Title: On Symmetries and Asymmetries at Hadron Colliders

Date: Apr 08, 2011 01:00 PM

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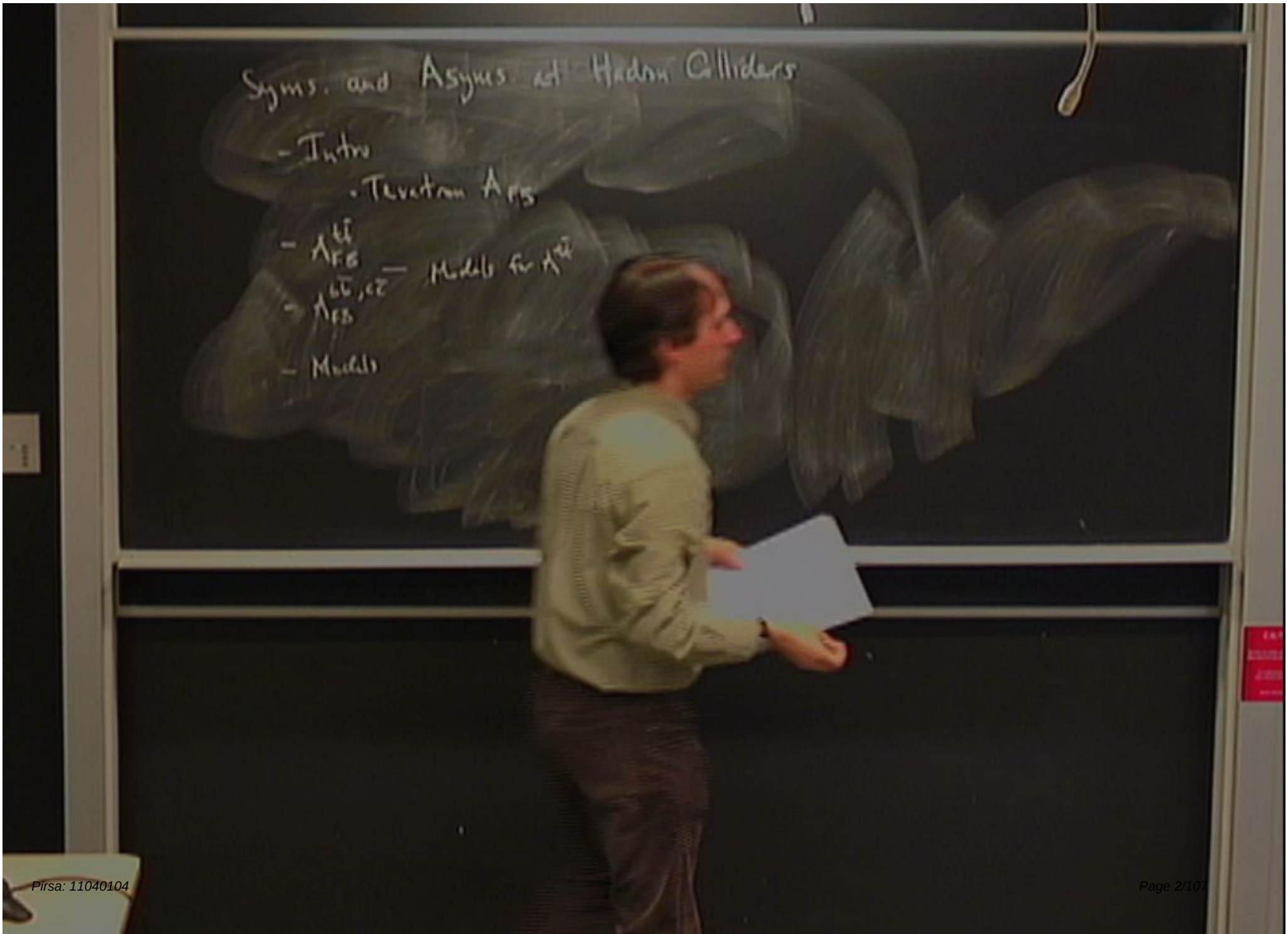
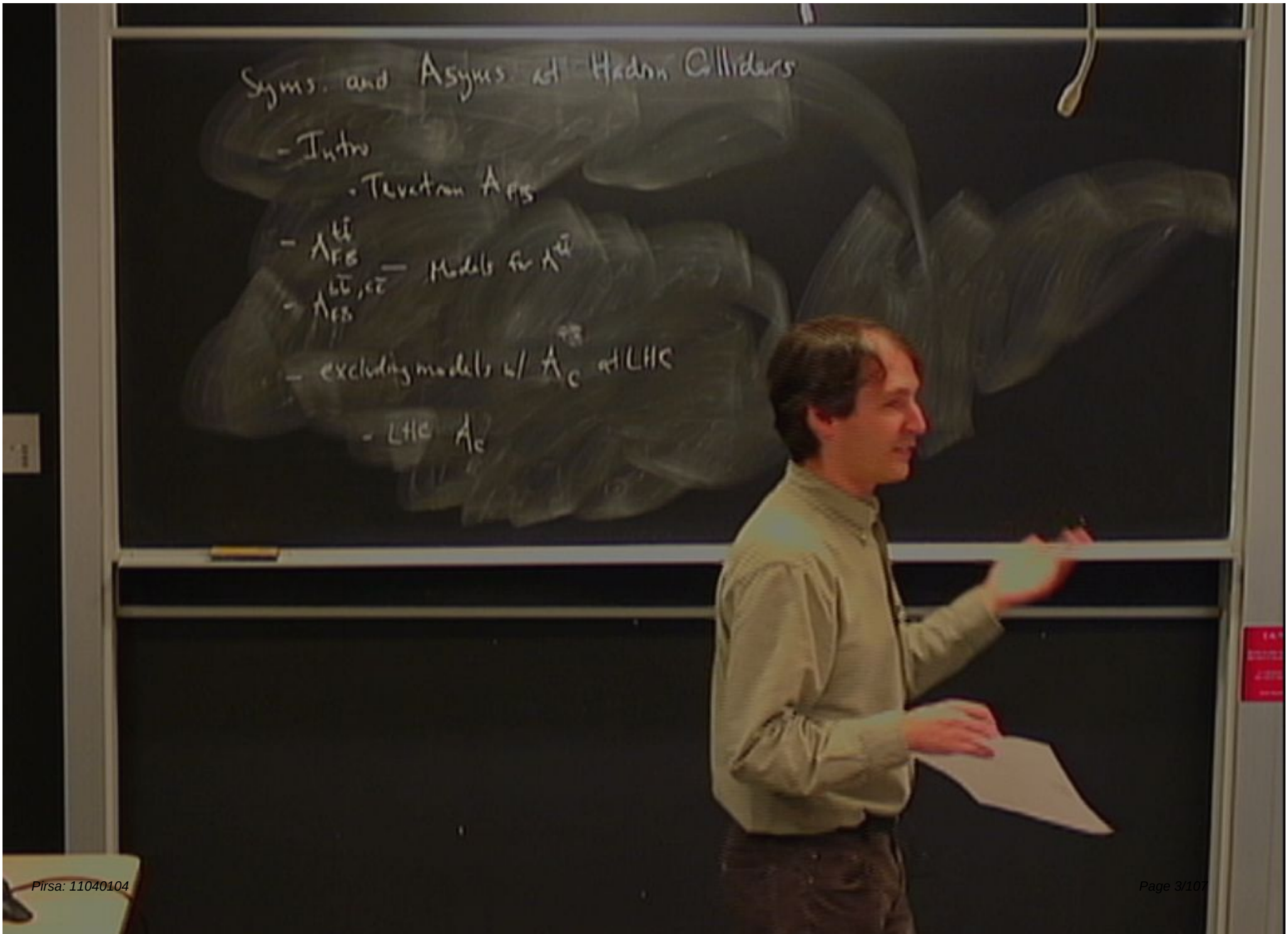
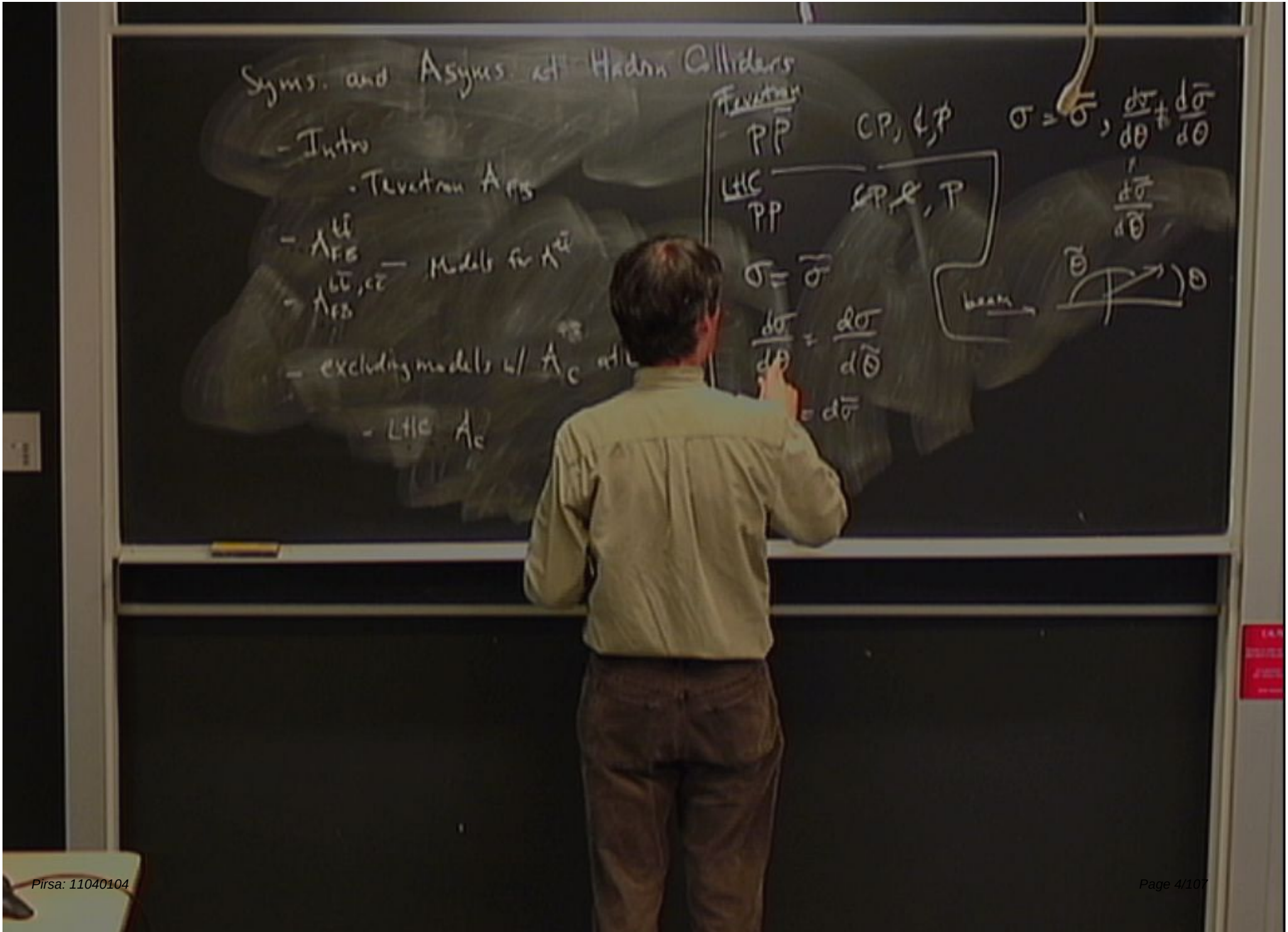
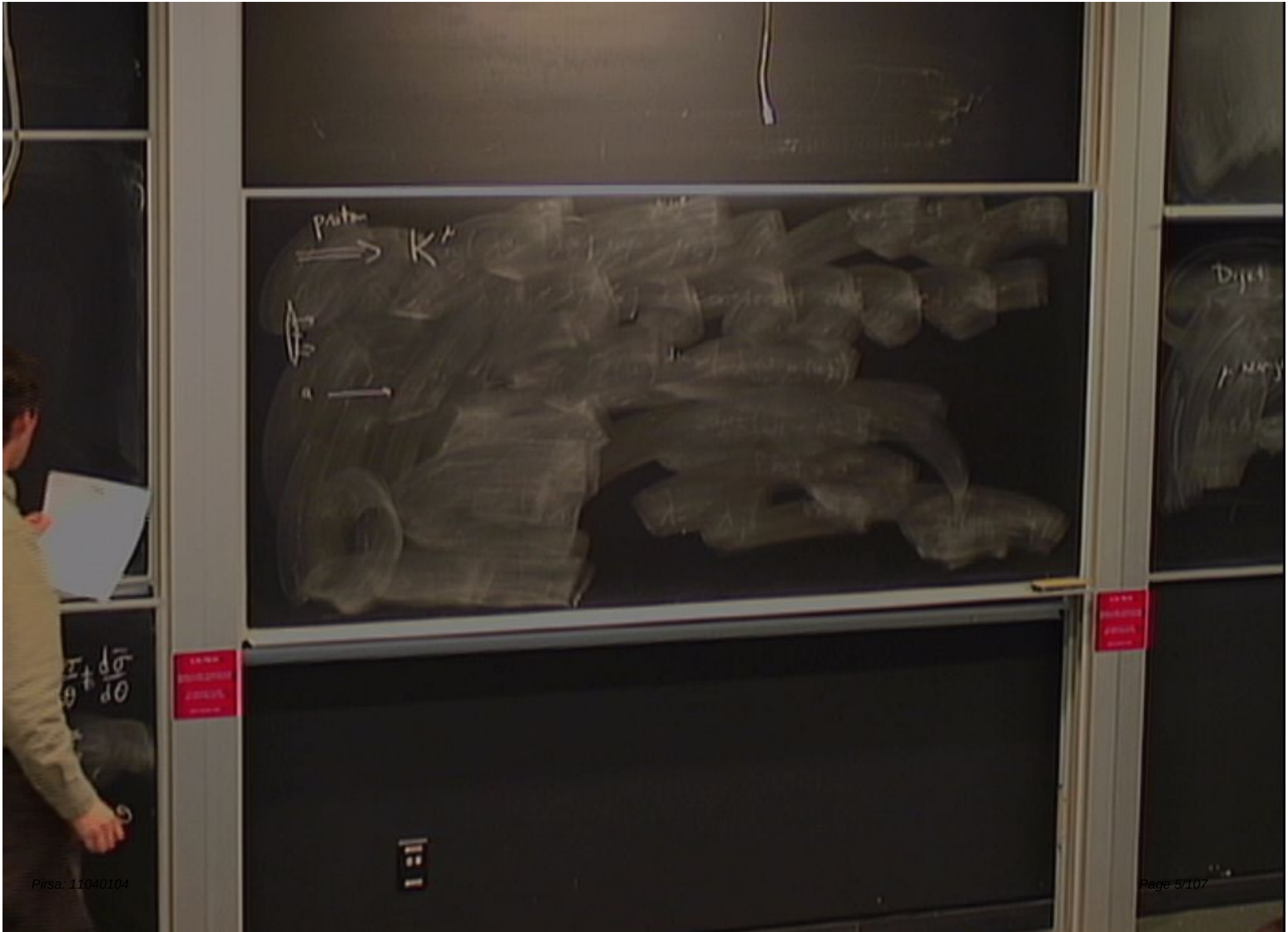
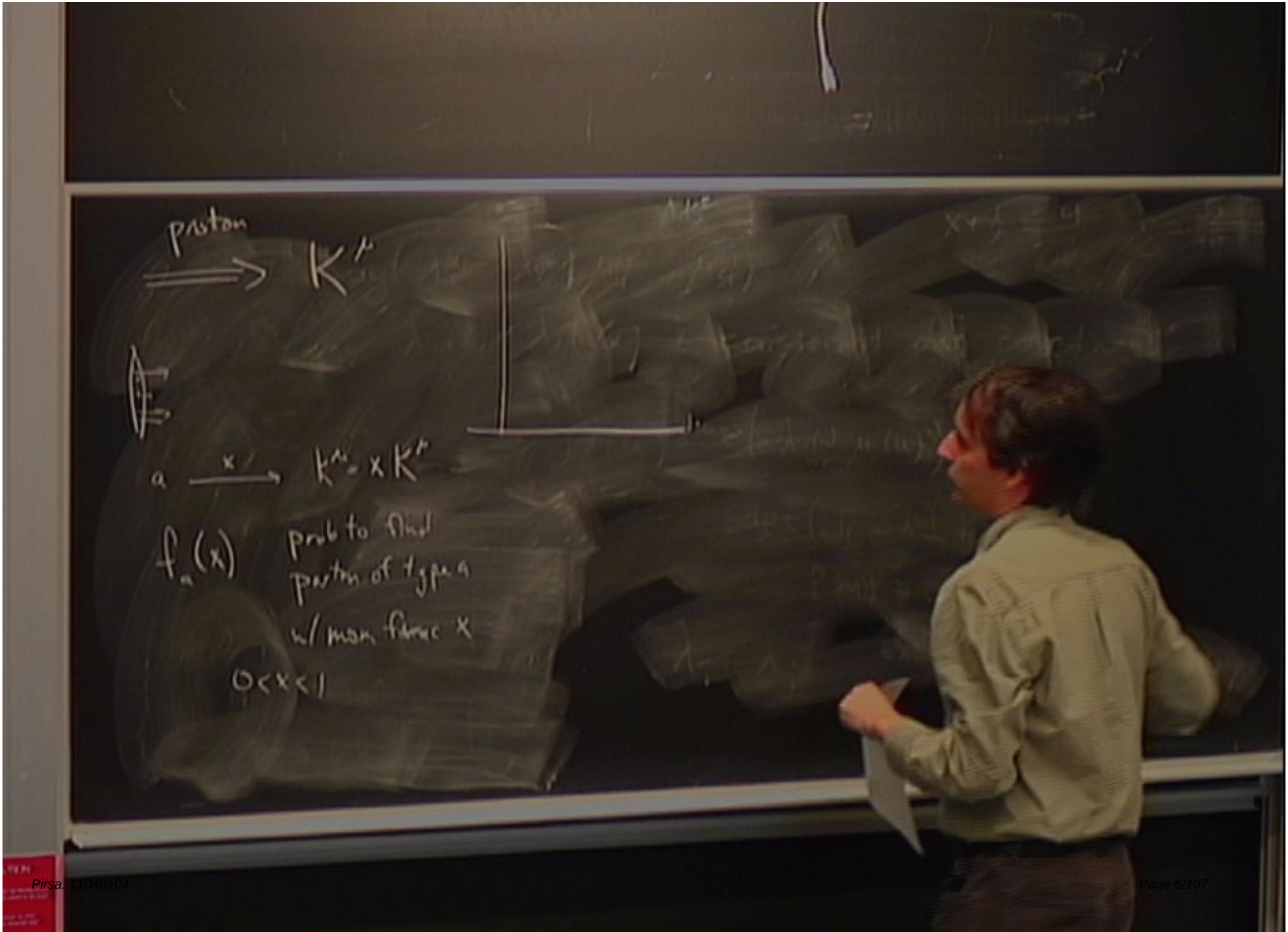
Abstract: TBA

