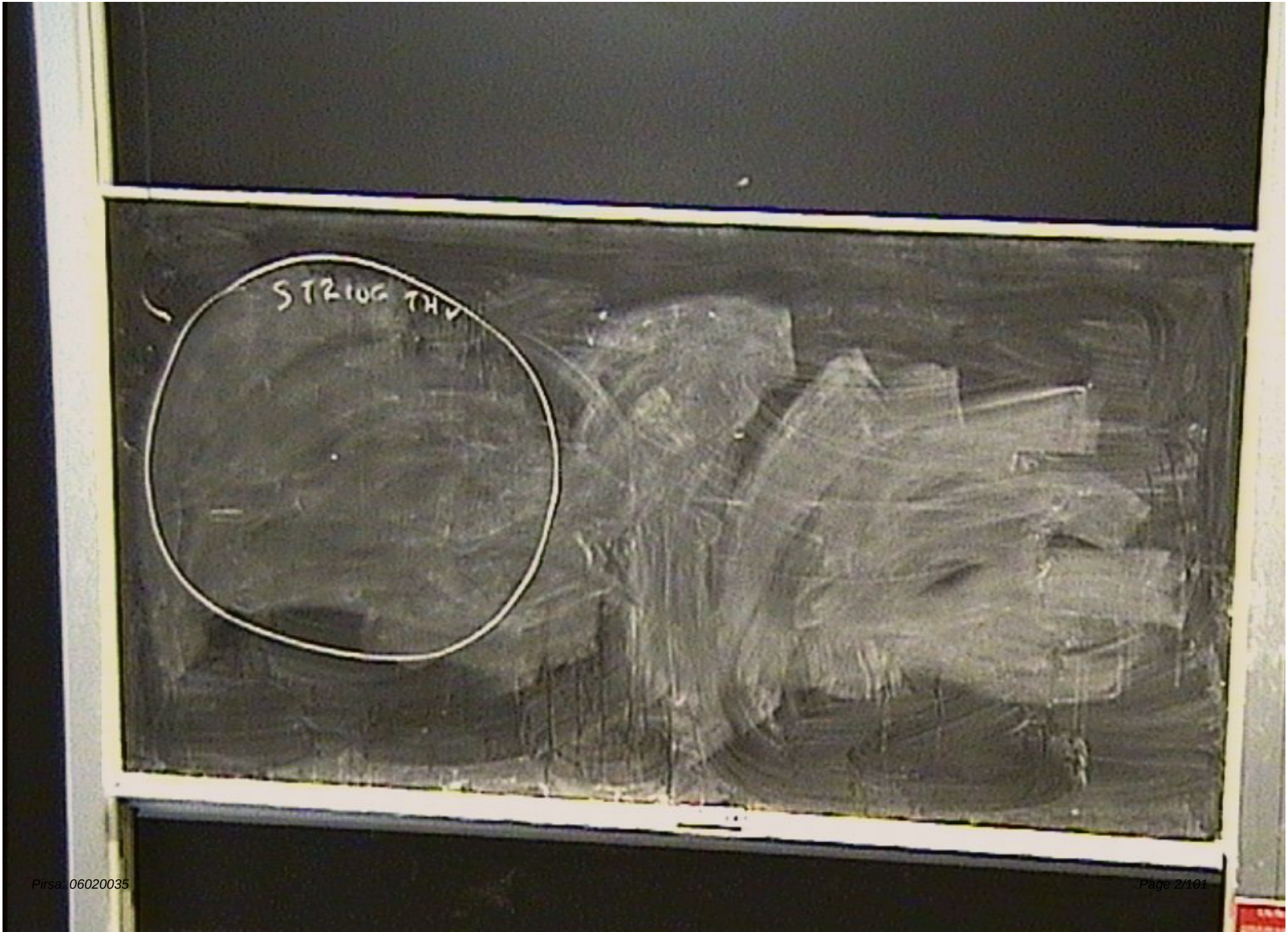
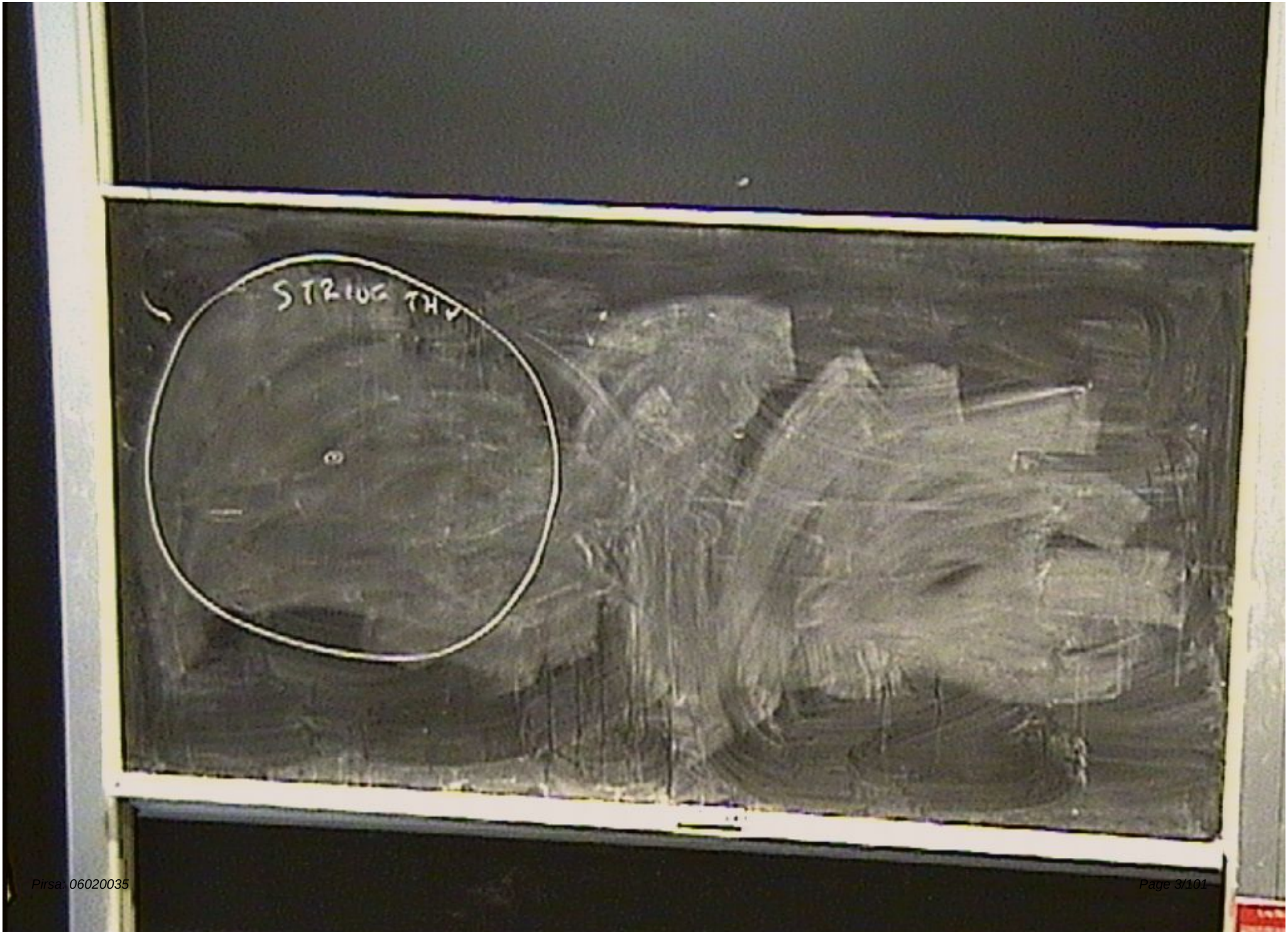
Title: tba

Date: Feb 21, 2006 02:00 PM

URL: http://pirsa.org/06020035

Abstract: tba


STRING THY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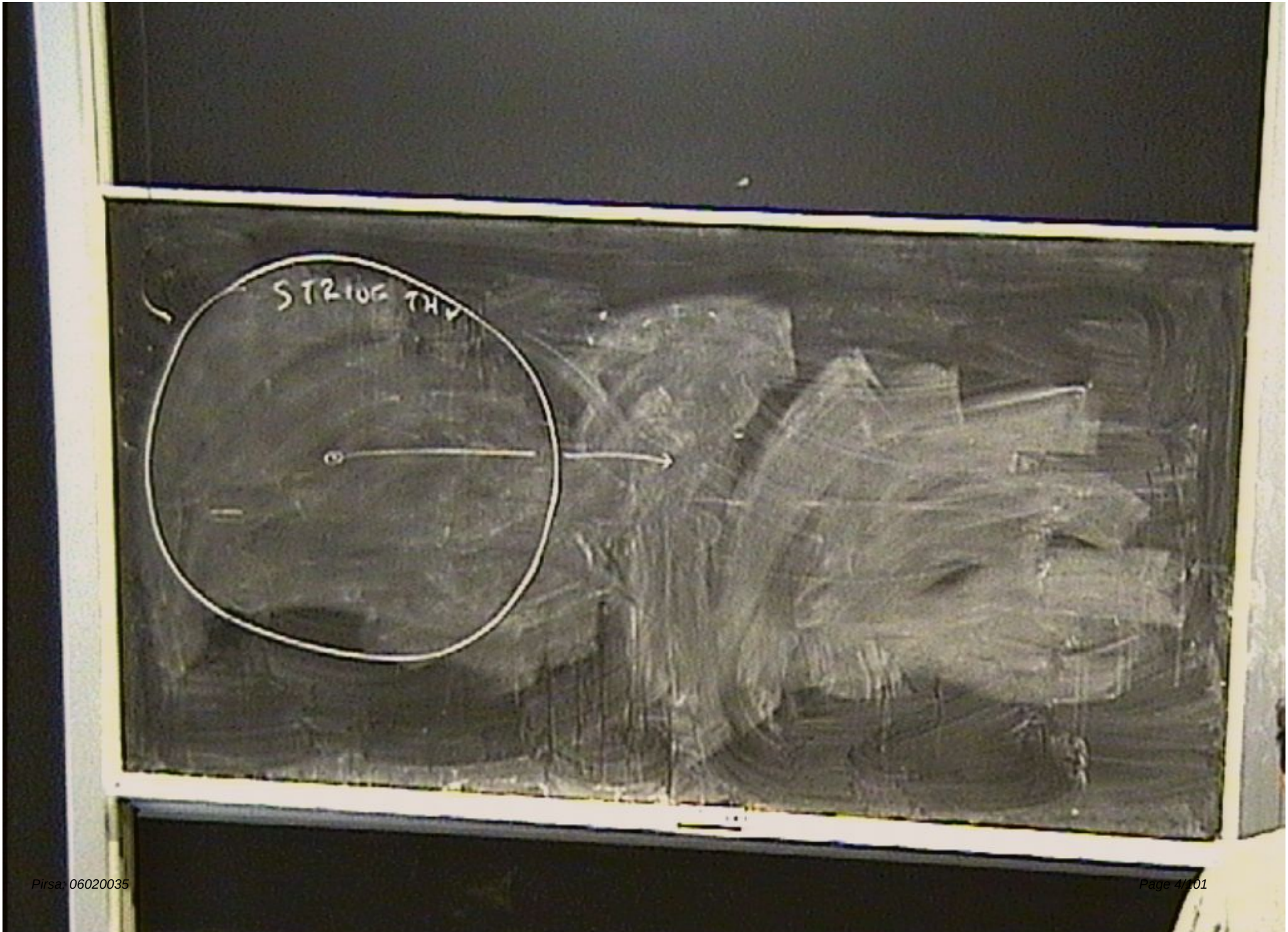
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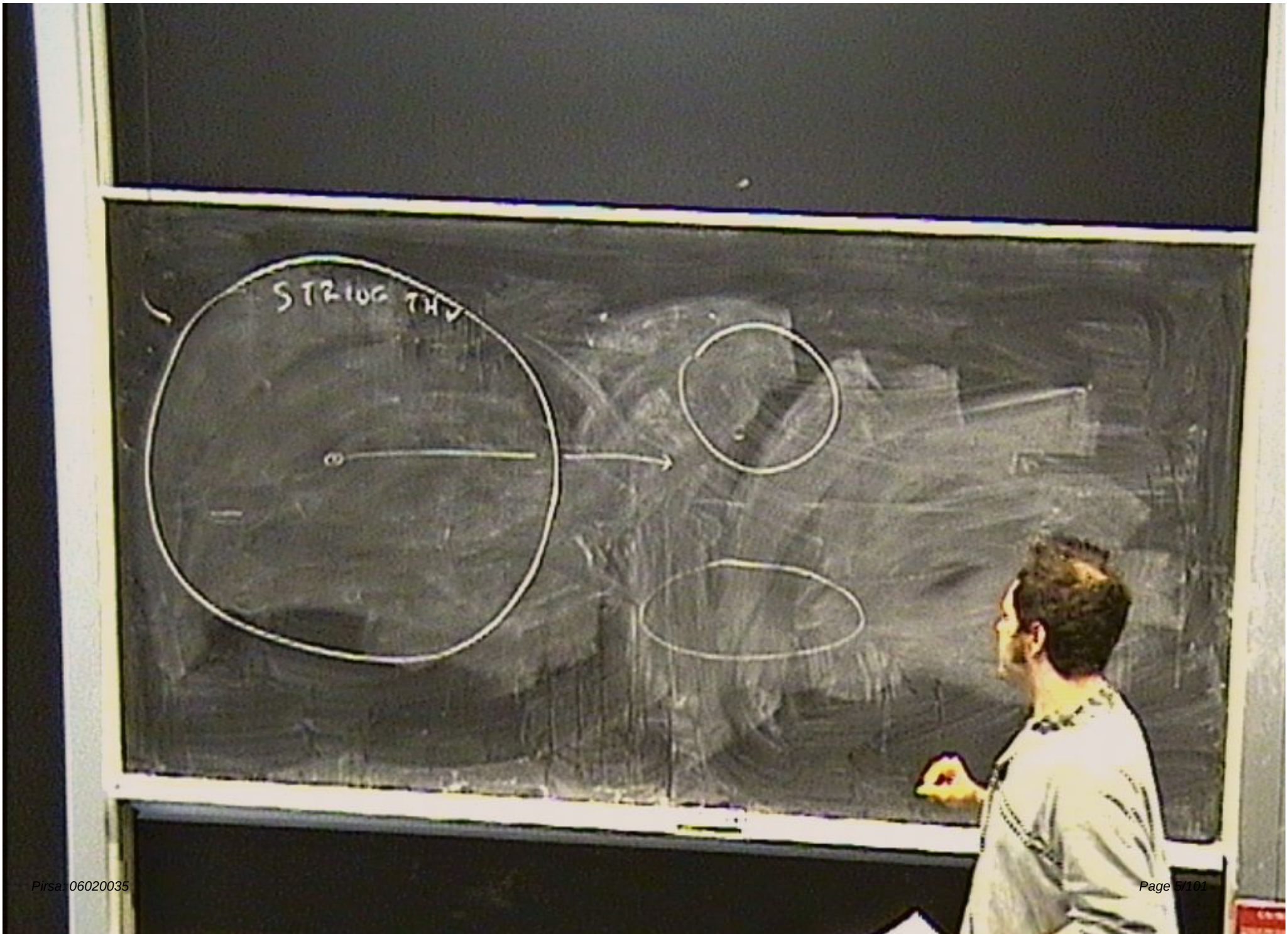
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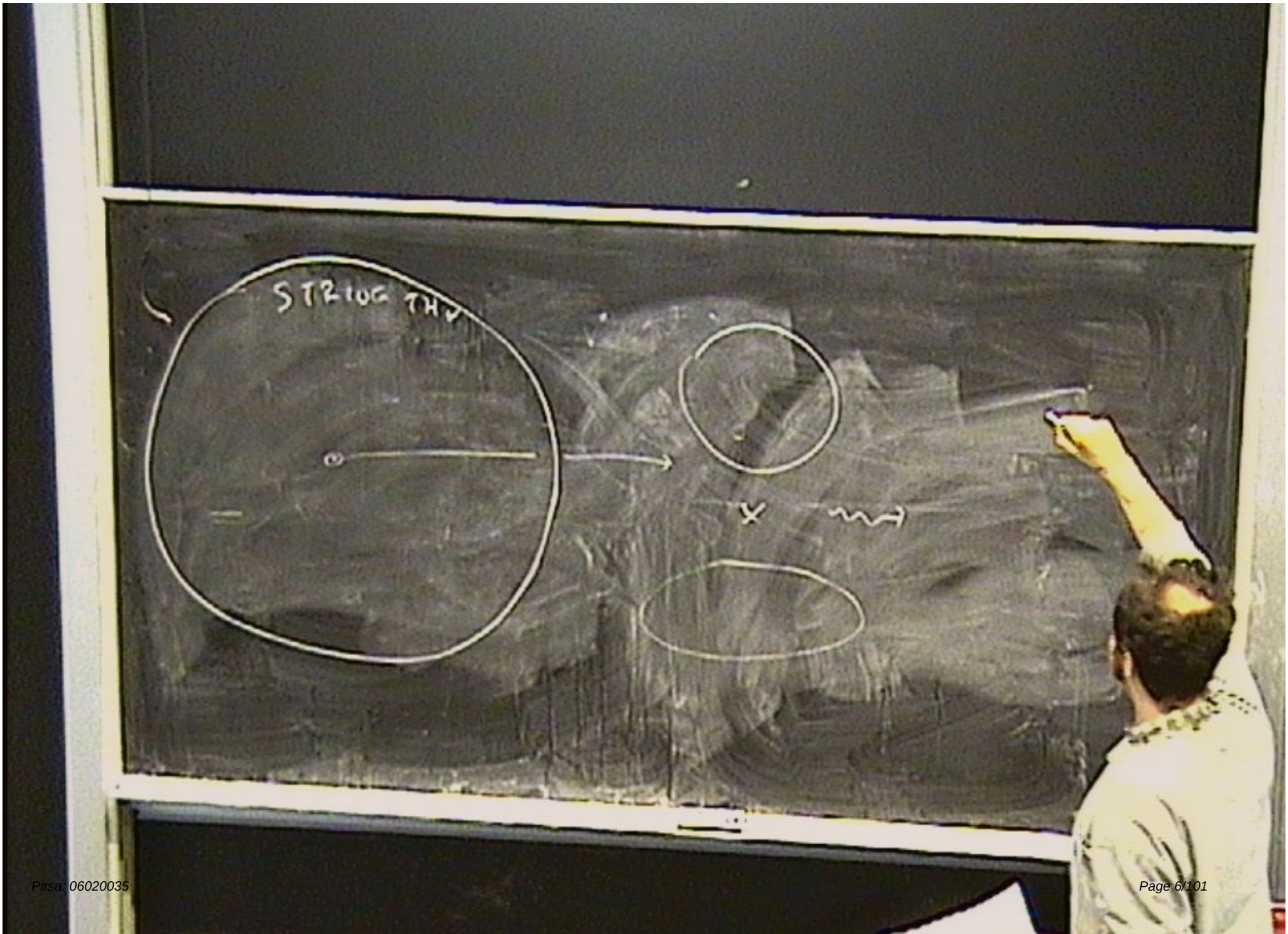
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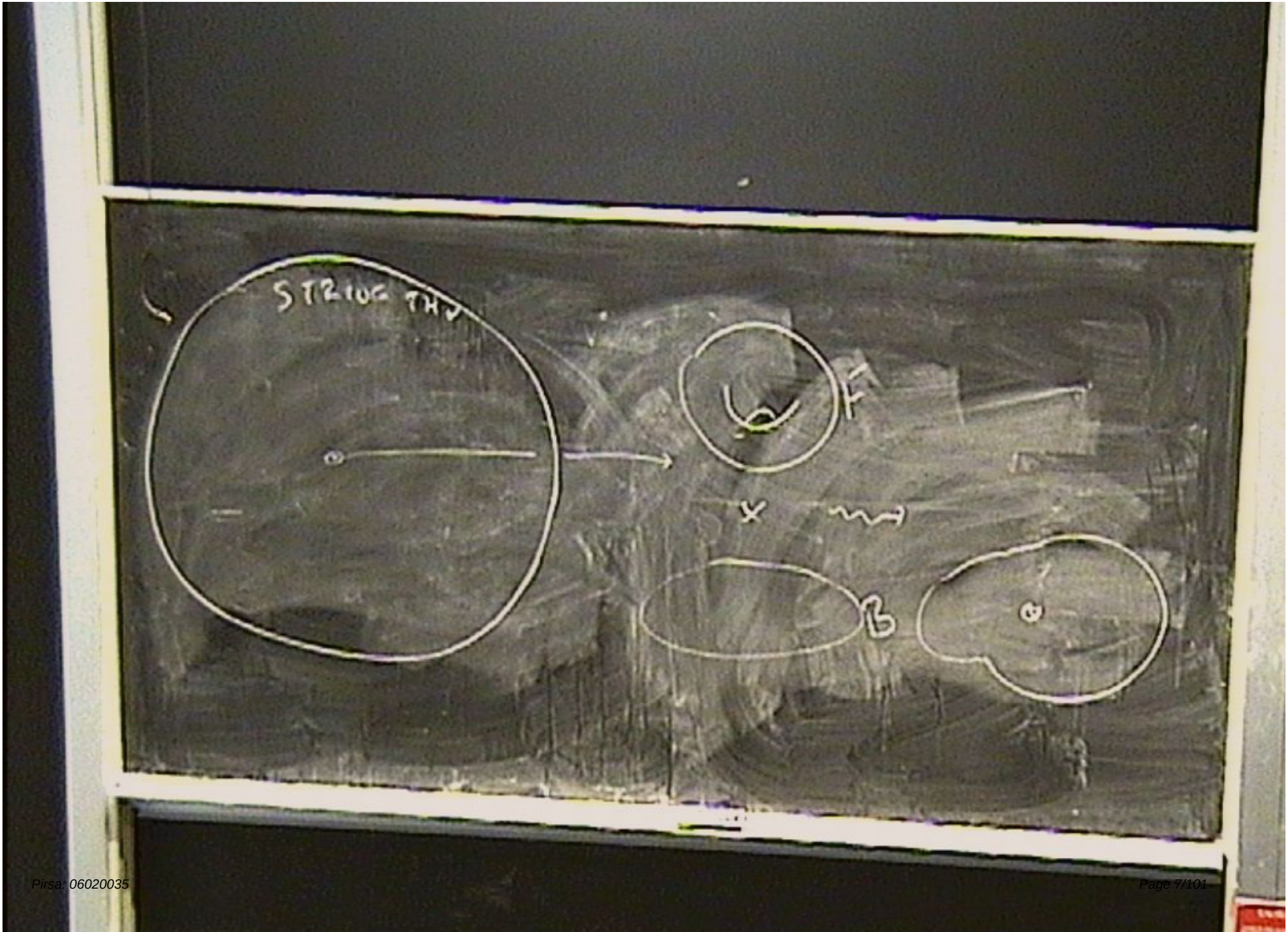
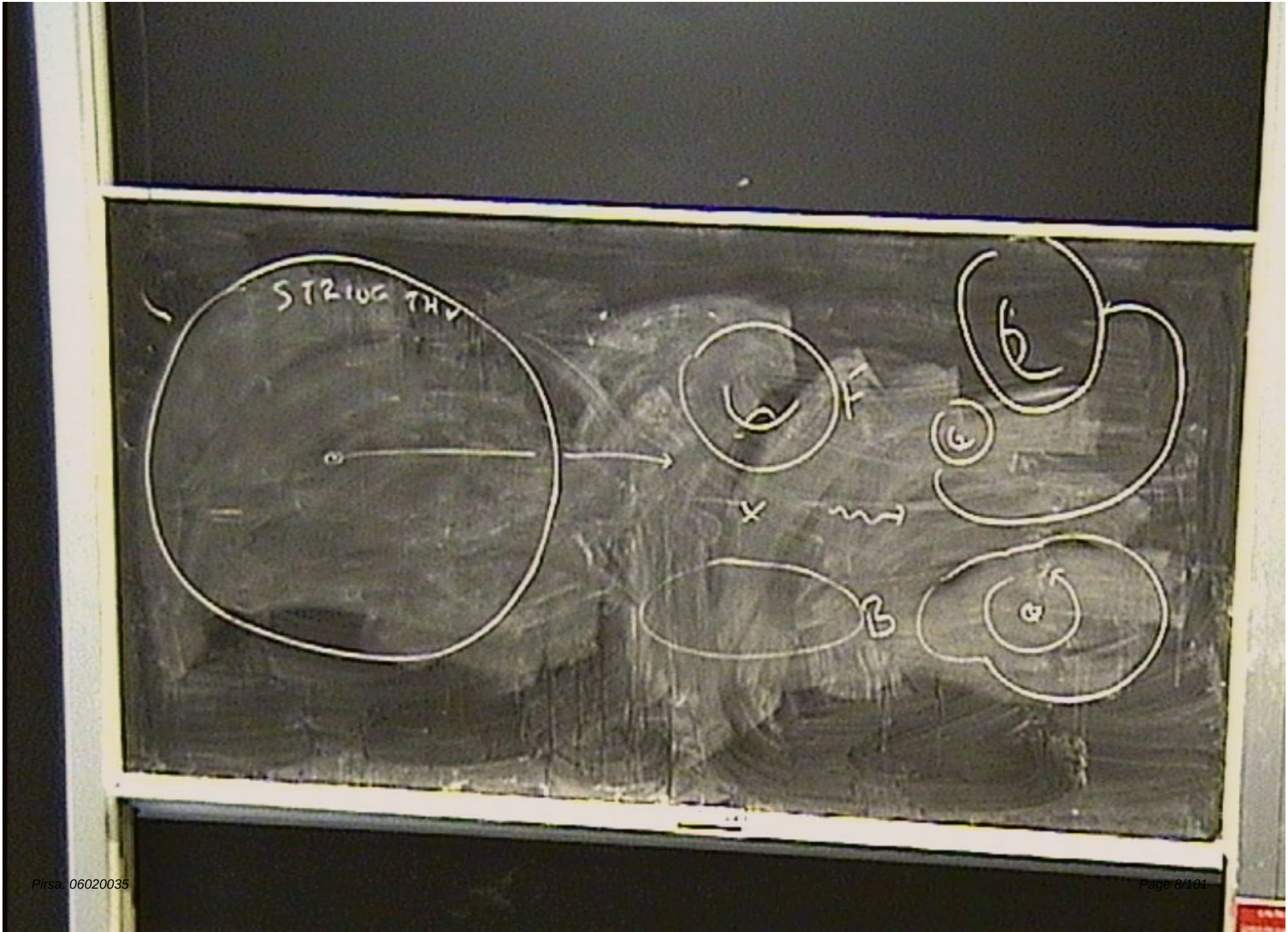
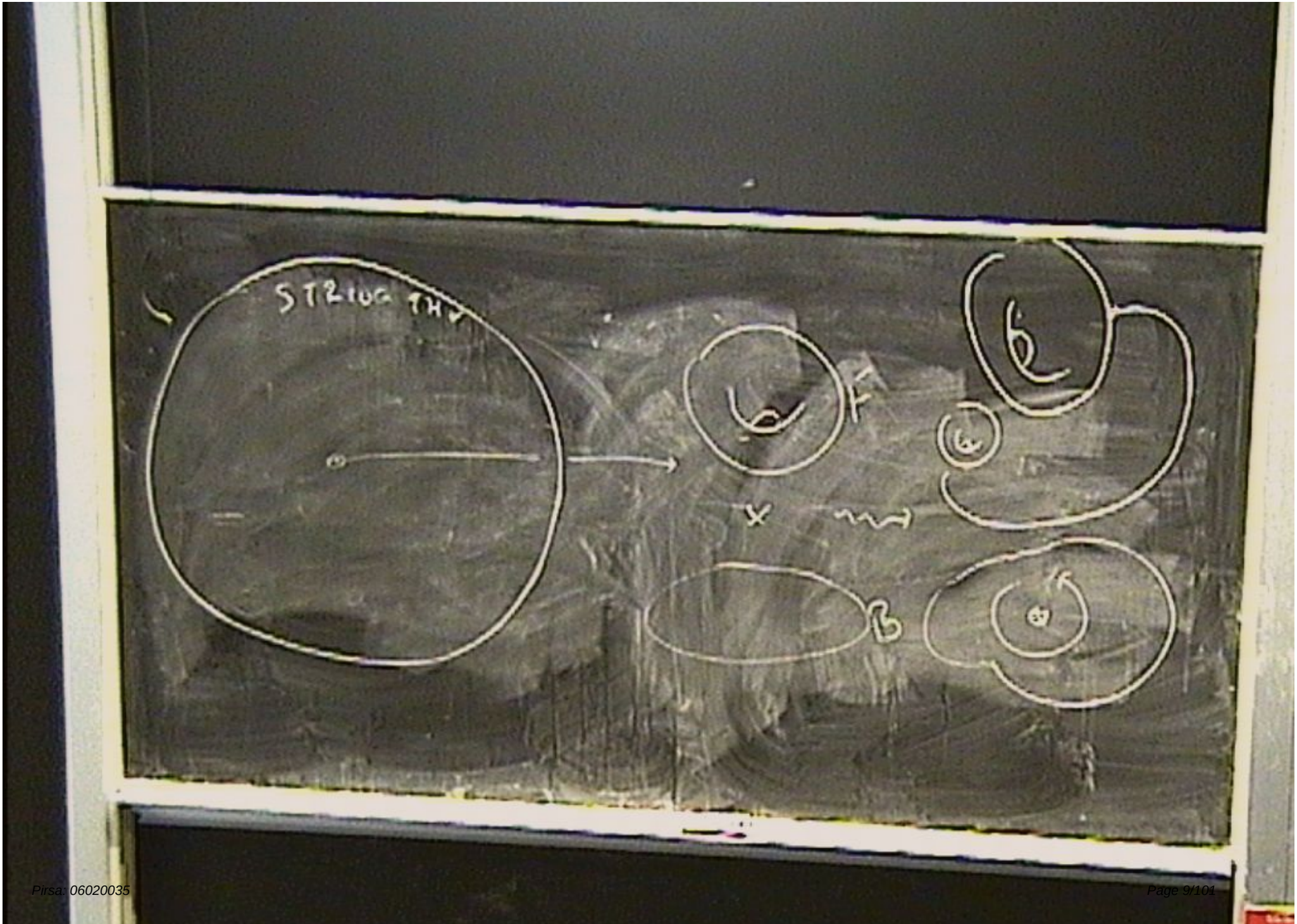
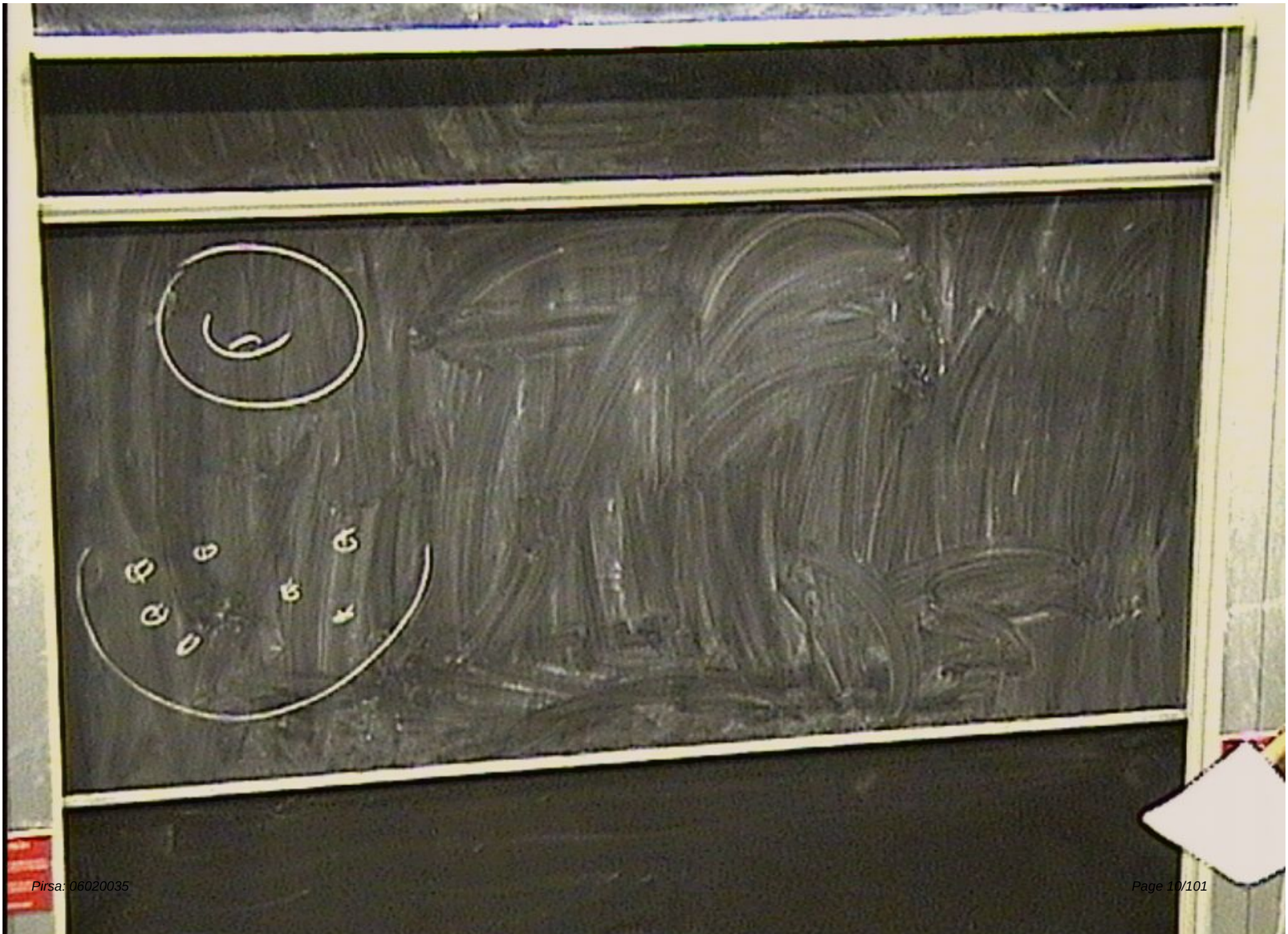
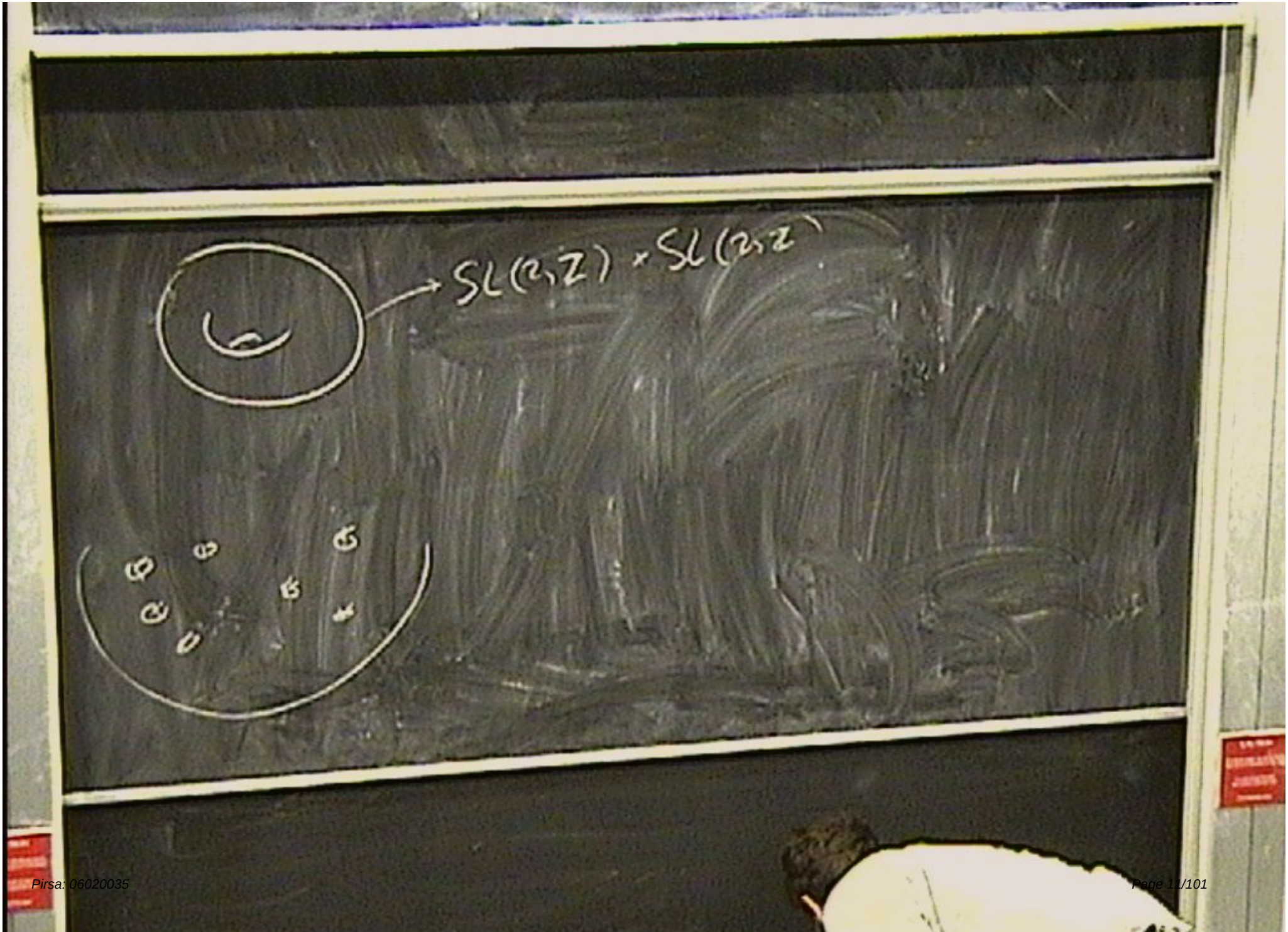
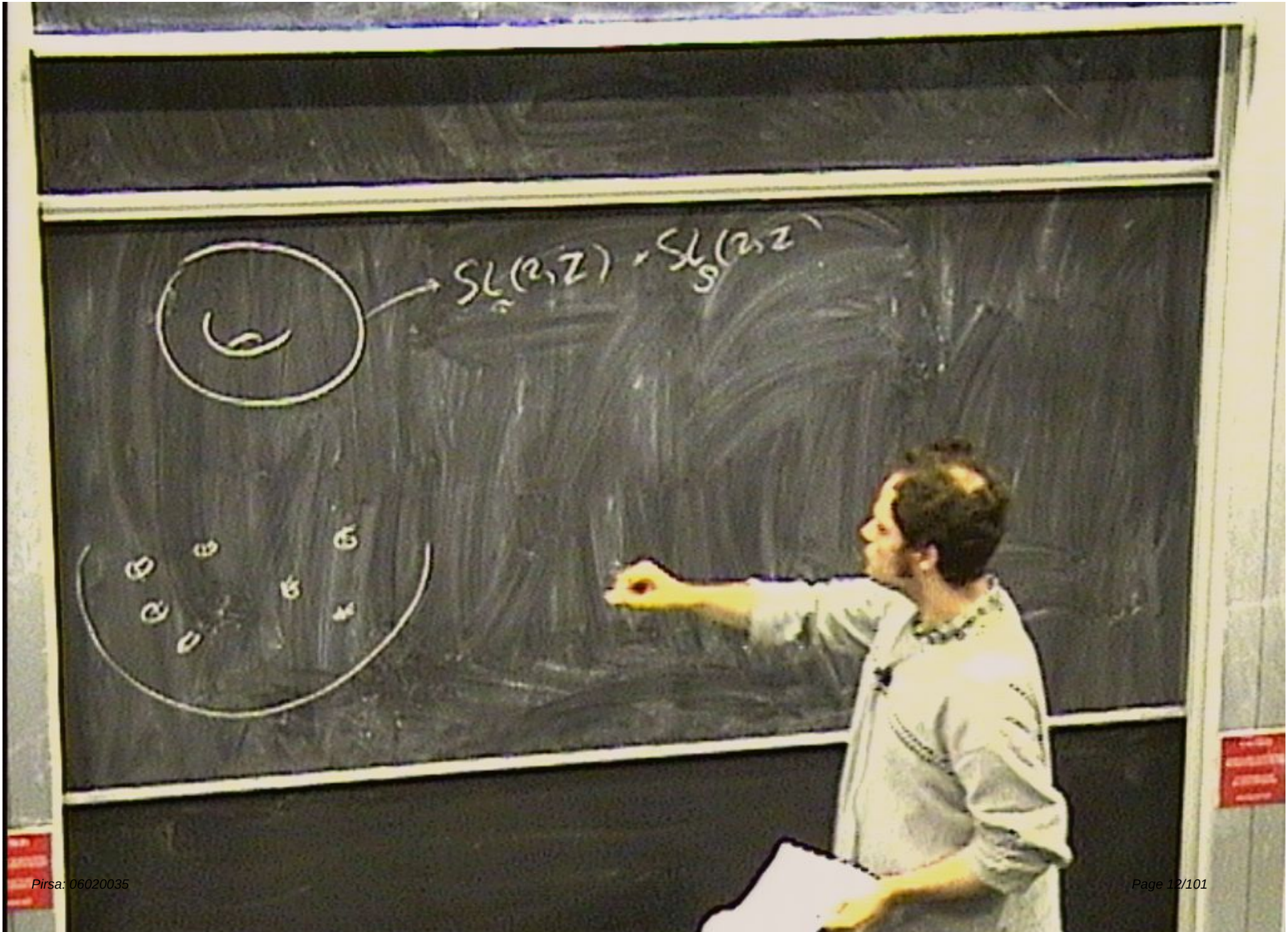

