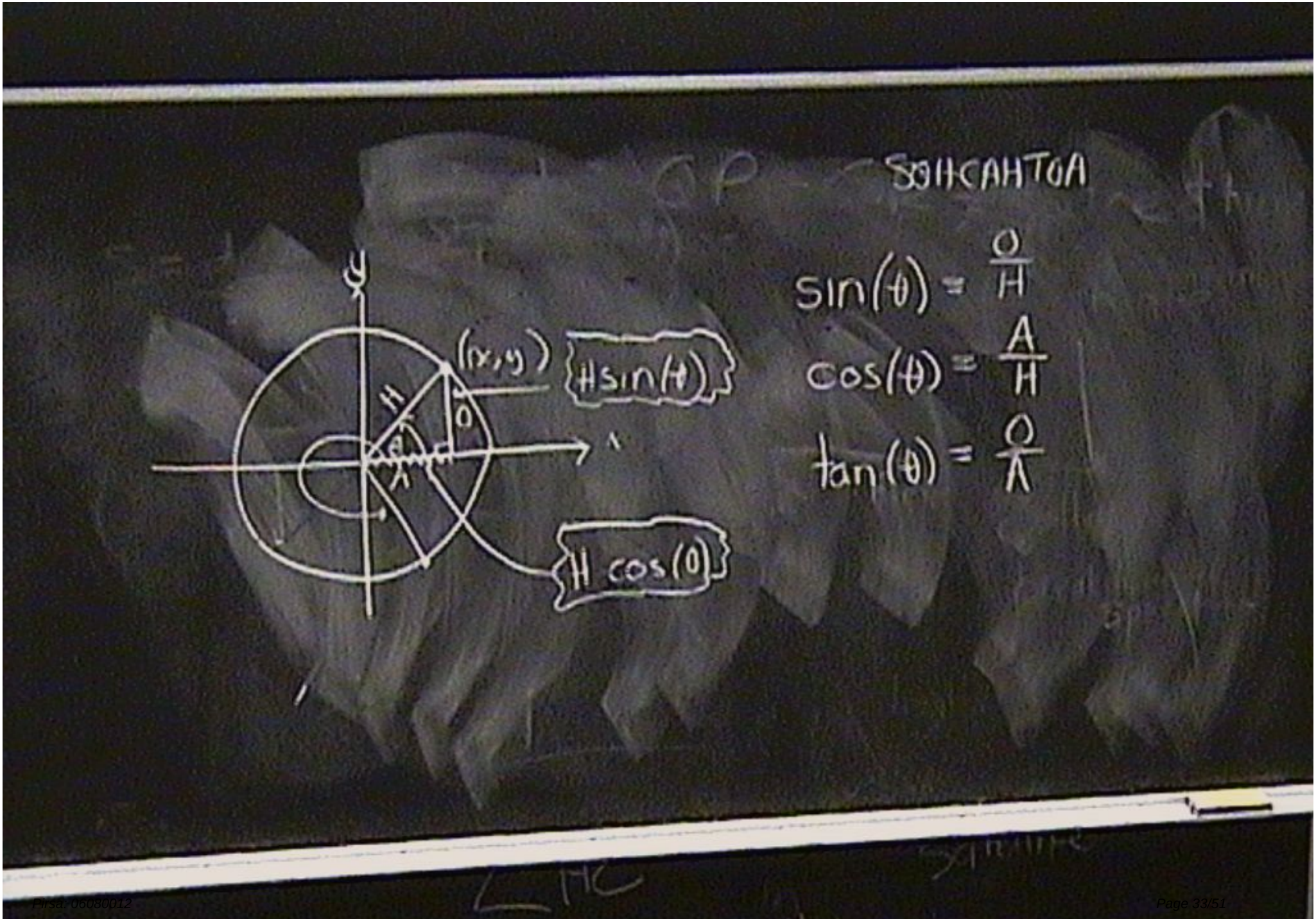
$$\cos(\theta) = \frac{A}{H}$$

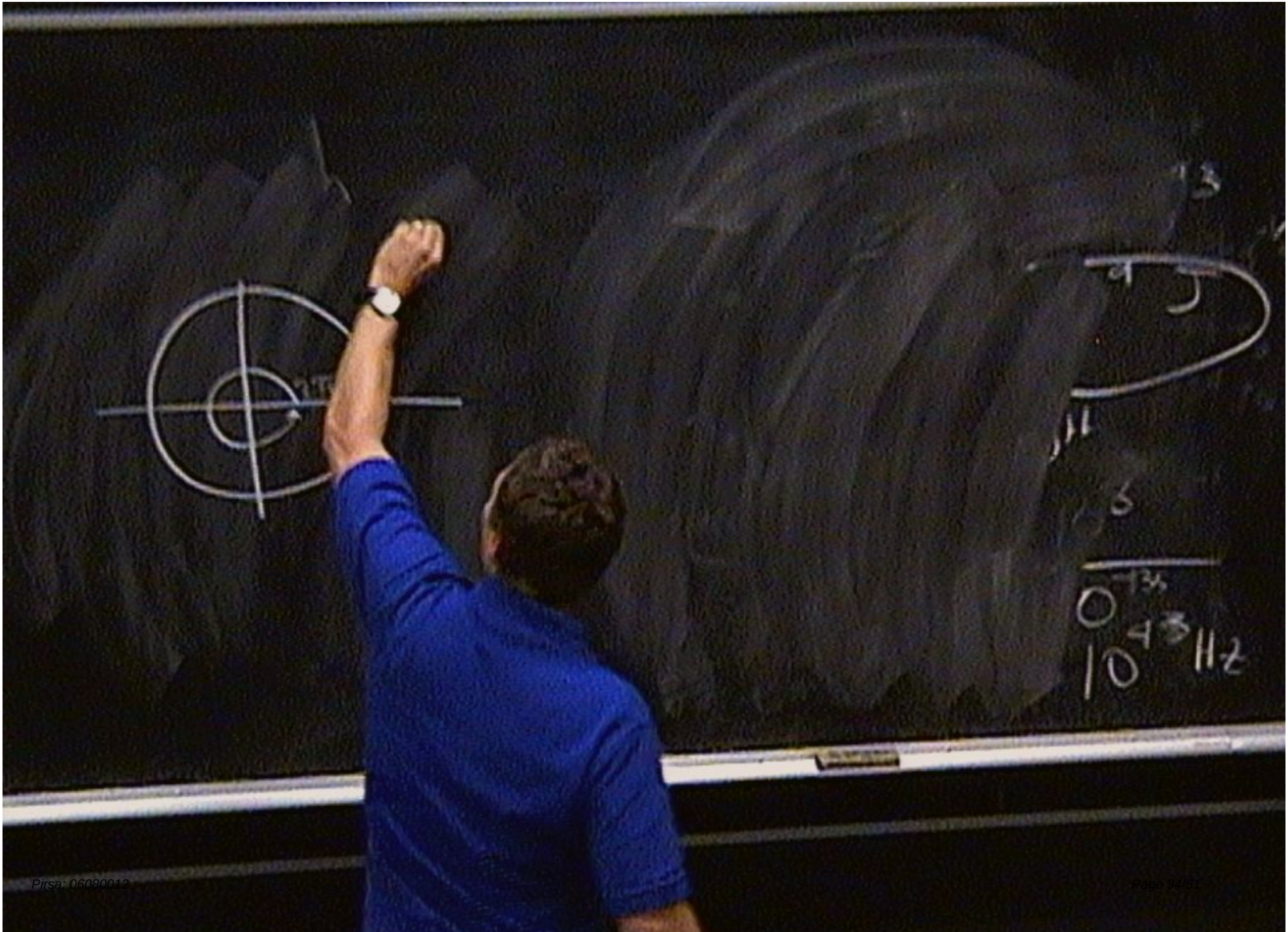
$$\tan(\theta) = \frac{O}{A}$$

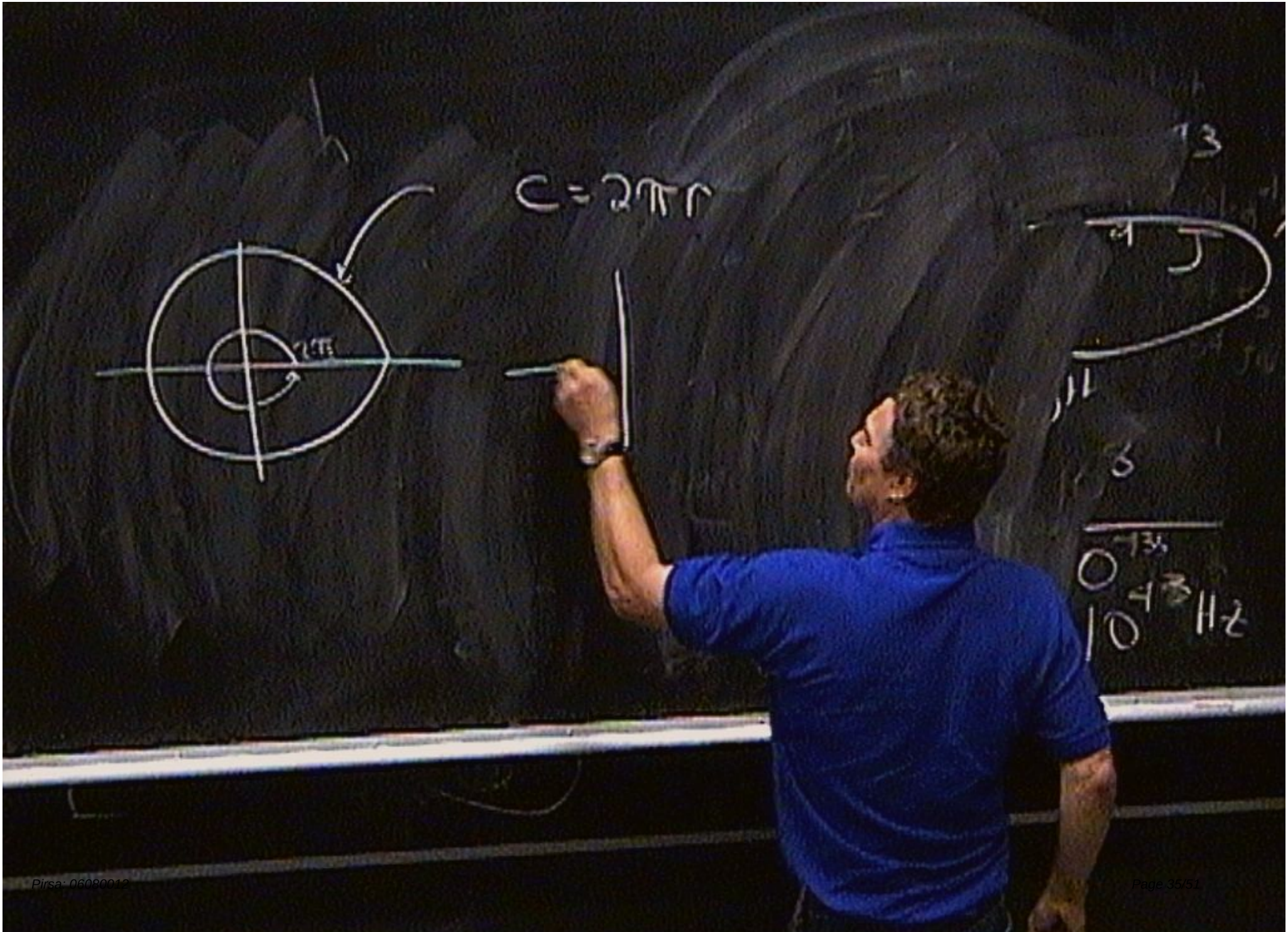

SOHCAHTOA
$\sin(\theta) = \frac{O}{H}$
