Title: Learning about topological quantum memory

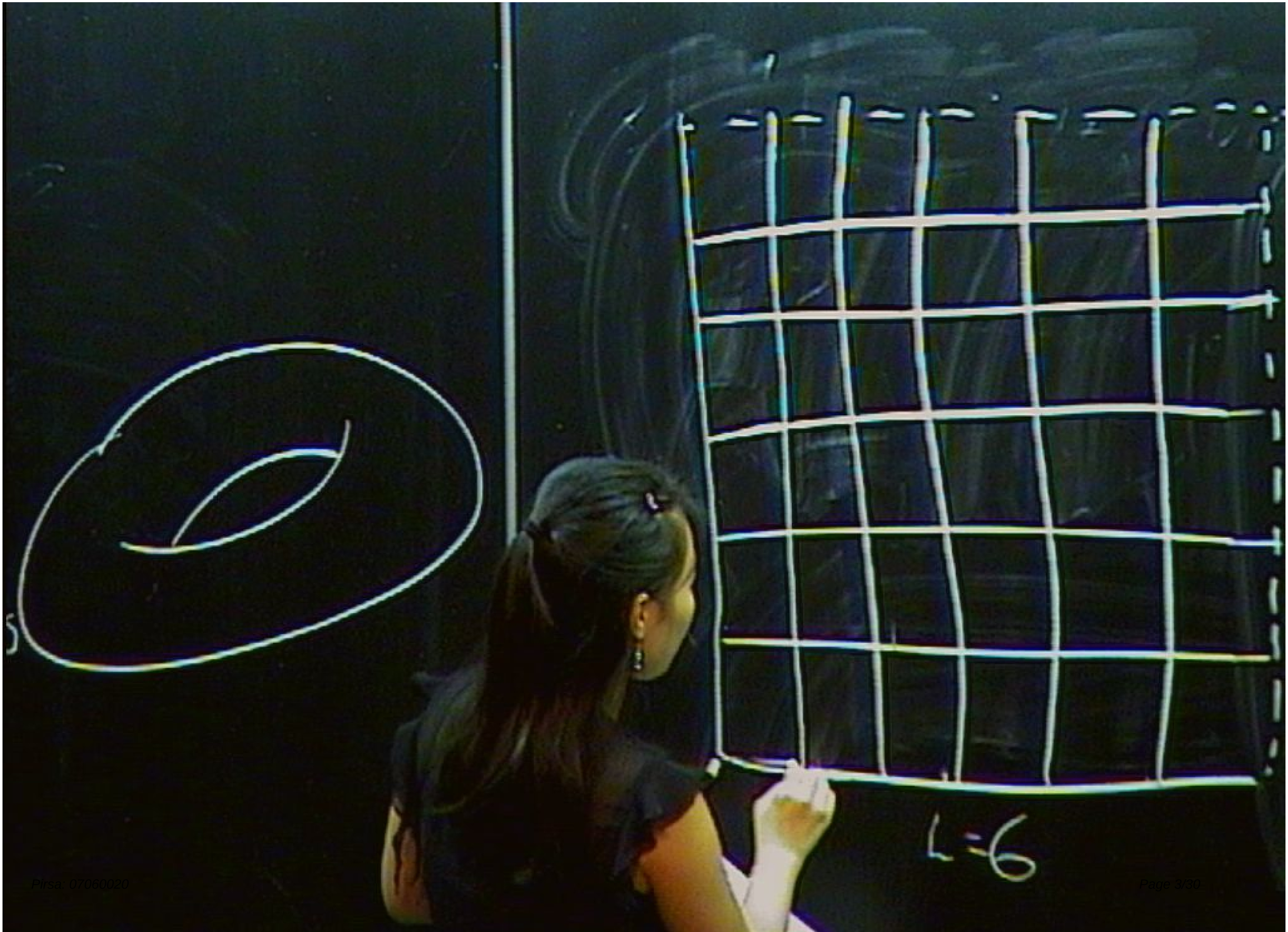
Date: Jun 04, 2007 10:00 AM

URL: http://pirsa.org/07060020

Abstract: I will introduce Kitaev's suface codes as a block quantum error-correcting code. Recovery procedures will be described in the case of imperfect syndrome measurements. More might be covered if time permits.

