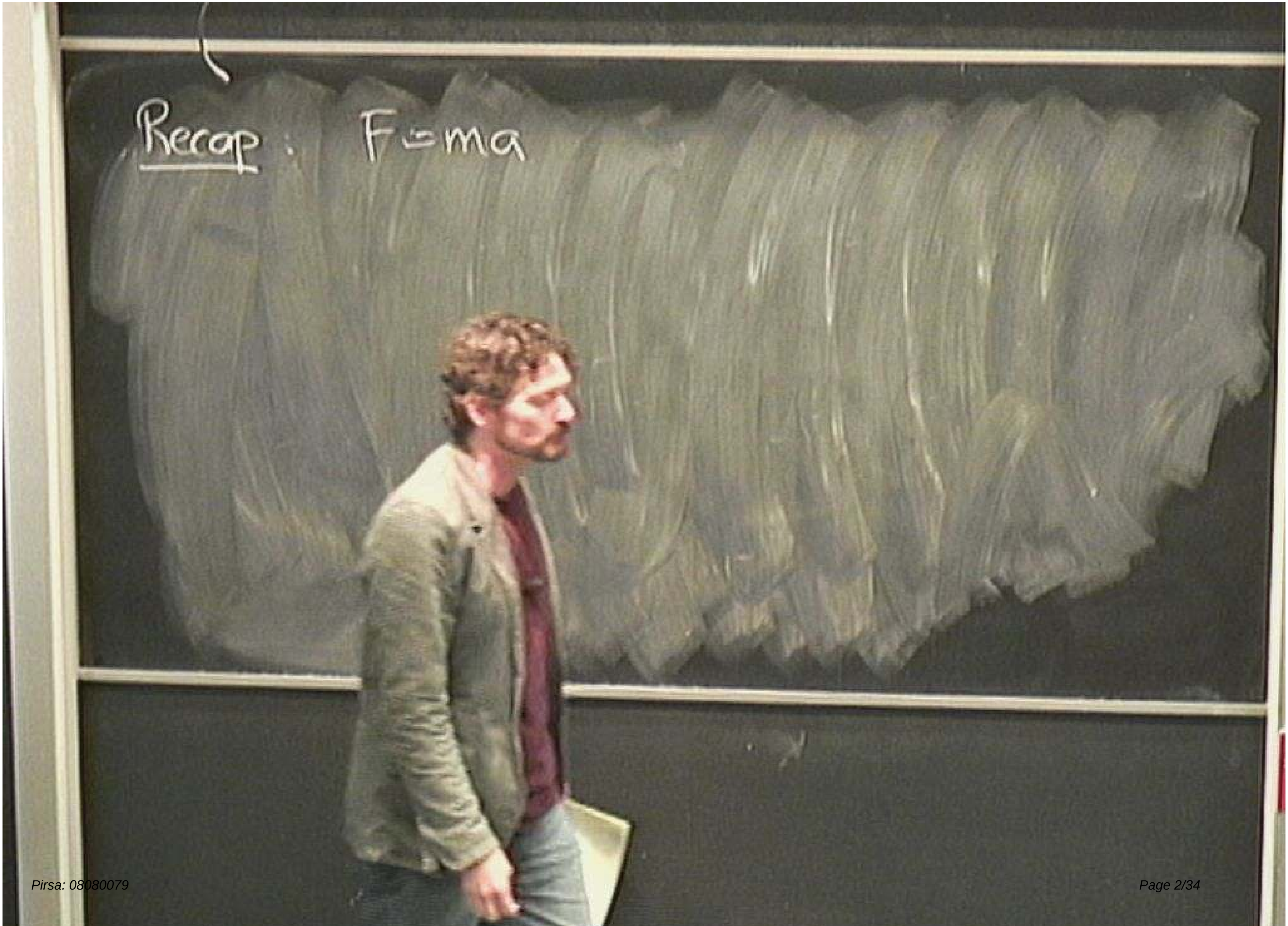
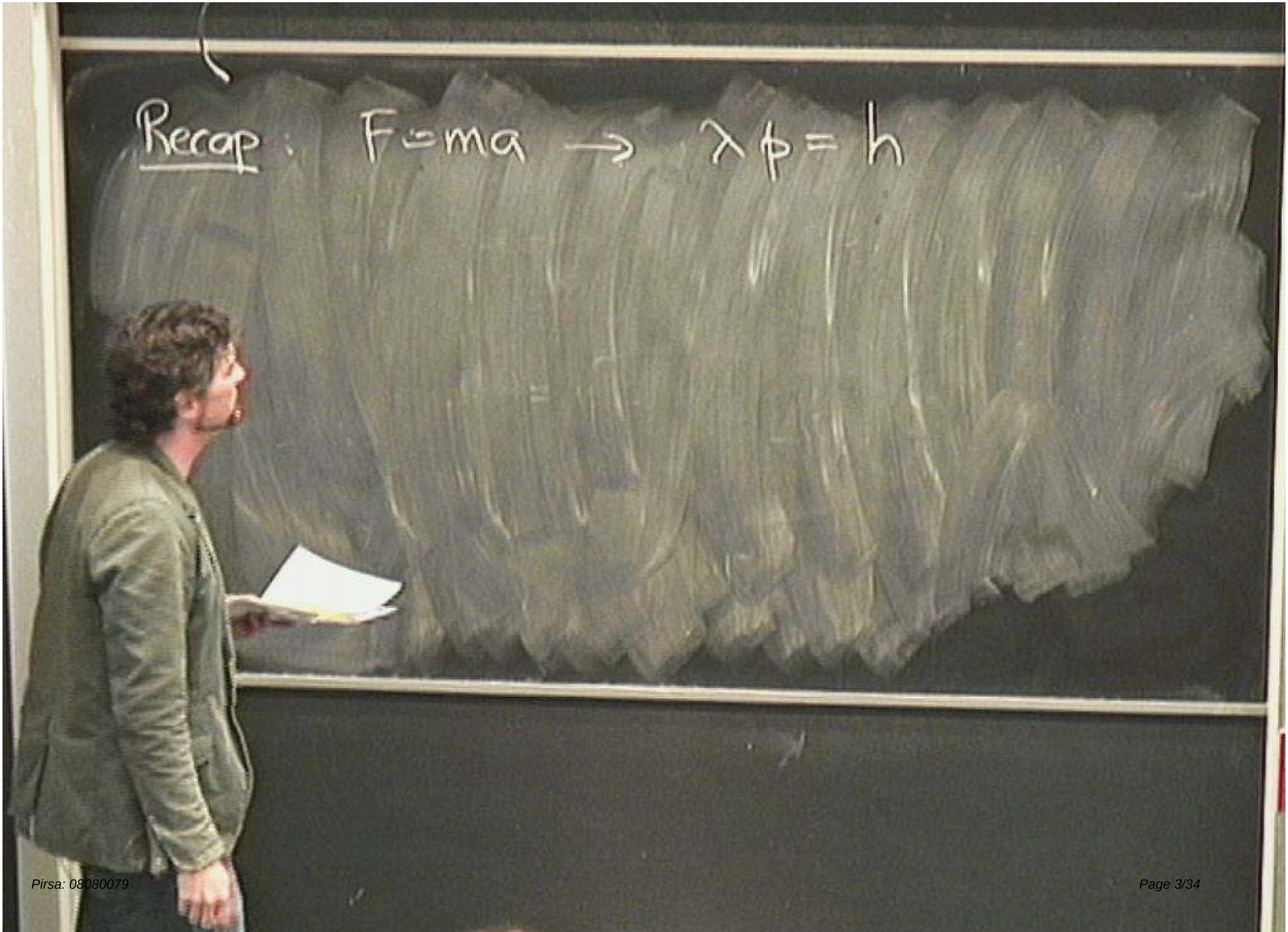
Title: Quantum Mechanics 4 - OR vs. AND