$\cos(\theta) = \frac{A}{H}$
$\tan(\theta) = \frac{O}{A}$
y
x
(x,y)
H
O
θ

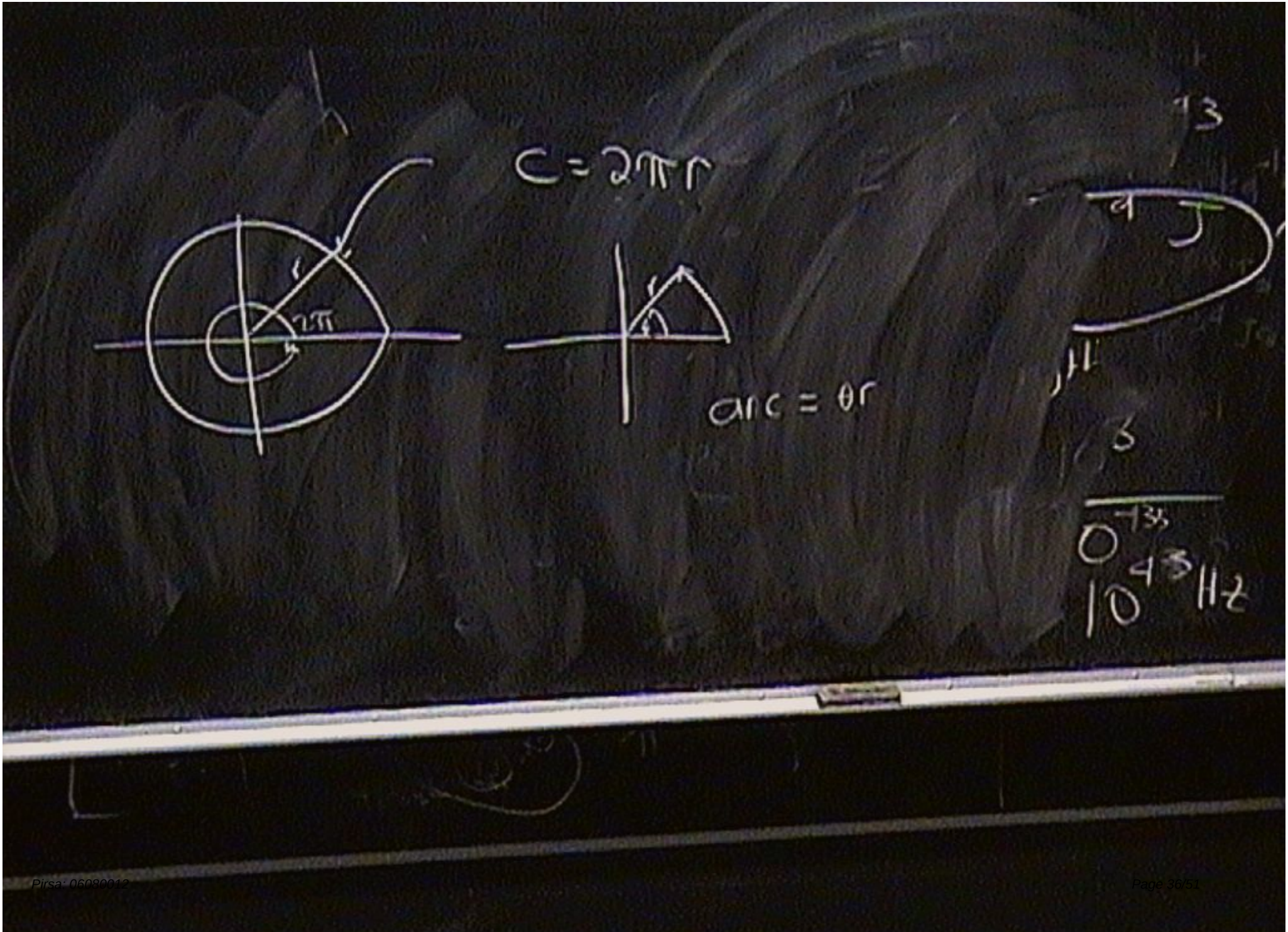

SOHCAHTOA
Sin(θ) = O/H
Cos(θ) = A/H
tan(θ) = O/A
y
(x,y)
H sin(θ)
H
O
θ
A
H cos(θ)

