Title: Special Relativity 14 - The Curved Geometry of a Rotating Space

Date: Jul 27, 2008 09:00 AM

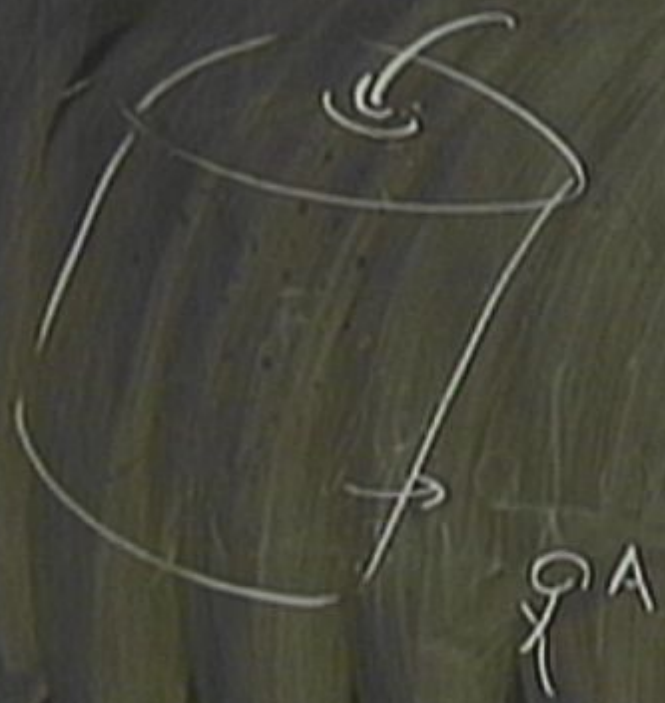
URL: http://pirsa.org/08070052

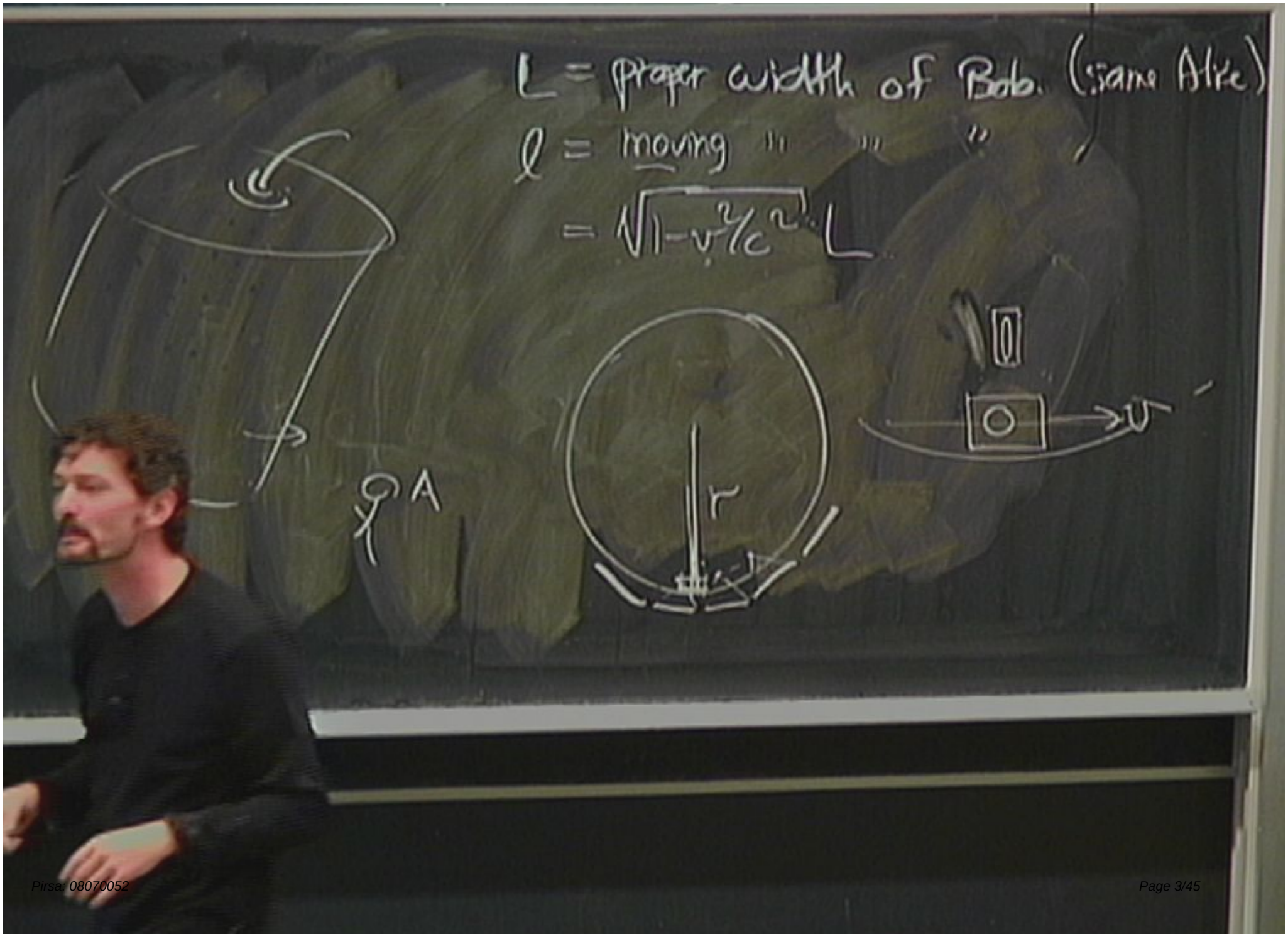
Abstract: The spacetime diagram of a rotating Bob is analyzed, leading us to conclude that his spatial geometry is curved.
 Learning Outcomes:
 â€¢ Understanding the physical effects of the rotation on the rotating observers, metal panels of the cylinder and so forth.
â€¢ Understanding the properties of a rotating cylinder using a spacetime diagram.
â€¢ Understanding curved spaces: The negatively curved space of a rotating observer and the positively curved space representing the real gravitational field of the Sun.

L = proper width of Bob. (same Alice)

ℓ = moving " " "