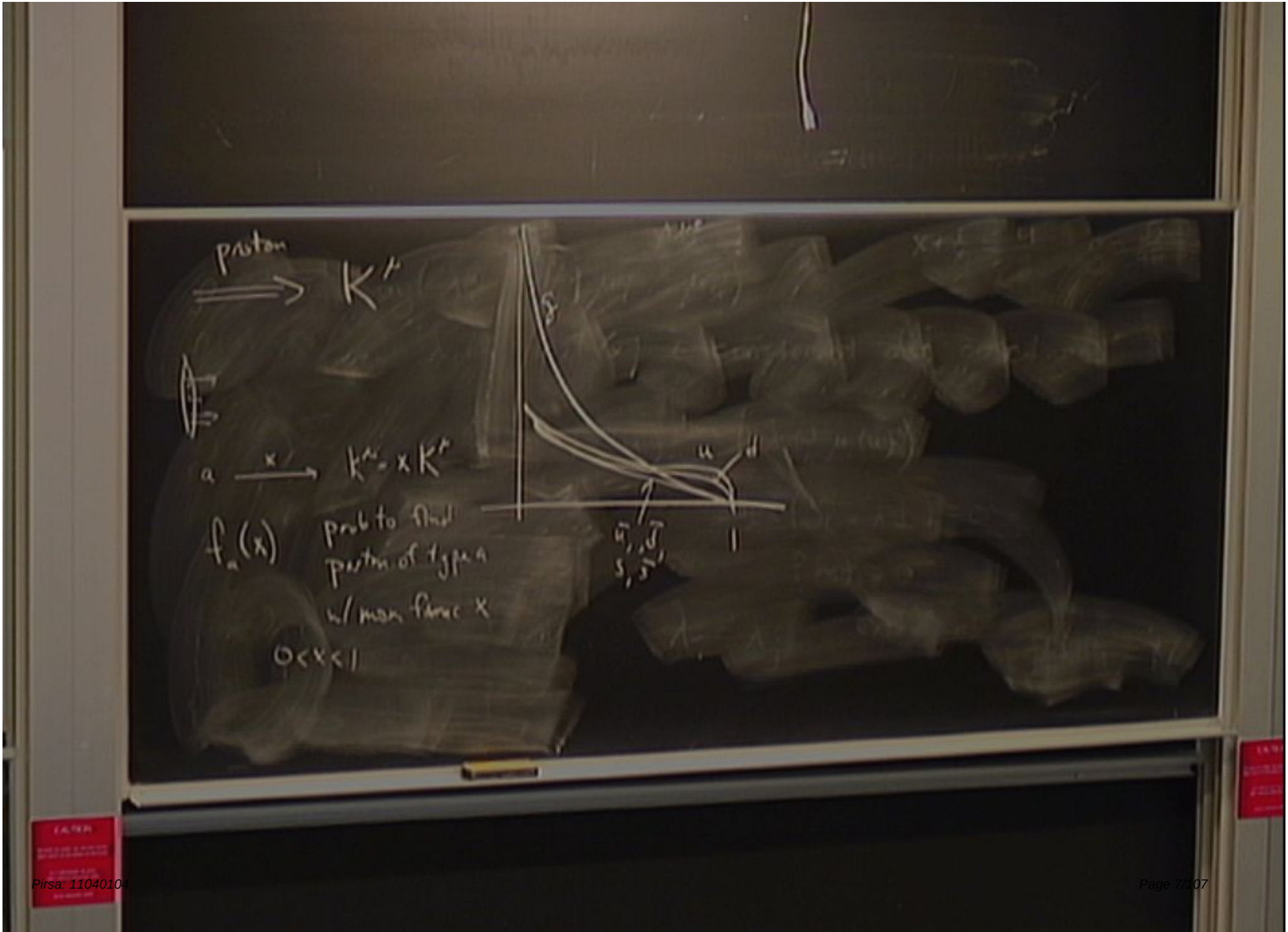

Sysms. and Asysms at Hadron Colliders
- Intro
• Tevatron A_{FB}
- $A_{FB}^{t\bar{t}}$
- $A_{FB}^{t\bar{t},cc}$ — Models for $A^{t\bar{t}}$
- Models

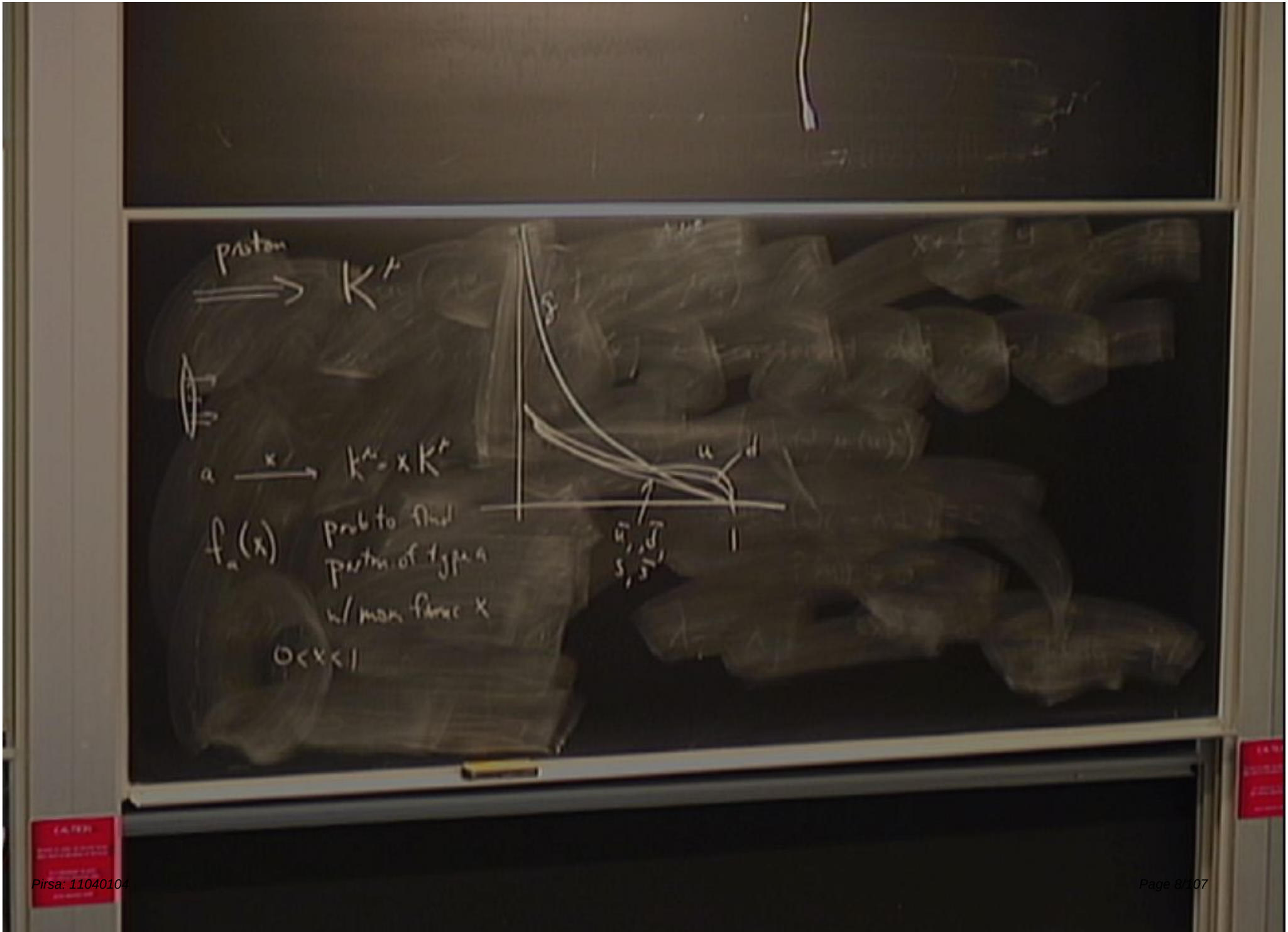

Syms. and Asyms at Hadron Colliders
- Intro
- Tevatron A_{FB}
- A_{FB}^{tt}
- $A_{FB}^{tt,cc}$ — Models for A^{tt}
- excluding models w/ A_C^{pp} at LHC
- LHC A_C

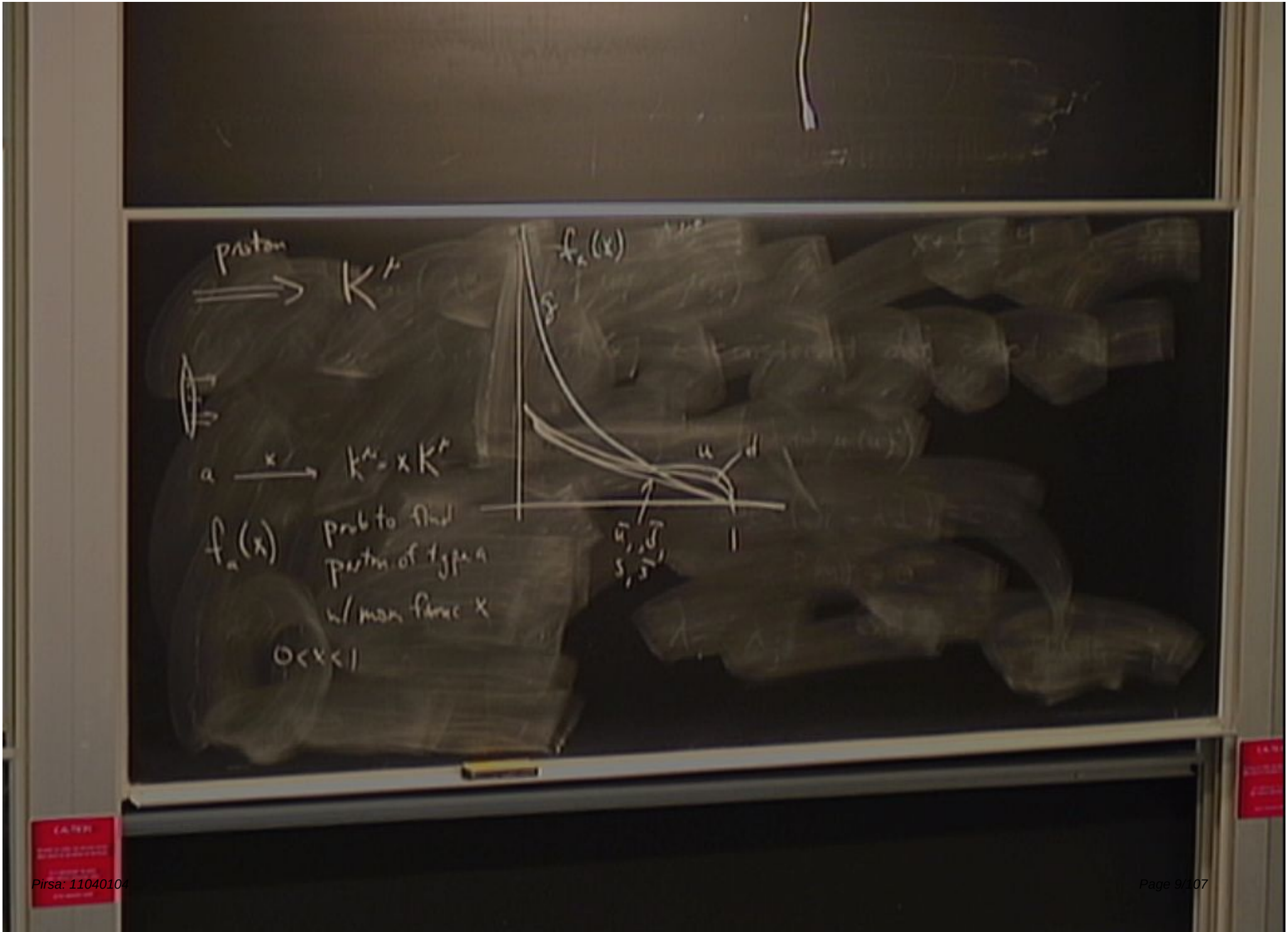

Syms. and Asyms at Hadron Colliders
- Intro
- Tevatron A_{FB}
- $A_{FB}^{t\bar{t}}$
- $A_{FB}^{b\bar{b},c\bar{c}}$ — Models for $A^{t\bar{t}}$
- excluding models w/ A_C
- LHC A_C
Tevatron
$p\bar{p}$ CP, $\not{C}\not{P}$
LHC
pp $\not{C}\not{P}$, $\not{C}$, P
$\sigma = \bar{\sigma}$
$\frac{d\sigma}{d\theta} = \frac{d\bar{\sigma}}{d\bar{\theta}}$
beam