Lucy: Topological Q. Memory

- Motivation
- Toric Code Construction
- Errors & Perfect Syndromes
- Recovery w/ perfect meas. & single pair of de
- Complications
- Recovery w/ imperfect meas.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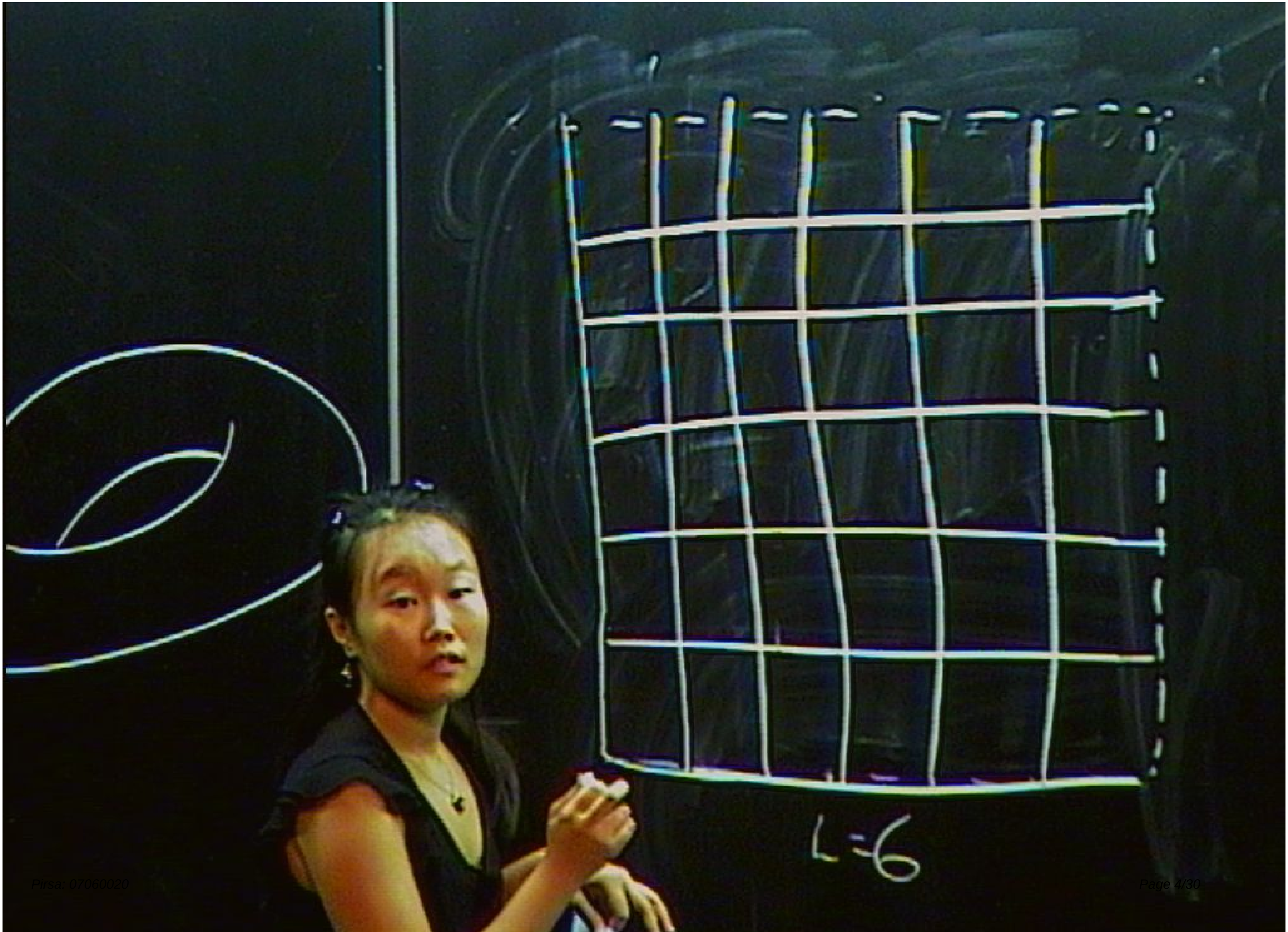