$= \sqrt{1-v^2/c^2}\, L$

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A
r
v

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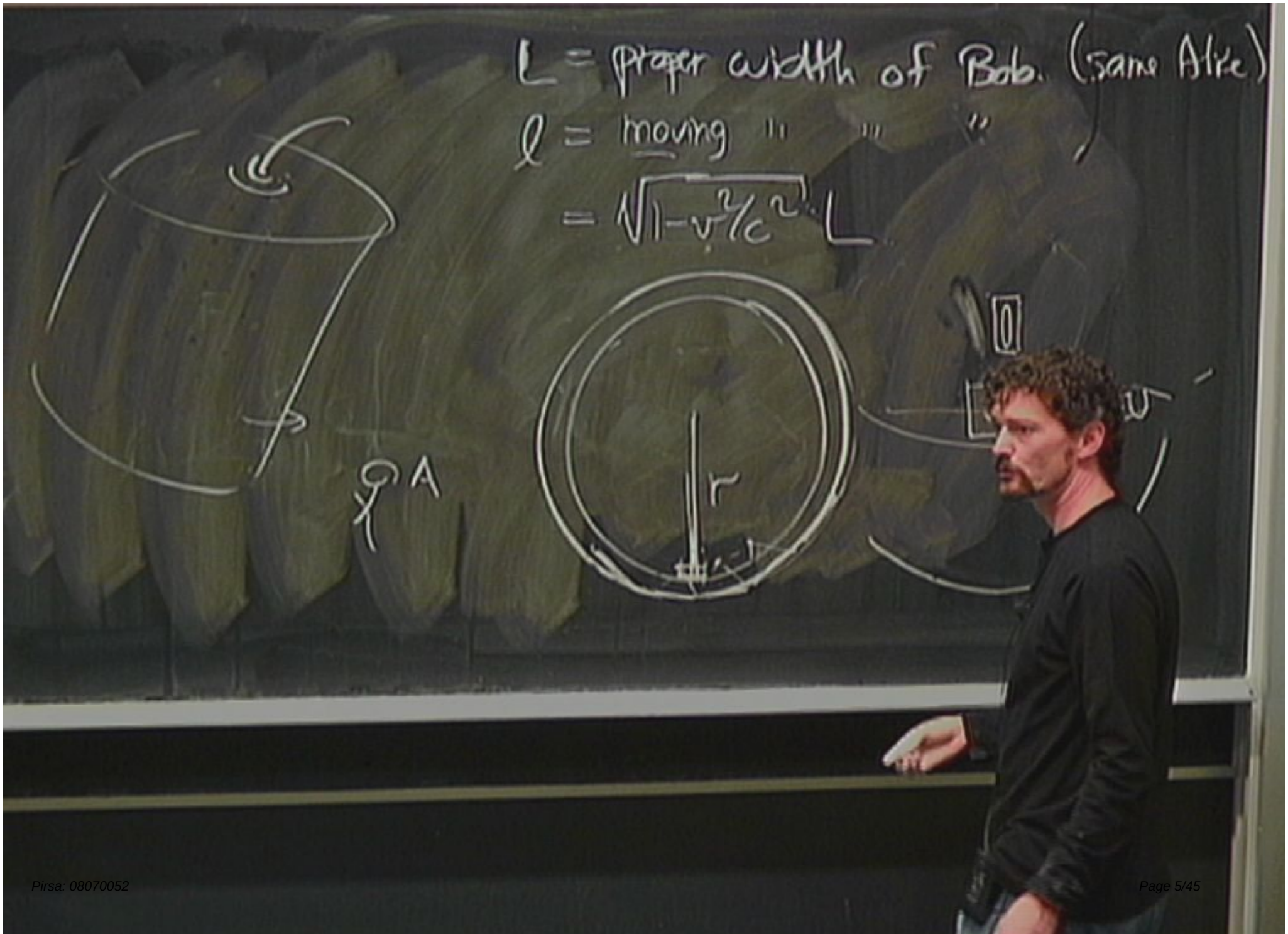
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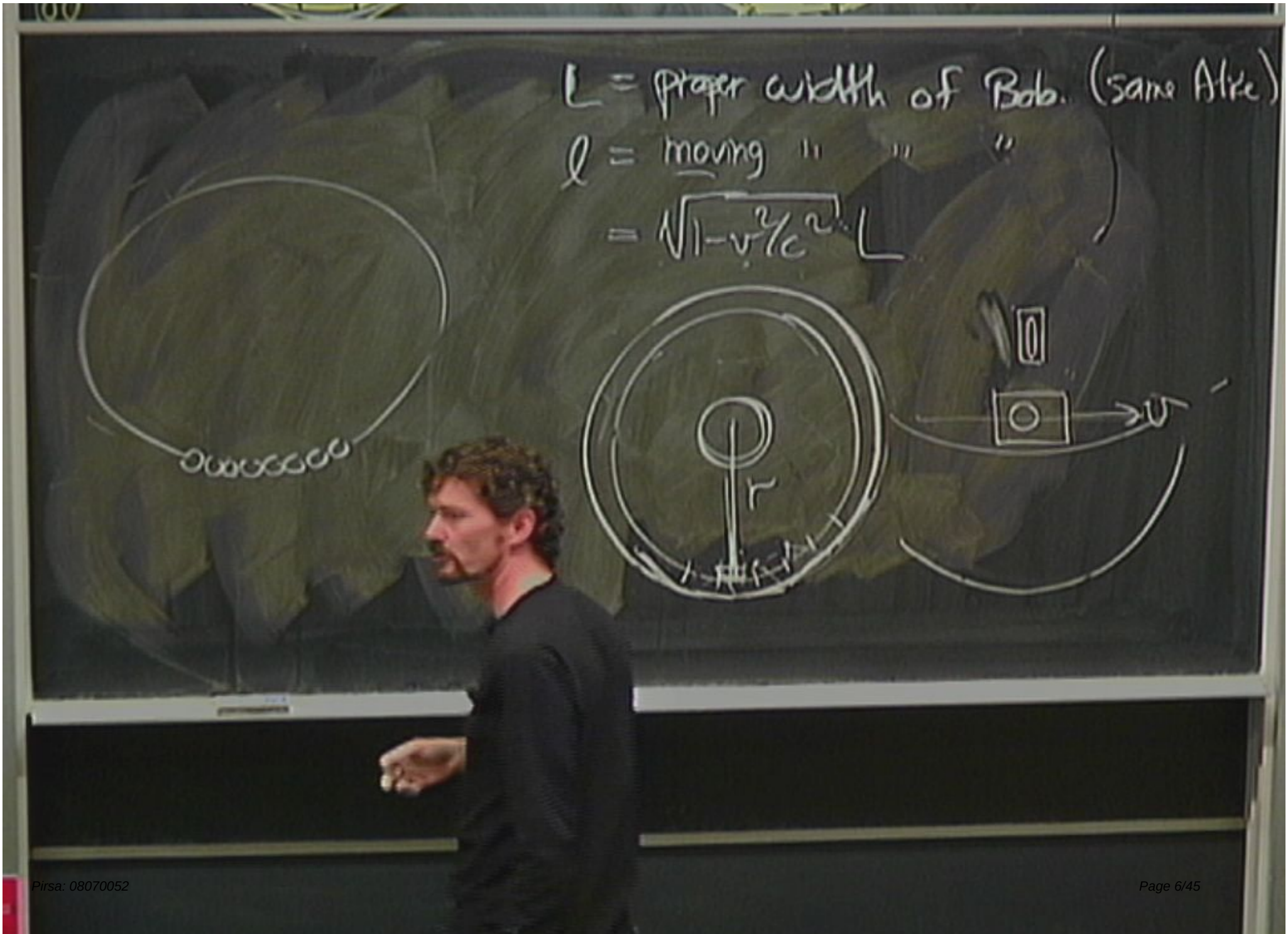
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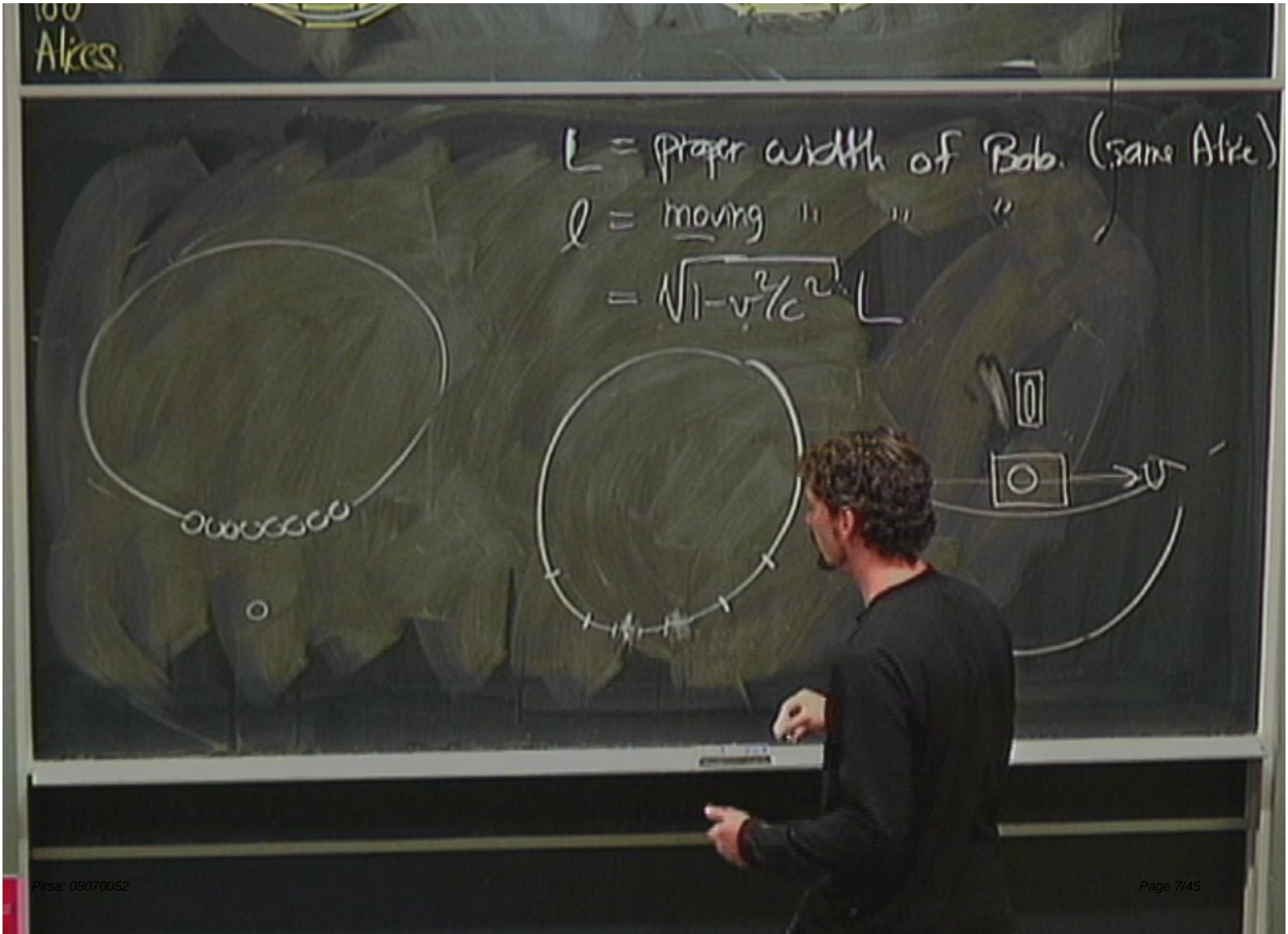
100
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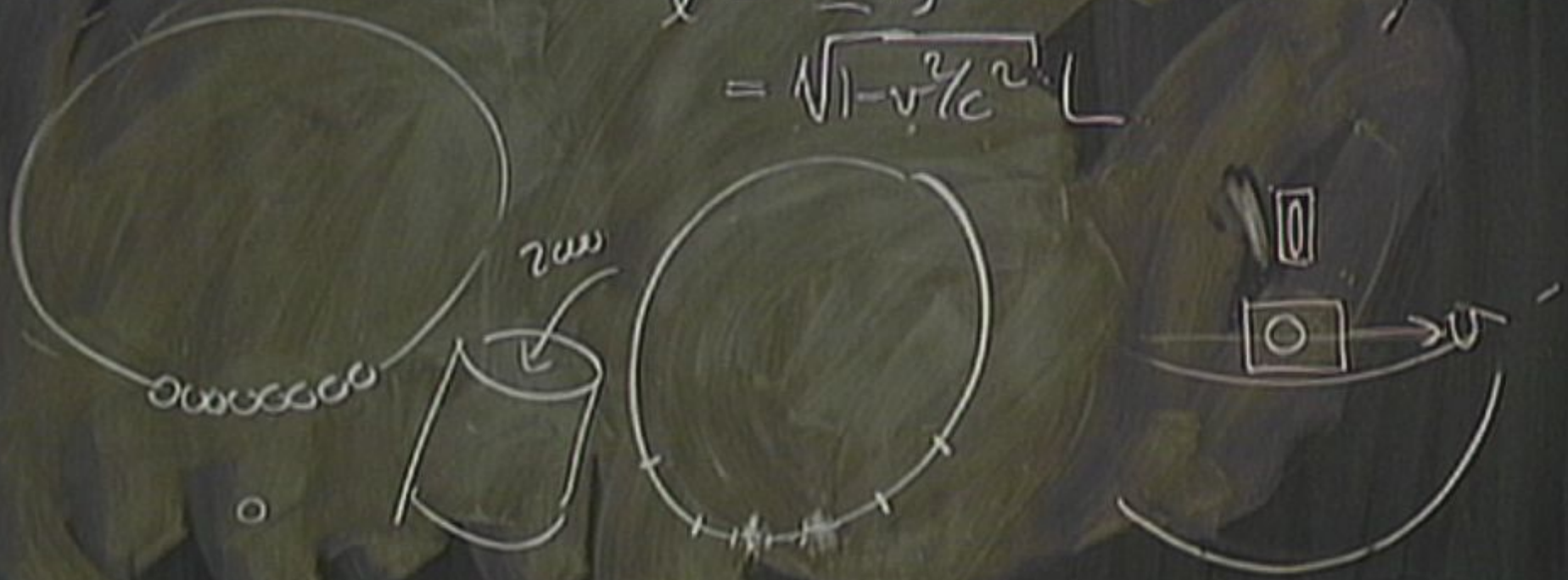
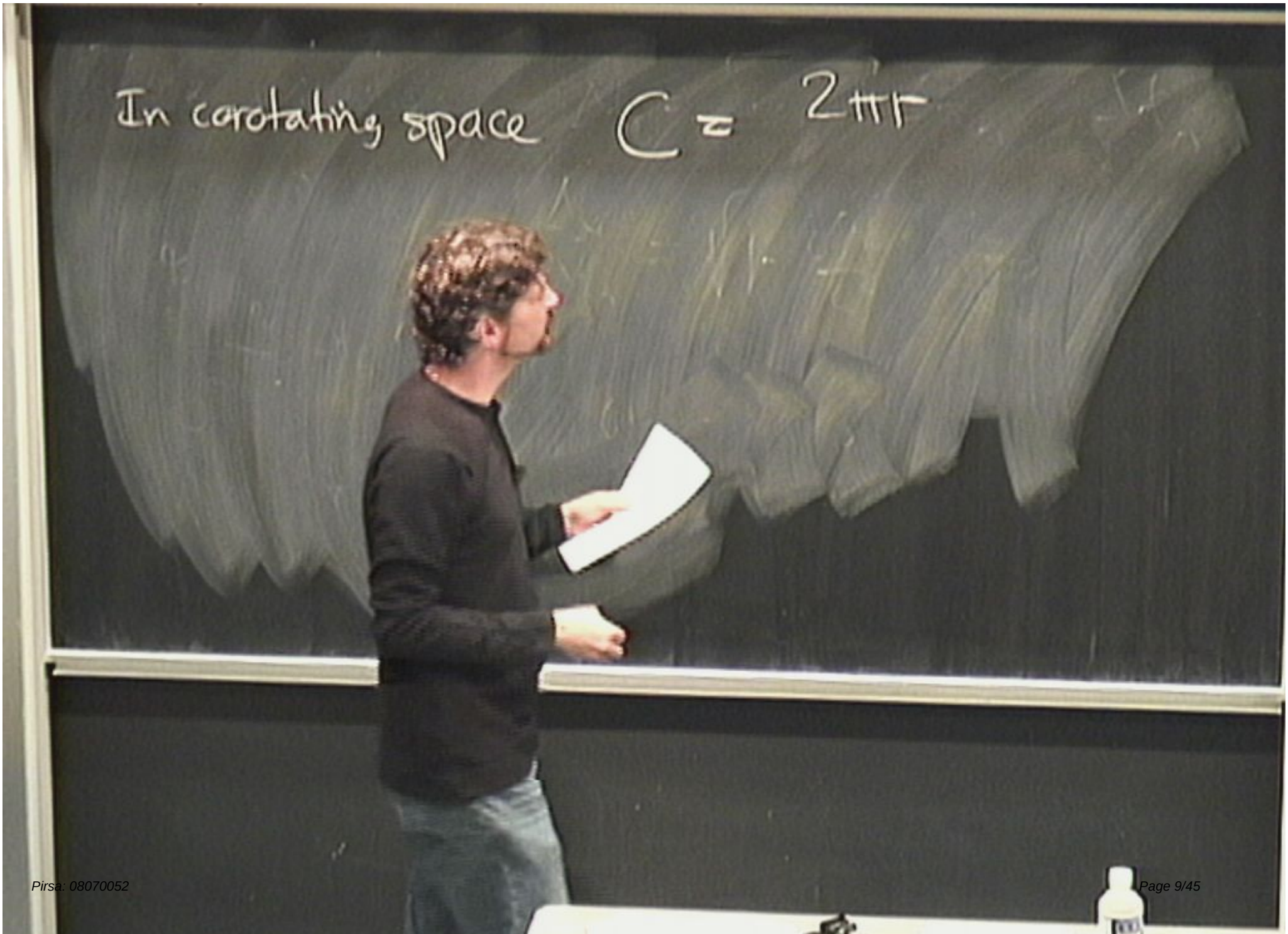
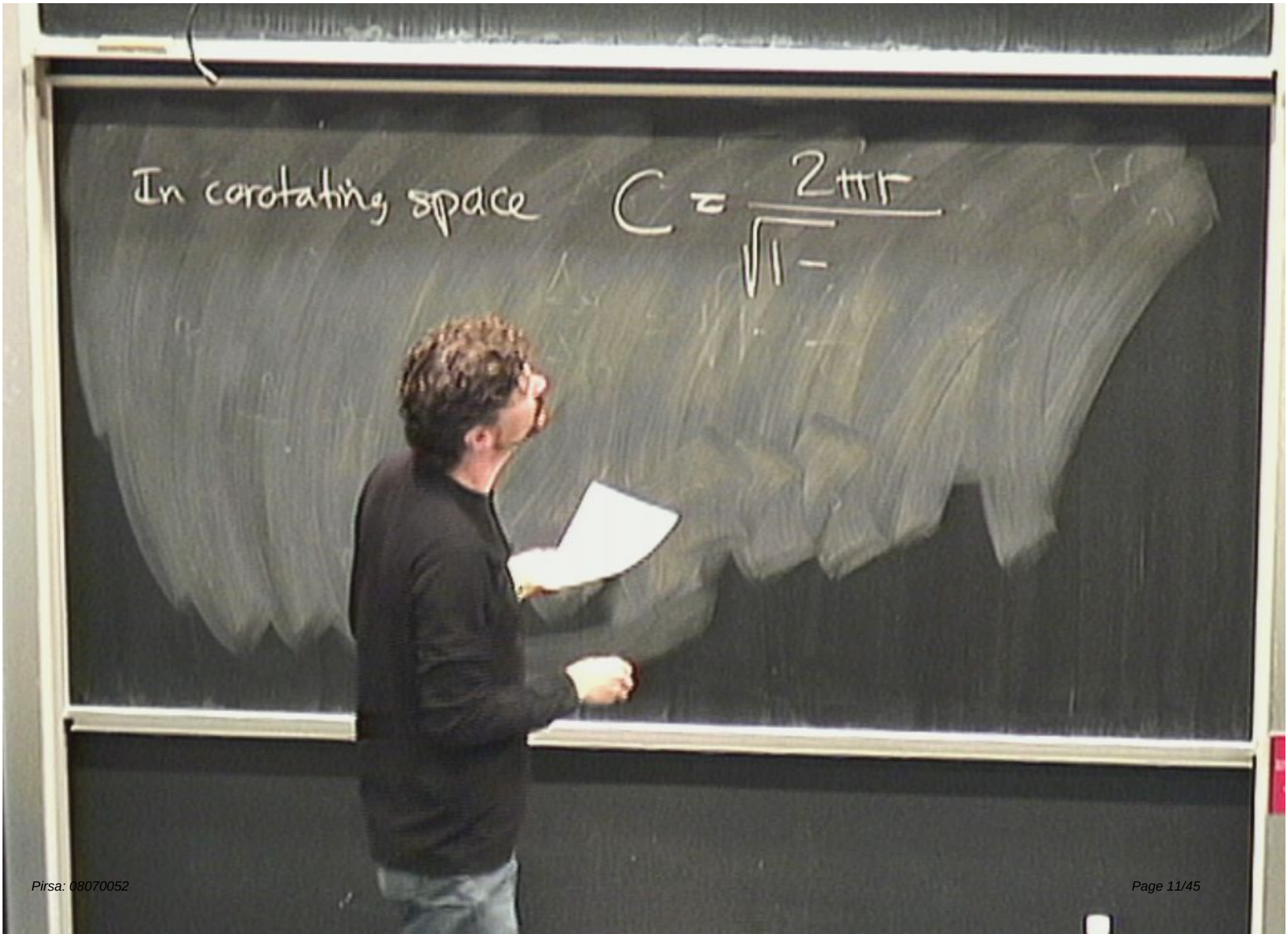
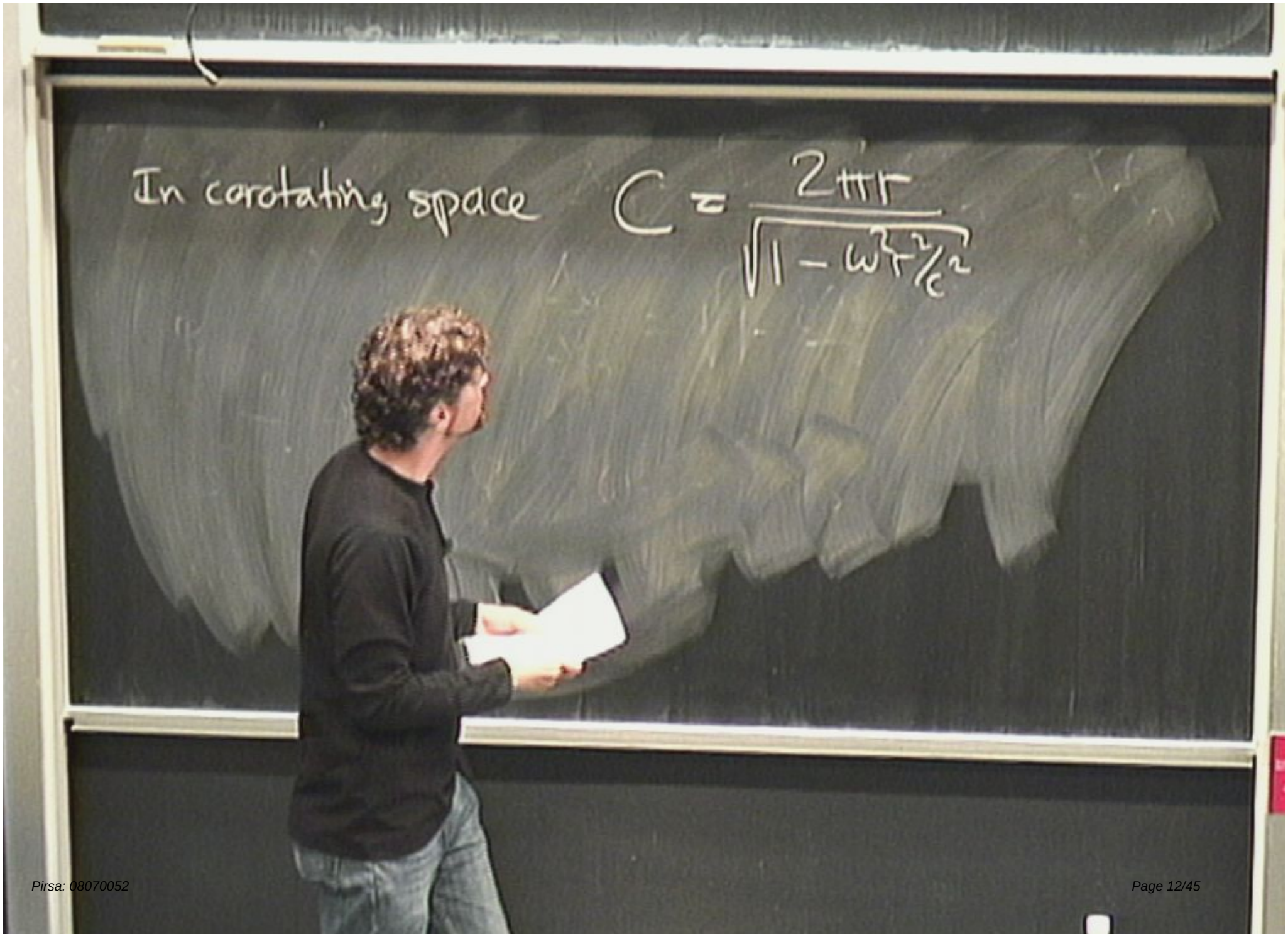
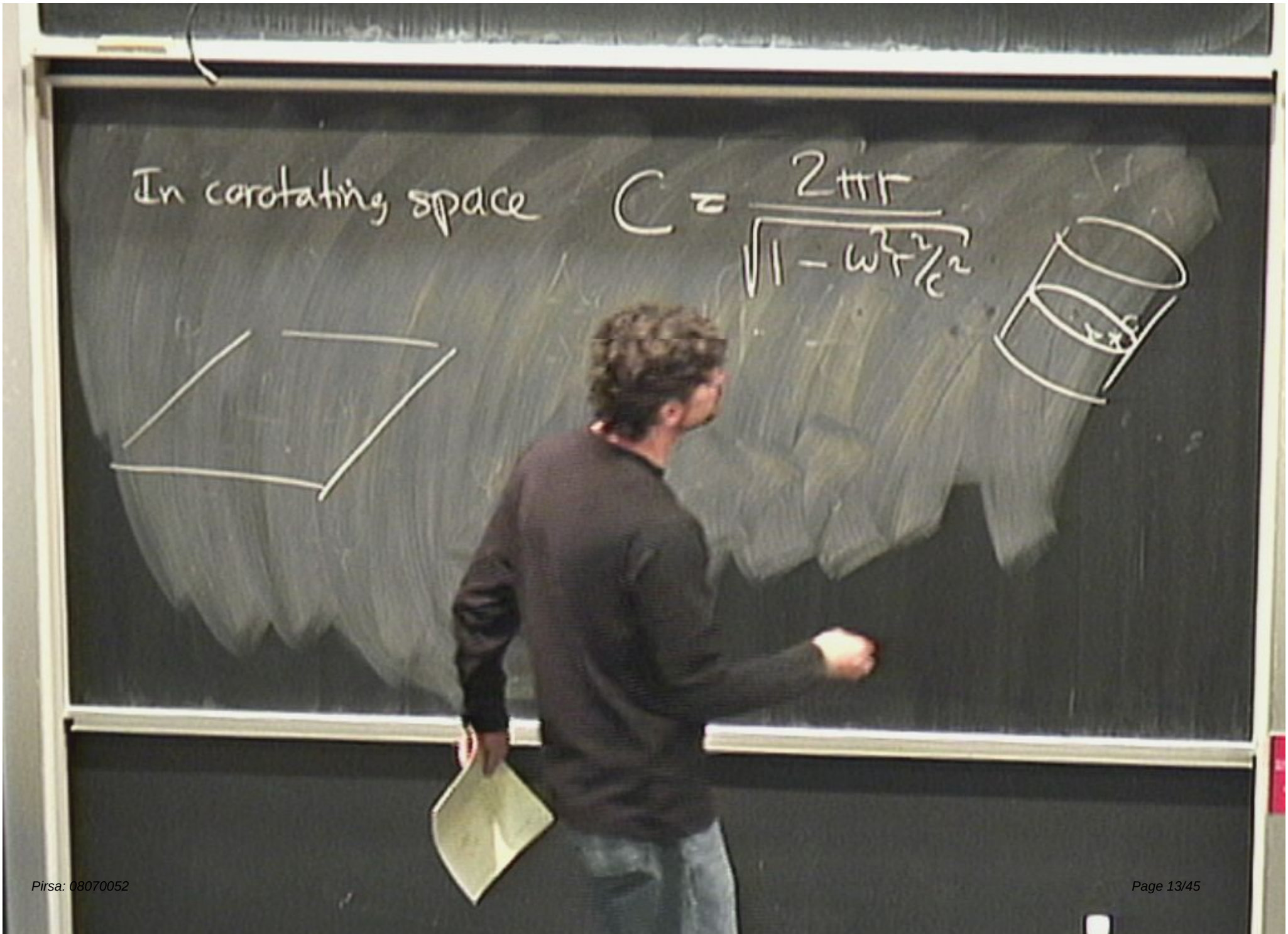