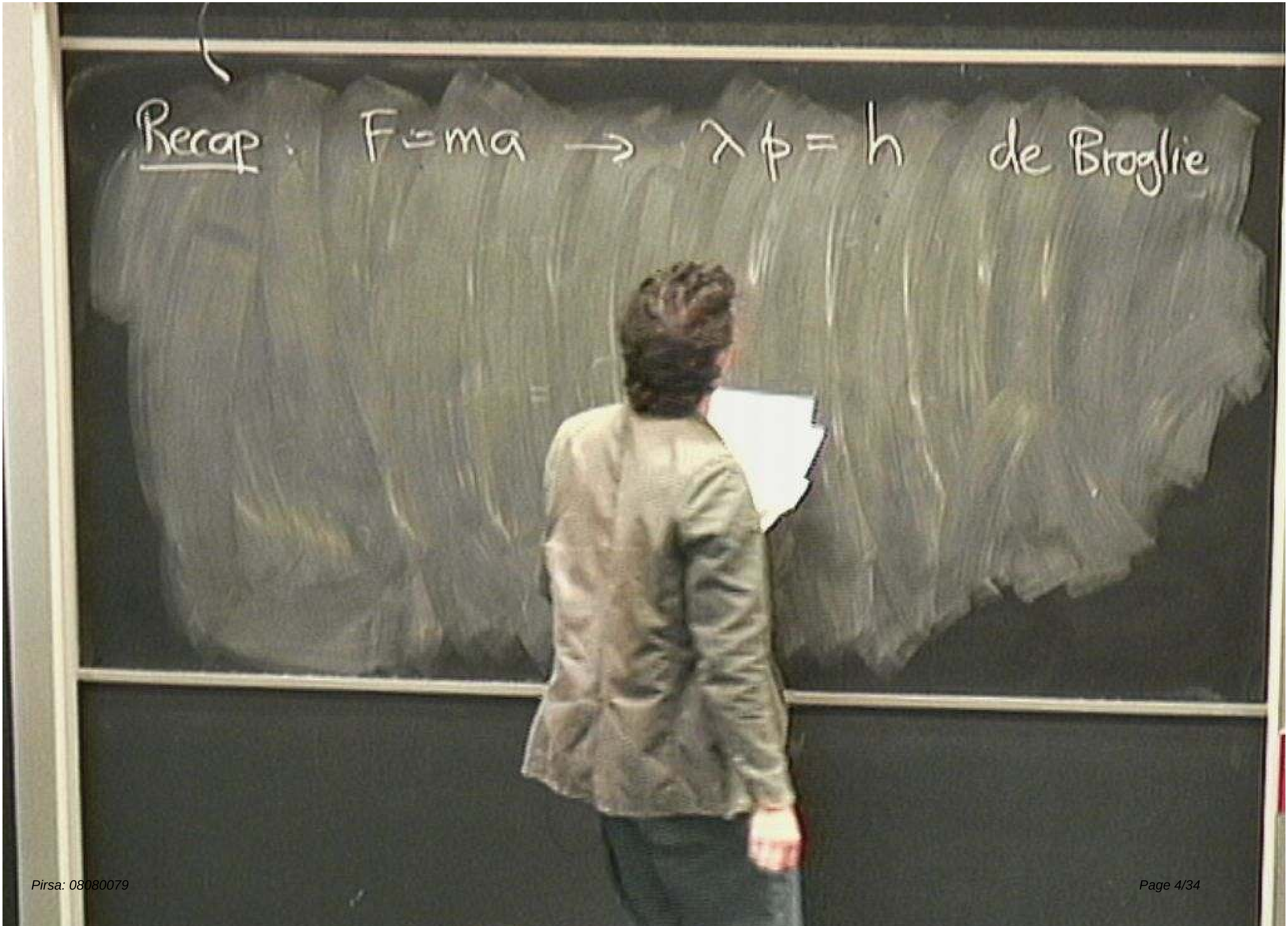
Date: Aug 11, 2008 10:30 AM

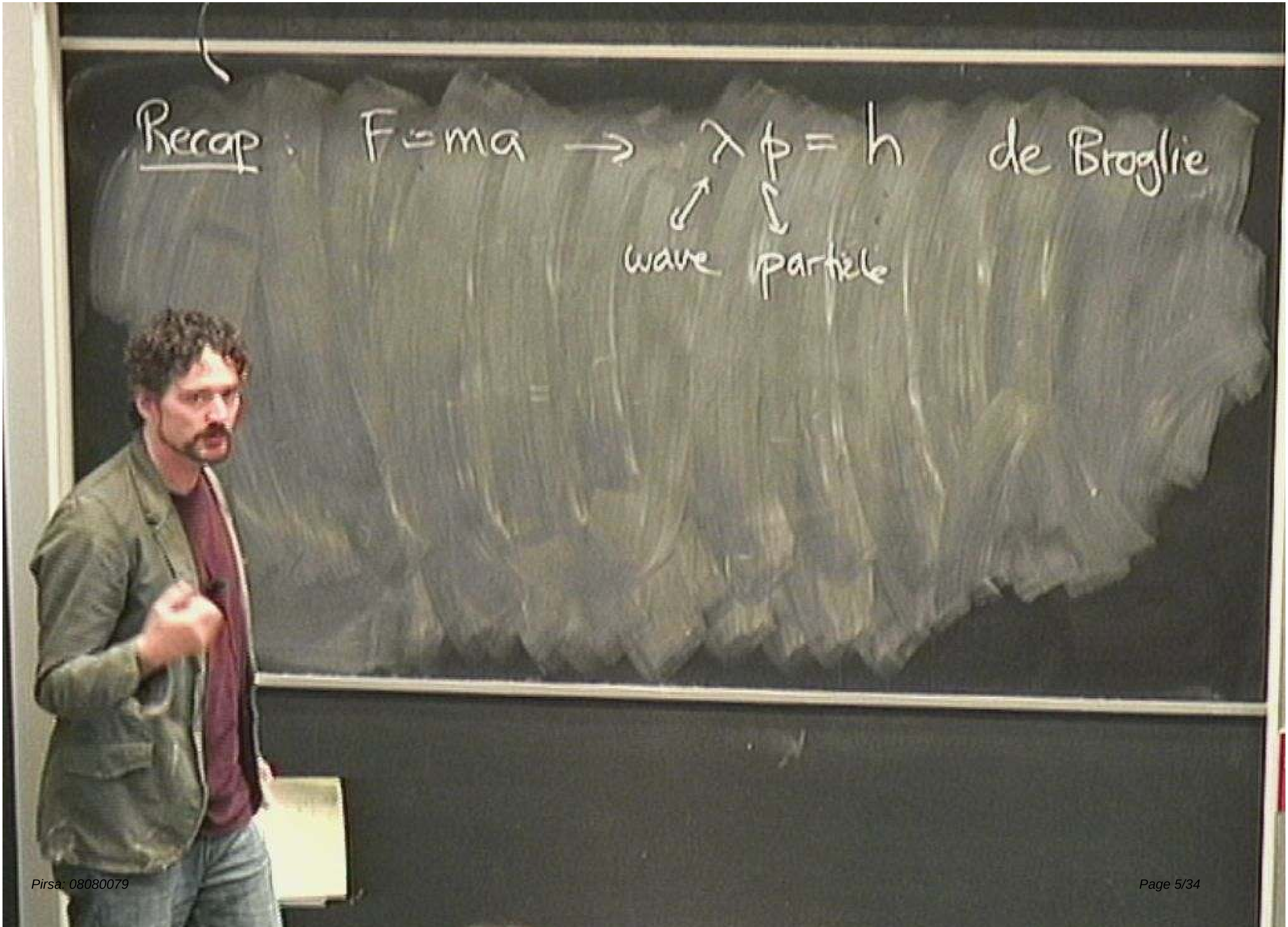
URL: http://pirsa.org/08080079

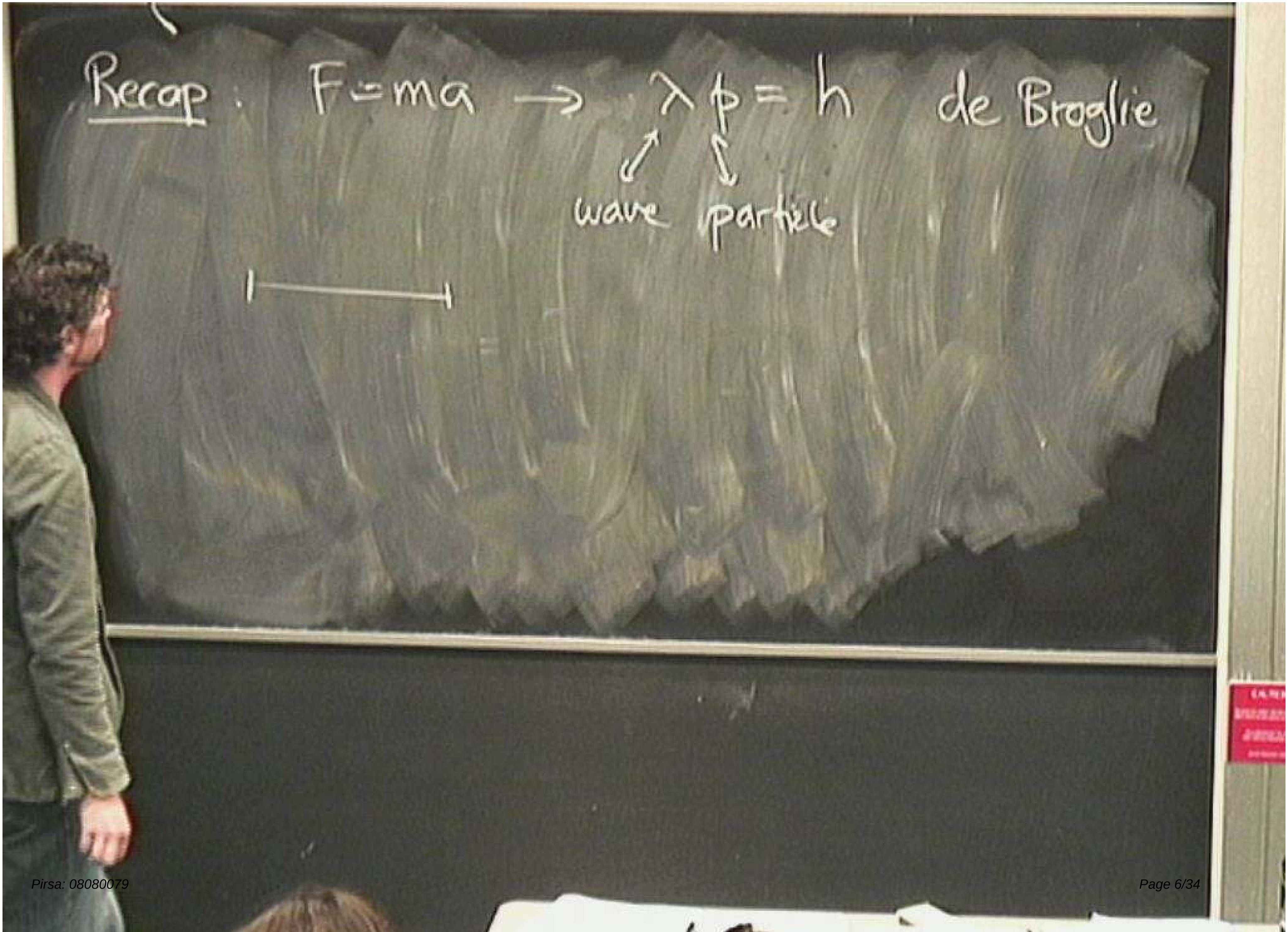
Abstract: Highlighting the essential difference between the classical and quantum worlds.
Learning Outcomes:
â€¢ A recap of what weâ€™ve learned so far.
â€¢ Understanding that in the classical world we have either â€œparticle moving to the rightâ€• OR â€œparticle moving to the left.â€•
â€¢ Understanding that, in the quantum world, OR can be replaced with AND: â€œparticle moving to the rightâ€• AND â€œparticle moving to the left.â€•