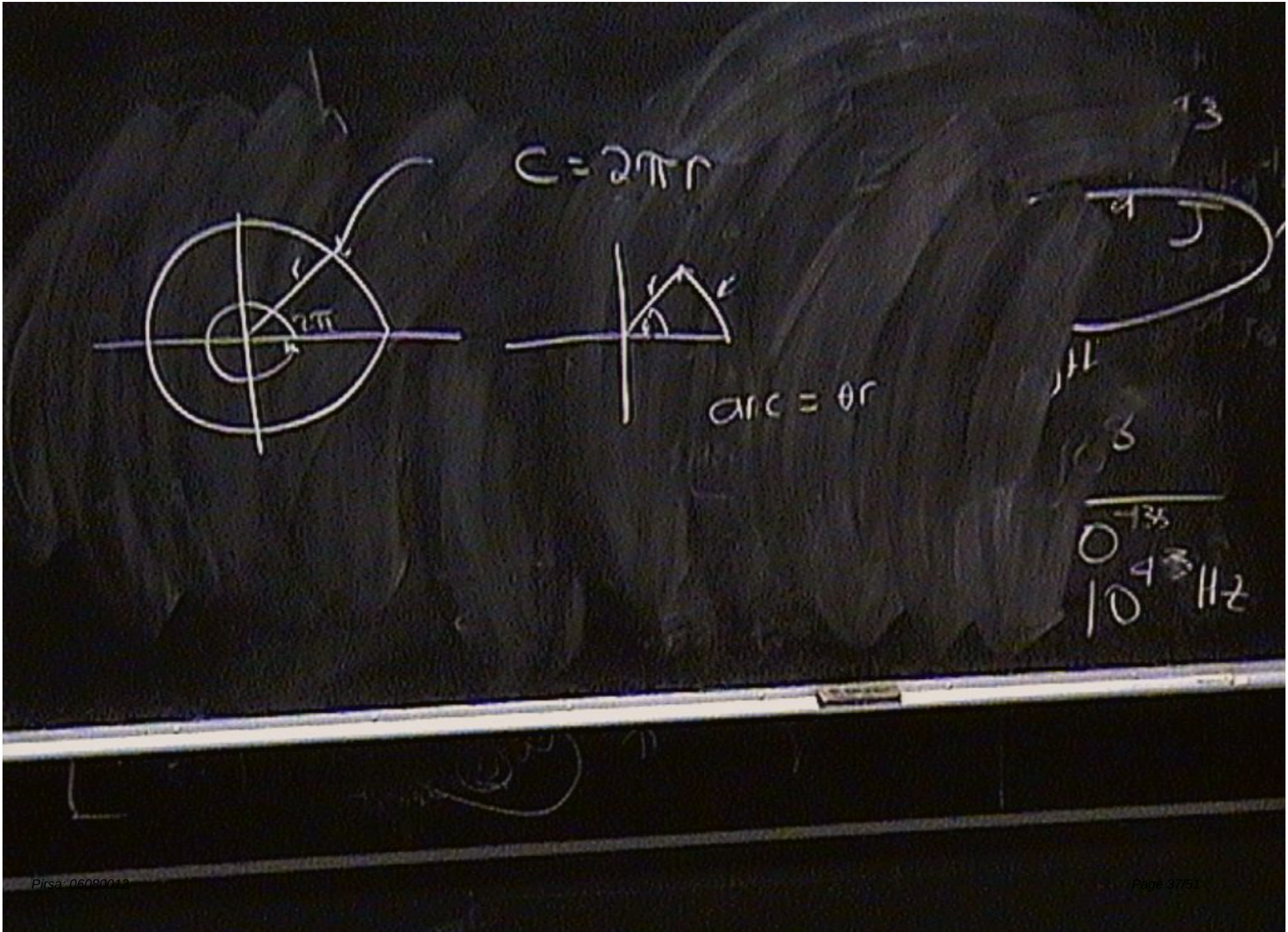

SOHCAHTOA
y
(x,y)
H sin(θ)
H
O
θ
A
H cos(θ)
sin(θ) = O/H
cos(θ) = A/H
tan(θ) = O/A

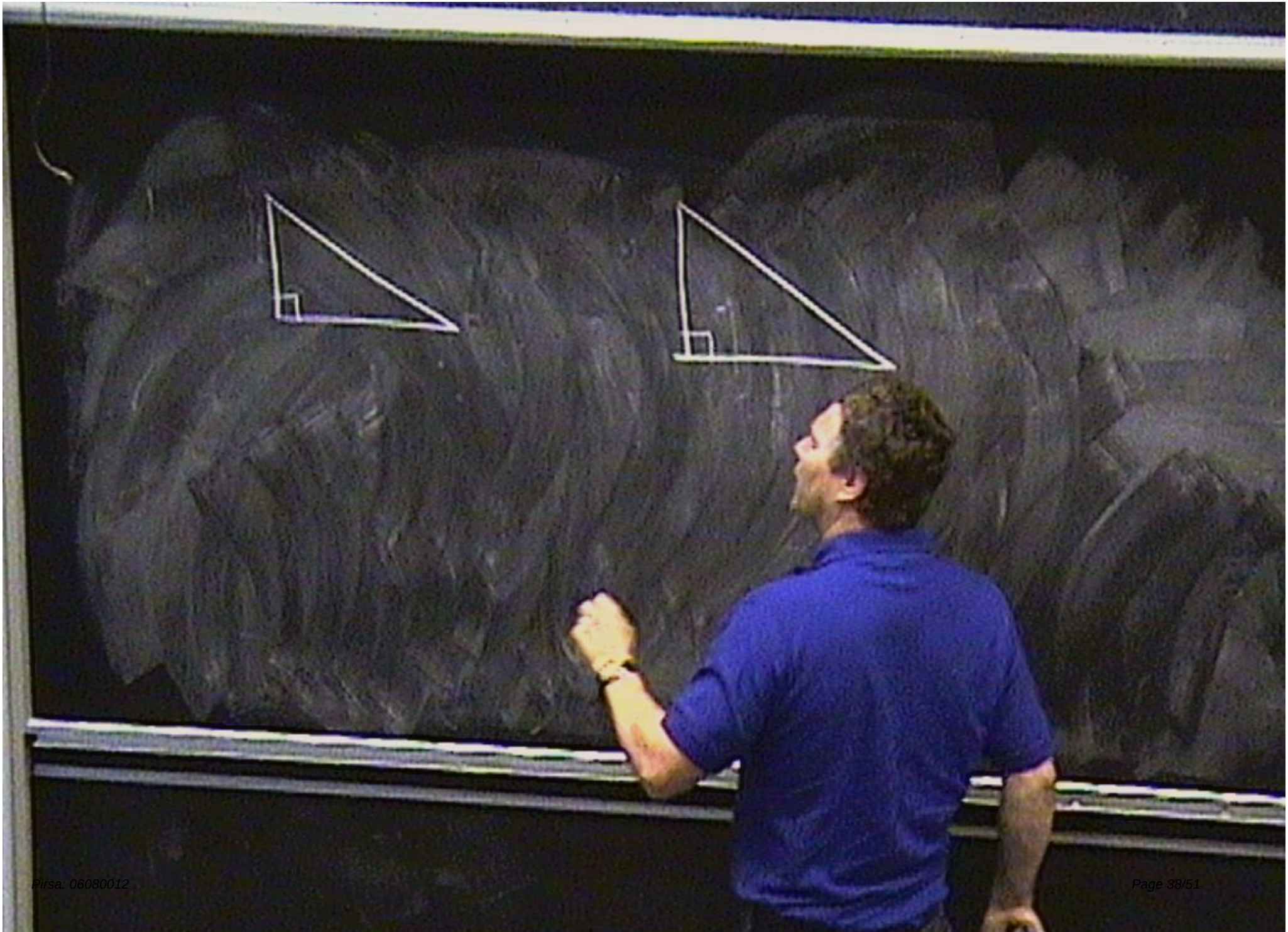

SOHCAHTOA
sin(θ) = O/H
cos(θ) = A/H
tan(θ) = O/A
(x,y)
{H sin(θ)}
{H cos(θ)}
H
O
θ
A
y
x