In corotating space C = 2πr

In corotating space $C = 2\pi r$


In corotating space
$C = \frac{2\pi r}{\sqrt{1-}}$


In corotating space
$C = \frac{2\pi r}{\sqrt{1 - \omega^2 r^2/c^2}}$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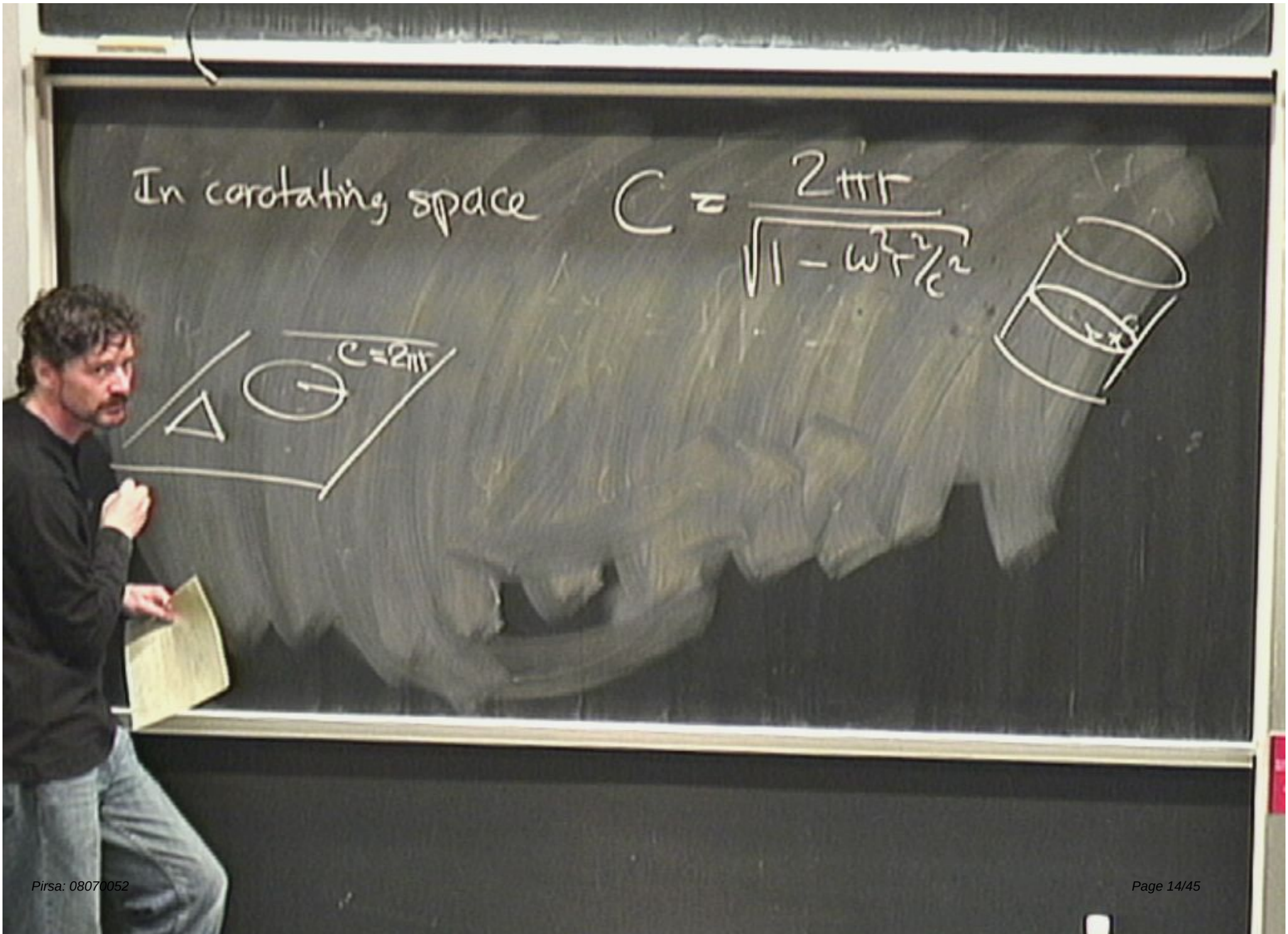
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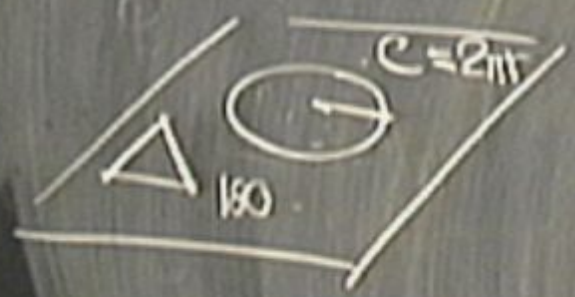
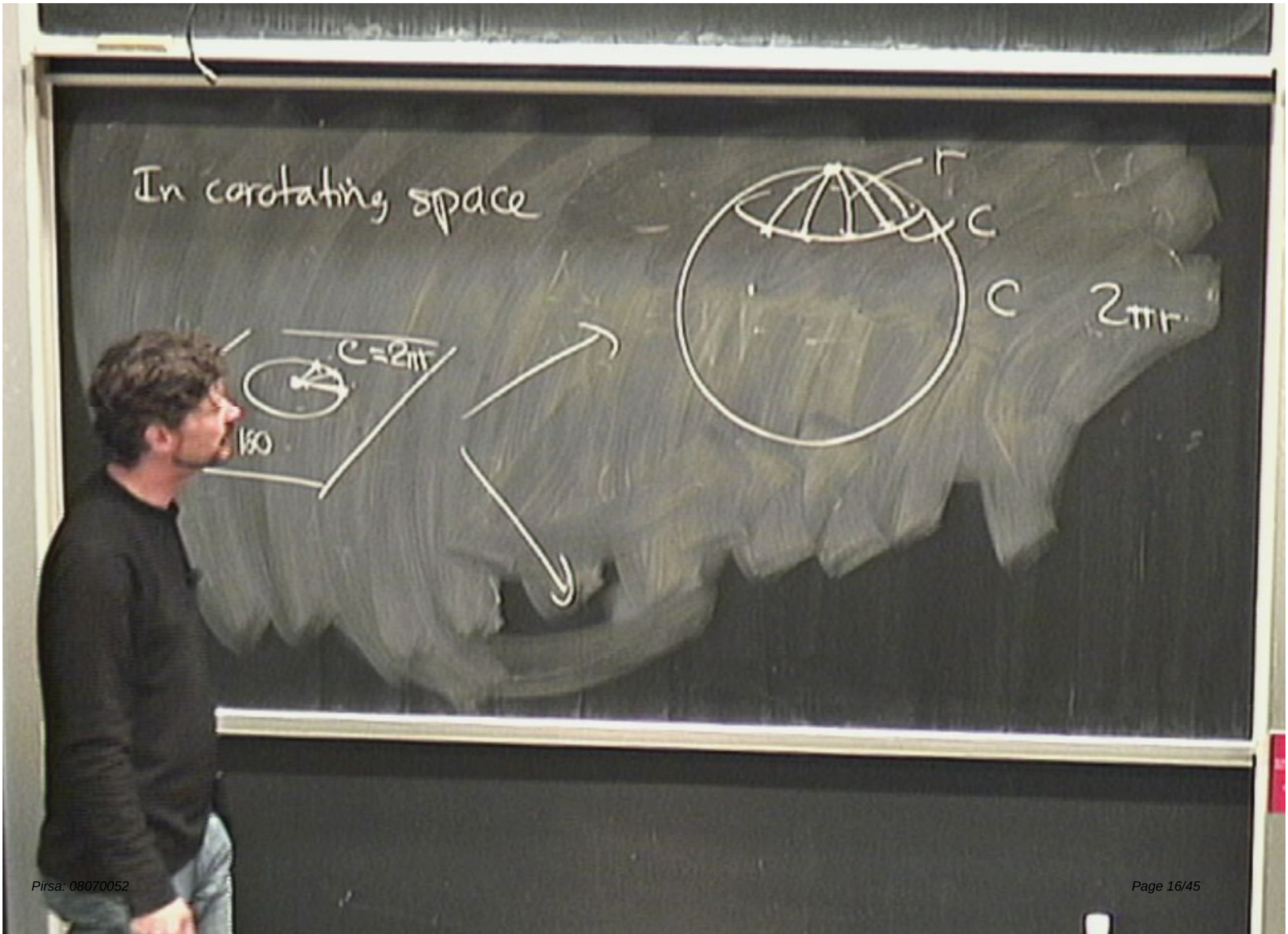
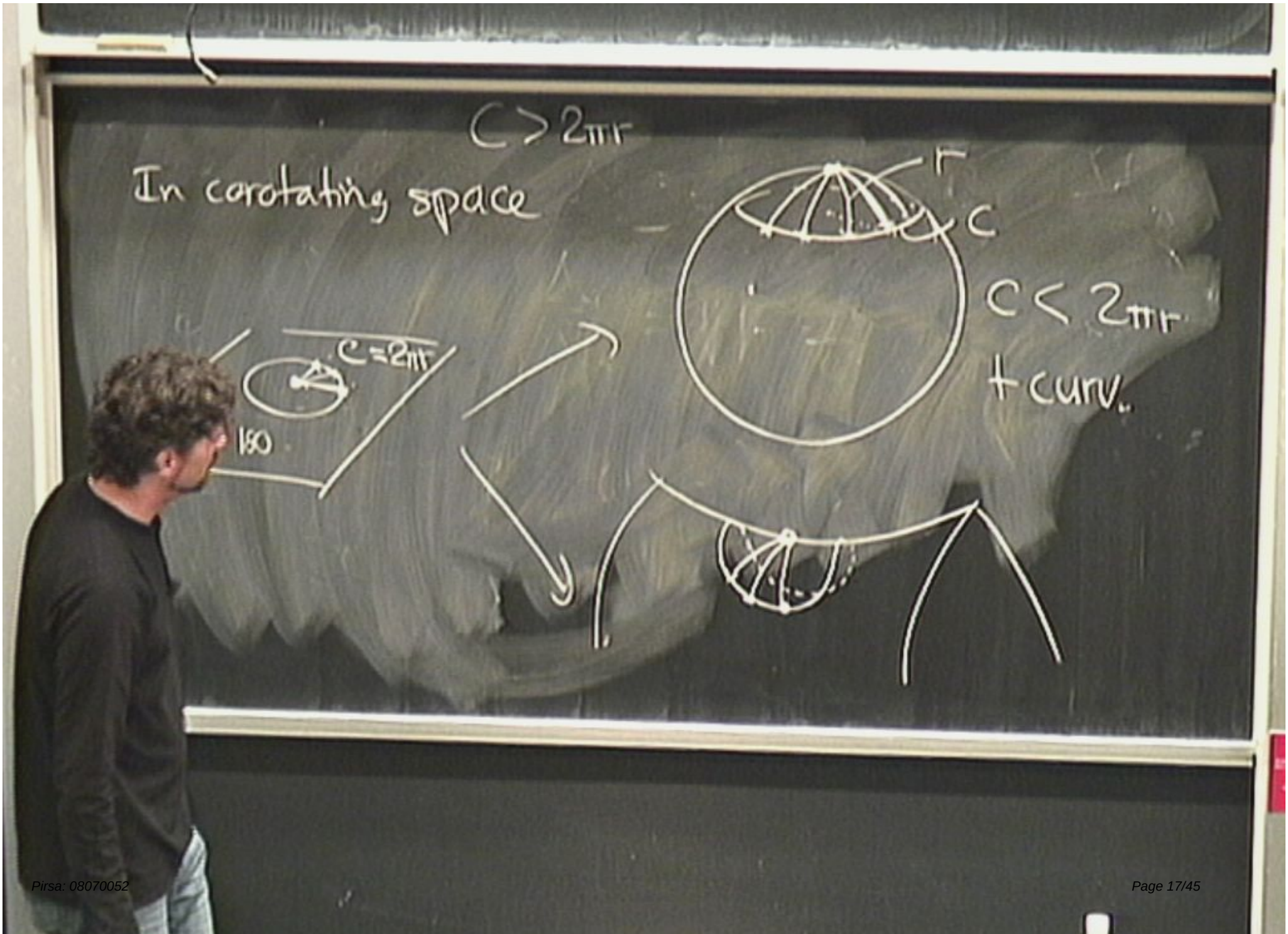
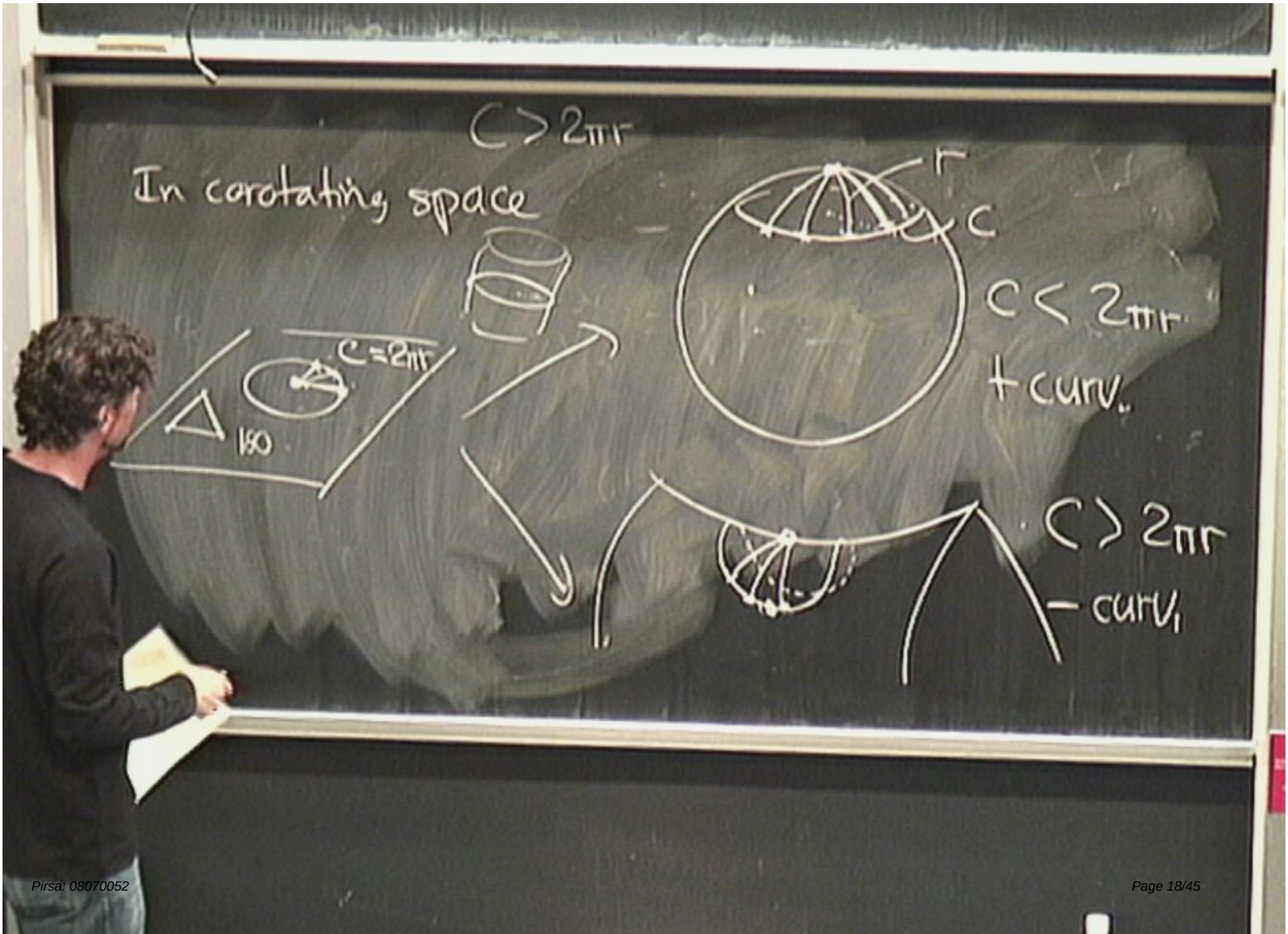
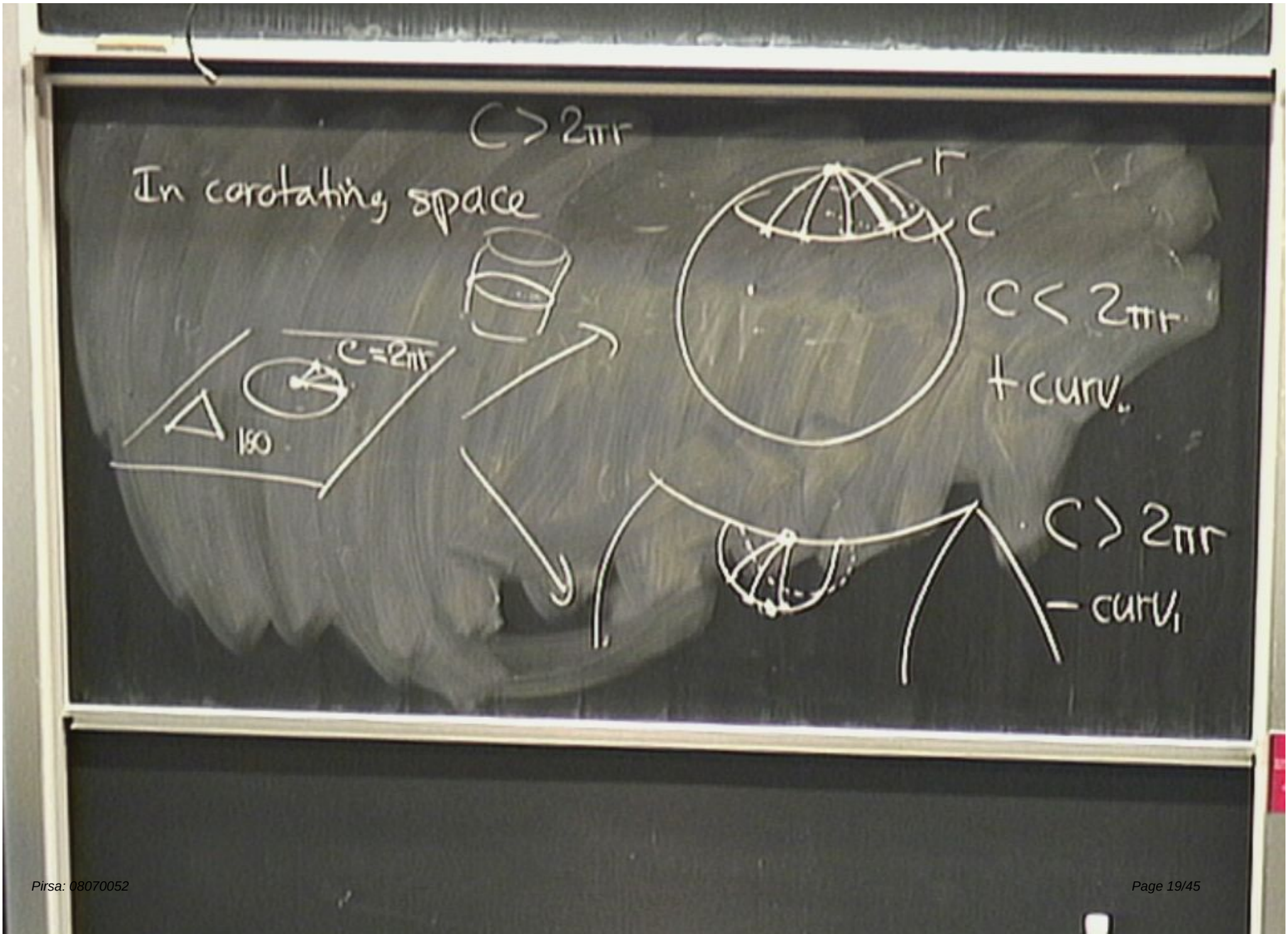