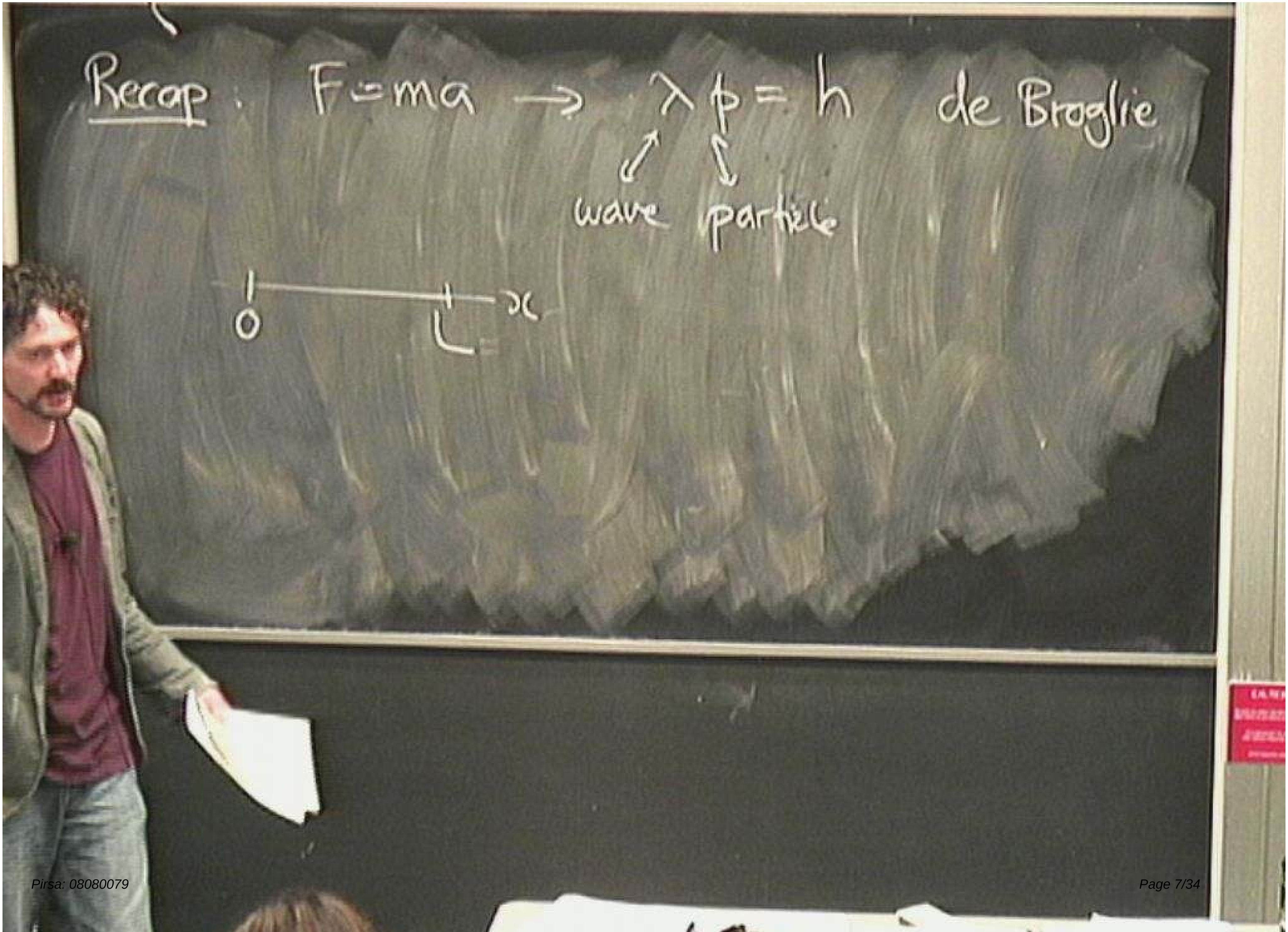

Recap: F = ma

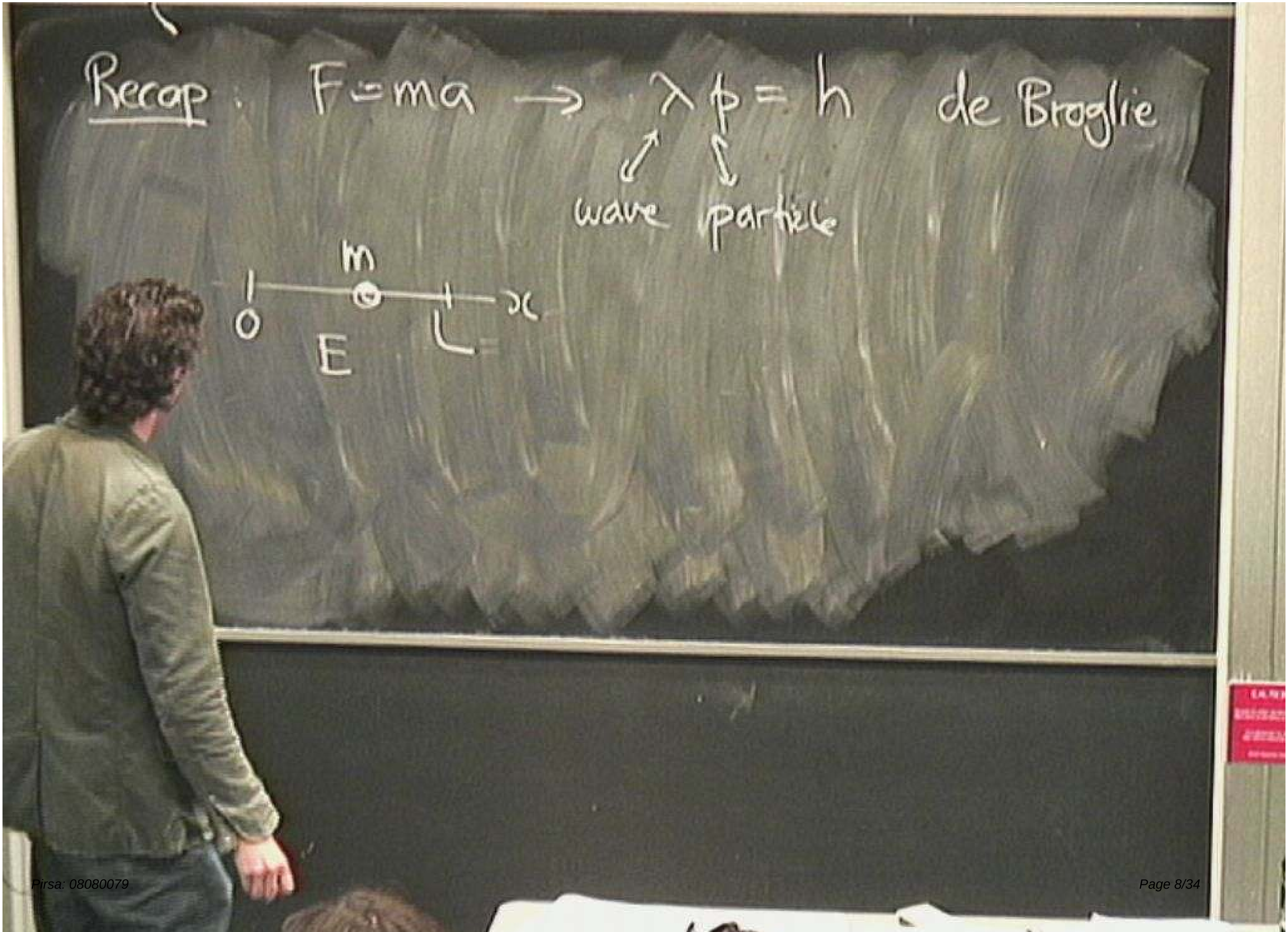

Recap: F=ma → λp = h

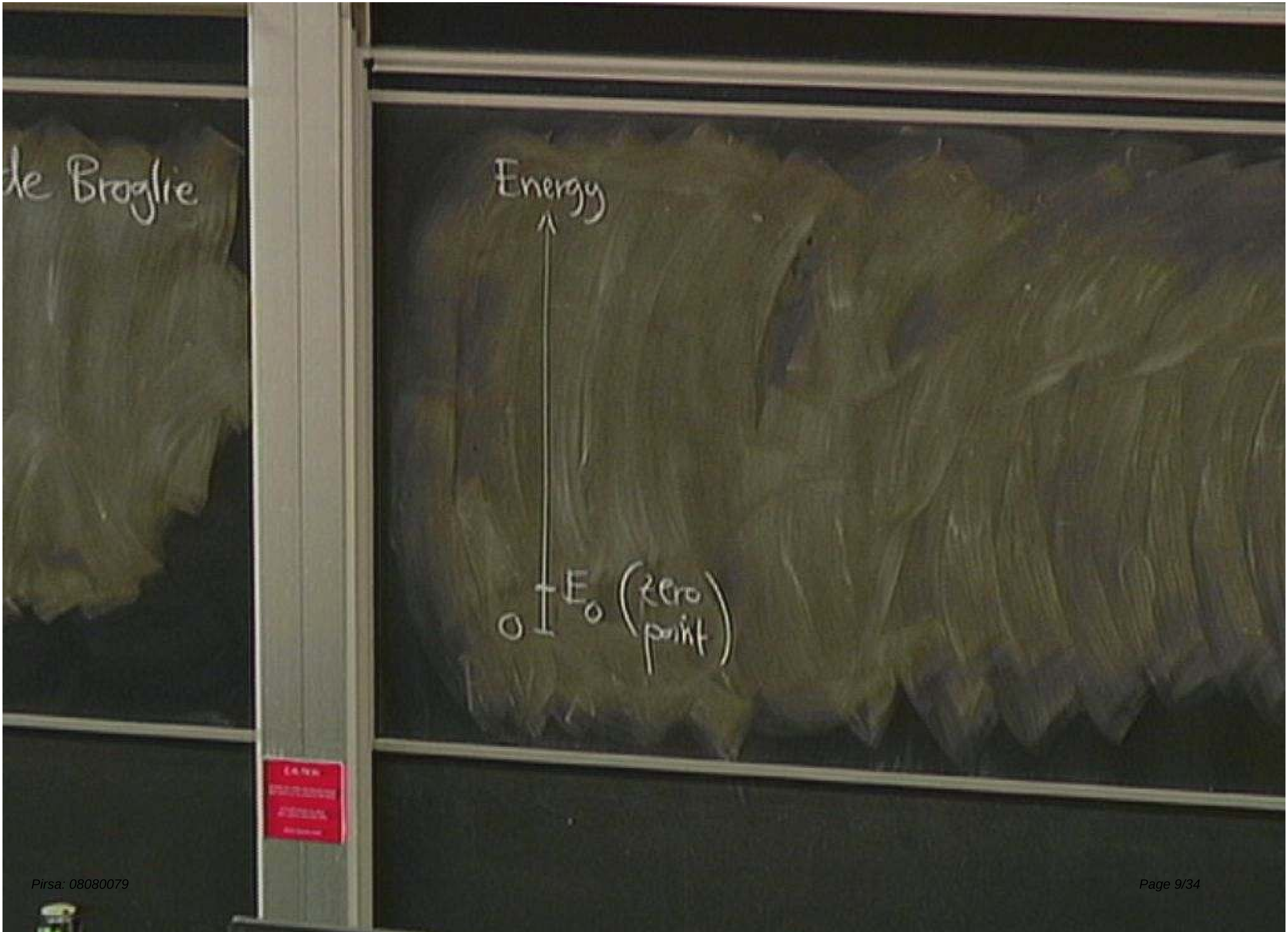

Recap: F=ma → λp = h de Broglie

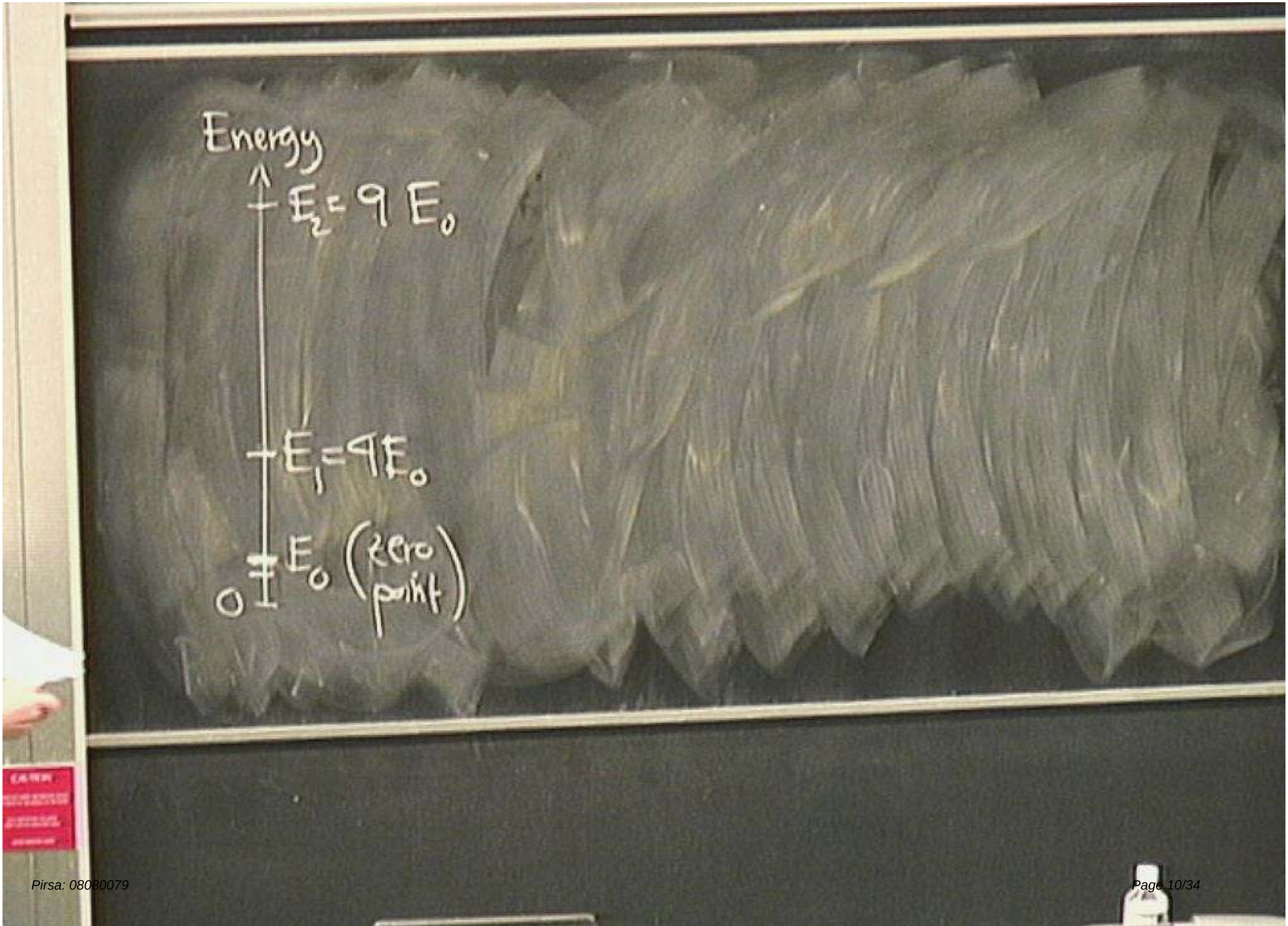

Recap: F = ma → λp = h de Broglie
wave
particle

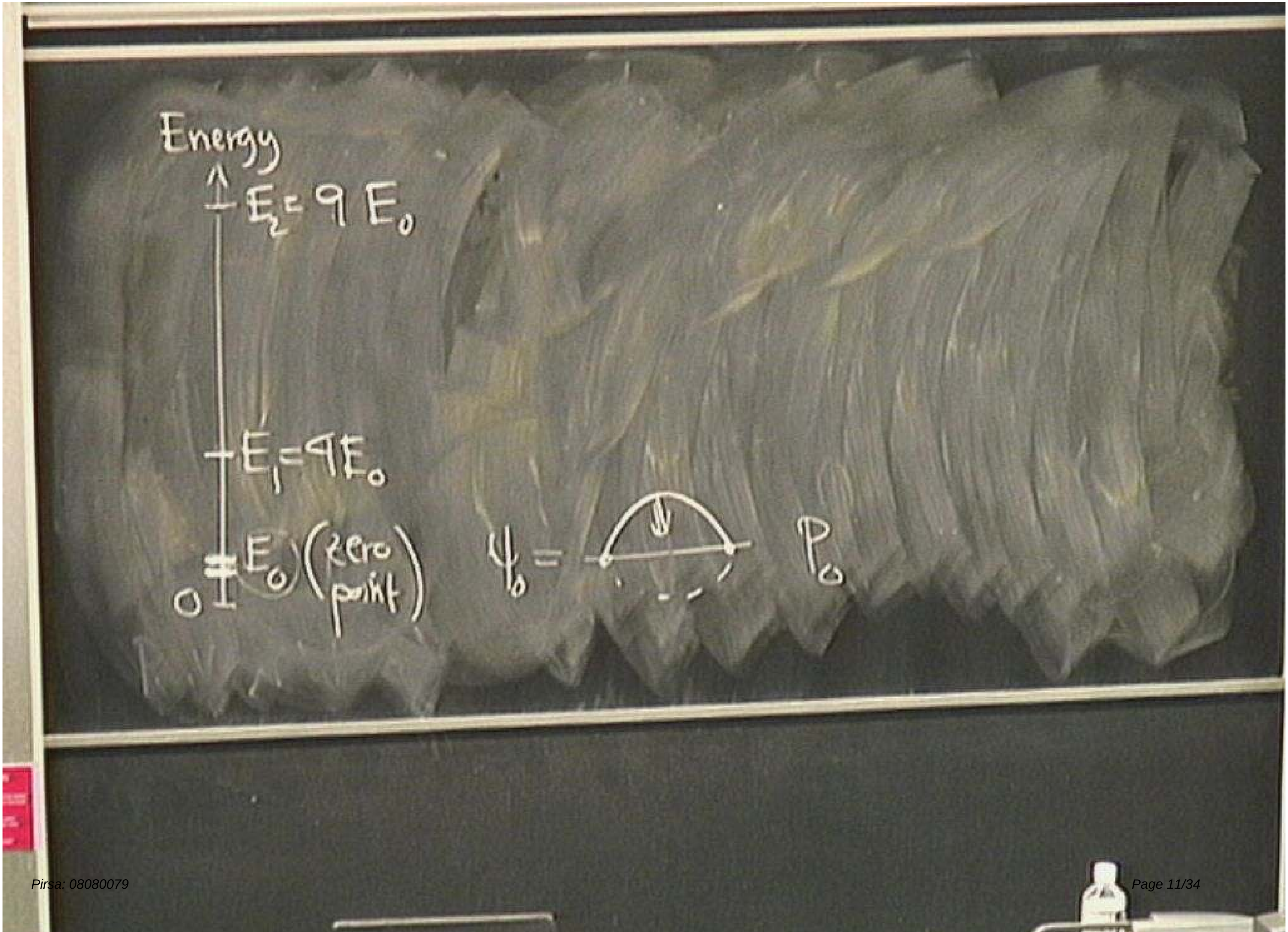