STRING THY
F
X
B
G

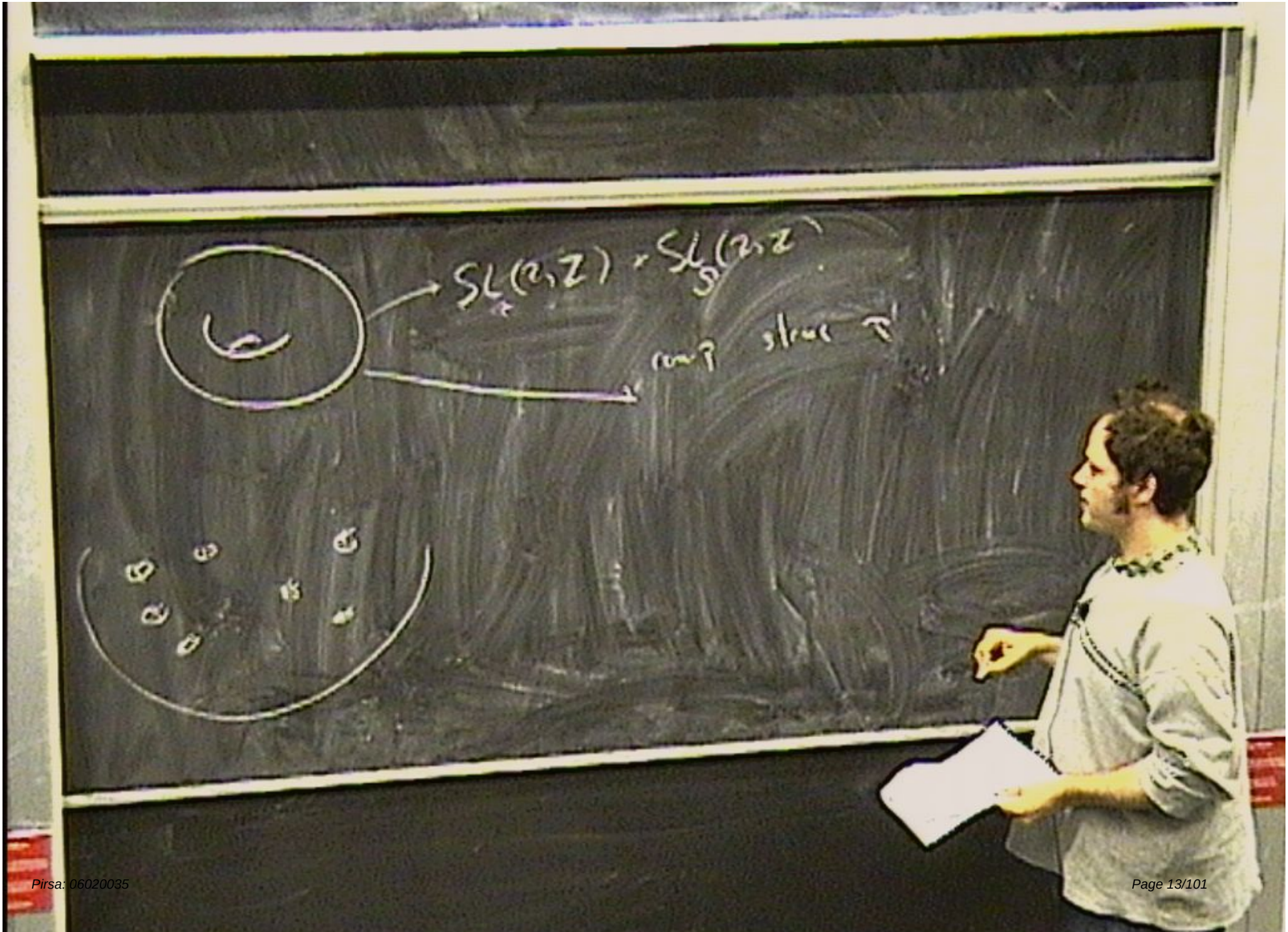

STRING THY

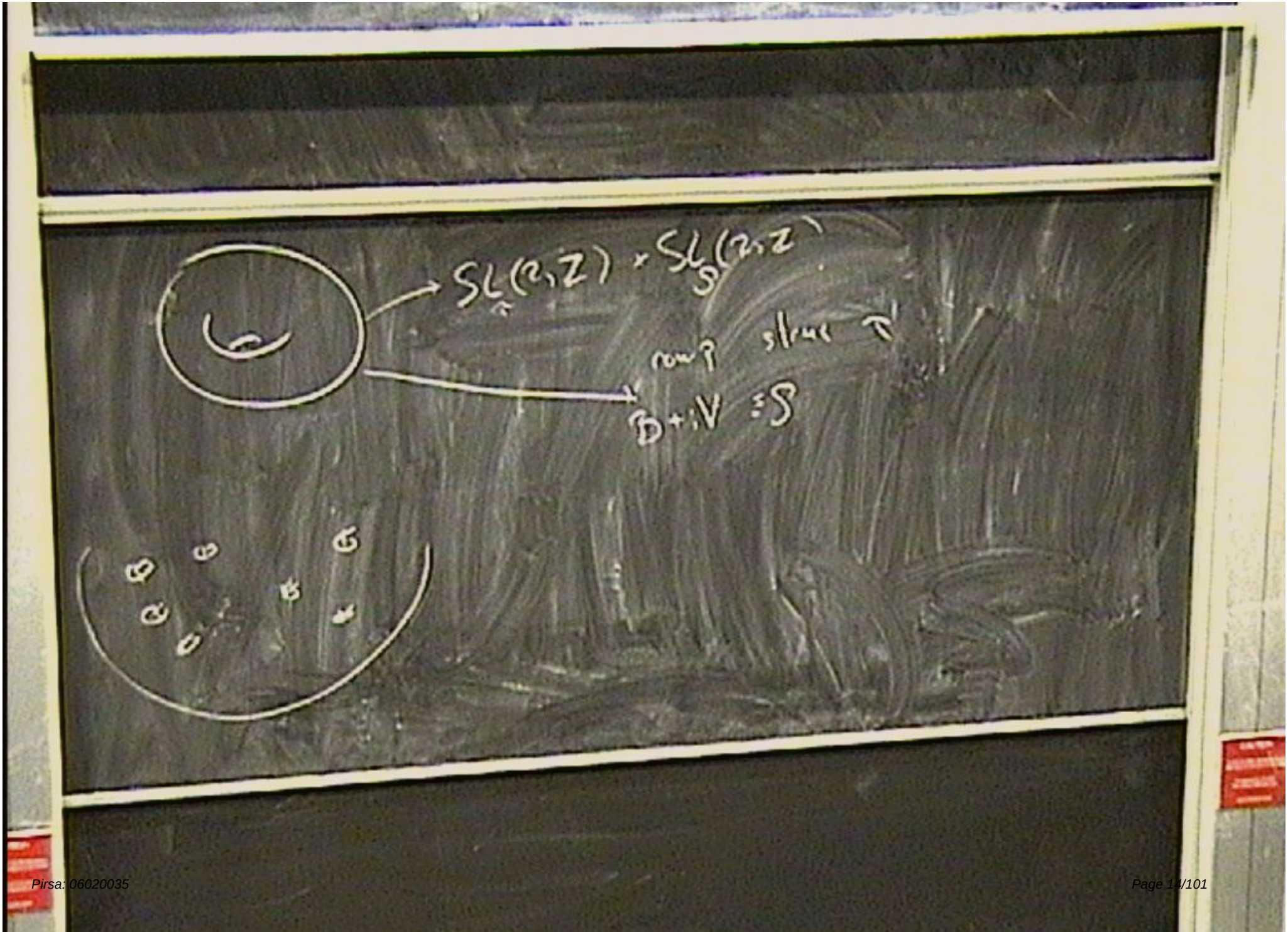

STRUCTURE
F
X

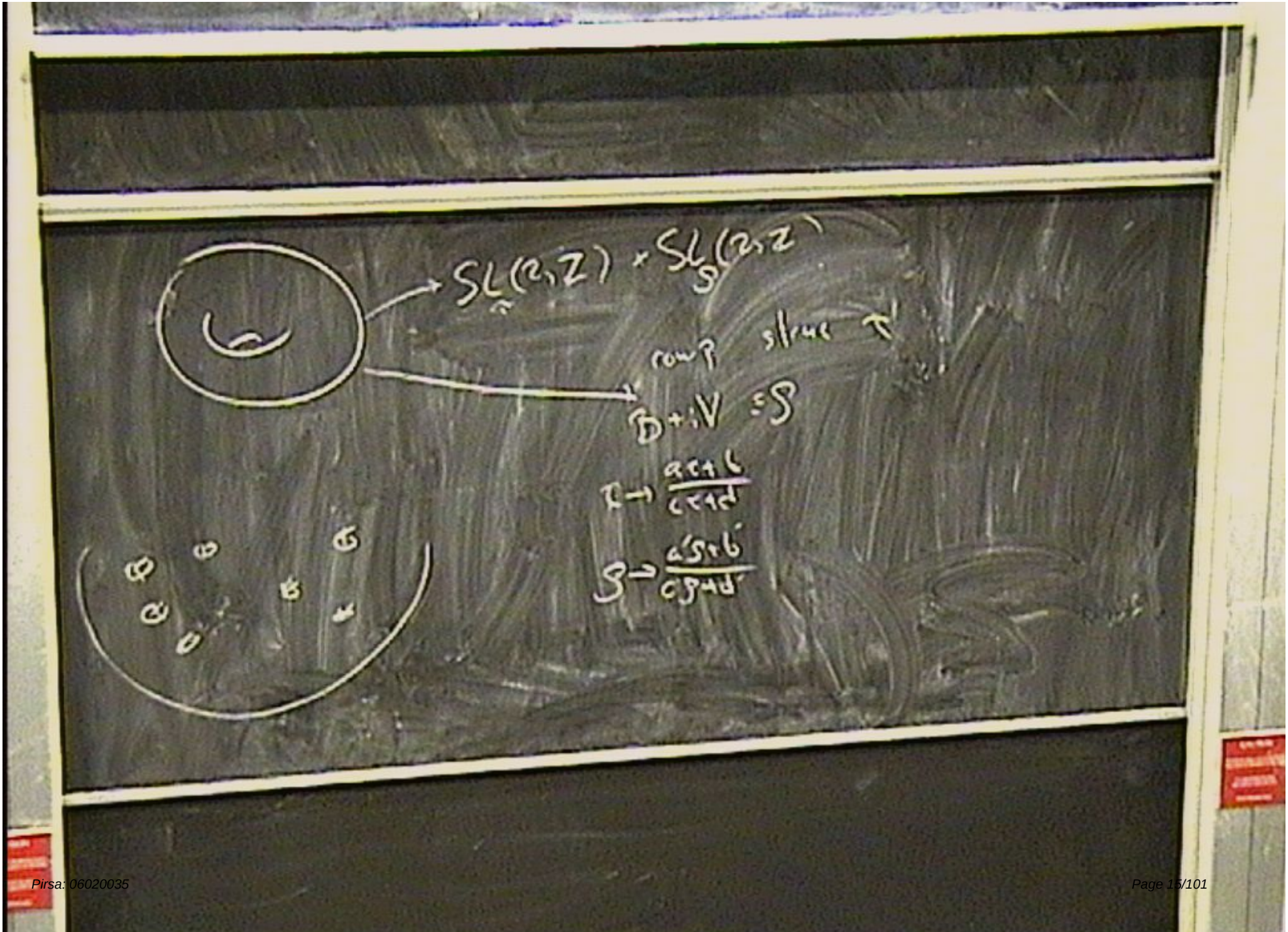


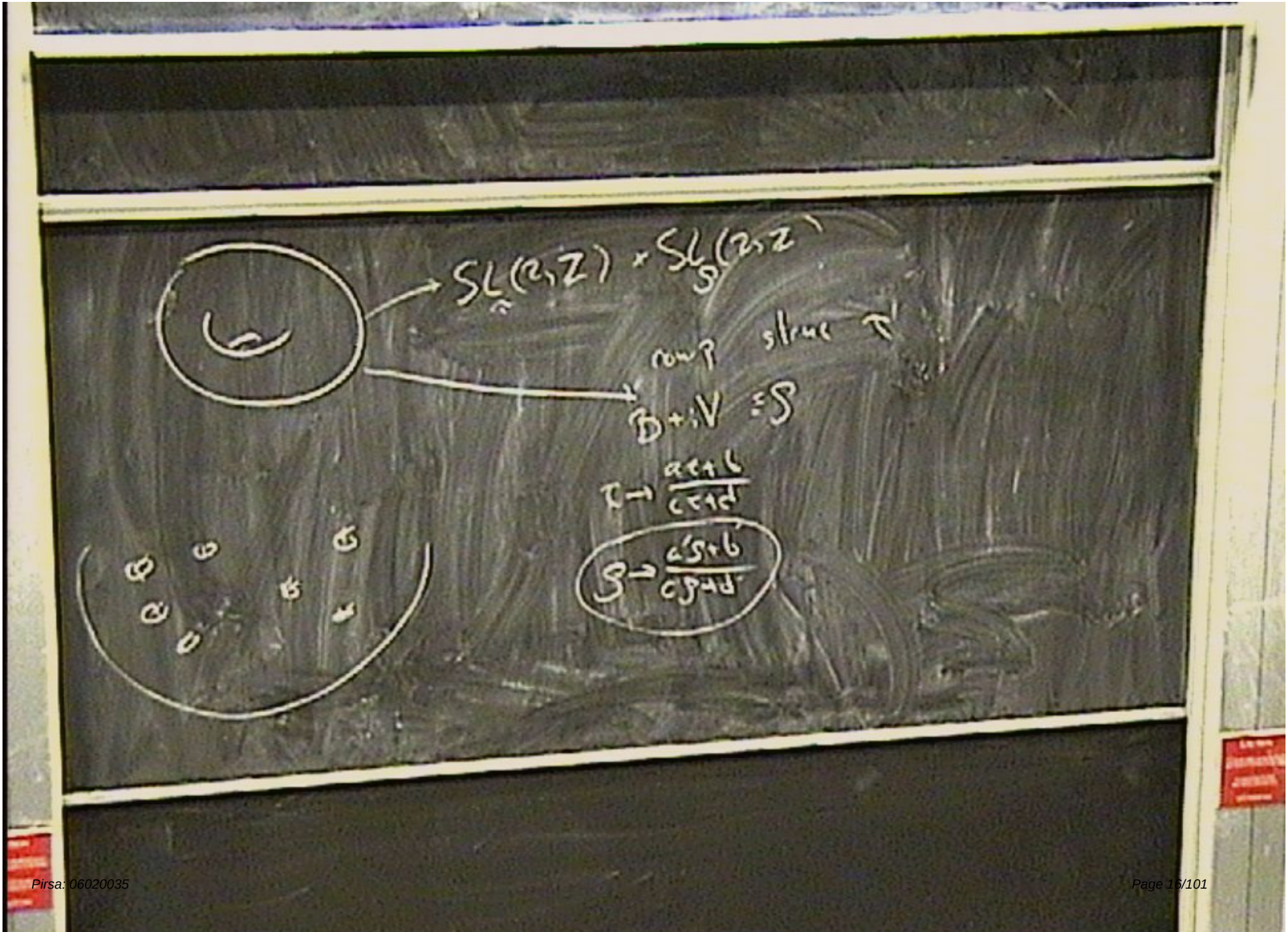

SL(2,Z) × SL(2,Z)

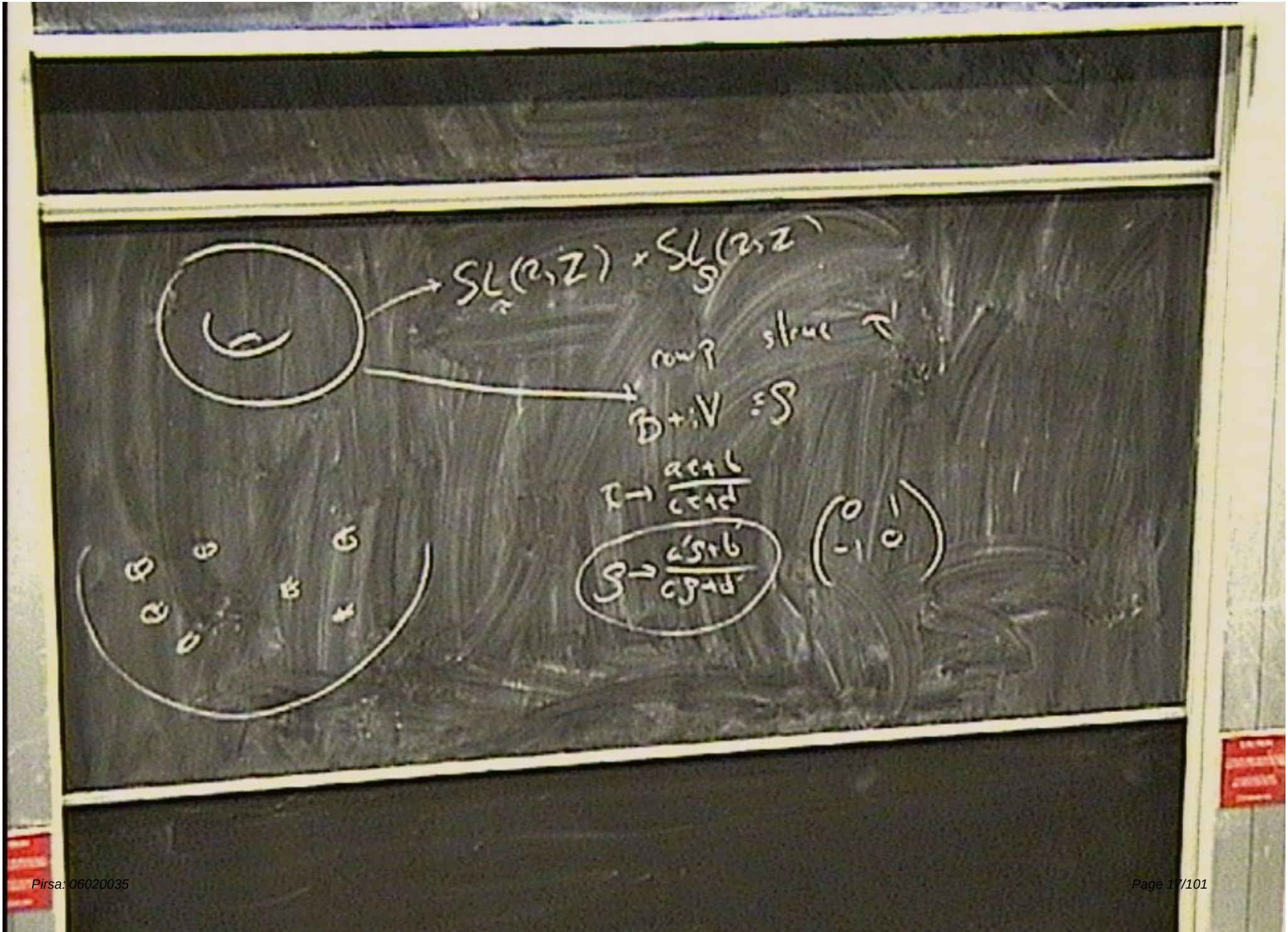

$SL_c(2,\mathbb{Z}) \cdot SL_S(2,\mathbb{Z})$

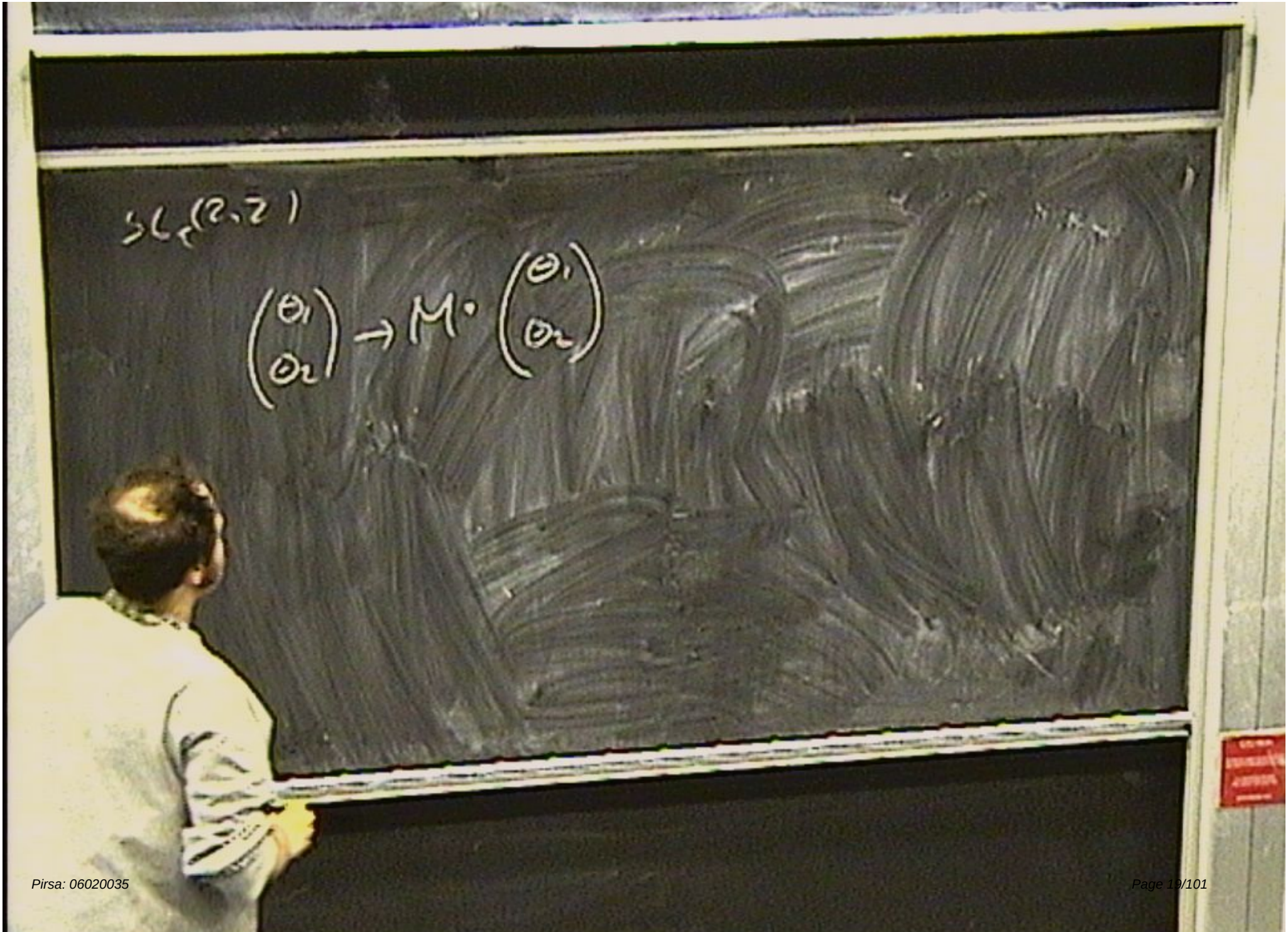

$SL_2(\mathbb{Z}) \times SL_2(\mathbb{Z})$


$SL_2(\mathbb{Z}) \times SL_2(\mathbb{Z})$
$\mathbb{D} + iV = S$


$SL_2(\mathbb{Z}) \times SL_2(\mathbb{Z})$
comp
$\mathbb{D} + iV = S$
$\tau \to \frac{a\tau+b}{c\tau+d}$
$S \to \frac{aS+b}{cS+d}$

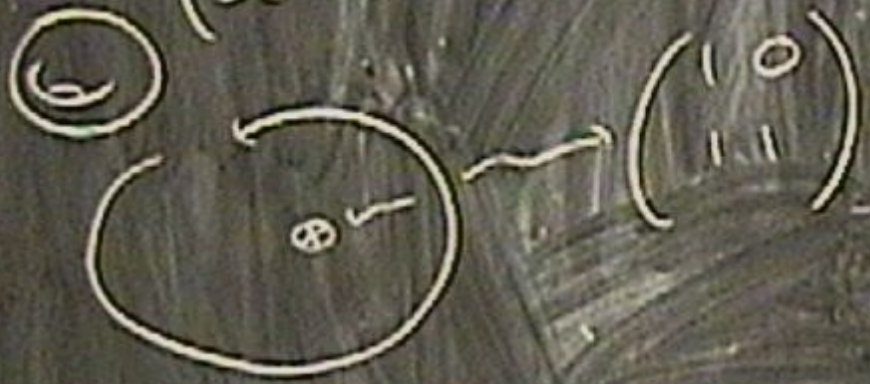

$SL_2(\mathbb{Z}) \times SL_2(\mathbb{Z})$
comp
$\mathbb{D} + iV = S$
$\tau \to \frac{a\tau+b}{c\tau+d}$
$S \to \frac{a'S+b'}{c'S+d'}$


$SL_2(\mathbb{Z}) \times SL_2(\mathbb{Z})$
comp
$\mathcal{H} \cup V \cup S$
$\tau \mapsto \frac{a\tau+b}{c\tau+d}$
$S \to \frac{a's+b'}{c's+d'}$
$\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$

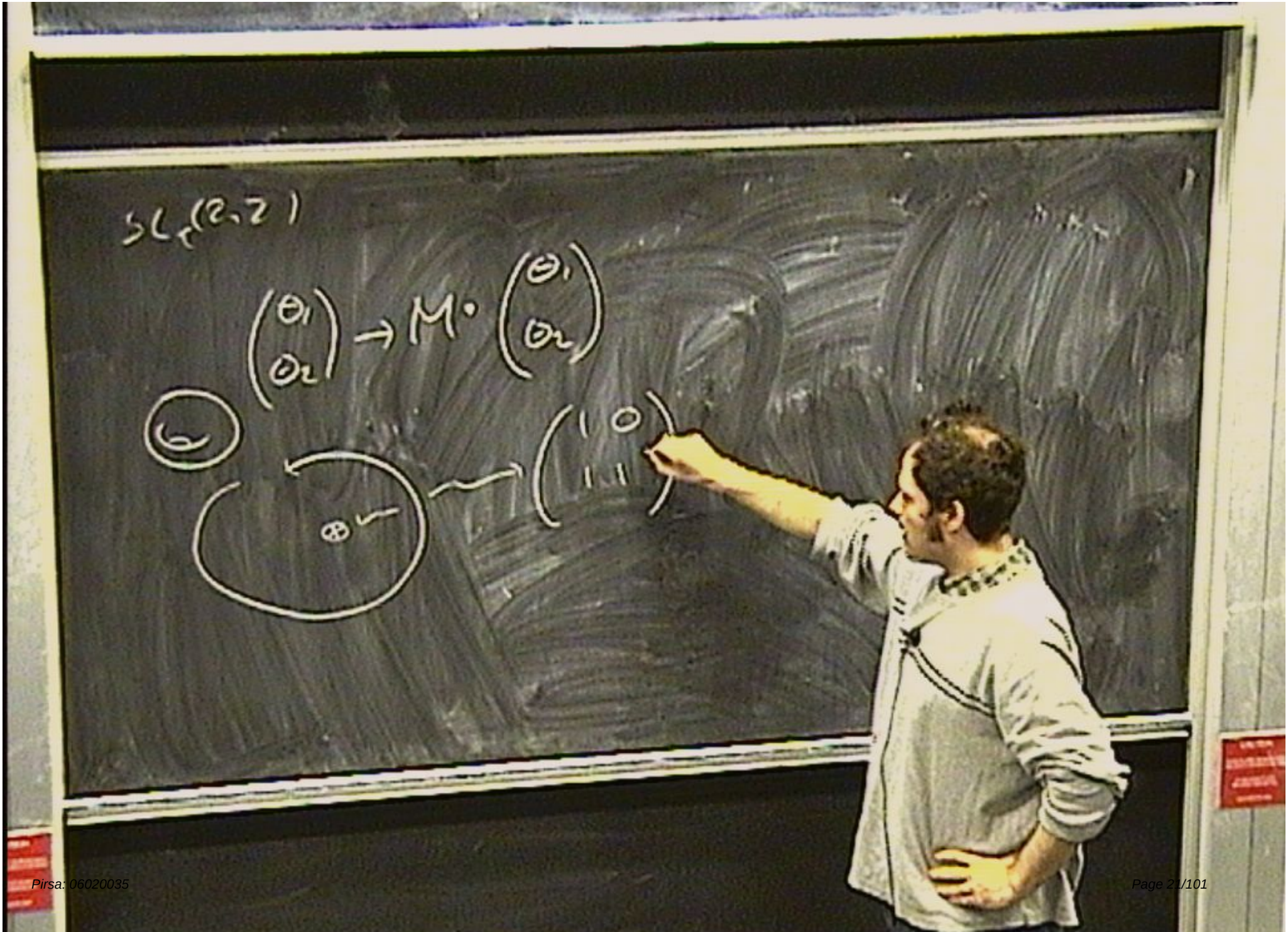

$SL_2(\mathbb{Z})$
$\begin{pmatrix} \theta_1 \\ \theta_2 \end{pmatrix} \to M \cdot \begin{pmatrix} \theta_1 \\ \theta_2 \end{pmatrix}$

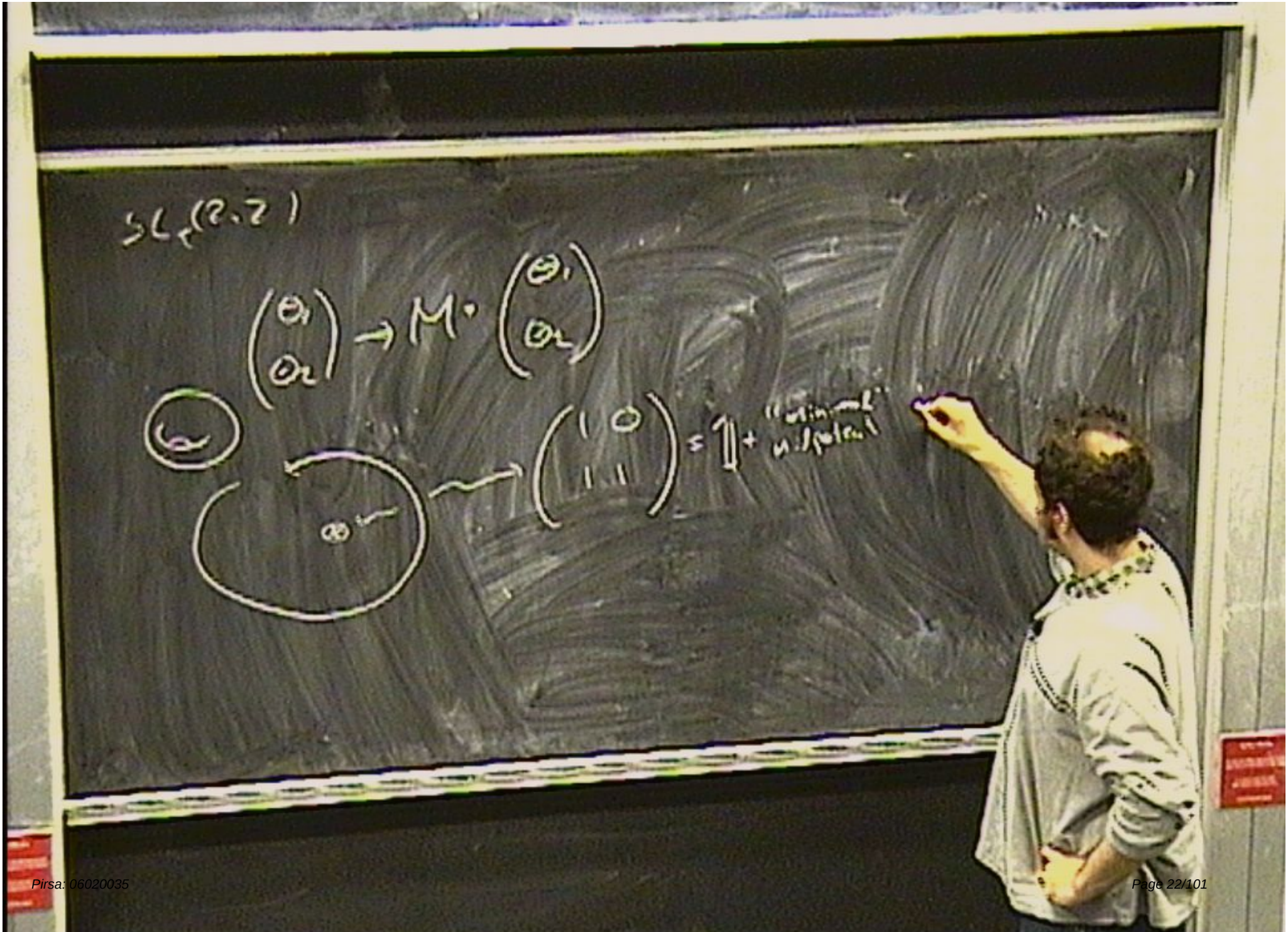
$SL_2(\mathbb{Z})$

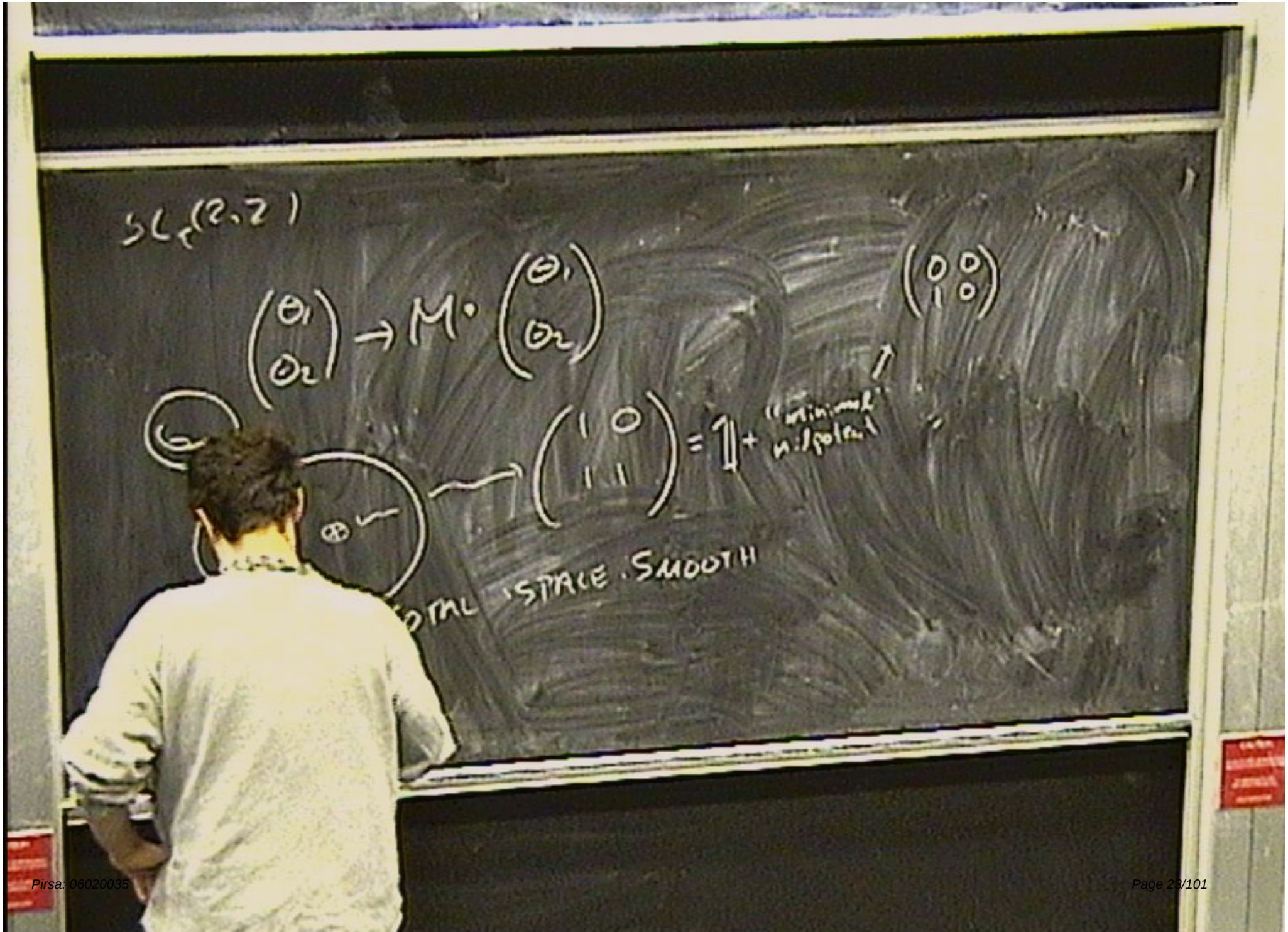
$$\begin{pmatrix}\theta_1\\ \theta_2\end{pmatrix} \to M \cdot \begin{pmatrix}\theta_1\\ \theta_2\end{pmatrix}$$

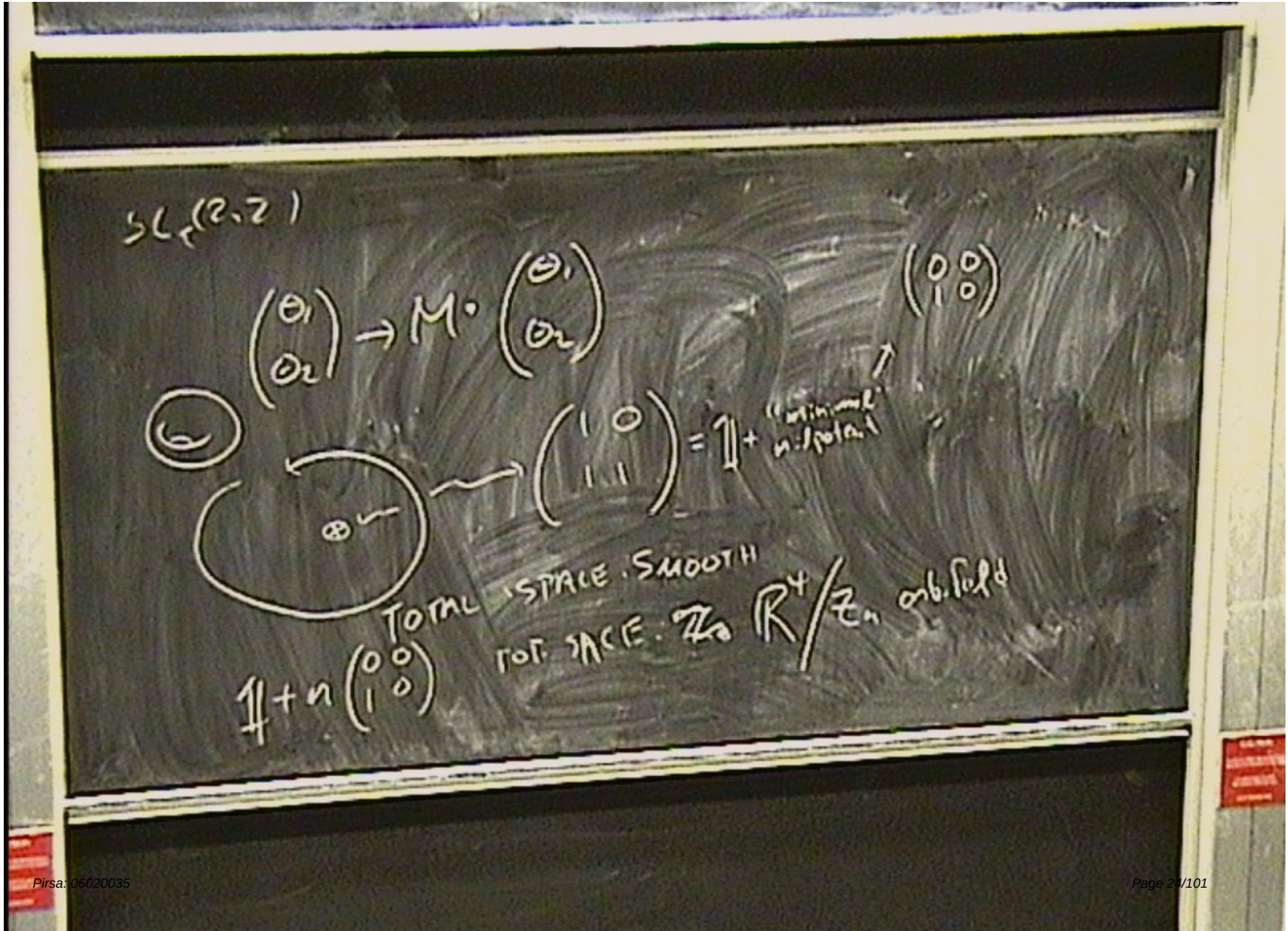


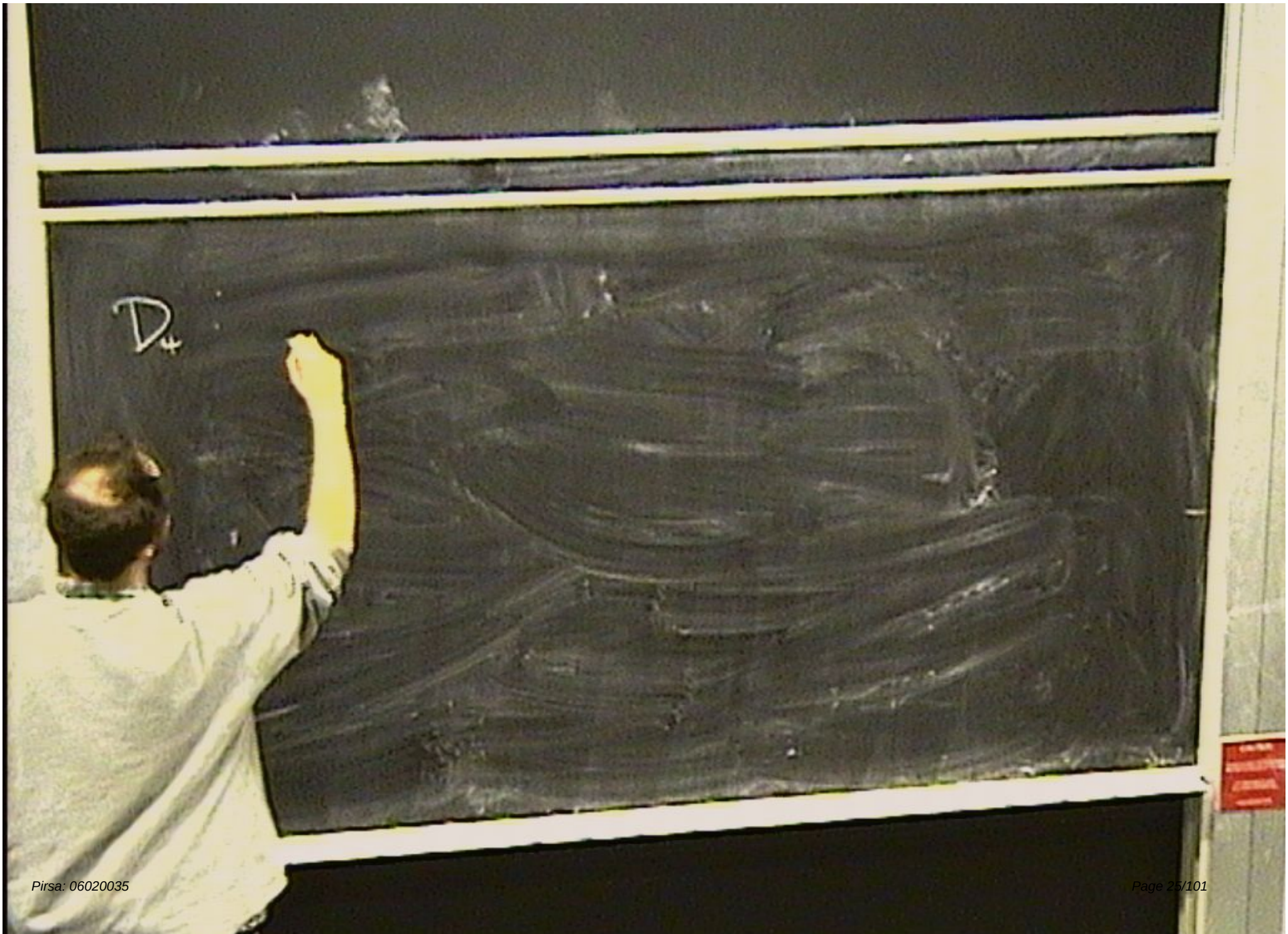
$$\to \begin{pmatrix}1 & 0\\ 1 & 1\end{pmatrix}$$

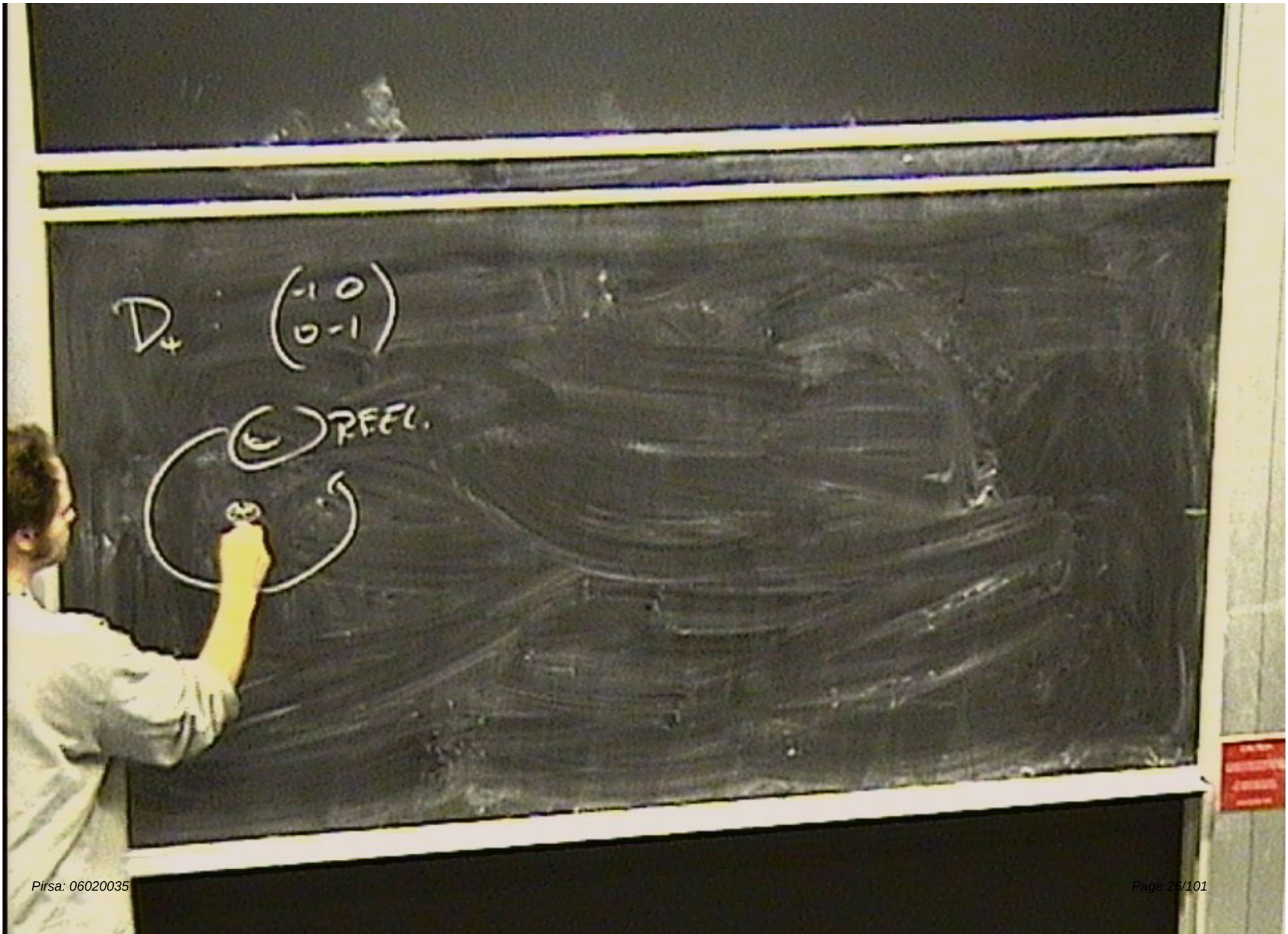

$SL_2(\mathbb{Z})$
$\begin{pmatrix}\theta_1\\ \theta_2\end{pmatrix} \to M \cdot \begin{pmatrix}\theta_1\\ \theta_2\end{pmatrix}$
$\begin{pmatrix}1 & 0\\ 1 & 1\end{pmatrix}$

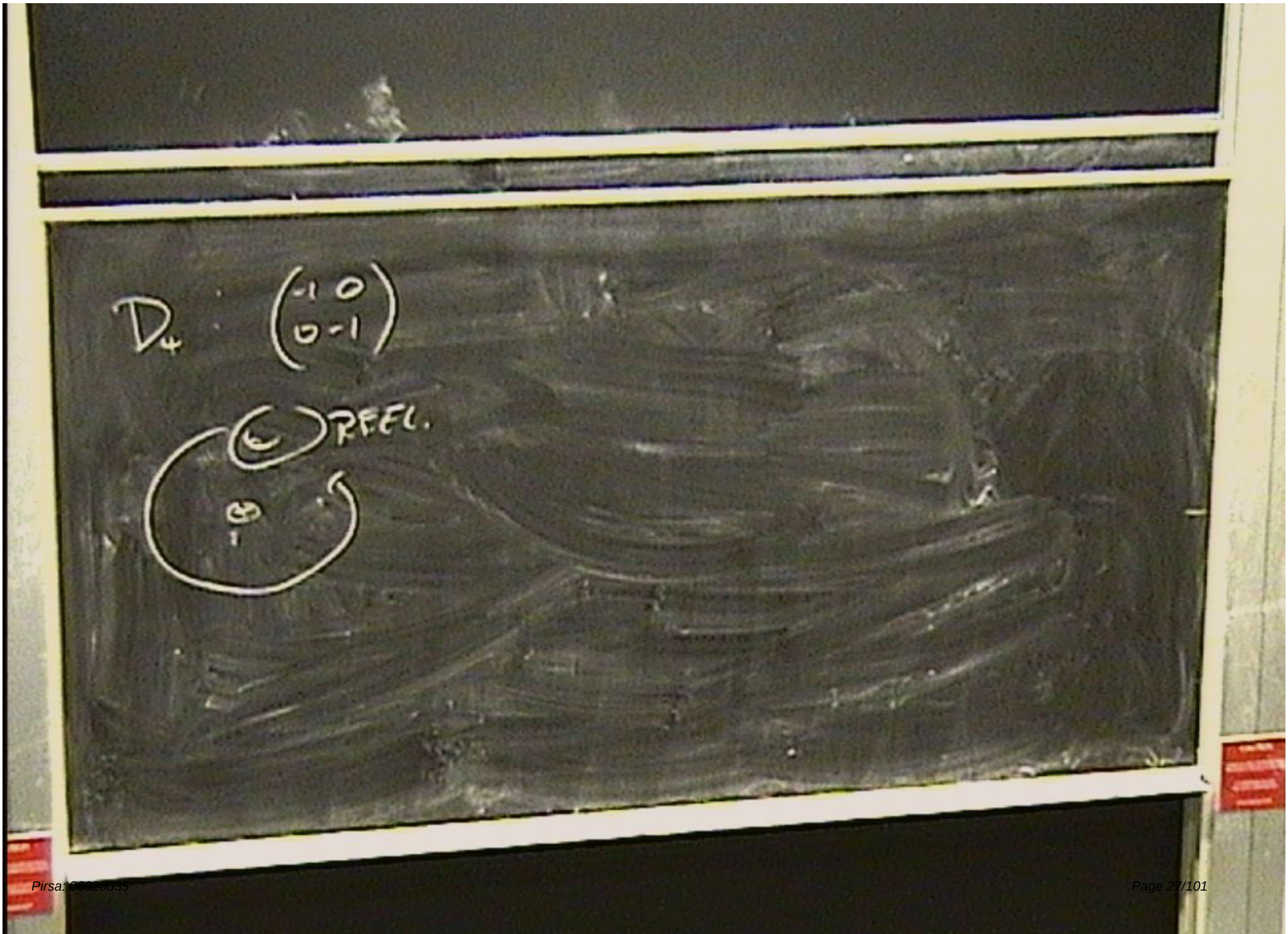

$SL_2(\mathbb{Z})$
$\begin{pmatrix} \theta_1 \\ \theta_2 \end{pmatrix} \to M \cdot \begin{pmatrix} \theta_1 \\ \theta_2 \end{pmatrix}$
$\begin{pmatrix} 1 & 0 \\ 1 & 1 \end{pmatrix} = \mathbb{1} +$


$SL_2(\mathbb{Z})$
$\begin{pmatrix}\theta_1\\ \theta_2\end{pmatrix} \to M \cdot \begin{pmatrix}\theta_1\\ \theta_2\end{pmatrix}$
$\begin{pmatrix}0&0\\1&0\end{pmatrix}$
$\begin{pmatrix}1&0\\1&1\end{pmatrix} = \mathbb{1} +$
"minimal" nilpotent
STACE. SMOOTH


$SL_2(\mathbb{Z})$
$\begin{pmatrix}\theta_1\\ \theta_2\end{pmatrix} \to M \cdot \begin{pmatrix}\theta_1\\ \theta_2\end{pmatrix}$
$\begin{pmatrix}0&0\\1&0\end{pmatrix}$
$\begin{pmatrix}1&0\\1&1\end{pmatrix} = \mathbb{1} +$ ("minimal" n.ilpotent)
TOTAL SPACE: SMOOTH
$\mathbb{1} + n\begin{pmatrix}0&0\\1&0\end{pmatrix}$
TOT. SPACE: $\mathbb{Z}_n$ $\mathbb{R}^4/\mathbb{Z}_n$ orb. fold


D_4

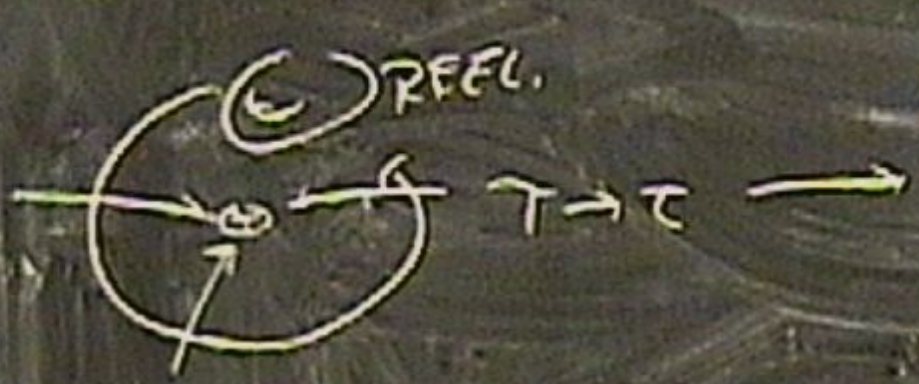

D_4 : $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$
REFL.