In corotating space
r
c
c
2πr
c=2πr
150


C > 2πr
In corotating space
r
C
C < 2πr
+ curv.
C = 2πr
150


C > 2πr
In corotating space
r
c
C < 2πr
+ curv.
C = 2πr
180
C > 2πr
− curv.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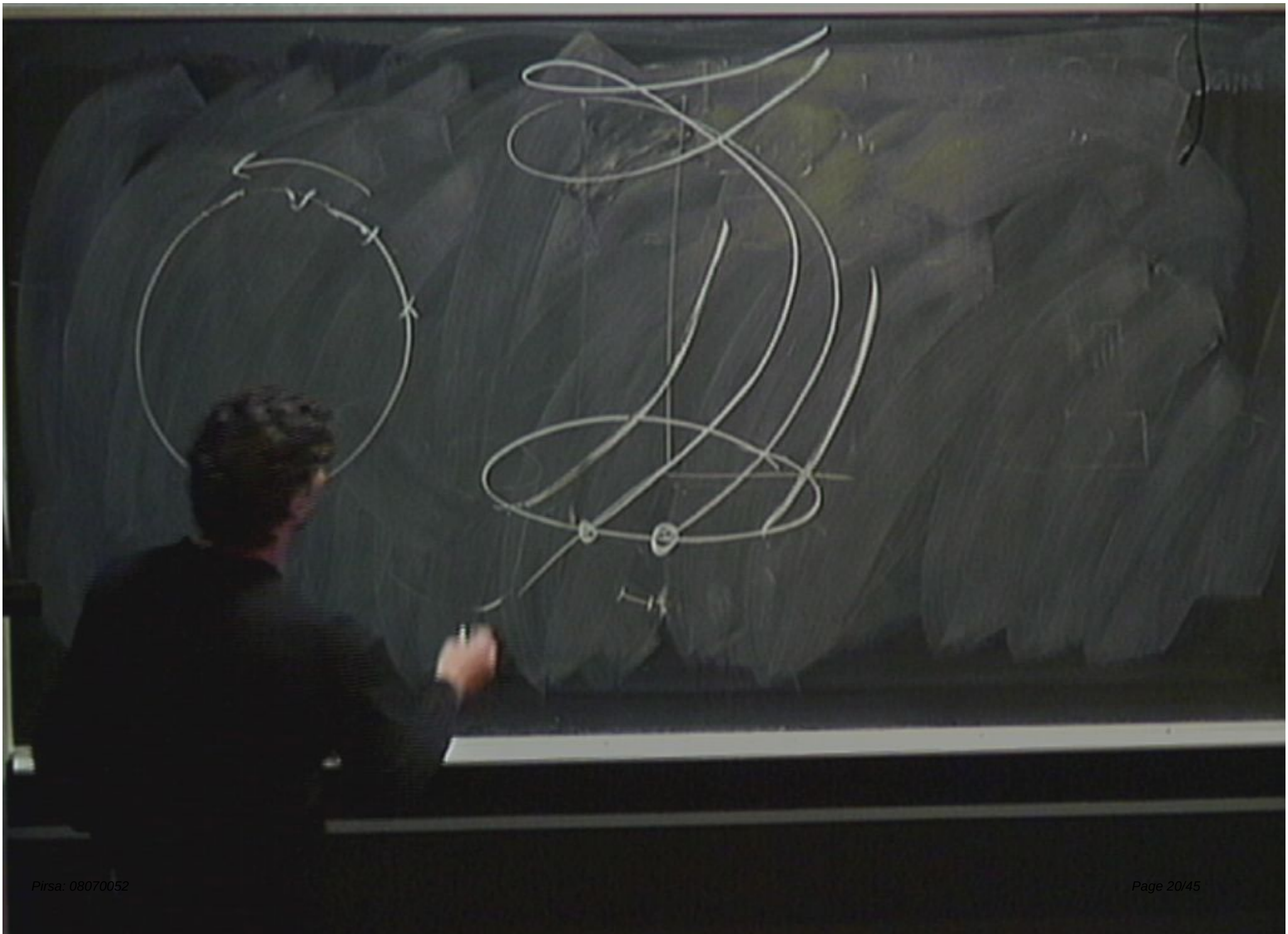