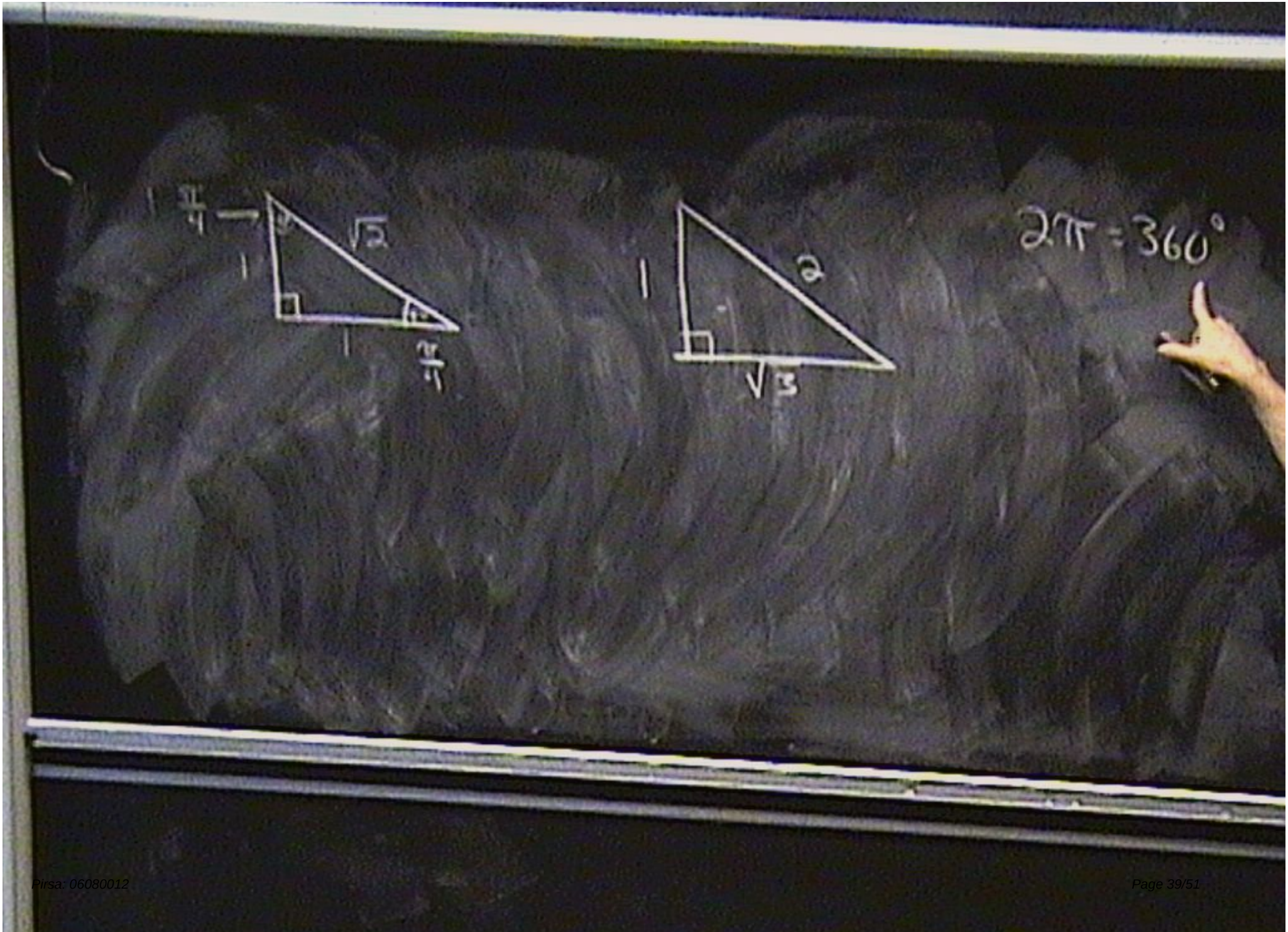


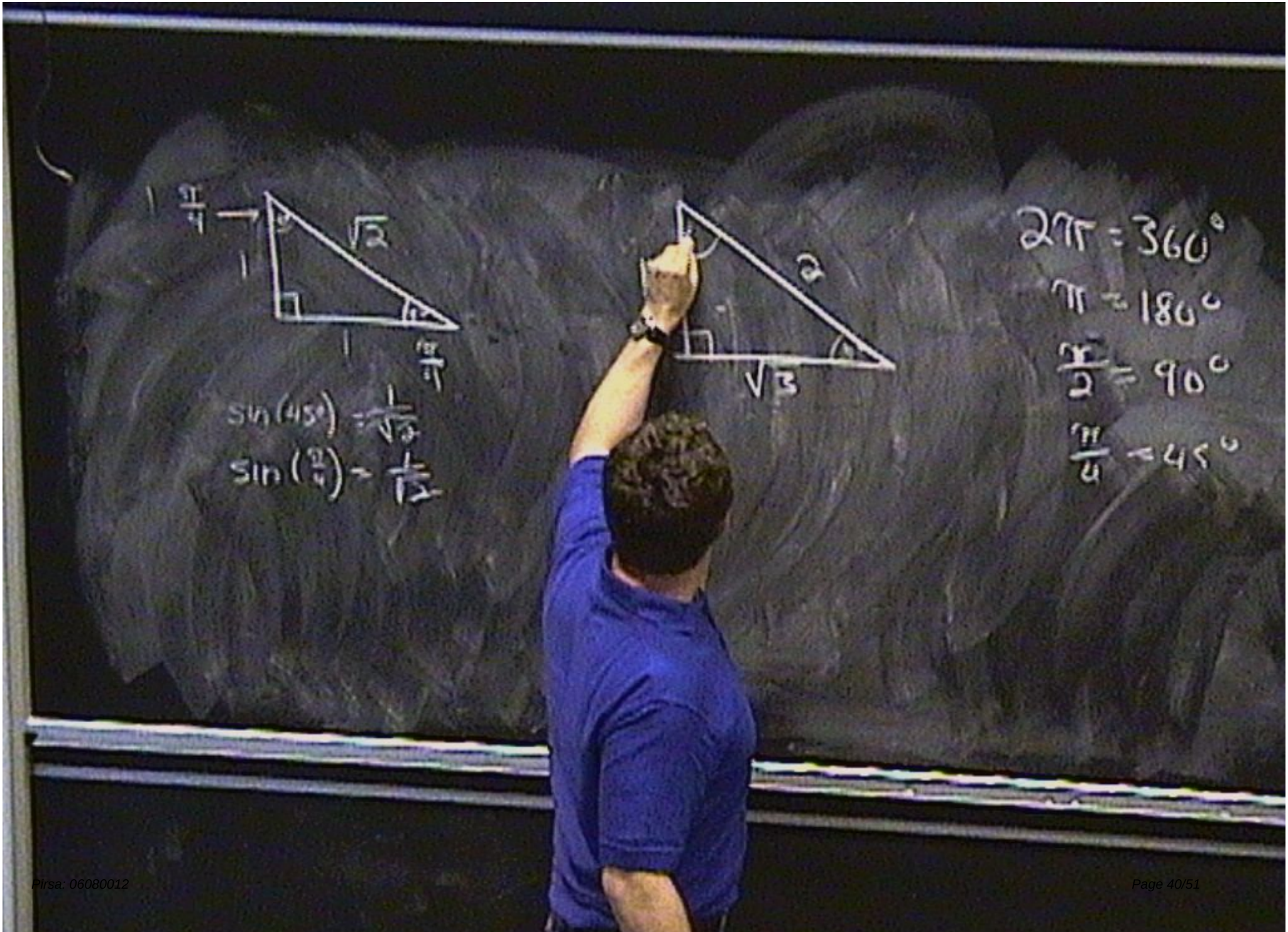

C = 2πr
2π

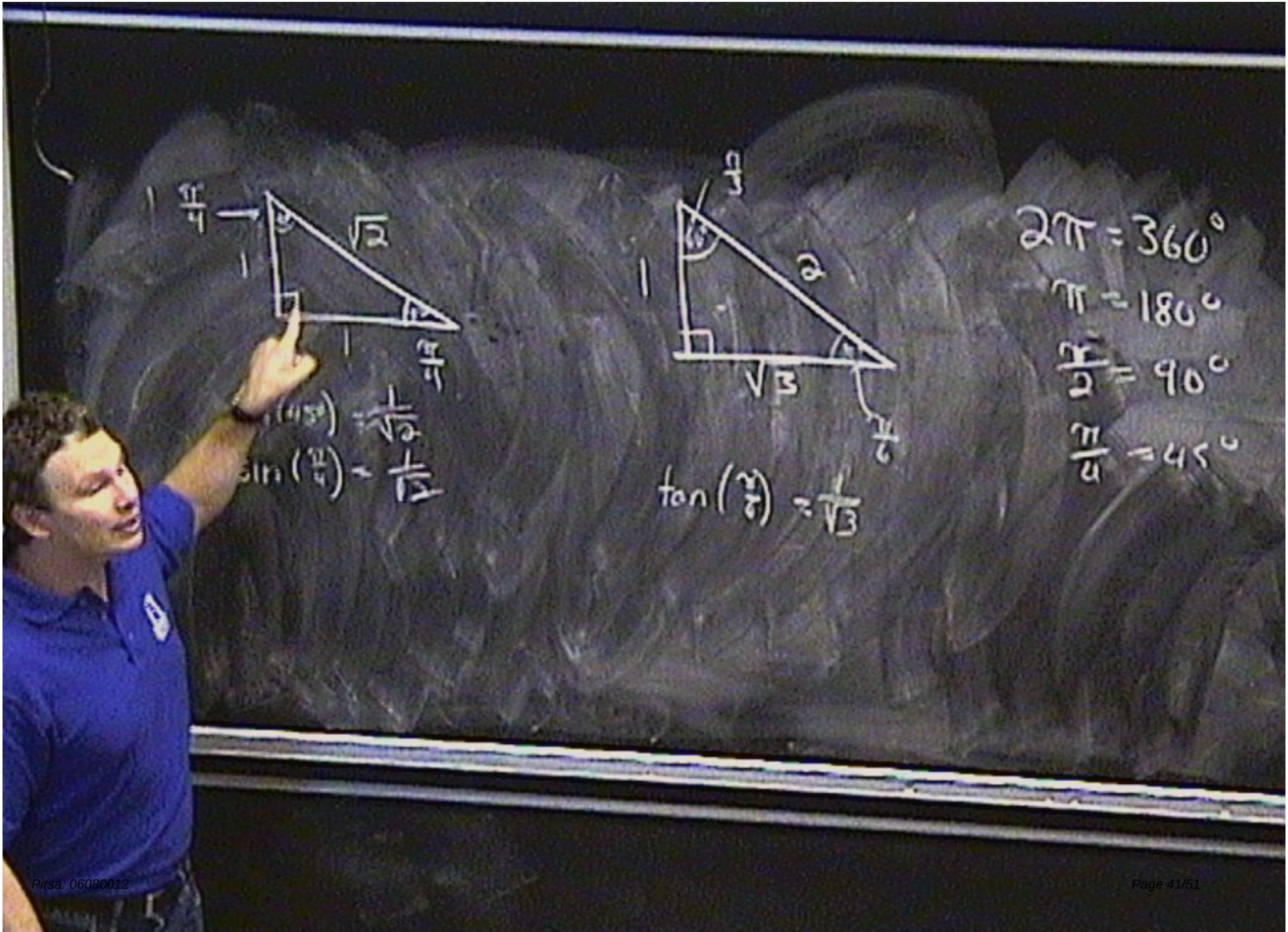

C = 2πr
2π
θ
arc = θr


C = 2πr
2π
arc = θr
θ
13
J
10^4 Hz




π/4
√2
1
1
π/3
1
2
√3
2π = 360°


π/4
√2
1
1
π/4
sin(45°) = 1/√2
sin(π/4) = 1/√2
2
√3
2π = 360°
π = 180°