D_4 : $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$
REFL.

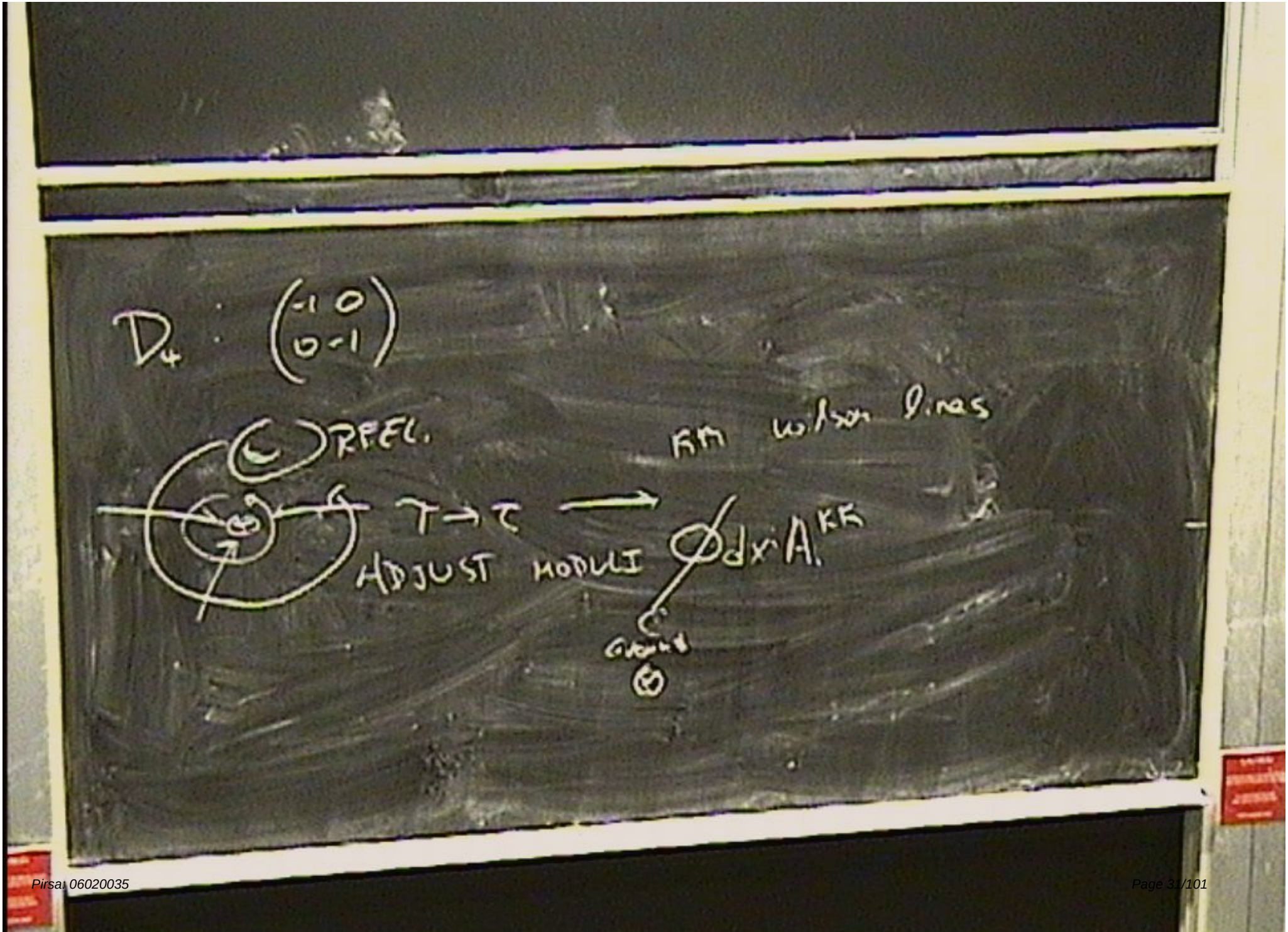
$D_4 : \begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$

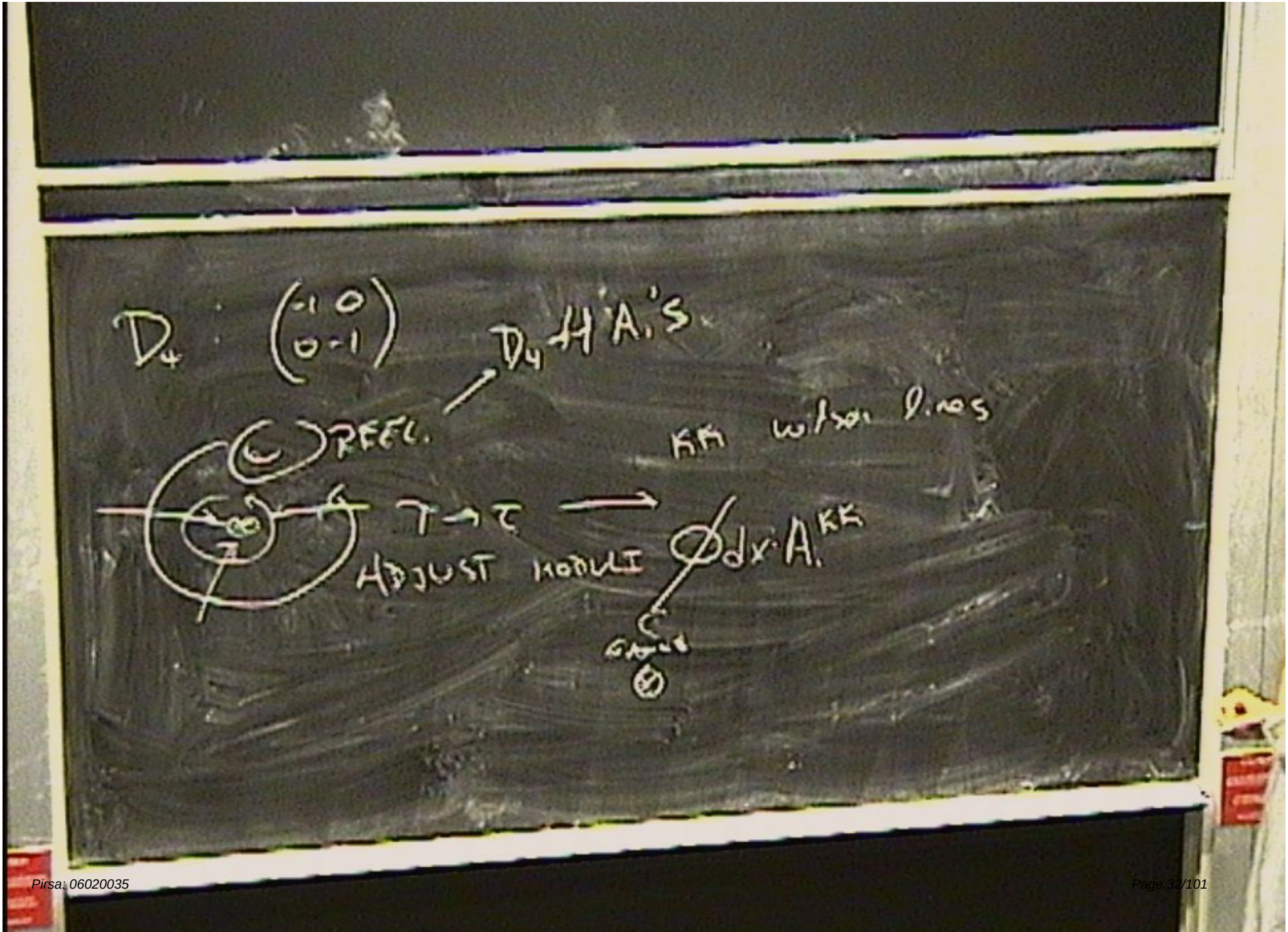
$D_4 : \begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$

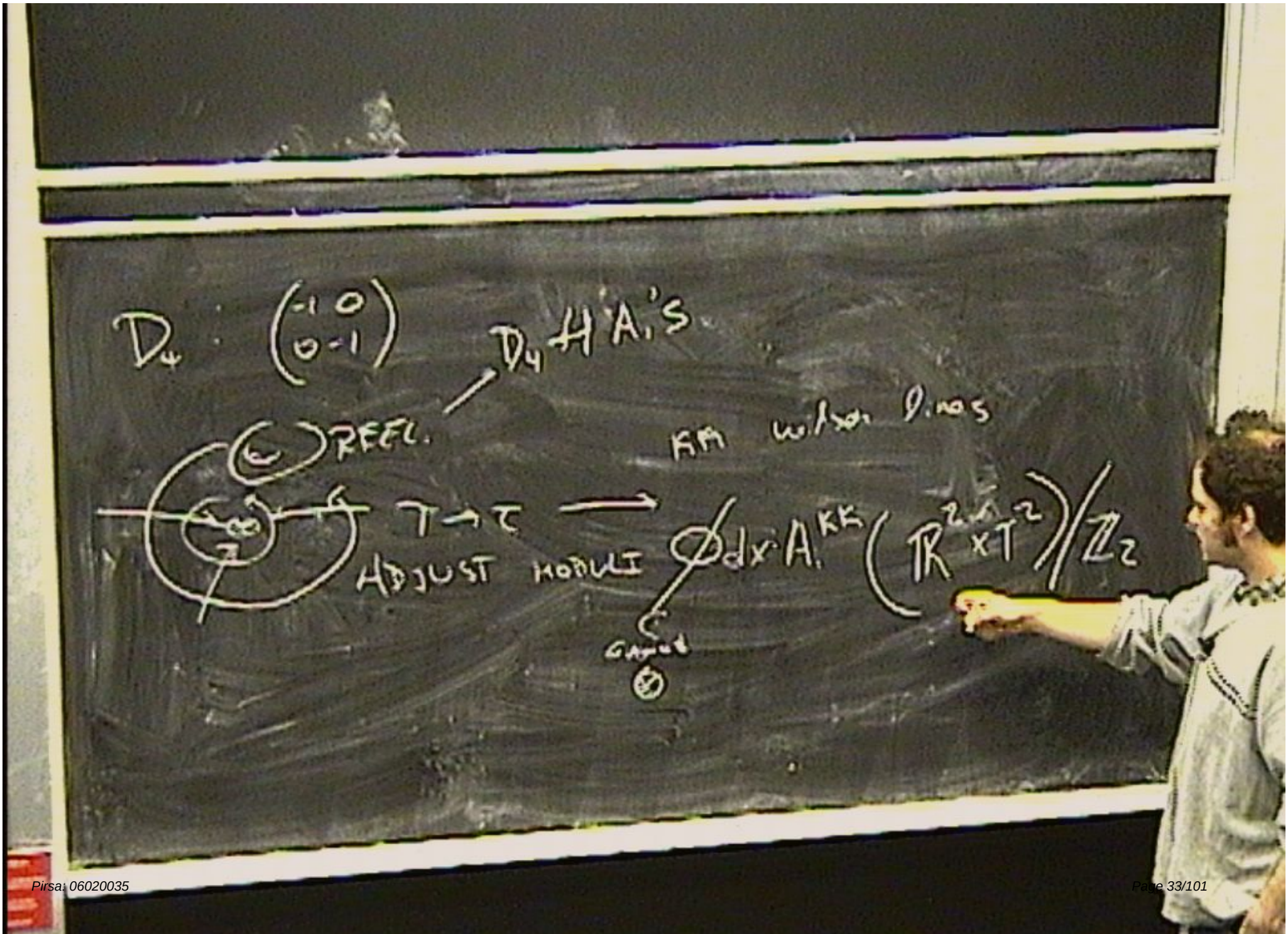
$D_4 : \begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$

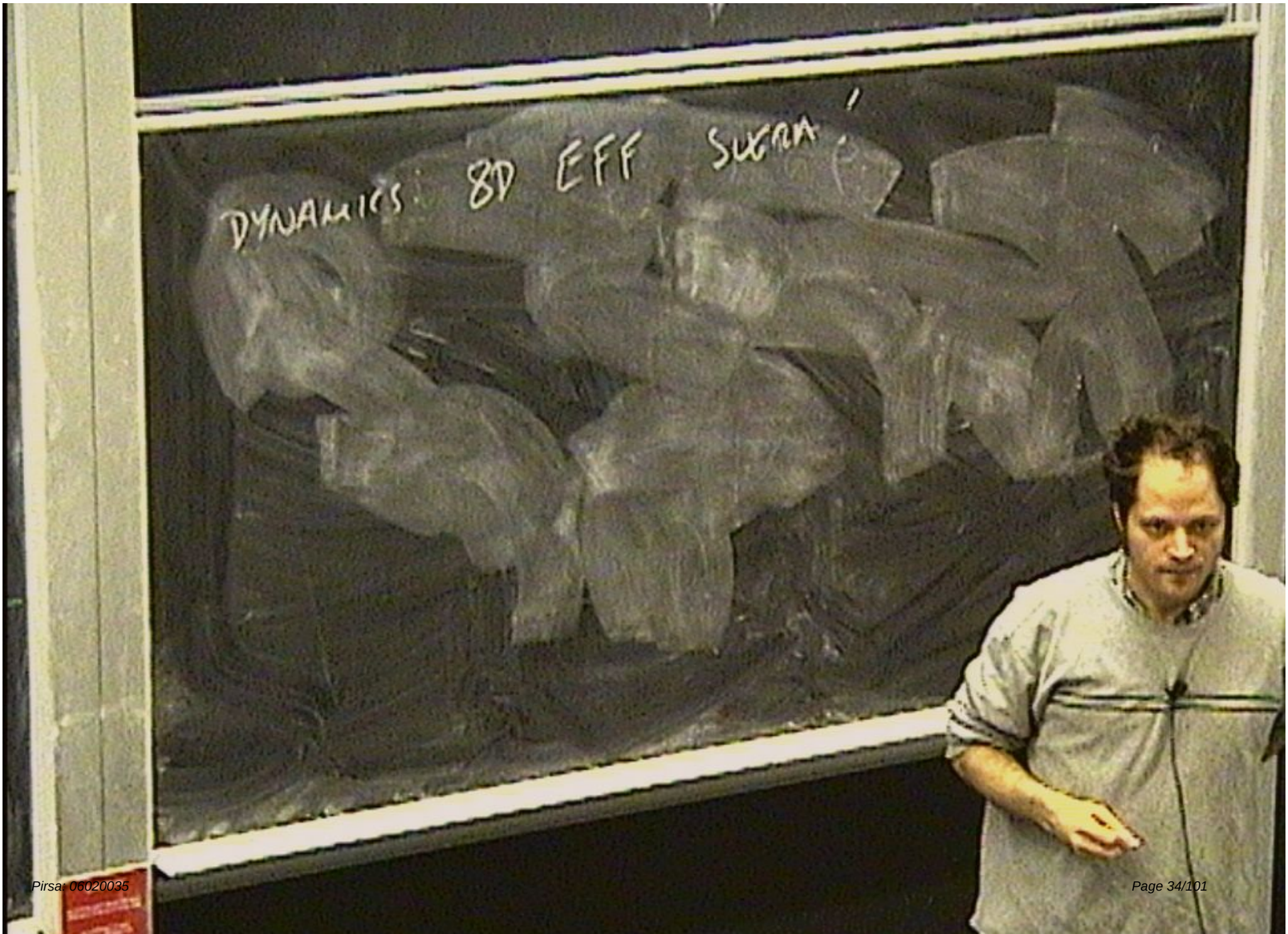


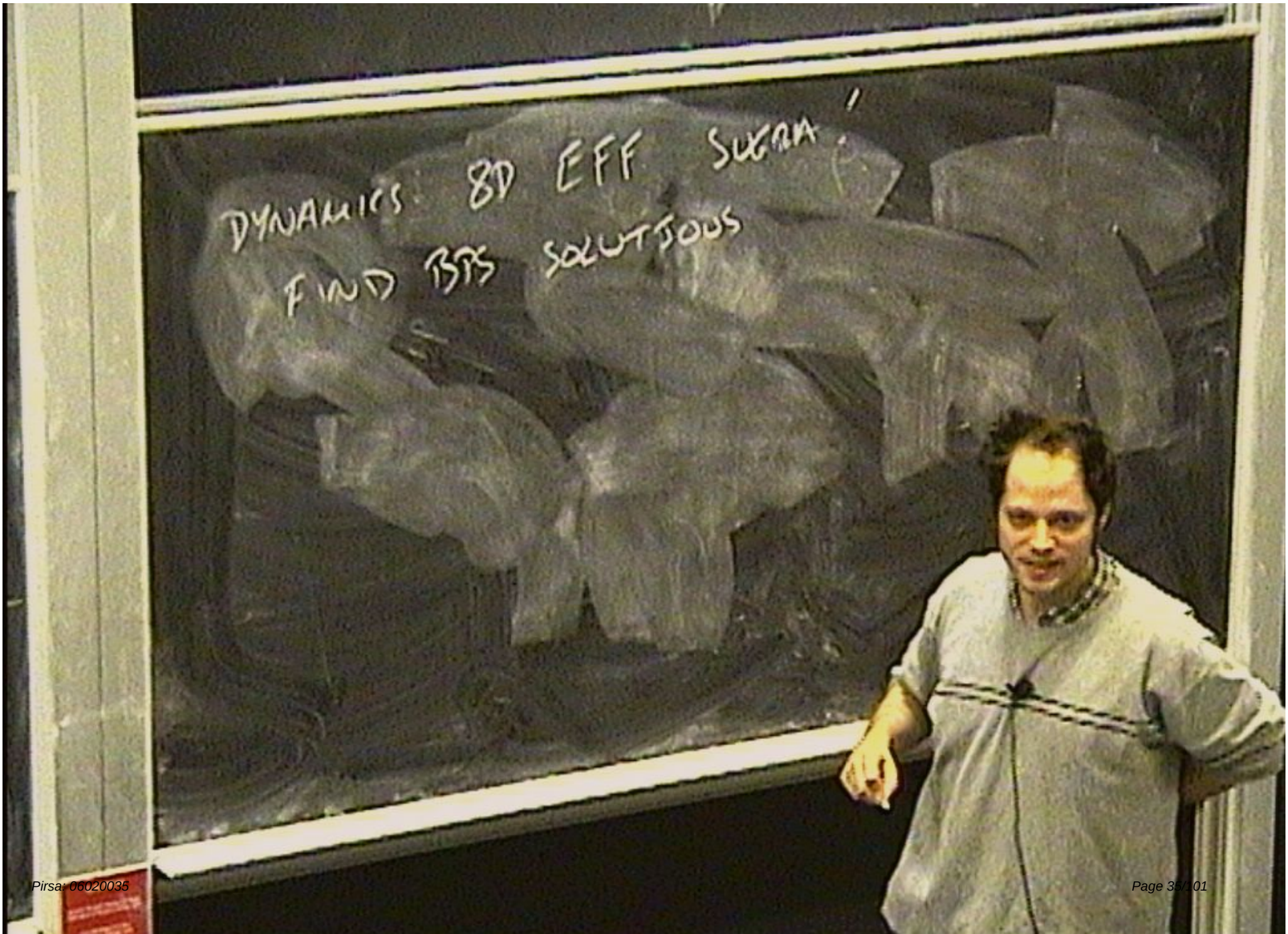
Am Wilson loops

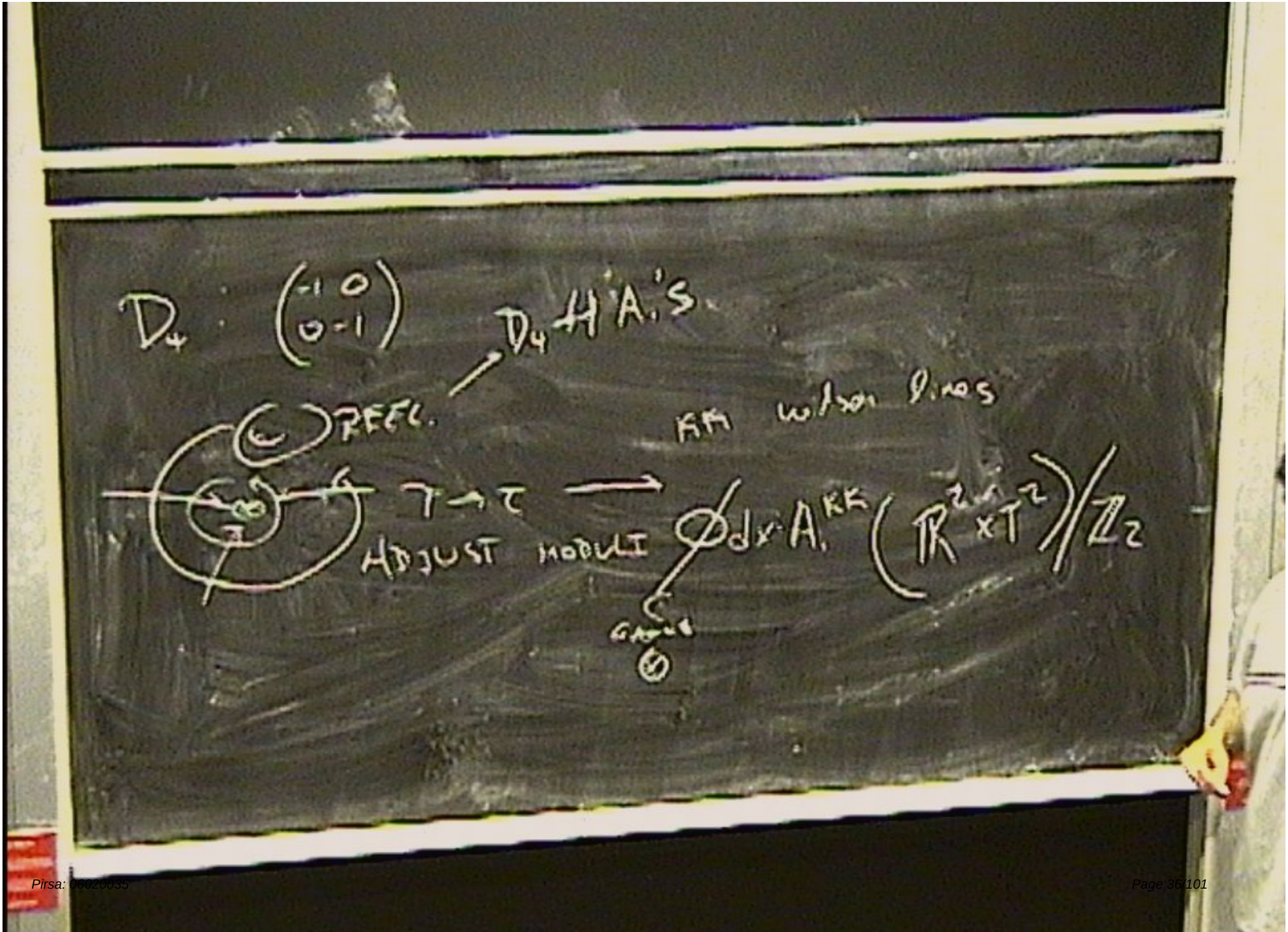

D_4 : $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$
REFL.
$\tau \to \tau$
ADJUST MODULI
Rm Wilson lines
$\oint dx^i A_i^{KK}$
ground

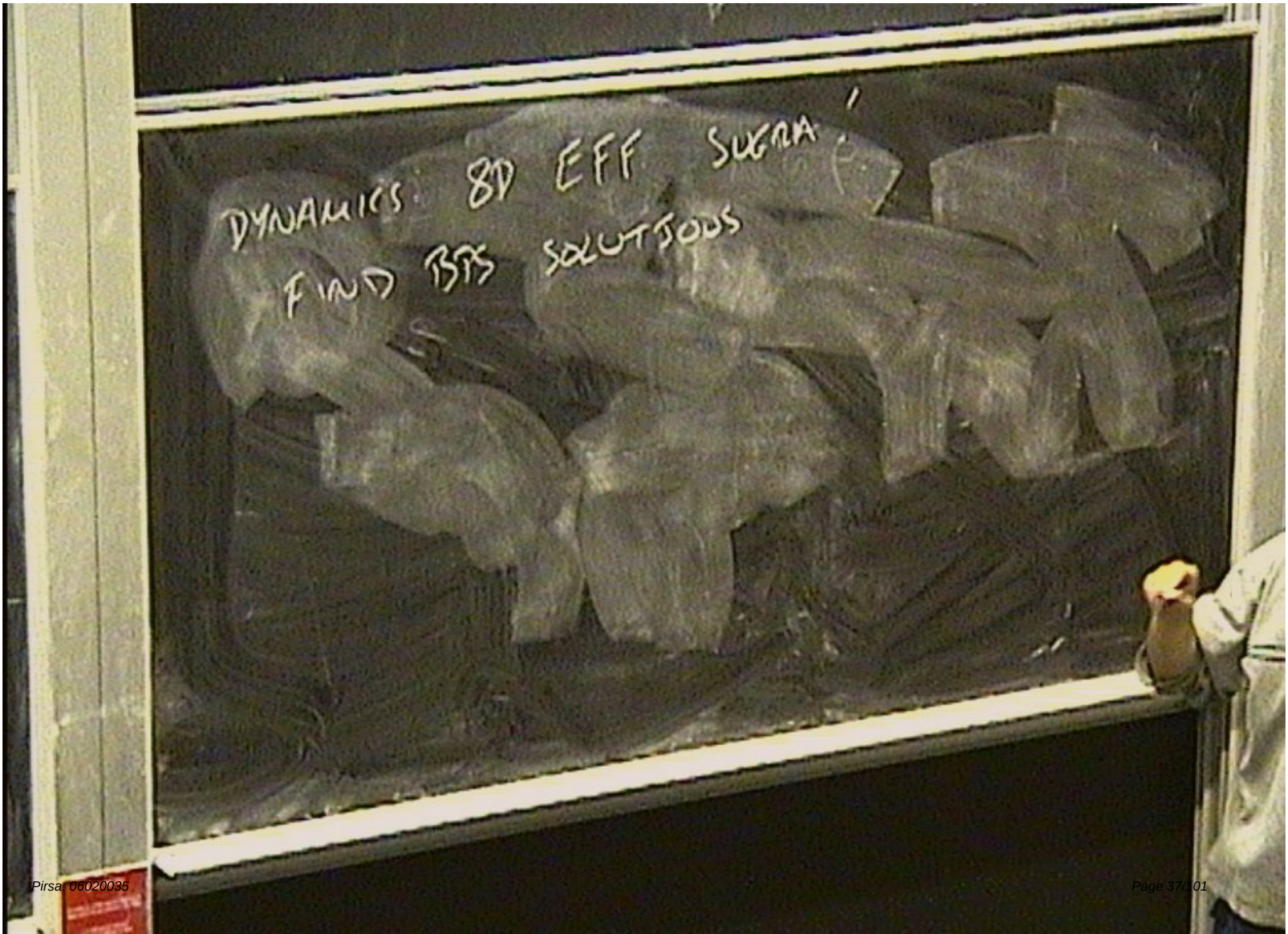

D_4 : $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$
D_4 4 H 'A.'s
REFL.
KK wilson l.nos
$T \to \tau$
ADJUST MODULI
$\oint dx \cdot A^{KK}$

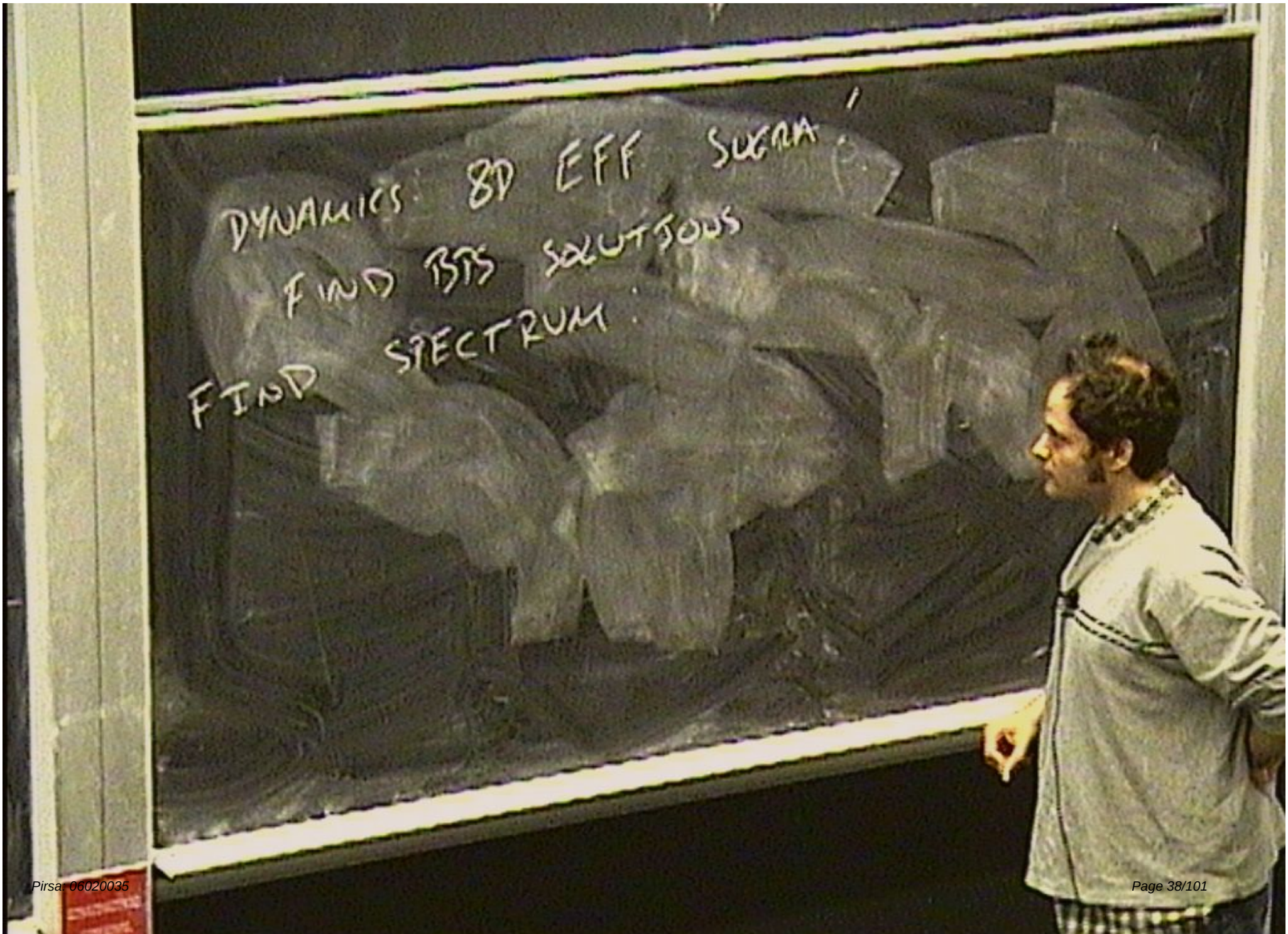

D_4 : $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$
D_4 H A.'s
REFL.
T → τ
ADJUST MODULI
$\oint dx \cdot A_\mu^{KK}$
$(TR^2 \times T^2)/\mathbb{Z}_2$

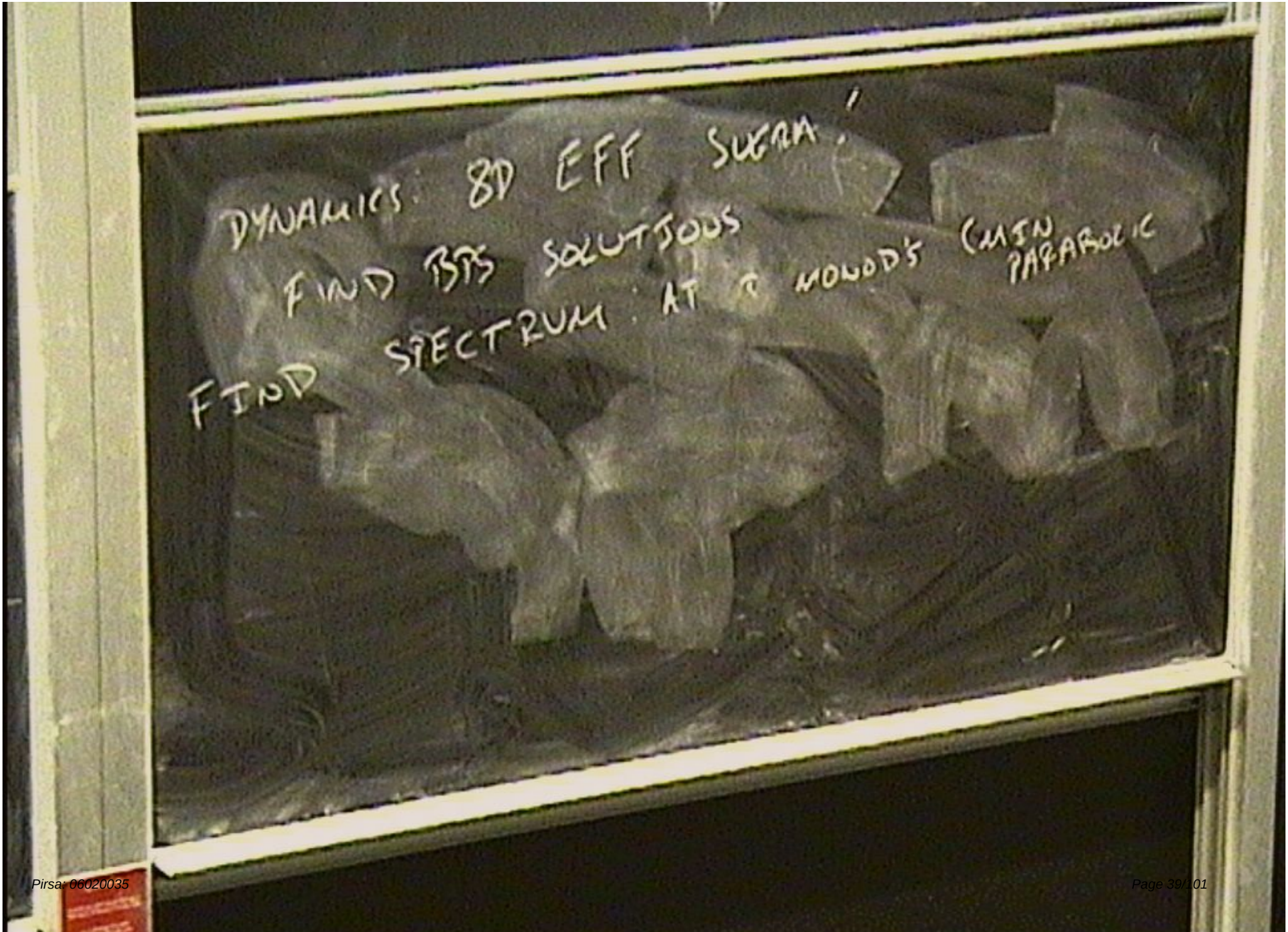

DYNAMICS: 8D EFF SUGRA

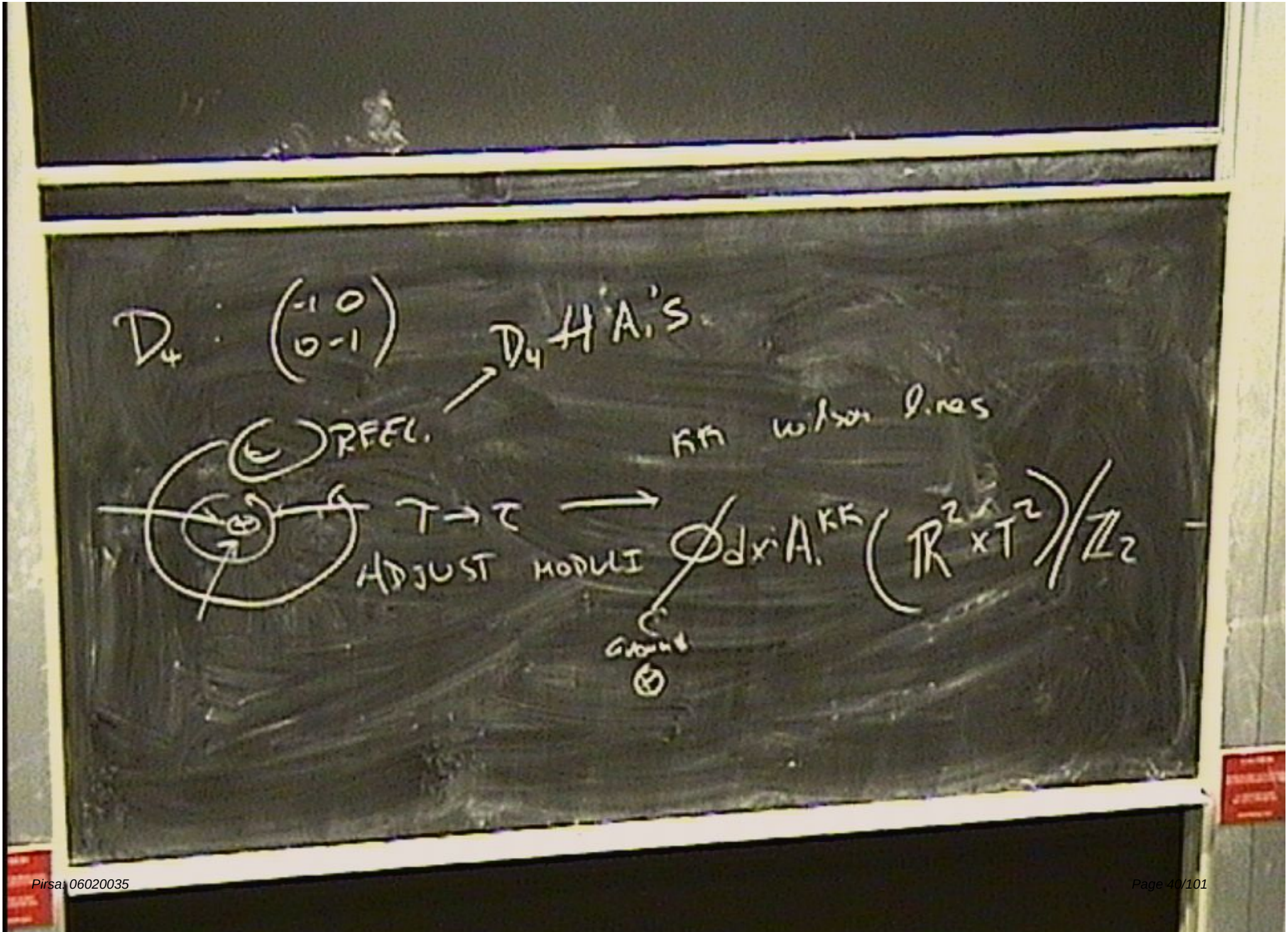

DYNAMICS 8D EFF SUGRA
FIND BPS SOLUTIONS

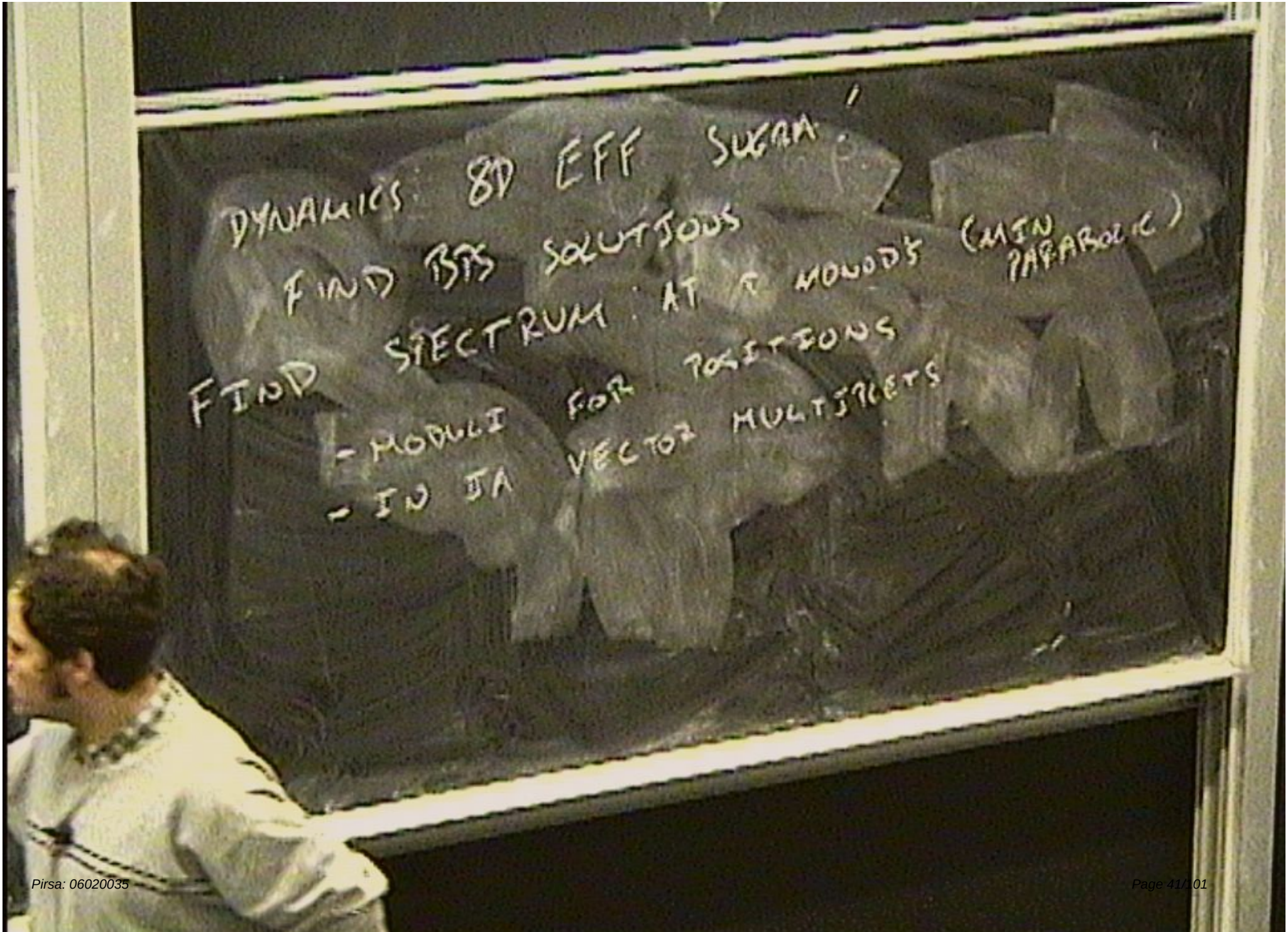

D_4 : $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$
D_4 H'A.'S.
REFL.
KK wilson lines
$\tau \to \tau$
ADJUST MODULI
$\int dx A_1^{KK}$
$(\mathbb{R}^2 \times T^2)/\mathbb{Z}_2$