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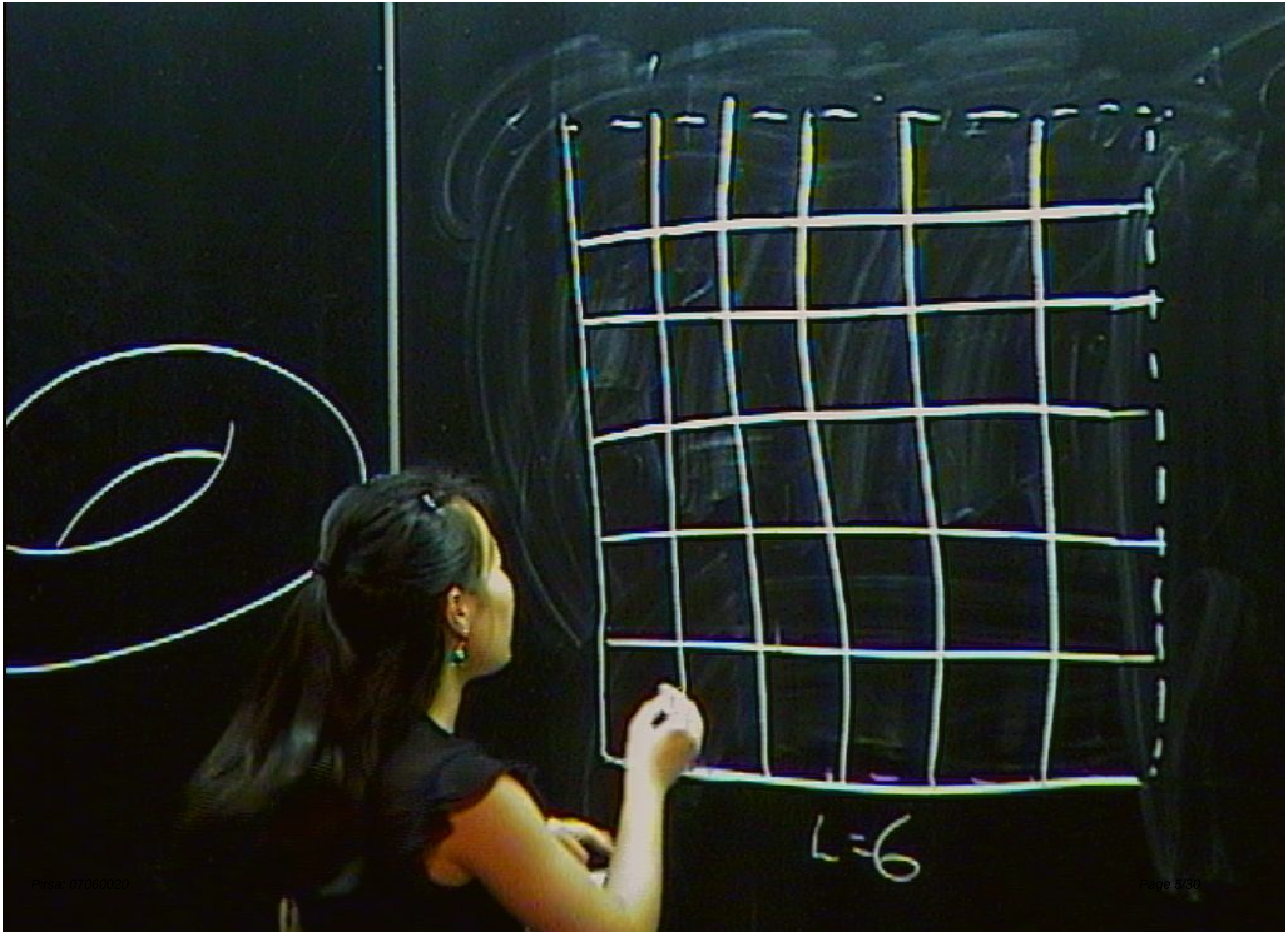
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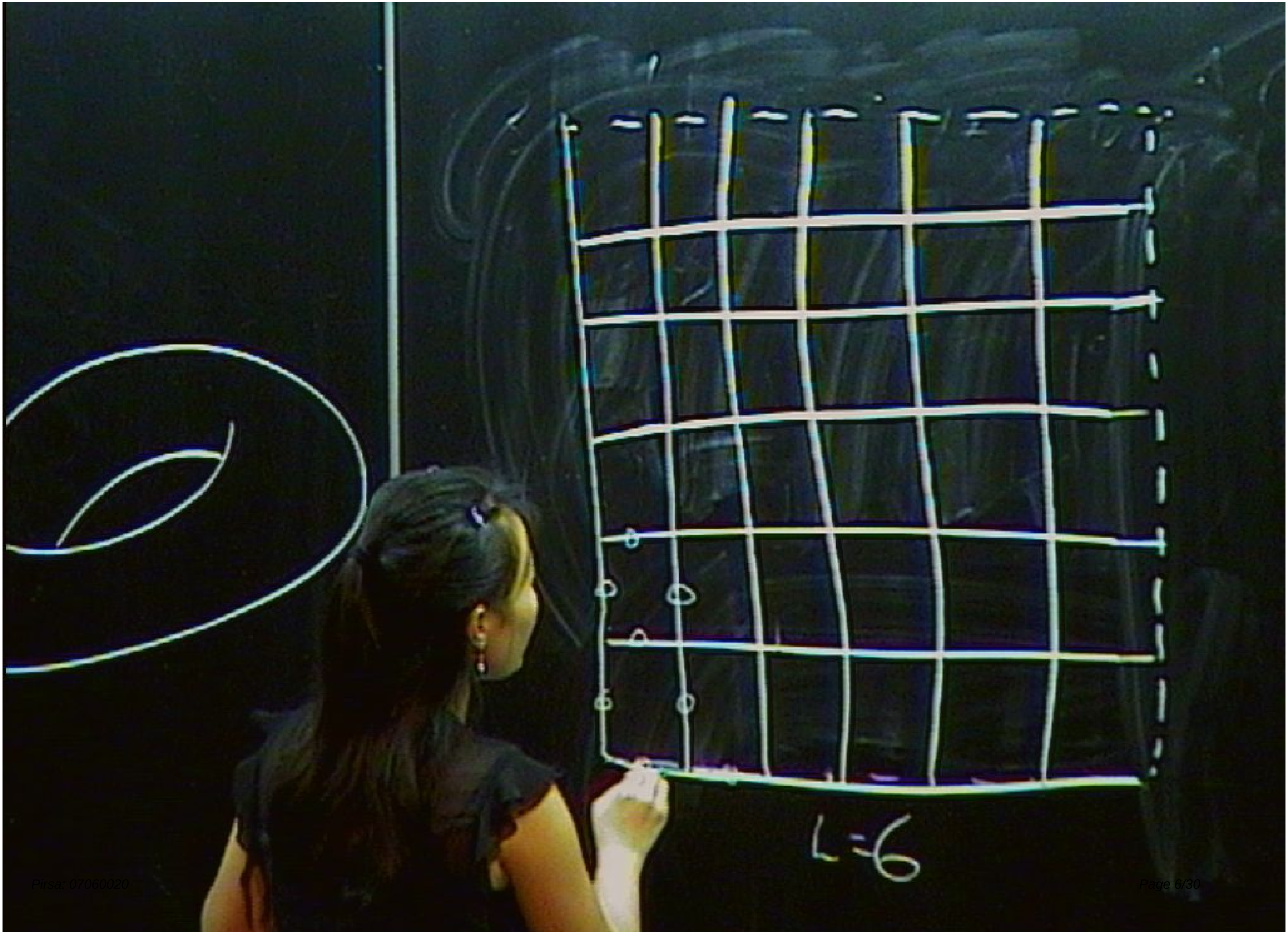
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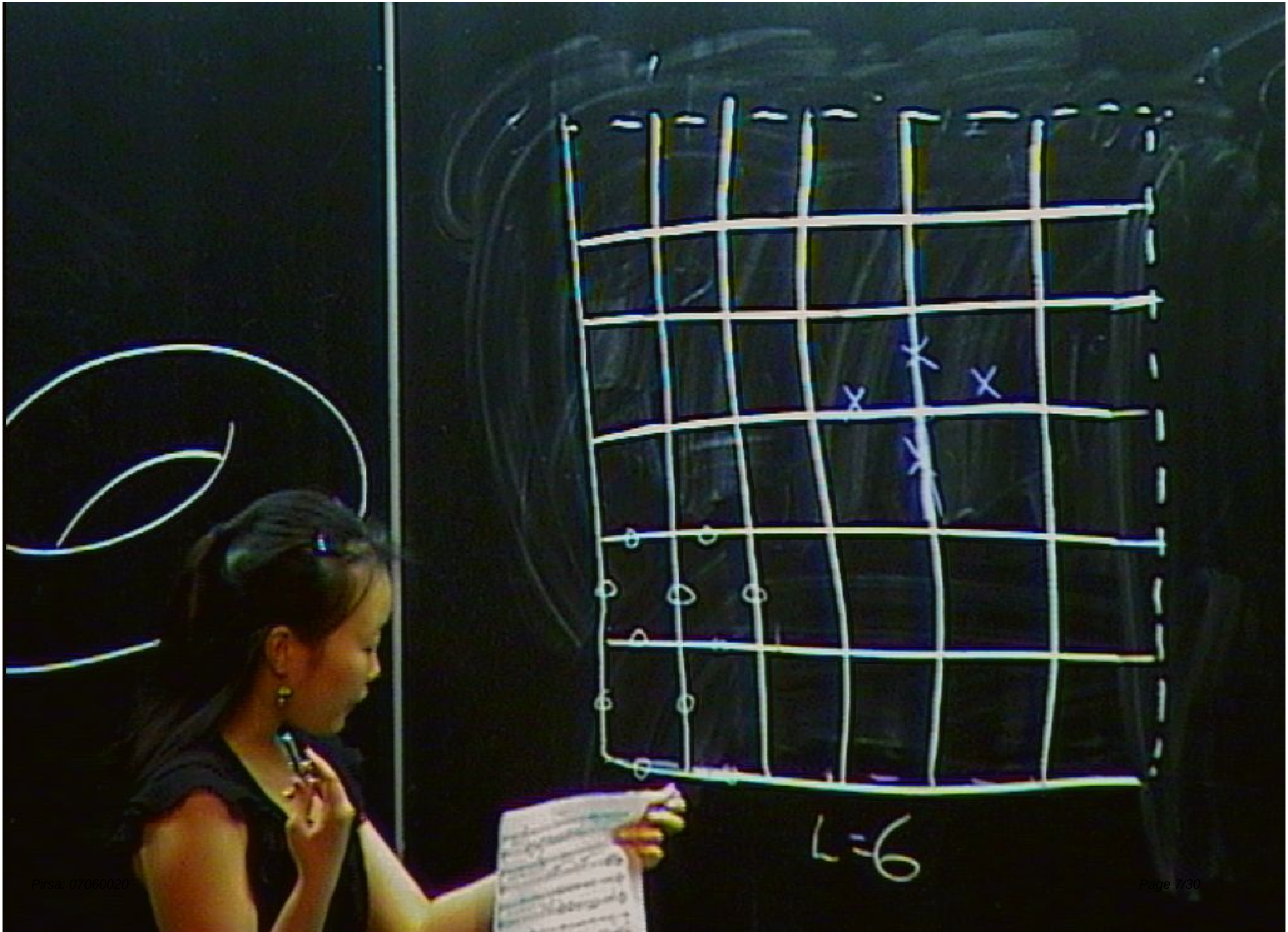