π/2 = 90°
π/4 = 45°


π/4
√2
1
1
π/4
sin(π/4) = 1/√2
π/3
2
1
√3
π/6
tan(π/3) = √3
2π = 360°
π = 180°
π/2 = 90°
π/4 = 45°

$\sin(45°) = \frac{1}{\sqrt{2}}$

$\sin\left(\frac{\pi}{4}\right) = \frac{1}{\sqrt{2}}$

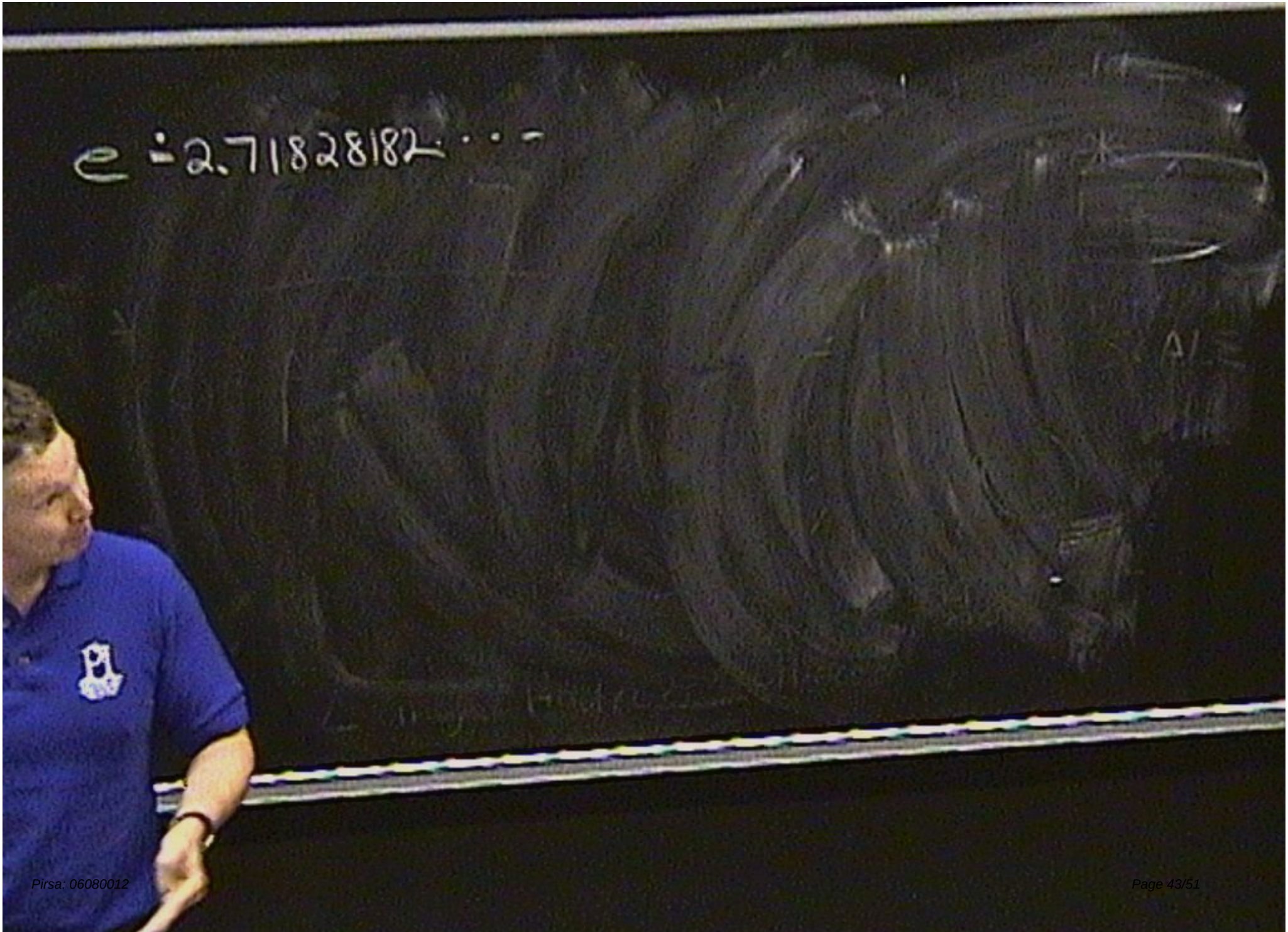
$\tan\left(\frac{\pi}{6}\right) = \frac{1}{\sqrt{3}}$