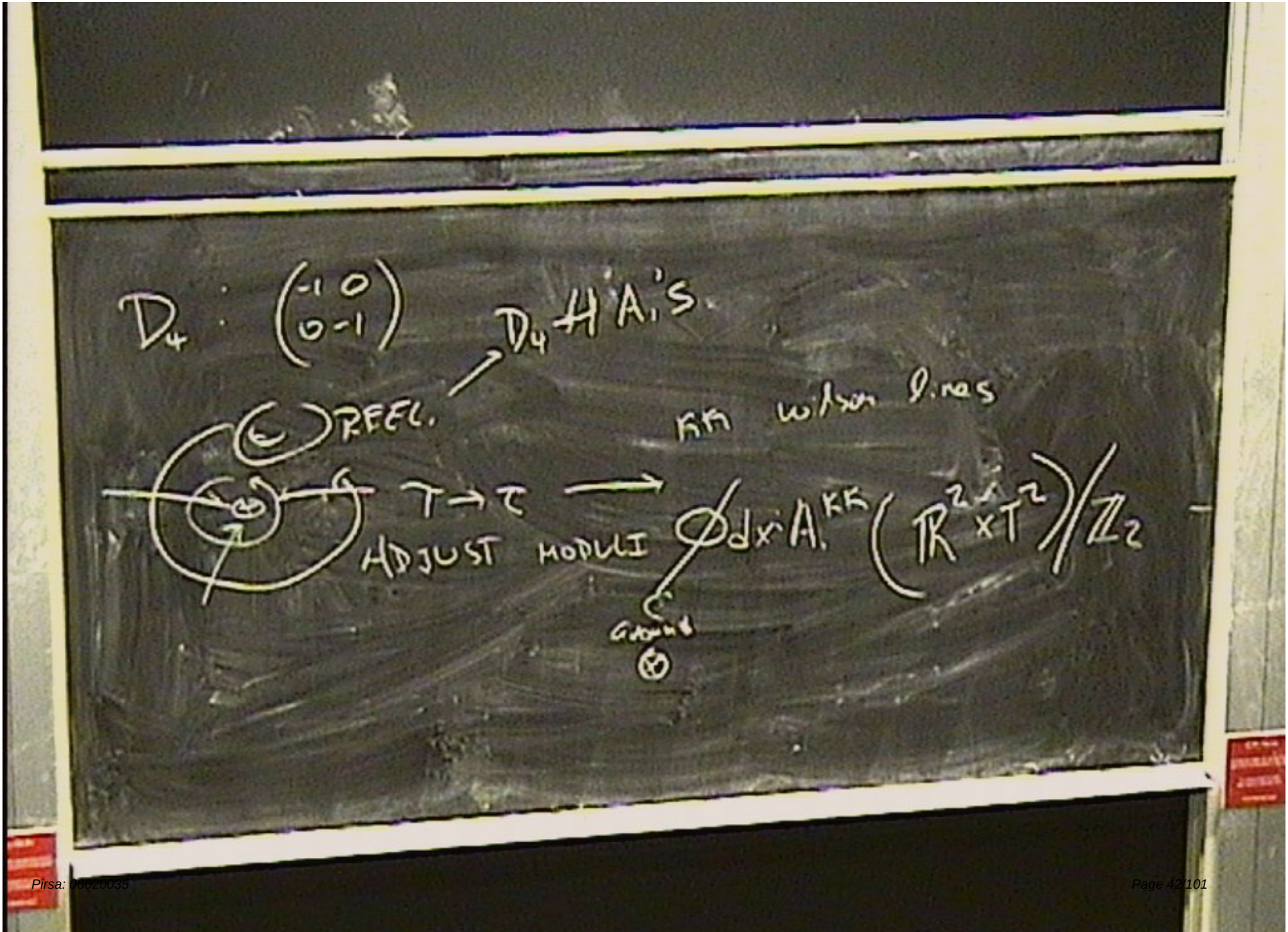

DYNAMICS 8D EFF SUGRA
FIND BPS SOLUTIONS

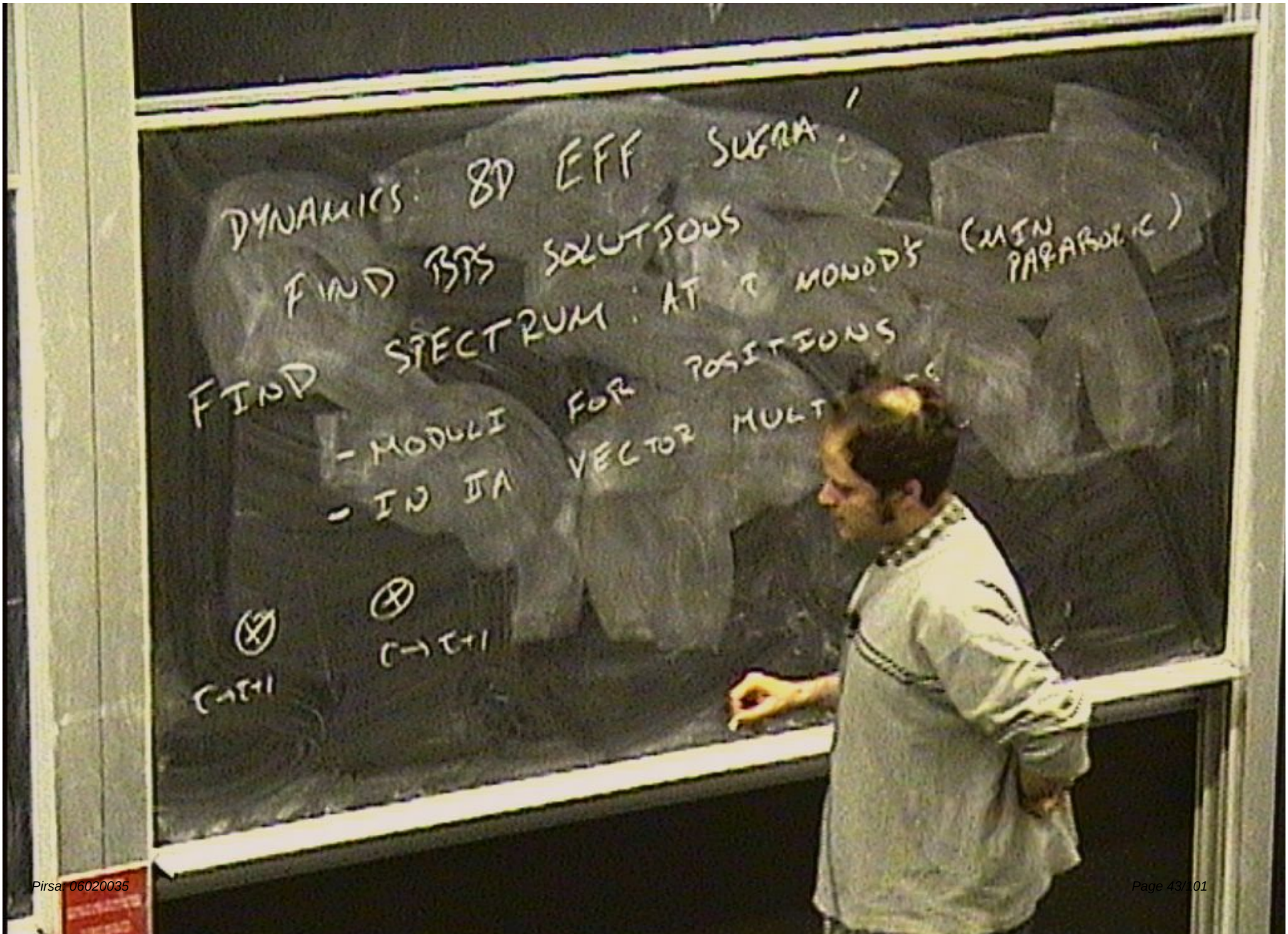

DYNAMICS 8D EFF SUGRA
FIND BPS SOLUTIONS
FIND SPECTRUM

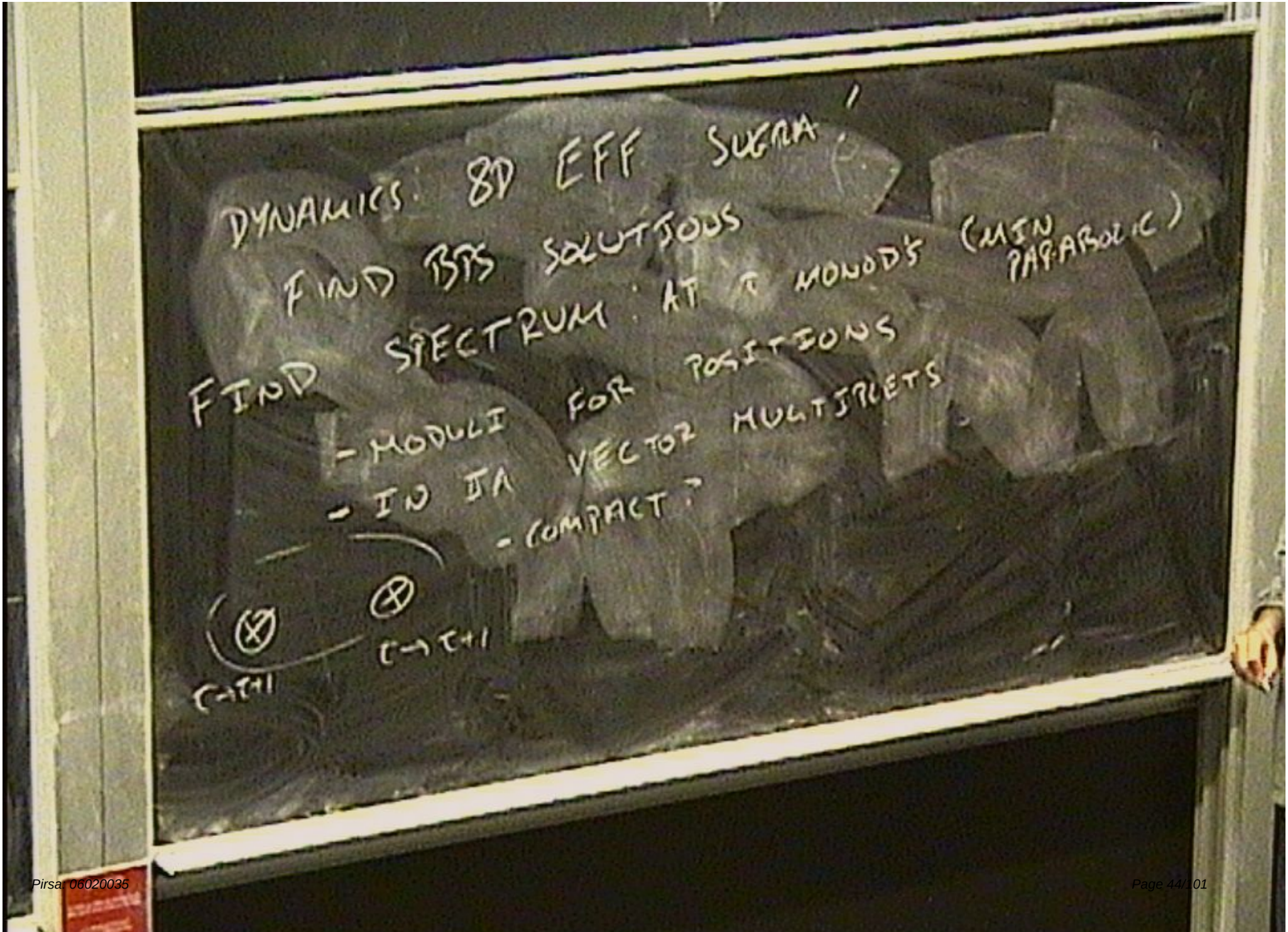

DYNAMICS: 8D EFF SUGRA!
FIND BPS SOLUTIONS
FIND SPECTRUM: AT ∞ MONOD'S CHAIN
PARABOLIC

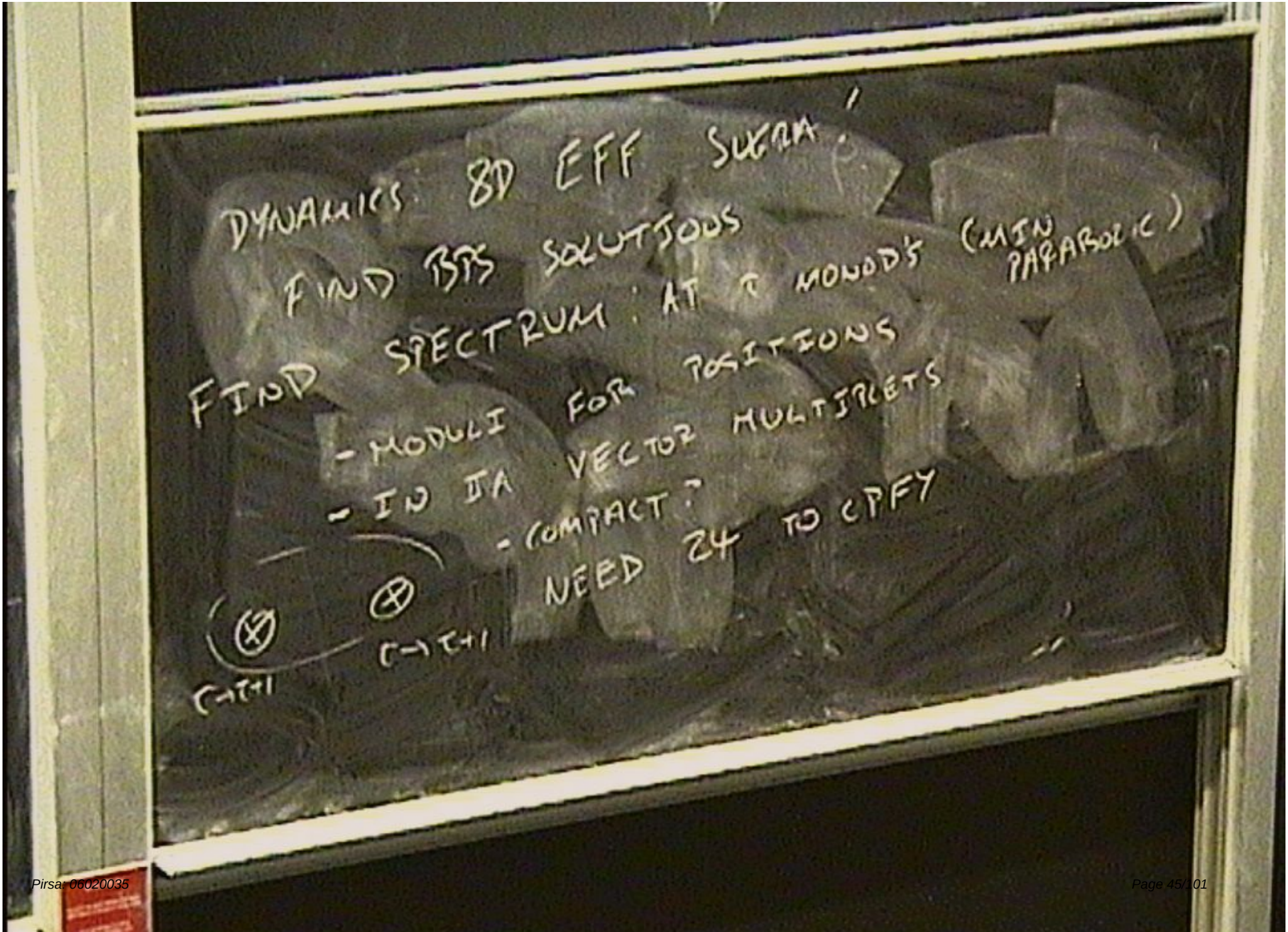

D_4 : $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$
D_4 H A.'s
REFL.
KK wilson lines
$T \to \tau$
ADJUST MODULI
$\oint dx A^{KK}$
$(\mathbb{R}^2 \times T^2)/\mathbb{Z}_2$
GROUND

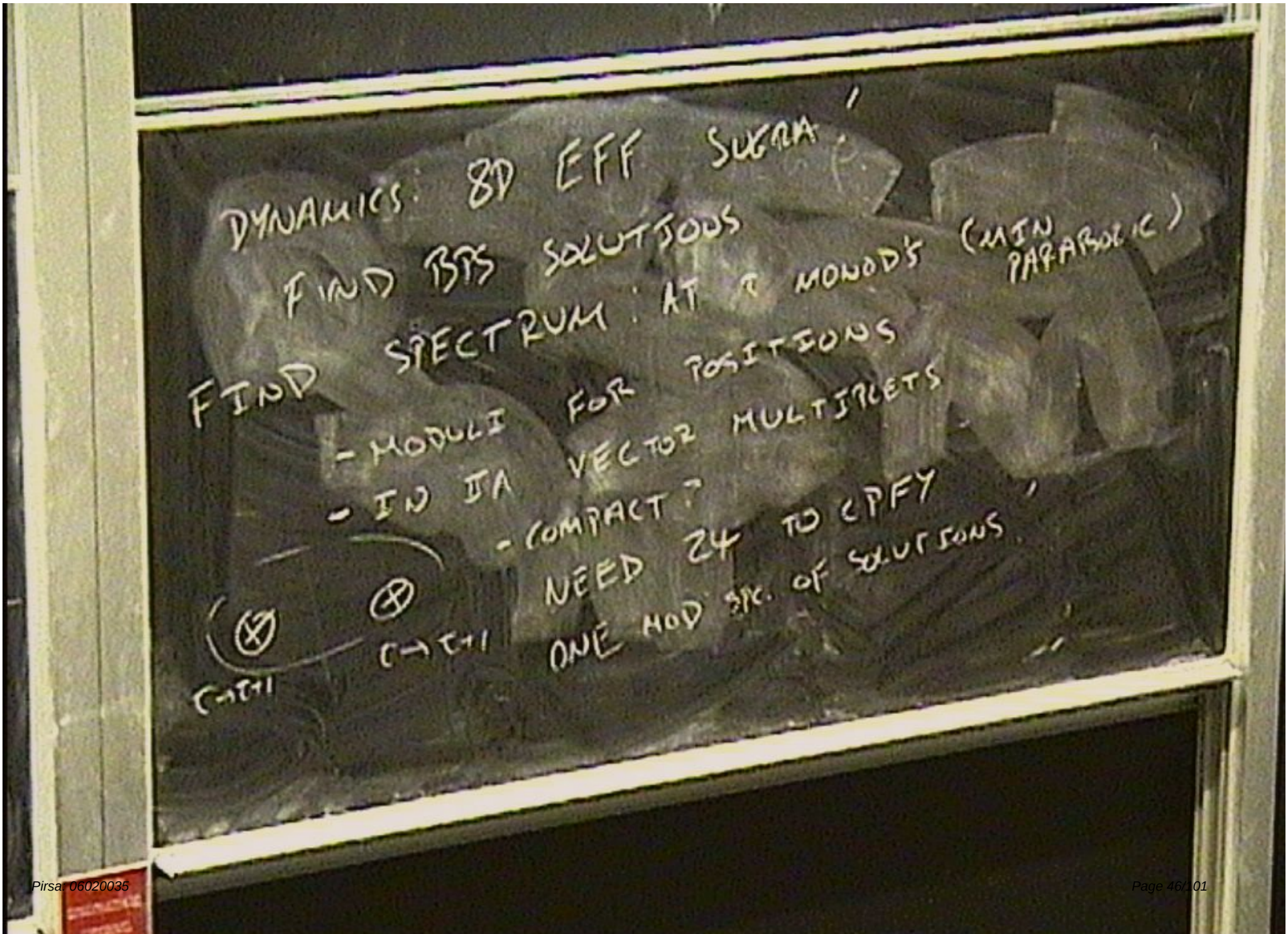

DYNAMICS 8D EFF SUGRA
FIND BPS SOLUTIONS
FIND SPECTRUM AT ∞ MODULI (MIN PARABOLIC)
- MODULI FOR POSITIONS
- IN IA VECTOR MULTIPLETS

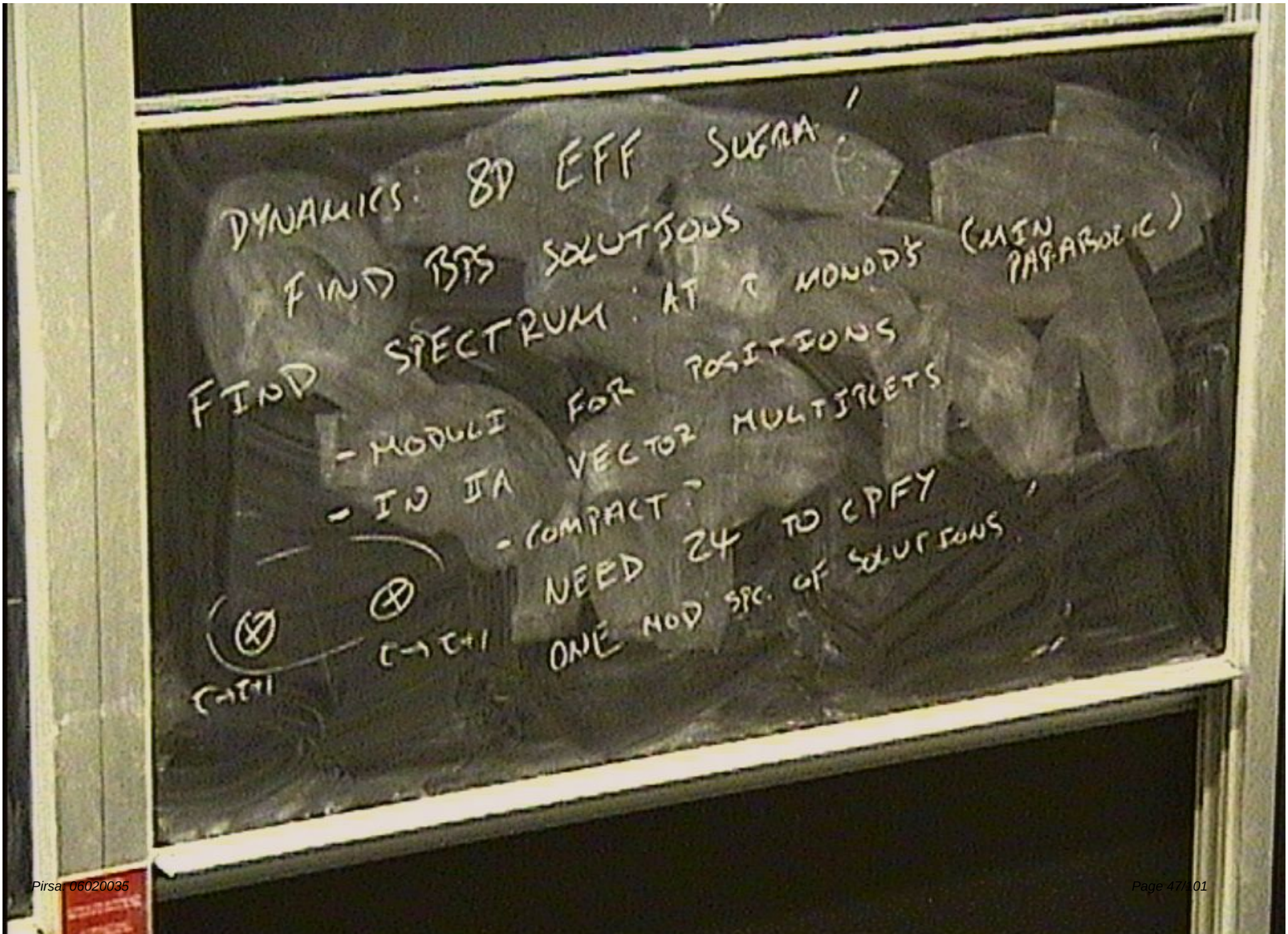

D_4 : $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$
D_4 H A.S.
REFL.
KK wilson l.nes
$T \to \tau$
ADJUST MODULI
$\oint dx A_1^{KK}$
$(\mathbb{R}^2 \times T^2)/\mathbb{Z}_2$
ground

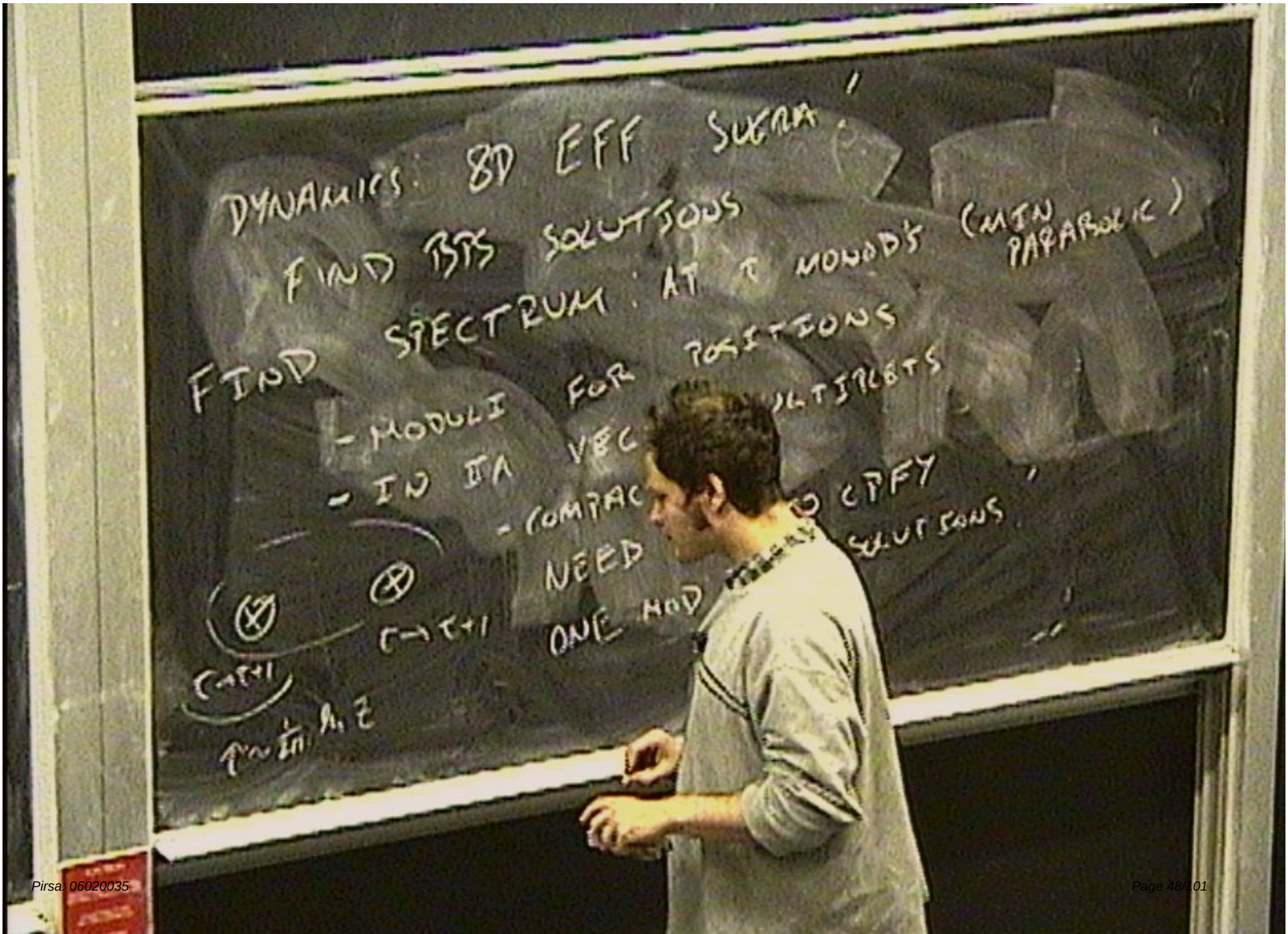

DYNAMICS: 8D EFF SUGRA!
FIND BPS SOLUTIONS
FIND SPECTRUM: AT ∞ MONOD'S (MIN PARABOLIC)
- MODULI FOR POSITIONS
- IN IIA VECTOR MULT
C→C+1
C→C+1

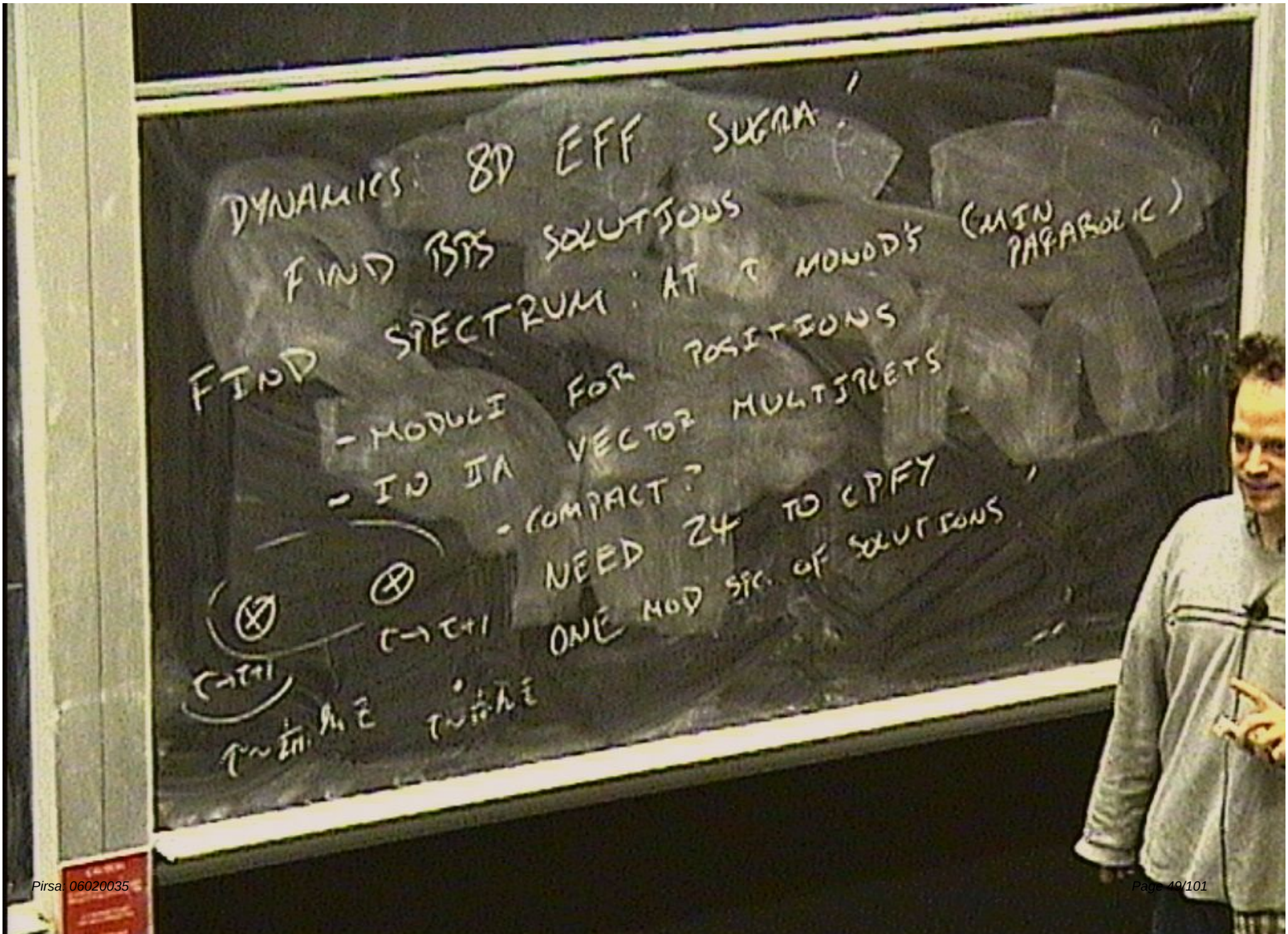

DYNAMICS: 8D EFF SUGRA!
FIND BPS SOLUTIONS
FIND SPECTRUM AT π MONOD'S (MIN PARABOLIC)
- MODULI FOR POSITIONS
- IN IIA VECTOR MULTIPLETS
- COMPACT?
C→C+1
C→C+1

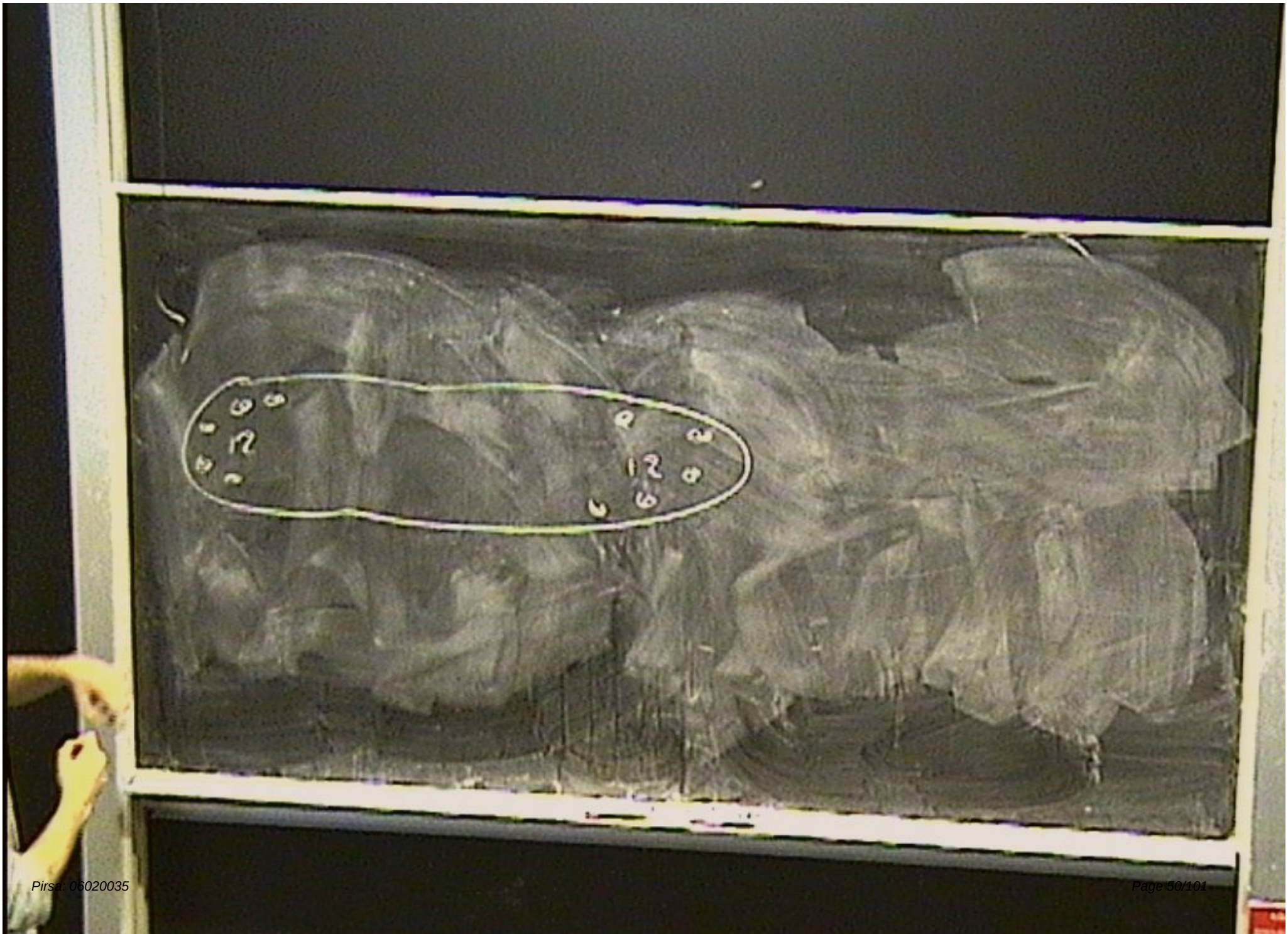

DYNAMICS 8D EFF SUGRA!
FIND BPS SOLUTIONS
FIND SPECTRUM: AT π MOND'S (MIN PARABOLIC)
- MODULI FOR POSITIONS
- IN IIA VECTOR MULTIPLETS
- COMPACT?
NEED 24 TO CPFY
C→C+1
C→C+1

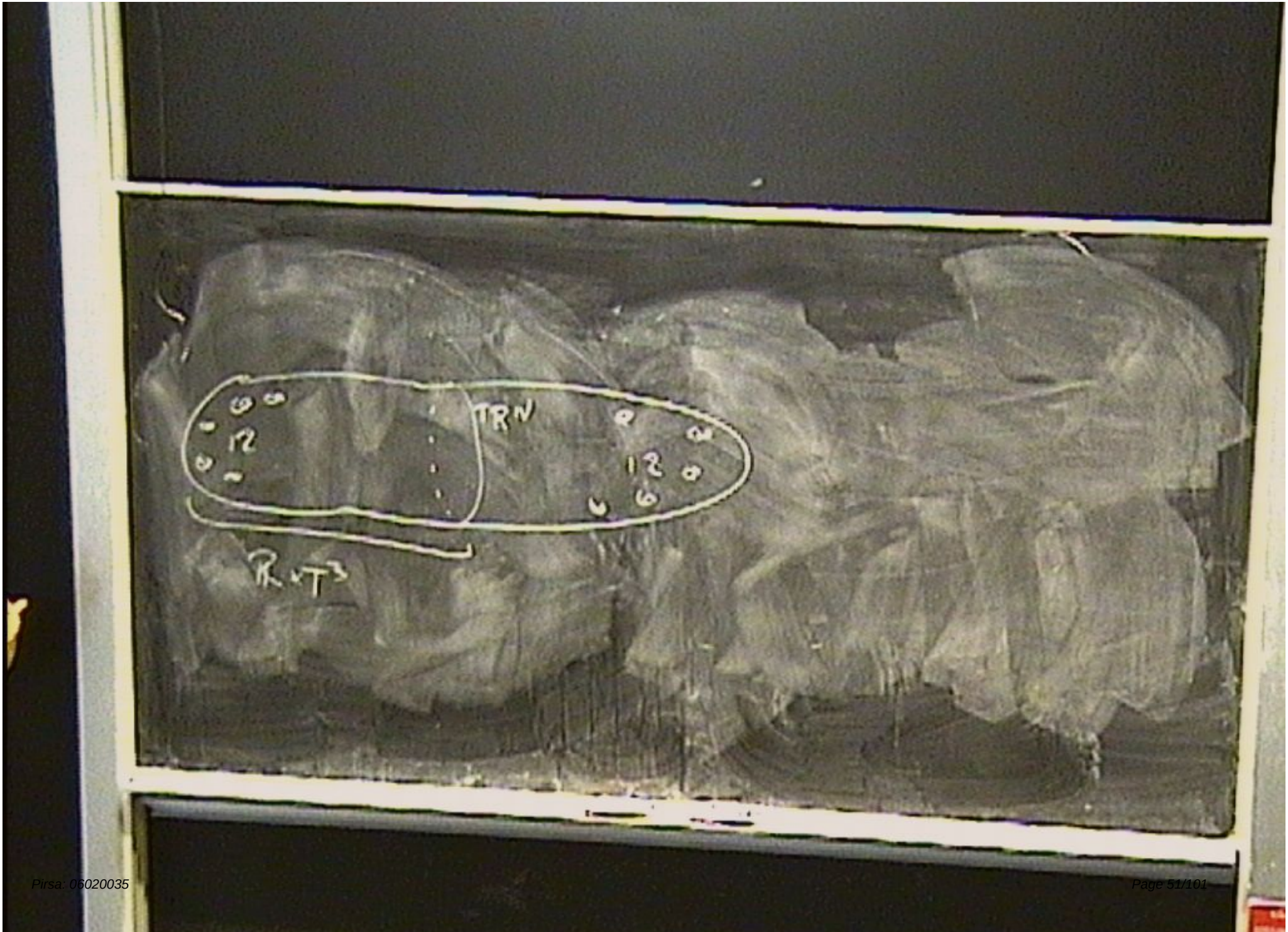

DYNAMICS: 8D EFF SUGRA
FIND BPS SOLUTIONS
FIND SPECTRUM: AT ∞ MONOD'S (MAIN PARABOLIC)
- MODULI FOR POSITIONS
- IN IIA VECTOR MULTIPLETS
- COMPACT?
NEED 24 TO CPFY
ONE MOD SPC. OF SOLUTIONS
C→C+1
C→C+1

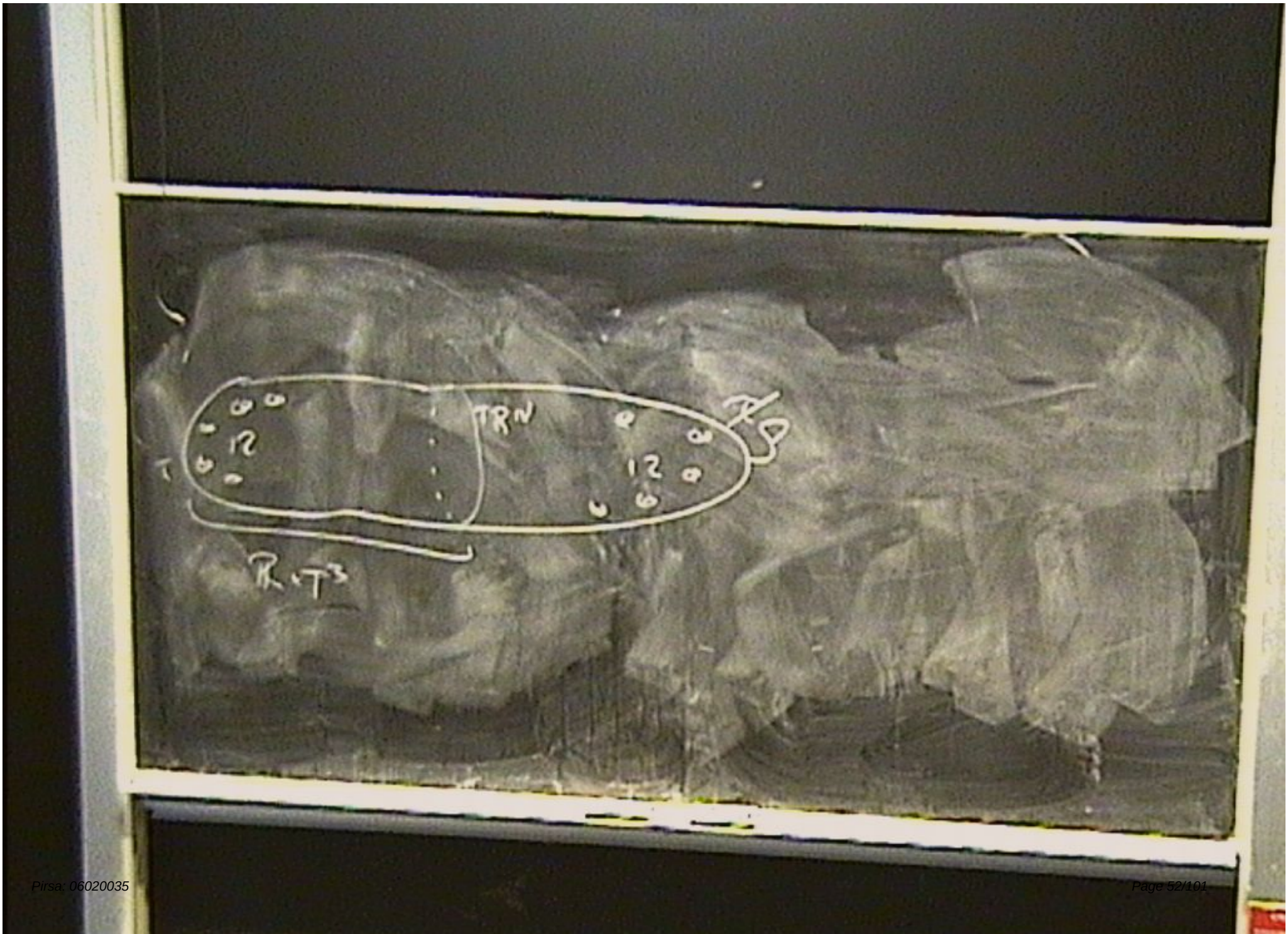

DYNAMICS: 8D EFF SUGRA!
FIND BPS SOLUTIONS
FIND SPECTRUM: AT ∞ MONOD'S (MIN PARABOLIC)
- MODULI FOR POSITIONS
- IN IIA VECTOR MULTIPLETS
- COMPACT?
NEED 24 TO CPFY
ONE MOD SPC. OF SOLUTIONS!
C→C+1
C→C+1