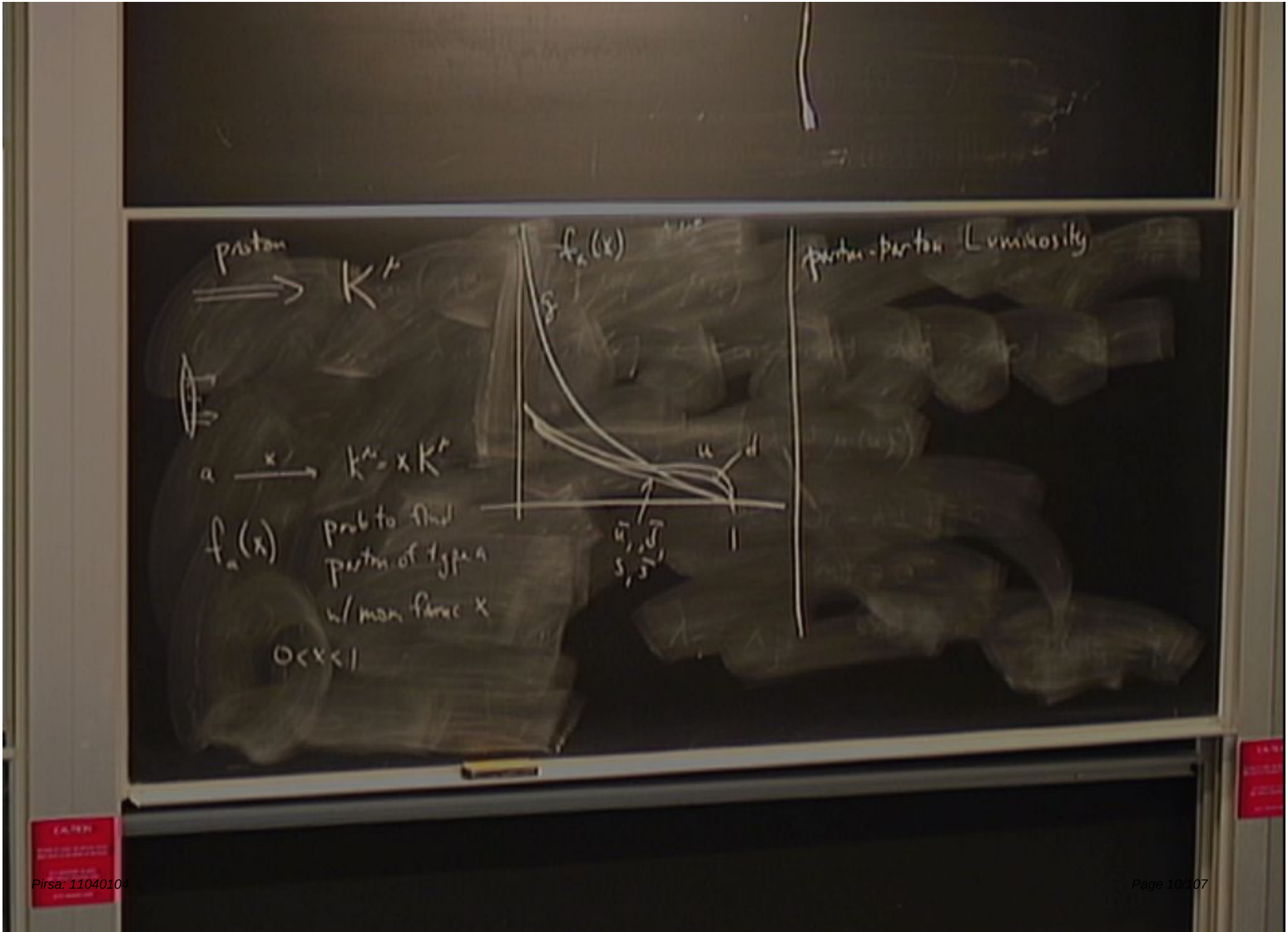

Pair
K

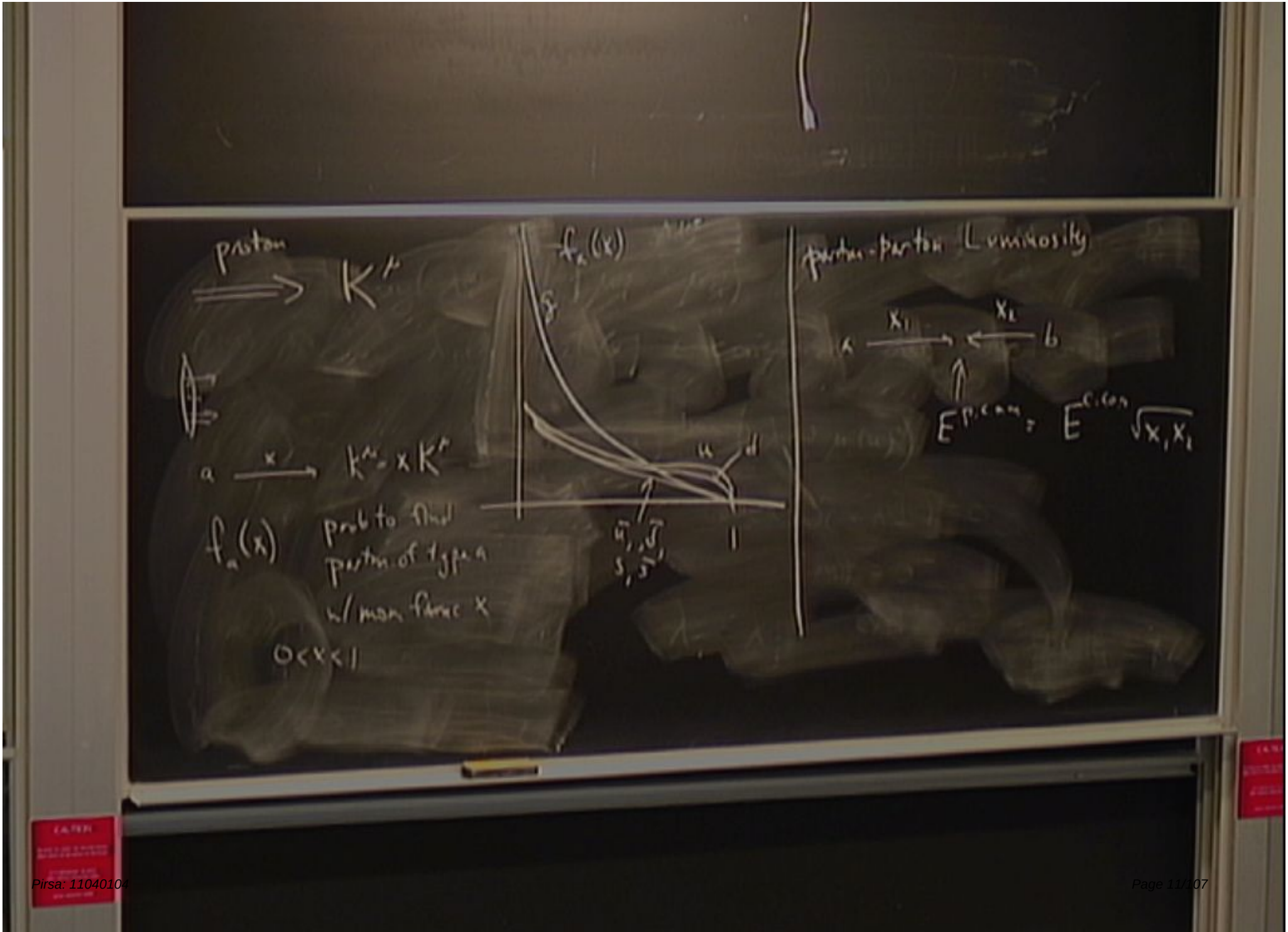

proton
K^μ
a
x
$k^\mu = x K^\mu$
$f_a(x)$
prob to find
proton of type a
w/ mom. fraction x
$0 < x < 1$

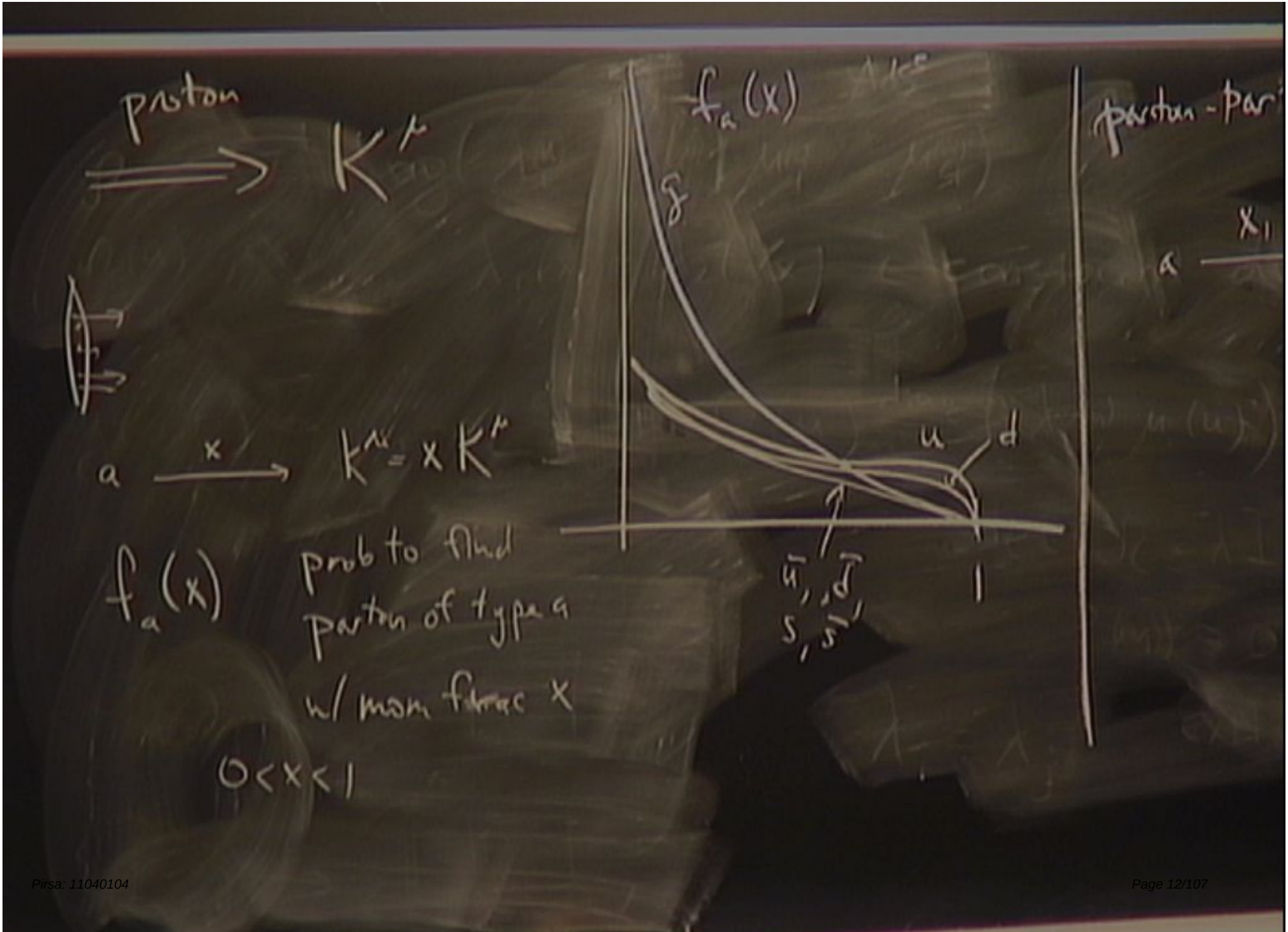

proton
K^μ
$a \xrightarrow{x} k^\mu = x K^\mu$
$f_a(x)$
Prob to find
proton of type a
w/ mom. fraction x
$0 < x < 1$
u
d
1

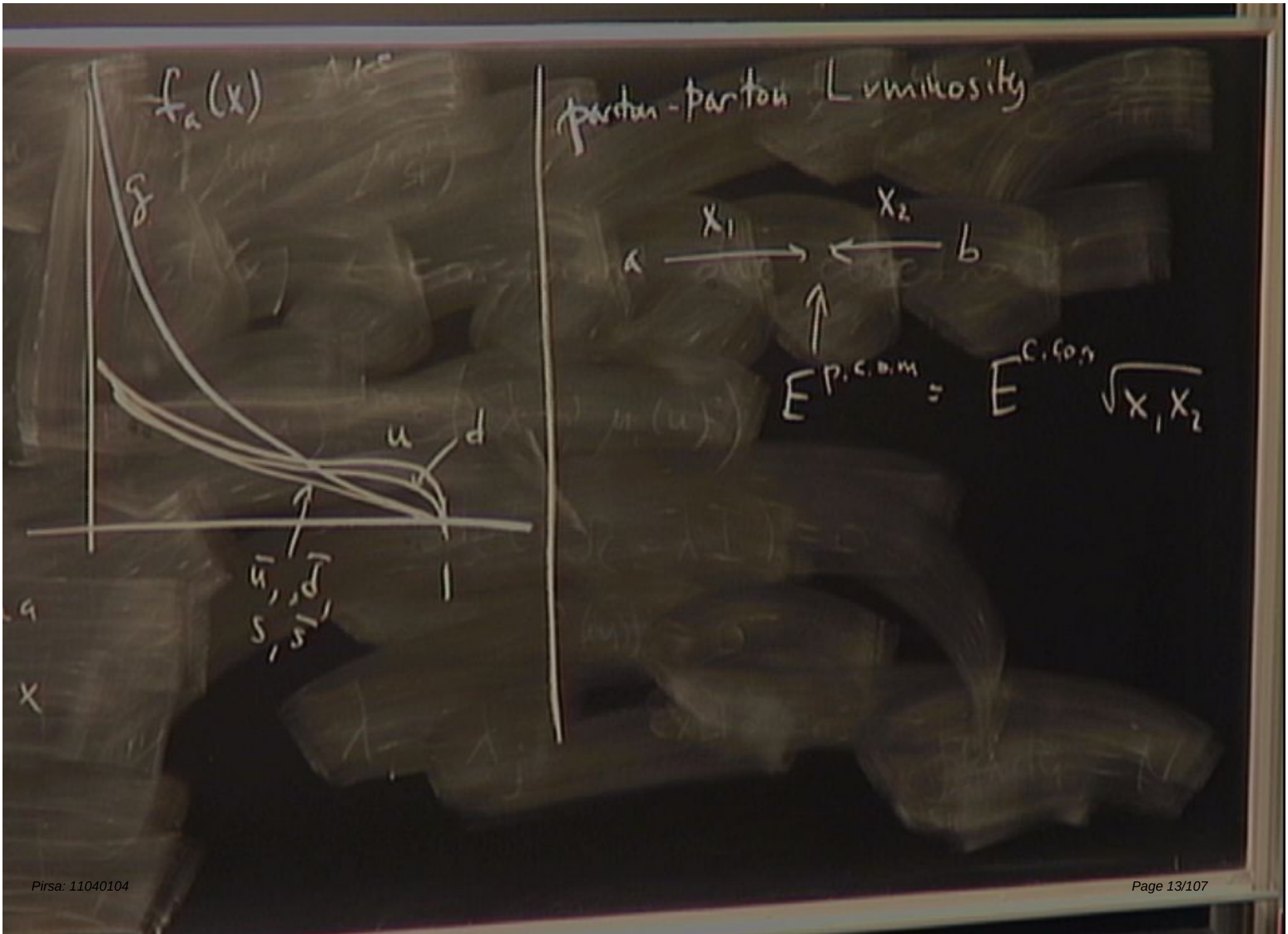

proton
K^+
F_2
$a \xrightarrow{x} K^+ \times K^+$
$f_a(x)$
prob to find
parton of type a
w/ momentum fraction x
$0 < x < 1$
u
d
1