$2\pi = 360°$

$\pi = 180°$

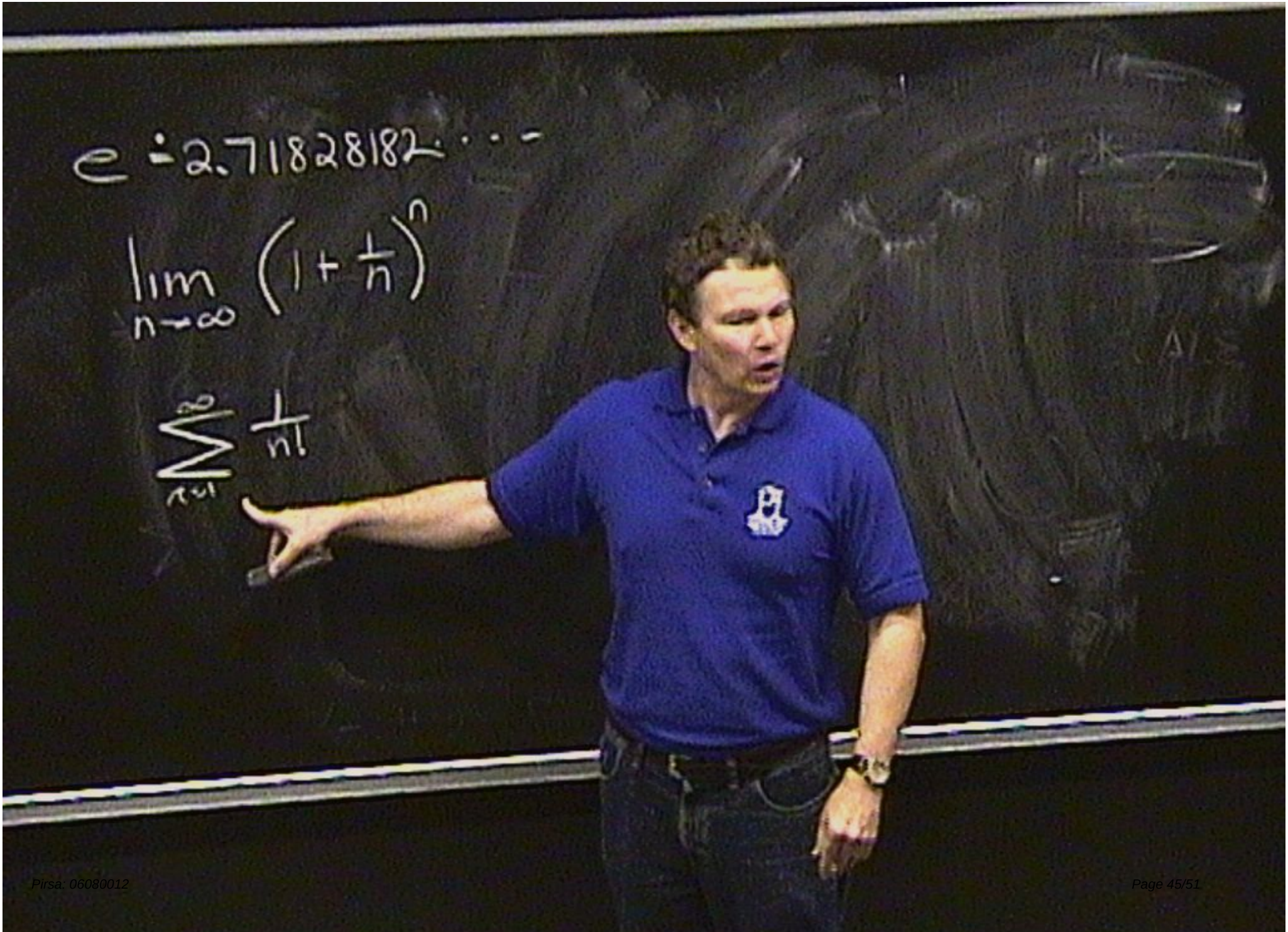
$\frac{\pi}{2} = 90°$

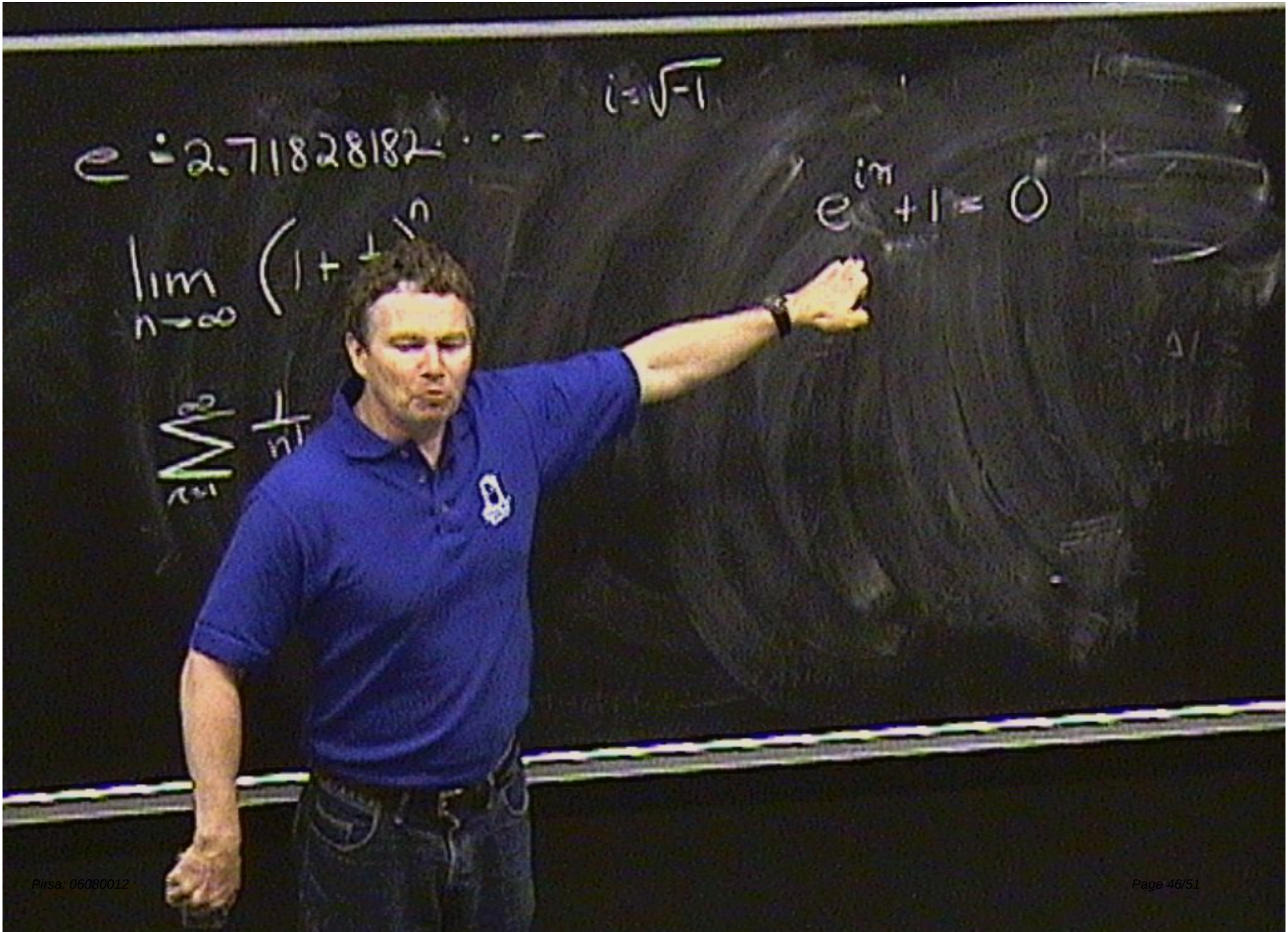
$\frac{\pi}{4} = 45°$


e ≈ 2.71828182...

$e \doteq 2.71828182\cdots$

$$\lim_{n\to\infty}\left(1+\frac{1}{n}\right)^n$$


e ≈ 2.71828182...
lim n→∞ (1 + 1/n)^n
Σ n=1 ∞ 1/n!


i = √-1
e = 2.718281828...
e^(iπ) + 1 = 0
lim n→∞ (1 + 1/n)^n
Σ 1/n!