Recap: F = ma → λ p = h de Broglie
wave
particle

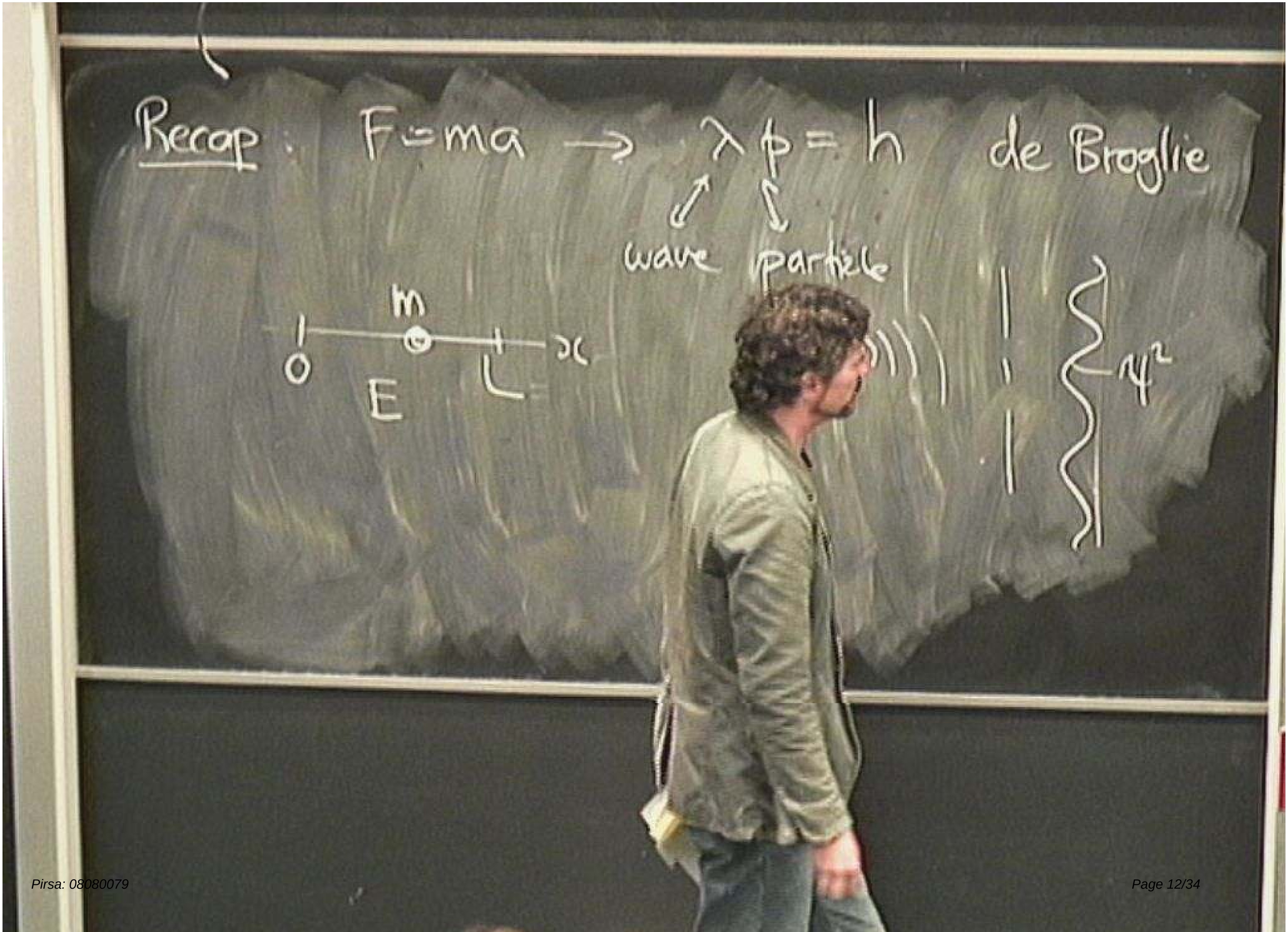

Recap: F=ma → λp = h de Broglie
wave
particle
0
L
x

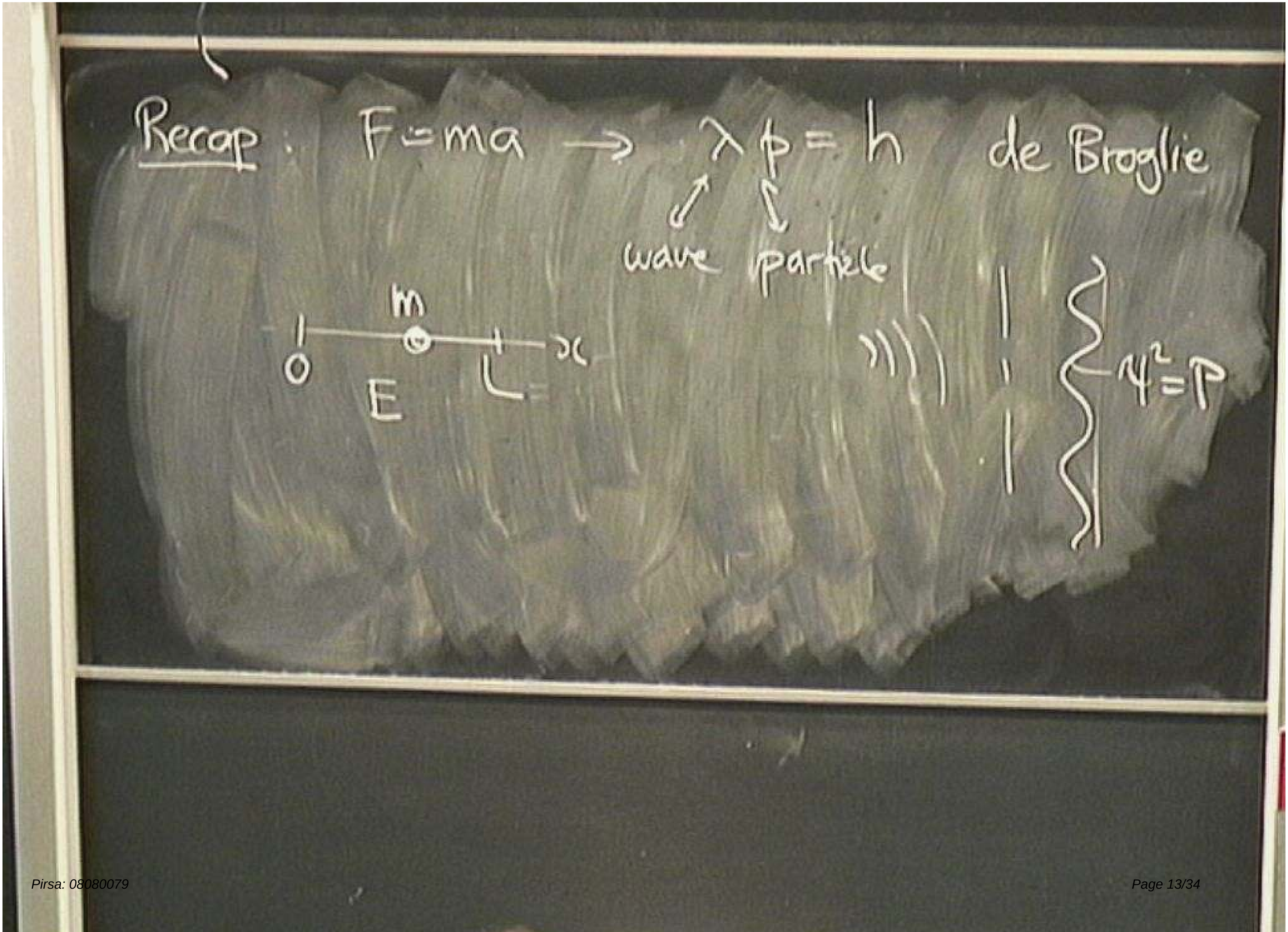

Recap: F = ma → λp = h de Broglie
wave
particle
m
x
0
L
E

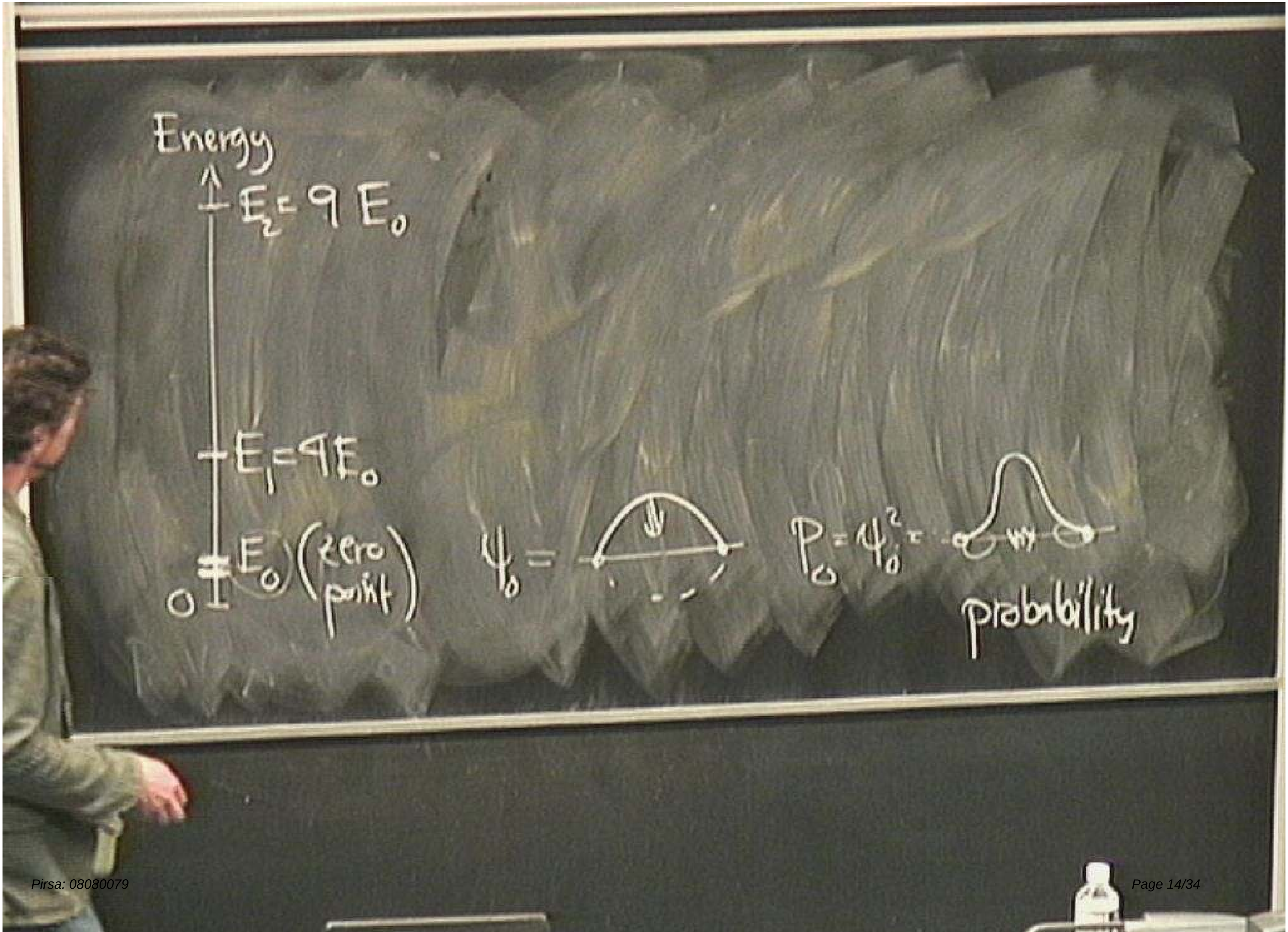

de Broglie
Energy
0
E0 (zero point)