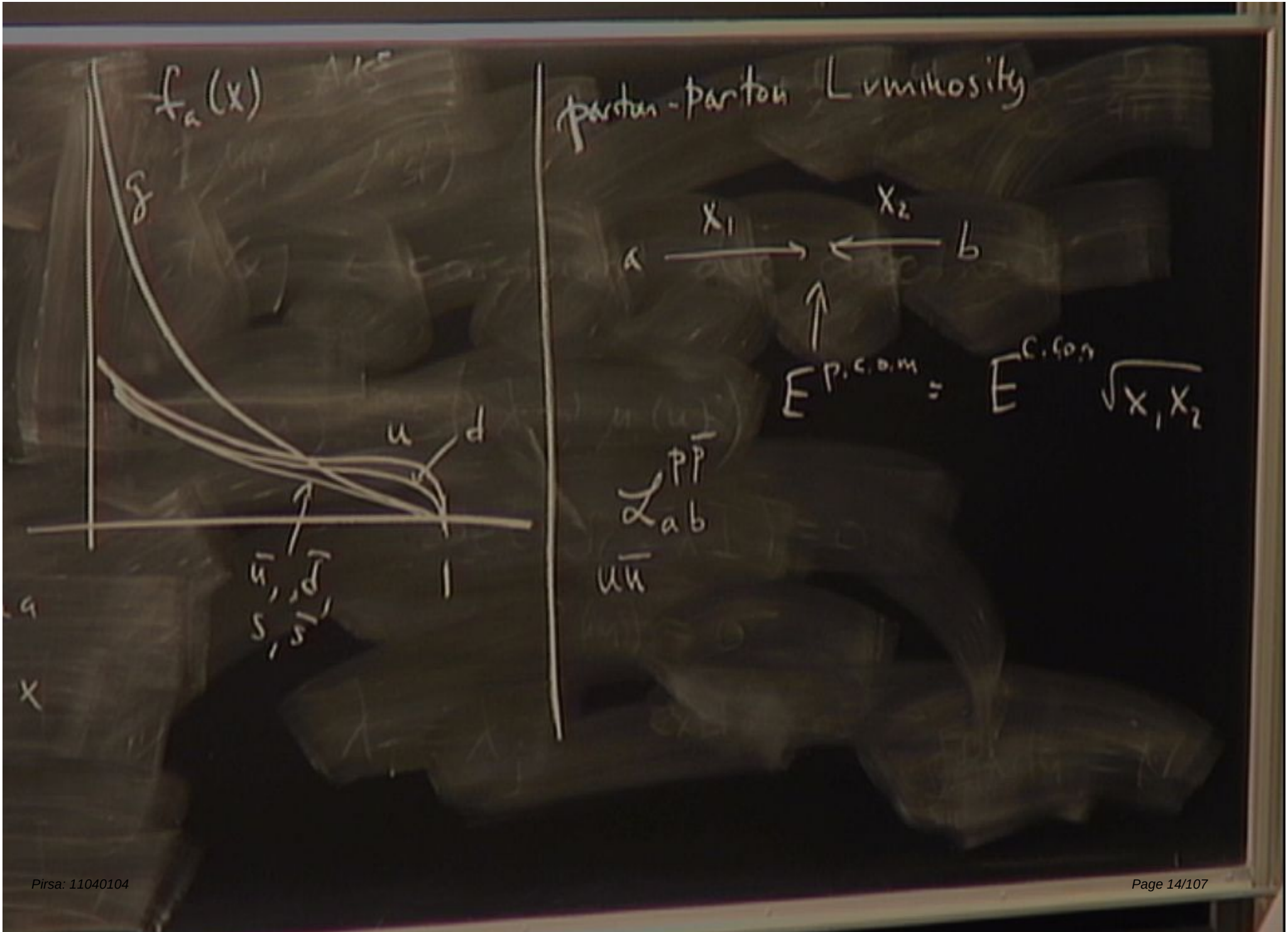

proton
K^+
$f_a(x)$
$a \xrightarrow{x} K^+ \times K^-$
$f_a(x)$ prob to find parton of type a w/ momentum fraction x
$0 < x < 1$
u
d
1

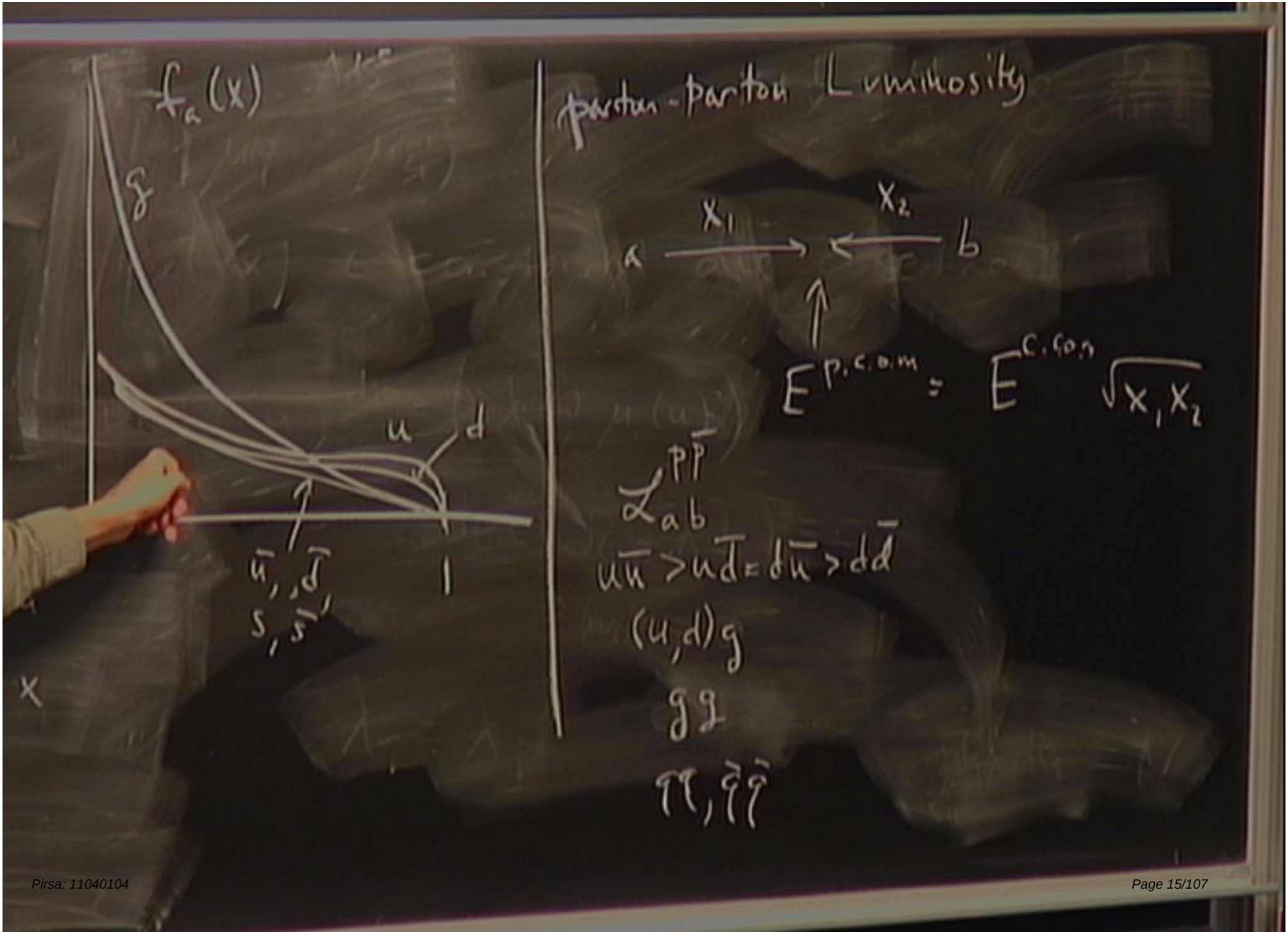

proton
K^μ
$f_a(x)$
$a \xrightarrow{x} k^\mu = x K^\mu$
$f_a(x)$ prob to find parton of type a w/ momentum fraction x
$0 < x < 1$
u
d
parton-parton Luminosity

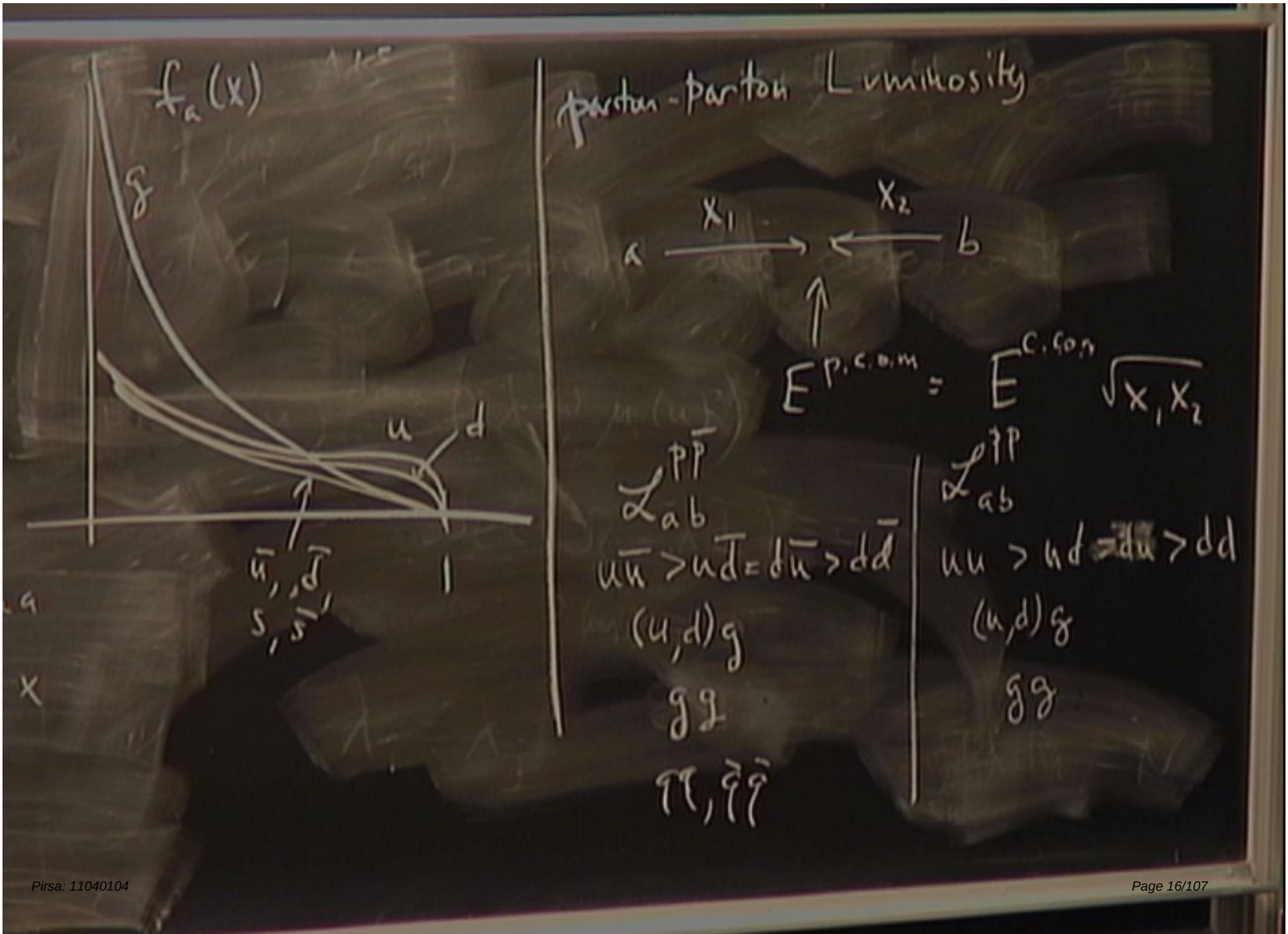

proton
K^μ
$a \xrightarrow{x} k^\mu = x K^\mu$
$f_a(x)$ prob to find parton of type a w/ mom. frac x
$0 < x < 1$
$f_a(x)$
g
u d
1
parton-parton Luminosity
x_1 x_2
a b
$E^{p,cm} = E^{c.o.m} \sqrt{x_1 x_2}$

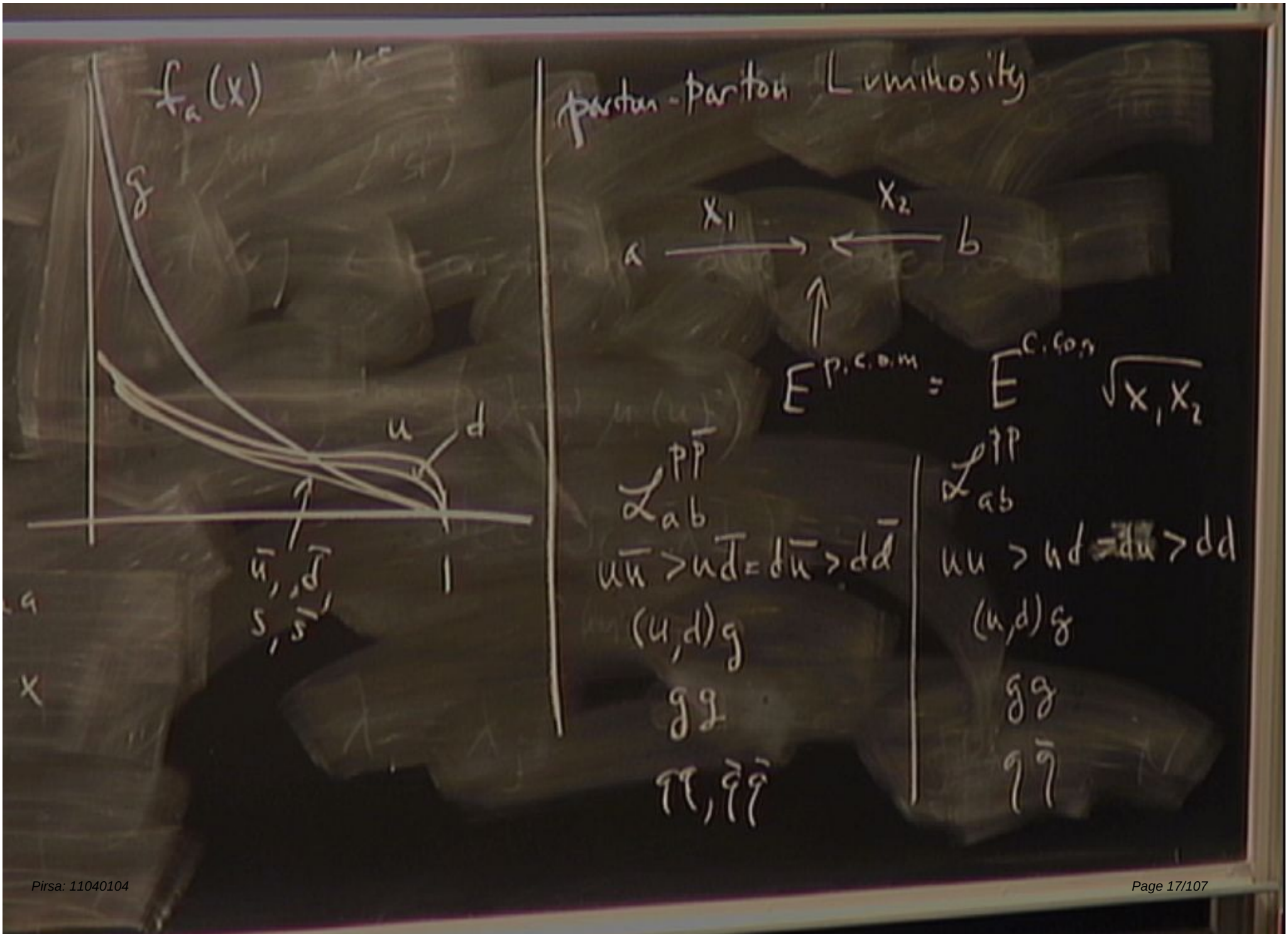

proton
K^μ
$f_a(x)$
parton - par
x_1
a
$k^\mu = x K^\mu$
u
d
$f_a(x)$
prob to find
parton of type a
w/ mom fract x
$0 < x < 1$
1