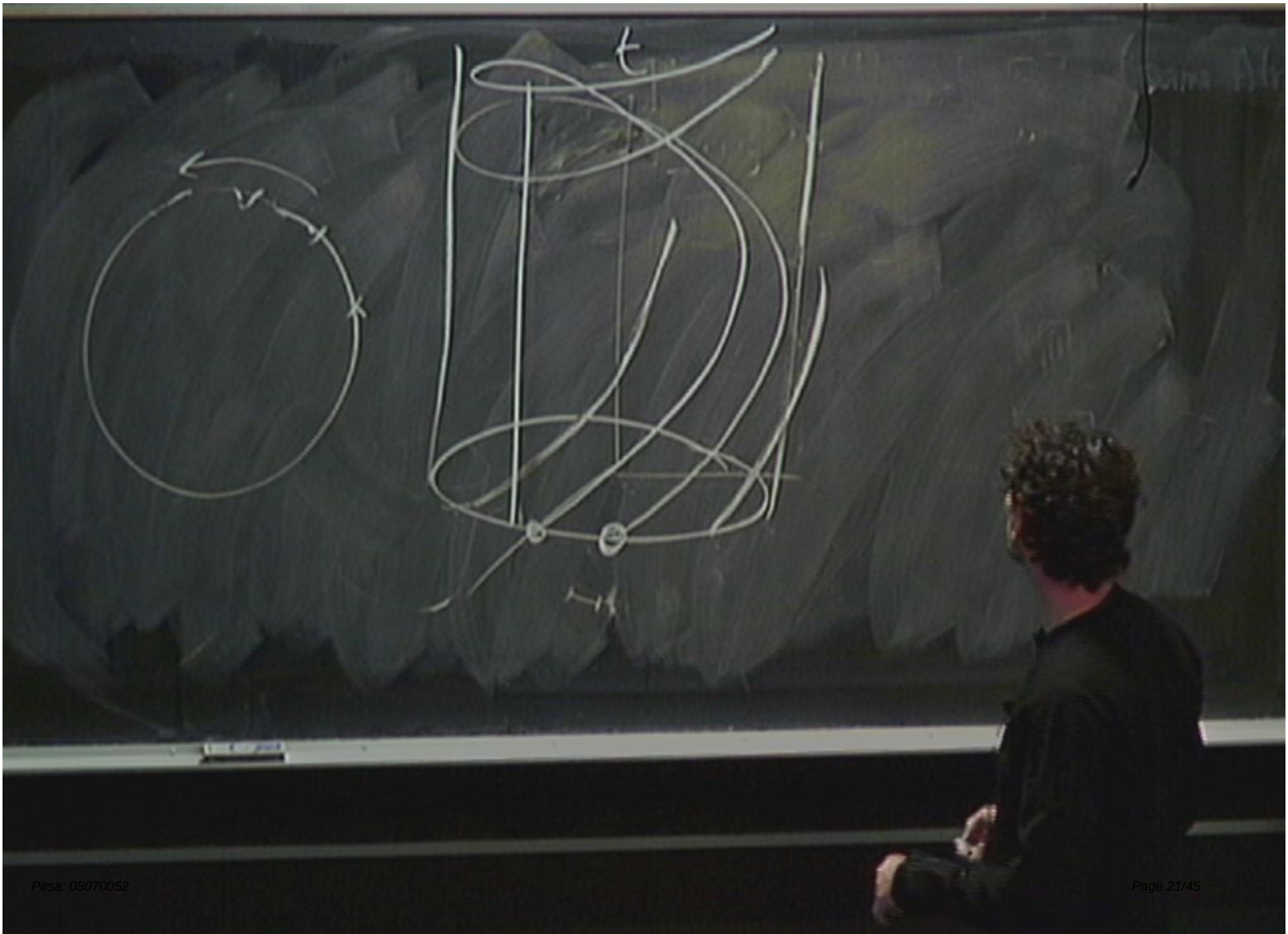
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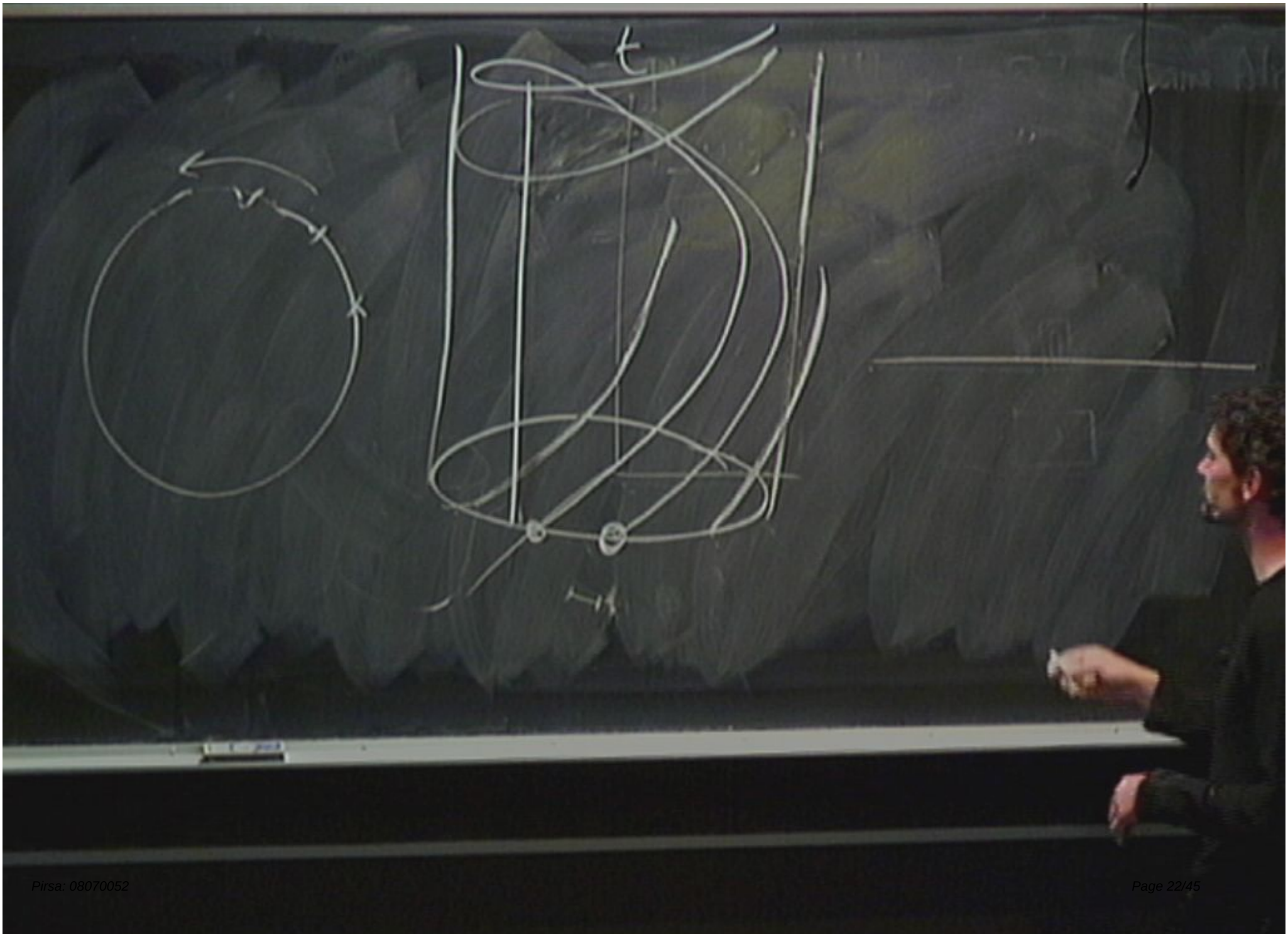
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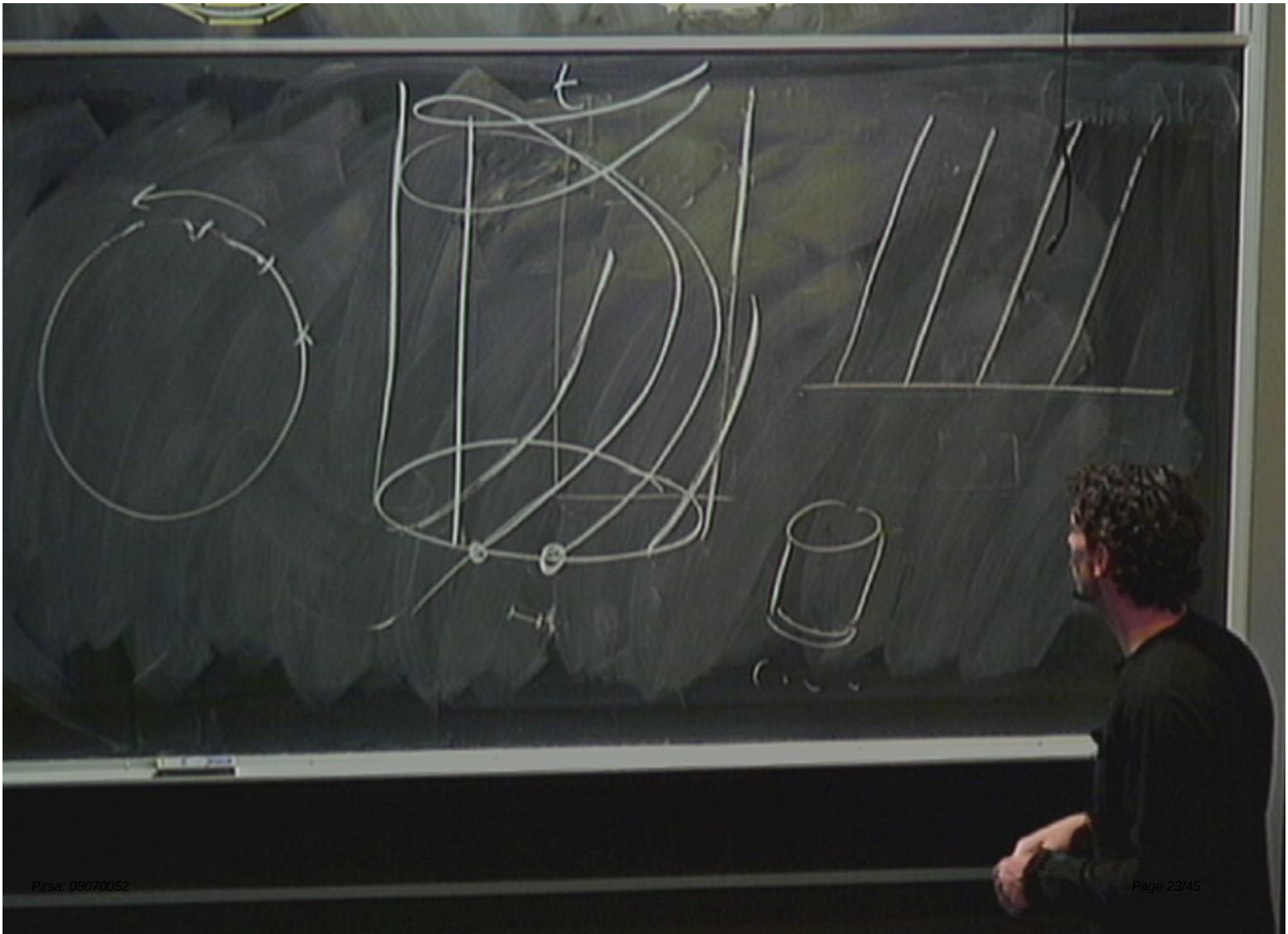
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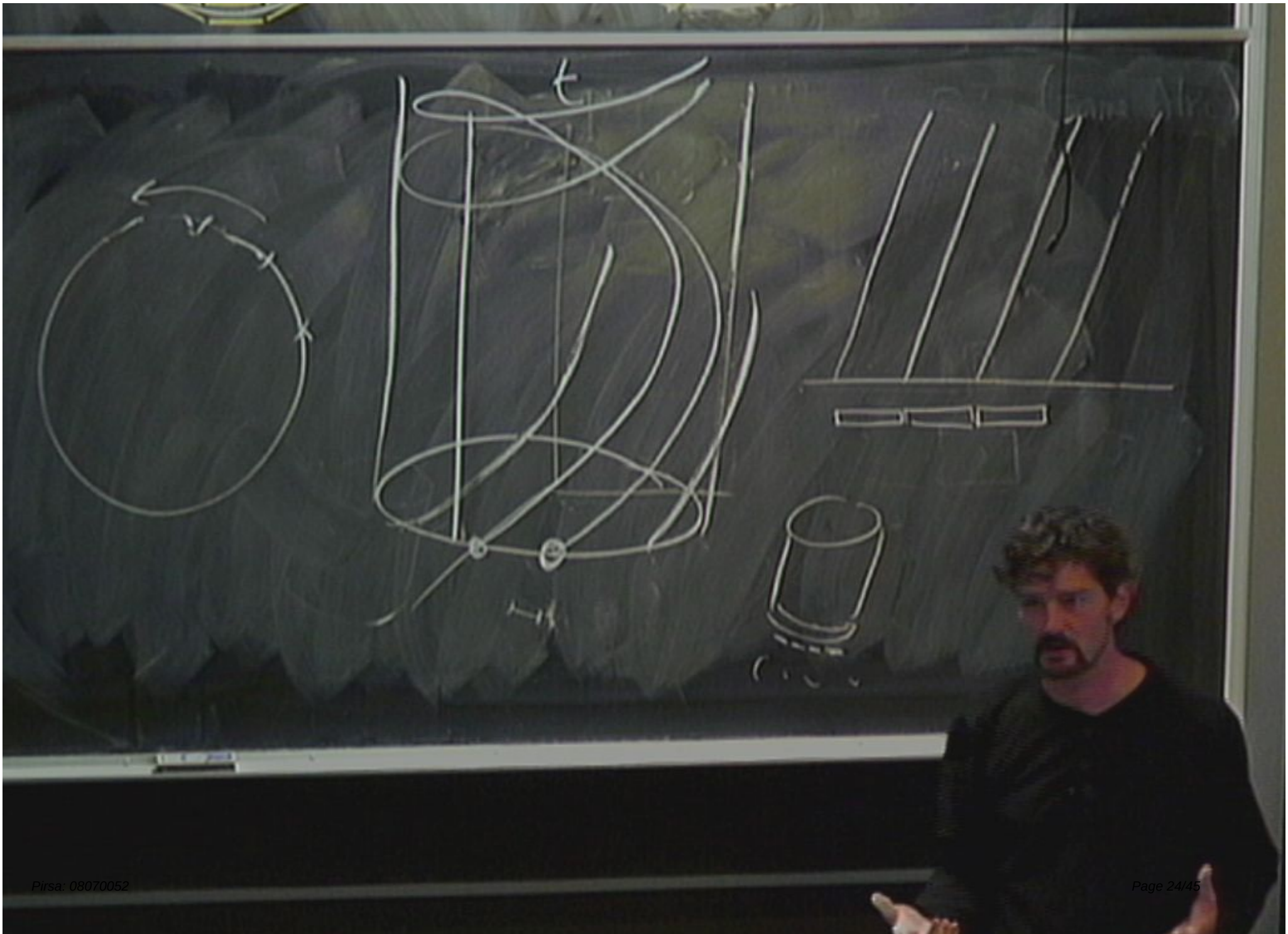
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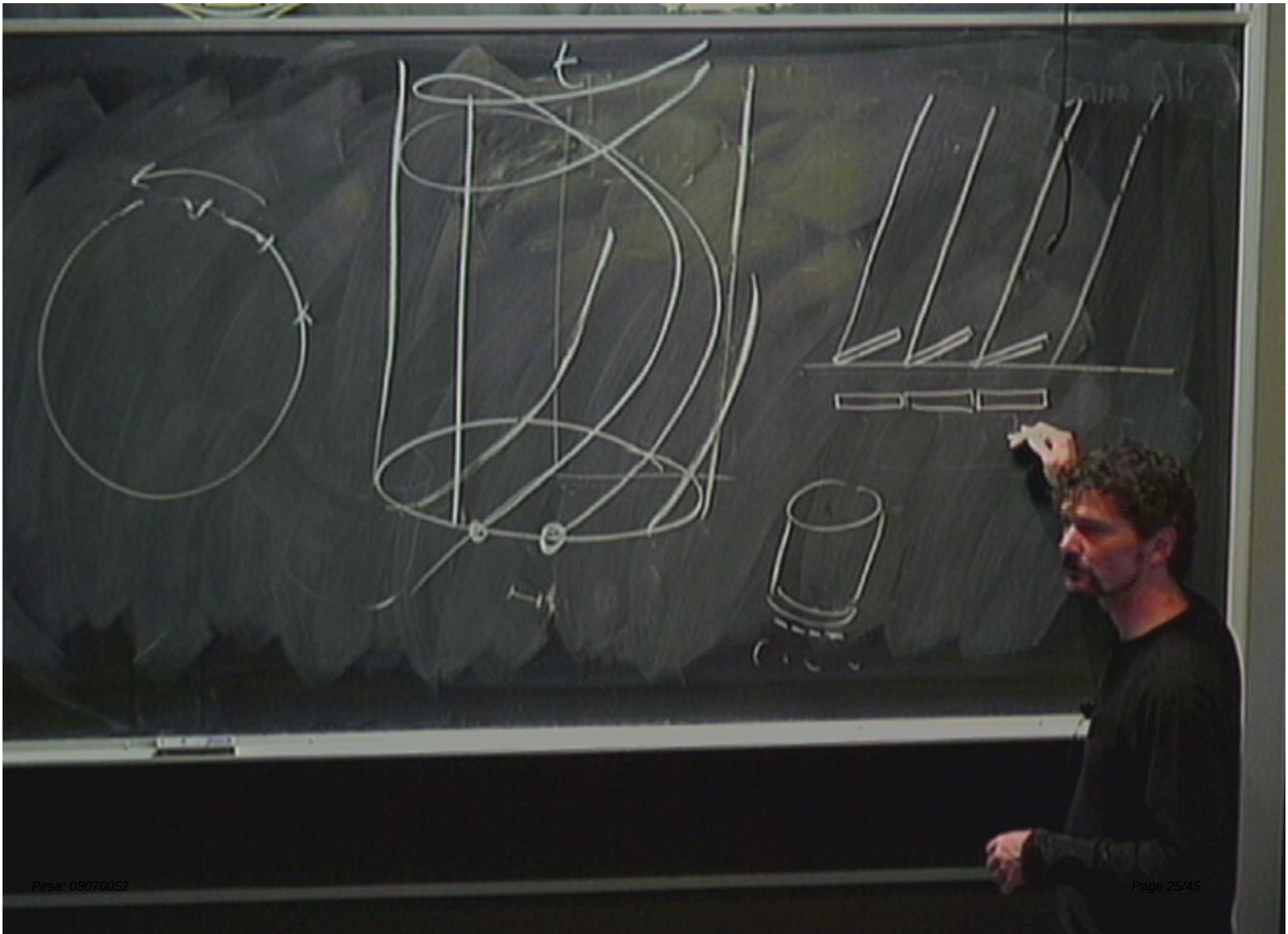
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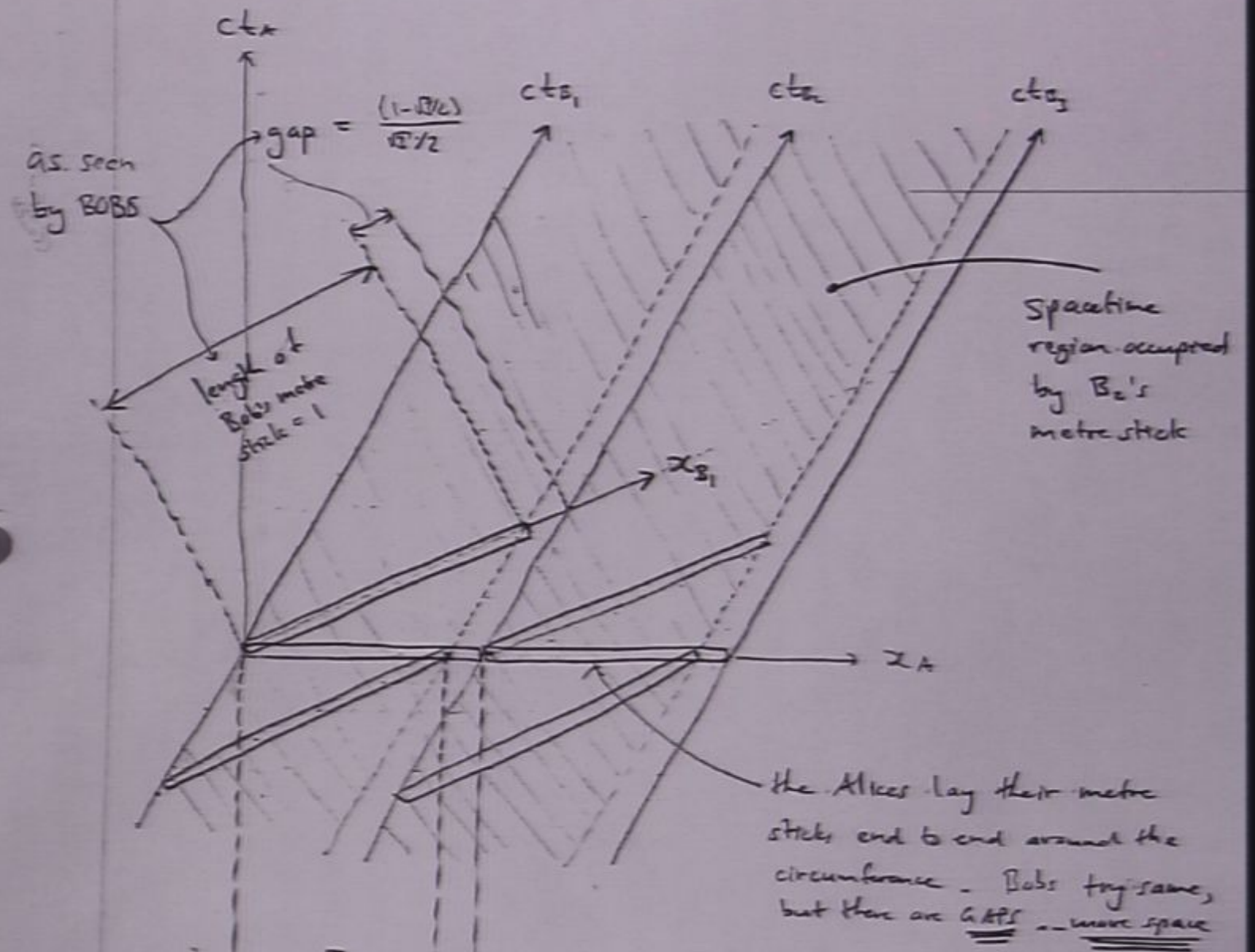
let all Alices & Bobs have identical metre sticks.