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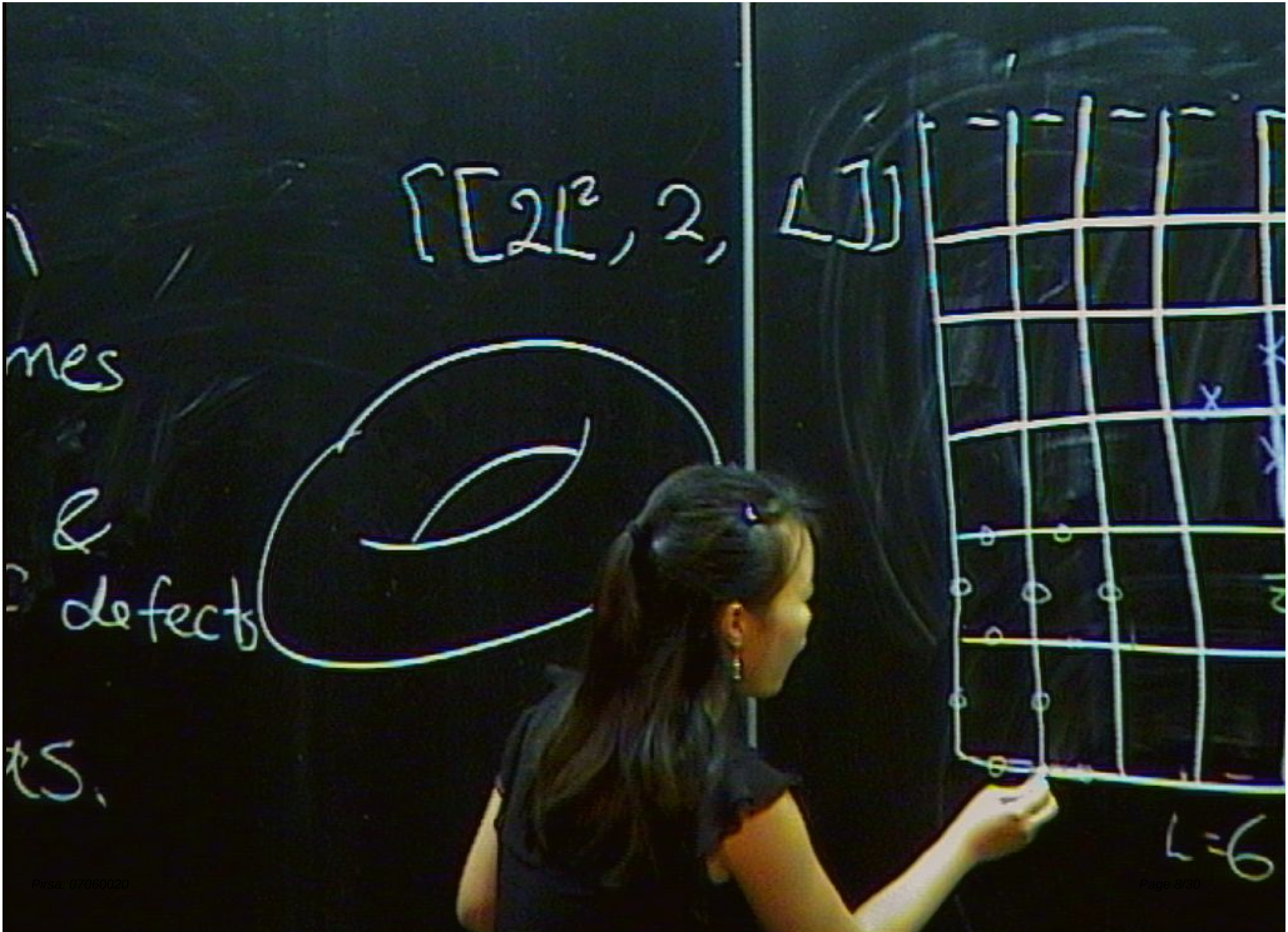
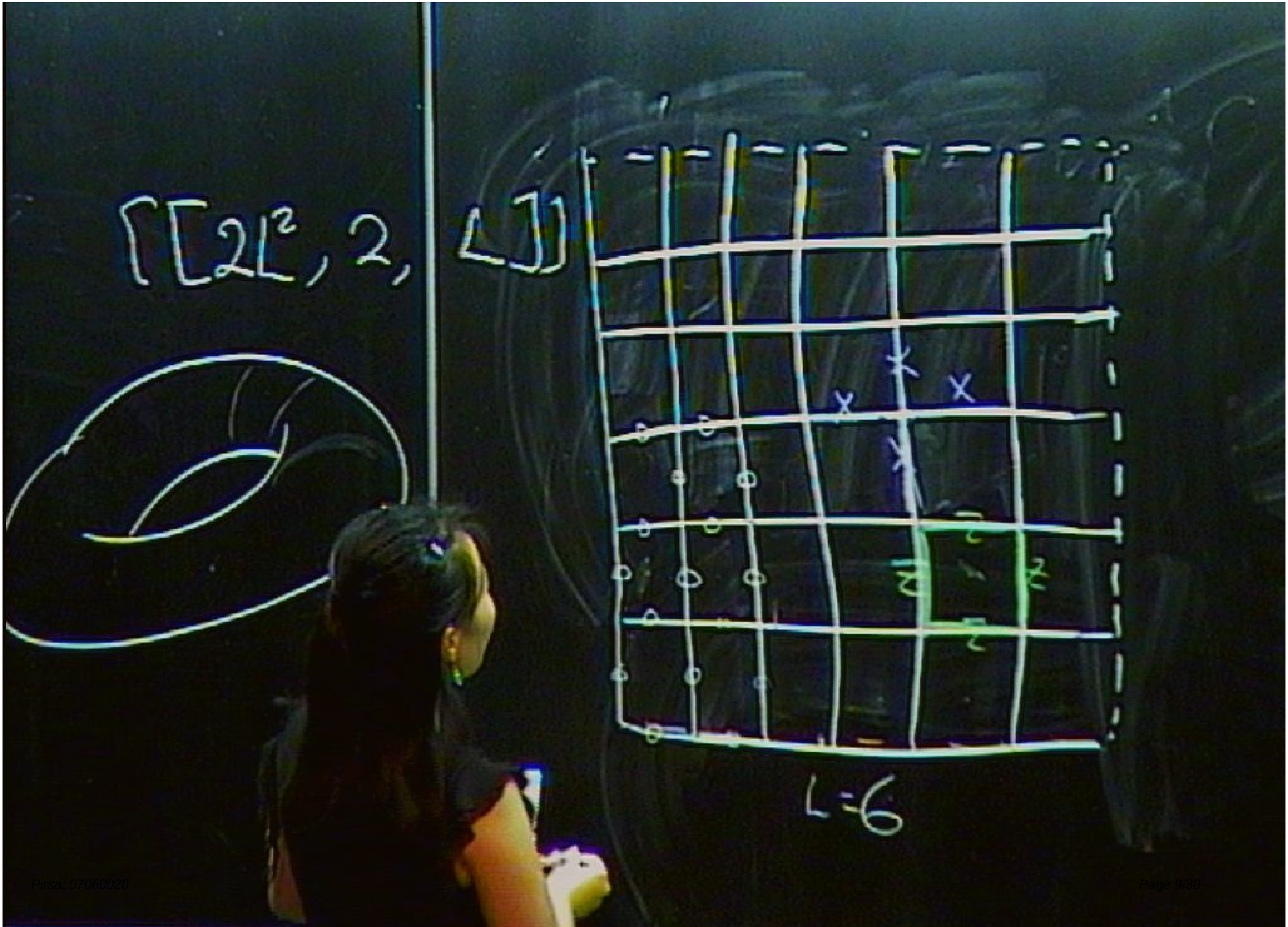
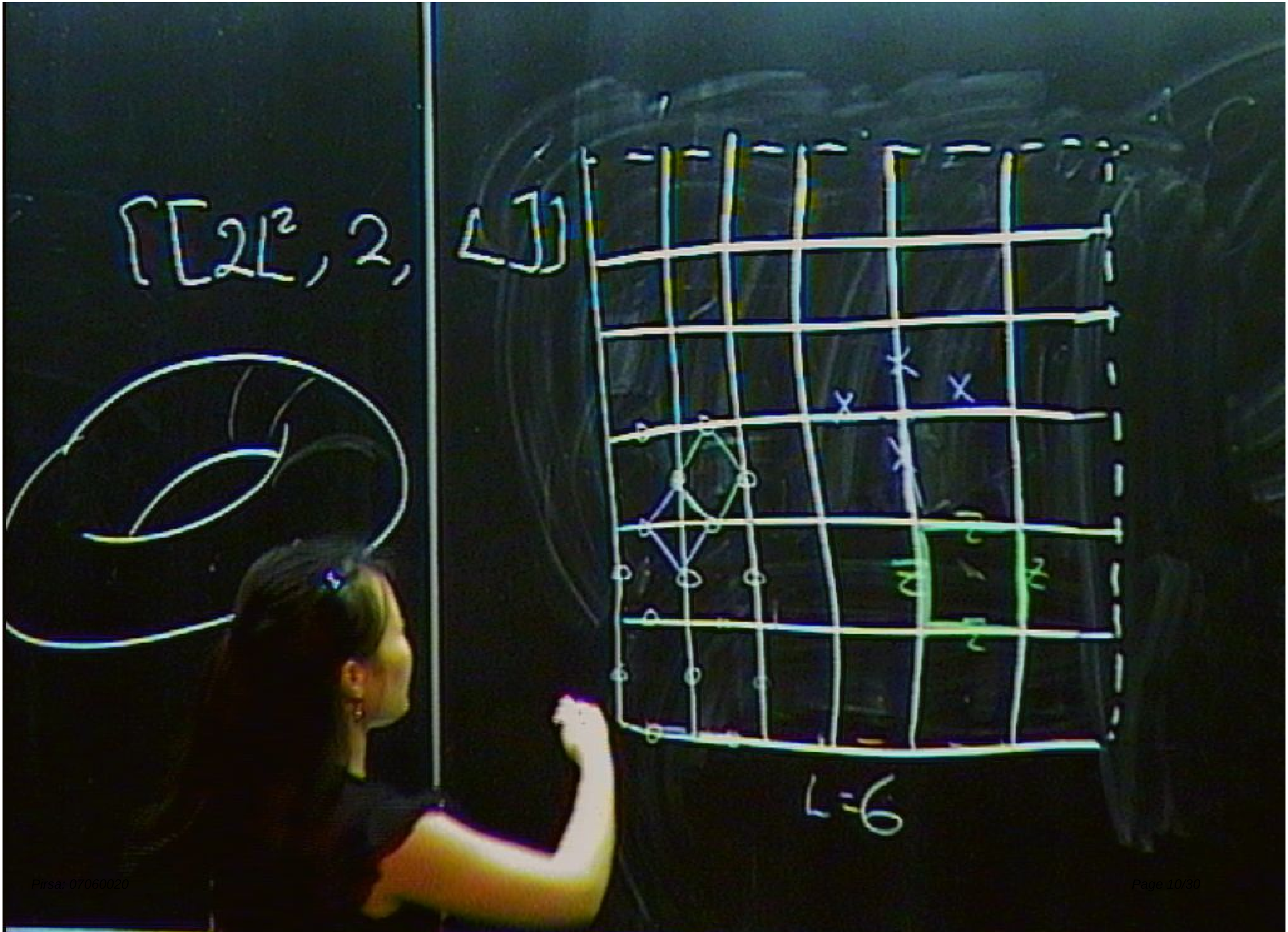
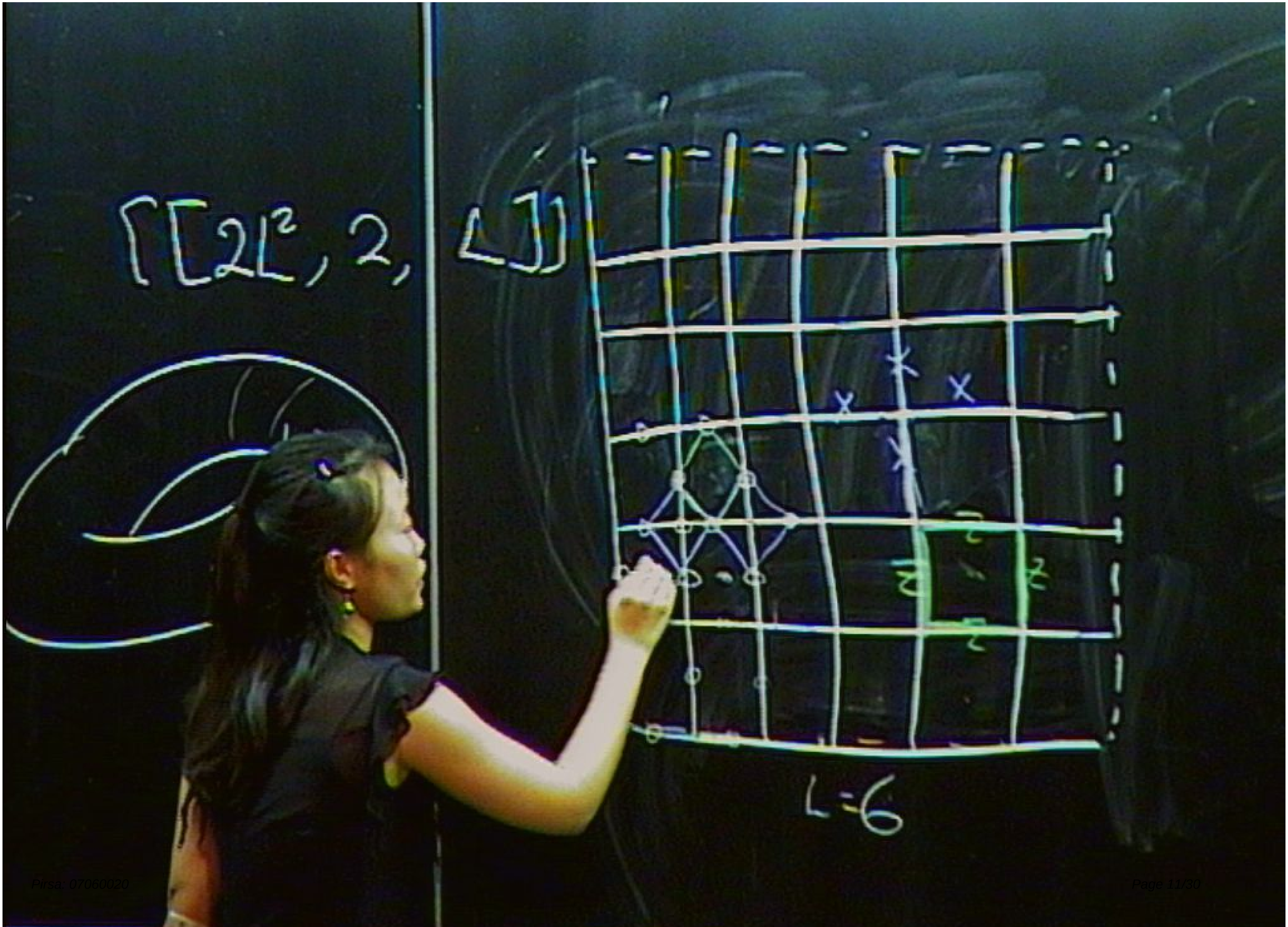
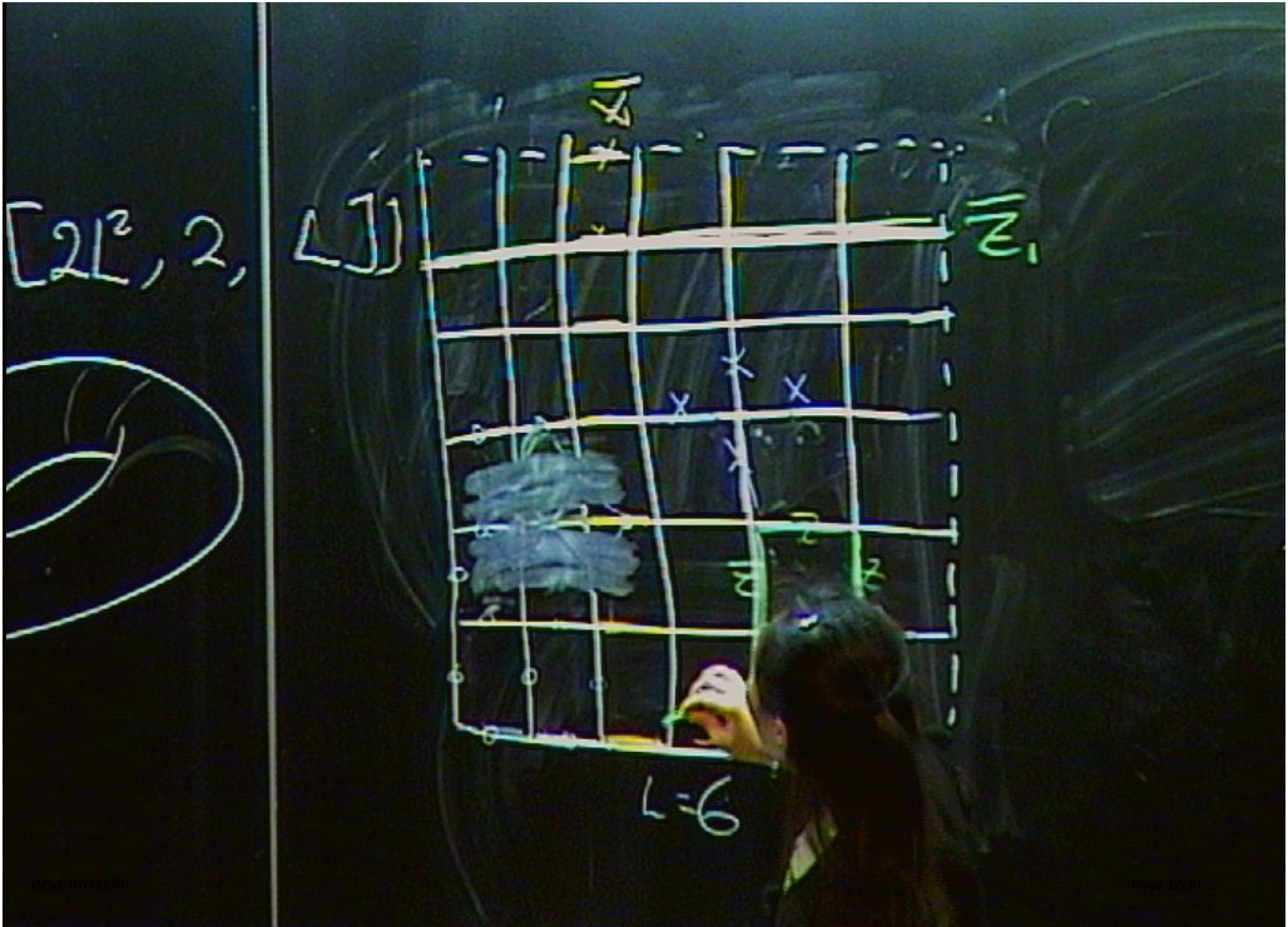
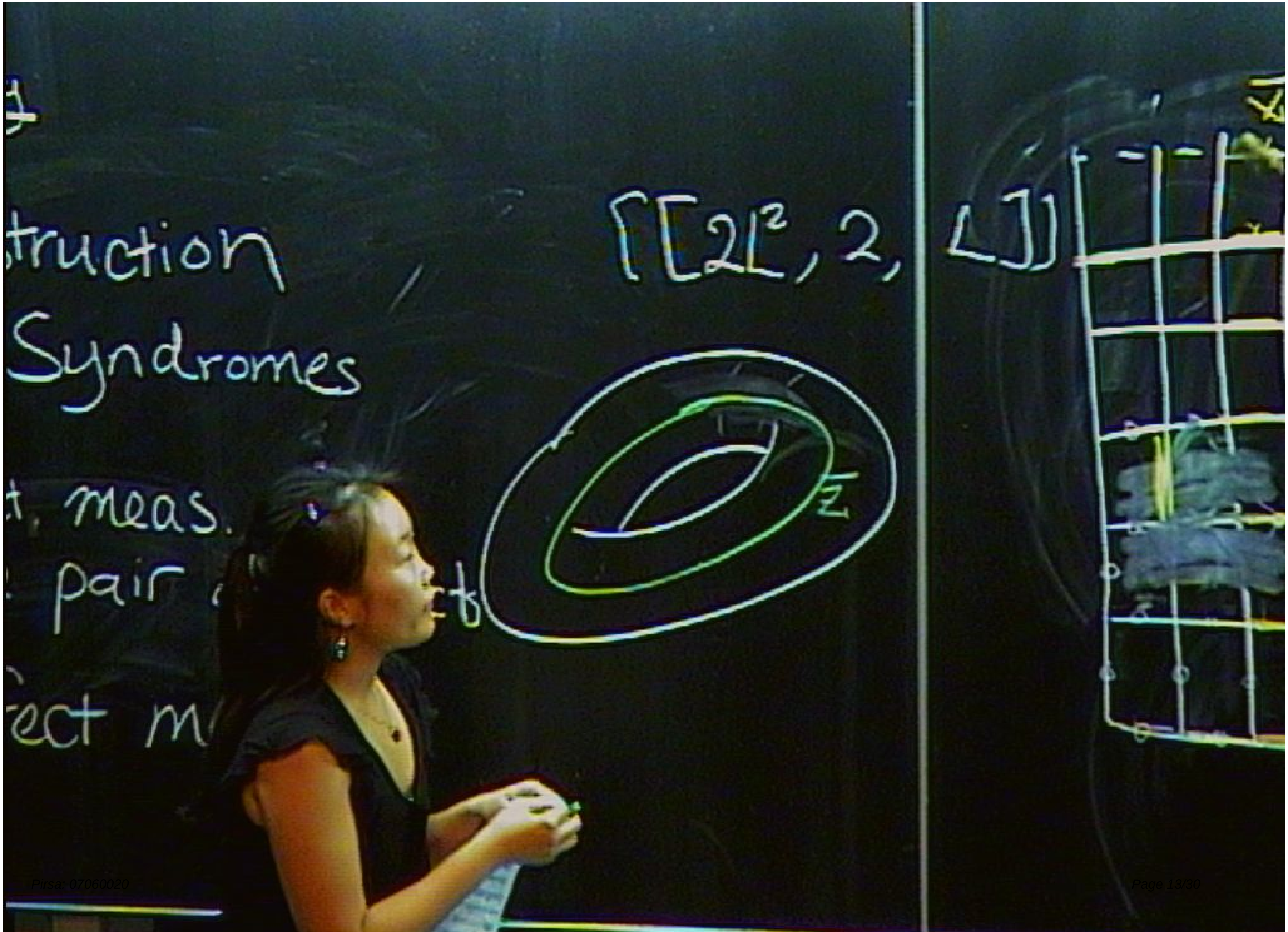