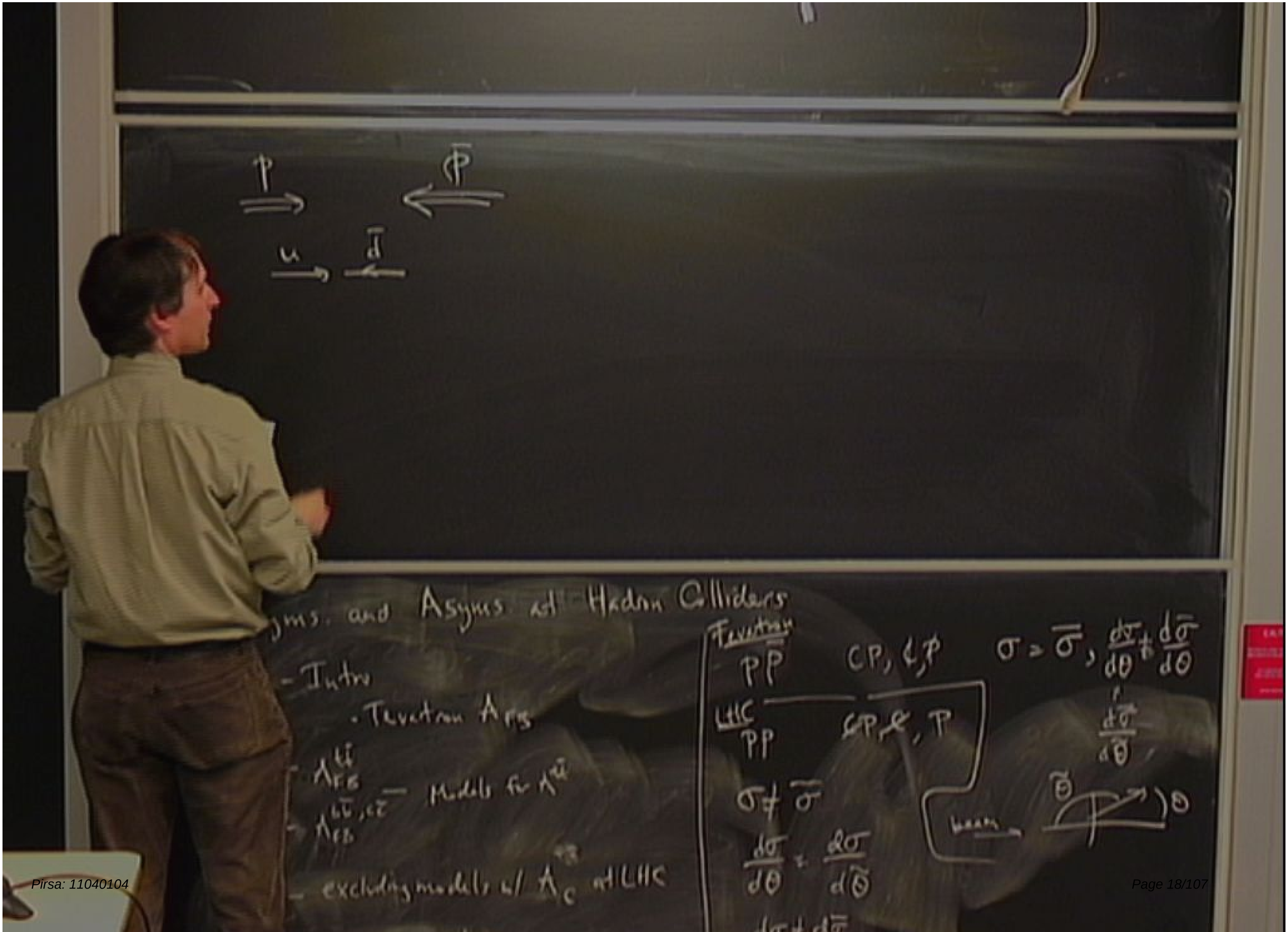

$f_a(x)$
g
u
d
1
parton - parton Luminosity
x_1
x_2
a
b
$E^{p.c.m} = E^{c.o.m} \sqrt{x_1 x_2}$

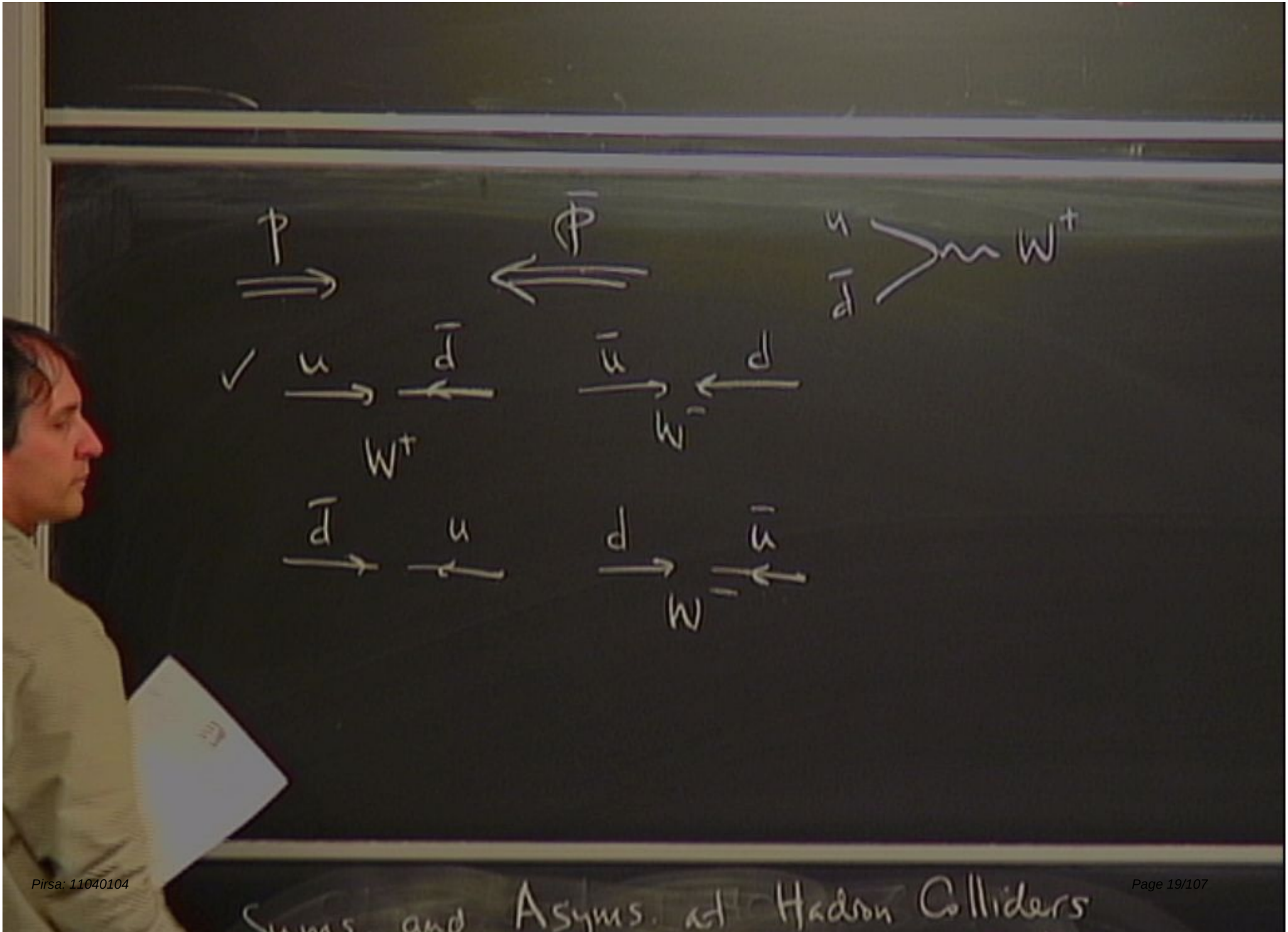

$f_a(x)$
g
u
d
$\bar{u}, \bar{d}$
$s, \bar{s}$
1
x
parton - parton Luminosity
x_1
x_2
a
b
$E^{p.c.o.m} = E^{c.o.m} \sqrt{x_1 x_2}$
$\mathcal{L}_{ab}^{p\bar{p}}$
$u\bar{u}$

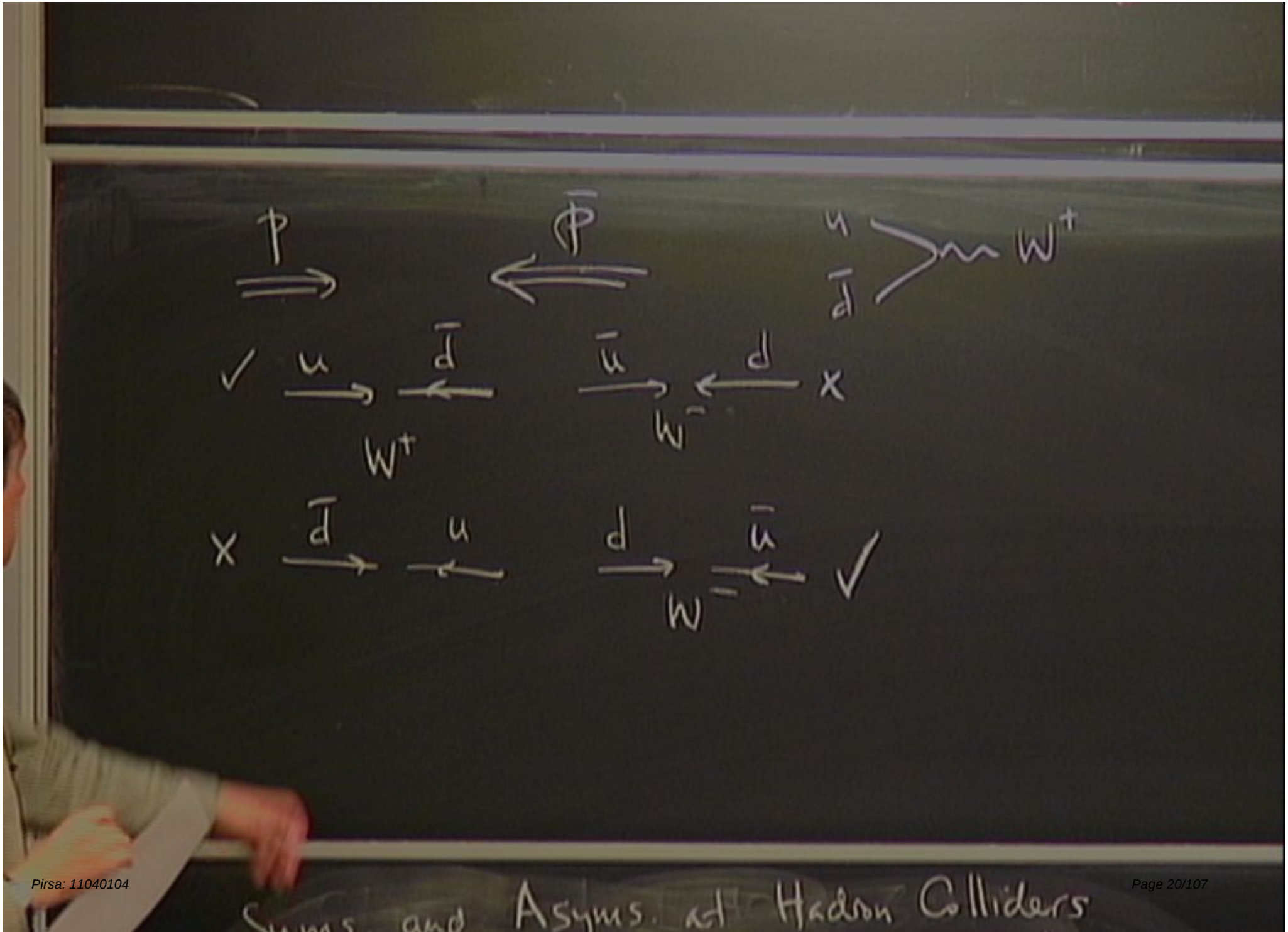

$f_a(x)$
g
u
d
$\bar{u}, \bar{d}$
$s, \bar{s}$
1
x
parton - parton Luminosity
x_1
x_2
a
b
$E^{p.c.o.m} = E^{c.o.m} \sqrt{x_1 x_2}$
$\mathcal{L}^{p\bar{p}}_{ab}$
$u\bar{u} > u\bar{d} = d\bar{u} > d\bar{d}$
$(u,d)g$
gg
$q\bar{q}, q\bar{q}$

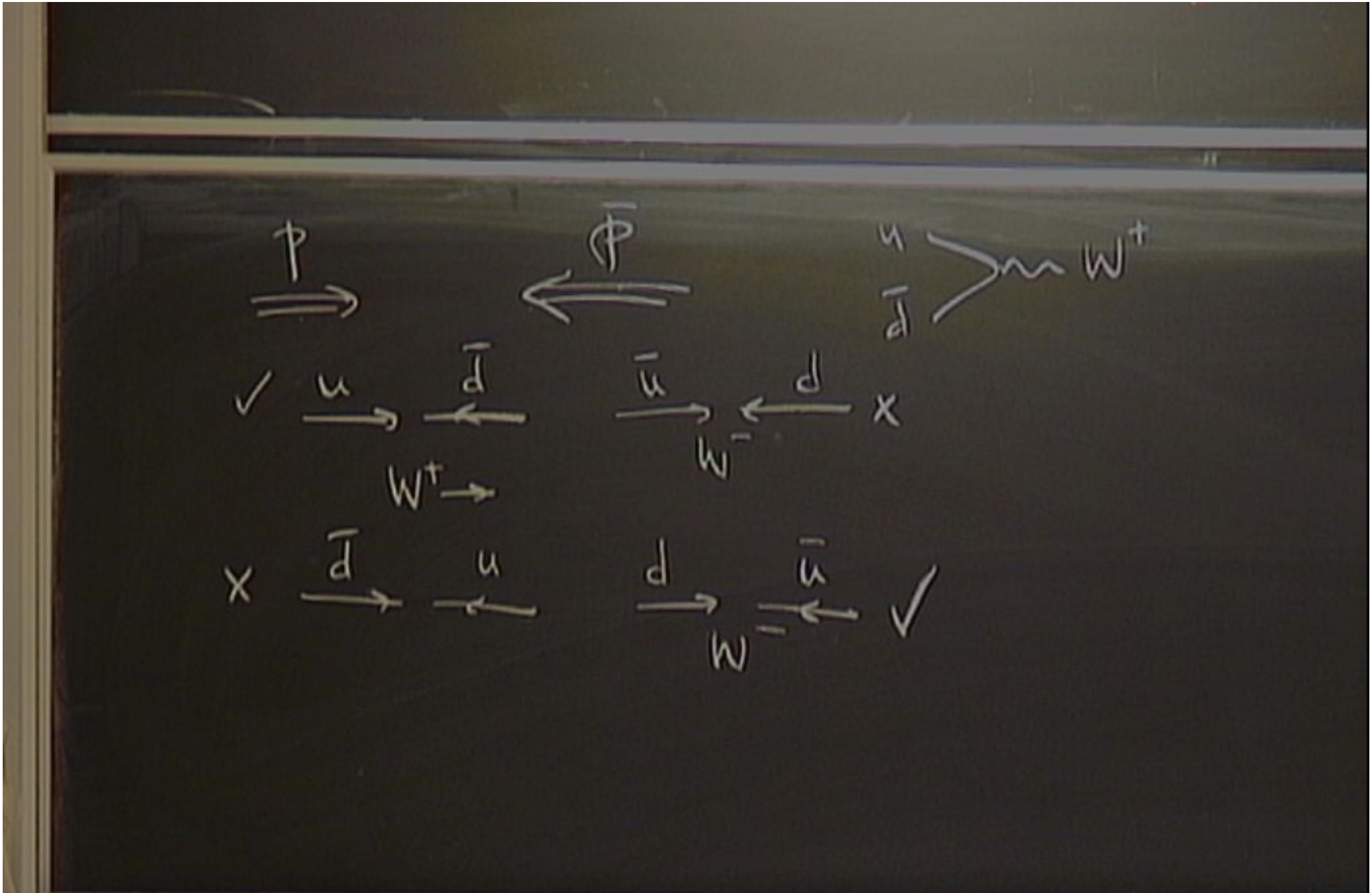

$f_a(x)$
g
u
d
$\bar{u}, \bar{d}$
$s, \bar{s}$
1
x
parton - parton Luminosity
x_1
x_2
a
b
$E^{p.c.o.m} = E^{c.o.m} \sqrt{x_1 x_2}$
$\mathcal{L}_{ab}^{p\bar{p}}$
$u\bar{u} > u\bar{d} = d\bar{u} > d\bar{d}$
$(u,d)g$
gg
$q\bar{q}, q\bar{q}$
$\mathcal{L}_{ab}^{pp}$
$uu > ud = d\bar{u} > dd$
$(u,d)g$
gg