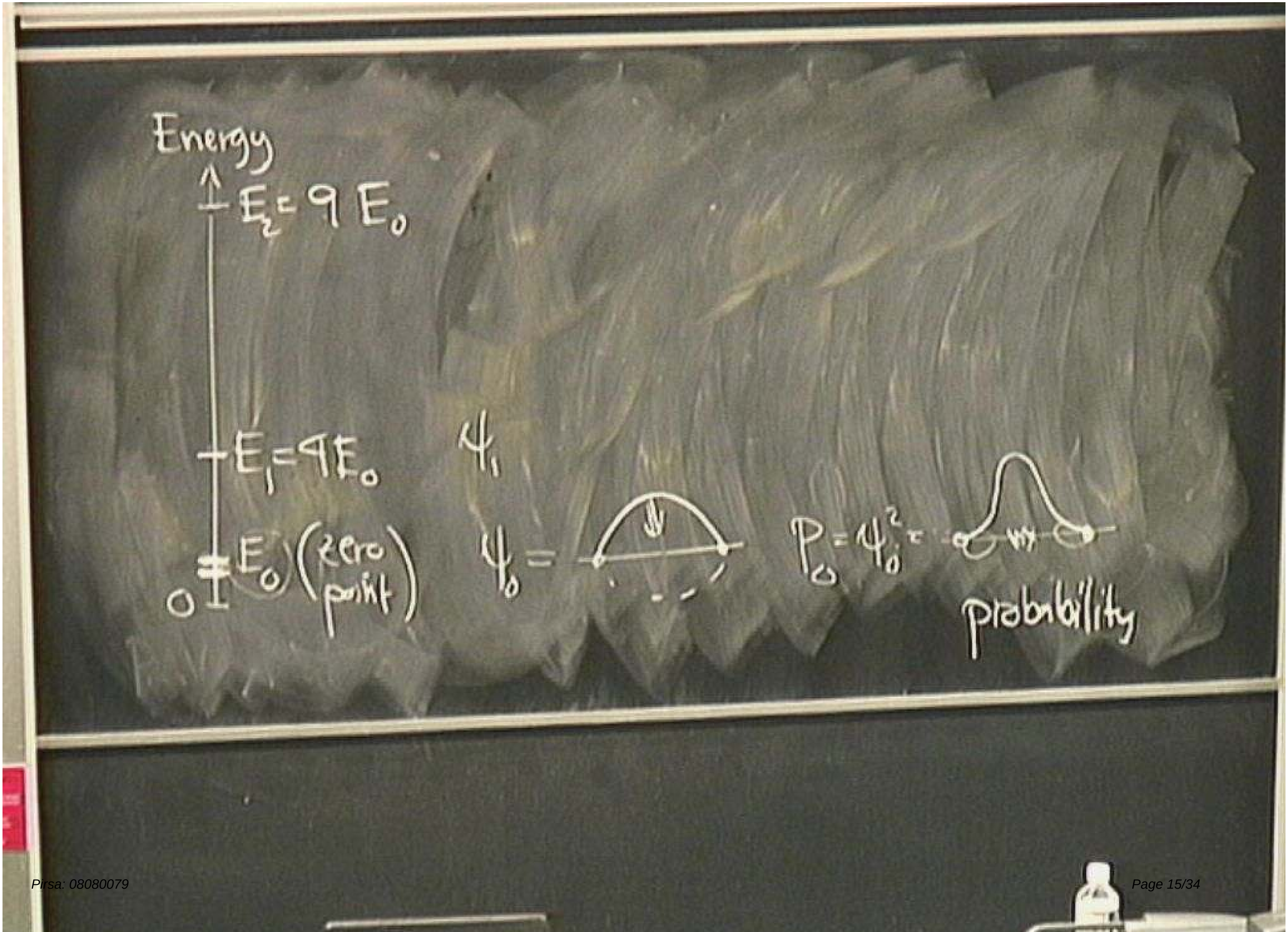

Energy
E2 = 9 E0
E1 = 4 E0
E0 (zero point)
0

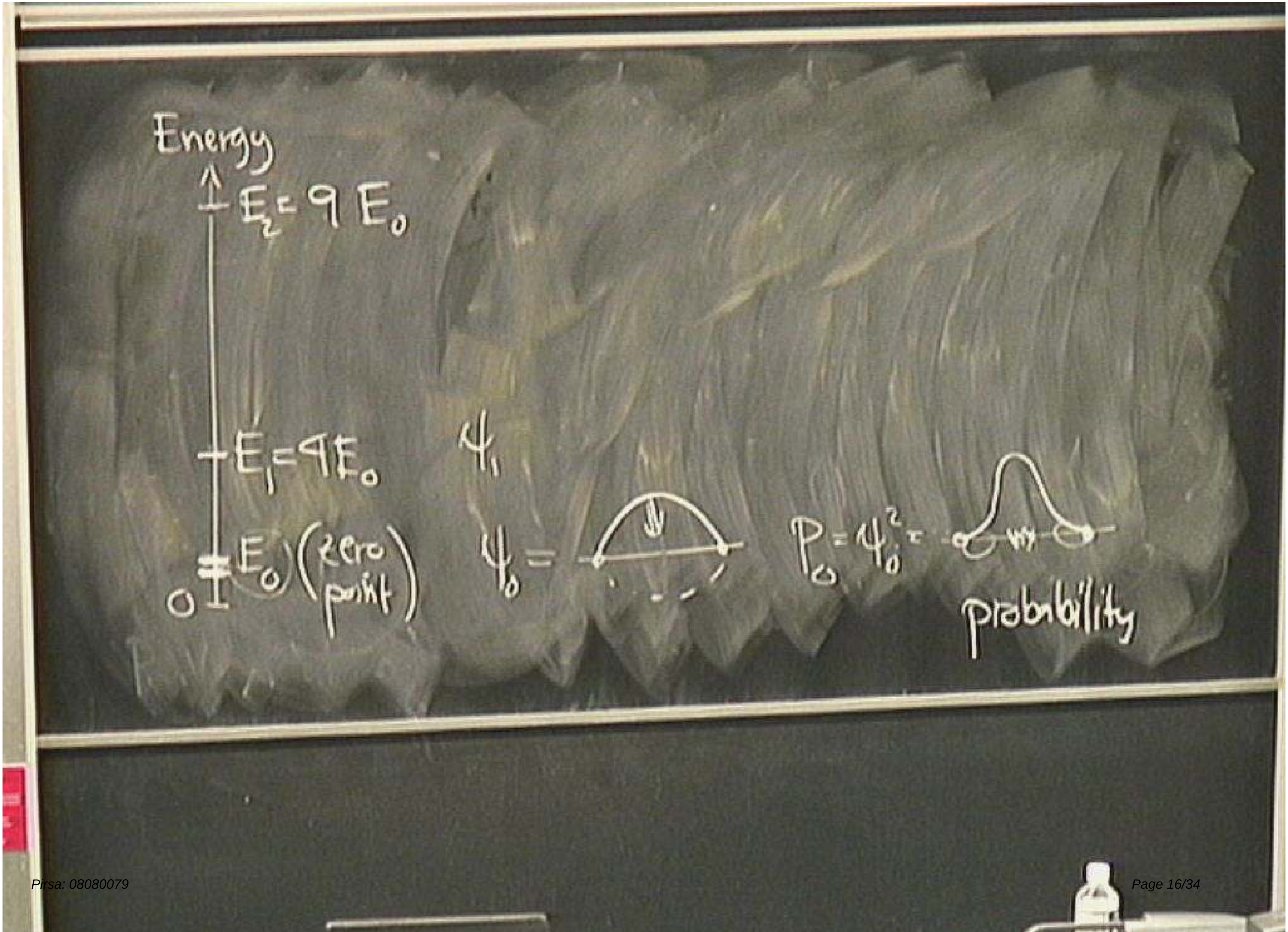

Energy
E2 = 9 E0
E1 = 4E0
E0 (zero point)
0
ψ0 =
P0

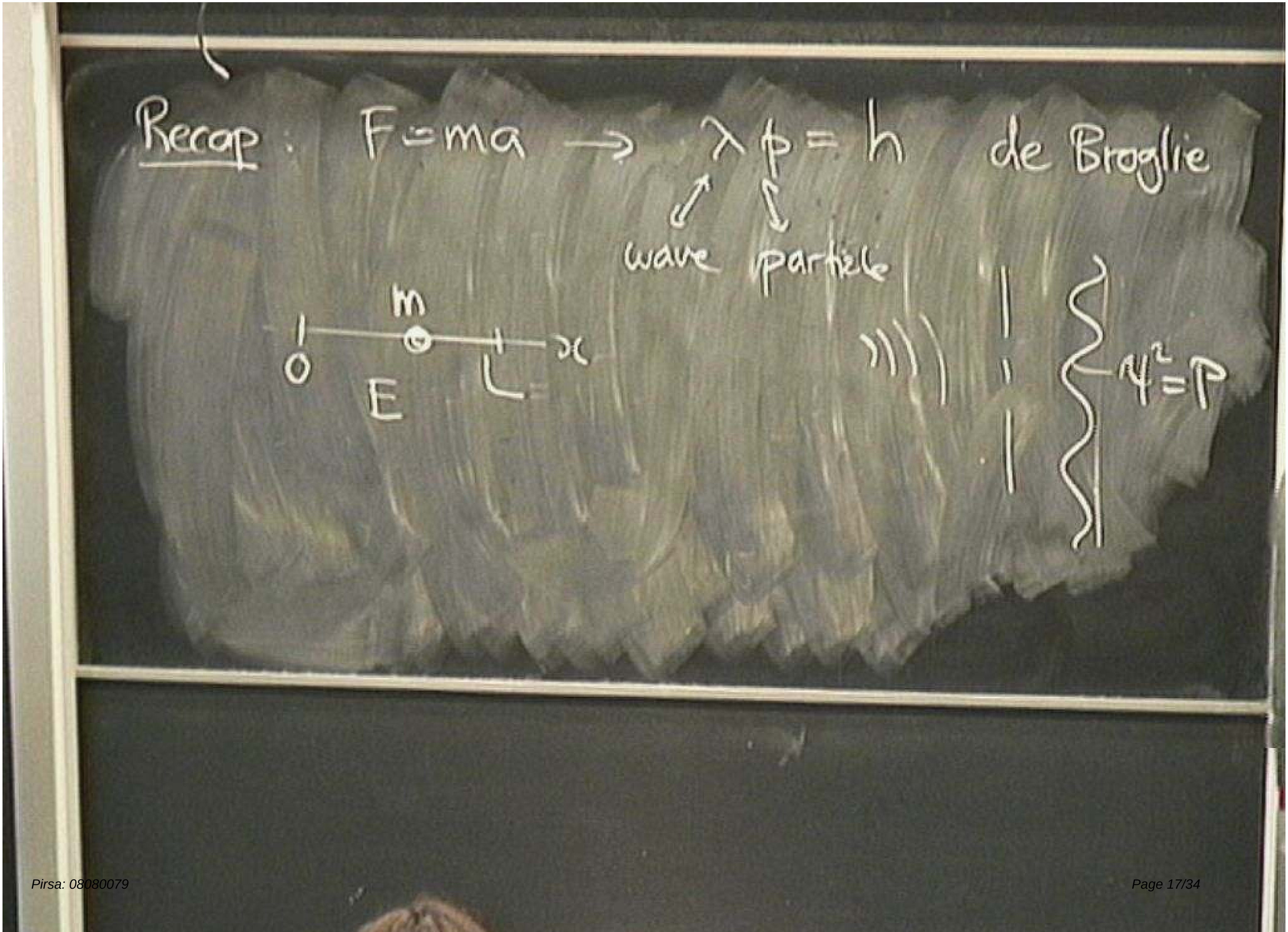

Recap: F = ma → λ p = h de Broglie
wave
particle
m
0
L
x
E
ψ²

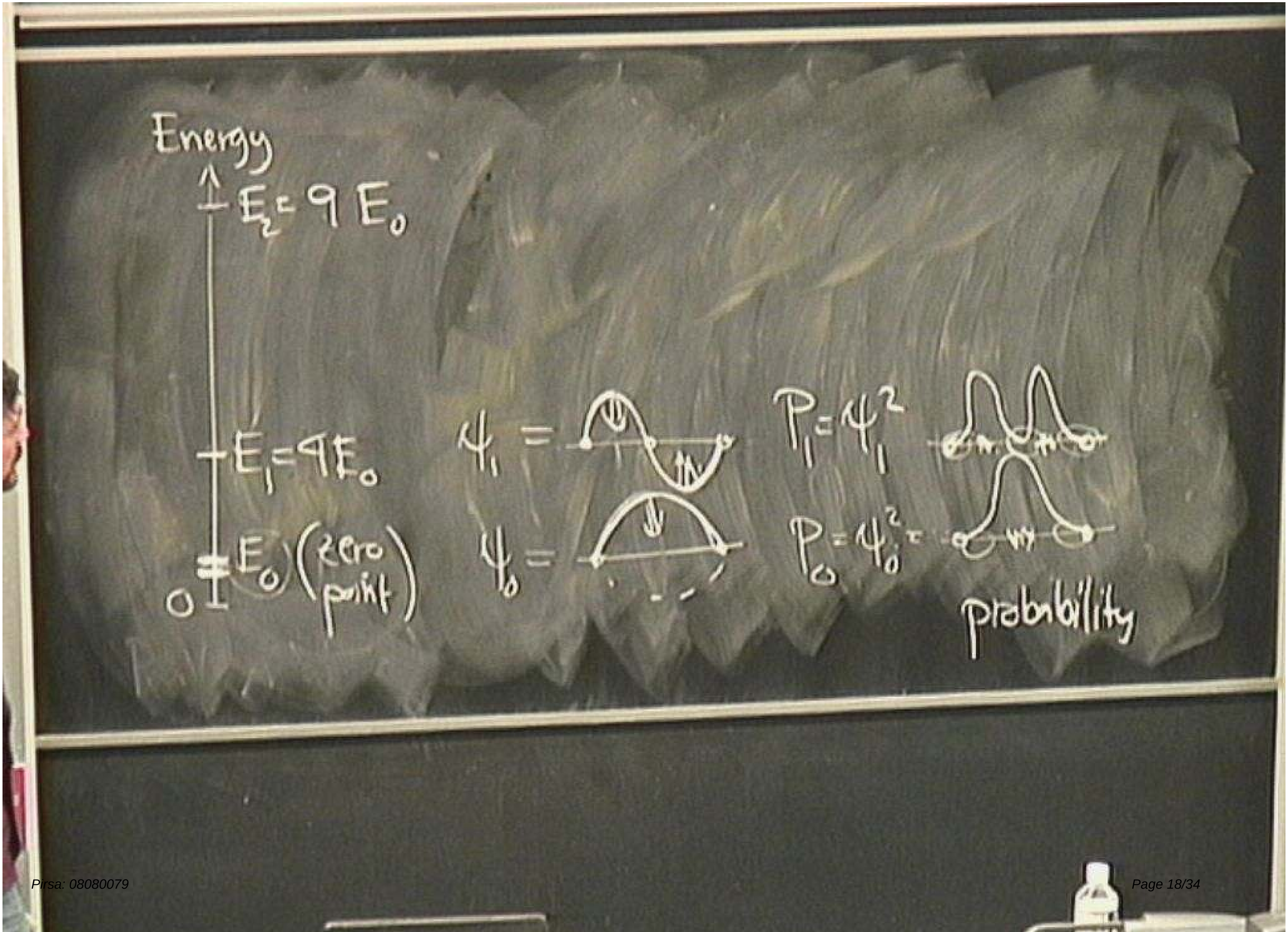

Recap: F = ma → λ p = h de Broglie
wave
particle
m
O
L
x
E
ψ² = P

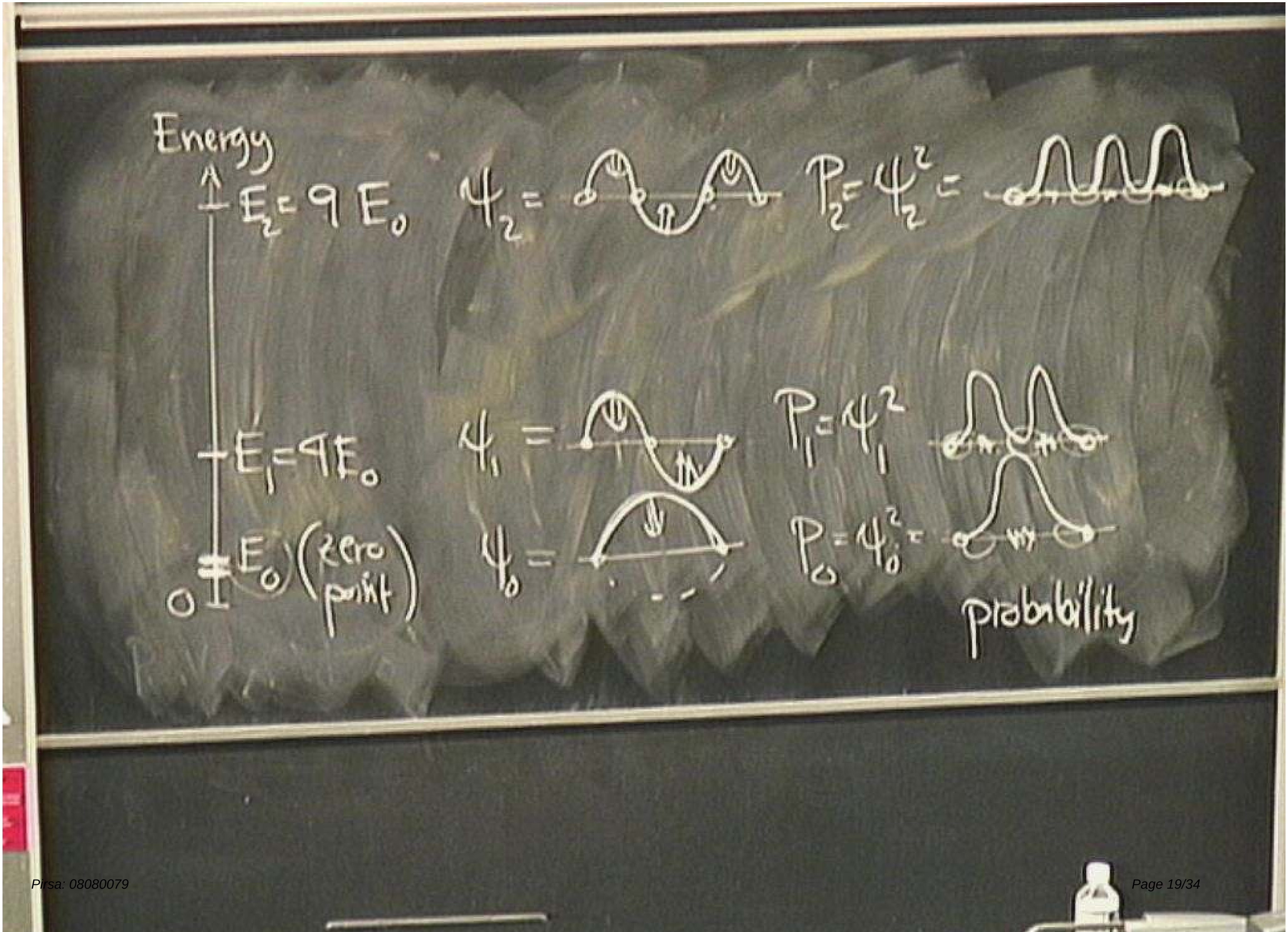

Energy
E2 = 9 E0
E1 = 4 E0
E0 (zero point)
0
ψ0 =
P0 = ψ0² =
probability


Energy
E2 = 9 E0
E1 = 4 E0
E0 (zero point)
0
ψ1
ψ0 =
P0 = ψ0² =
probability

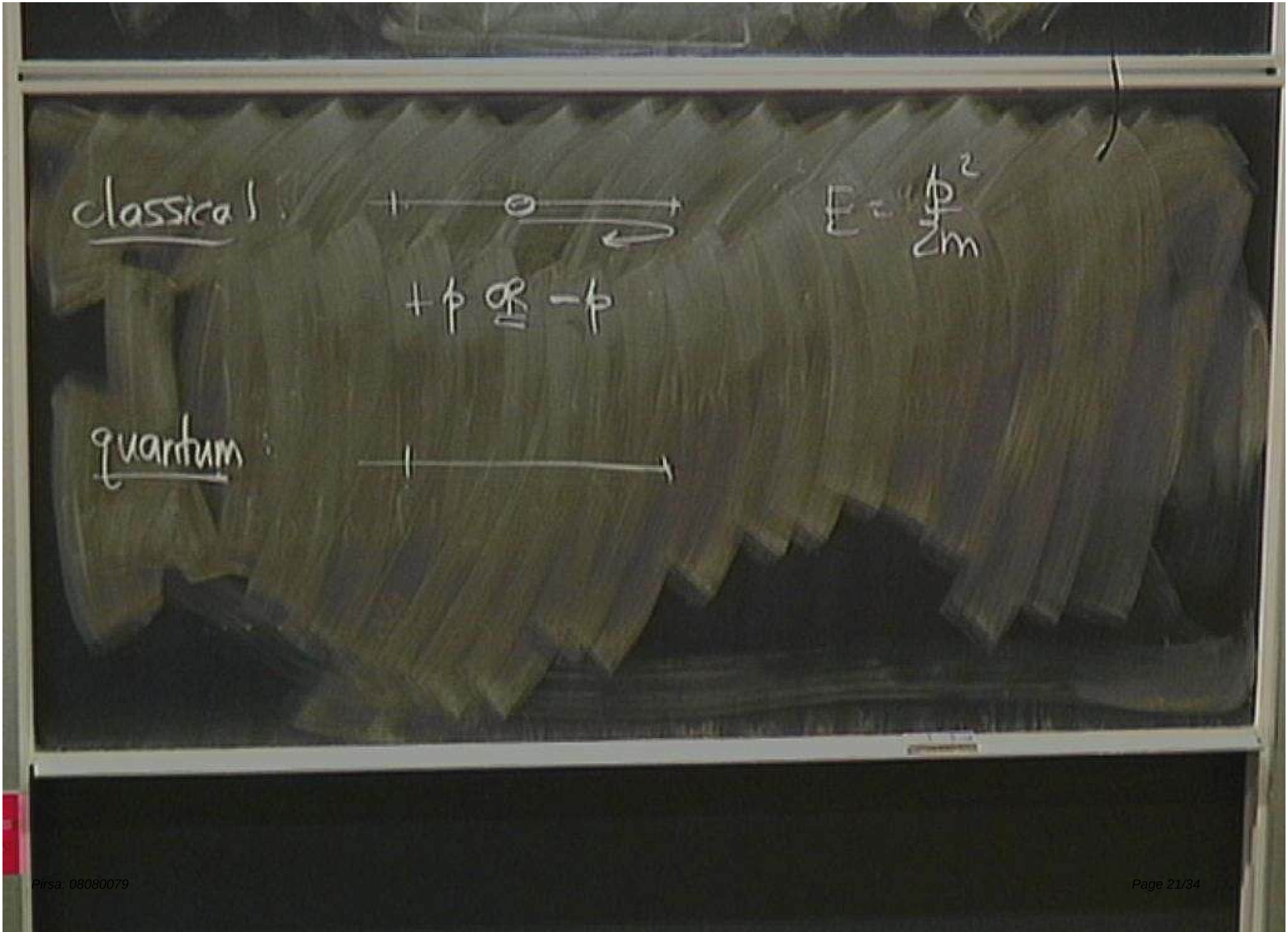

Energy