[[2L², 2, L]]
mes
defects
L=6

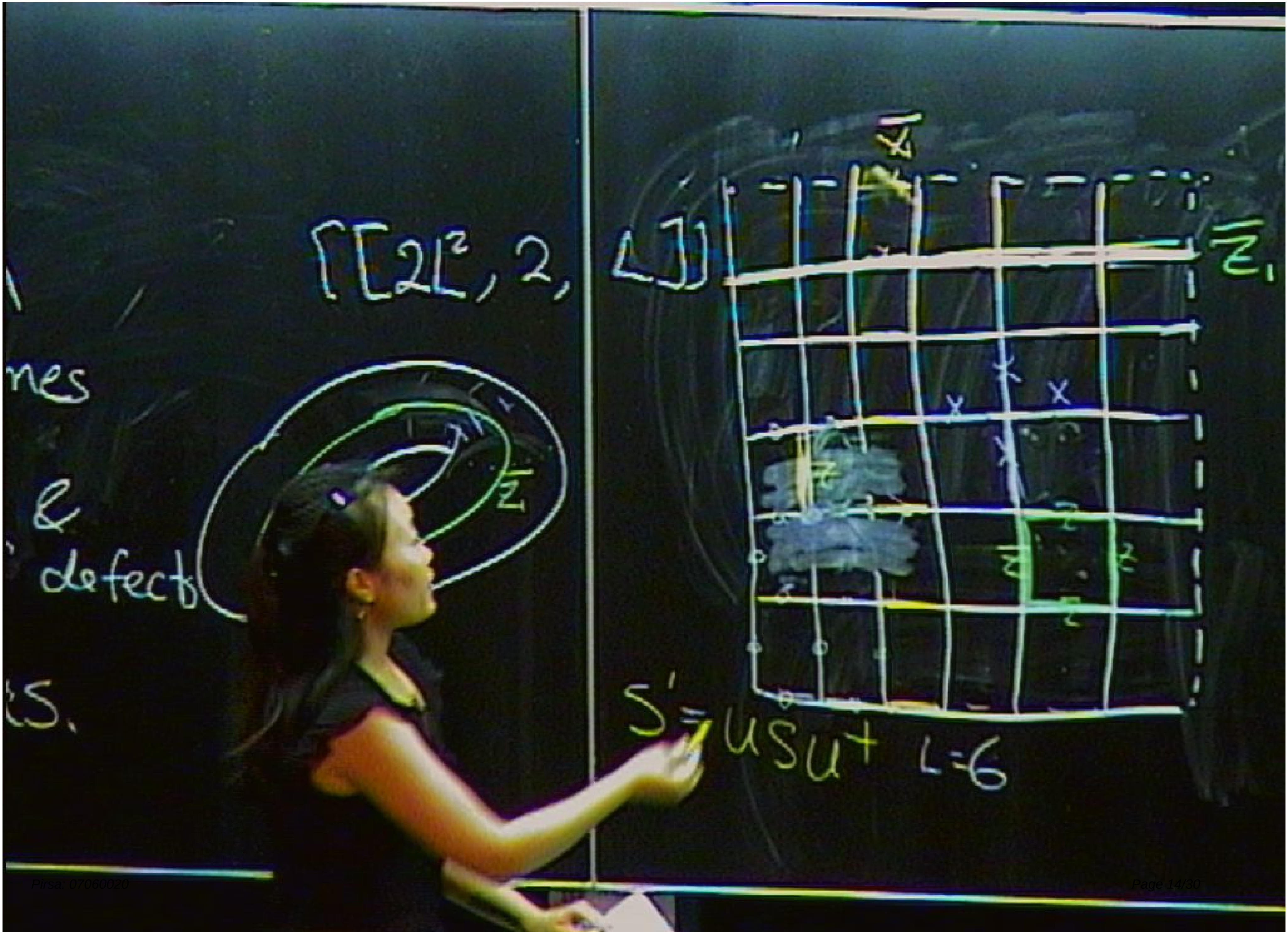

Γ[[2L², 2, L]]
L=6

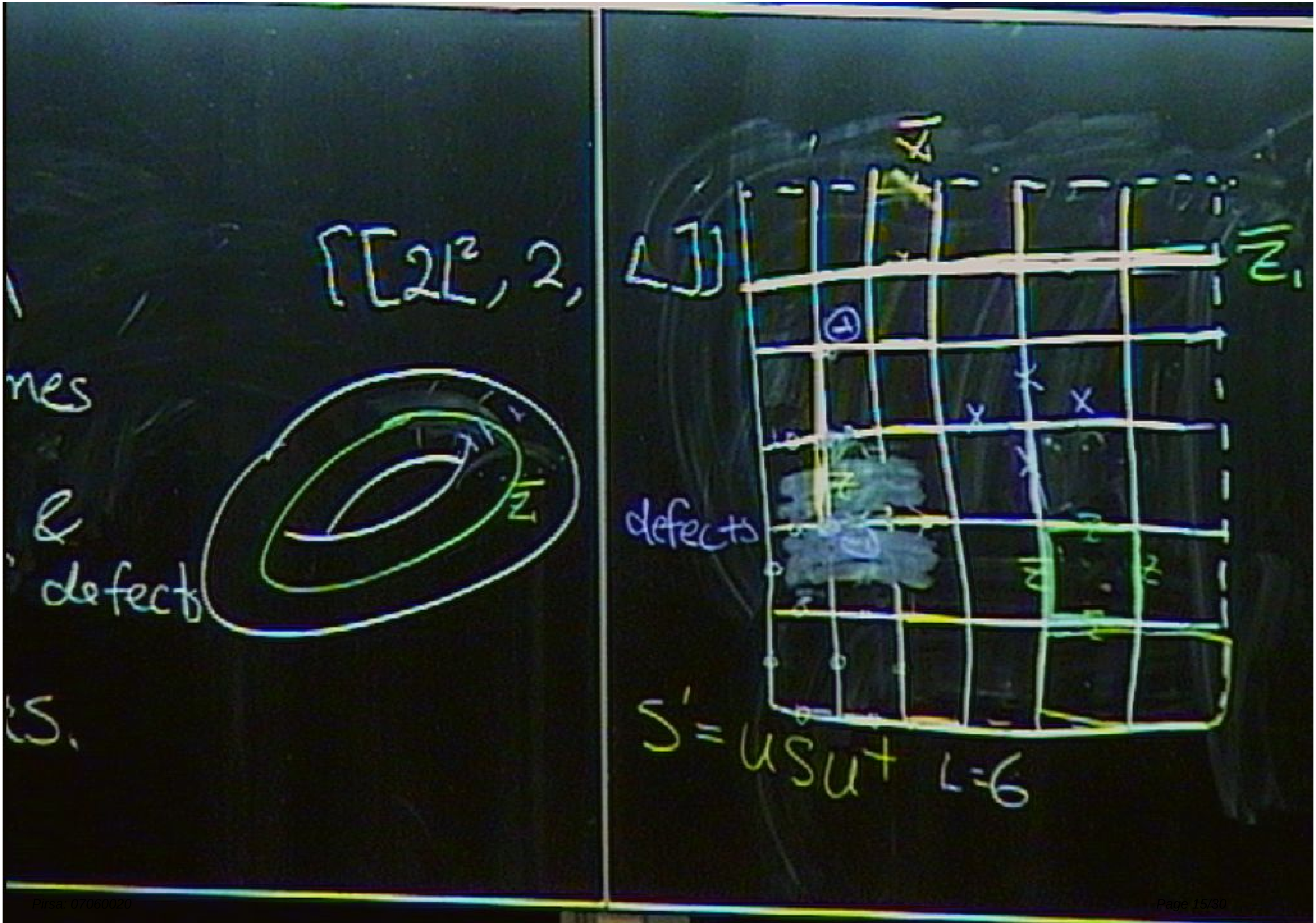

[[2L², 2, L]]
L=6

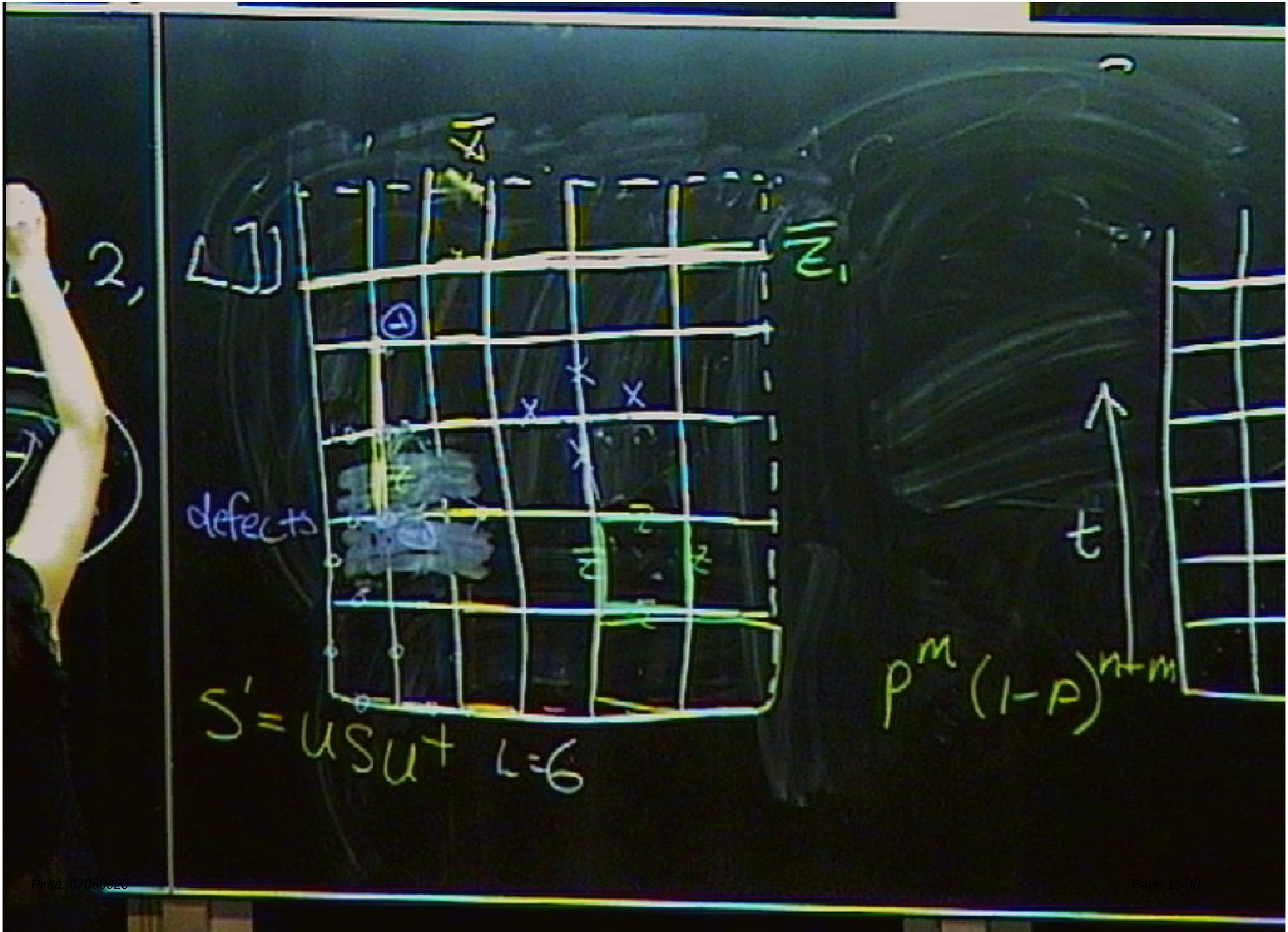

$\Gamma[[2L^2, 2, L]]$
$L=6$

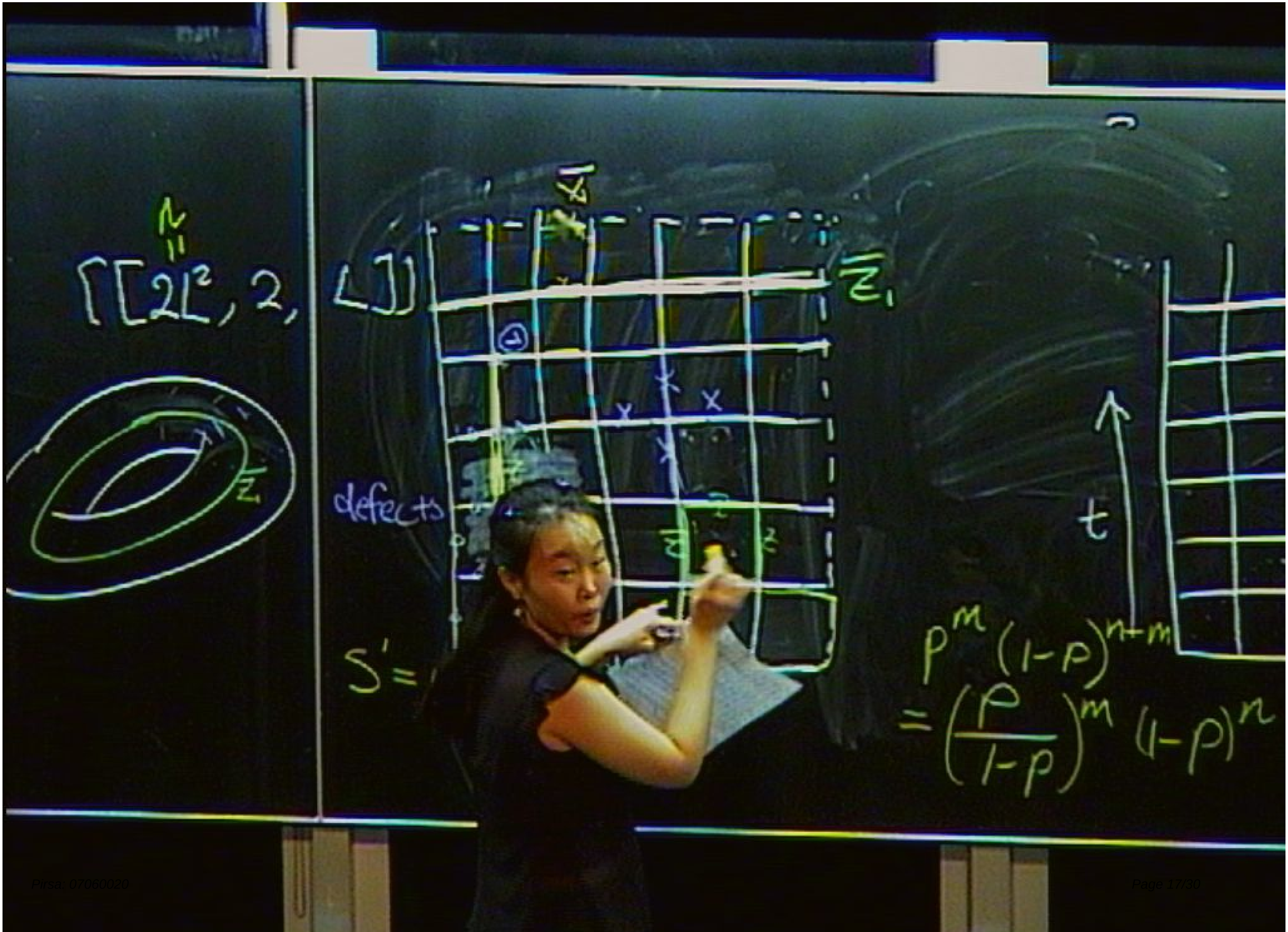

[2L², 2, L]]
L=6

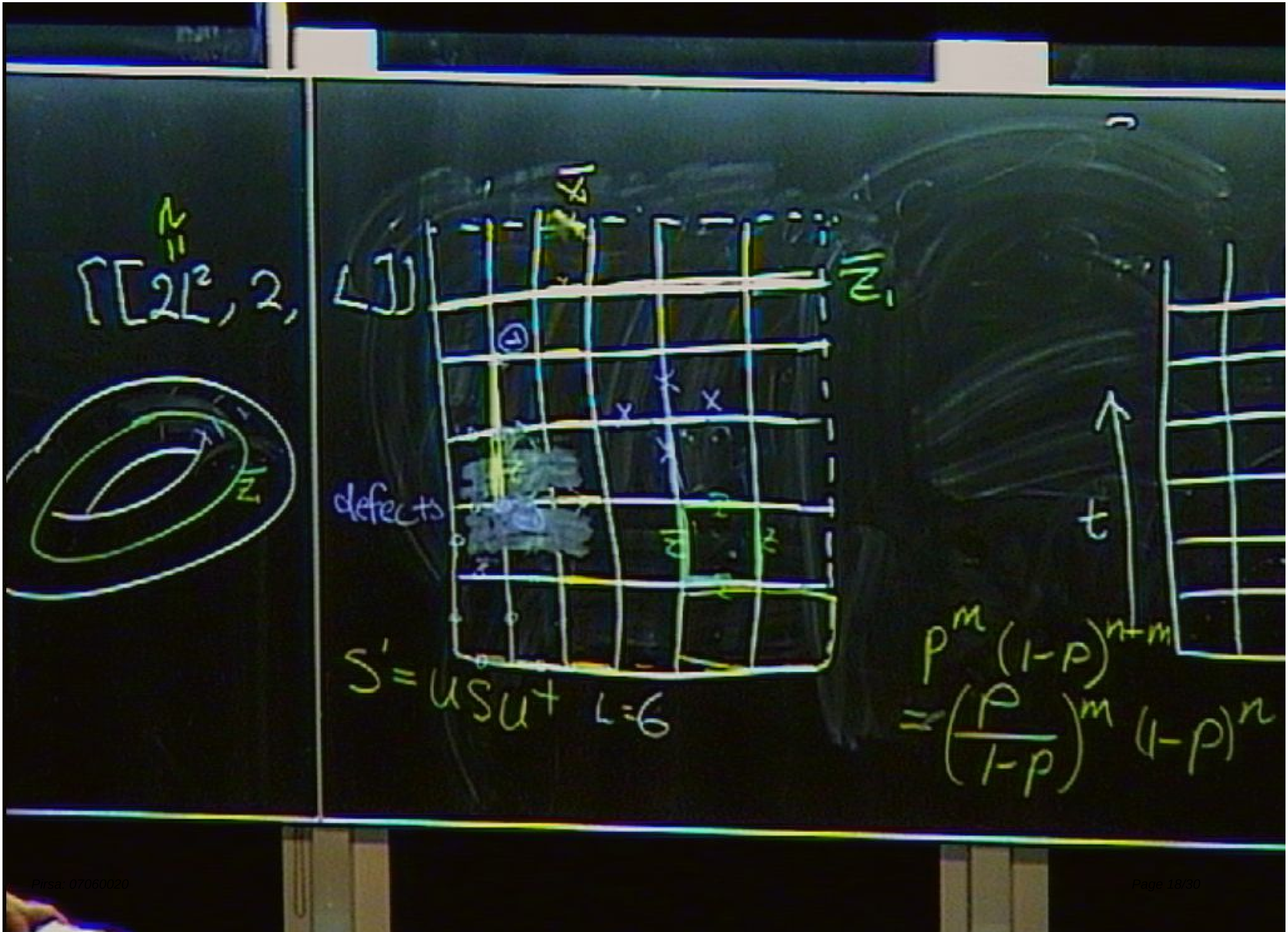

struction
Syndromes
meas.
pair
ect m
[[2L², 2, L]]
Z

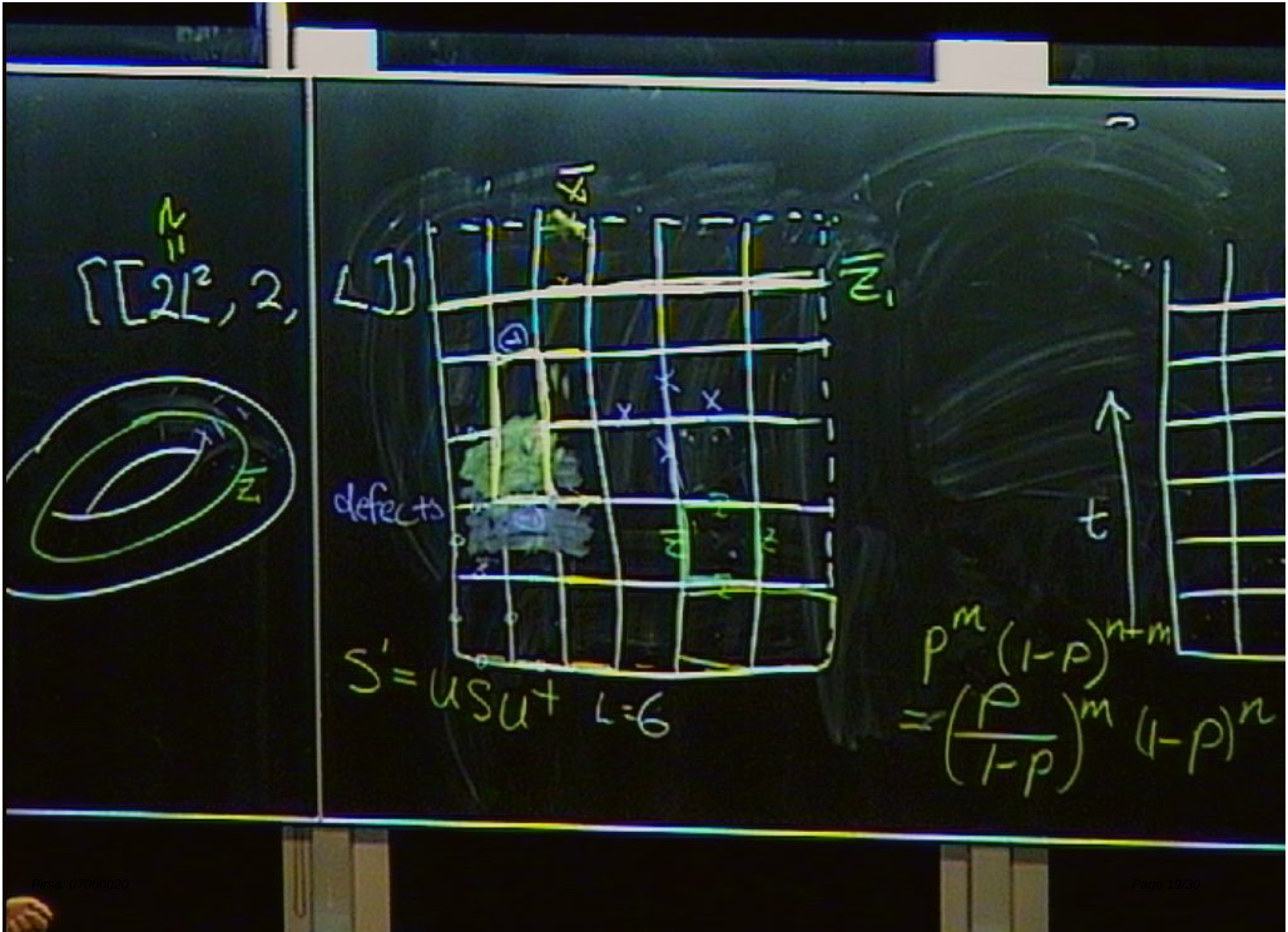