$f_a(x)$
g
u
d
$\bar{u}, \bar{d}$
$s, \bar{s}$
1
x
parton - parton Luminosity
x_1
x_2
a
b
$E^{p.c.o.m} = E^{c.o.m} \sqrt{x_1 x_2}$
$\mathcal{L}^{p\bar{p}}_{ab}$
$u\bar{u} > u\bar{d} = d\bar{u} > d\bar{d}$
(u,d) g
gg
$q\bar{q}, q\bar{q}$
$\mathcal{L}^{pp}_{ab}$
$uu > ud = \bar{d}\bar{u} > dd$
(u,d) g
gg
$q\bar{q}$

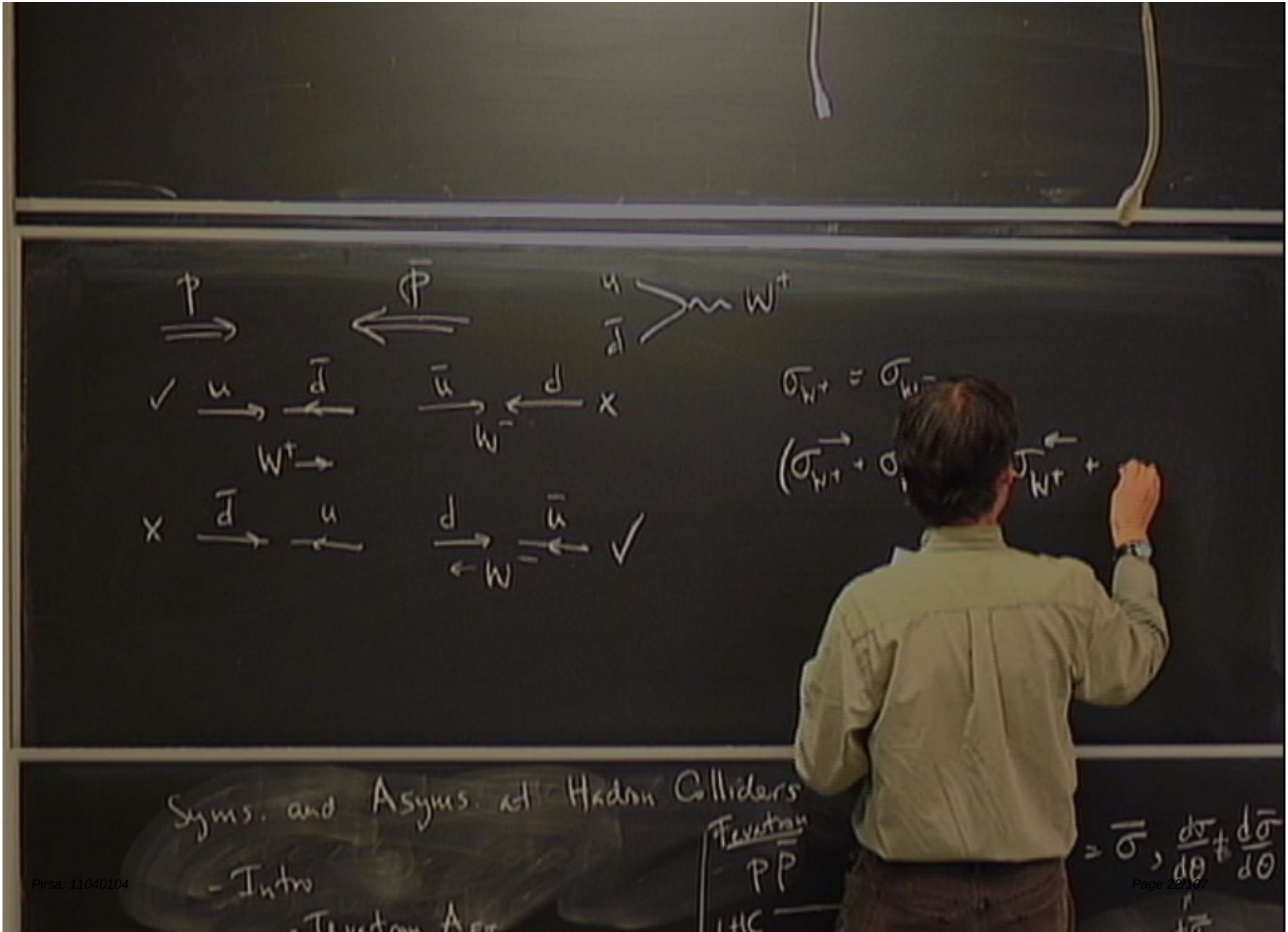

Hadron Colliders
Tevatron
LHC
- Intro
. Tevatron
Models for
excluding models

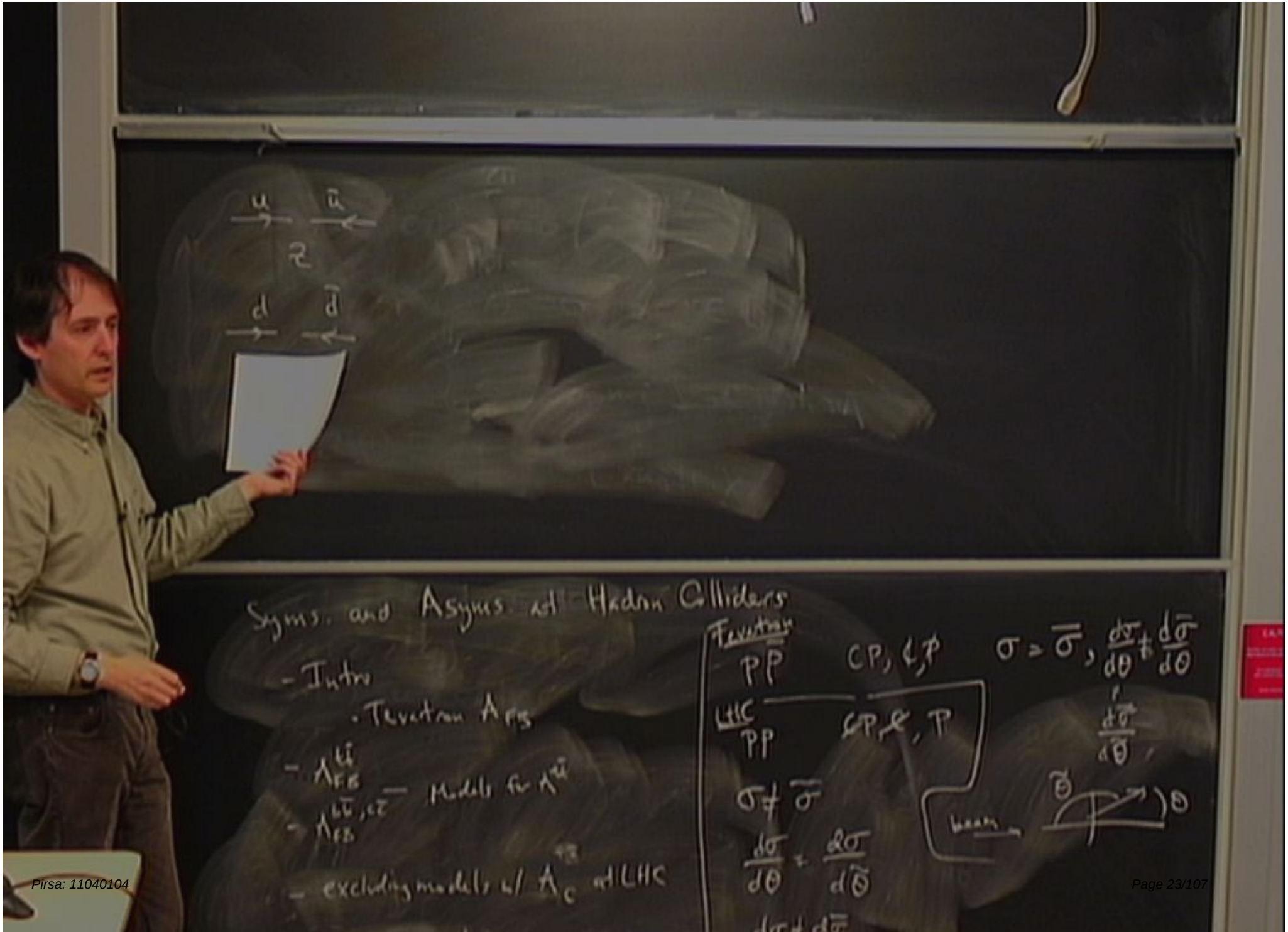

p
p̄
u
d̄
W+
ū
d
W−
Asyms at Hadron Colliders