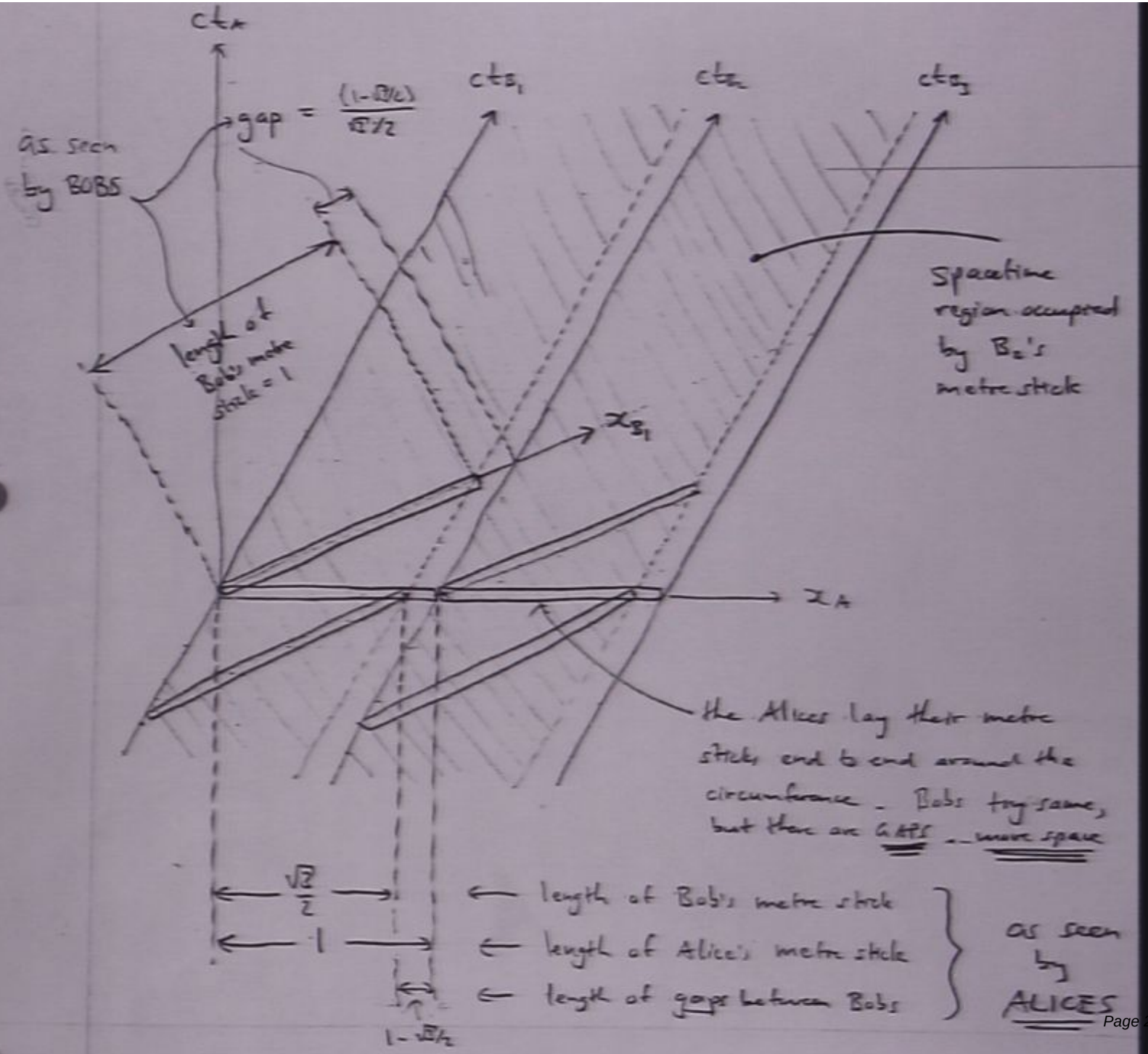


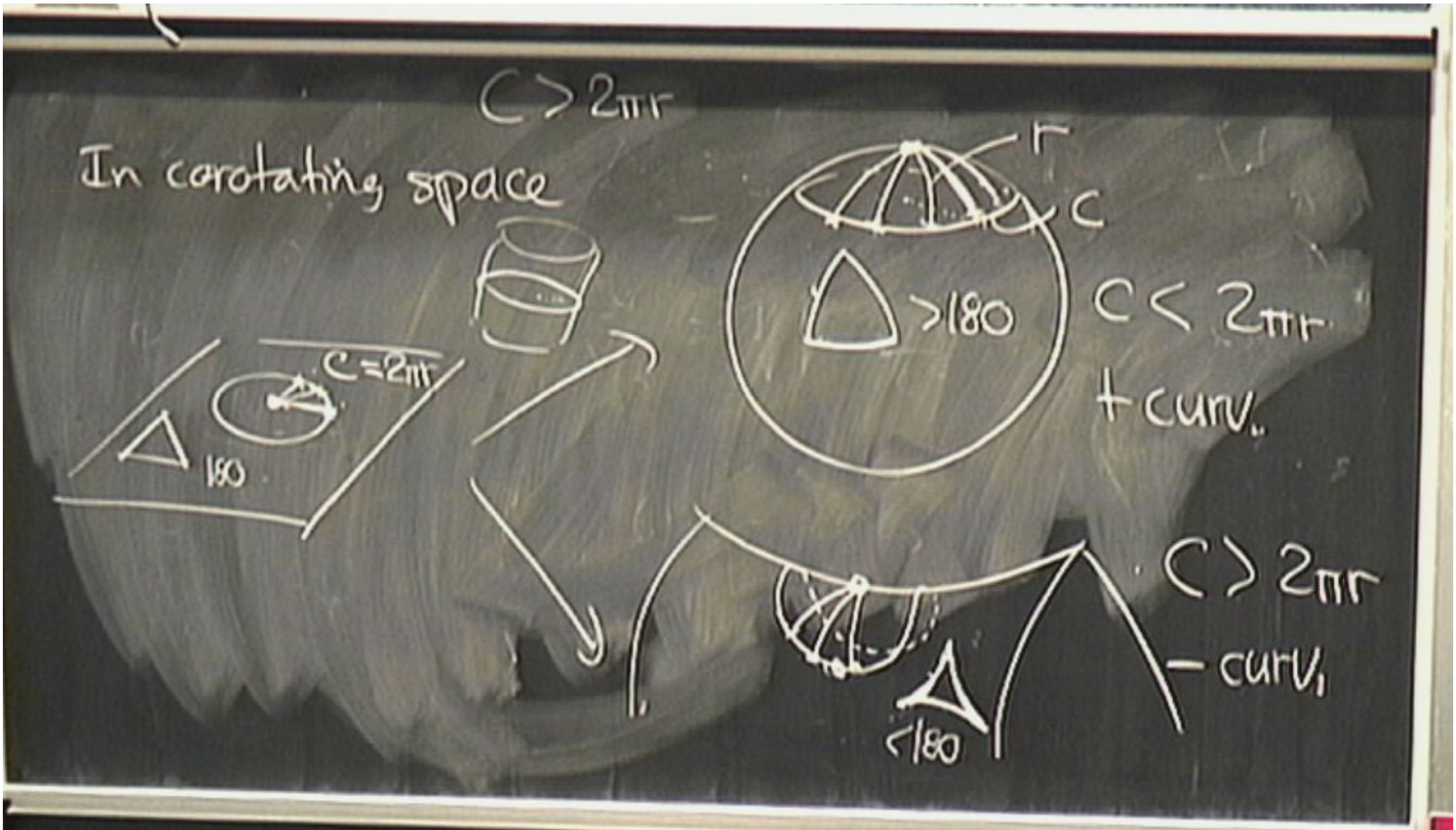
$\frac{\sqrt{2}}{2}$ ← length of Bob's metre stick

1 ← length of Alice's metre stick

← length of gap between B's

as seen by ALICE


ct_A
ct_{B_1}
ct_{B_2}
ct_{B_3}
gap = $\frac{(1-\sqrt{2}/2)}{\sqrt{2}/2}$
as seen by BOBS
length of Bob's metre stick = 1
spacetime region occupied by B_2's metre stick
x_{B_1}
x_A
the Alices lay their metre sticks end to end around the circumference. Bobs try same, but there are GAPS ... more space
$\frac{\sqrt{2}}{2}$
1
$1-\sqrt{2}/2$
← length of Bob's metre stick
← length of Alice's metre stick
← length of gaps between Bobs
as seen by ALICES