Γ[2L², 2, L]]
nes
defect
s' = usu† L=6

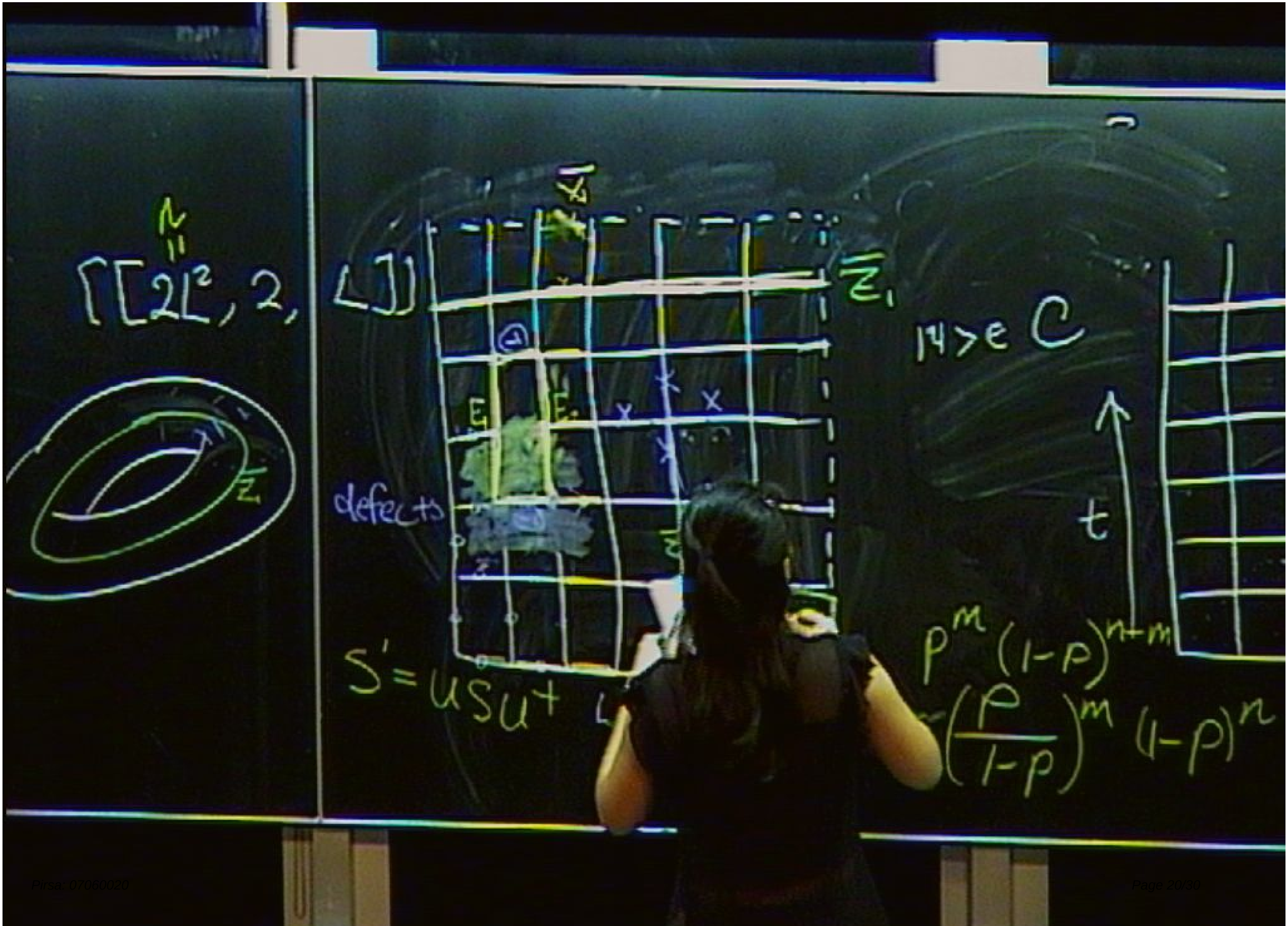

Γ[2L², 2, L]]
nes
&
defect
defects
S' = USU† L=6


defects
S'=USU+ L=6
t
p^m (1-p)^n-m

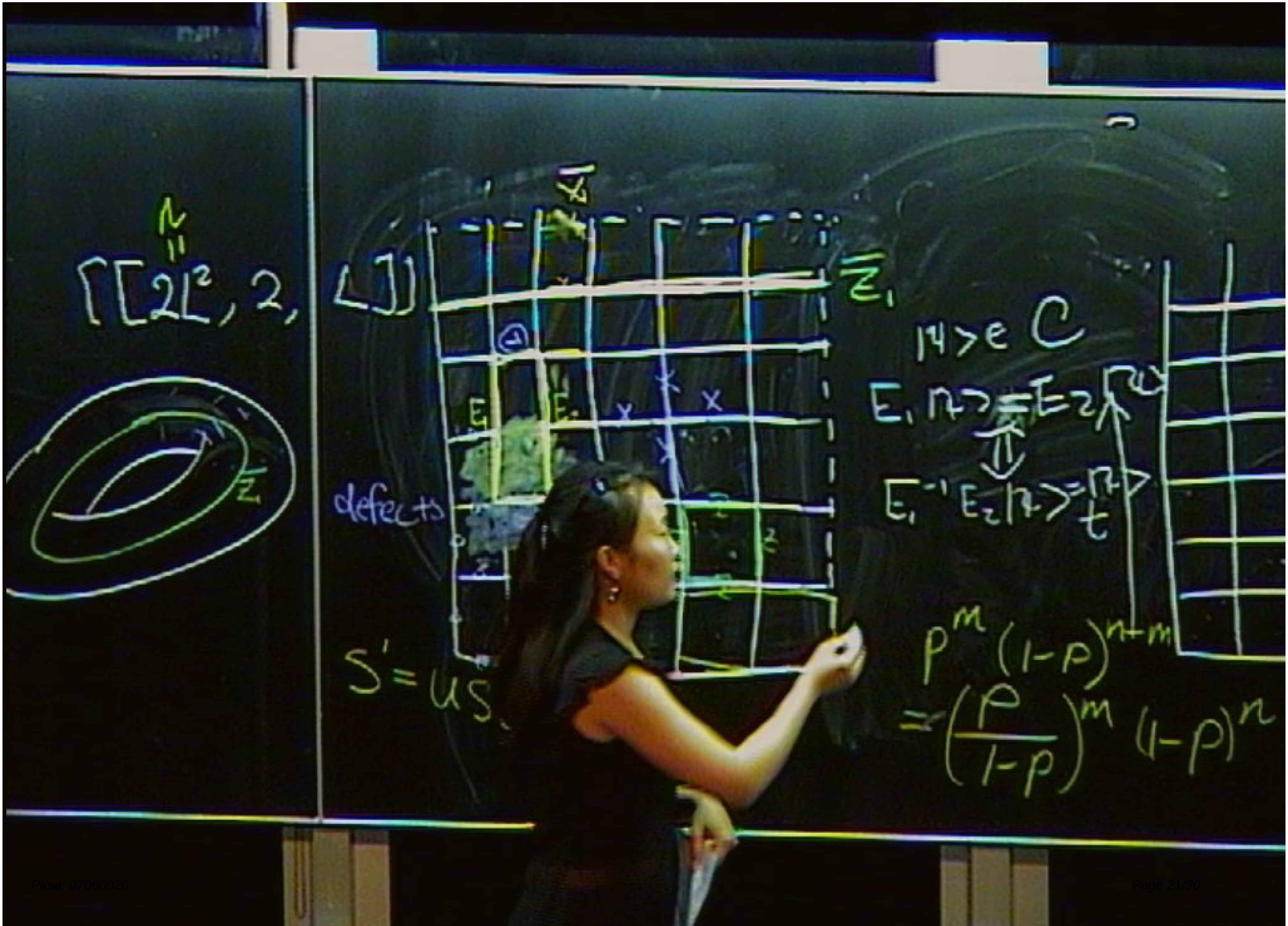

[[2L², 2, L]]
defects
S' =
t
p^m (1-p)^{n-m}
= (p/(1-p))^m (1-p)^n

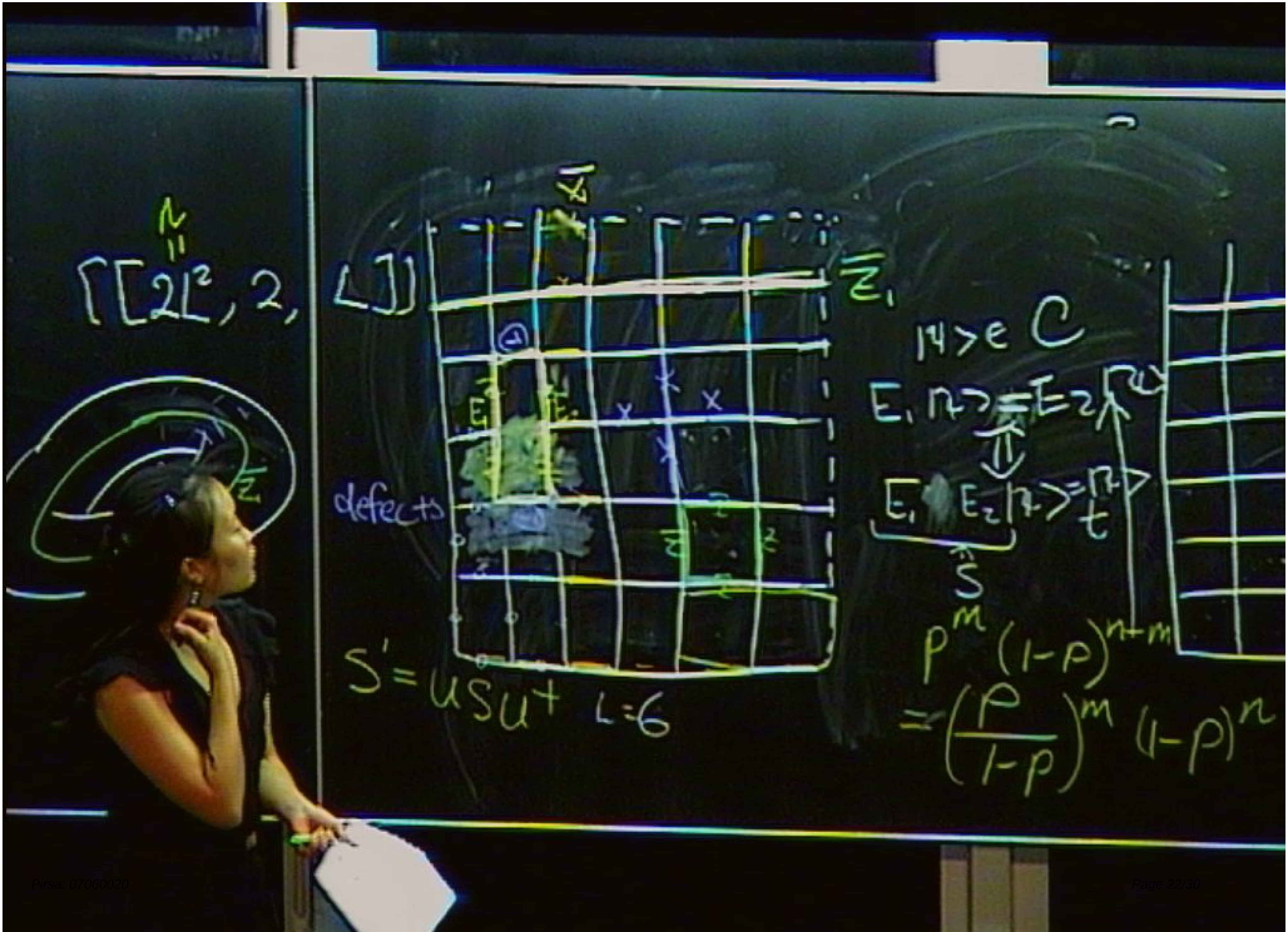

[[2L², 2, L]]
defects
S' = USU† L=6
p^m (1-p)^(n-m)
= (p/(1-p))^m (1-p)^n
t