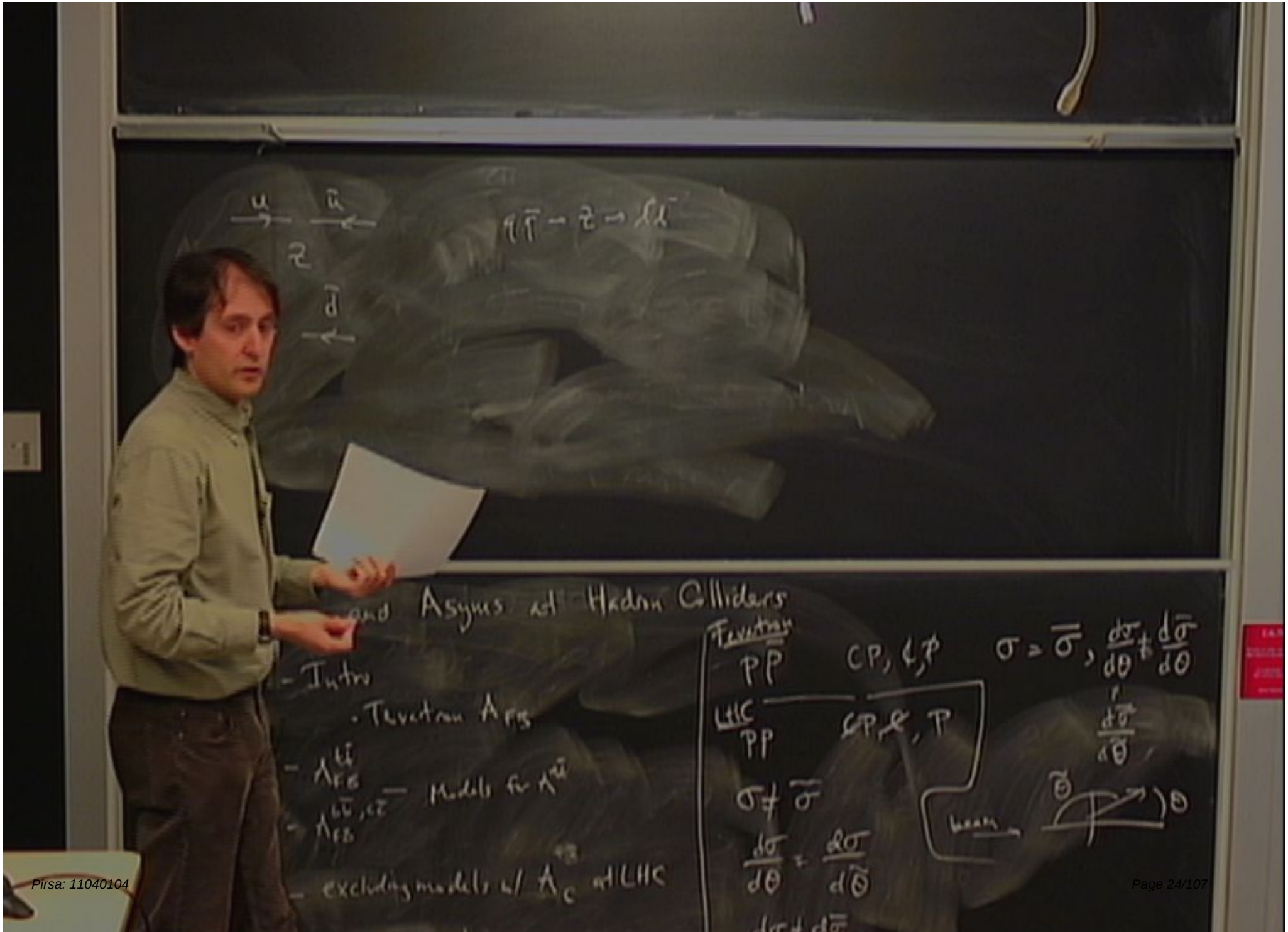

p
p̄
u
d̄
W+
u
d̄
ū
d
W+
W−
x
x
d̄
u
d
ū
W−
✓
✓

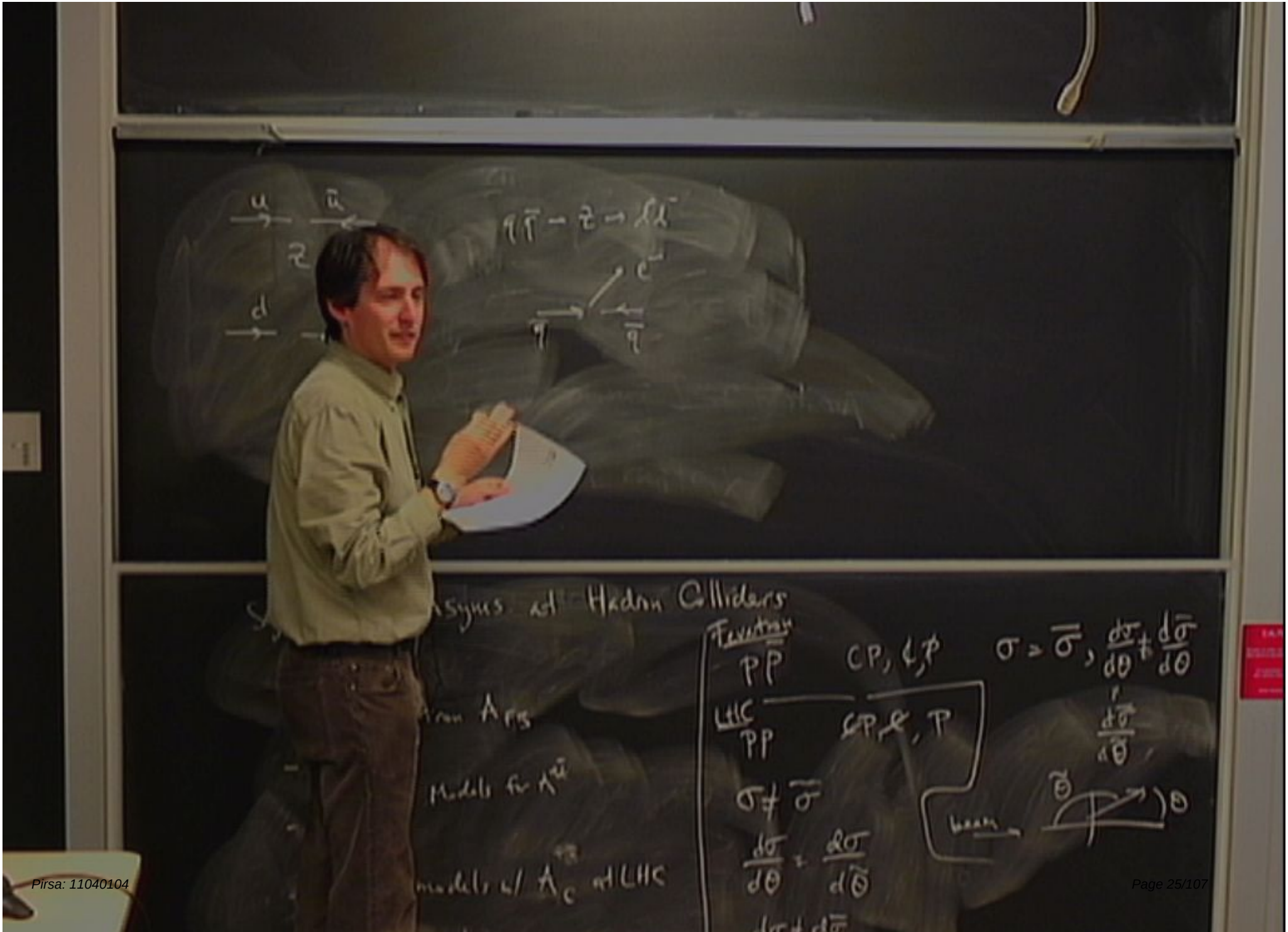


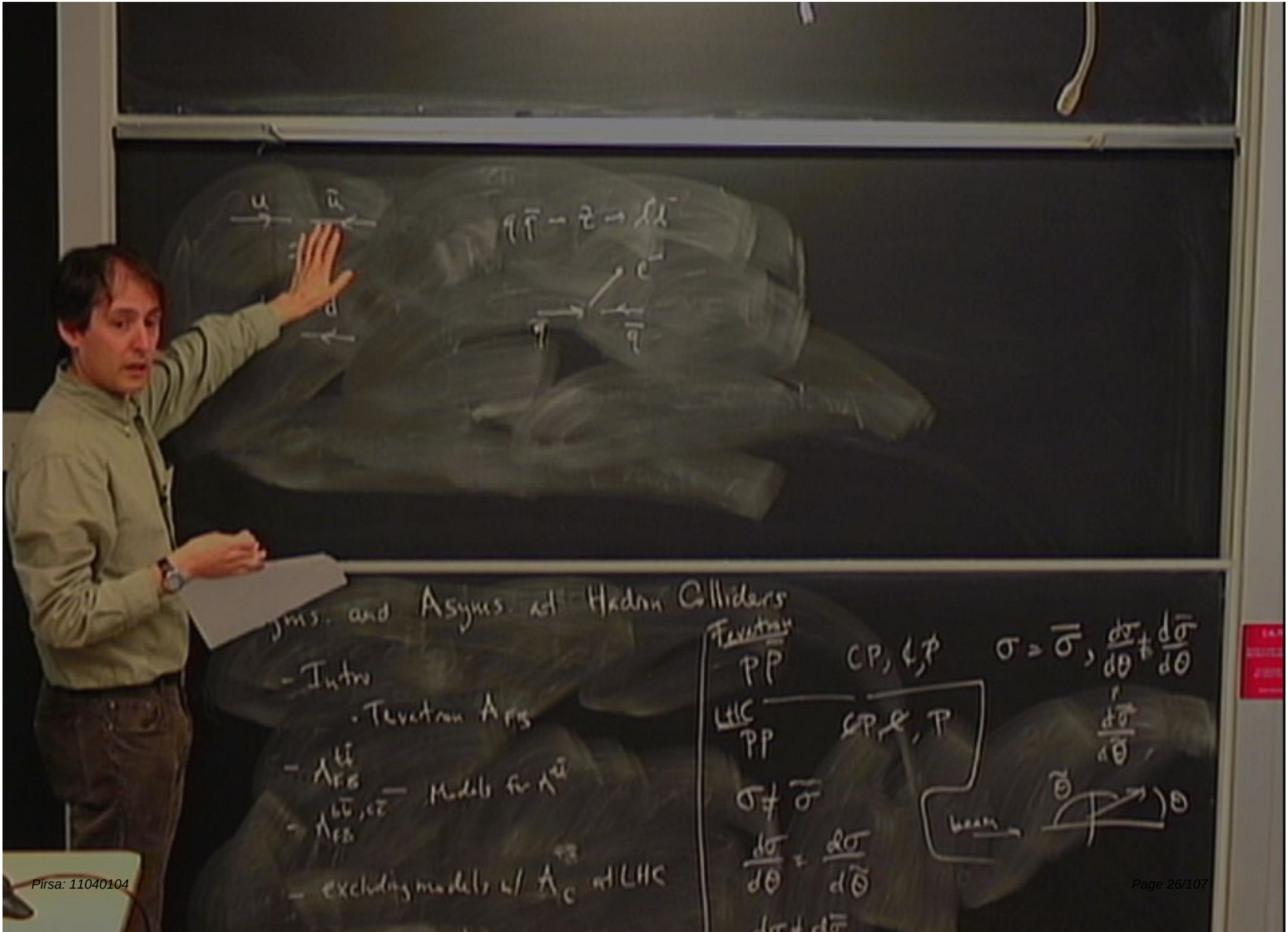
Syms and Asyms at Hadron Colliders

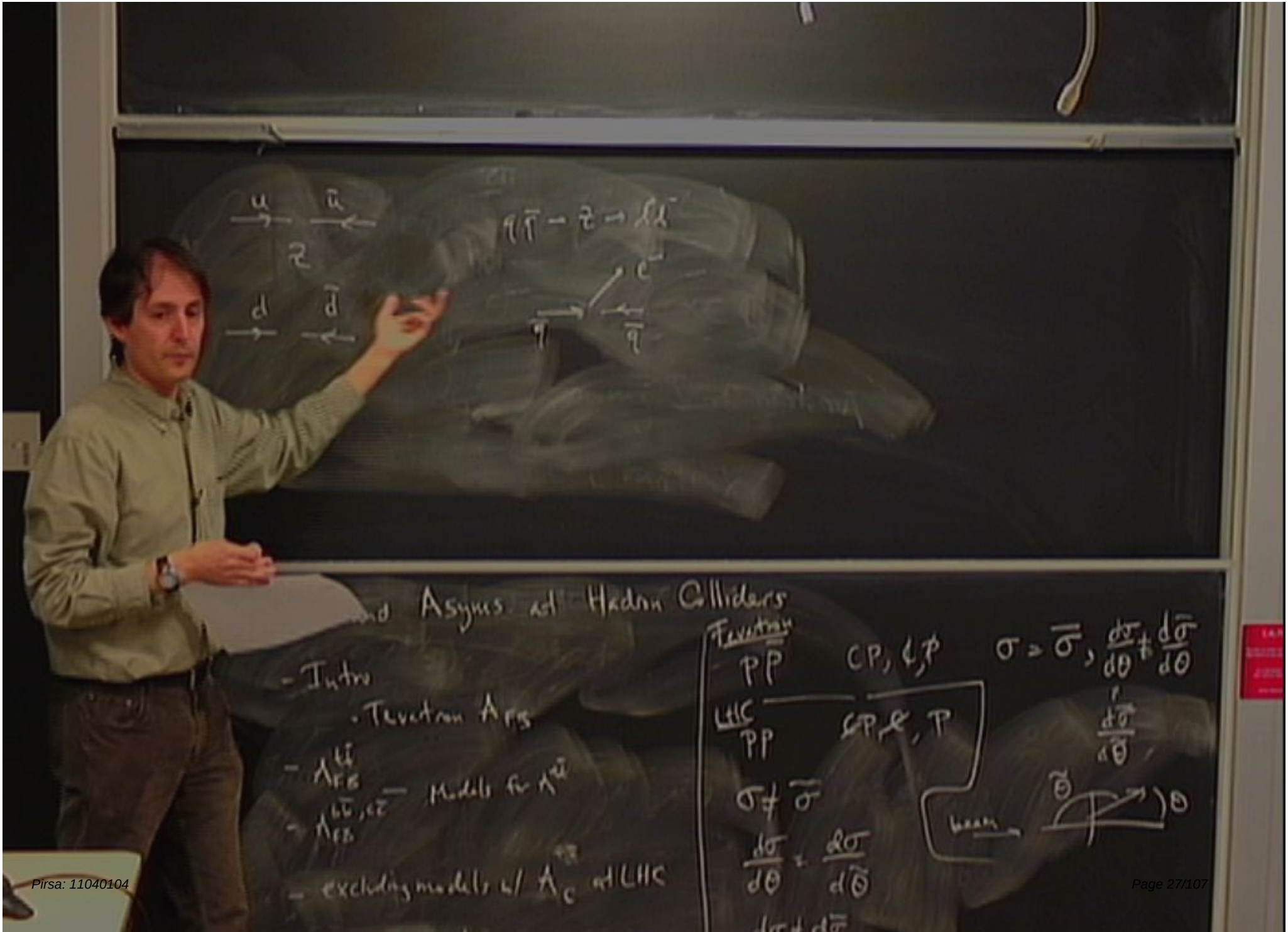


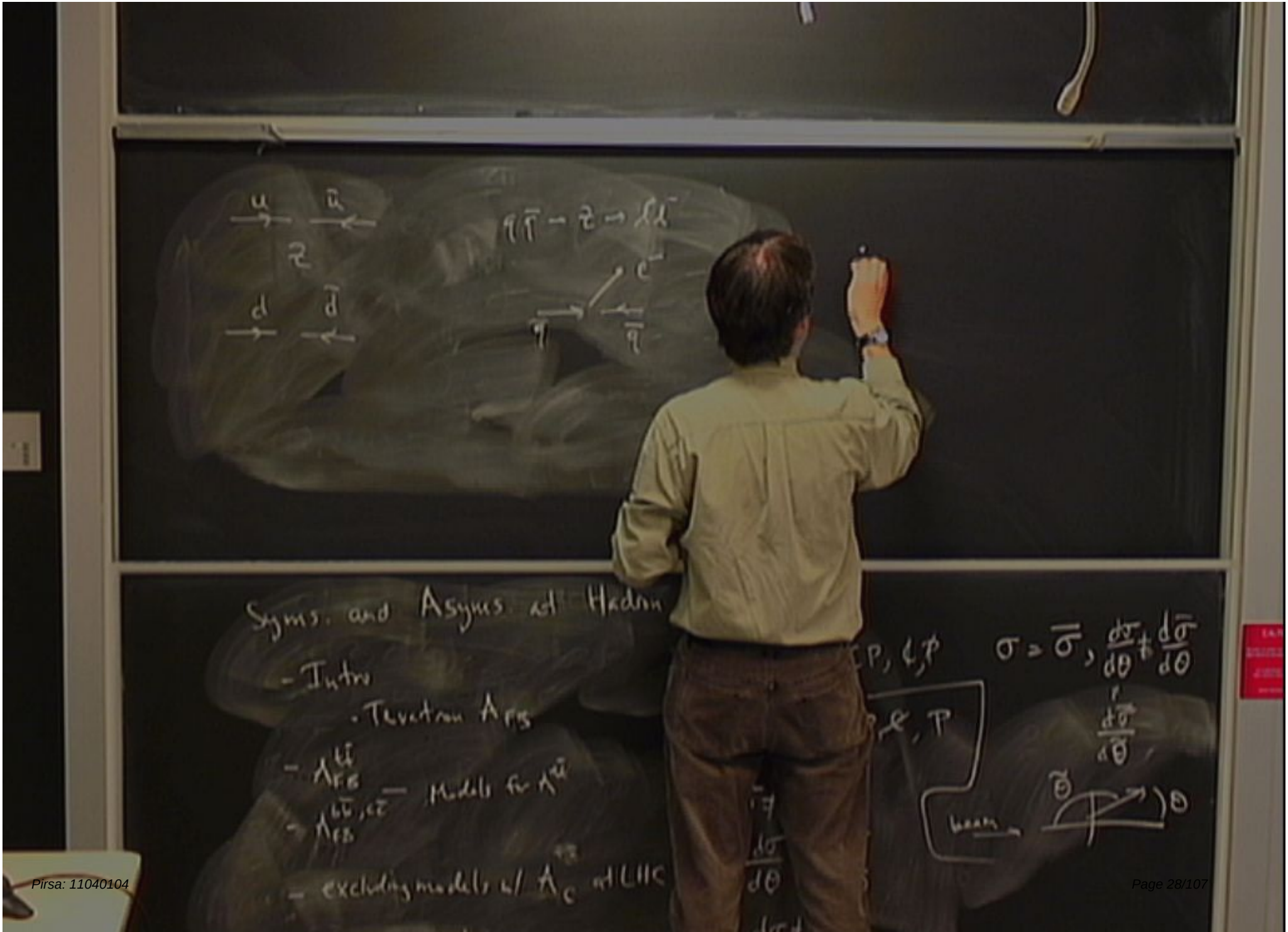

u ū
Z
d d̄
Syms. and Asyms. at Hadron Colliders
- Intro
• Tevatron A_FB
- A_FB^tt̄ — Models for A^tt̄
- A_FB^tt̄,zz
- excluding models w/ A_C^tt̄ at LHC
Tevatron
pp̄ CP, ℓ, p σ = σ̄, dσ/dθ + dσ̄/dθ
LHC
pp CP, ℓ, P
σ ≠ σ̄
dσ/dθ ± dσ̄/dθ
dσ/dθ
beam
θ
θ