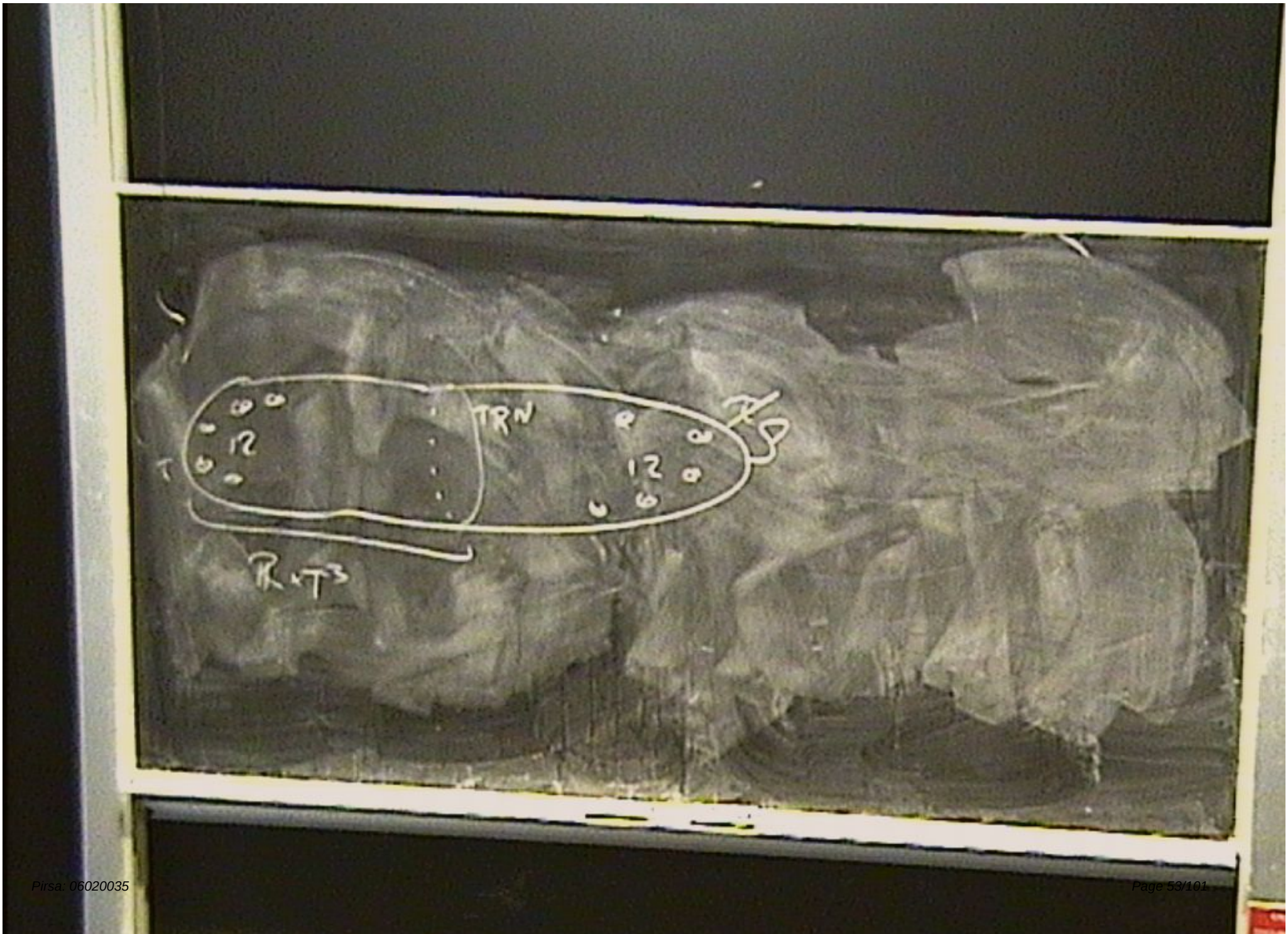

DYNAMICS: 8D EFF SUGRA
FIND BPS SOLUTIONS
FIND SPECTRUM: AT ∞ MONOD'S (MIN PARABOLIC)
- MODULI FOR POSITIONS
- IN IIA VEC
- COMPAC
NEED
ONE MOD
SOLUTIONS

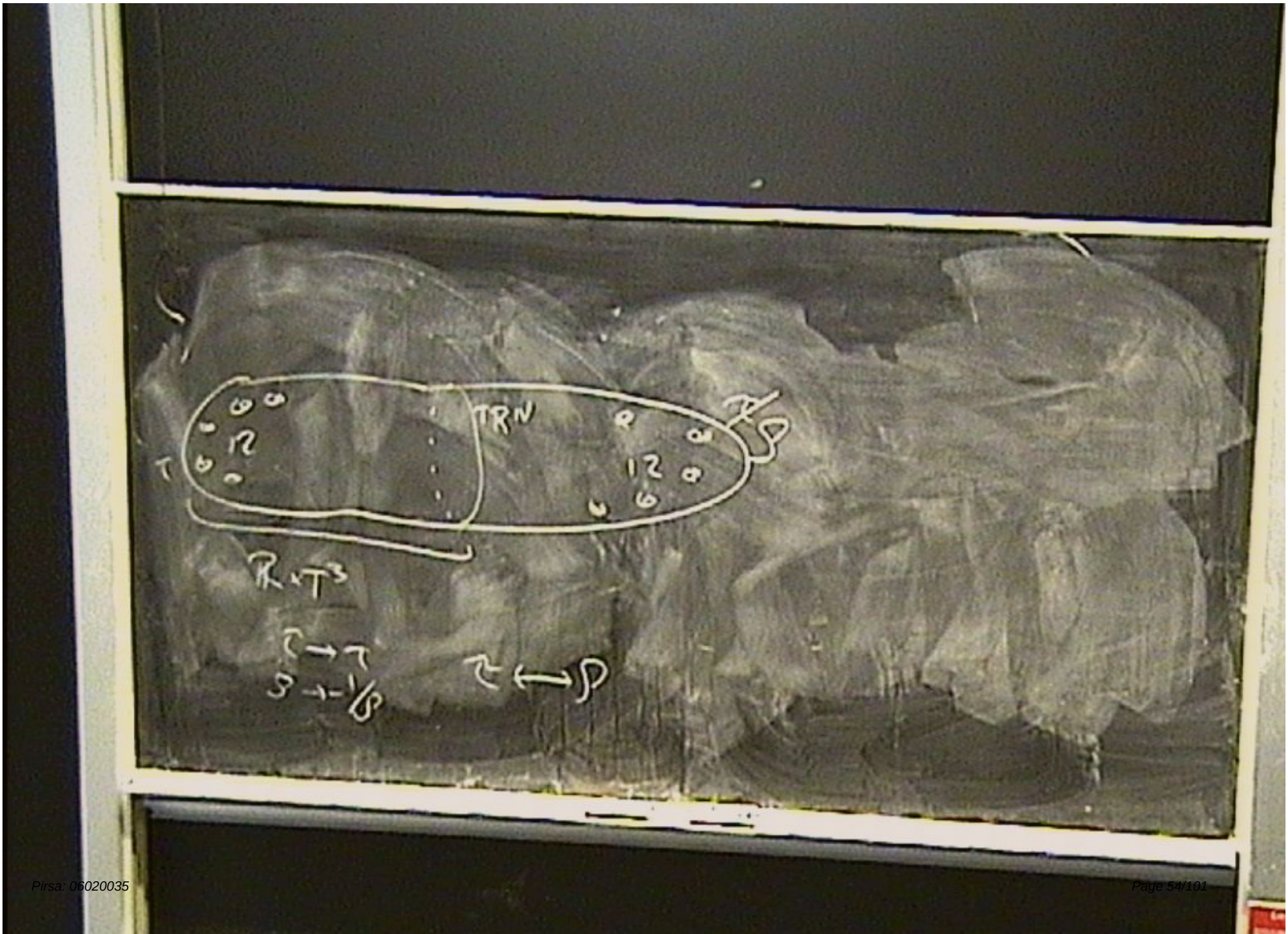

DYNAMICS: 8D EFF SUGRA
FIND BPS SOLUTIONS
FIND SPECTRUM AT ∞ MONOD'S (MIN PARABOLIC)
- MODULI FOR POSITIONS
- IN IIA VECTOR MULTIPLETS
- COMPACT?
NEED 24 TO CPFY
ONE MOD SPC OF SOLUTIONS
C→C+1
C→C+1
C→C+1

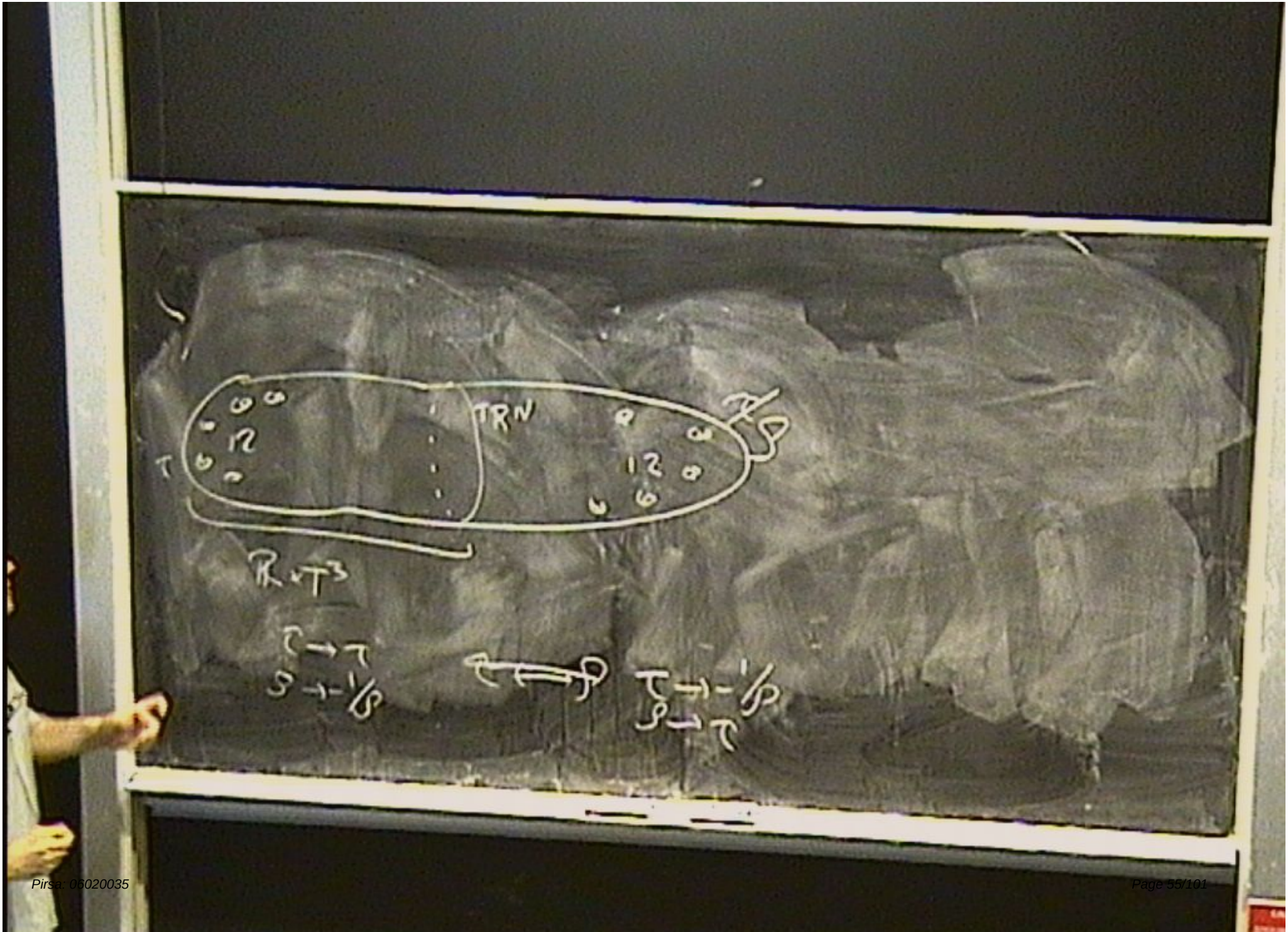


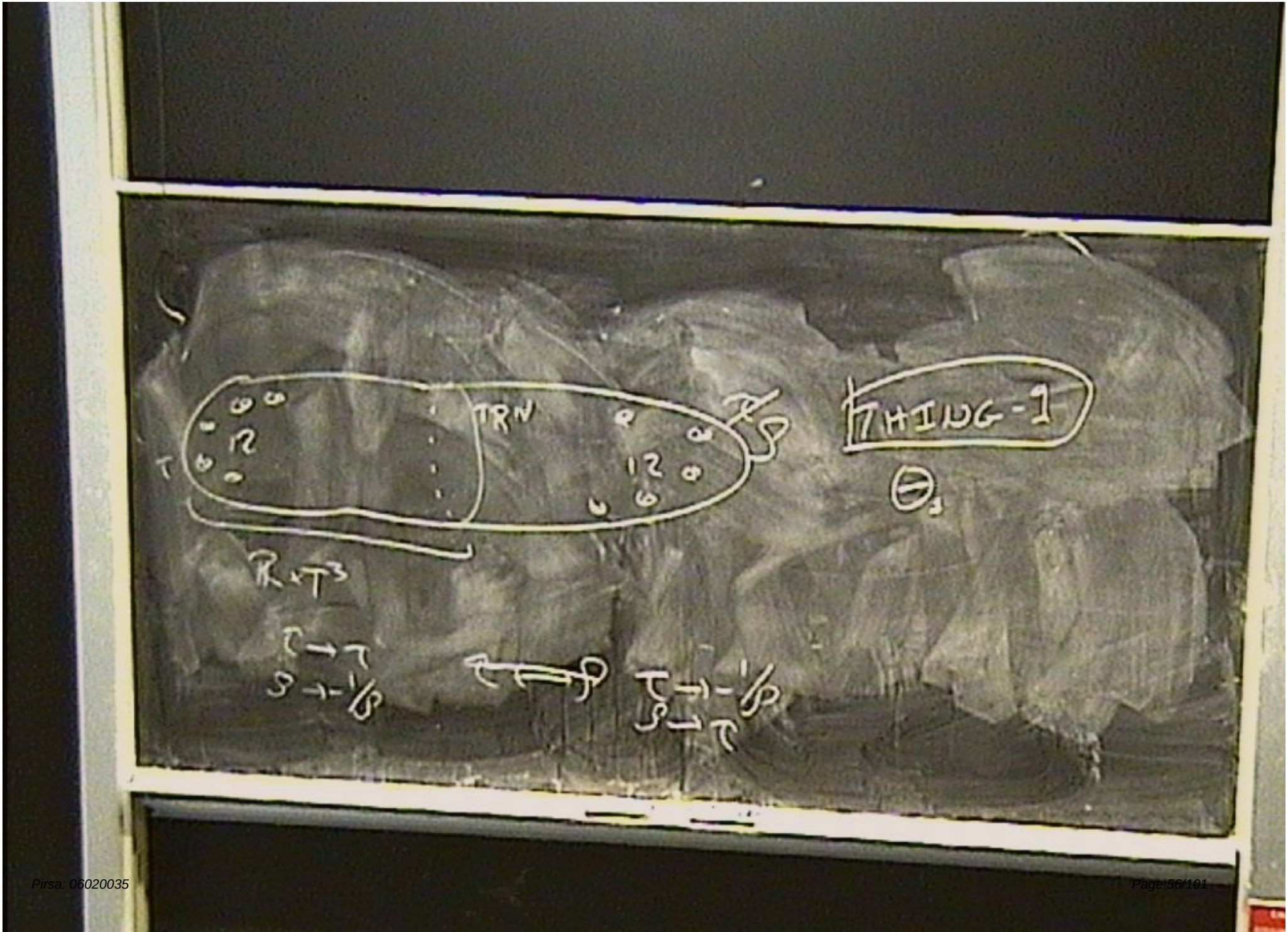

TRN
RxT³

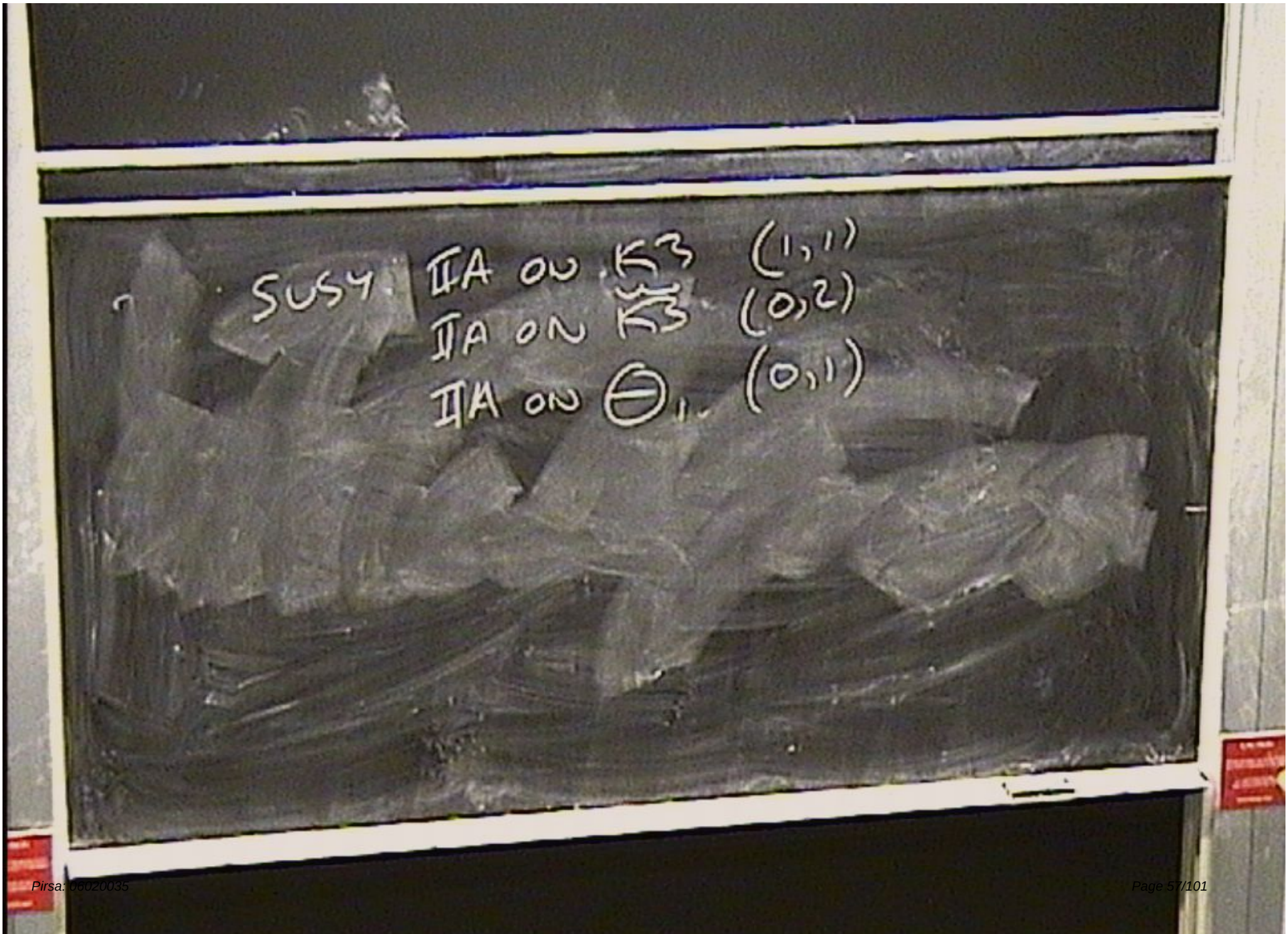

TRN
12
12
R × T³


12
TRN
12
$\mathbb{R}\times T^3$


TRN
$\mathbb{R} \times T^3$
$\tau \to \tau$
$\beta \to -1/\beta$
$\tau \longleftrightarrow \beta$

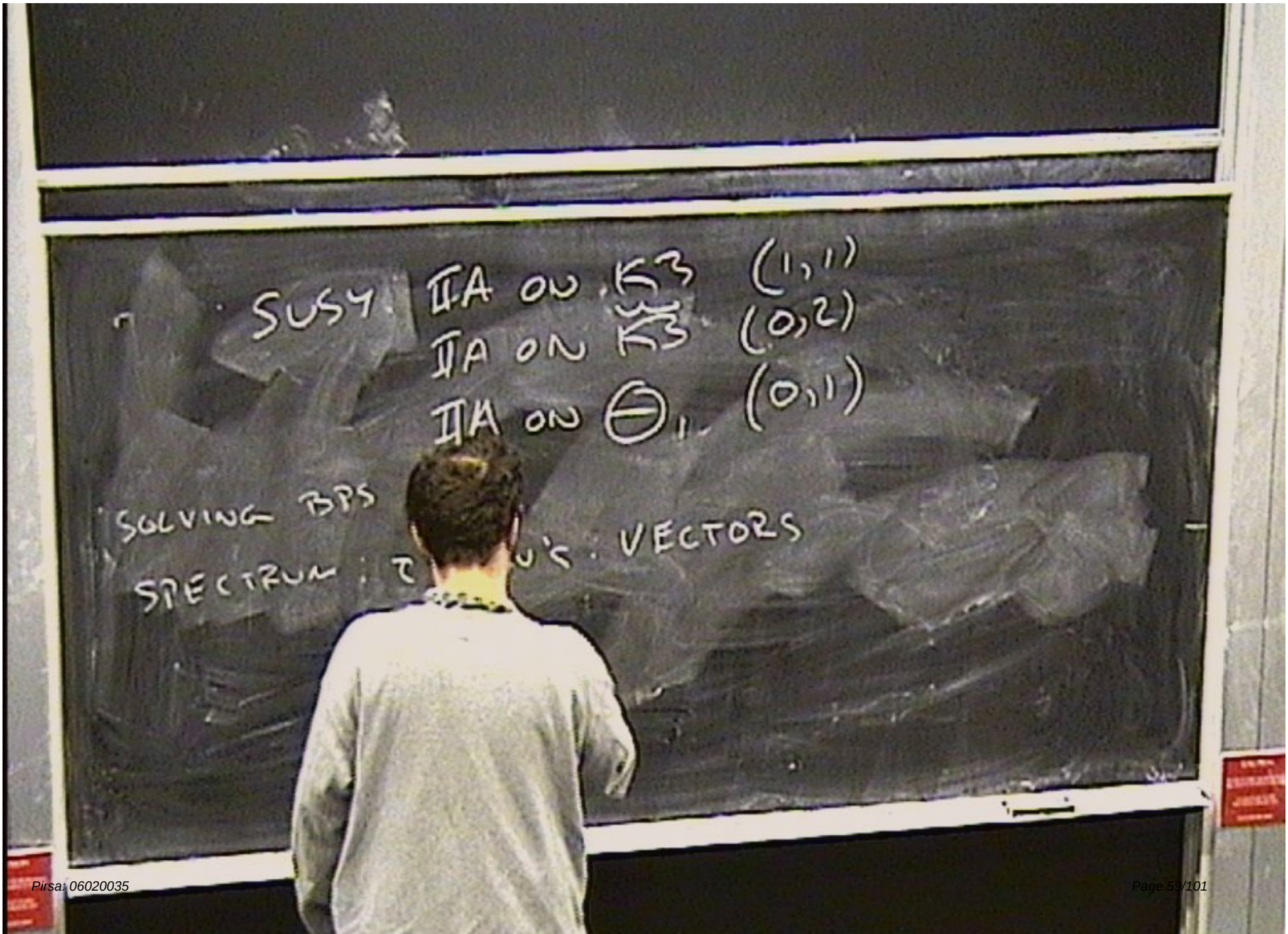

TRN
$\mathbb{R} \times T^3$
$\tau \to \tau$
$\beta \to -1/\beta$
$\tau \to -1/\beta$
$\beta \to \tau$


TRN
THING-1
Θ_1
$\mathbb{R}\times T^3$
$\tau \to \tau$
$s \to -1/s$
$\tau \to -1/s$
$s \to \tau$


SUSY
IIA on K3 (1,1)
IIA on K3 (0,2)
IIA on Θ1 (0,1)

SUSY: IIA on $K3$ (1,1)
IIA on $\overline{K3}$ (0,2)
IIA on $\ominus_1$ (0,1)

SOLVING BPS

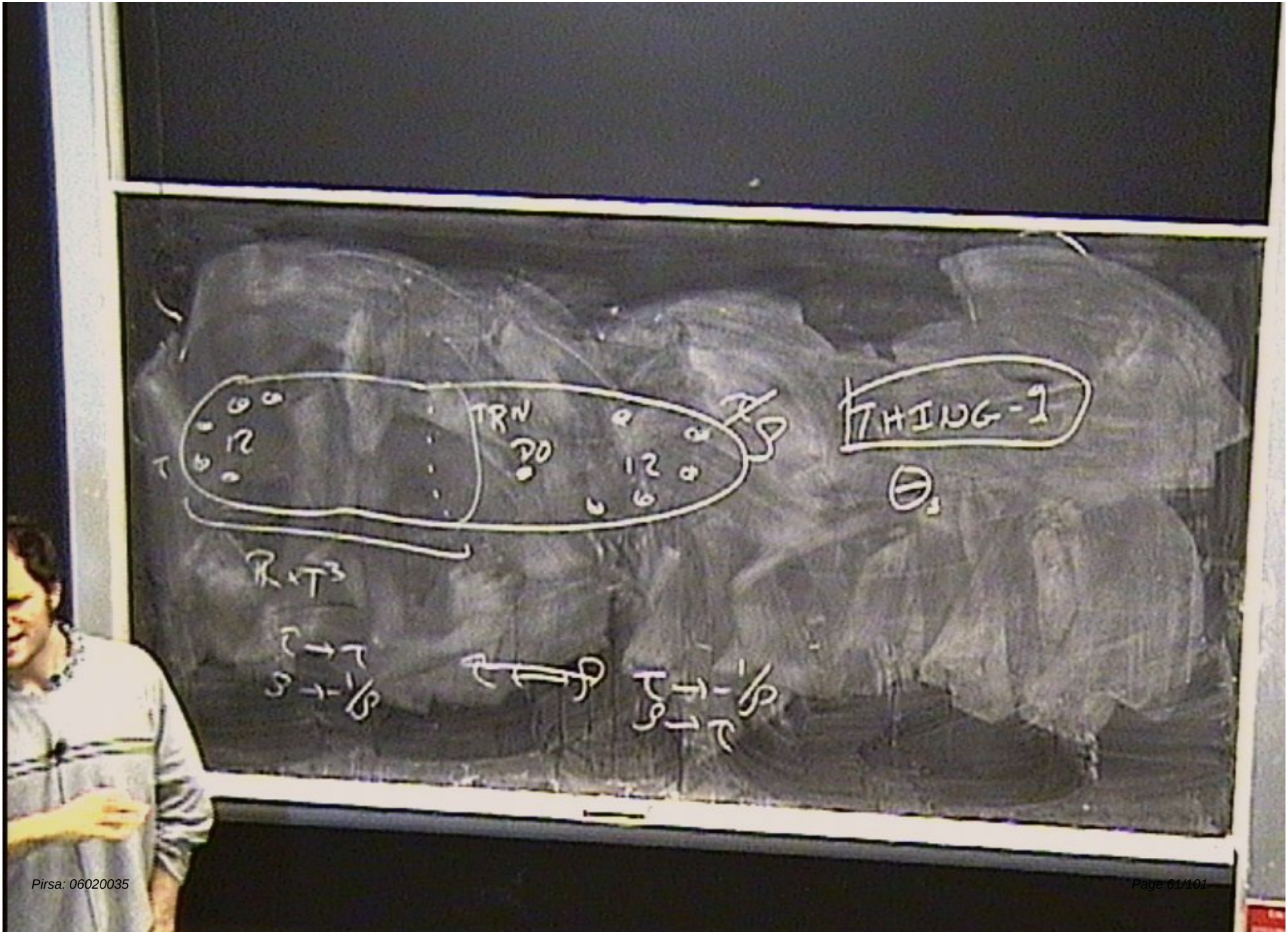

SUSY
IIA ON K3 (1,1)
IIA ON K3 (0,2)
IIA ON Θ (0,1)
SOLVING BPS
SPECTRUM : T U'S . VECTORS

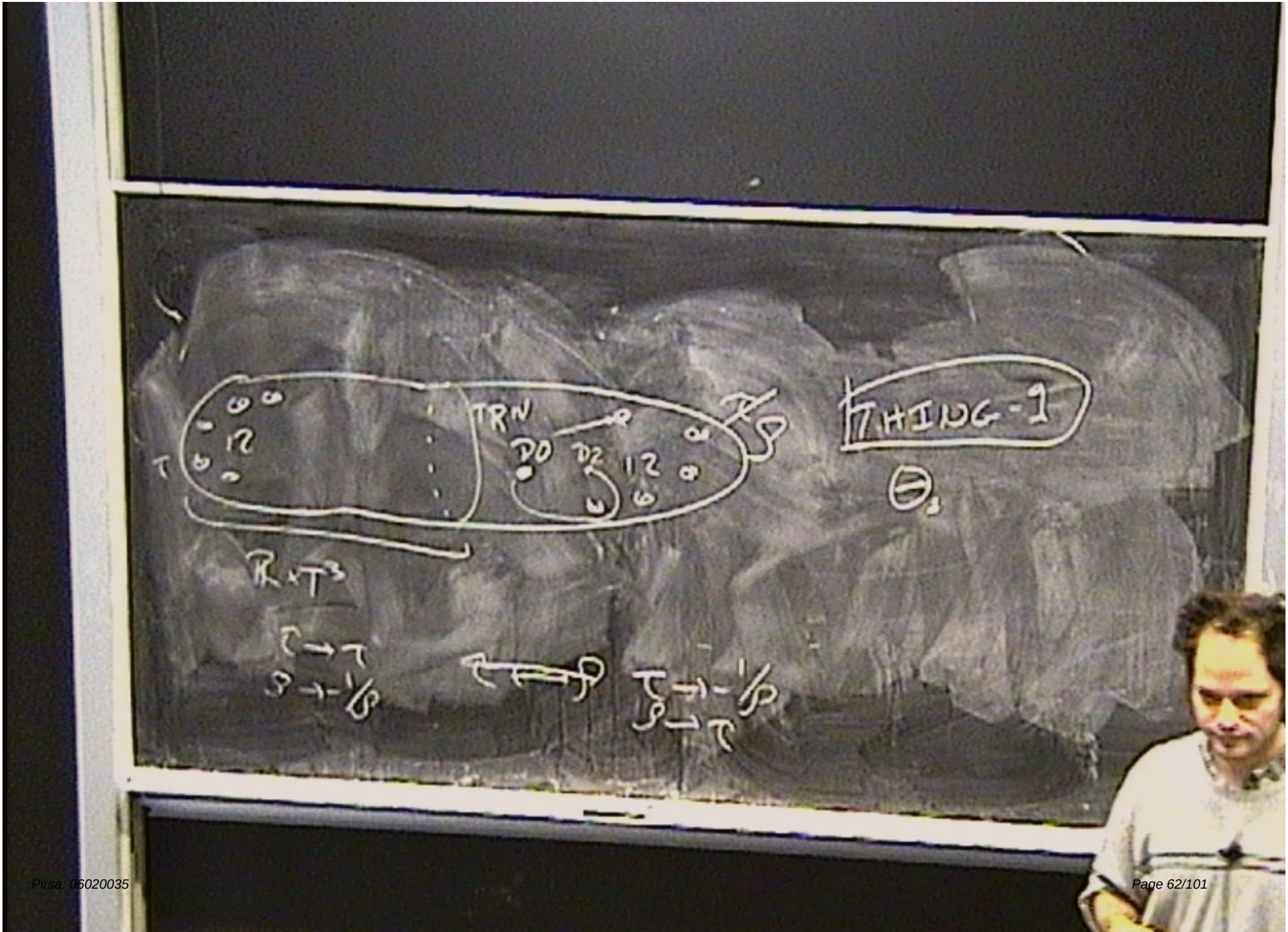
SUSY. IIA on K3 (1,1)
IIA on K3 (0,2)
IIA on $\mathbb{T}^4$ (0,1)

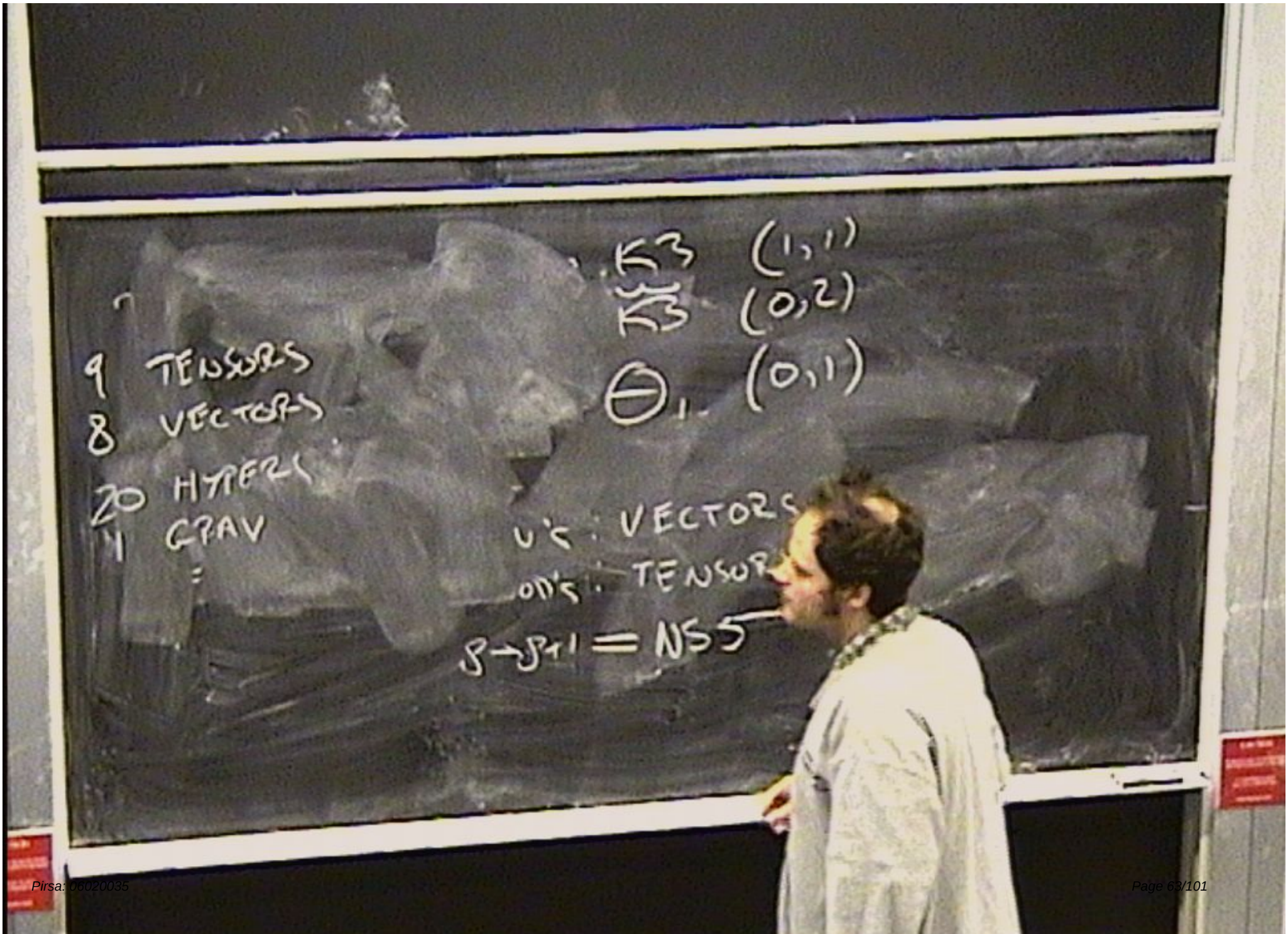
SOLVING BPS

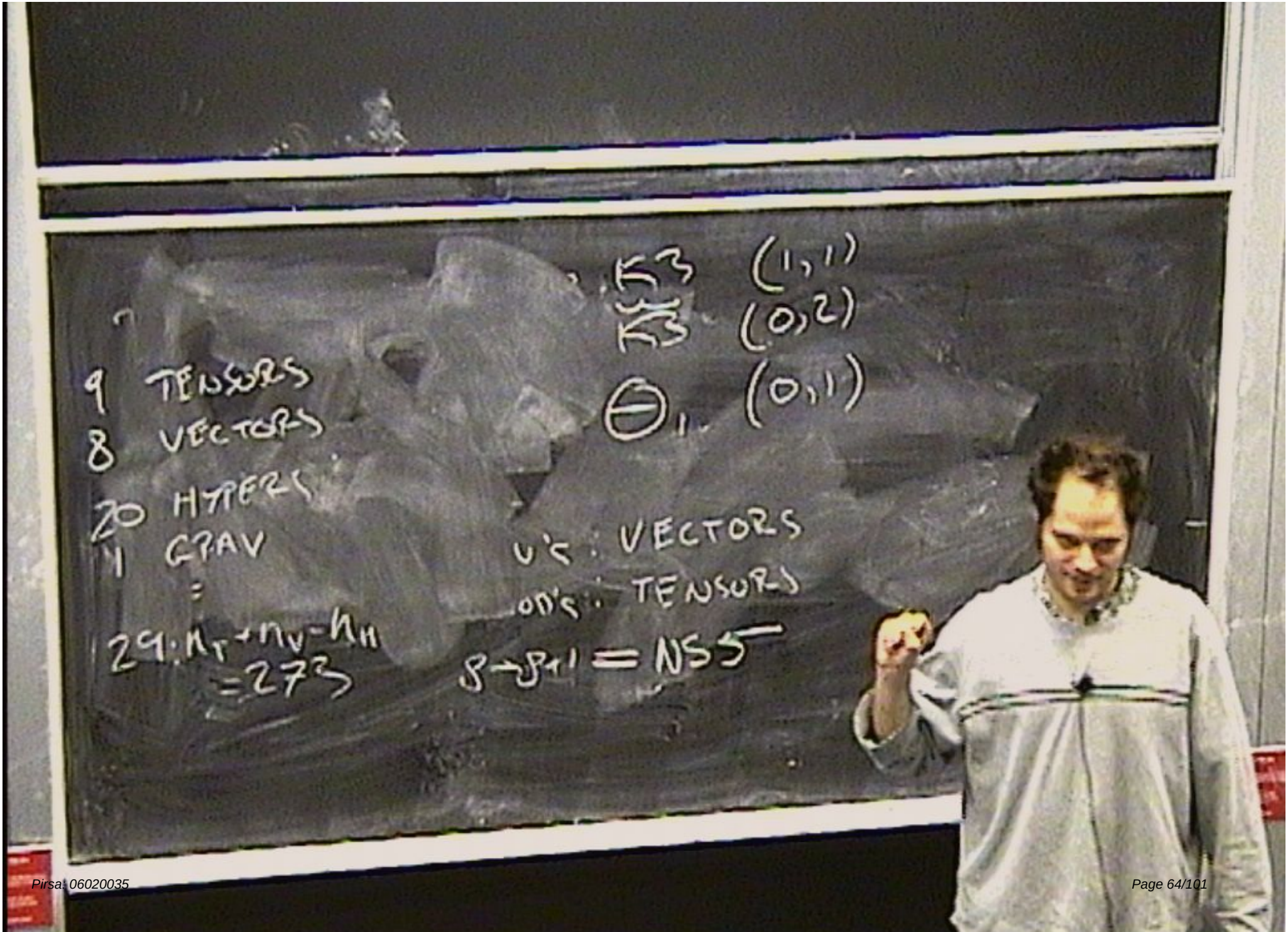
SPECTRUM: 8 MON'S: VECTORS
8 MONO'S: TENSORS

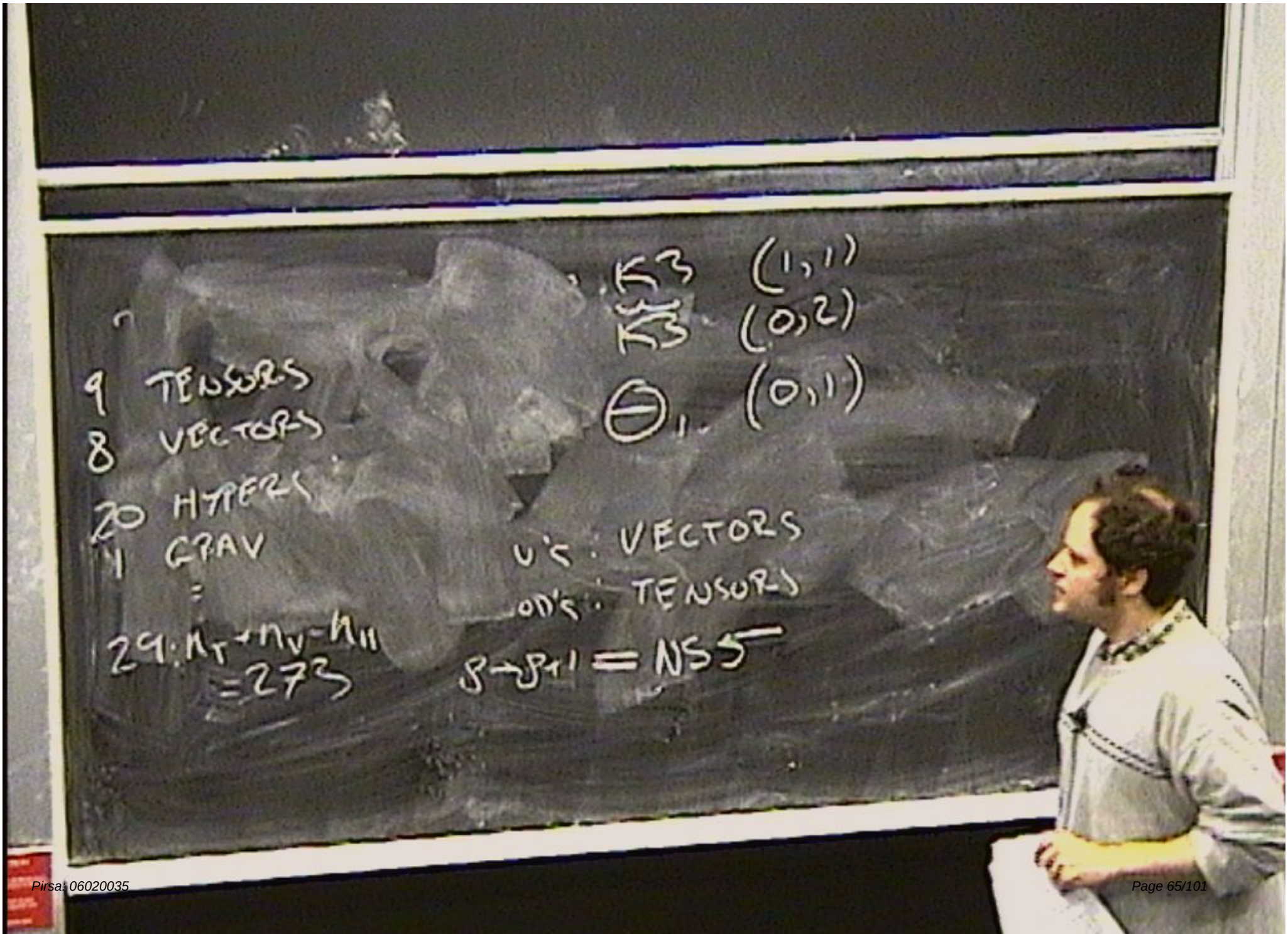
$8 \to 9+1 = NS5$

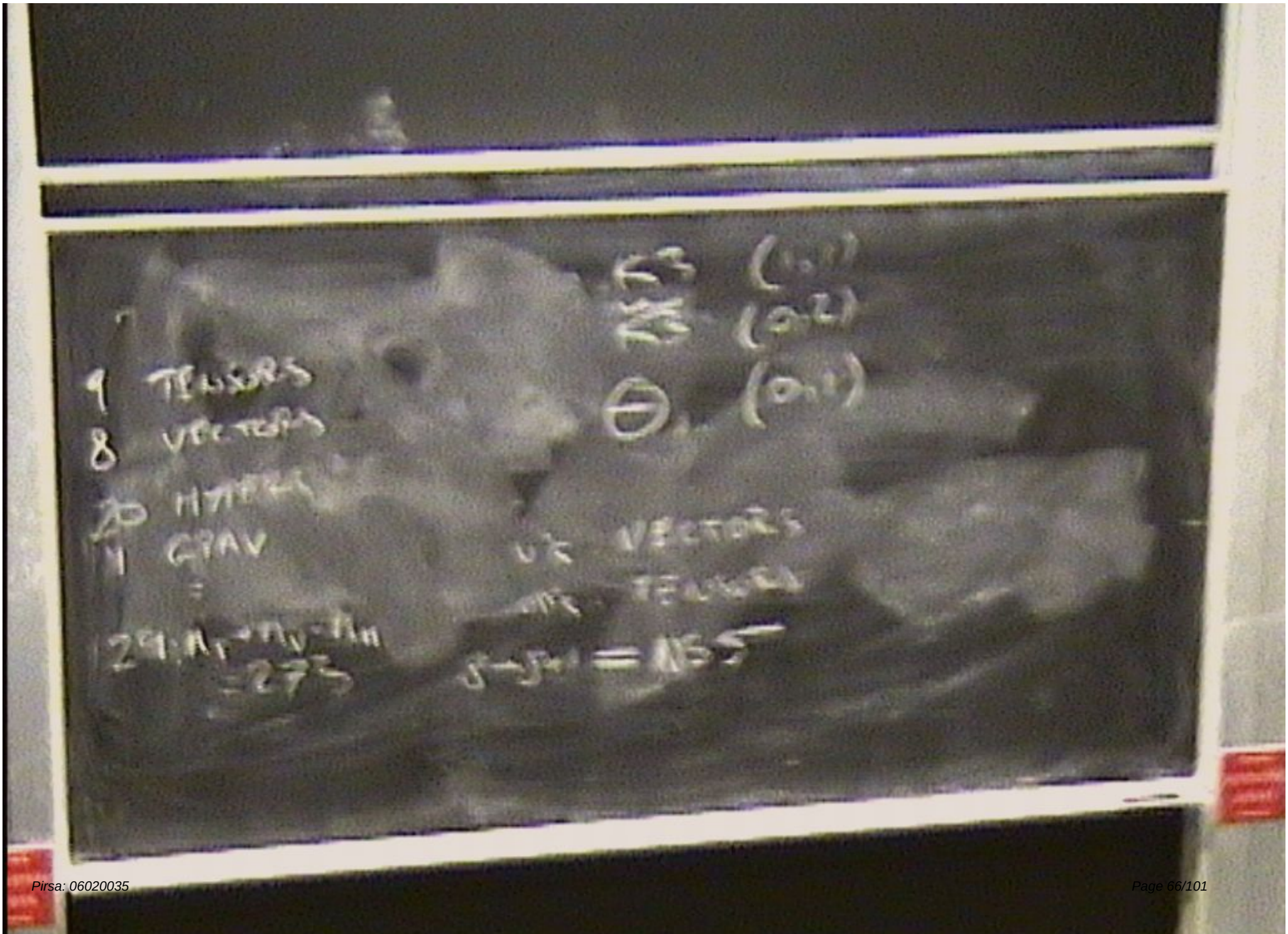

THING-1
$\mathbb{R} \times T^3$
$\tau \to \tau$
$\beta \to -1/\beta$
$\tau \to -1/\beta$
$\beta \to \tau$