E2 = 9 E0
E1 = 4E0
E0 (zero point)
0
ψ1
ψ0 =
P0 = ψ0² =
probability

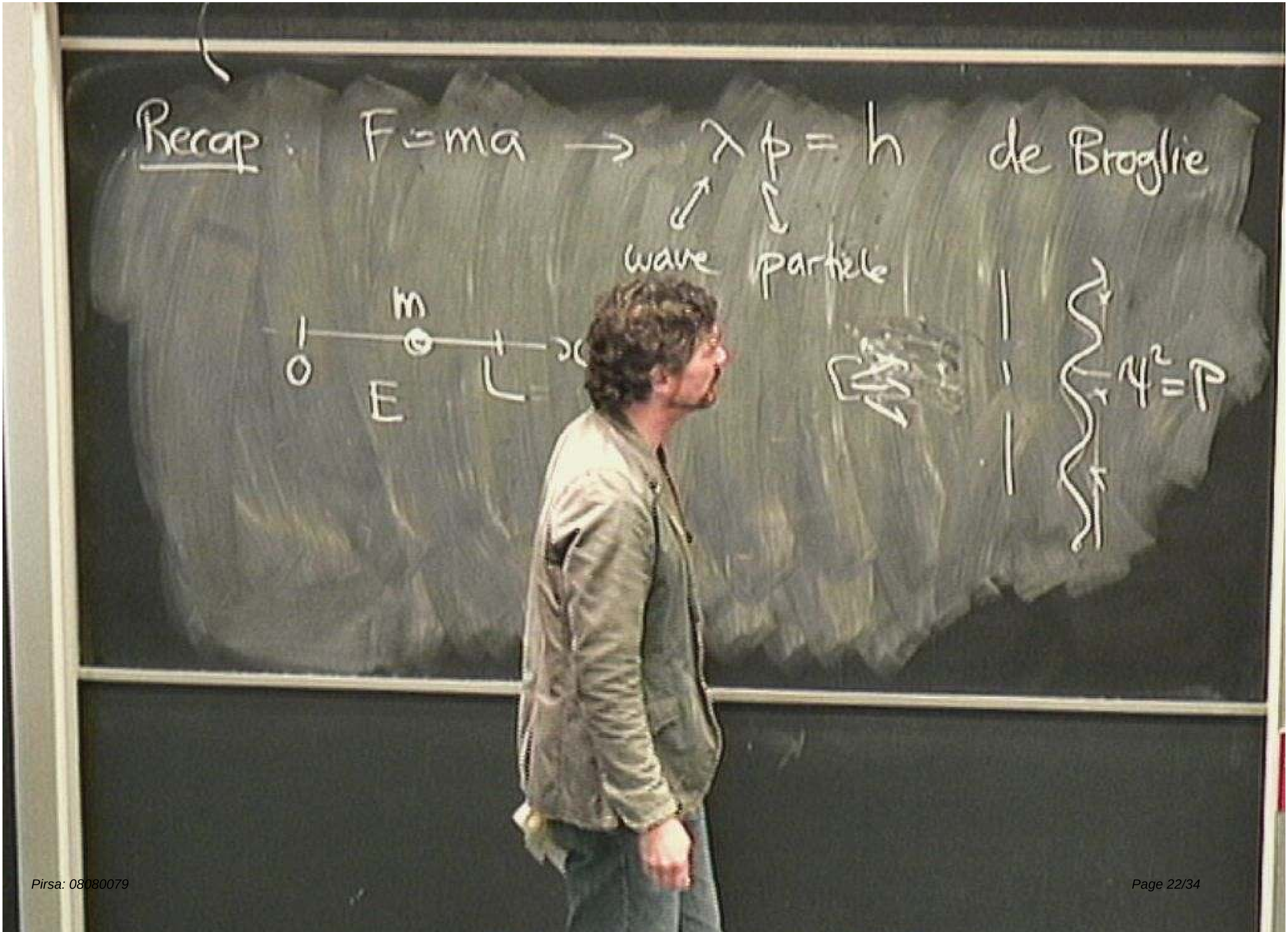

Recap: F=ma → λp = h de Broglie
wave
particle
m
0
x
E
L
ψ² = P

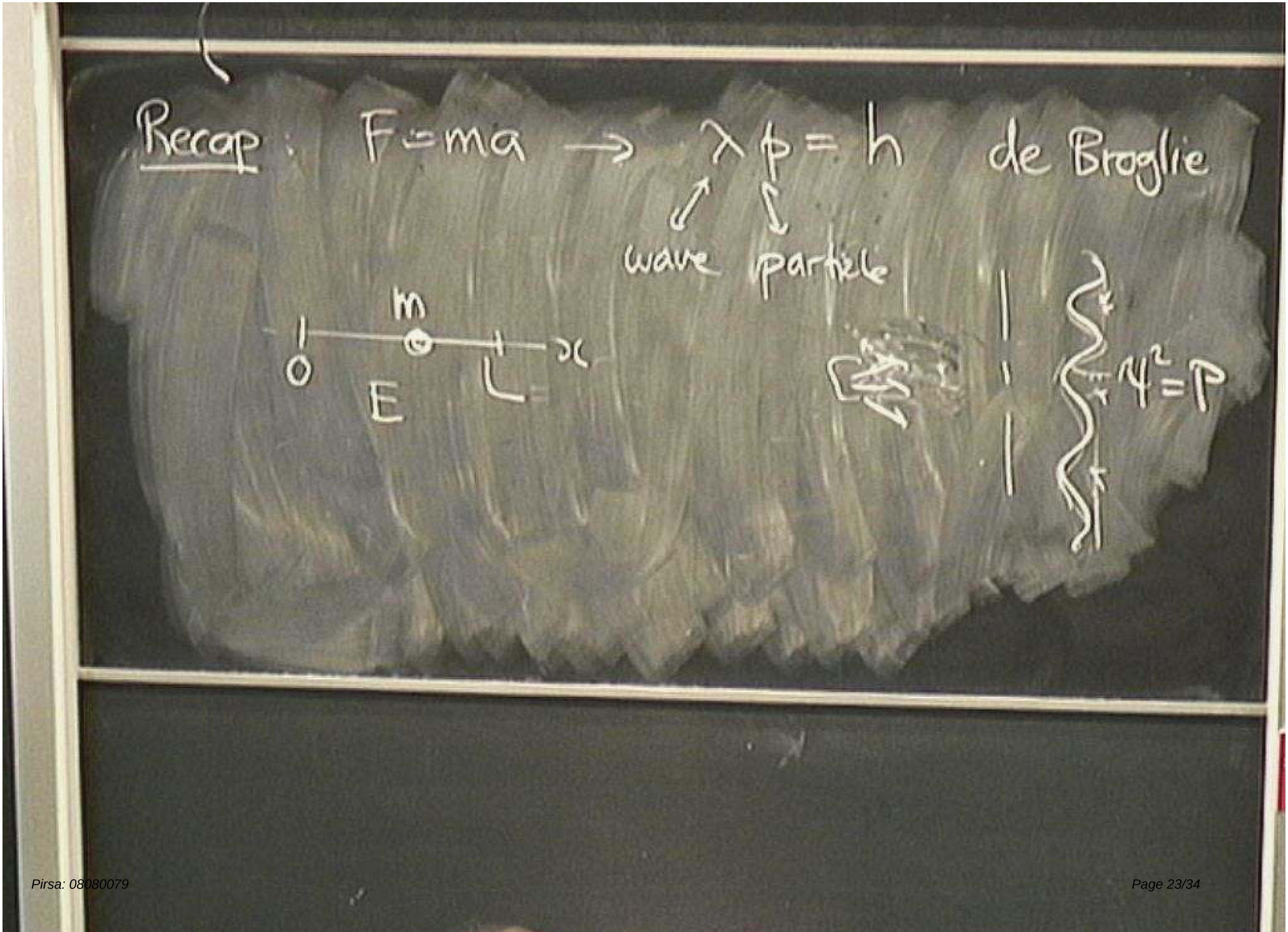

Energy
$E_2 = 9 E_0$
$E_1 = 4 E_0$
E_0 (zero point)
0
$\psi_1 =$
$\psi_0 =$
$P_1 = \psi_1^2$
$P_0 = \psi_0^2 =$
probability

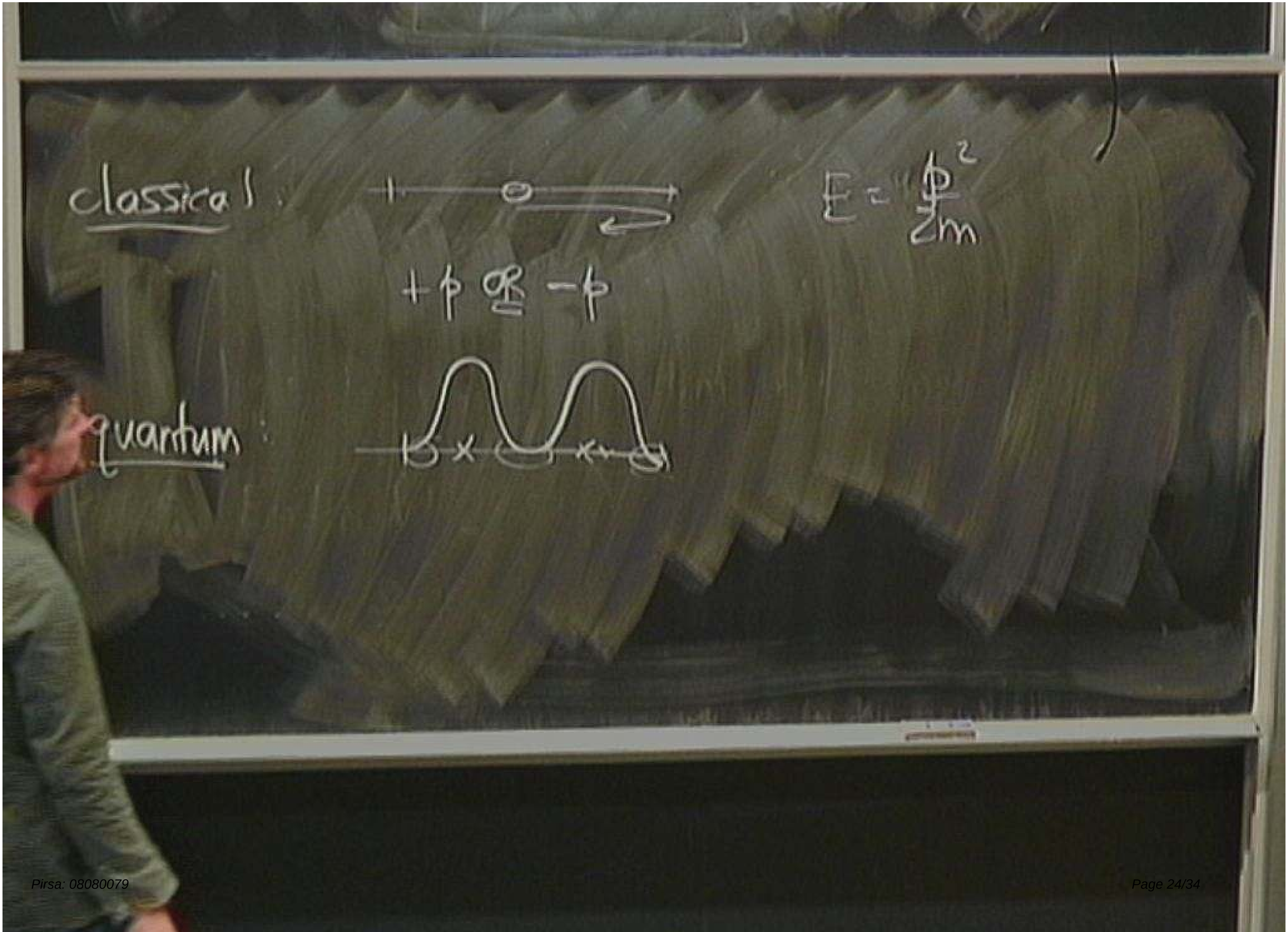

Energy
E2 = 9 E0
ψ2 =
P2 = ψ2² =
E1 = 4E0
ψ1 =
P1 = ψ1²
E0 (zero point)
ψ0 =
P0 = ψ0² =
0
probability

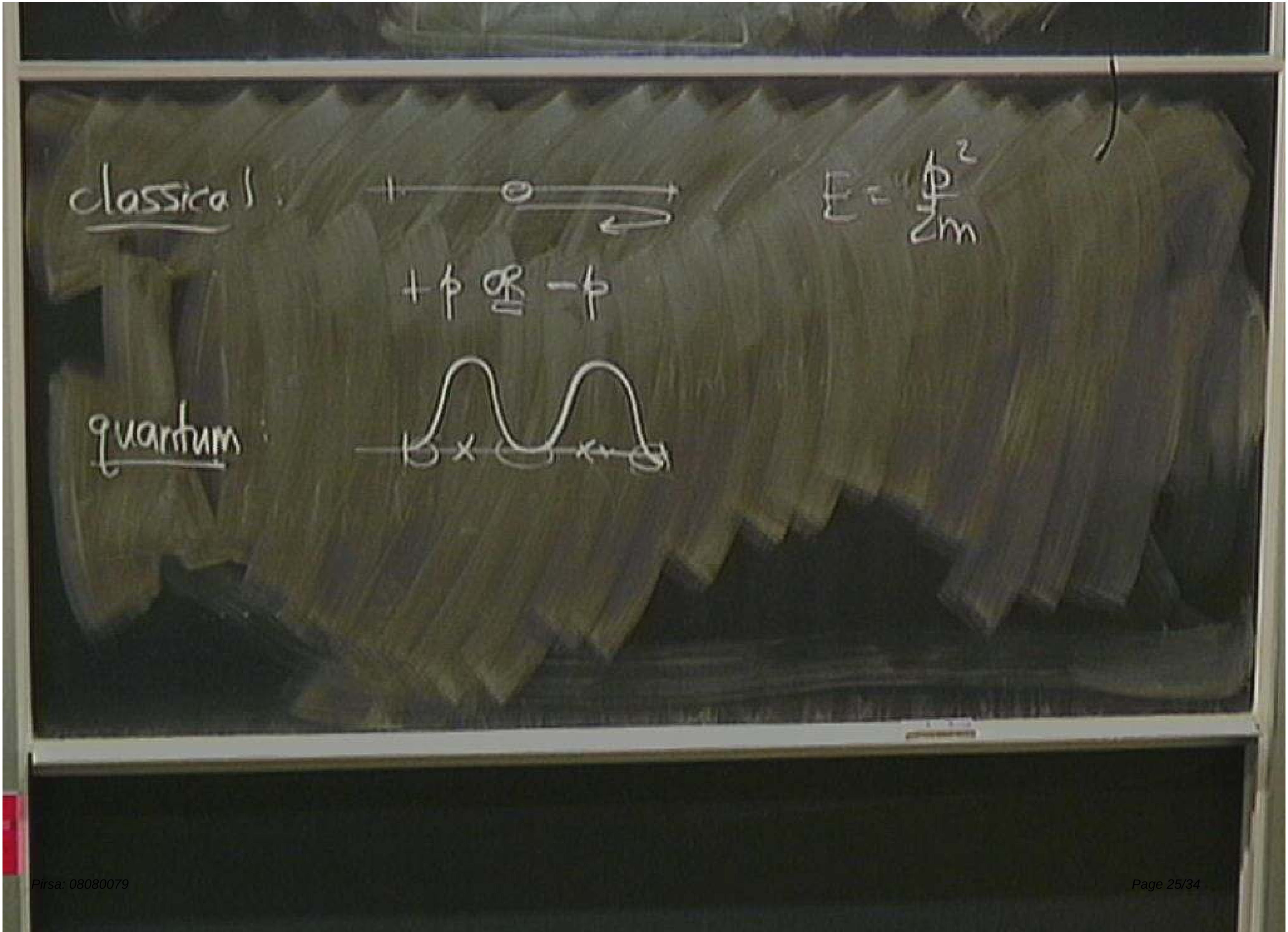

classical:
+p OR -p

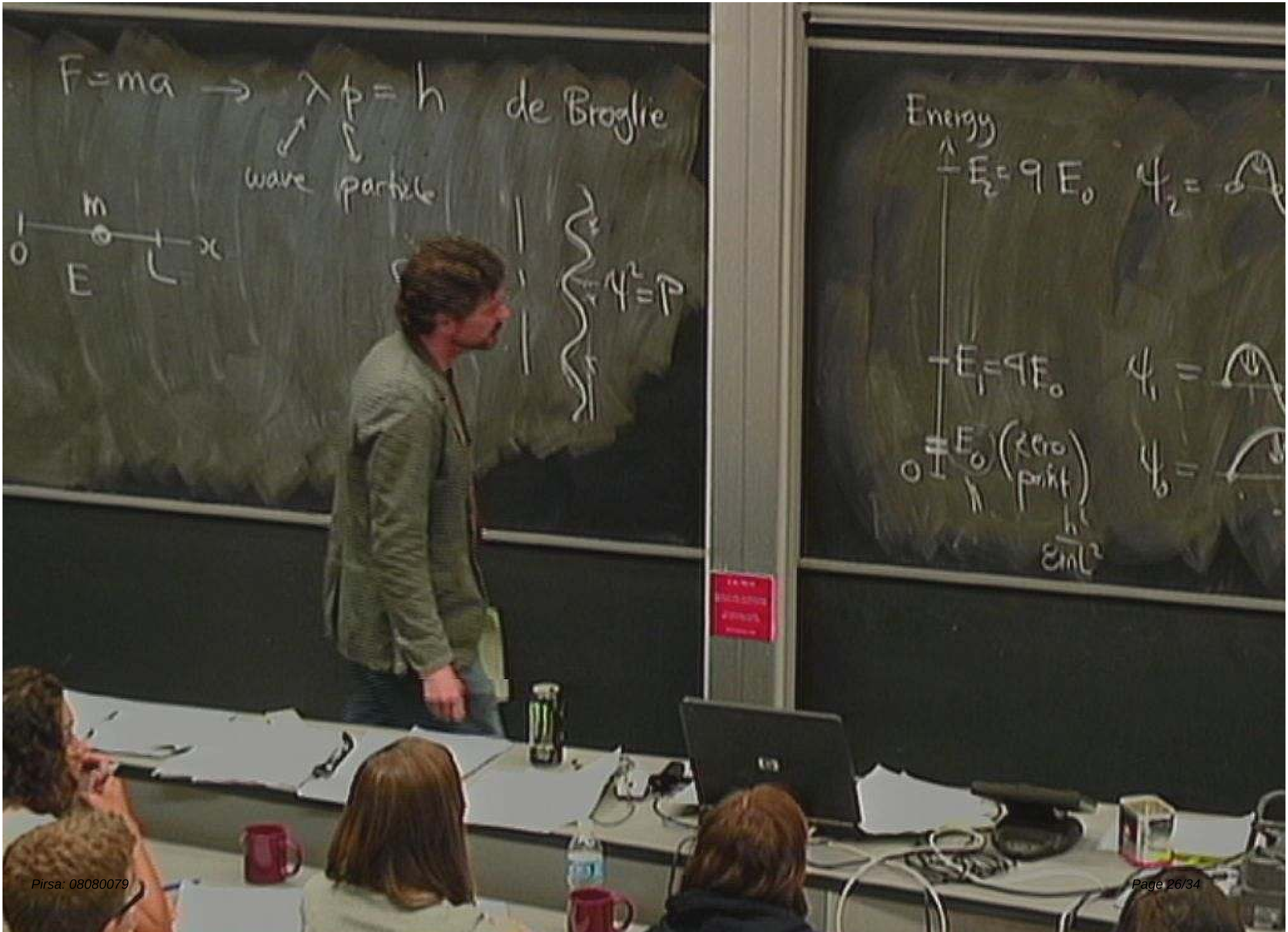

classical :
+p or -p
E = p^2/2m
quantum :