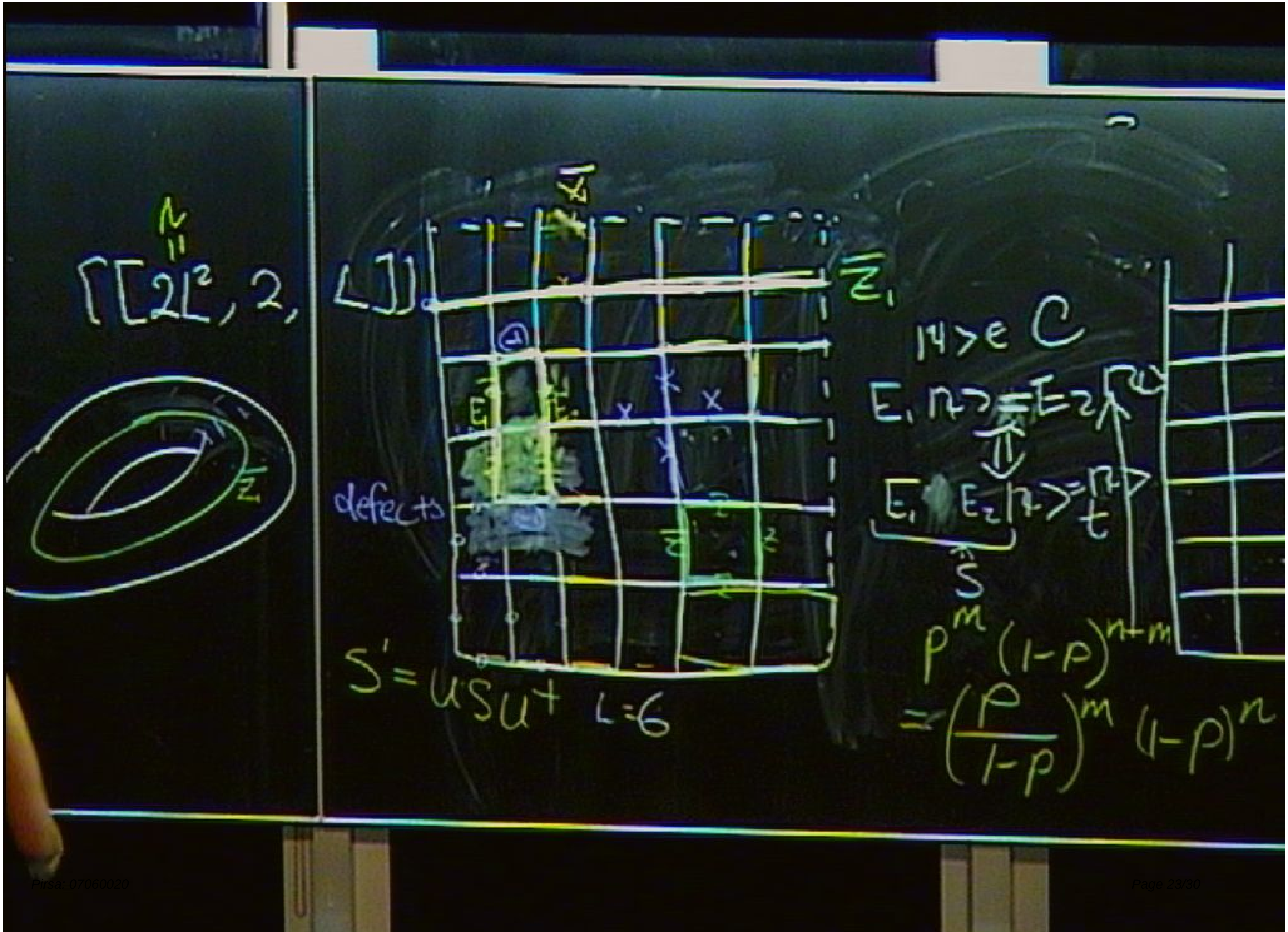

Γ[[2L², 2, L]]
defects
S' = USU† L=6
t
p^m (1-p)^(n-m)
= (p/(1-p))^m (1-p)^n

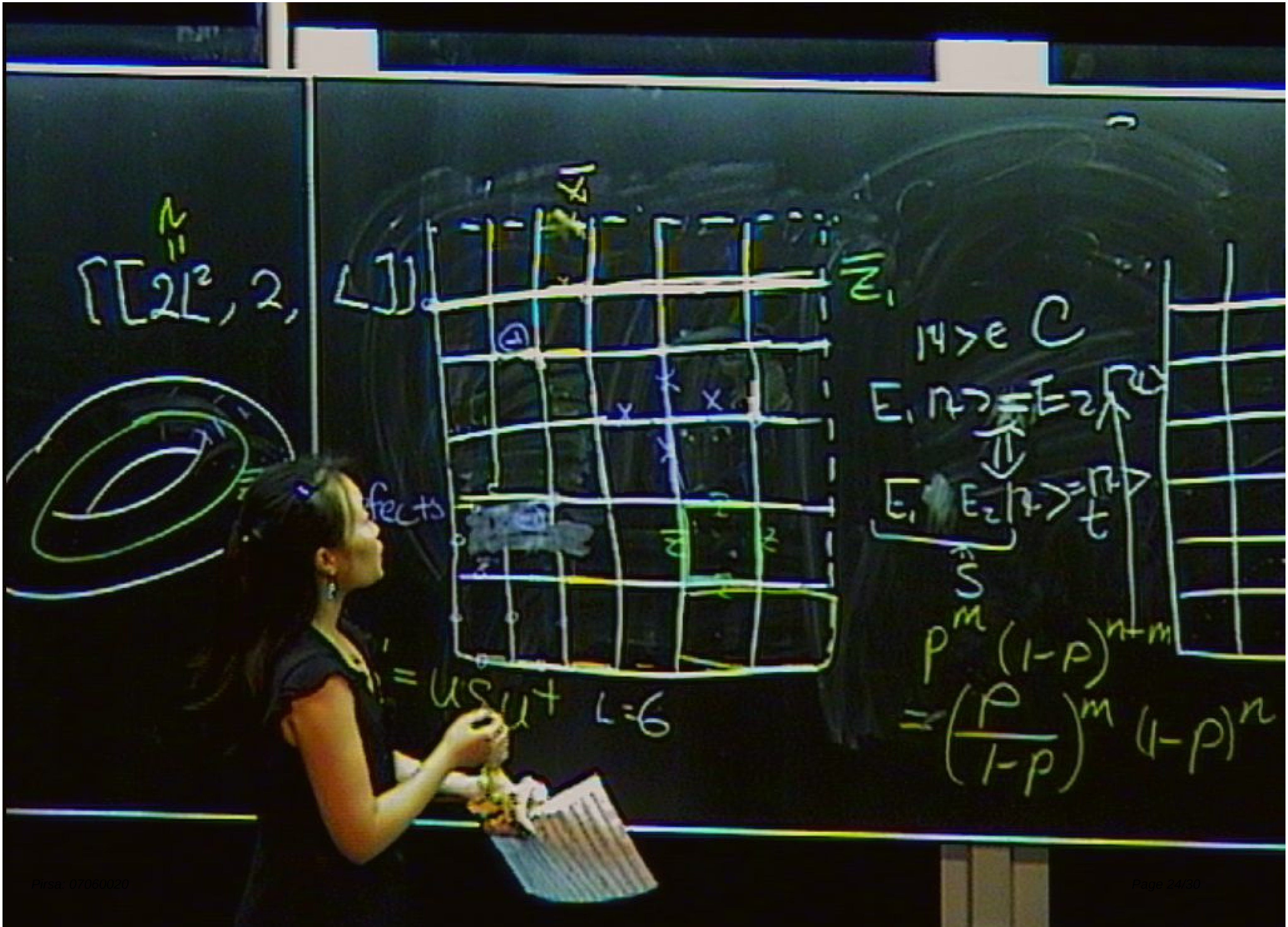


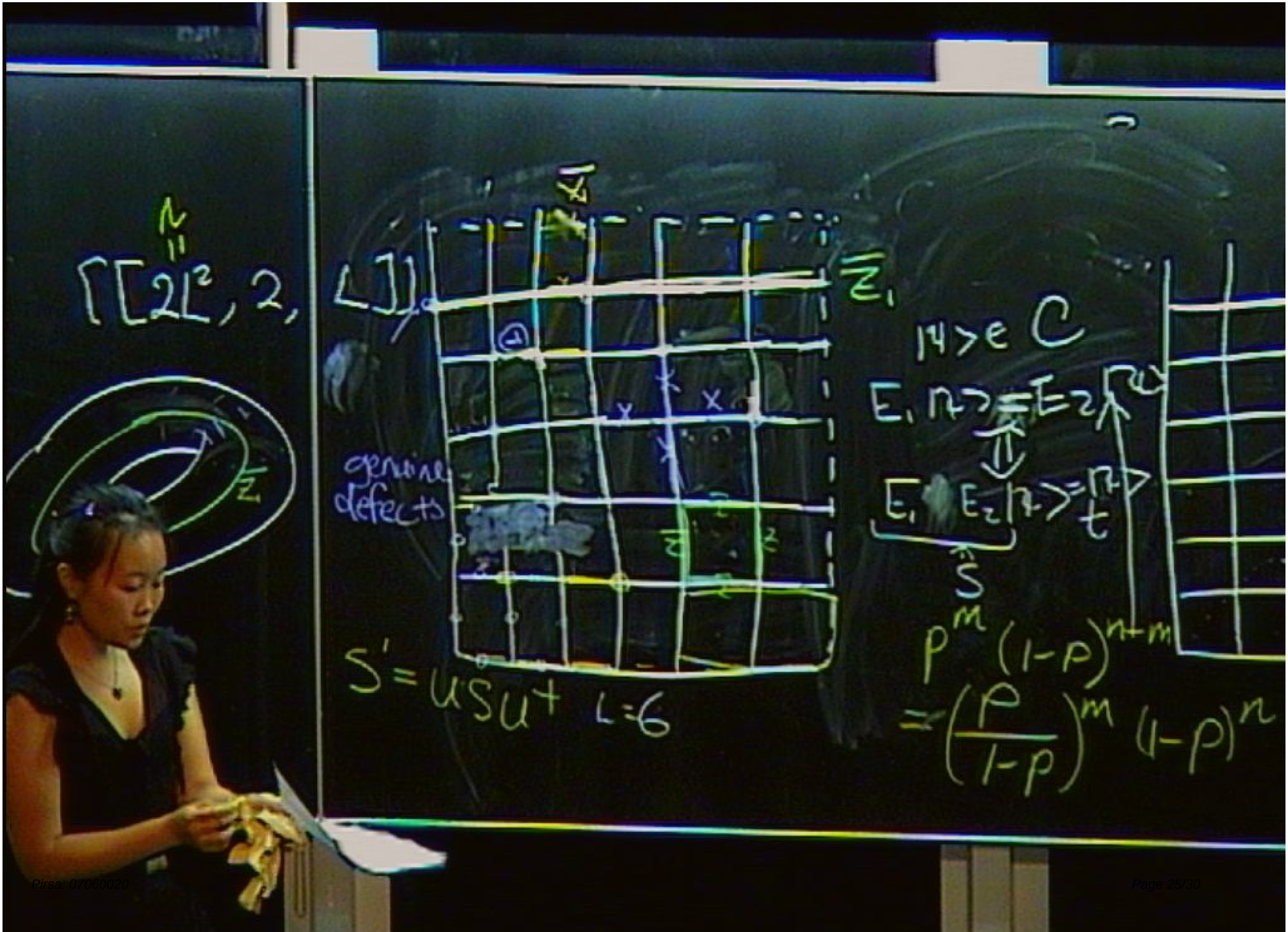
Γ[[2L², 2, L]]
defects
|ψ> ∈ C
t
S' = usu†
p^m (1-p)^{n-m}
(p/(1-p))^m (1-p)^n

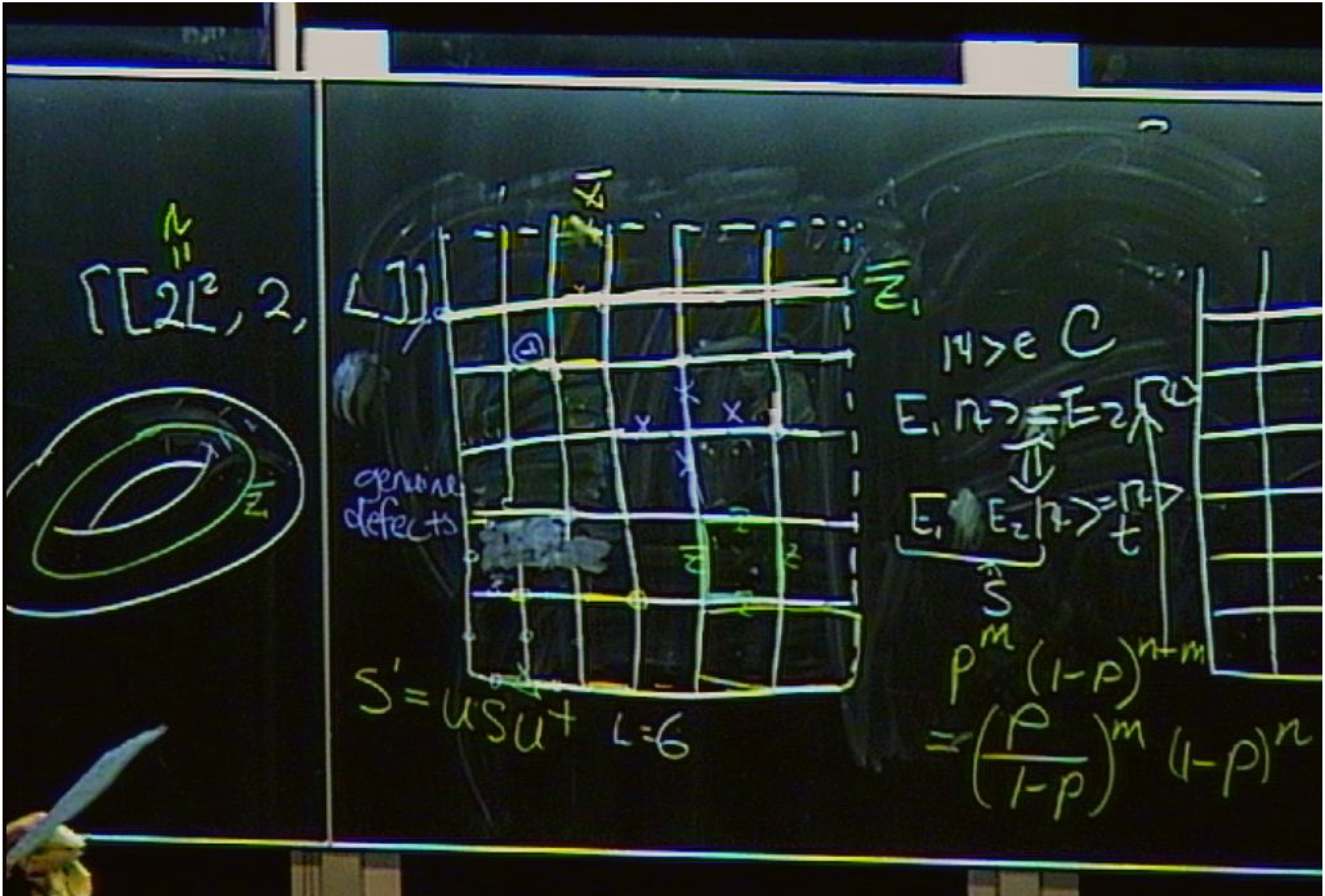

Γ[[2L², 2, L]]
Z̄₁
|ψ> ∈ C
E₁|n> = E₂|n>
E₁⁻¹E₂|n> = |n>
defects
S' = US
p^m (1-p)^(n-m)
= (p/(1-p))^m (1-p)^n