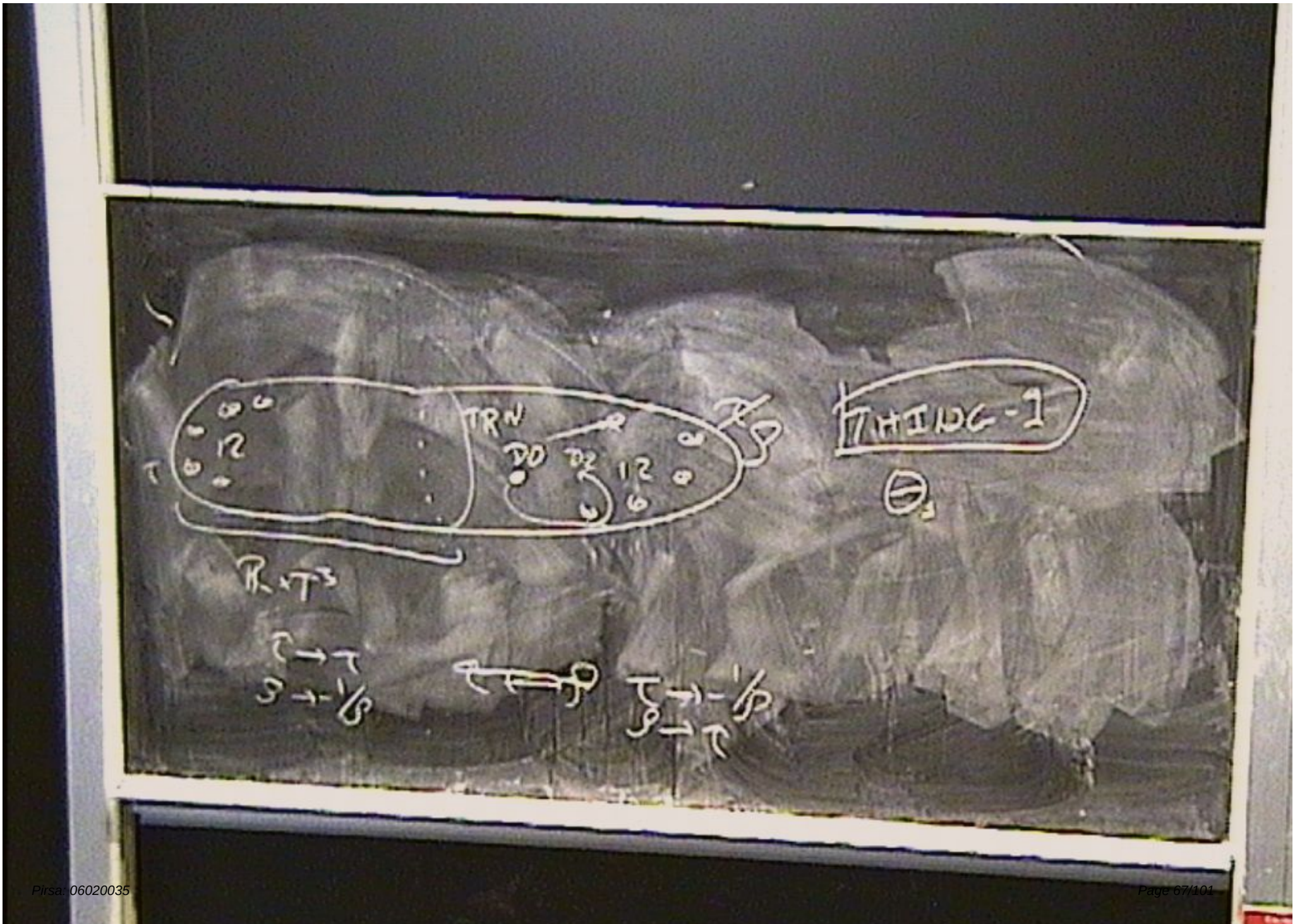

TRN
D0
D2
I2
THING-1
Θ_3
$R \times T^3$
$\tau \to \tau$
$\beta \to -1/\beta$
$\tau \to -1/\beta$
$\beta \to \tau$

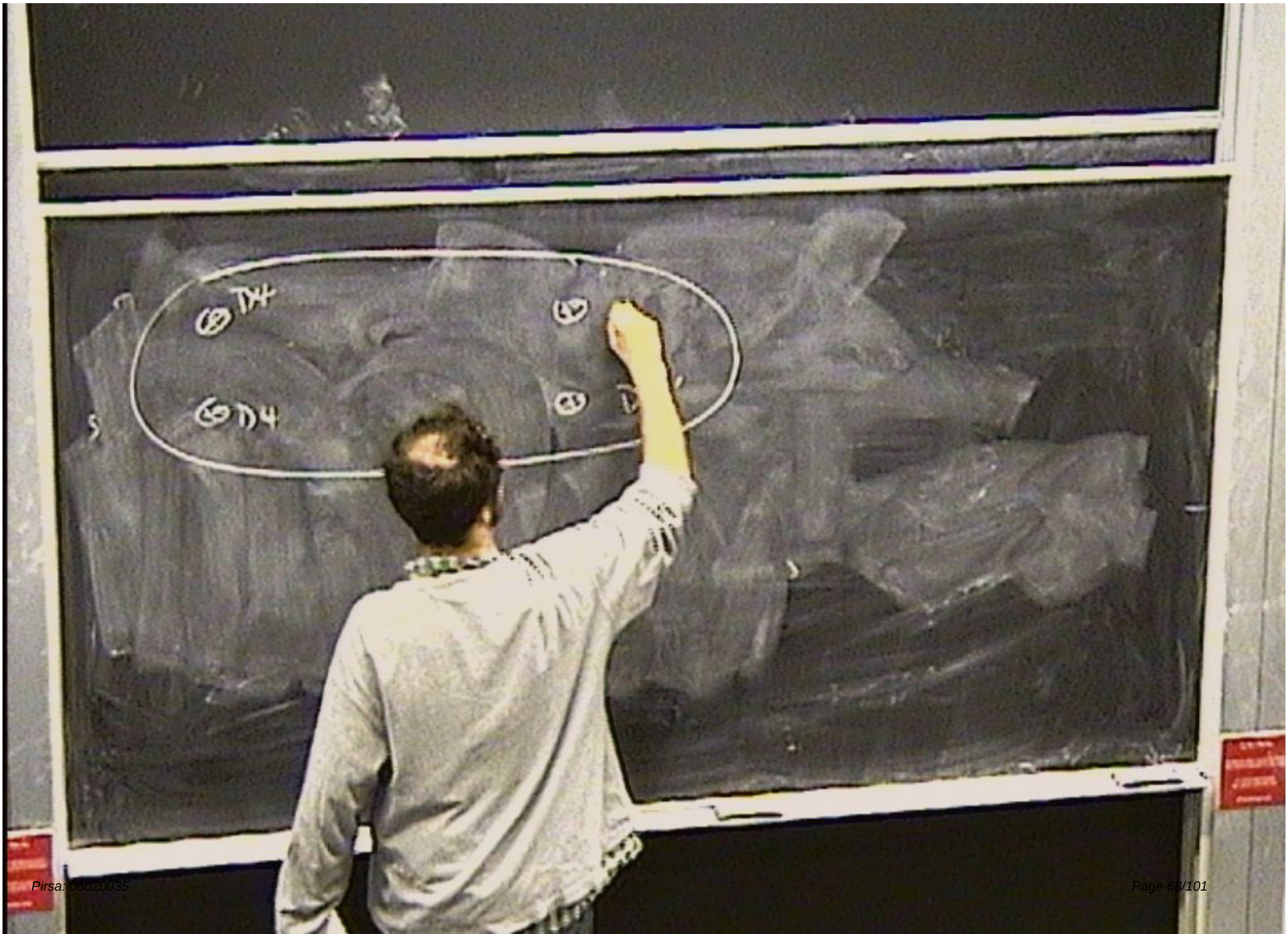

K3 (1,1)
K3 (0,2)
Θ1 (0,1)
9 TENSORS
8 VECTORS
20 HYPERS
1 GRAV
U's: VECTORS
dD's: TENSOR
D→D+1 = NS5

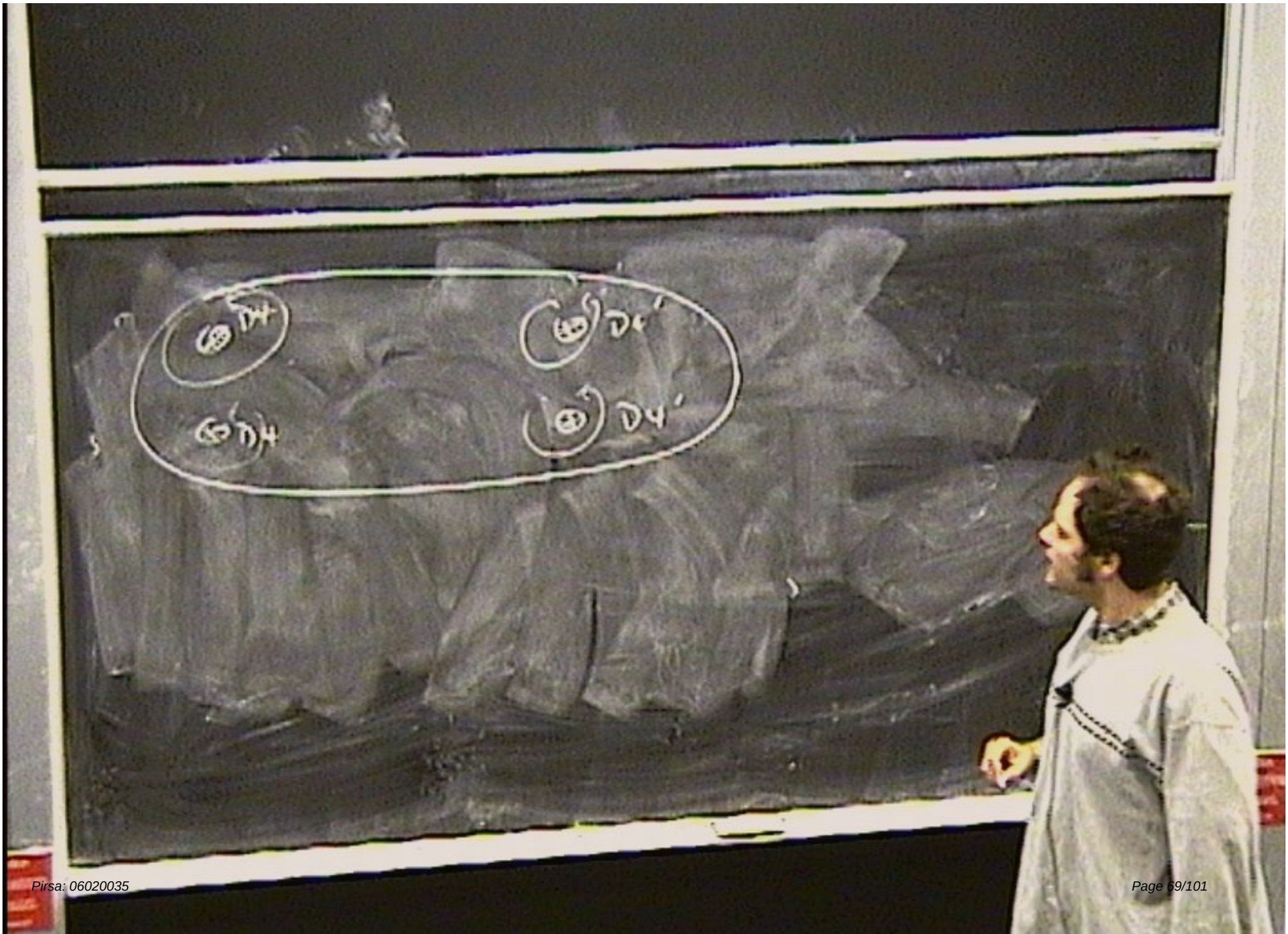

K3 (1,1)
K3 (0,2)
⊖ (0,1)
9 TENSORS
8 VECTORS
20 HYPERS
1 GRAV
=
29: $n_T + n_V - n_H$
$= 273$
U's: VECTORS
OD's: TENSORS
$\beta \to \beta + 1 = NS5$

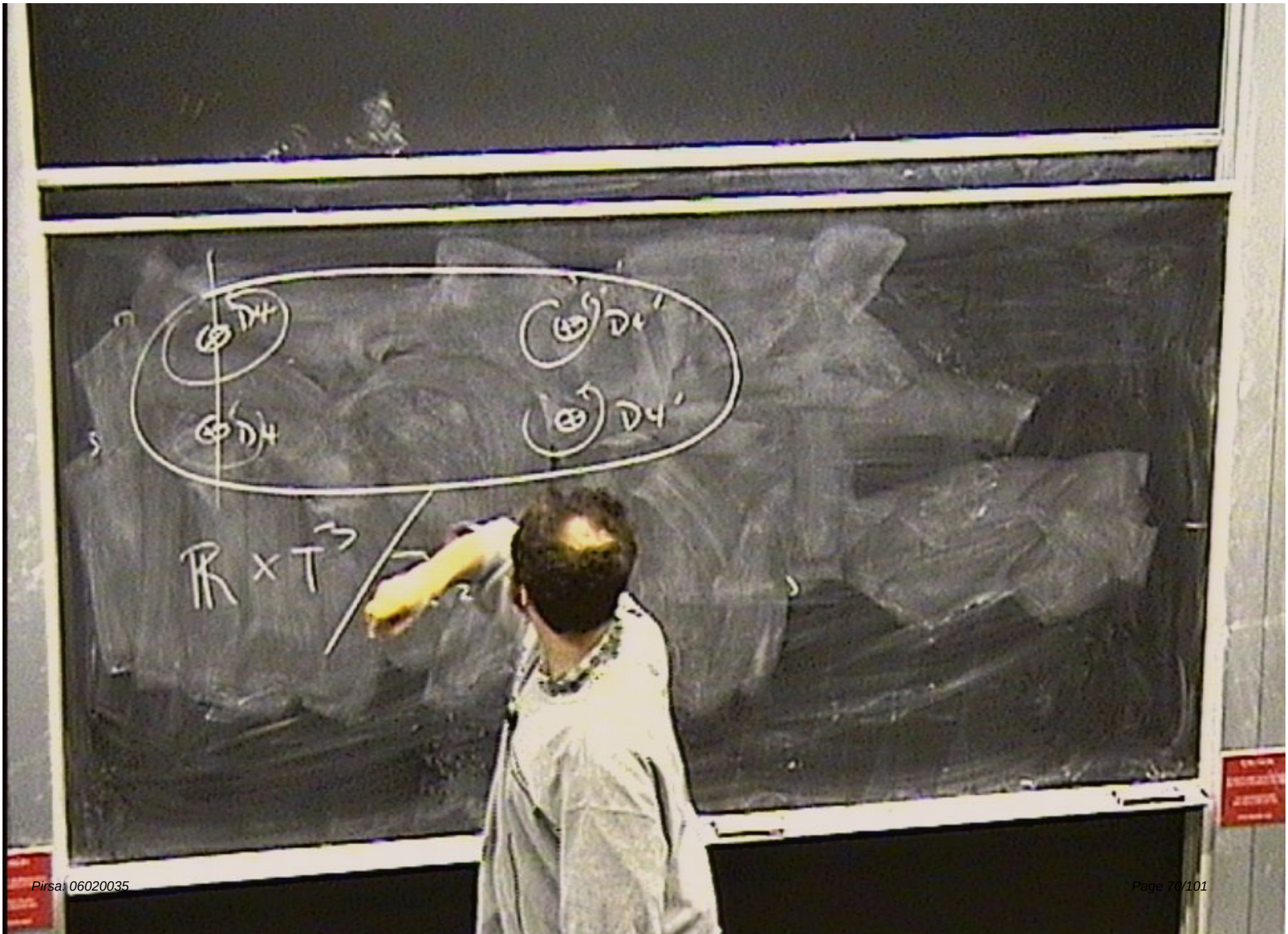

K3 (1,1)
K3 (0,2)
Θ (0,1)
9 TENSORS
8 VECTORS
20 HYPERS
1 GRAV
=
29: $n_T + n_V - n_H$
$= 273$
U's: VECTORS
OD's: TENSORS
$\beta \to \beta + 1 = NS5$

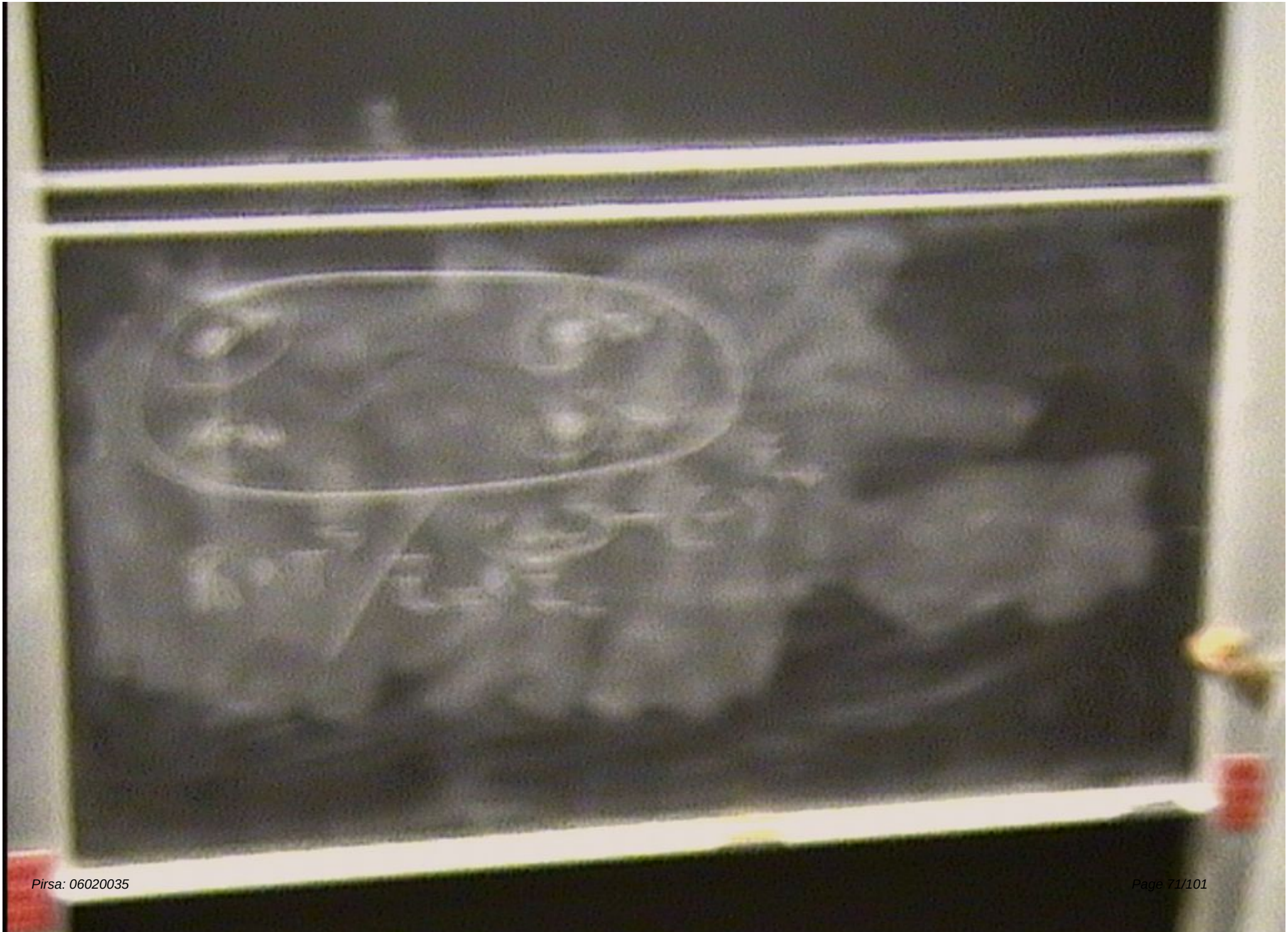

1 TENSORS
8 VECTORS
1 GRAV
VECTORS
TENSORS

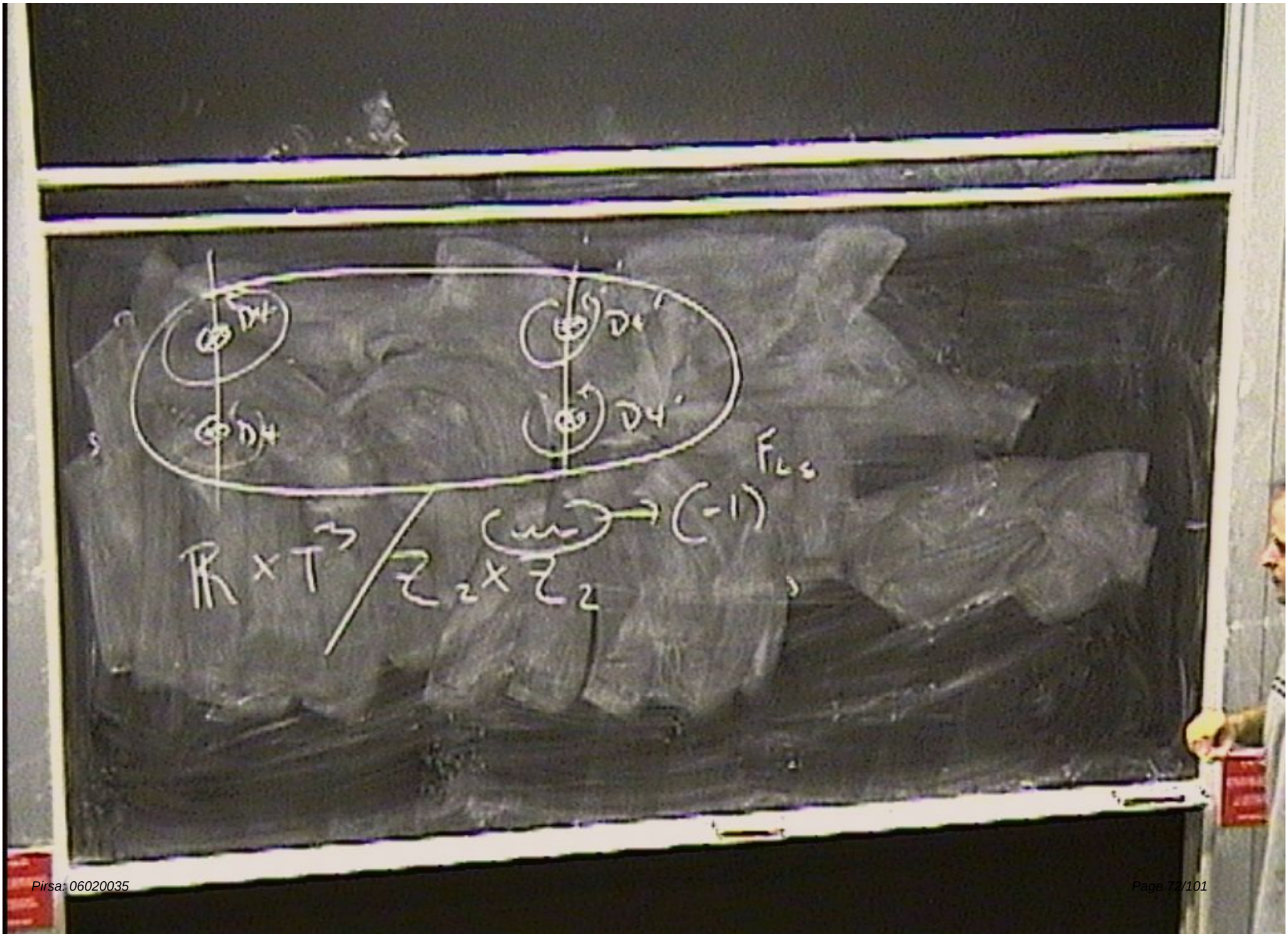

TRN
D0
D2
I2
I2
$\mathbb{R}\times T^3$
$\tau \to \tau$
$\beta \to -1/\beta$
$\tau \to -1/\beta$
$\beta \to \tau$
Θ_3

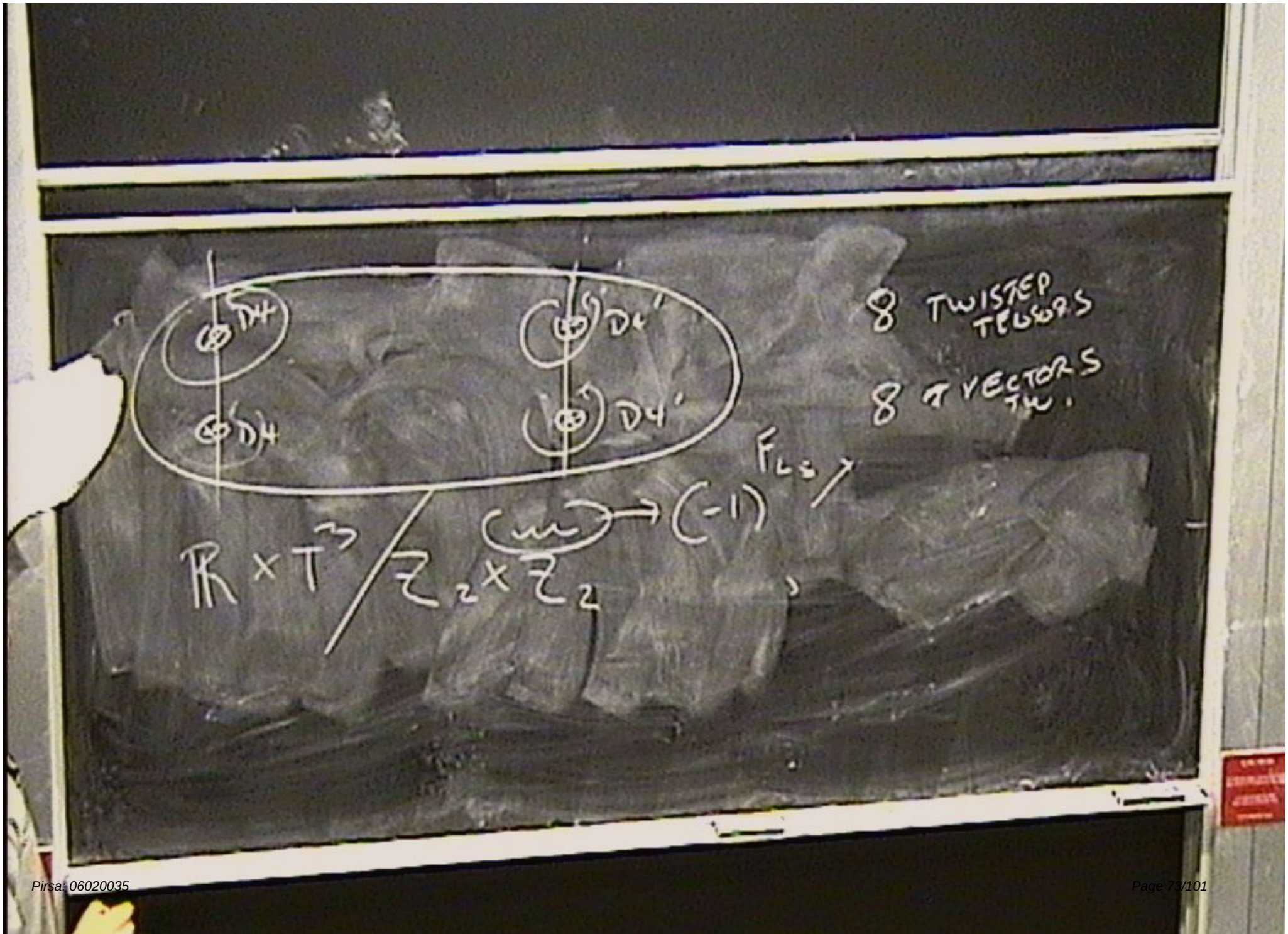


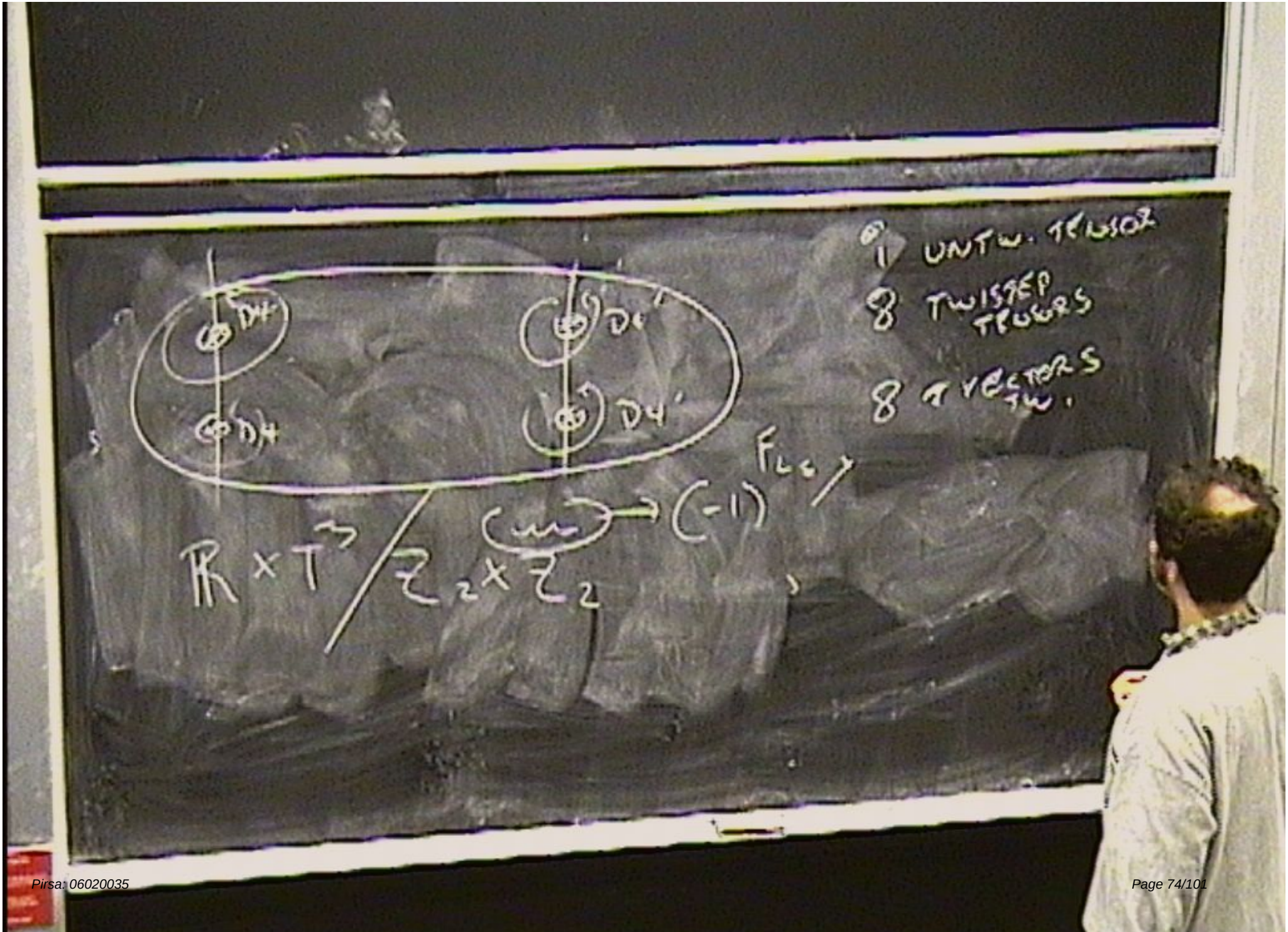

D+
D-
D4
D4'

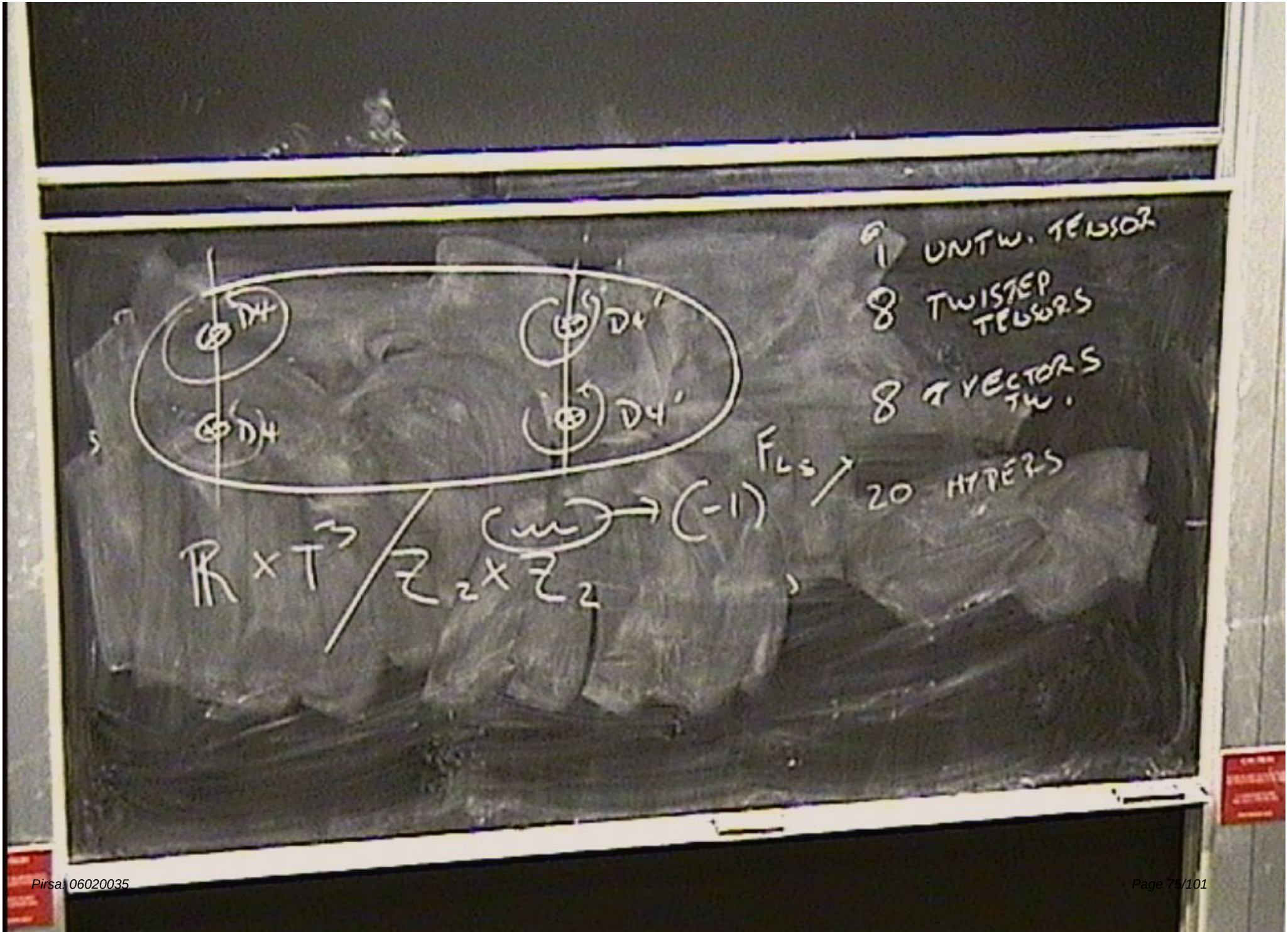

D4
D4'
D4
D4'
$\mathbb{R} \times T^3$

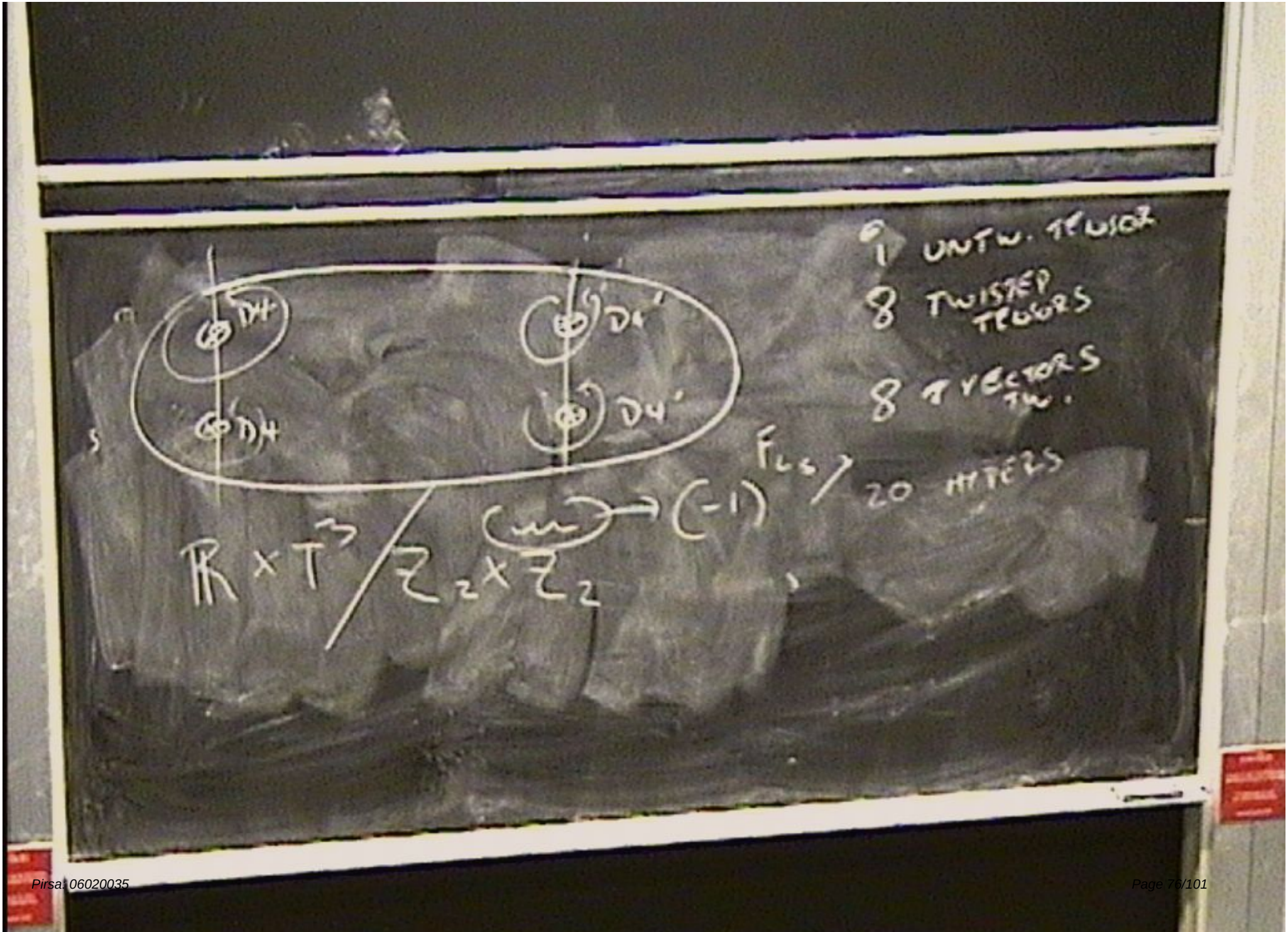


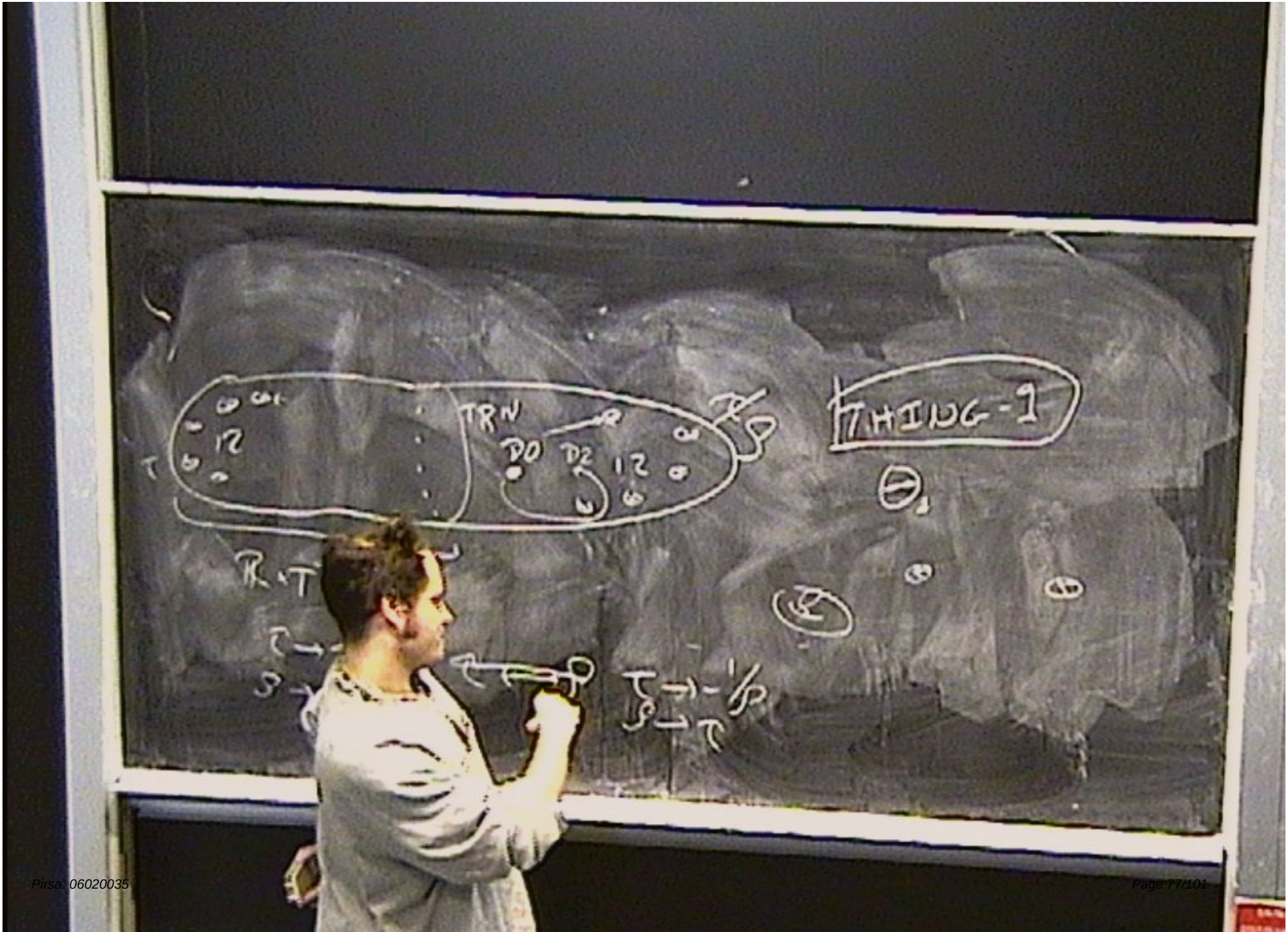

D4
D4
D4'
D4'
$F_{L.C}$
$(-1)^{F_{L.C}}$
$\mathbb{R} \times T^3 / \mathbb{Z}_2 \times \mathbb{Z}_2$

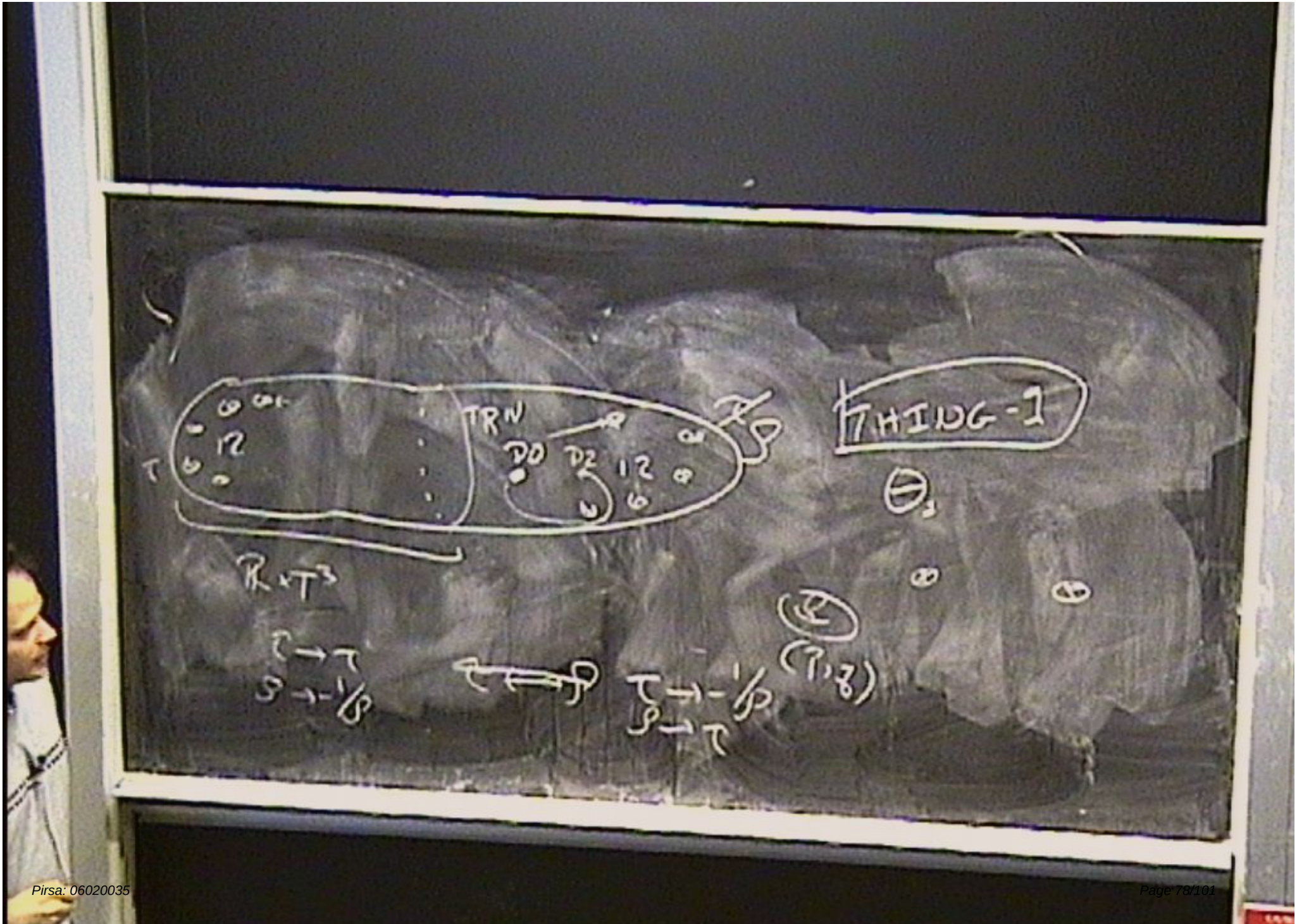

D4
D4'
D4
D4'
8 TWISTED TENSORS
8 VECTORS
$\mathbb{R} \times T^3 / Z_2 \times Z_2$
$(\omega) \to (-1)^{F_{L3}}$