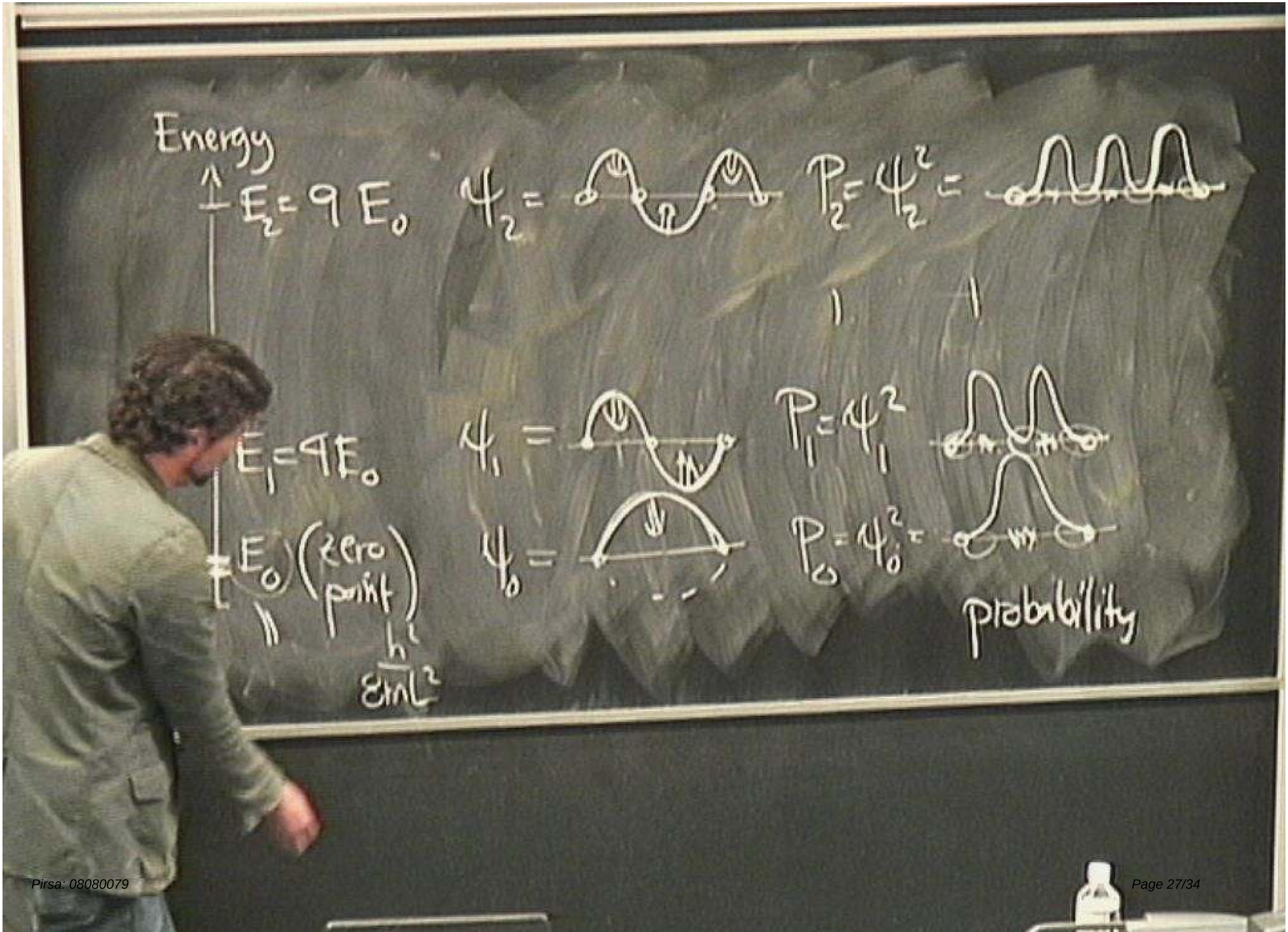

Recap: F=ma → λp = h de Broglie
wave particle
m
0 E L x
$\psi^2 = P$


Recap: F = ma → λp = h de Broglie
wave
particle
m
O
x
E
L =
ψ² = P

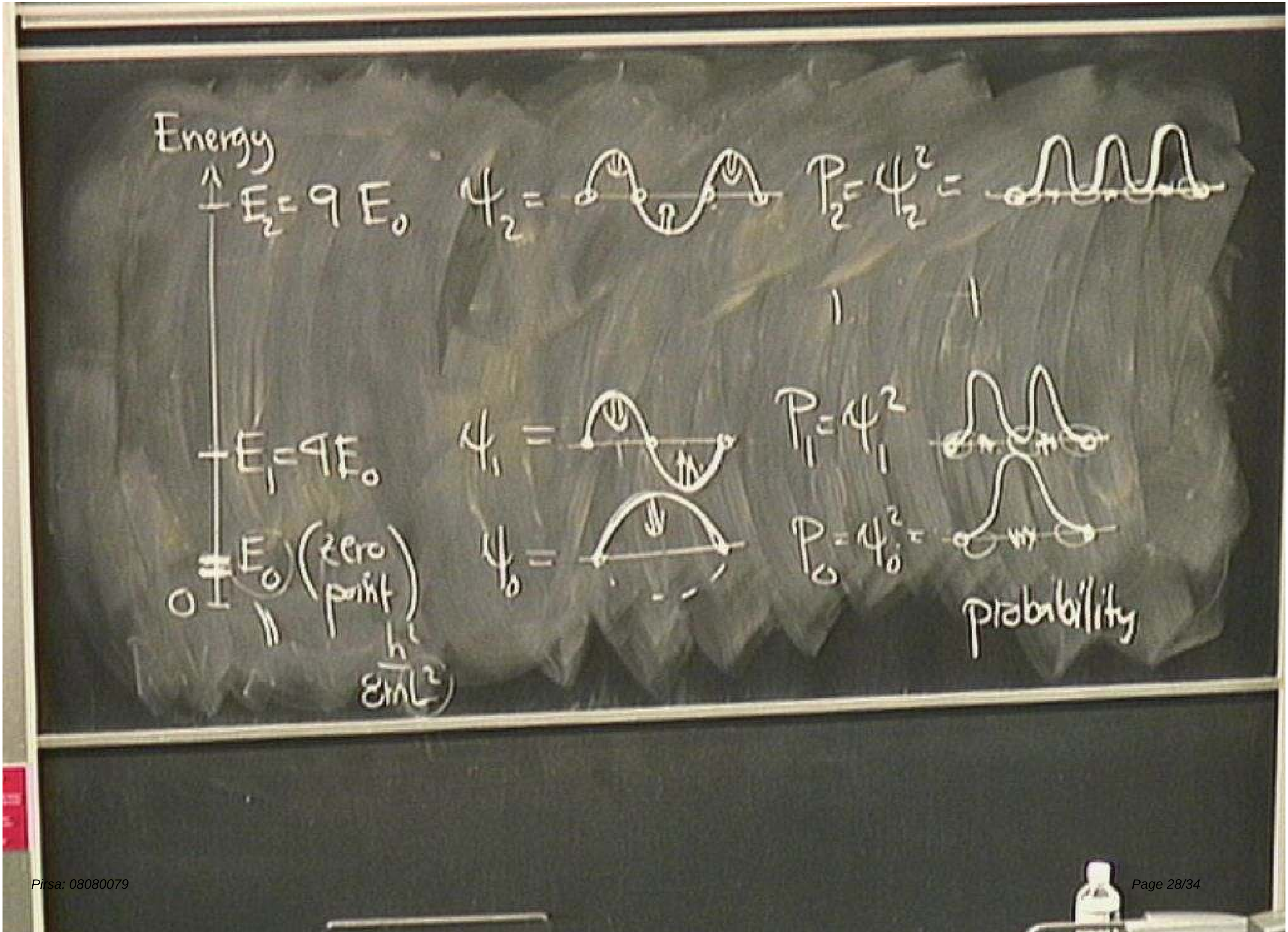

classical
E = p²/2m
+p OR −p
quantum


classical
+p or −p
E = p²/2m
quantum

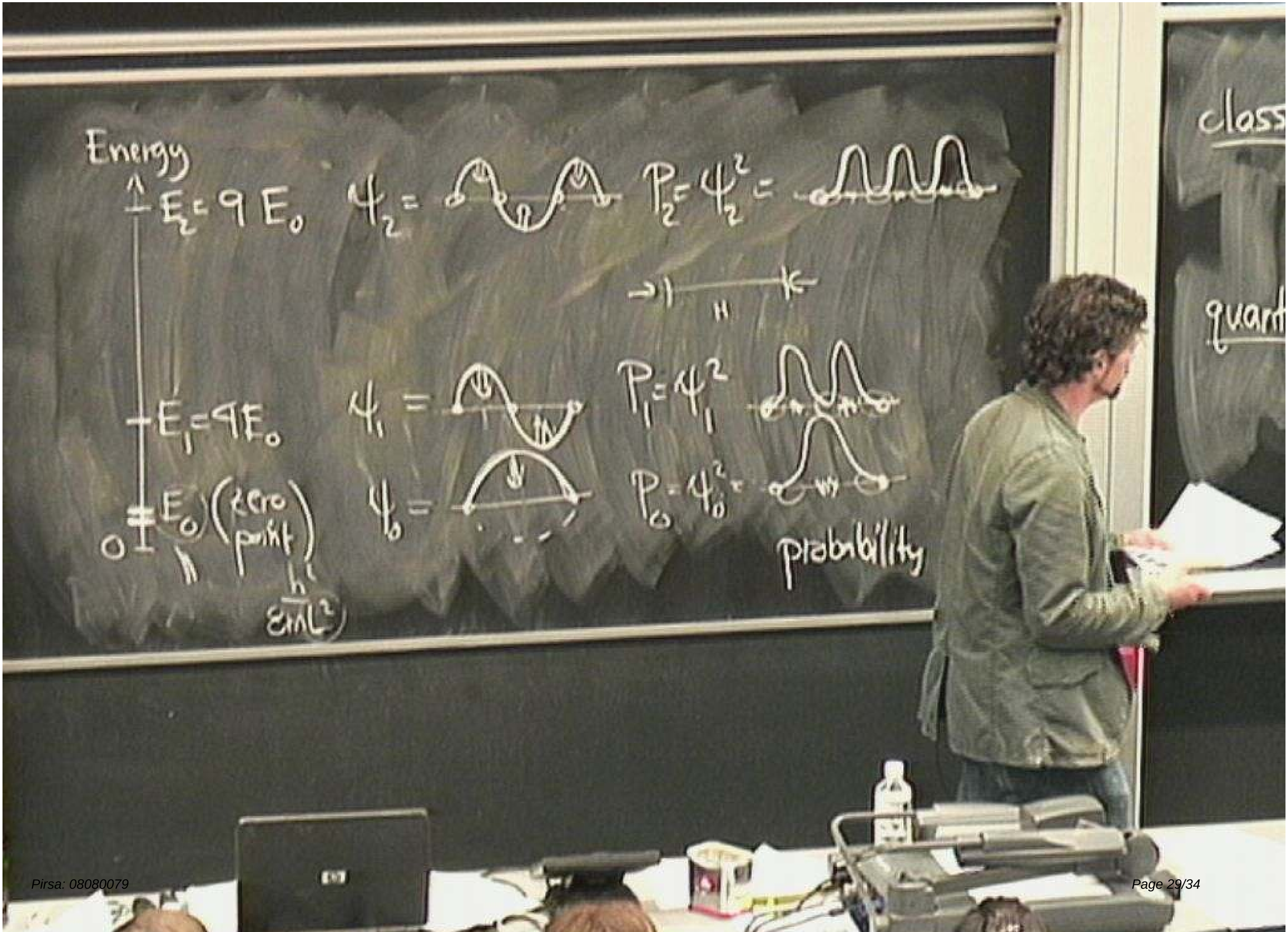

F=ma → λp=h de Broglie
wave particle
m
0 L x
E
ψ²=P
Energy
E₂=9E₀ ψ₂=
E₁=4E₀ ψ₁=
E₀ (zero point) ψ₀=
h²/8mL²