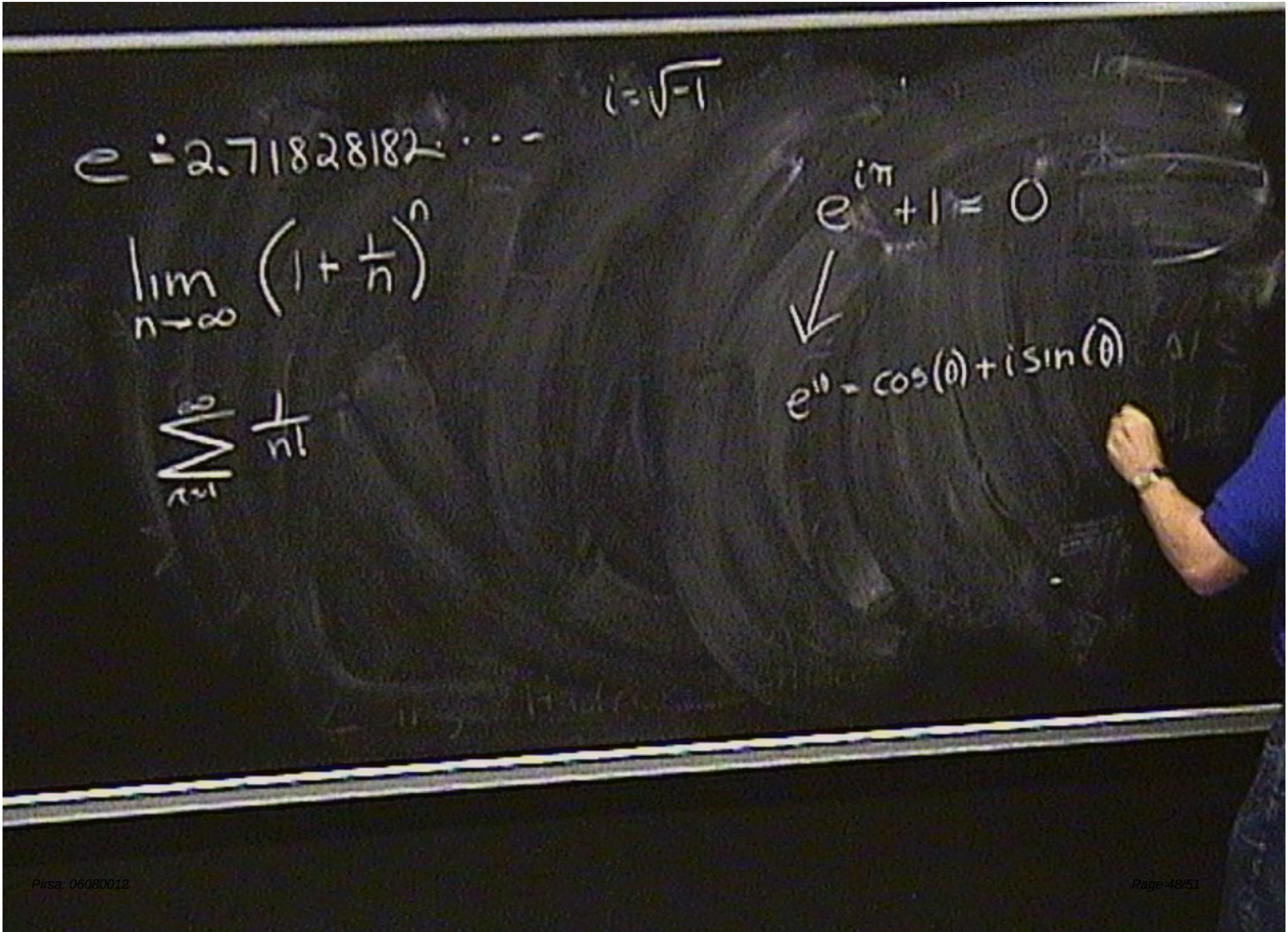
$e \doteq 2.71828182\cdots$

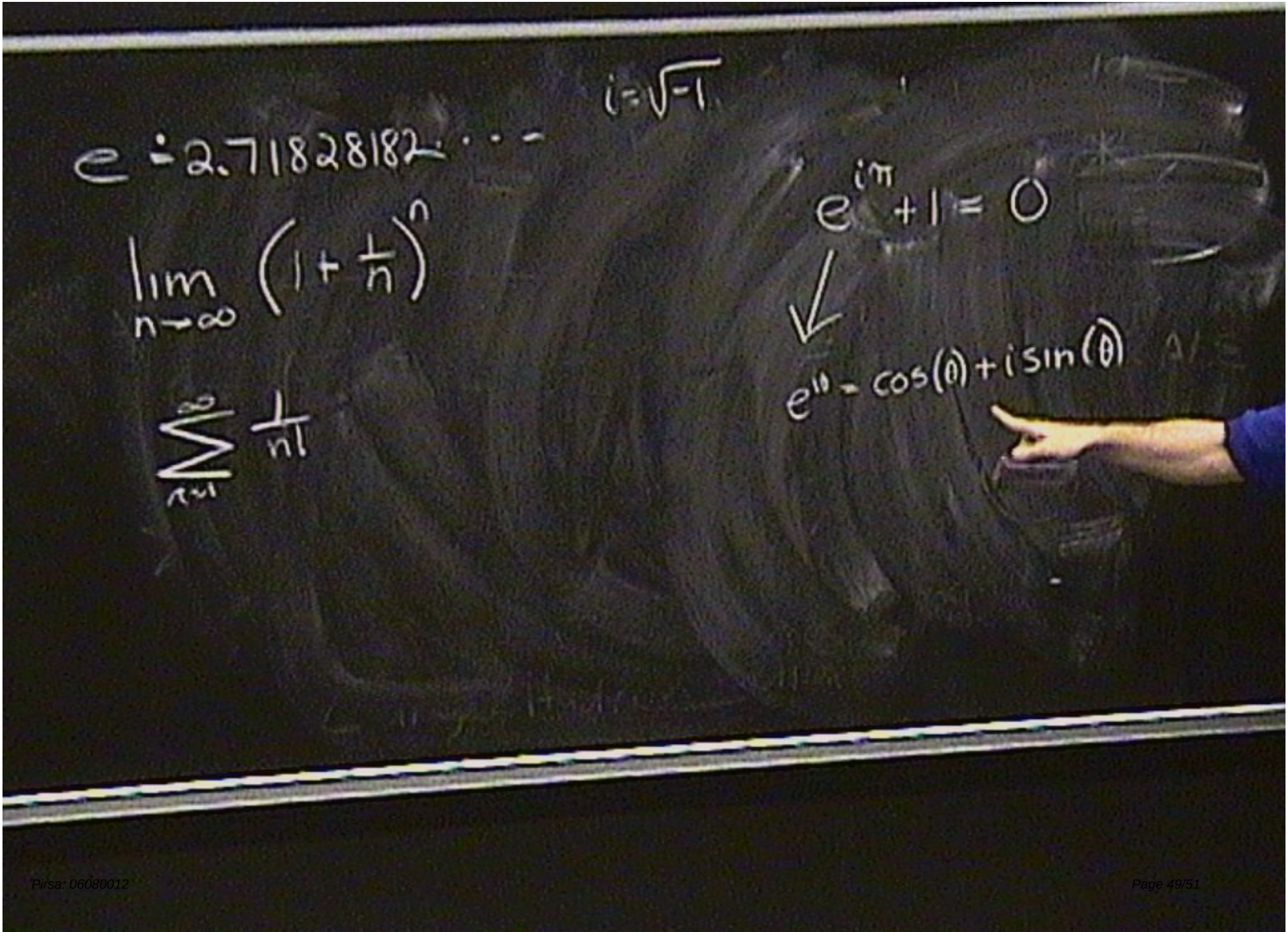
$i = \sqrt{-1}$

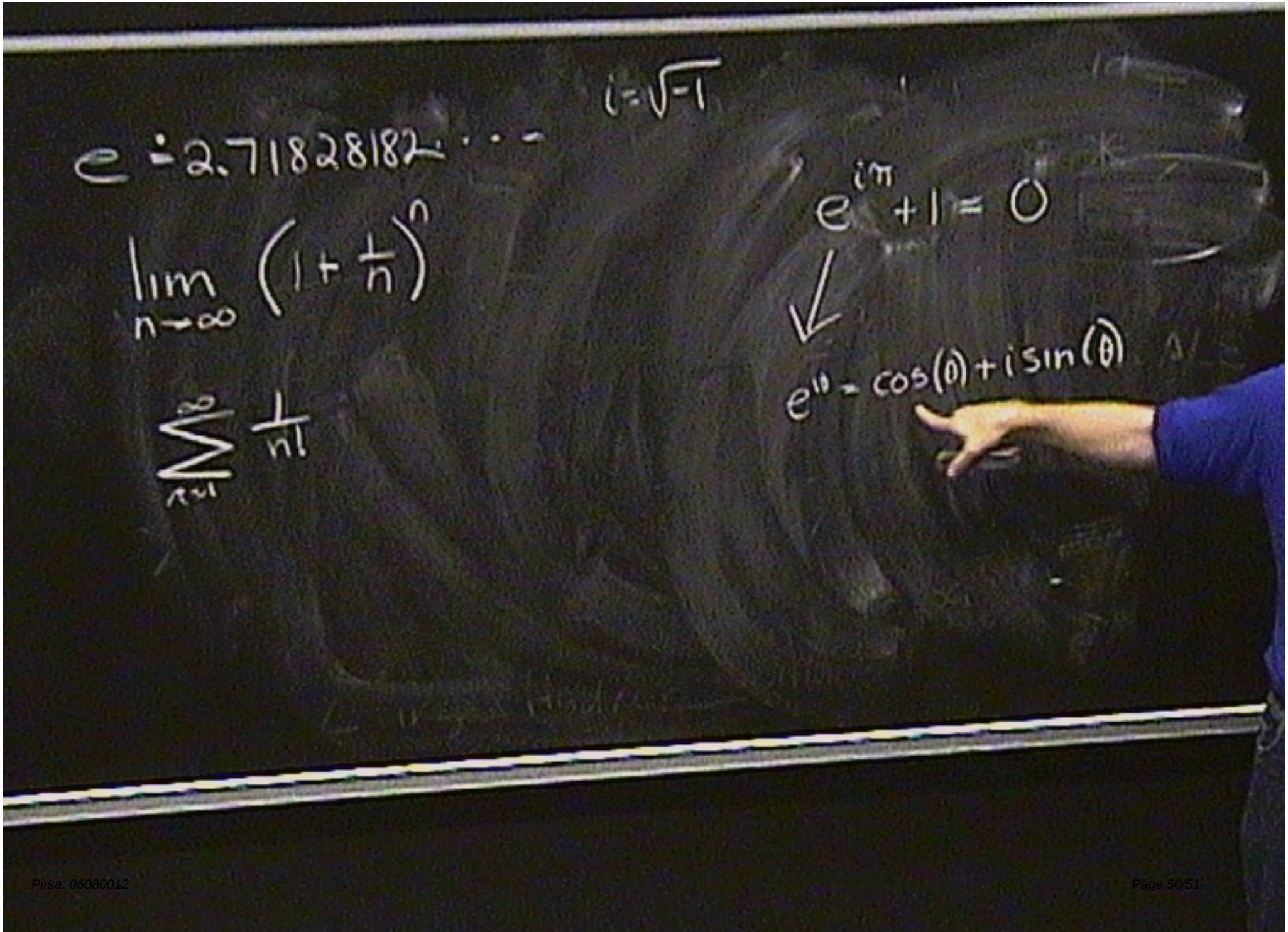
$$e^{i\pi} + 1 = 0$$

$$\lim_{n\to\infty}\left(1+\frac{1}{n}\right)^n$$

$$\sum_{n=1}^{\infty}\frac{1}{n!}$$


$i = \sqrt{-1}$
$e \doteq 2.71828182\ldots$
$\lim_{n\to\infty}\left(1+\frac{1}{n}\right)^n$
$\sum_{n=1}^{\infty}\frac{1}{n!}$
$e^{i\pi}+1=0$
$e^{i\theta}=\cos(\theta)+i\sin(\theta)$


$i = \sqrt{-1}$
$e \doteq 2.718281828\ldots$
$e^{i\pi} + 1 = 0$
$\lim_{n\to\infty} \left(1 + \frac{1}{n}\right)^n$
$e^{i\theta} = \cos(\theta) + i\sin(\theta)$
$\sum_{n=1}^{\infty} \frac{1}{n!}$


$i = \sqrt{-1}$
$e = 2.71828182\ldots$
$e^{i\pi} + 1 = 0$
$\lim_{n\to\infty} \left(1 + \frac{1}{n}\right)^n$
$e^{i\theta} = \cos(\theta) + i\sin(\theta)$
$\sum_{n=1}^{\infty} \frac{1}{n!}$

$i = \sqrt{-1}$

$e \doteq 2.71828182\ldots$

$e^{i\pi} + 1 = 0$

$\lim_{n\to\infty} \left(1 + \frac{1}{n}\right)^n$

$\sum_{n=0}^{\infty} \frac{1}{n!}$

$e^{i\theta} = \cos(\theta) + i\sin(\theta)$