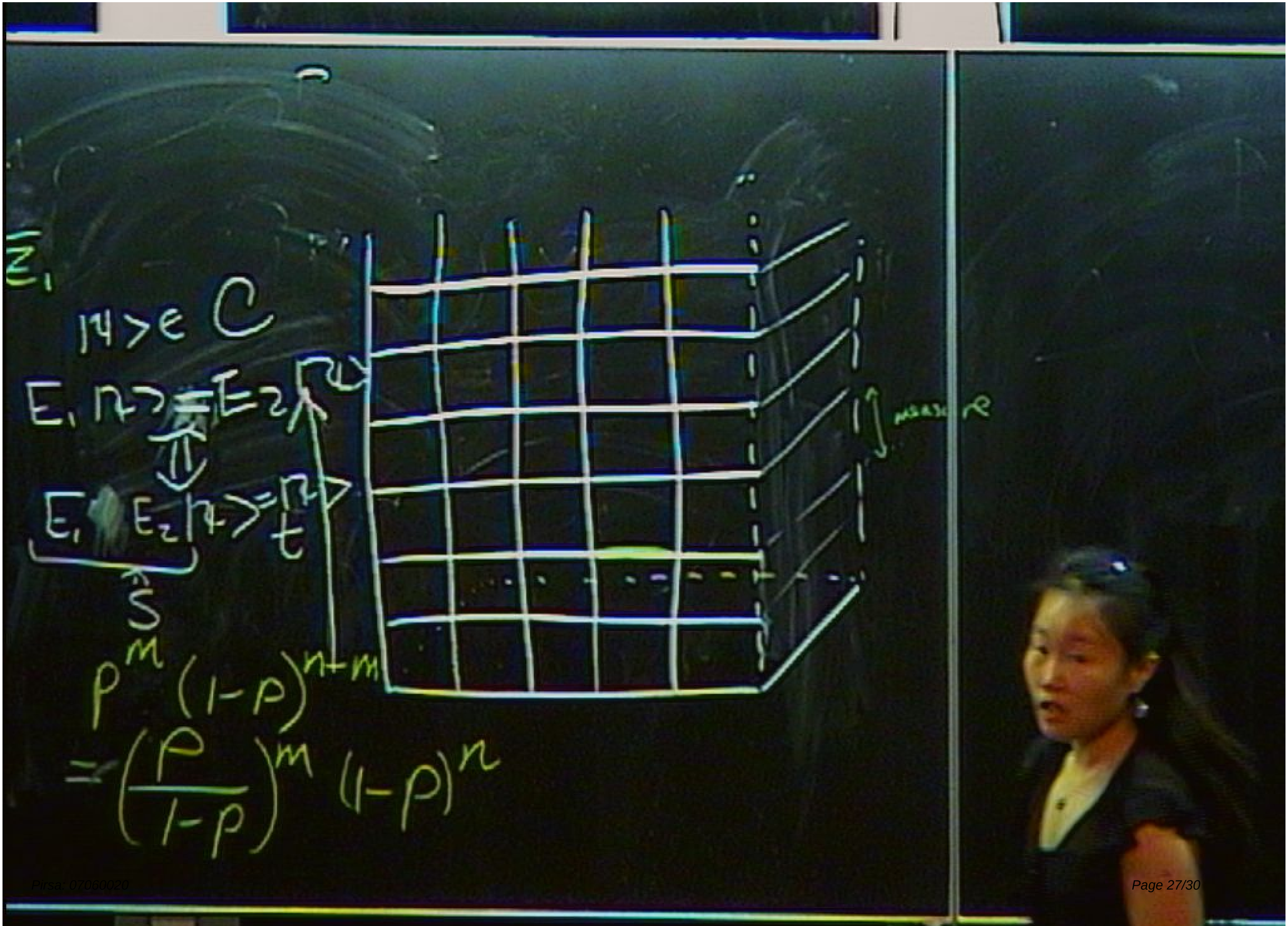

Γ[[2L², 2, L]]
defects
S' = USU† L=6
|ψ> ∈ C
S
p^m (1-p)^{n-m}
= (p/(1-p))^m (1-p)^n

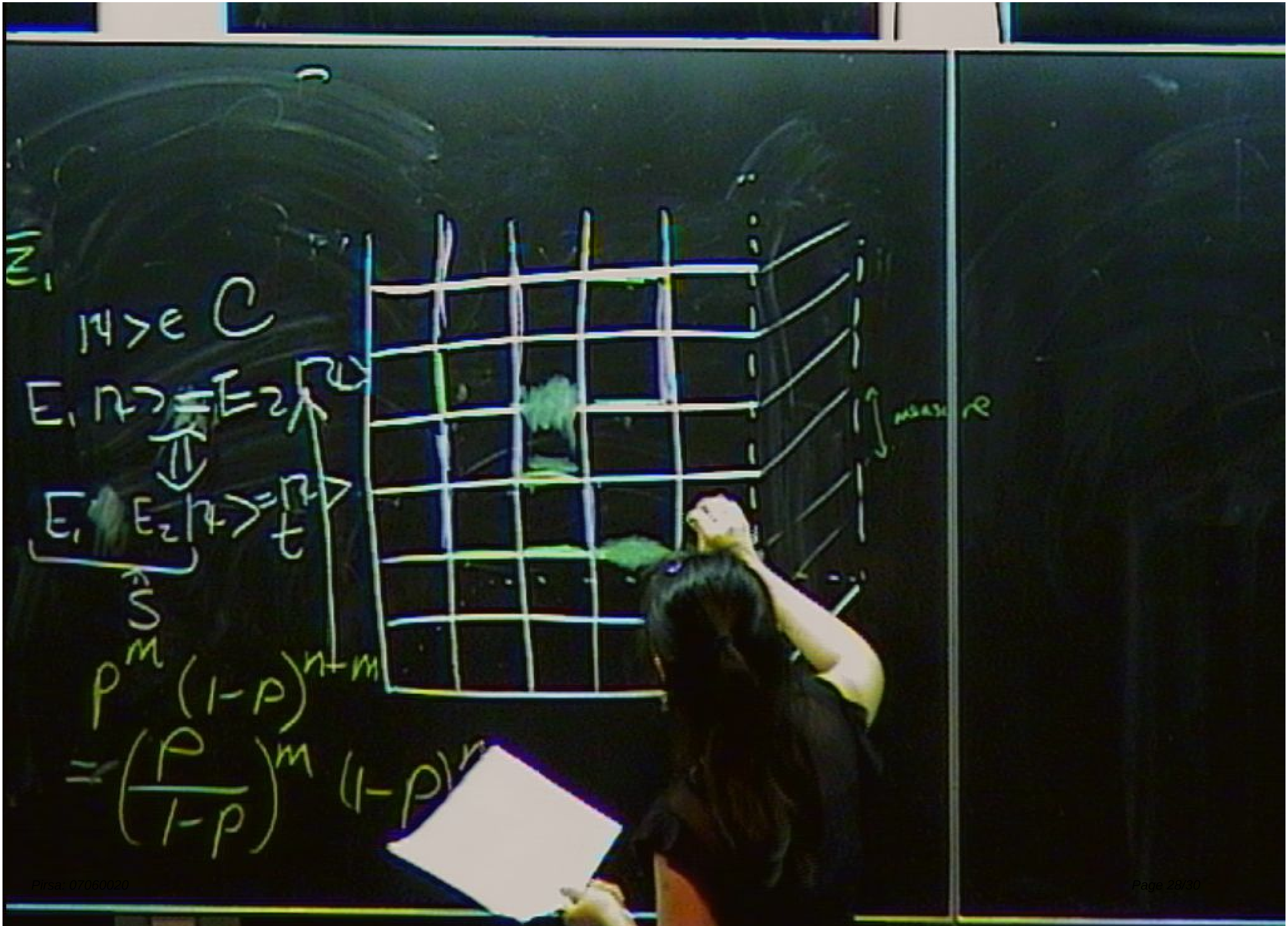

[[2L², 2, L]]
defects
S' = uSu+ L=6
|ψ> ∈ C
p^m (1-p)^(n-m)
= (p/(1-p))^m (1-p)^n


fects
L=6

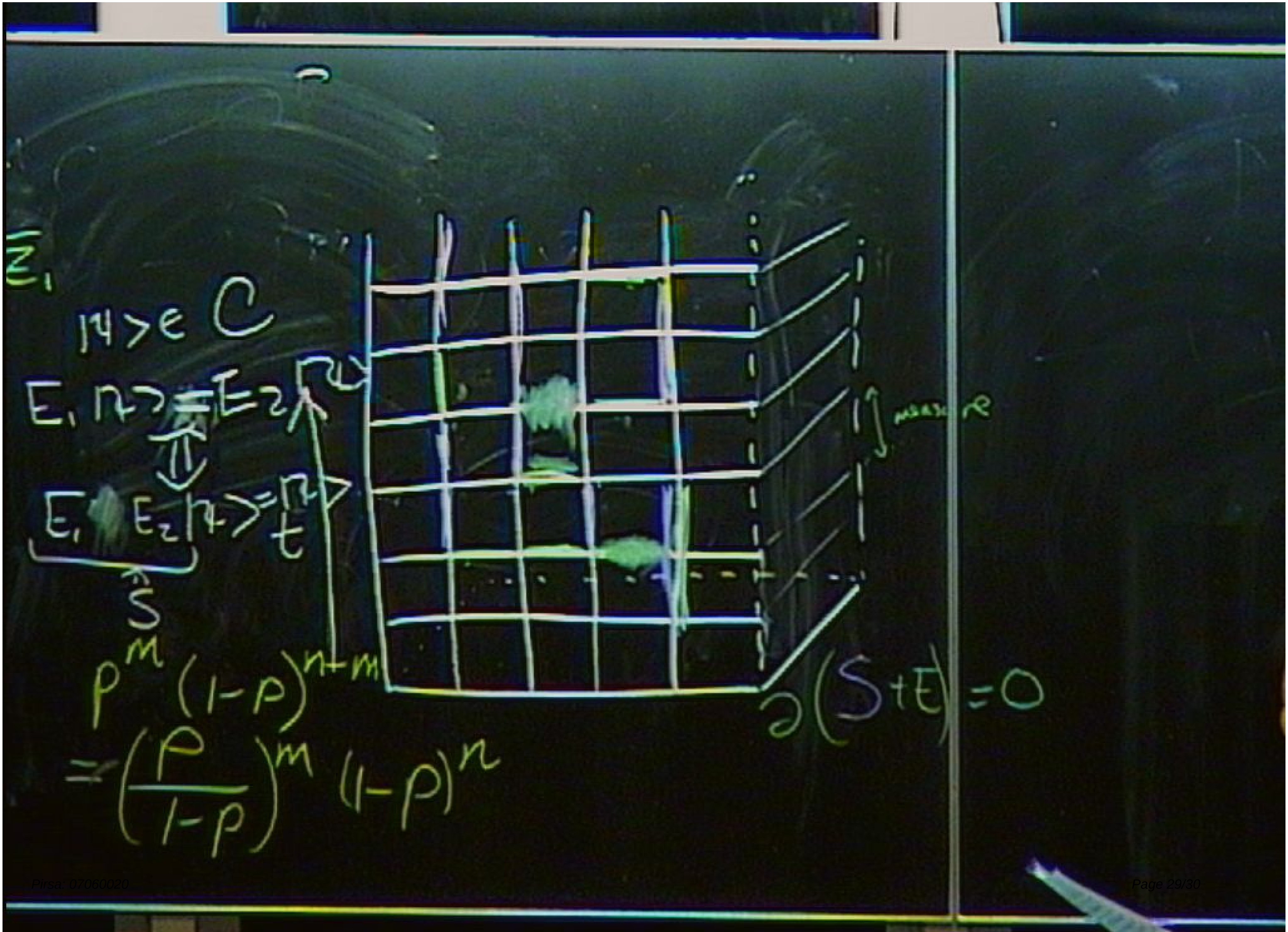

[[2L², 2, L]]
genuine defects
|ψ> ∈ C
S' = USU† L=6
p^m (1-p)^(n-m)
= (p/(1-p))^m (1-p)^n


Γ[[2L², 2, L]]
genuine defects
|ψ> ∈ C
E₁|ψ> = E₂|ψ>
E₁ E₂|ψ> = |ψ>
S
S' = USU† L=6
p^m (1-p)^(n-m)
= (p/(1-p))^m (1-p)^n


|ψ> ∈ C
E1|η> = E2|η>
E1 E2|η> = |η>
t
S
p^m (1-p)^(n-m)
= (p/(1-p))^m (1-p)^n
measure



|ψ> ∈ C
E₁|n> = E₂|n>
E₁ E₂|n> = |n>
S
t
measure
p^m (1-p)^{n-m}
= (p/(1-p))^m (1-p)^n



E,
|ψ> ∈ C
E₁|ψ> = E₂|ψ>
E₁ E₂|ψ> = |ψ>
t
S
p^m (1-p)^{n-m}
= (p/(1-p))^m (1-p)^n
measure
∂(S+E) = 0


kgilles
measure
$\{X_{S_i}\}_{i=1,L^2}$
$\prod_{i=1}^{L^2} X_{S_i} = I$
=0