C > 2πr
In corotating space
r
C
>180
C < 2πr
+ curv.
C = 2πr
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C > 2πr
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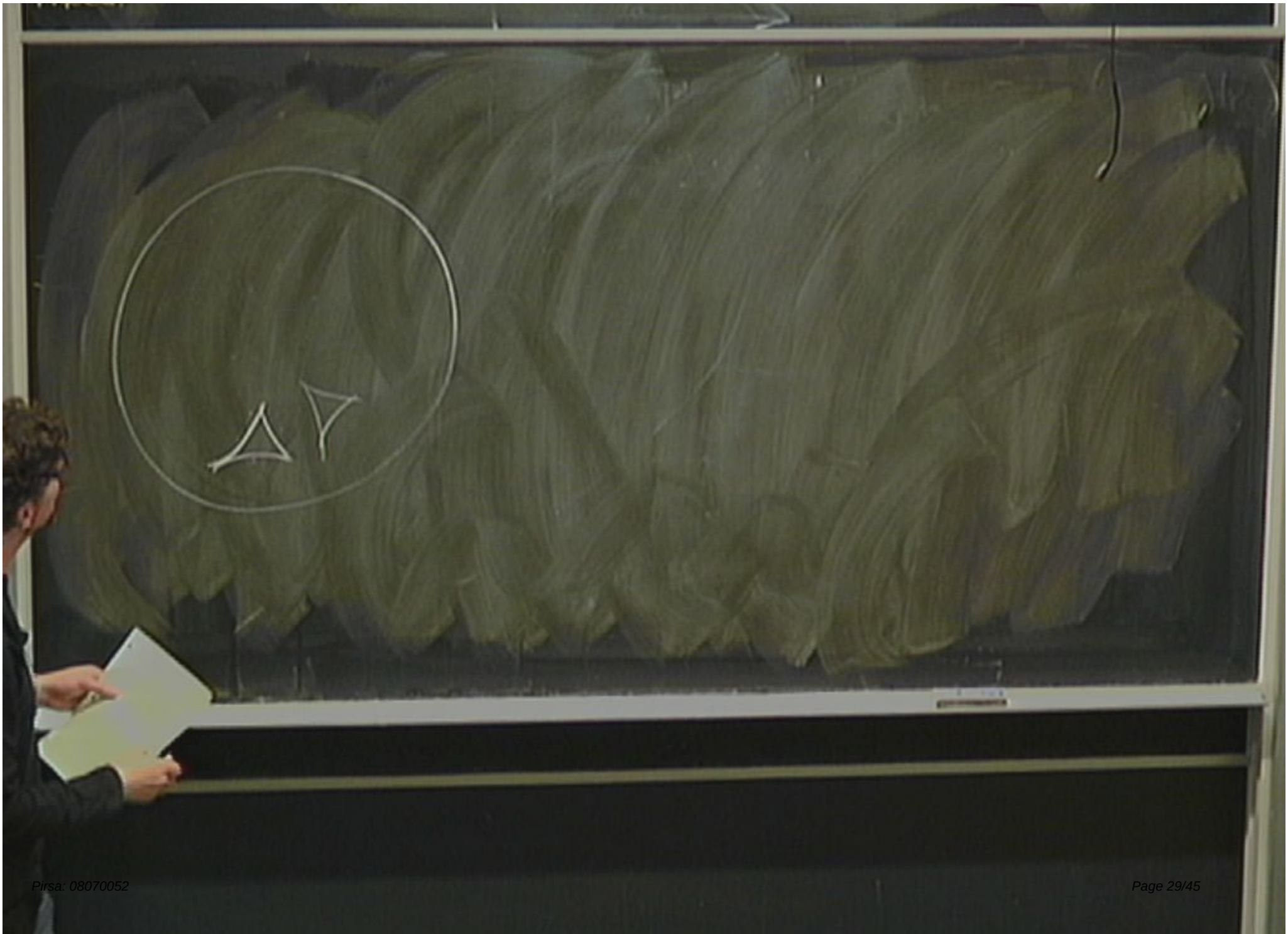
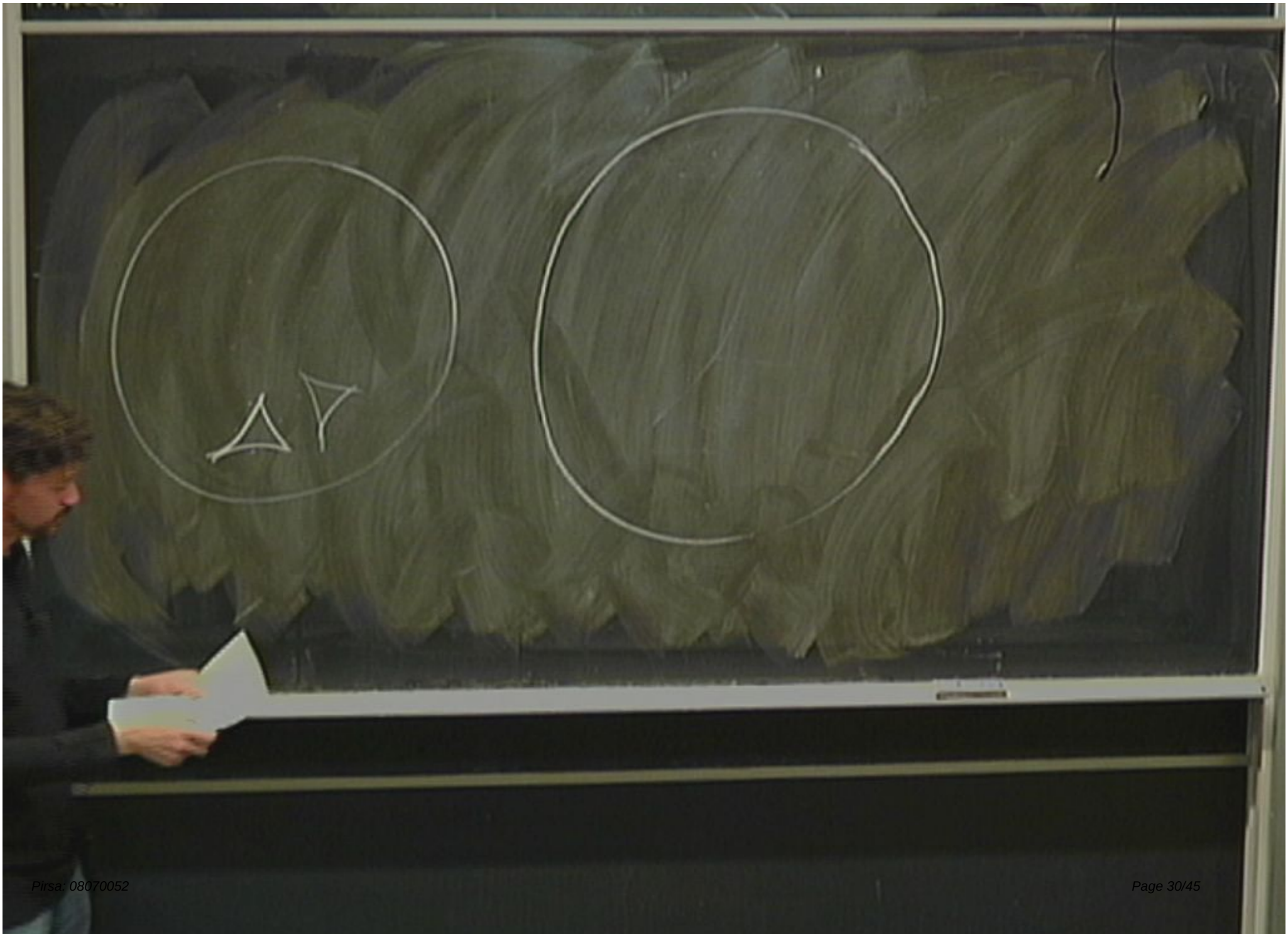
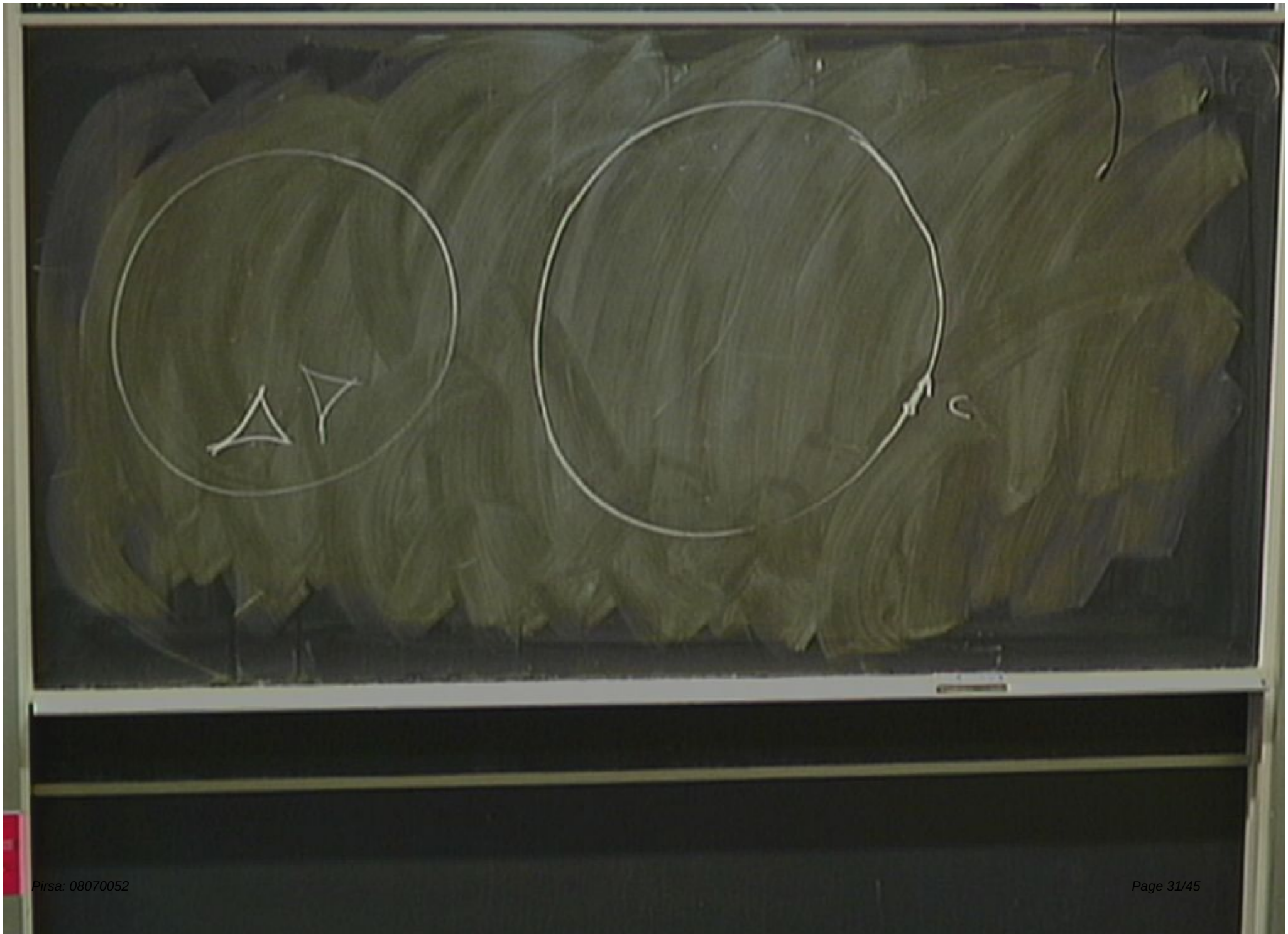
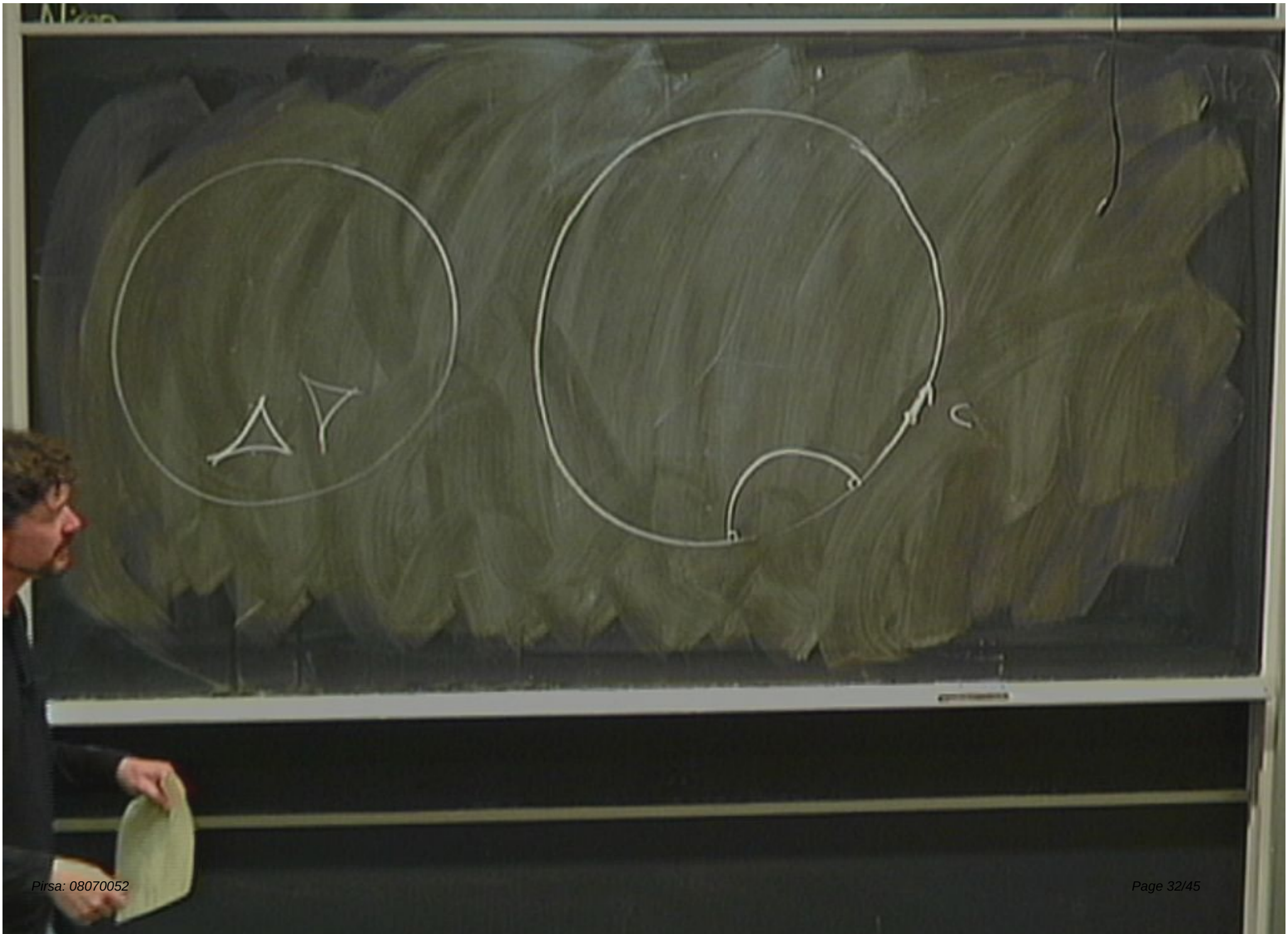
<180