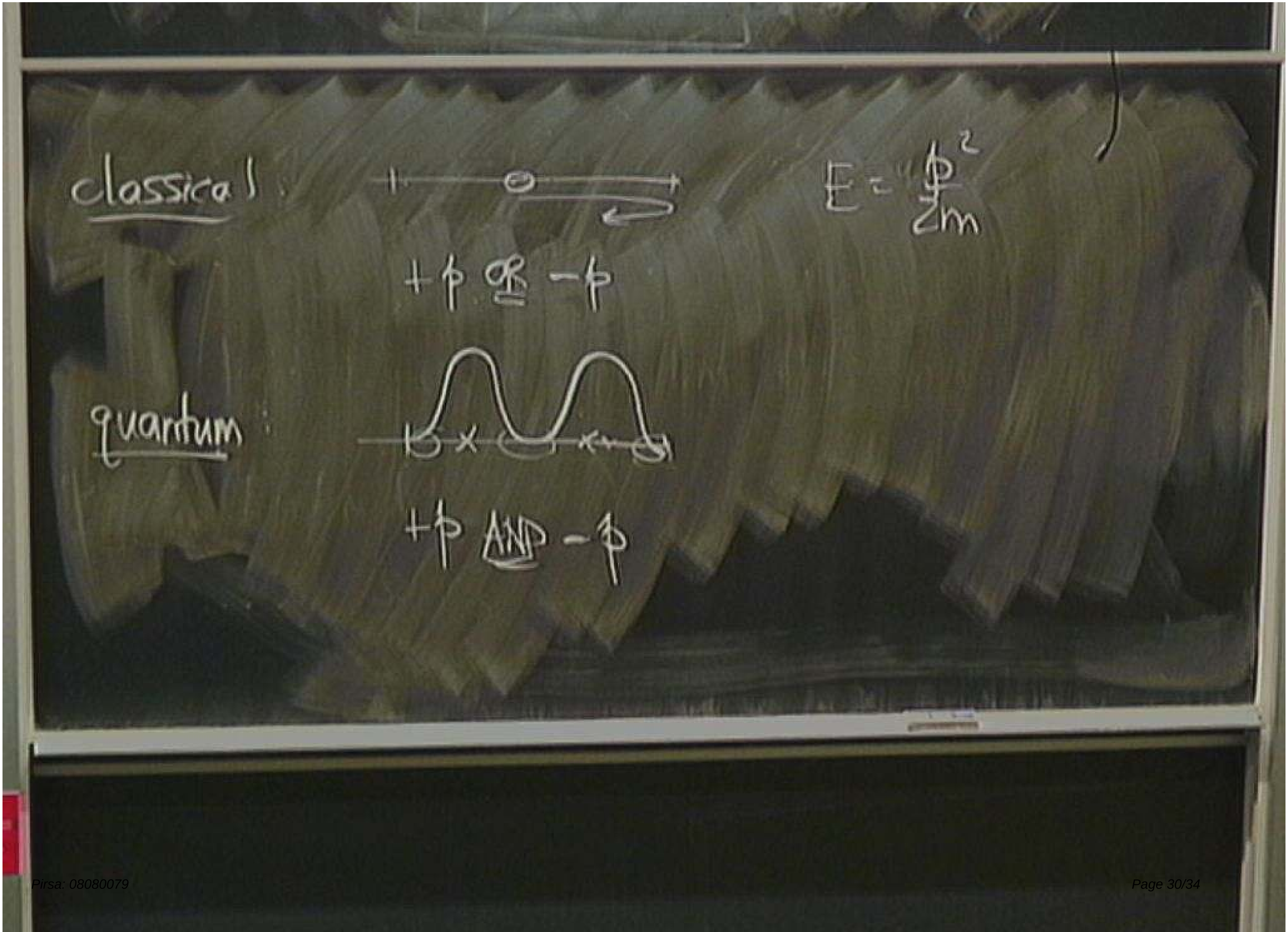


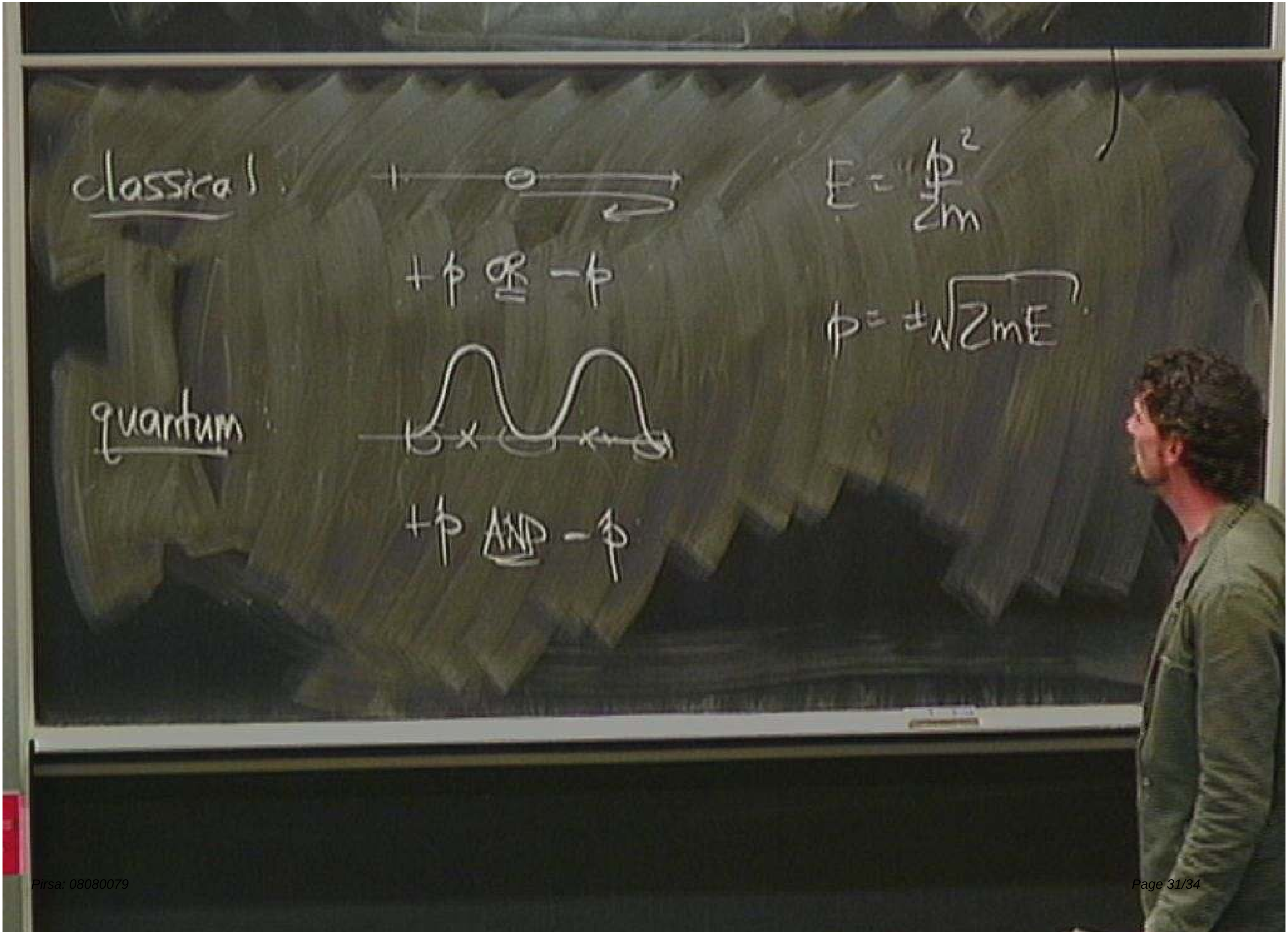
Energy
E2 = 9 E0
ψ2 =
P2 = ψ2² =
E1 = 4 E0
ψ1 =
P1 = ψ1²
E0 (zero point)
ψ0 =
P0 = ψ0² =
h²/8mL²
probability

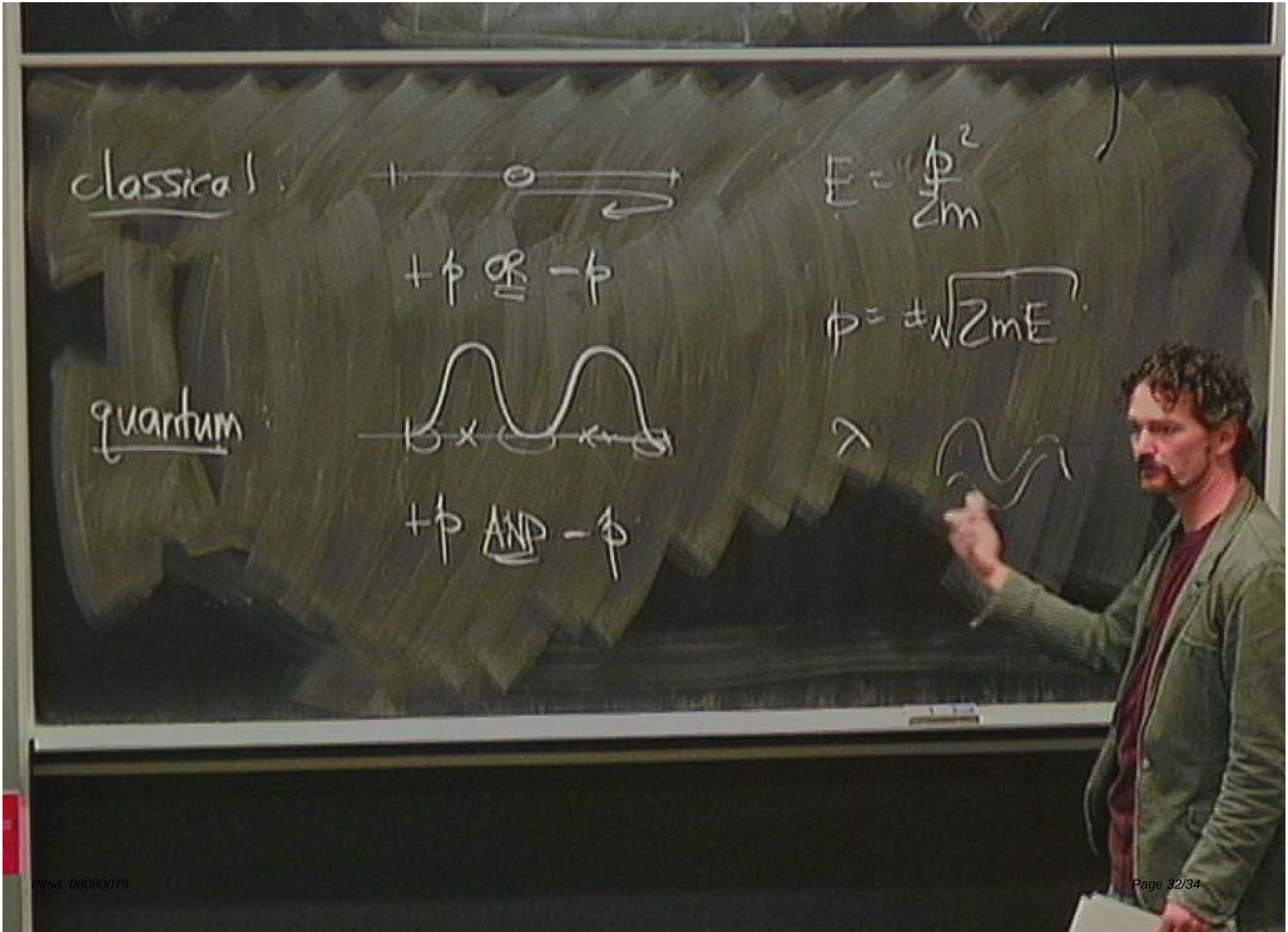


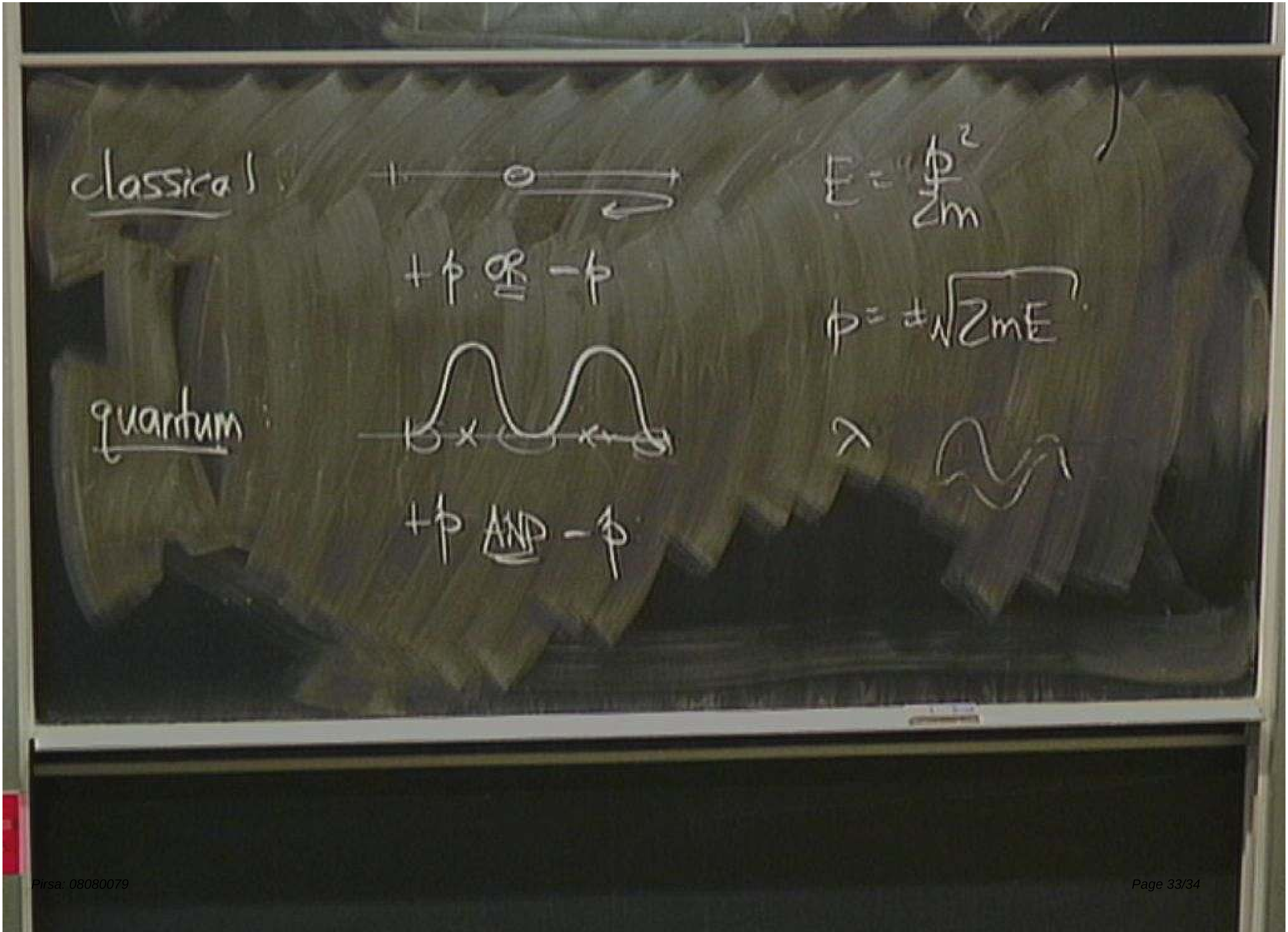
Energy
E2 = 9 E0
ψ2 =
P2 = ψ2² =
E1 = 4 E0
ψ1 =
P1 = ψ1²
E0 (zero point)
ψ0 =
P0 = ψ0² =
probability
0
h²/8mL²

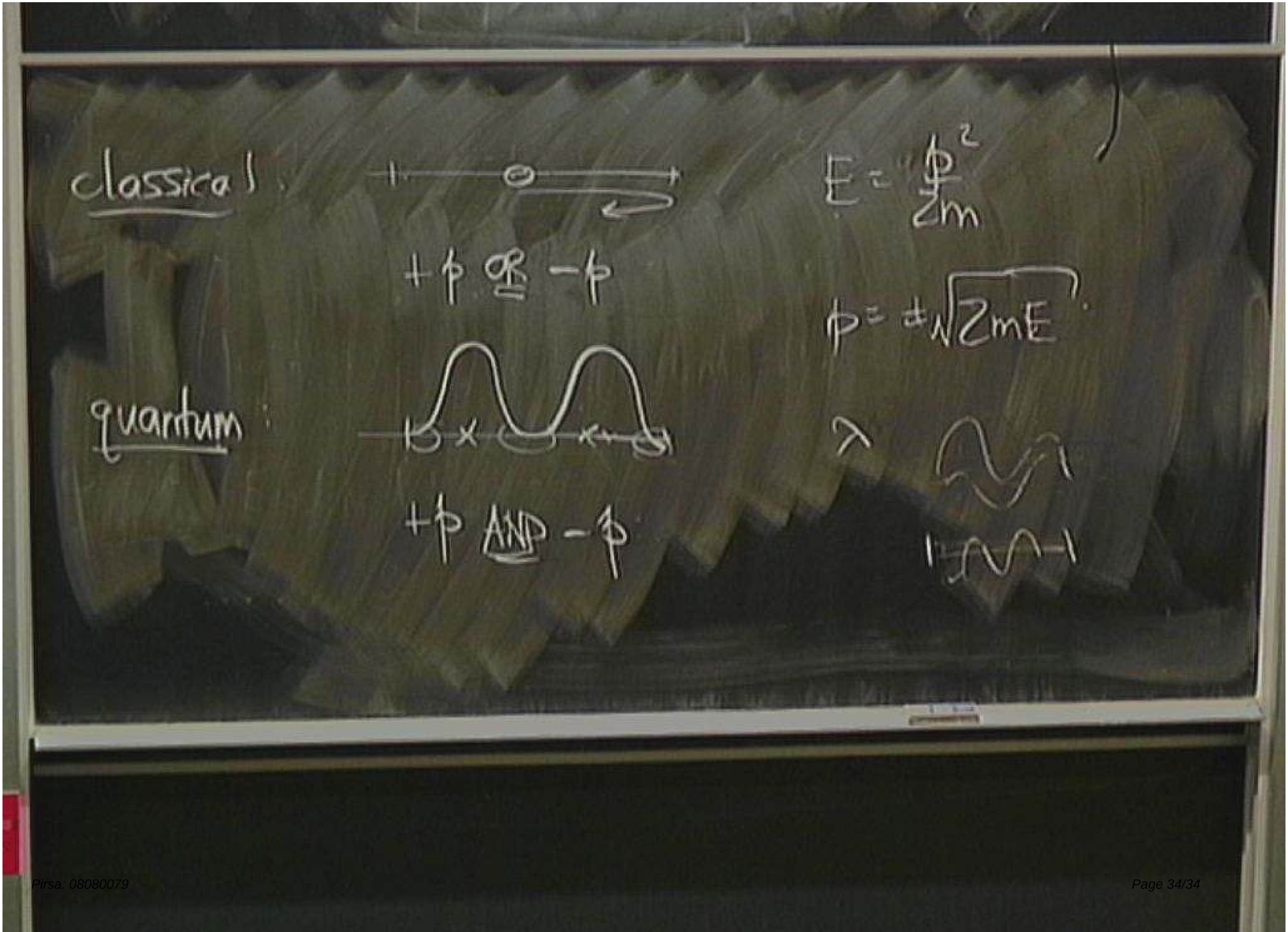

Energy
E2 = 9 E0
ψ2 =
P2 = ψ2² =
E1 = 4 E0
ψ1 =
P1 = ψ1²
ψ0 =
P0 = ψ0² =
E0 (zero point)
probability
class
quant


classical
E = p²/2m
+p OR −p
quantum
+p AND −p


classical
+p OR −p
E = p²/2m
p = ±√2mE
quantum
+p AND −p


classical
+p OR −p
E = p²/2m
p = ±√2mE
quantum
+p AND −p
λ


classical
+p OR −p
E = p²/2m
p = ±√2mE
quantum
+p AND −p
λ


classical
+p OR −p
E = p²/2m
p = ±√2mE
quantum
+p AND −p
λ