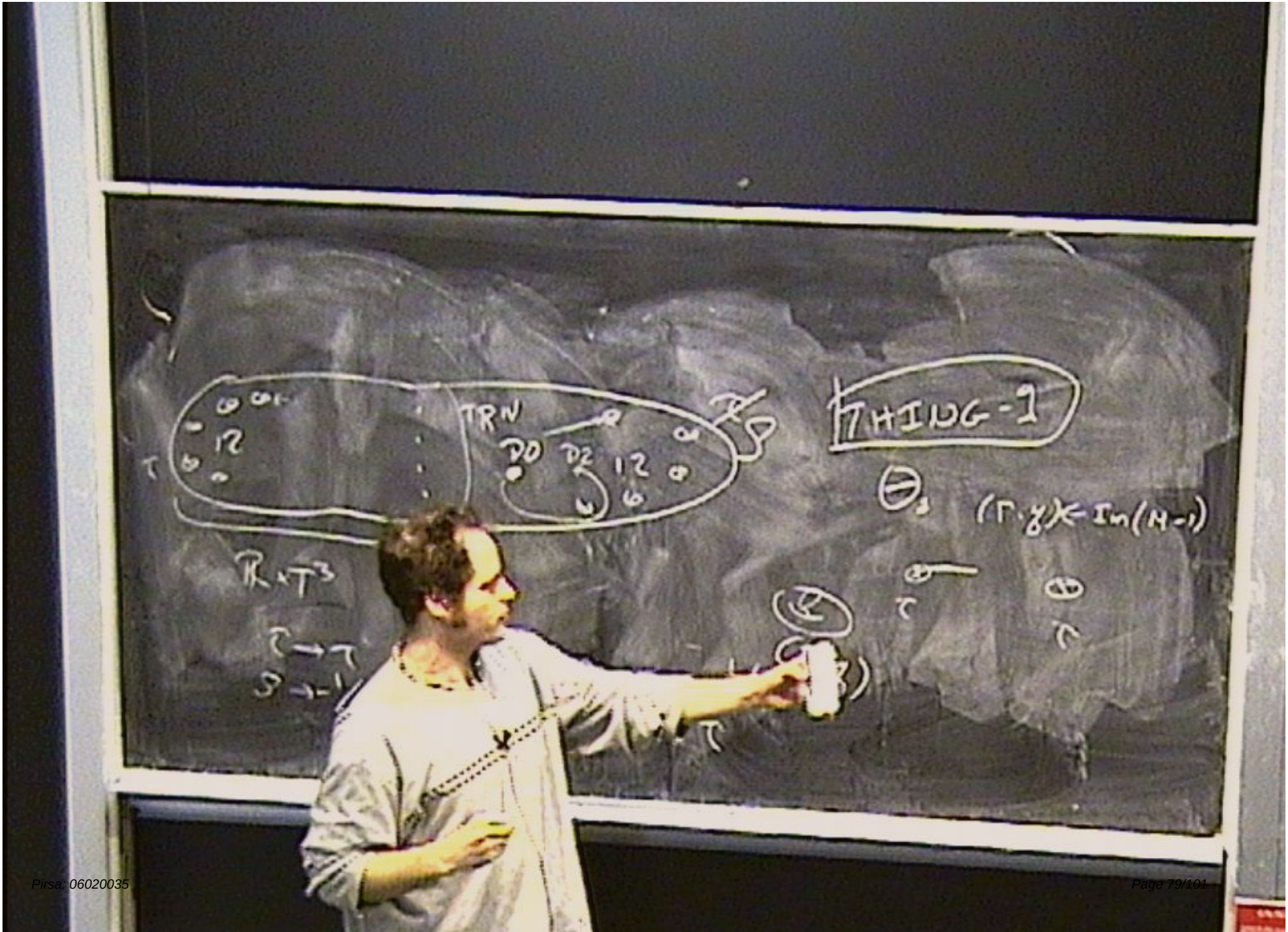

1 UNTW. TENSOR
8 TWISTED TENSORS
8 VECTORS TW.
D4
D4
D4'
D4'
$\mathbb{R} \times T^3 / \mathbb{Z}_2 \times \mathbb{Z}_2$
$(-1)^{F_{L6}}$

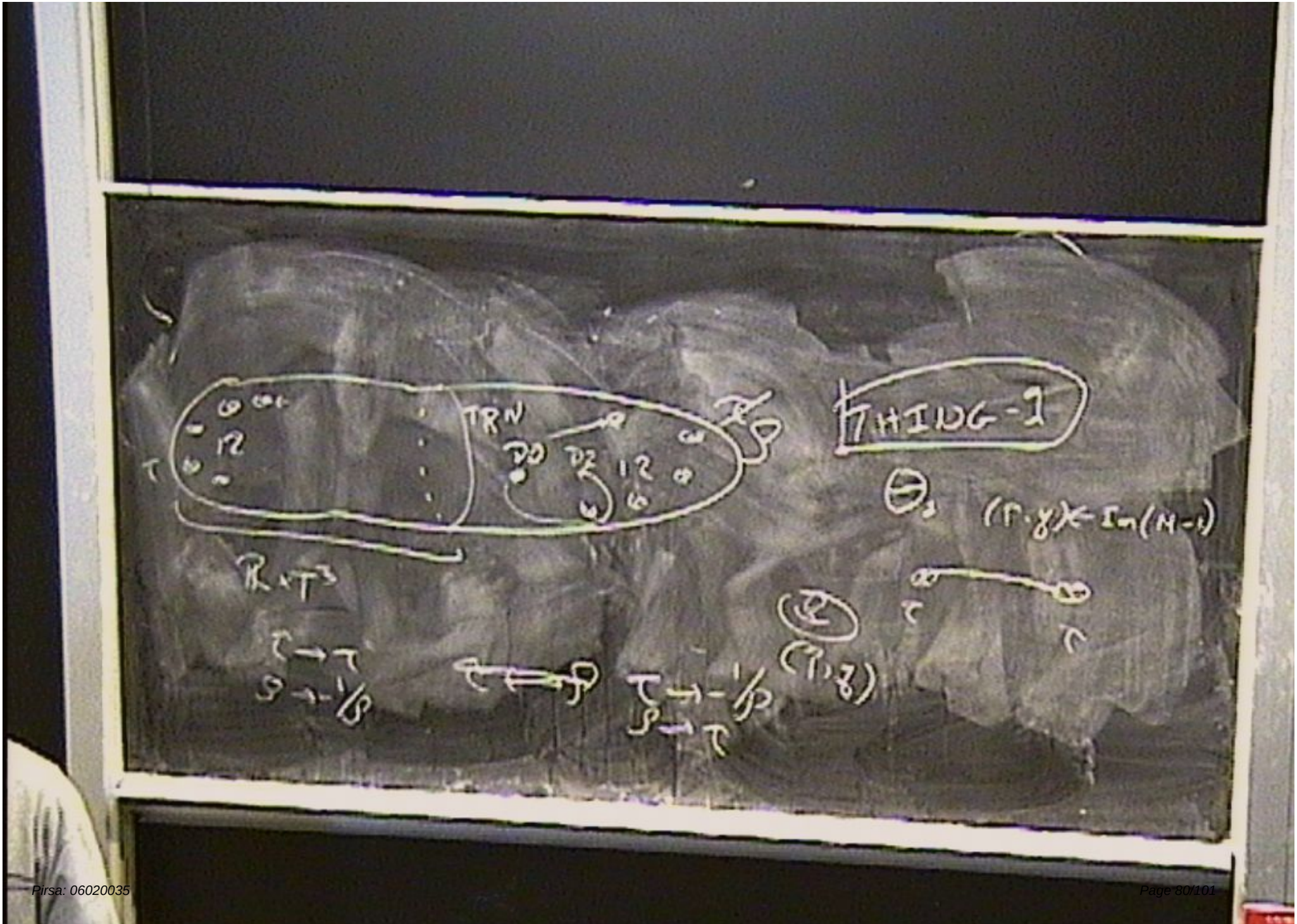

D4
D4
D4'
D4'
$\mathbb{R} \times T^3 / Z_2 \times Z_2$
$(\omega \to (-1)^{F_{L6}})$
1 UNTW. TENSOR
8 TWISTED TENSORS
8 VECTORS TW.
20 HYPERS

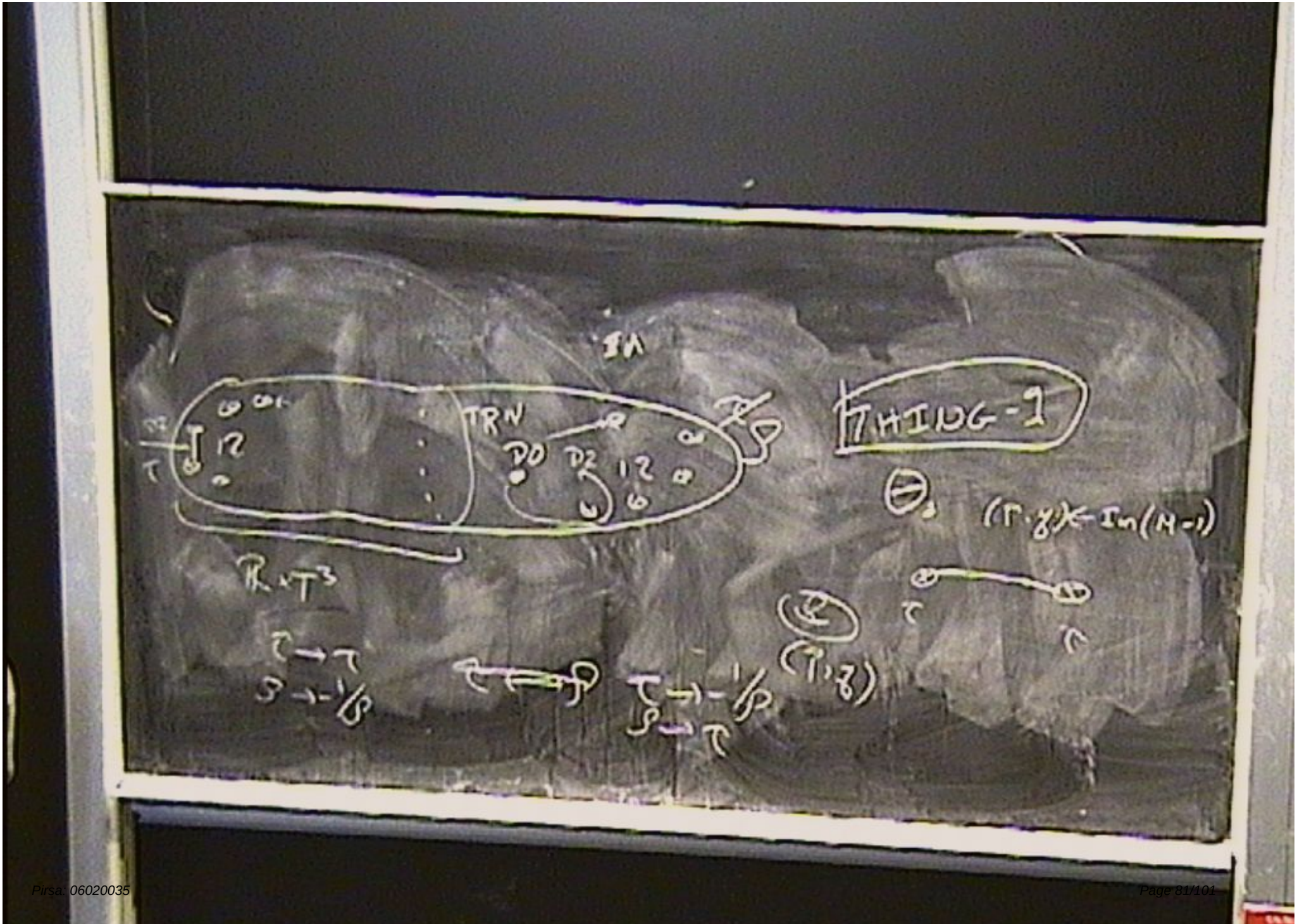

1 UNTW. TENSOR
8 TWISTED TENSORS
8 VECTORS TW.
20 HYPERS
$\mathbb{R} \times T^3 / Z_2 \times Z_2$
$(-1)^{F_{L,S}}$

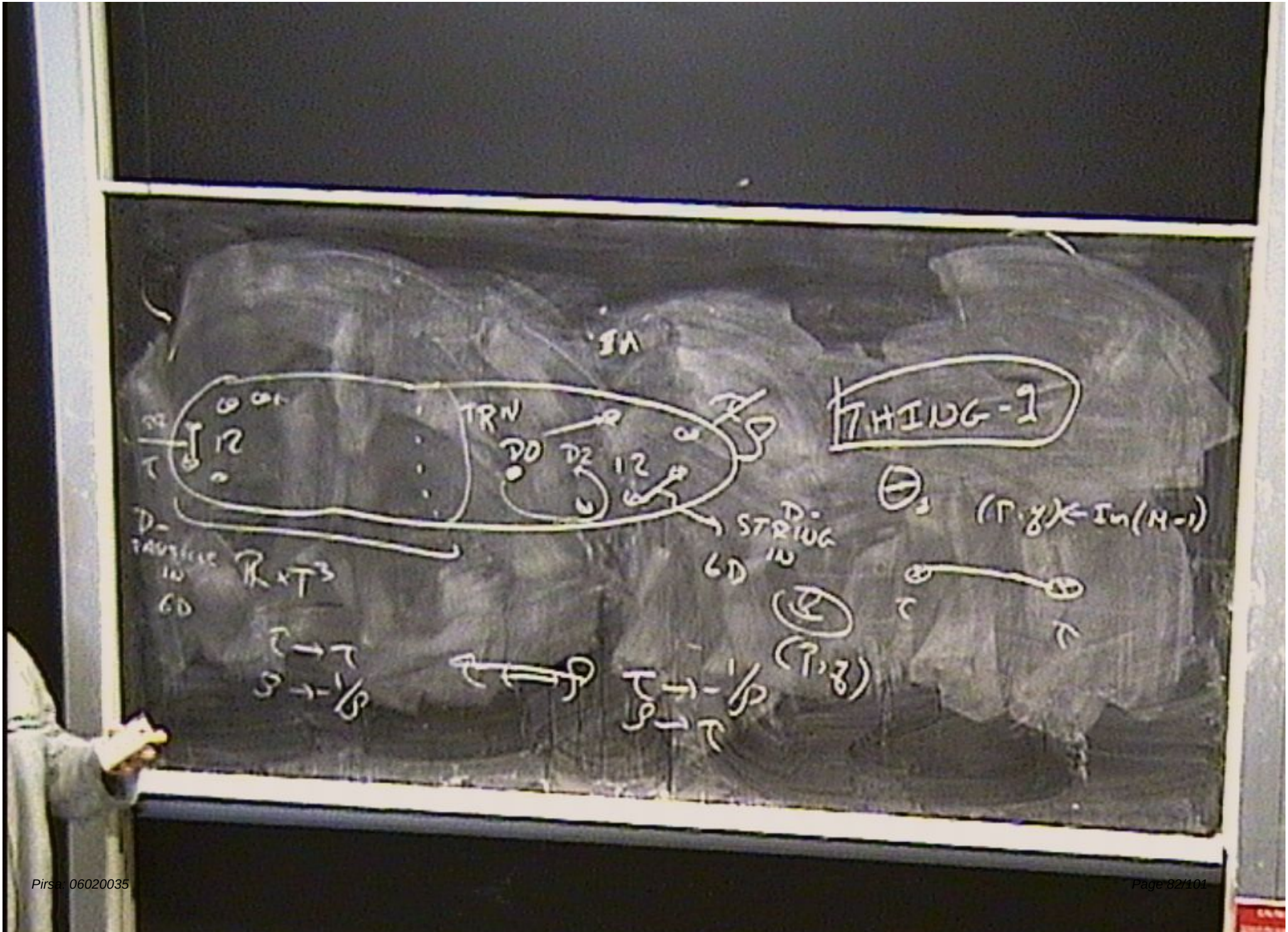

TRN
D0
D2
I2
THING-1

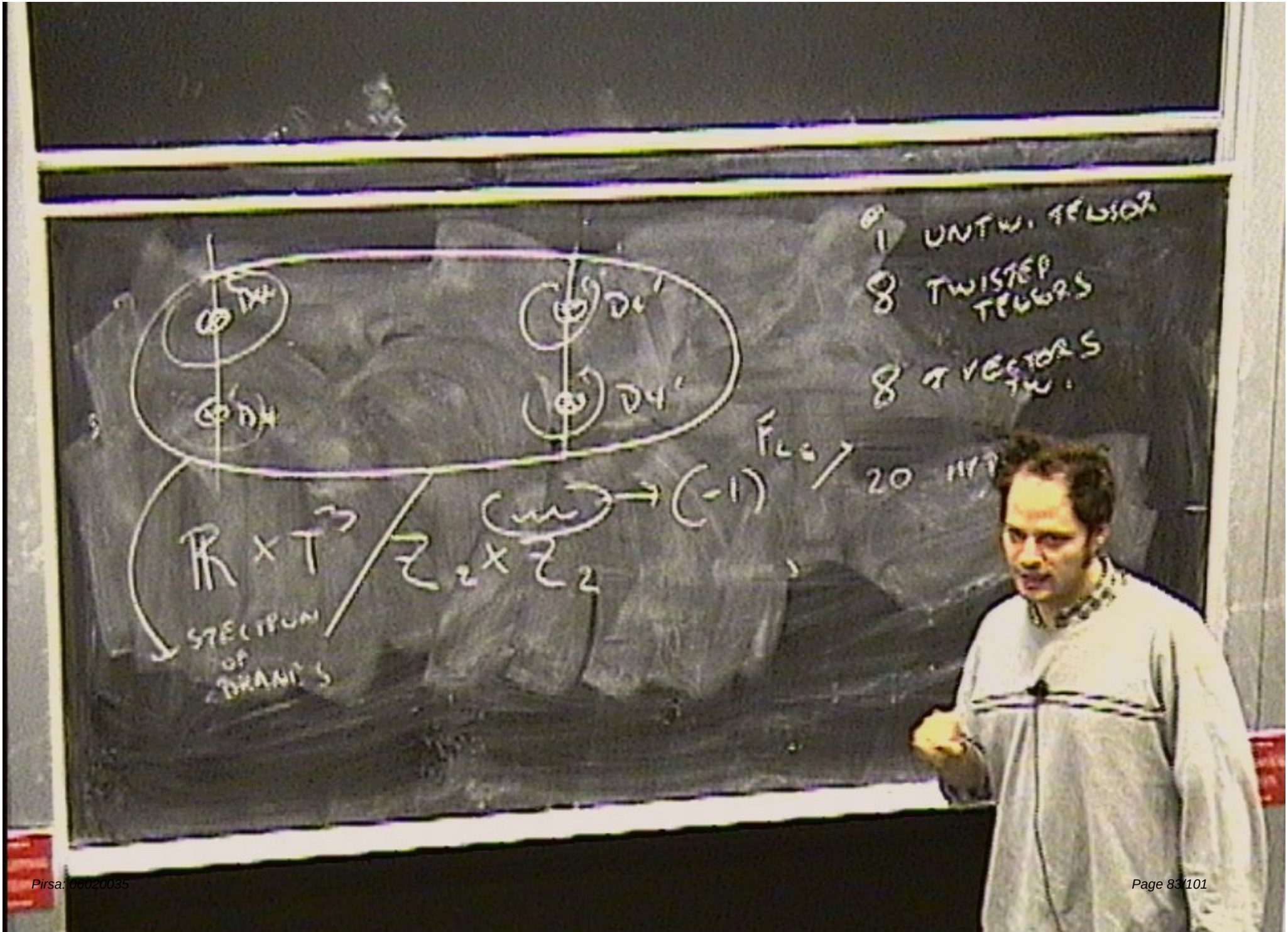

TRN
D0
D2
I2
THIDG-1
$\mathbb{R}\times T^2$
$\tau \to \tau$
$\beta \to -1/\beta$
$\tau \to -1/\beta$
$\beta \to \tau$
(τ, β)

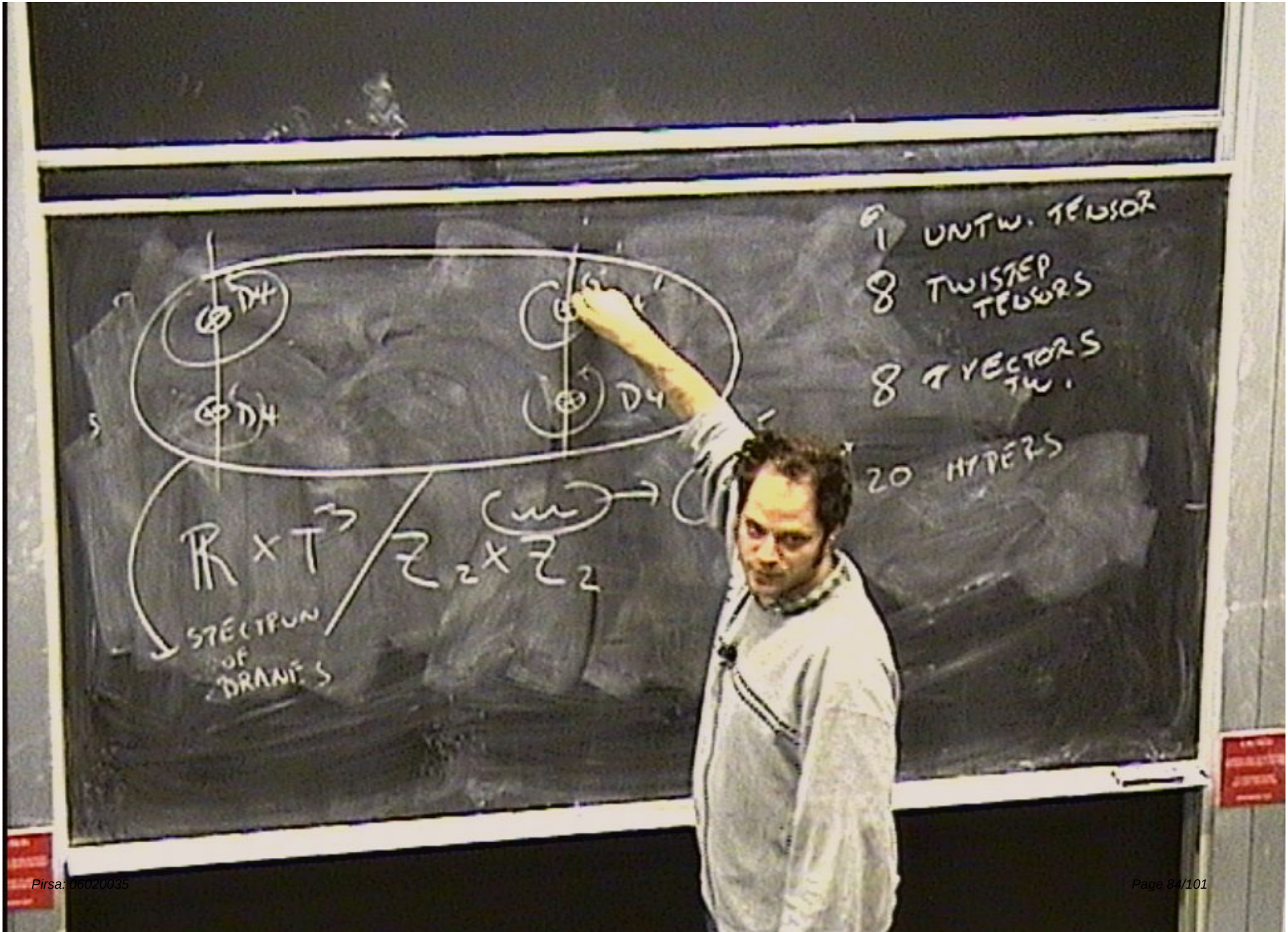

TRN
THING-1
$\mathbb{R}\times T^3$
$\Gamma \to \Gamma$
$S \to -1$
$(\Gamma \cdot \gamma) \leftarrow \mathrm{Im}(H-1)$

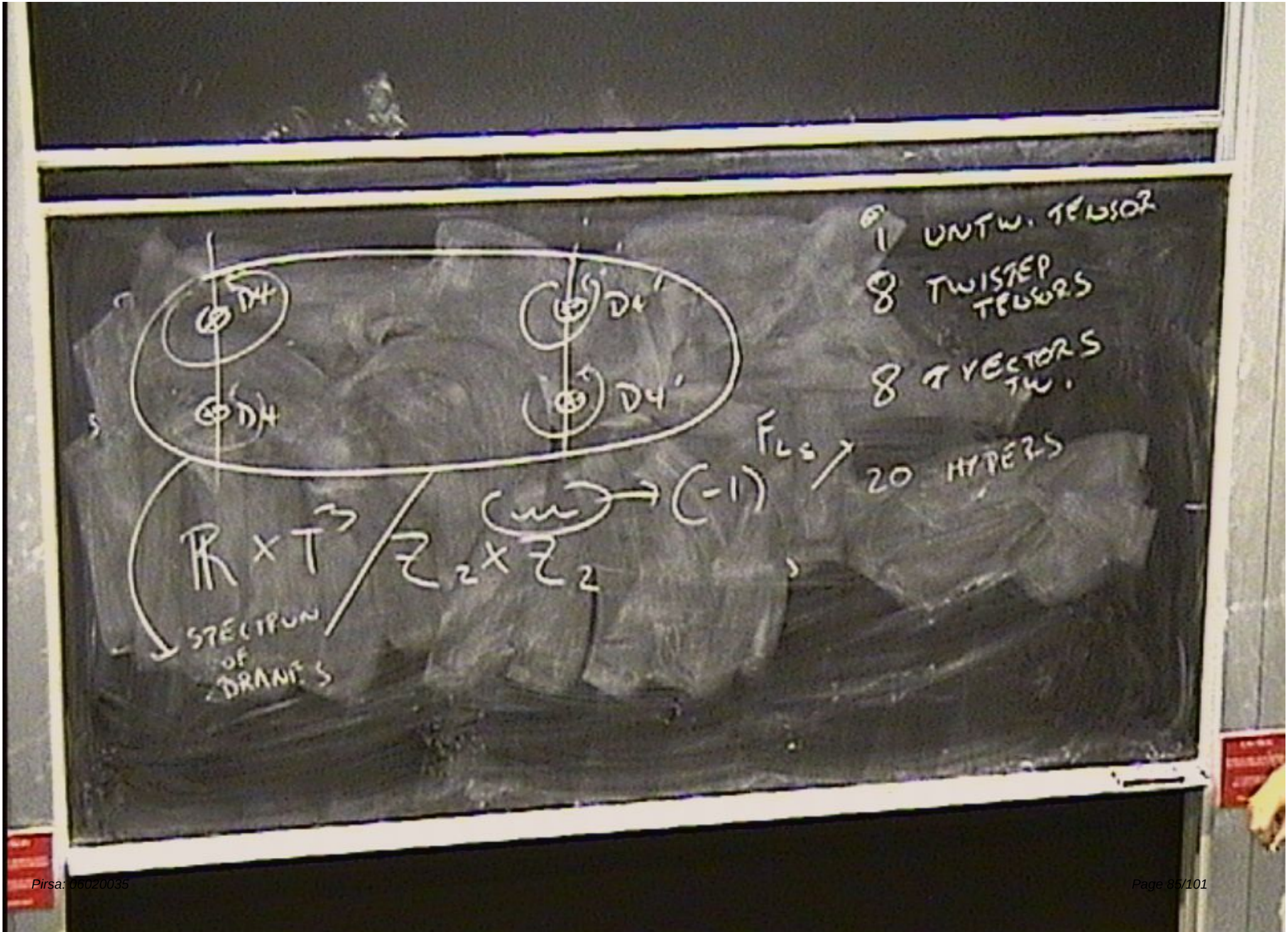

THIDG-1
TRN
$\mathbb{R}\times T^3$
$\tau \to \tau$
$s \to -1/s$
$\tau \to -1/\tau$
$s \to \tau$
$(\Gamma, \gamma) \subset \mathrm{Im}(H-i)$

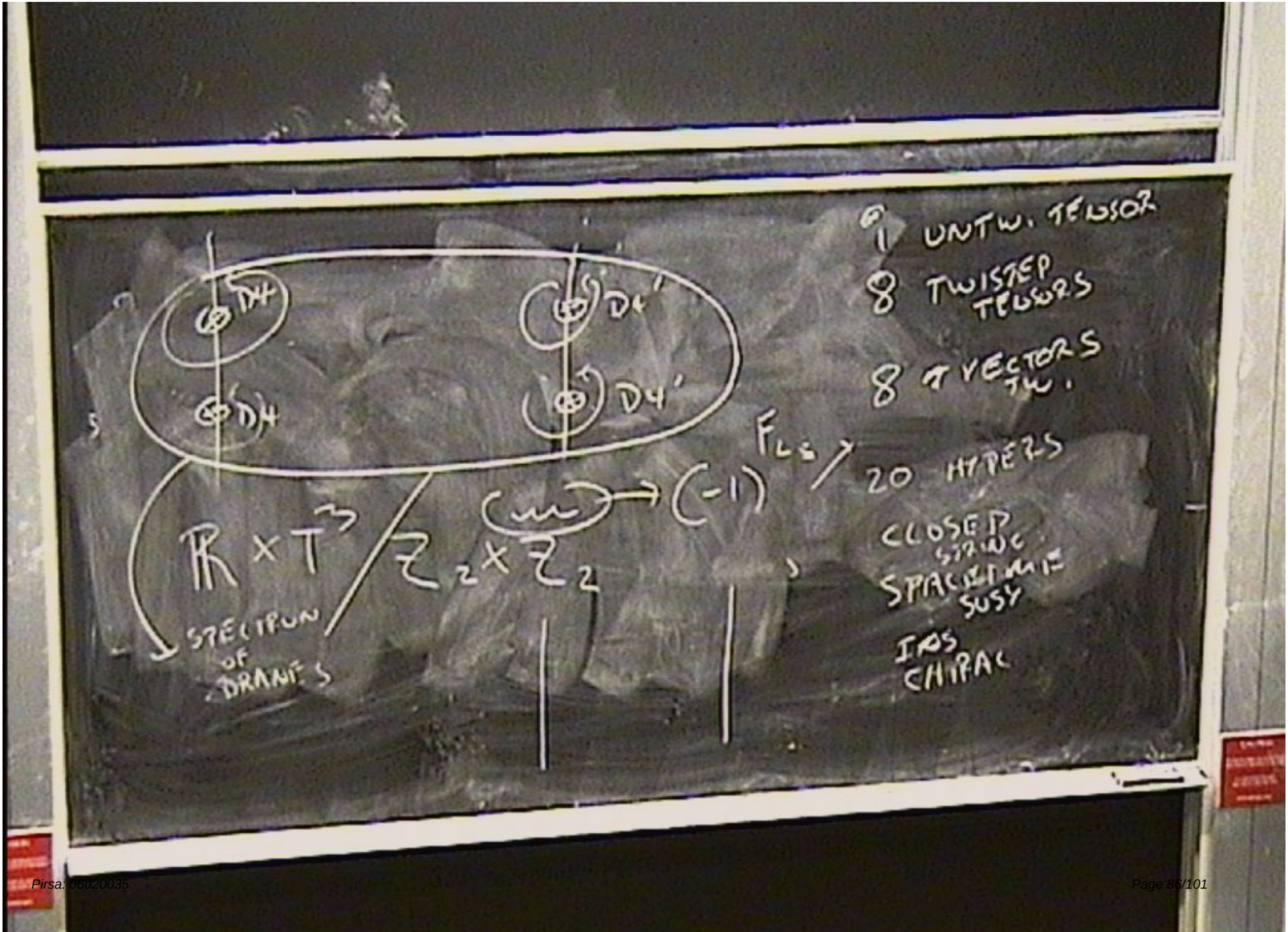

M
TRN
THIDG-1
$\mathbb{R} \times T^3$
$\tau \to \tau$
$s \to -1/s$
$\tau \to -1/s$
$s \to \tau$
(Γ, g)
$(\Gamma, g) \leftarrow \mathrm{Im}(H-i)$

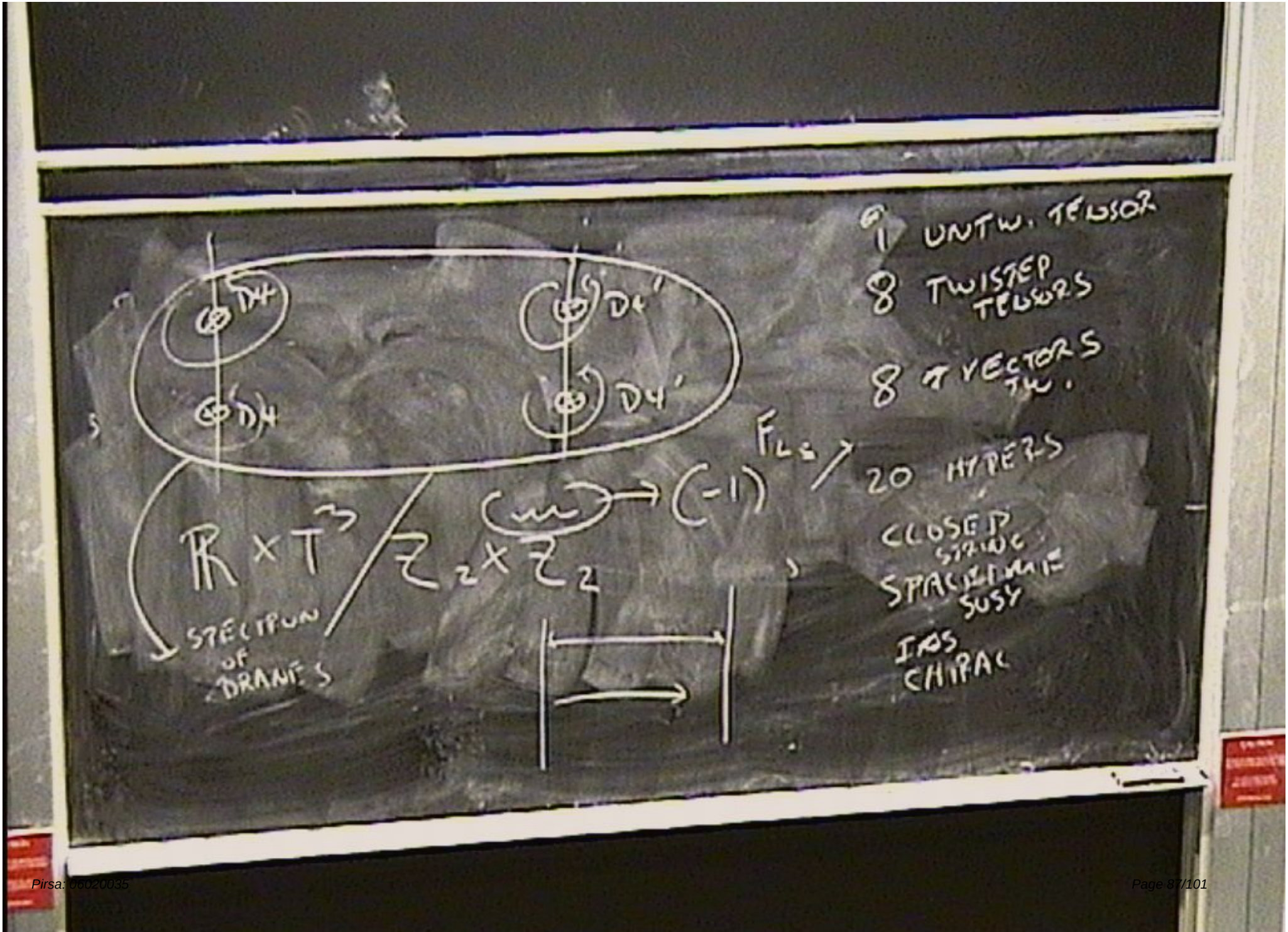

SM
TRN
D0
D2
12
THIDG-1
STRUG
6D
$\mathbb{R}\times T^3$
$\tau \to \tau$
$S \to -1/S$
$\tau \to -1/\tau$
$S \to \tau$
(Γ, γ)
$(\Gamma, \gamma) \backslash \mathrm{Im}(H-1)$

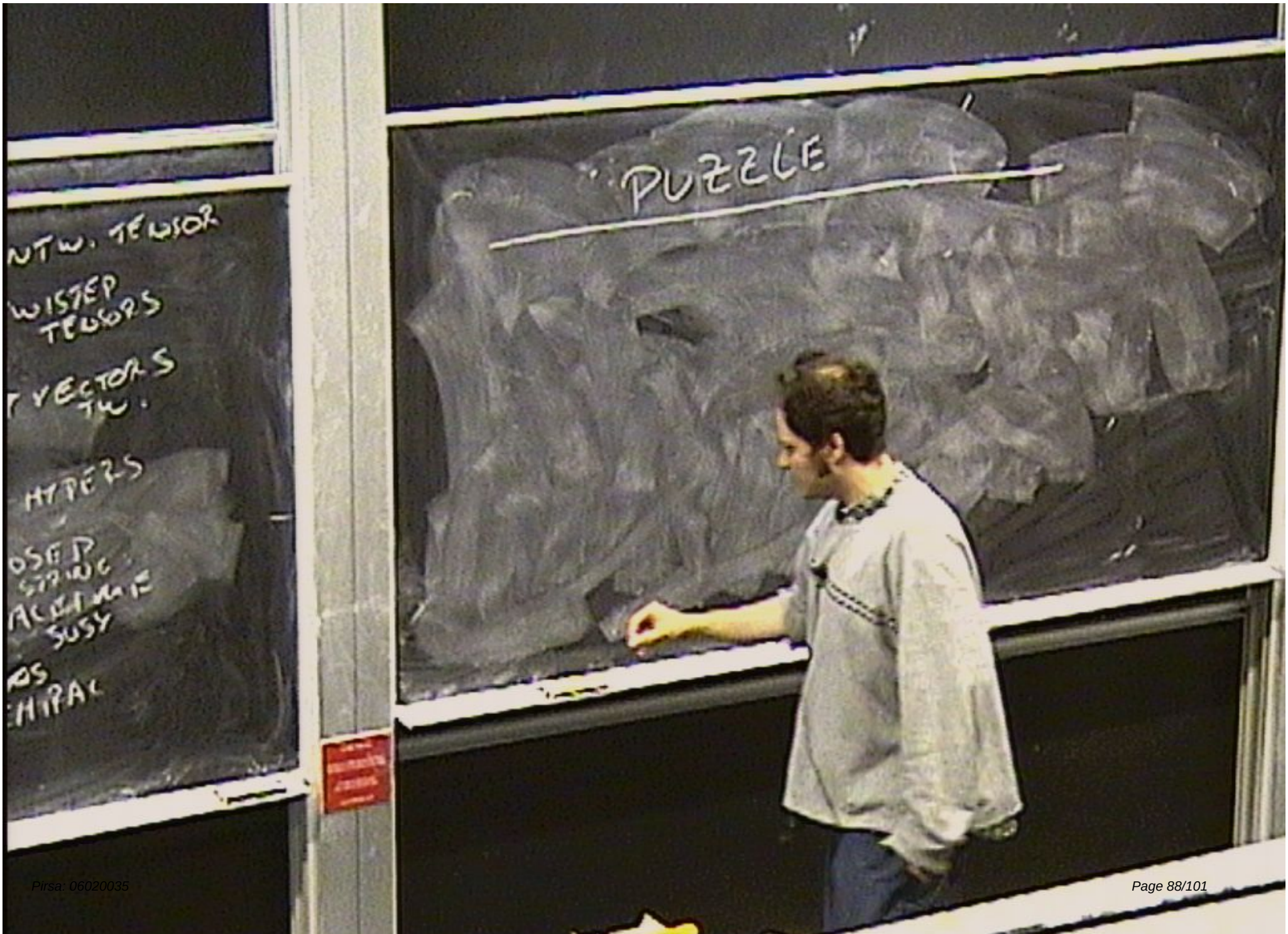

1 UNTW. TENSOR
8 TWISTED TENSORS
8 VECTORS
20
$\mathbb{R} \times T^3 / \mathbb{Z}_2 \times \mathbb{Z}_2$
SPECTRUM OF BRANES

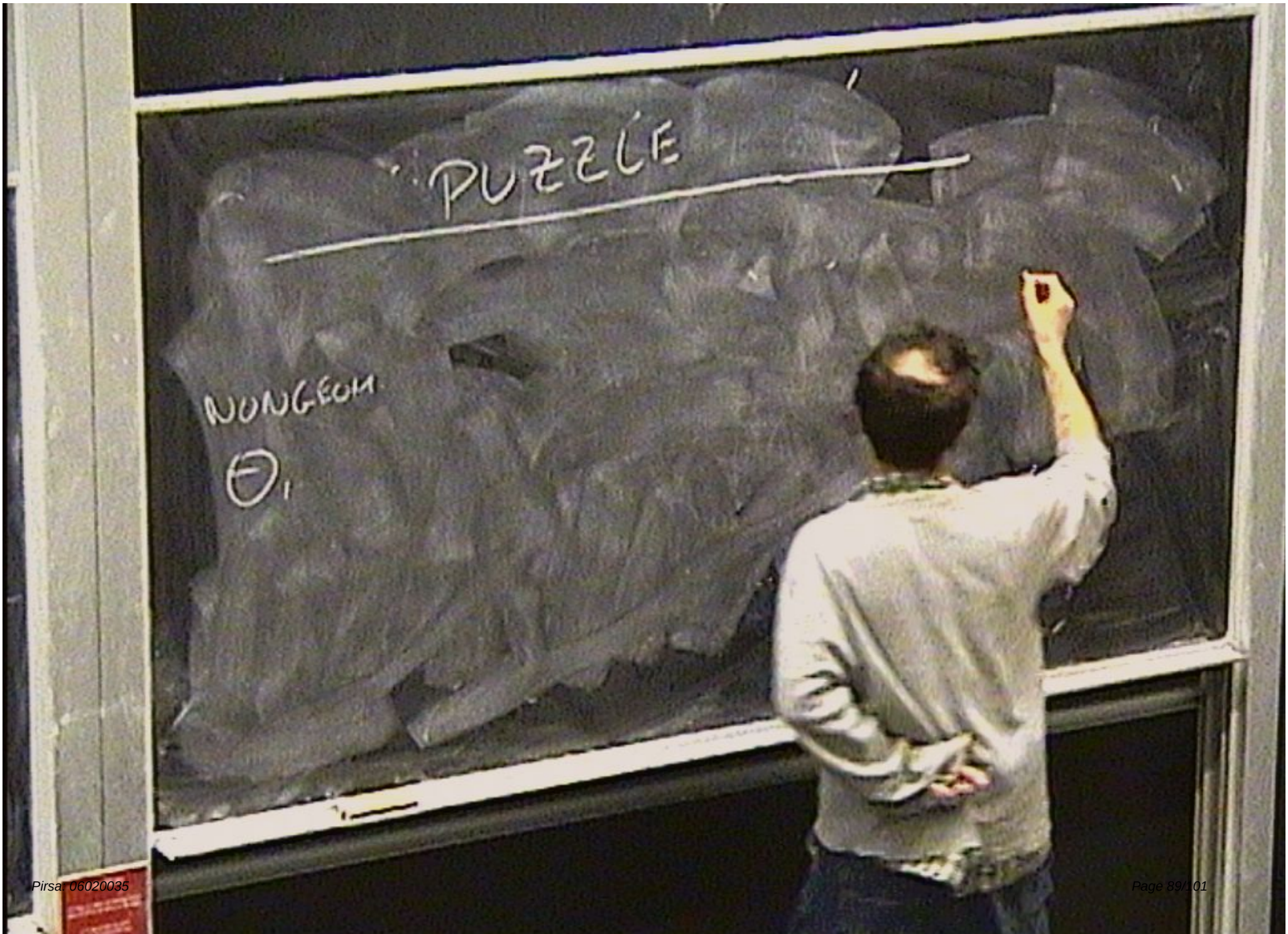

1 UNTW. TENSOR
8 TWISTED TENSORS
8 VECTORS TW.
20 HYPERS
D4
D4
D4
$\mathbb{R} \times T^3 / \mathbb{Z}_2 \times \mathbb{Z}_2$
SPECTRUM OF BRANES