C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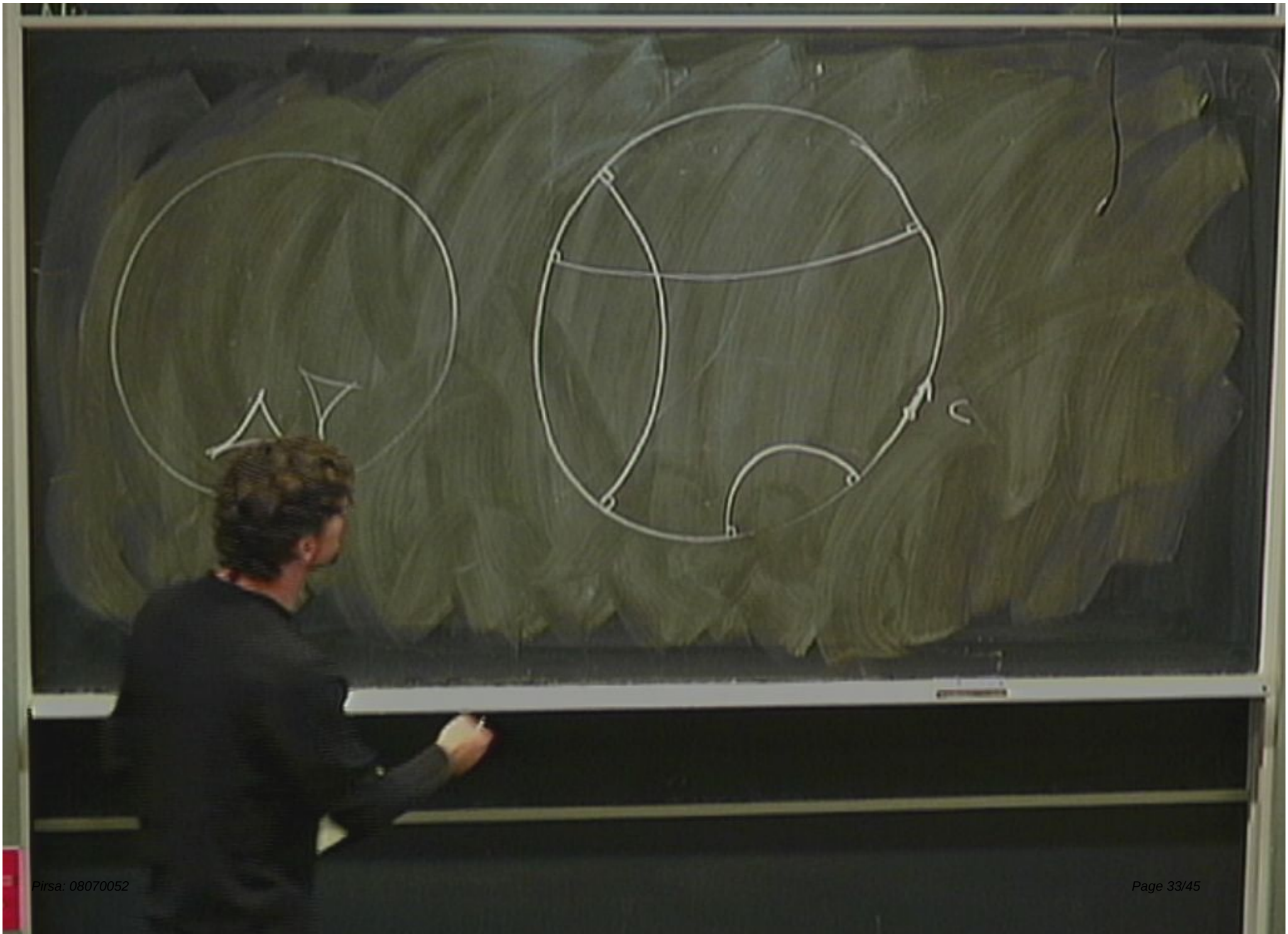
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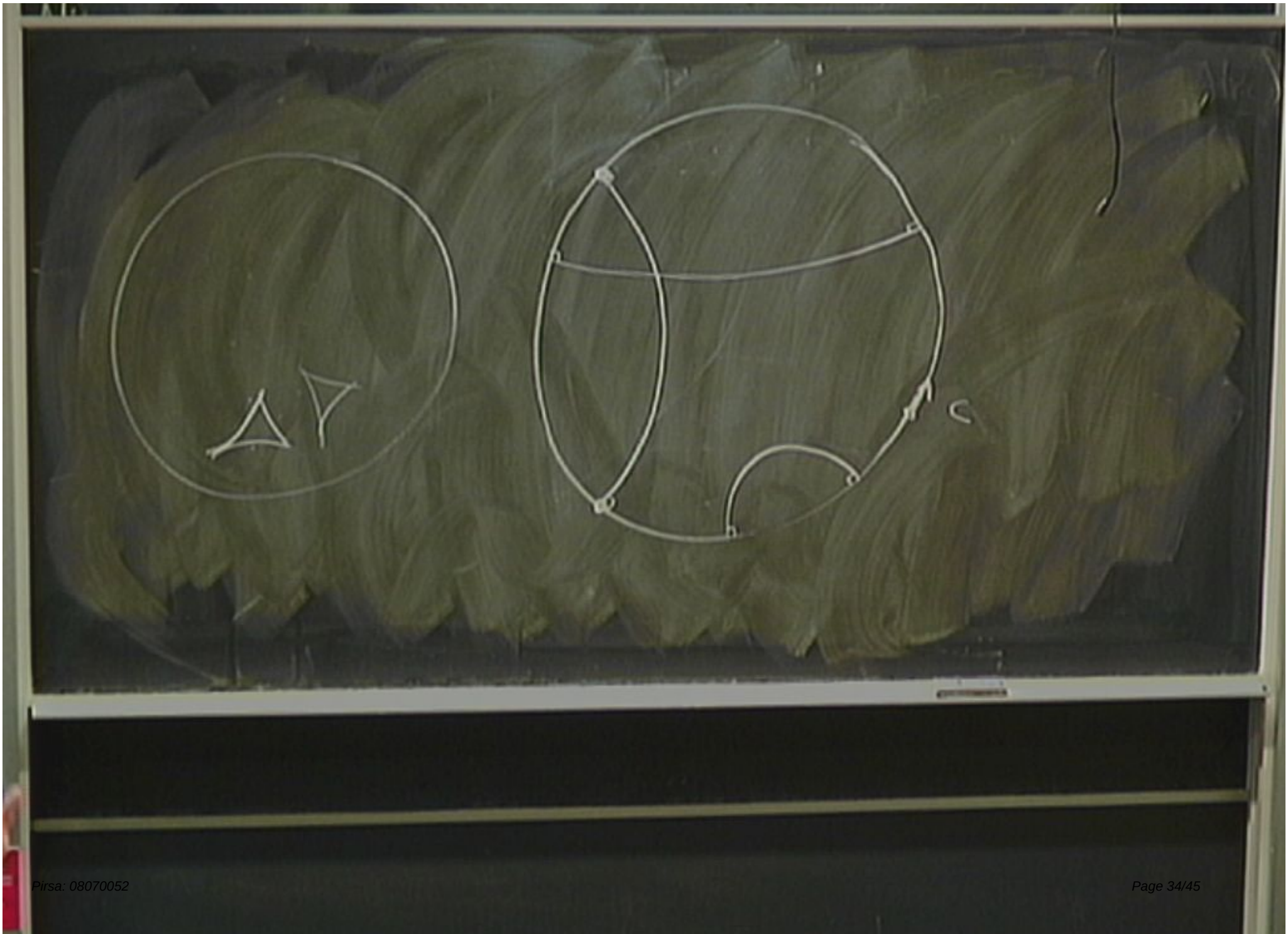
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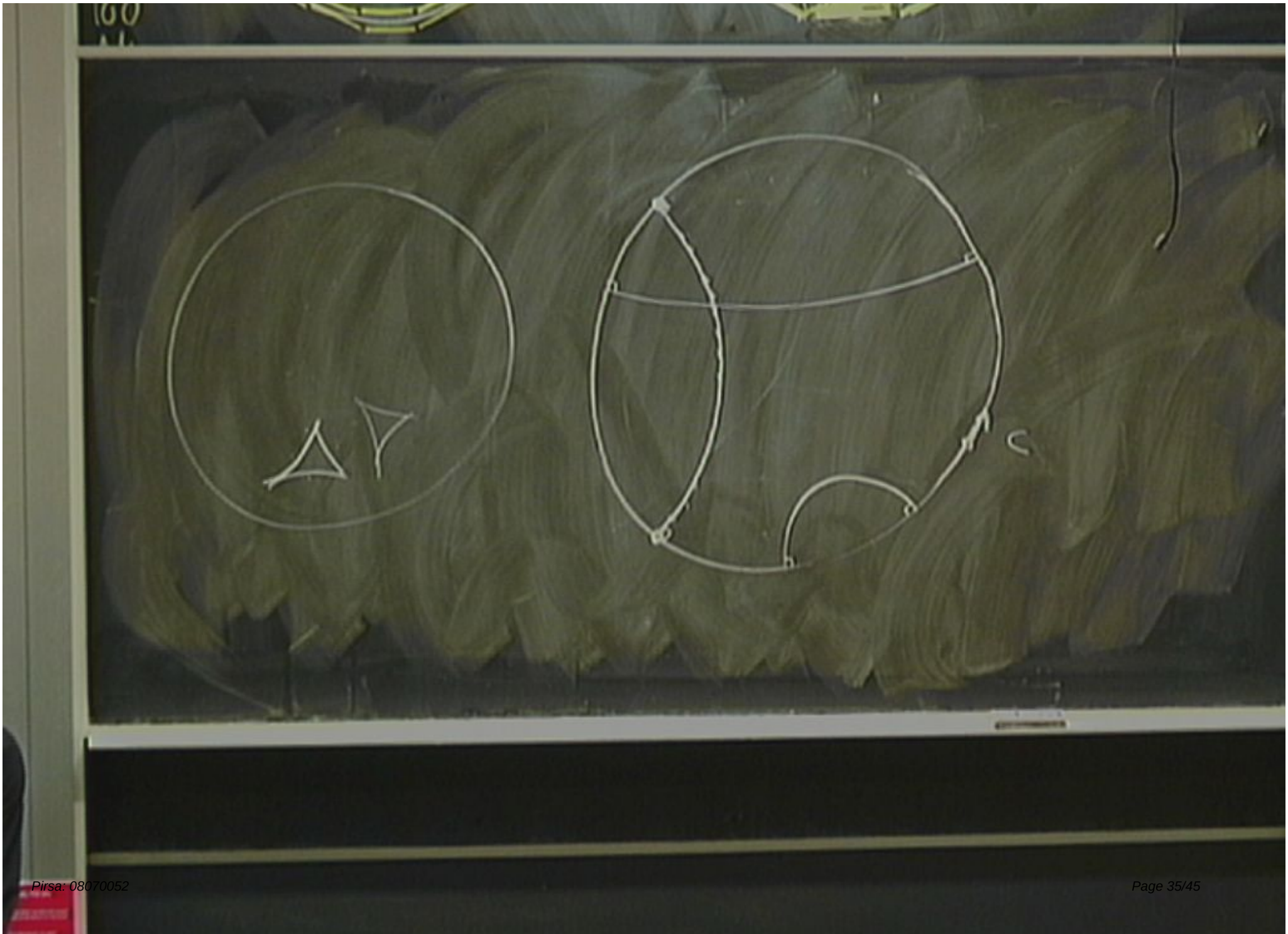
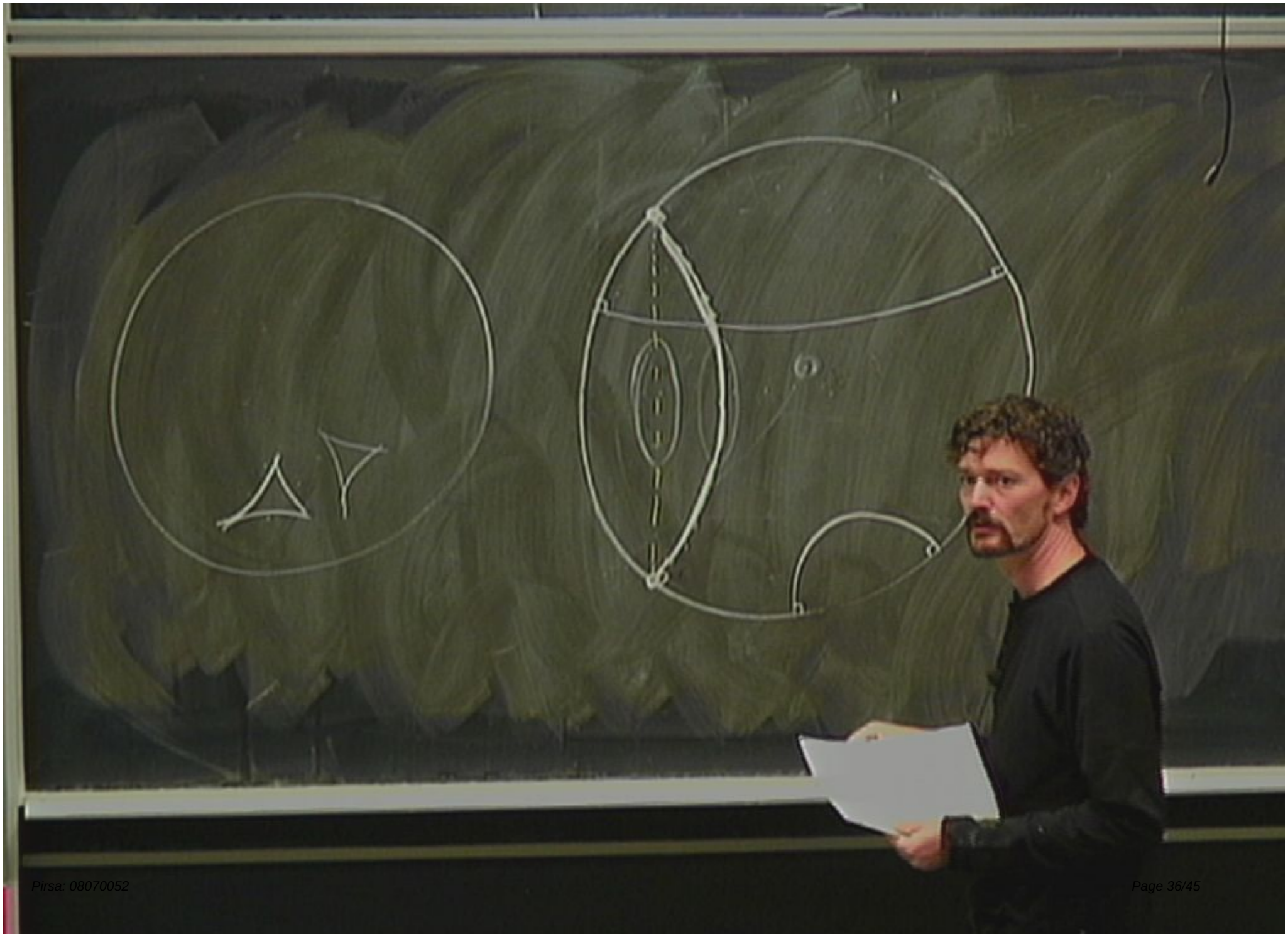
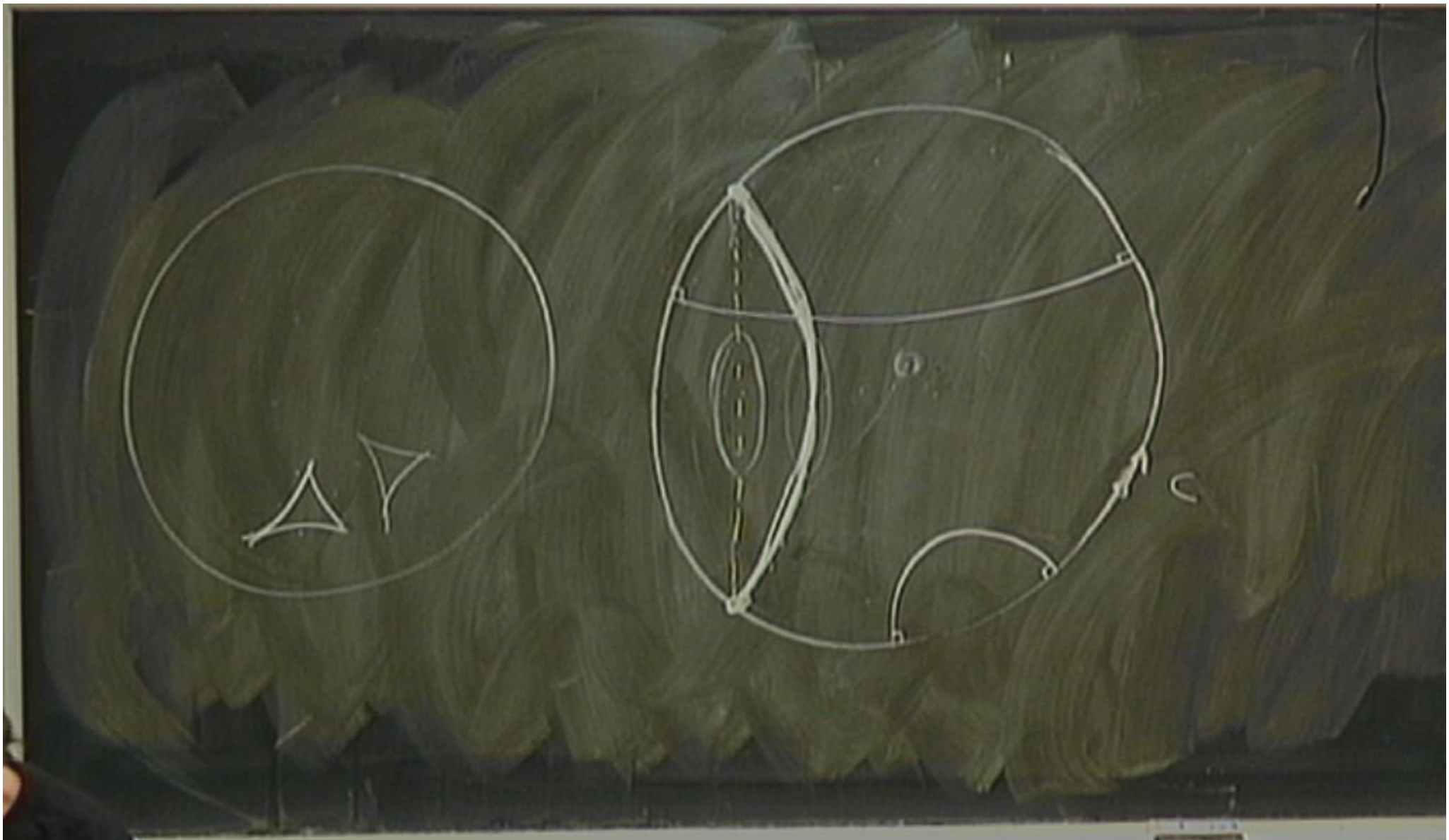

$\Delta\gamma$
c




$\Delta\Gamma$
σ
c