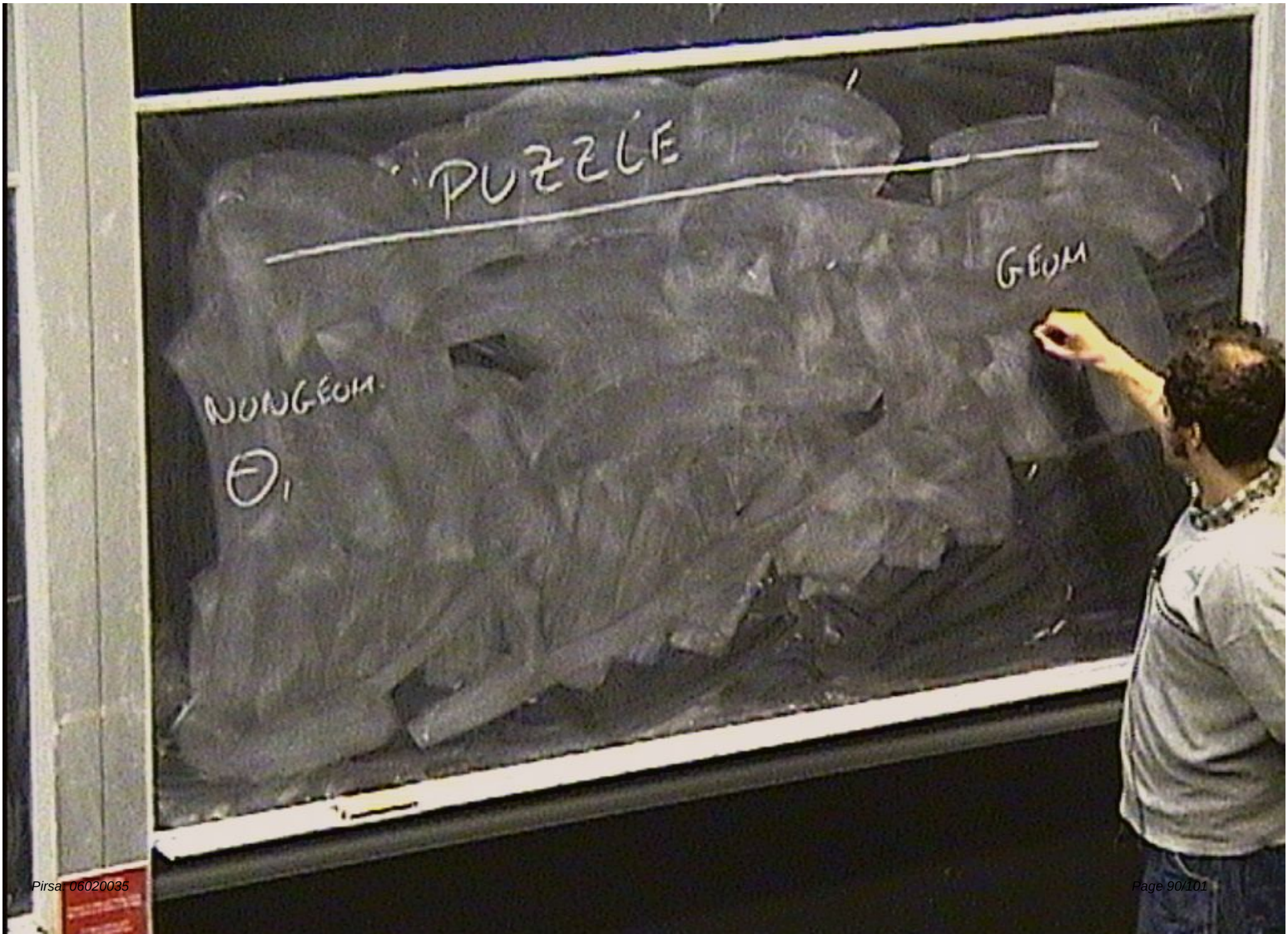

D4
D4'
D4
D4'
1 UNTW. TENSOR
8 TWISTED TENSORS
8 VECTORS TW.
20 HYPERS
$F_{L,S}$
$\mathbb{R} \times T^3 / \mathbb{Z}_2 \times \mathbb{Z}_2$
$(\omega \to (-1))$
SPECTRUM OF BRANES

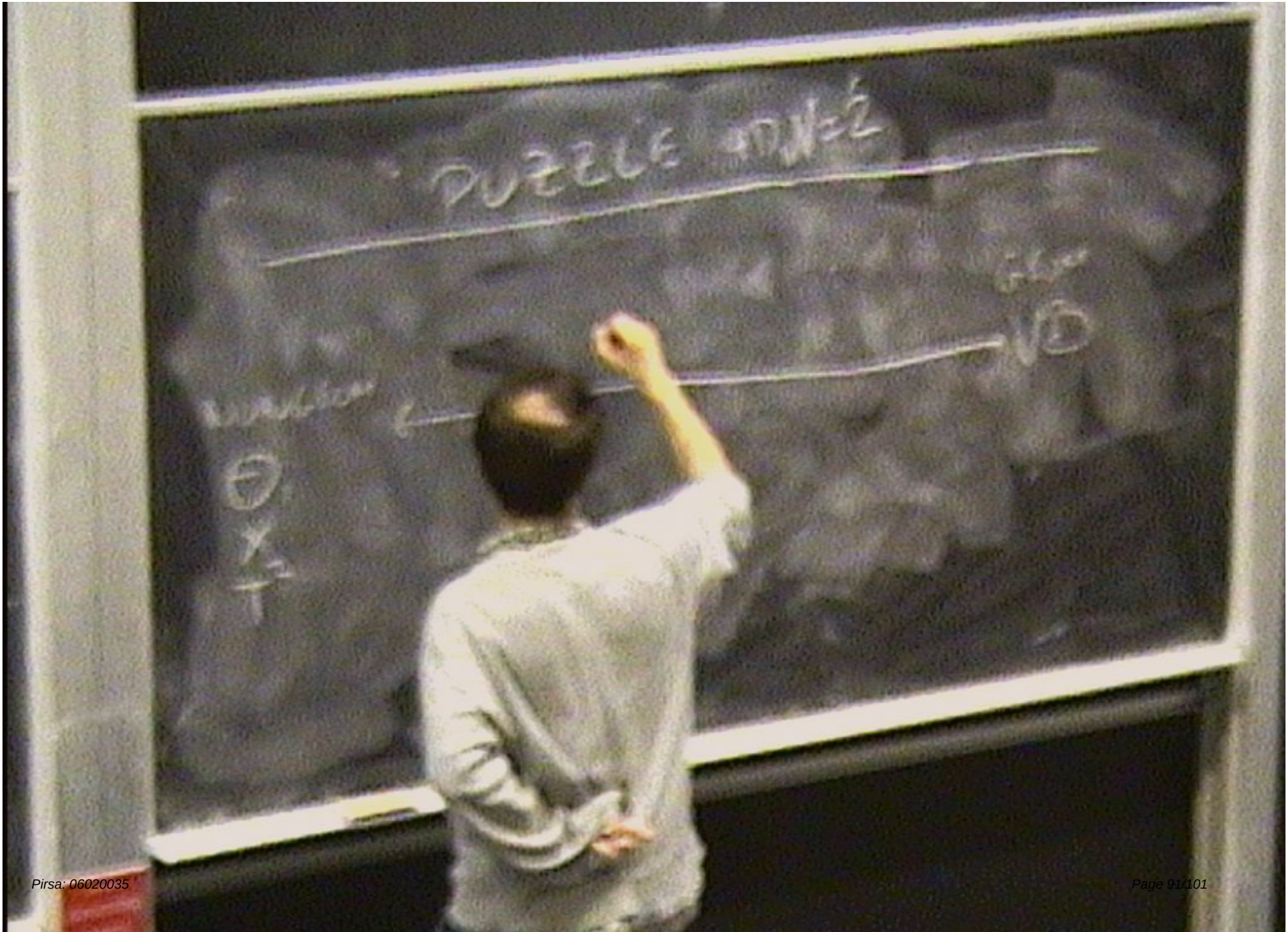

D4
D4'
D4
D4'
$\mathbb{R} \times T^3 / \mathbb{Z}_2 \times \mathbb{Z}_2$
$\omega \to (-1)$
F_L
SPECTRUM OF BRANES
1 UNTW. TENSOR
8 TWISTED TENSORS
8 VECTORS TW.
20 HYPERS
CLOSED STRING SPACETIME SUSY
IRS CHIRAL

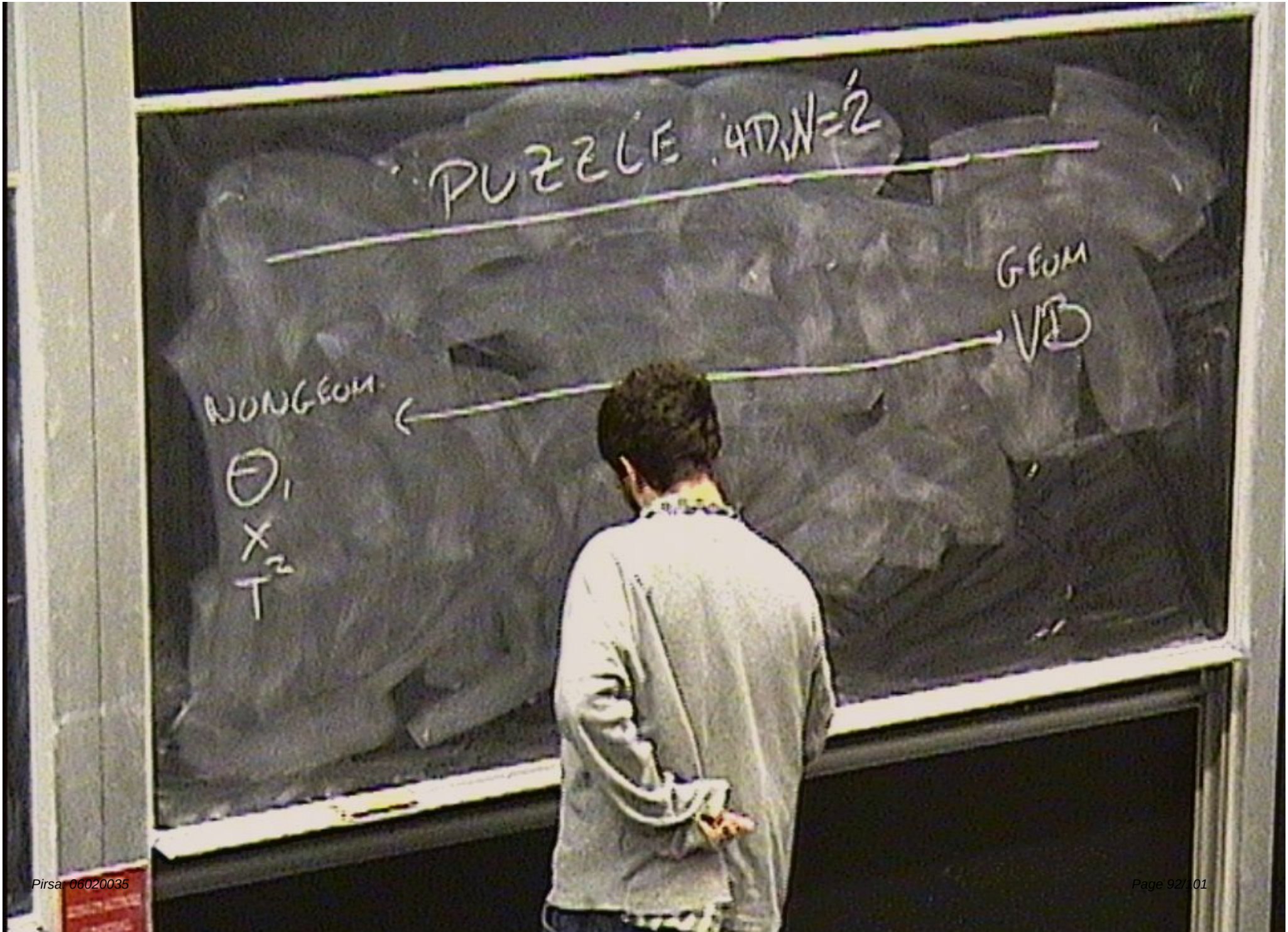

D4
D4'
D4
D4'
$\mathbb{R} \times T^3 / \mathbb{Z}_2 \times \mathbb{Z}_2$
$\omega \to (-1)^{F_L}$
SPECTRUM OF BRANES
1 UNTW. TENSOR
8 TWISTED TENSORS
8 VECTORS
20 HYPERS
CLOSED STRING
SPACETIME SUSY
IRS
CHIRAL

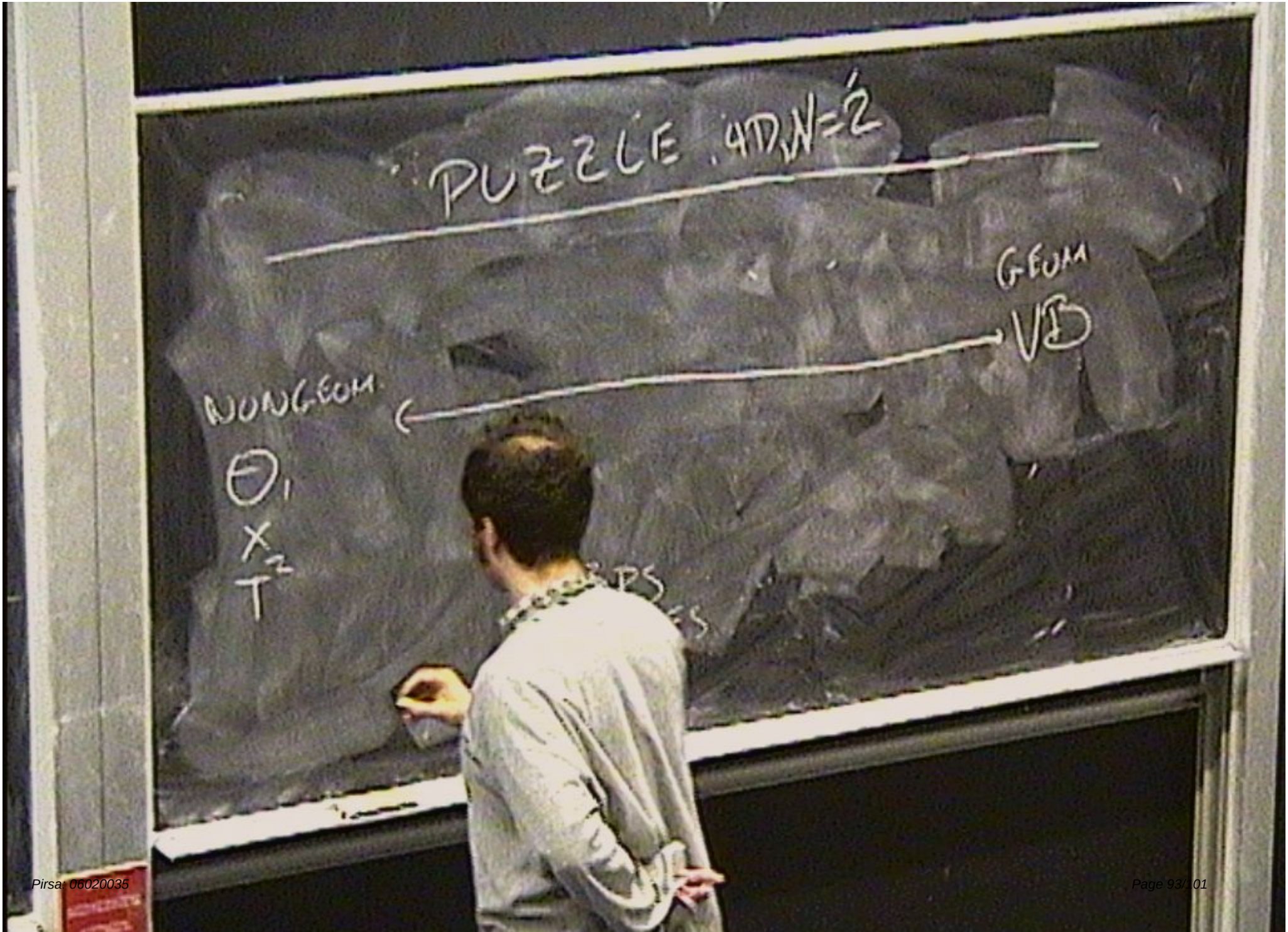

PUZZLE

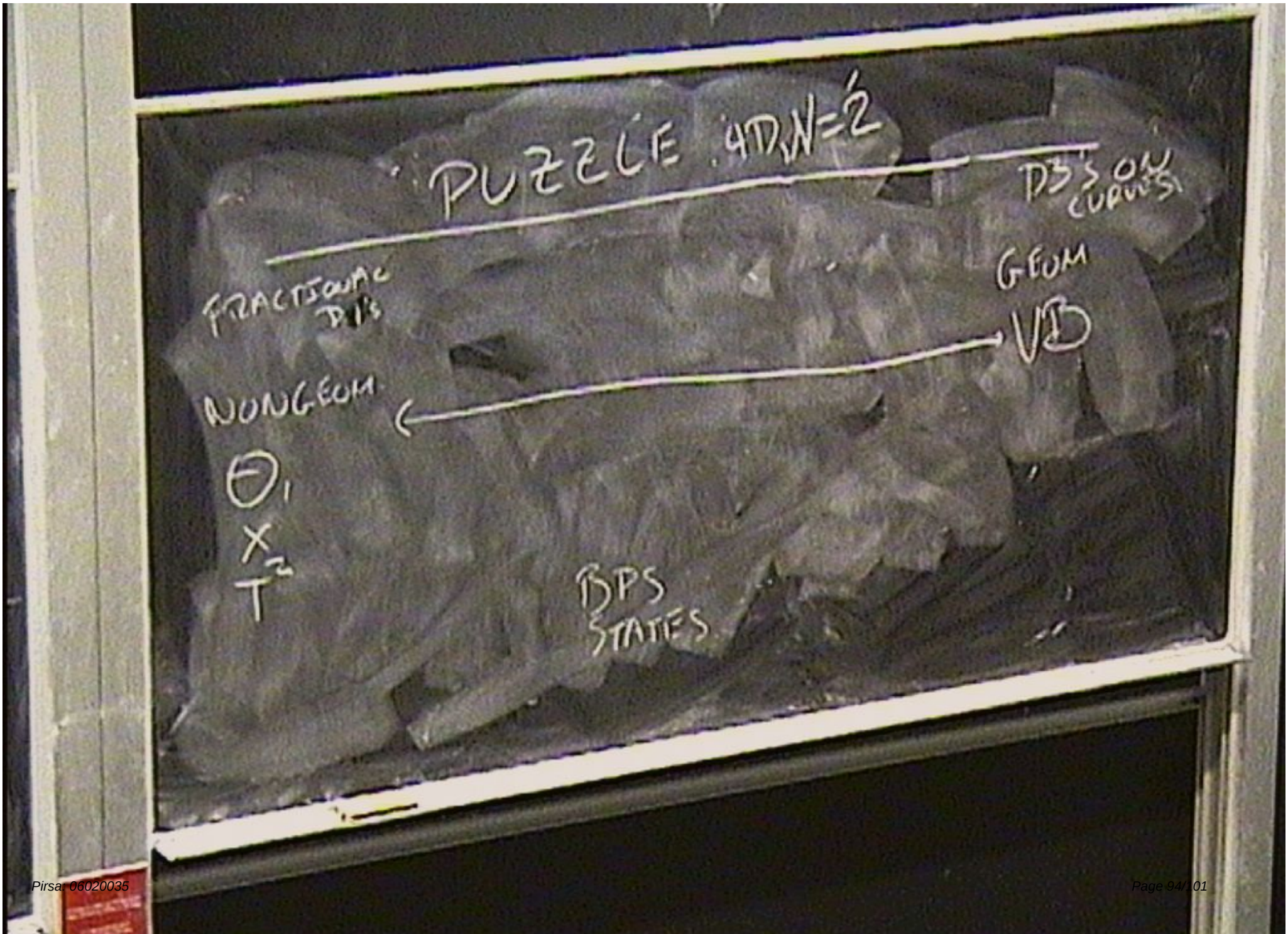

PUZZLE
NONGEOM

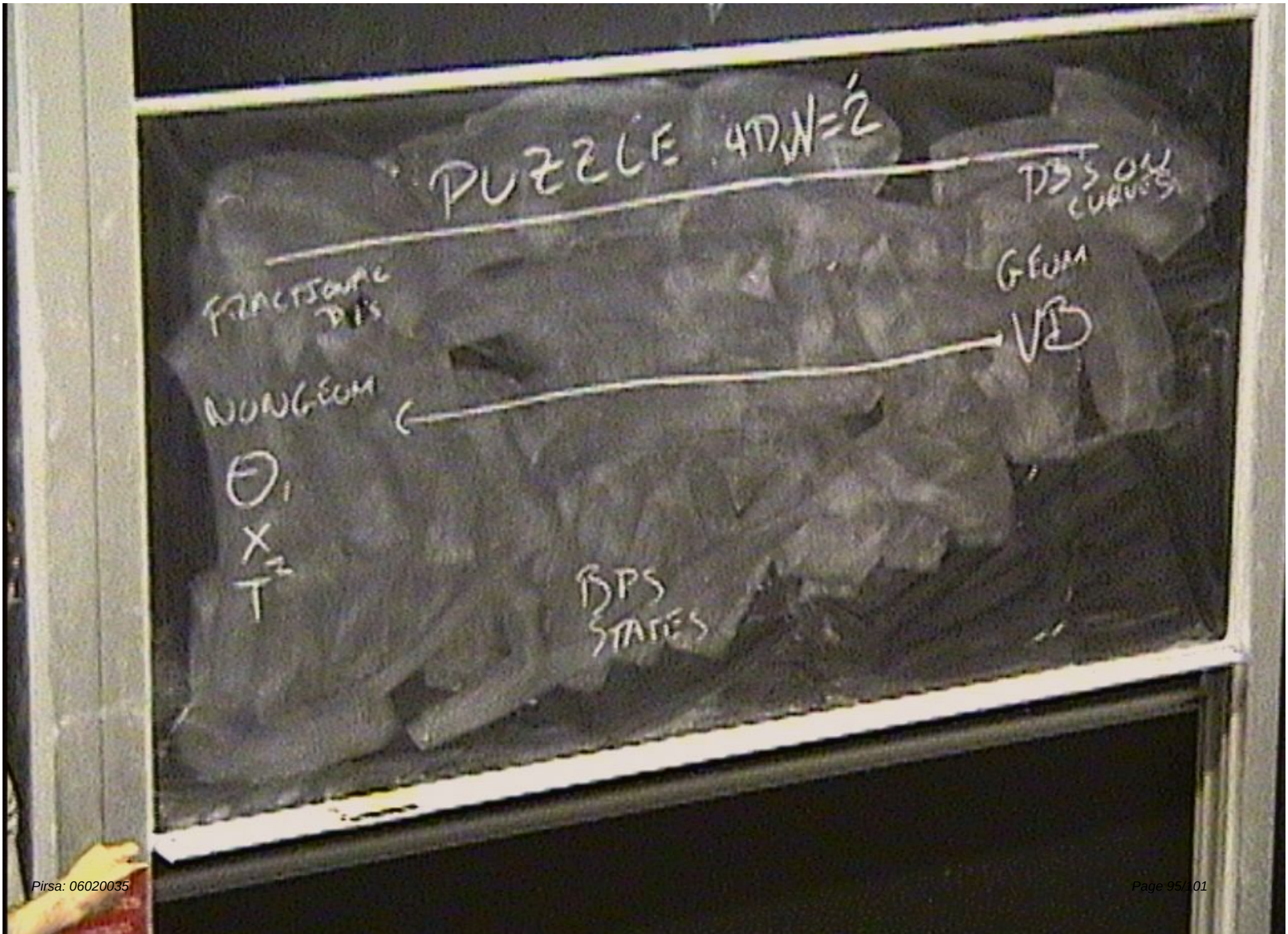

PUZZLE
GEOM
NONGEOM

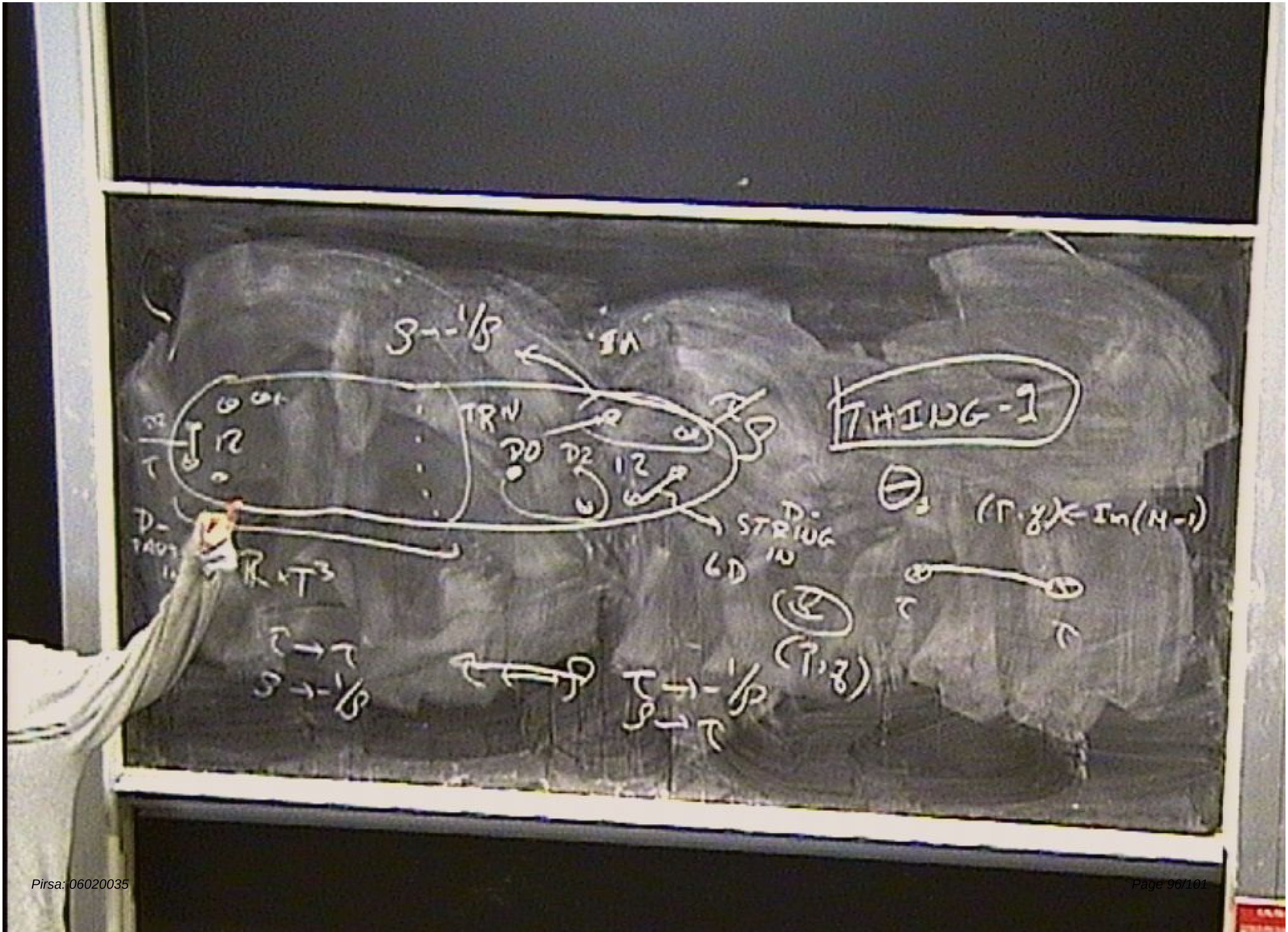


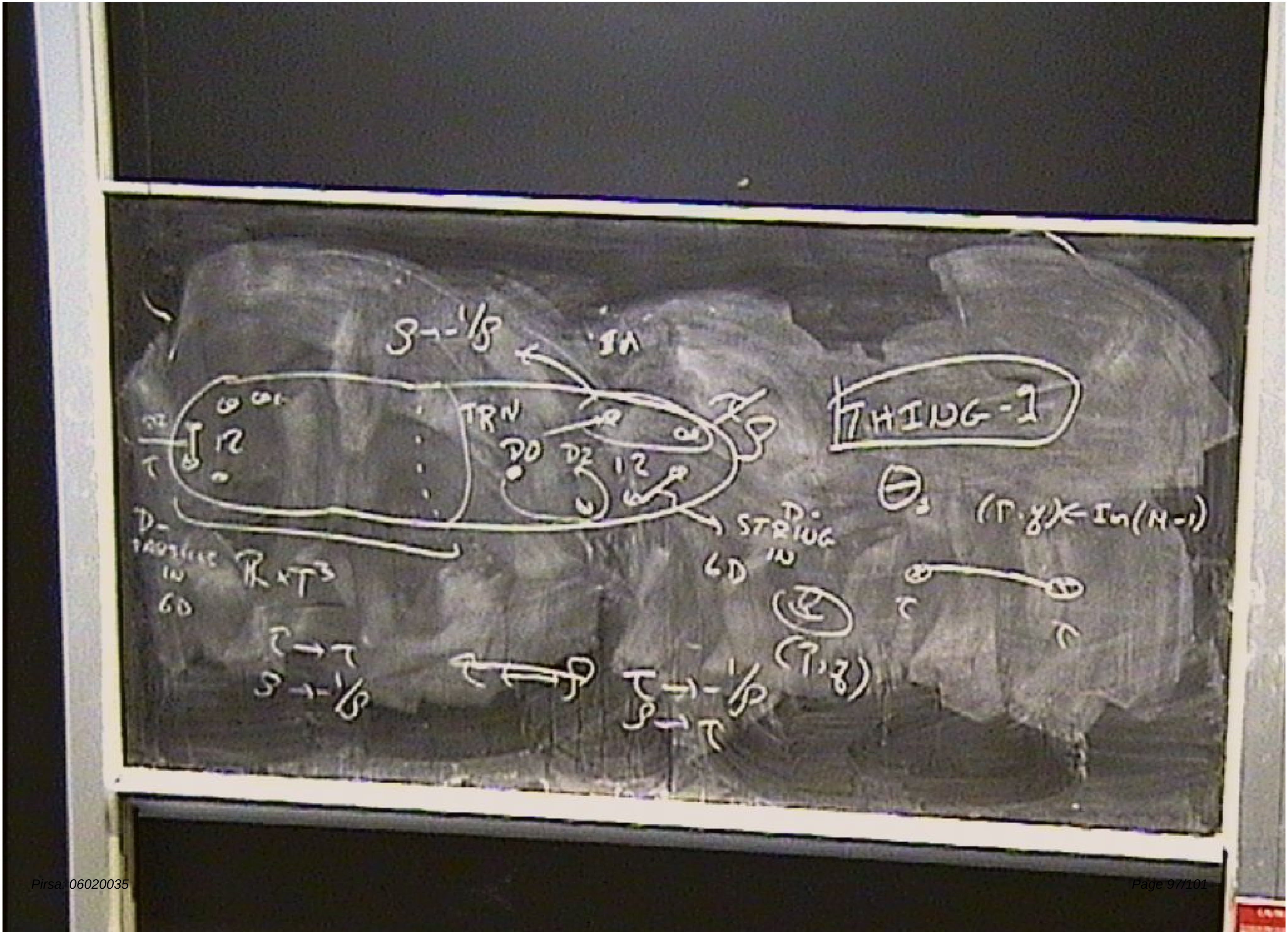

PUZZLE 4D, N=2
GEOM
VB
NONGEOM
Θ_1
X
T^2

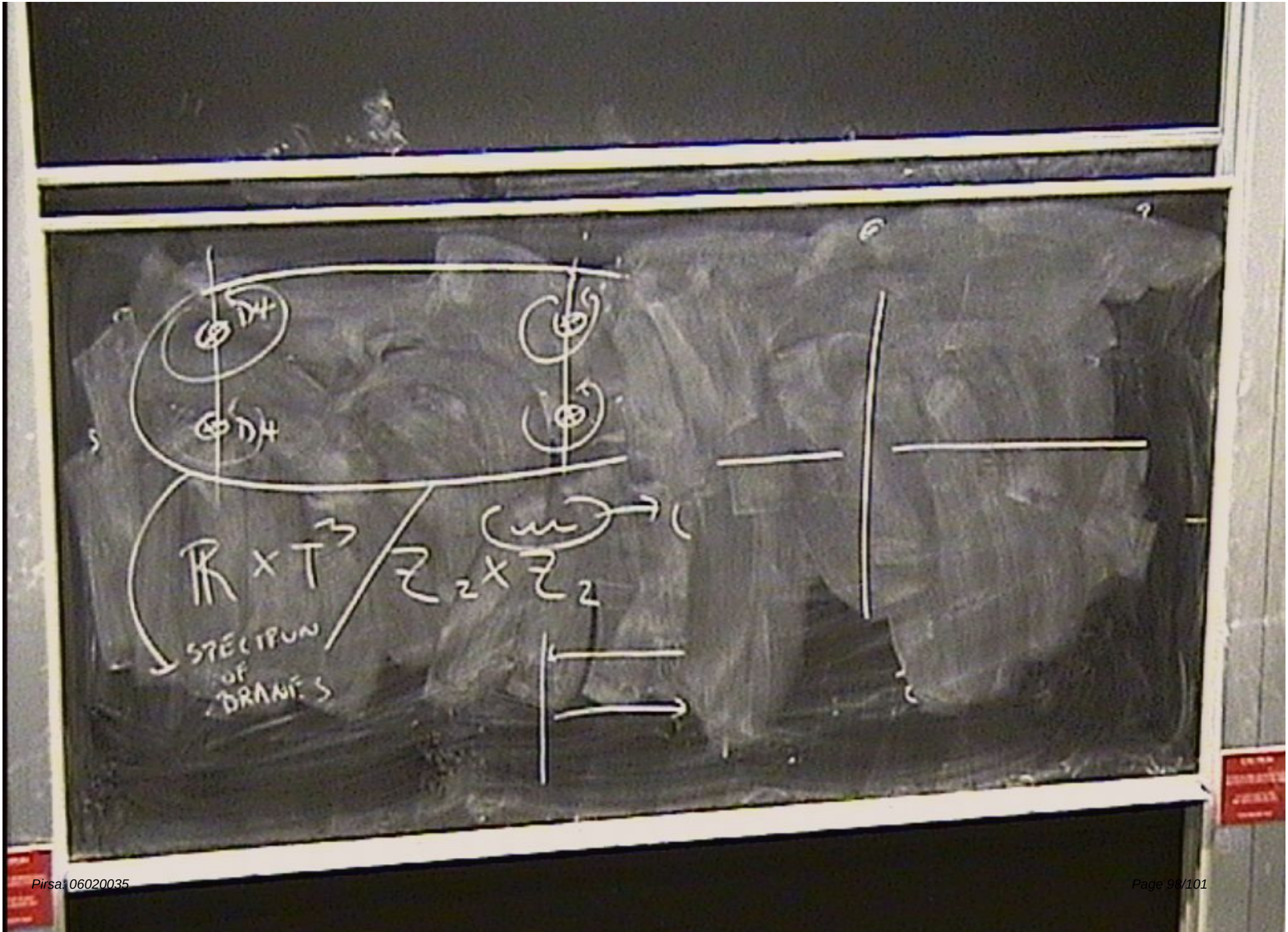

PUZZLE: 4D, N=2
G-EOM
VD
ADJOINT-EOM
Θ_1
X_2
T^2

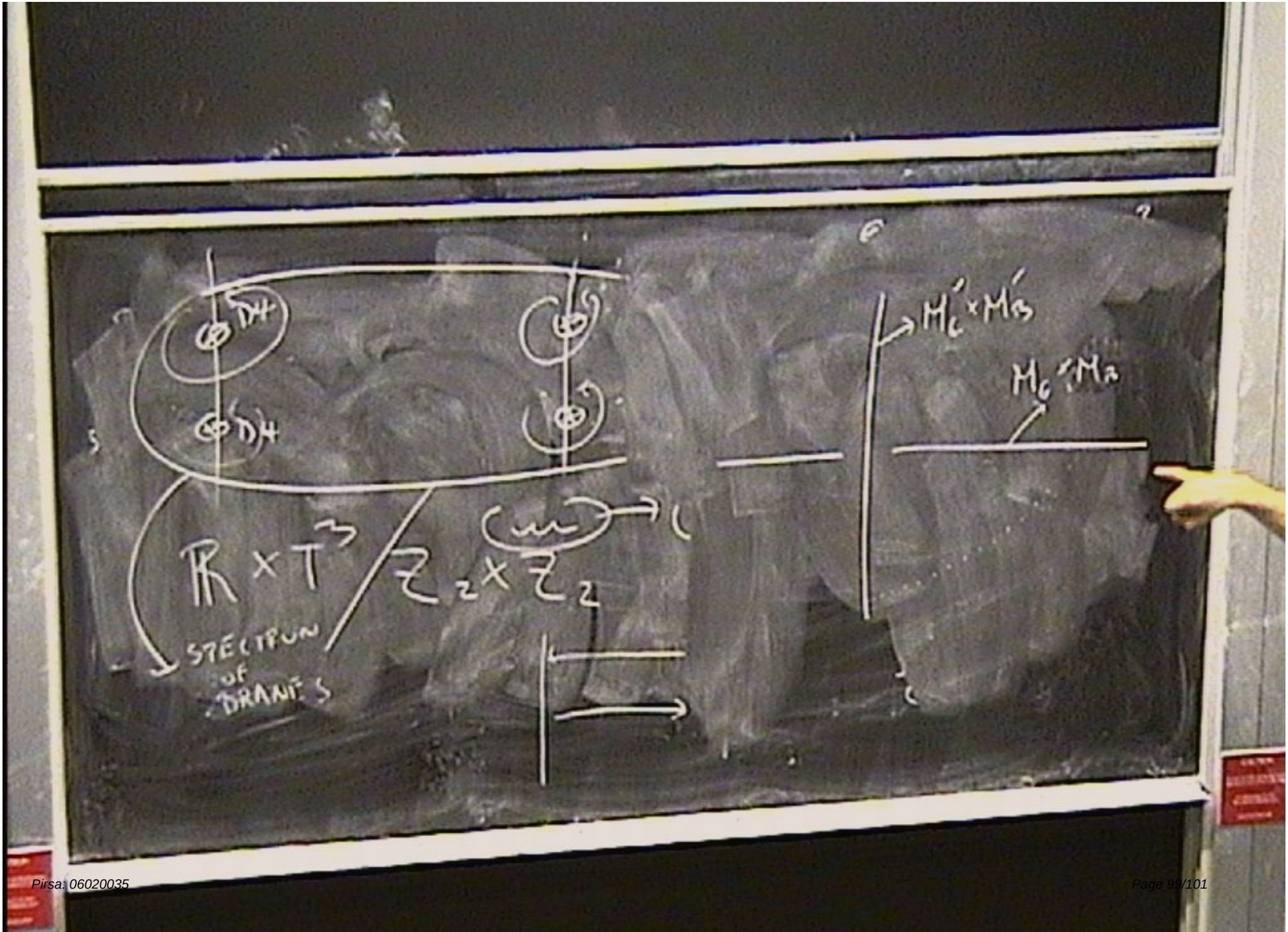

PUZZLE 4D, N=2
D3's ON CURVES
FRACTIONAL D1's
GEOM
VD
NONGEOM
Θ_1
X
T^2
BPS STATES

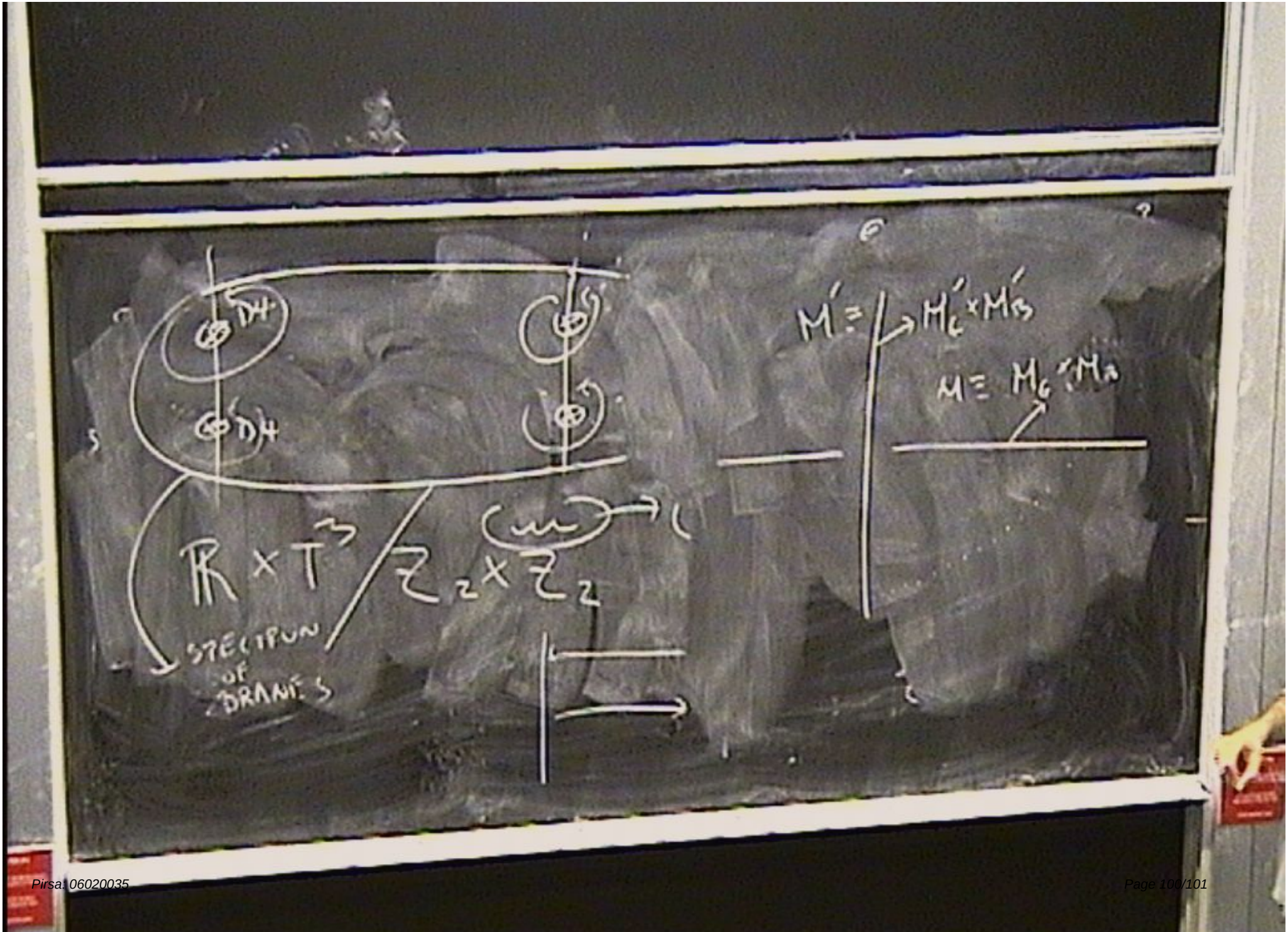

PUZZLE 4D N=2
D3's ON CURVES
FRACTIONAL D1's
GEOM
VB
NONGEOM
Θ_1
X
T^2
BPS STATES

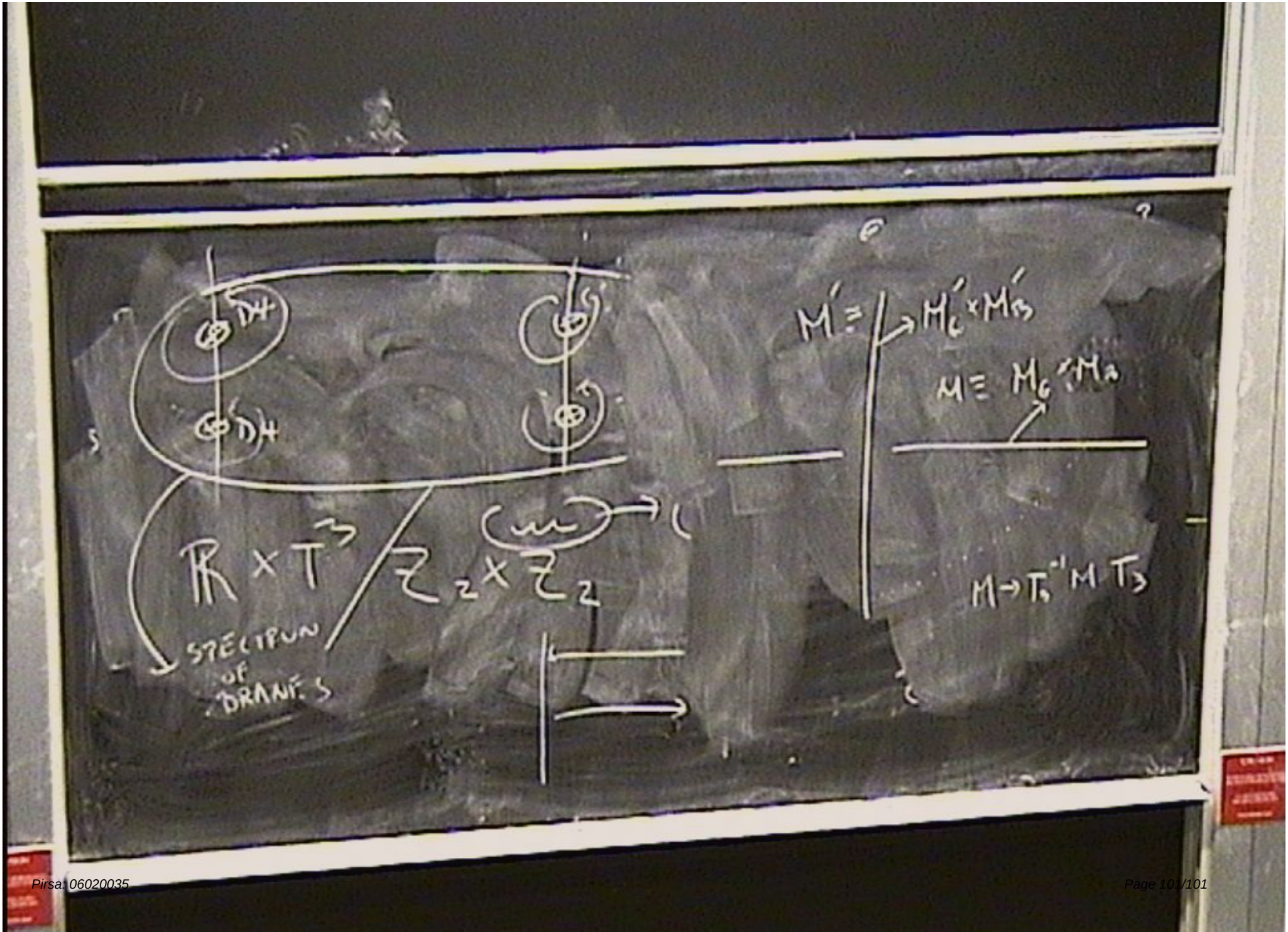

THING-1
TRN
STRING
6D


THING-1
STRING
6D
TRN
D0
D2
12
(τ, g)


D4
D4
$\mathbb{R} \times T^3$
$\mathbb{Z}_2 \times \mathbb{Z}_2$
SPECTRUM
OF
BRANES


D4
D4
$\mathbb{R} \times T^3$
$\mathbb{Z}_2 \times \mathbb{Z}_2$
SPECTRUM OF BRANES
$M_6' \times M_3$
$M_6 : M_3$


D4
D4
$\mathbb{R} \times T^3 / Z_2 \times Z_2$
SPECTRUM OF BRANES
$M' = M_6' \times M_5'$
$M = M_6 \times M_5$


D4
D4
$\mathbb{R} \times T^3 / \mathbb{Z}_2 \times \mathbb{Z}_2$
SPECTRUM OF BRANES
$M' = M'_6 \times M'_3$
$M = M_6 \times M_3$
$M \to T_3^{-1} M T_3$