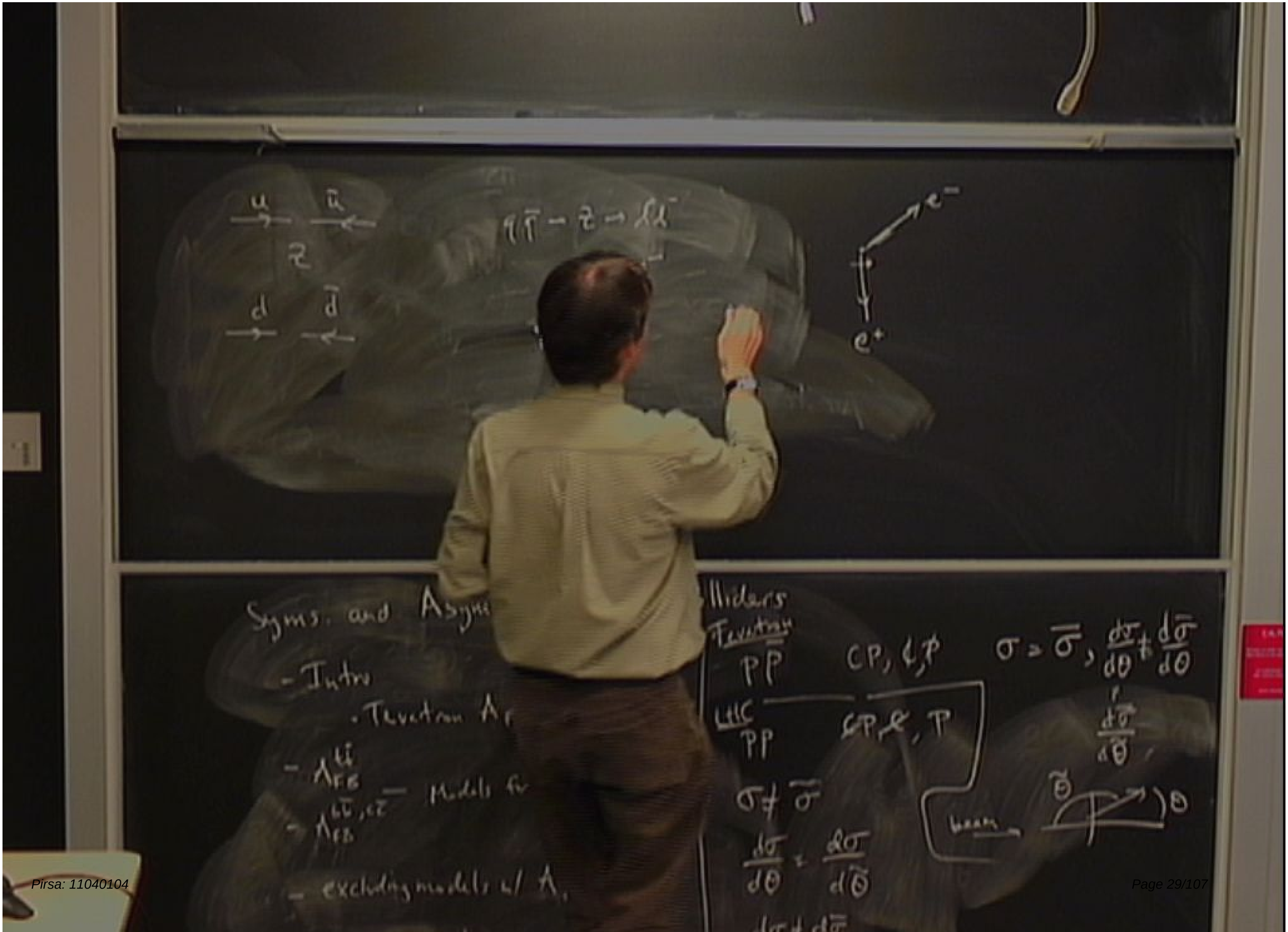

u ū
Z
d̄
q q̄ → Z → l l̄
and Asyms at Hadron Colliders
- Intro
• Tevatron A_FB
- A_FB^tt̄
- A_FB^bb̄,cc̄ — Models for A^tt̄
- excluding models w/ A_C at LHC
Tevatron
p p̄ CP, ℓ, P σ = σ̄, dσ/dθ + dσ̄/dθ
LHC
pp CP, ℓ, P
σ ≠ σ̄
dσ/dθ ≠ dσ̄/dθ
beam
θ
dσ/dθ̄
θ̄

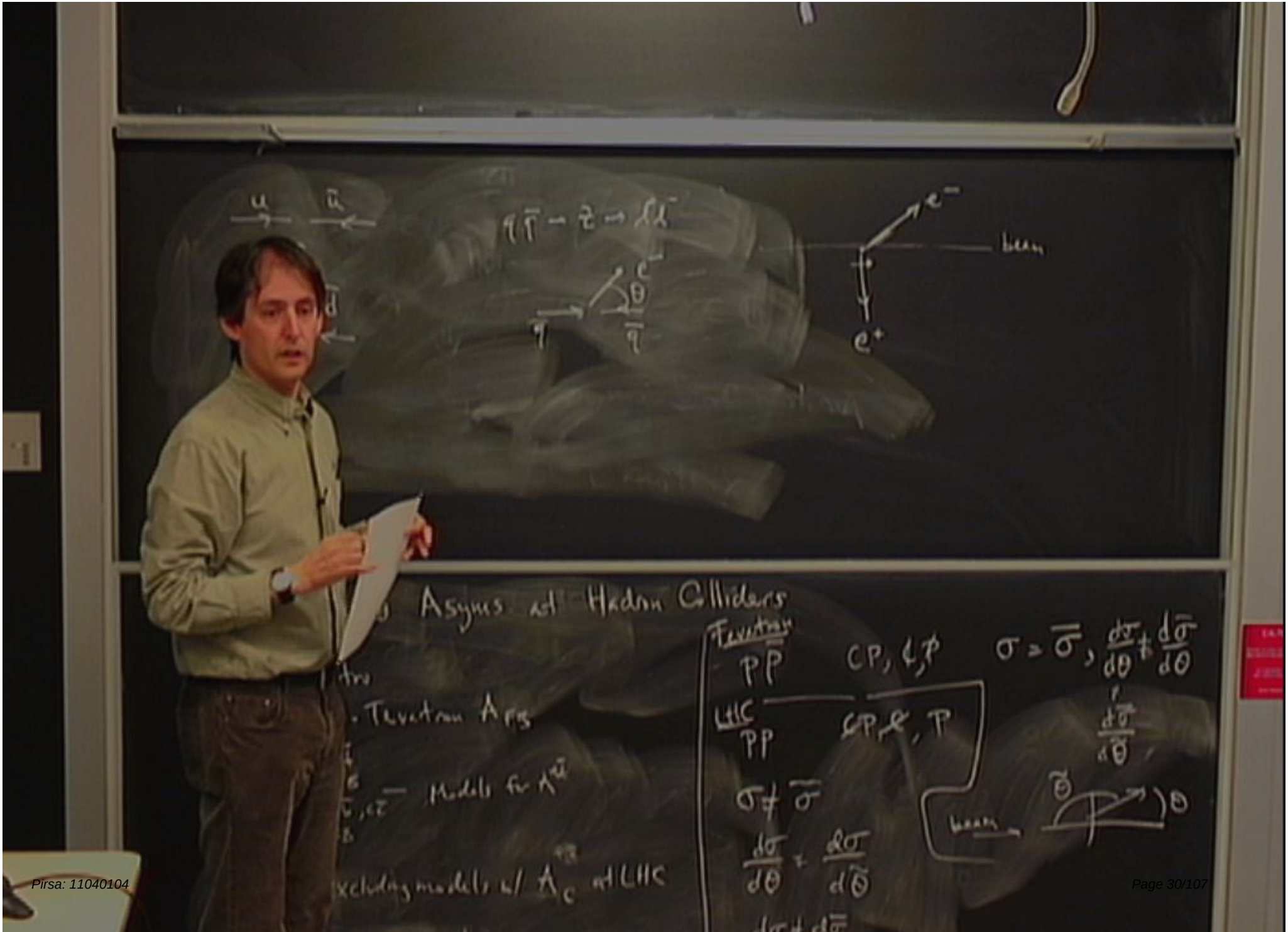

Hadron Colliders
CP, ℓ, P
σ = σ̄, dσ/dθ + dσ̄/dθ
PP
σ ≠ σ̄
dσ/dθ + dσ̄/dθ
beam
θ

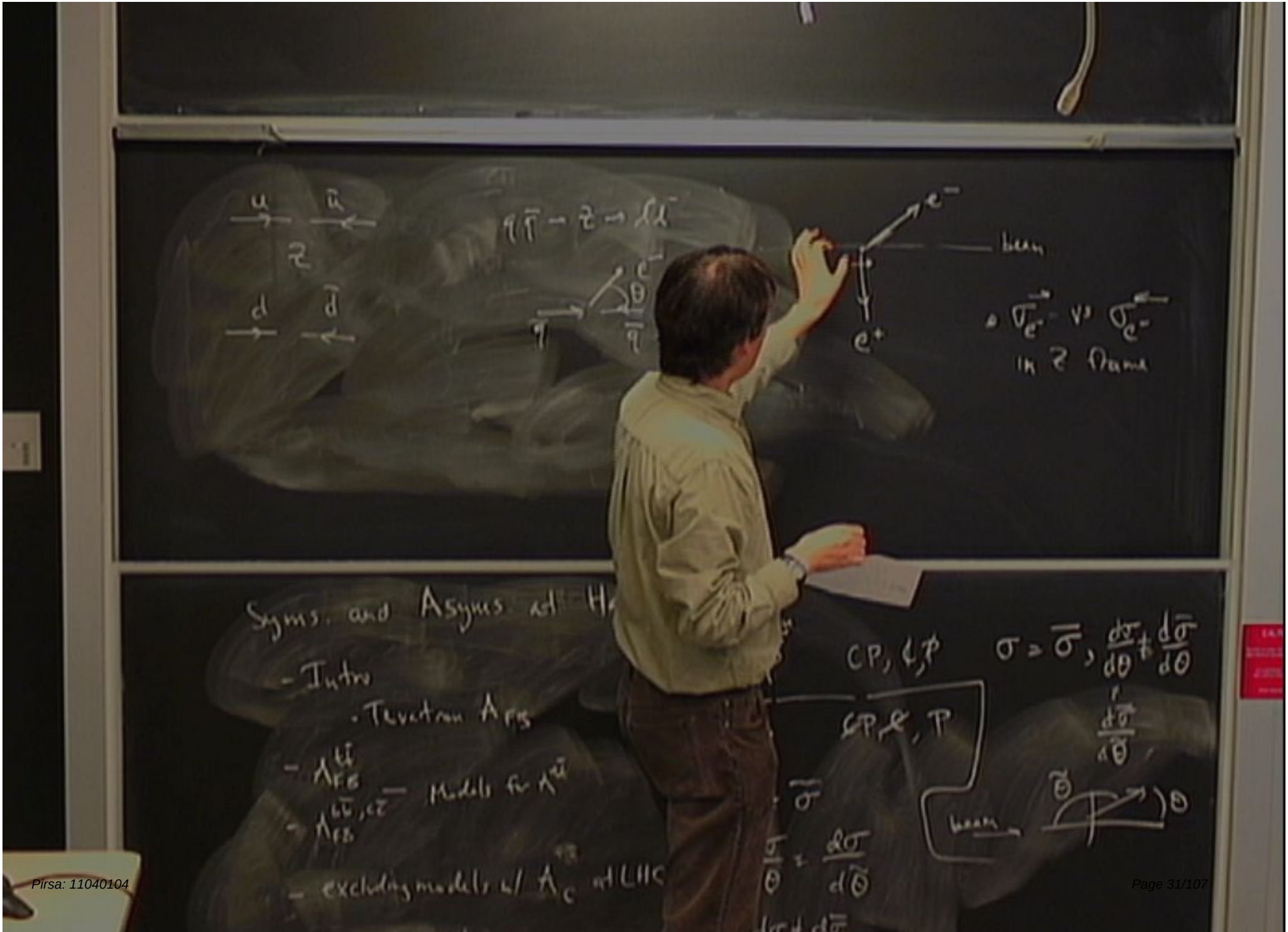

u ū
d
q q̄ → t t̄
c̄
q
q̄
Intro
Tevatron A_FB
Models for A
excluding models w/ A_C at LHC
Tevatron
pp̄ CP, ℓ, p σ = σ̄, dσ/dθ + dσ̄/dθ
LHC
pp CP, ℓ, T
σ ≠ σ̄
dσ/dθ ≠ dσ̄/dθ
beam
θ̄
θ

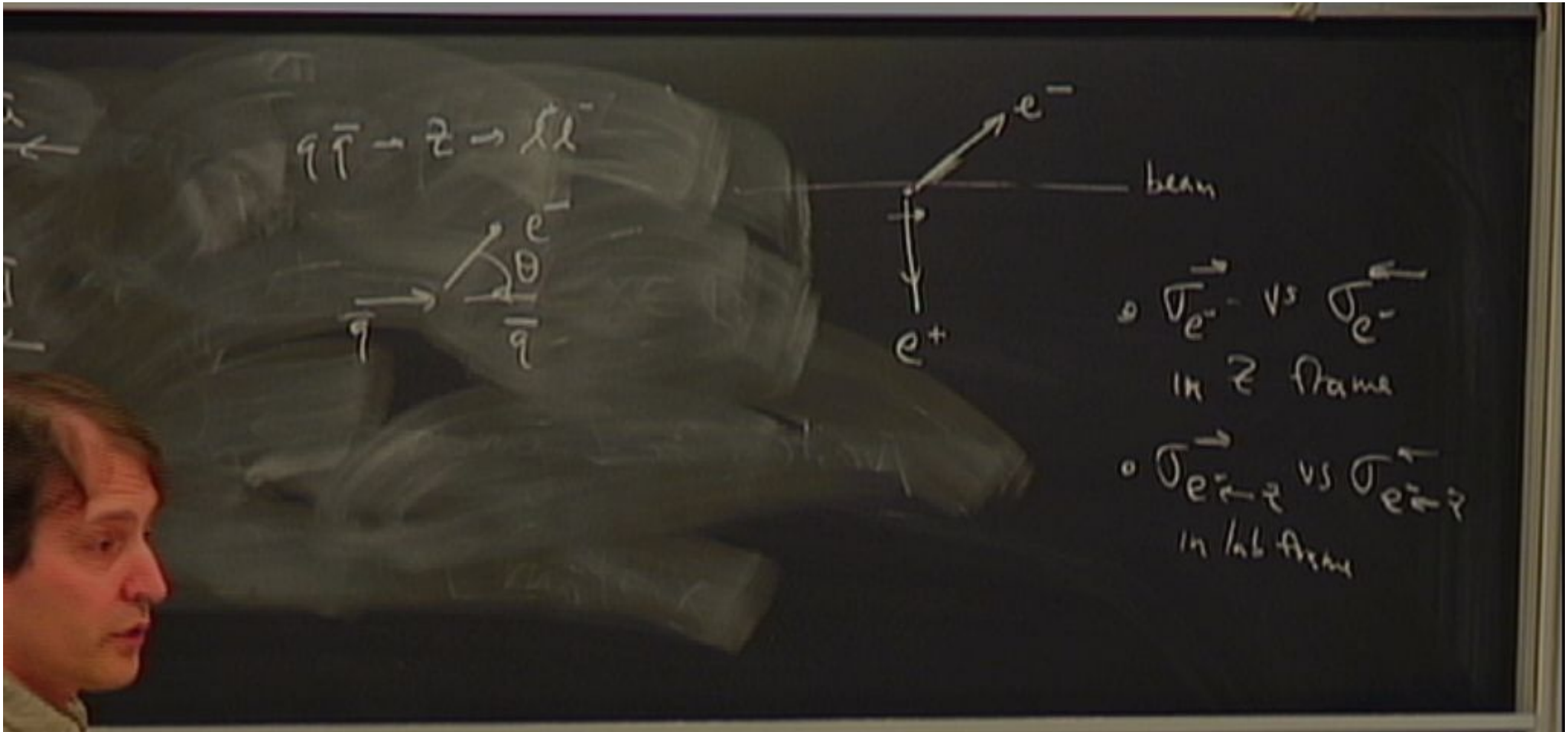

u ū
Z
d d̄
q q̄ → Z → ℓ ℓ̄
c c̄
q q̄
Asyms at Hadron Colliders
- Intro
- Tevatron A_FB
- A_FB^tt̄ — Models for A^tt̄
- A_FB^tt̄,zz — excluding models w/ A_C^tt̄ at LHC
Tevatron
pp̄ CP, ℓ, p σ = σ̄, dσ/dθ + dσ̄/dθ
LHC
pp CP, ℓ, p
σ ≠ σ̄
dσ/dθ ± dσ̄/dθ
dσ/dθ
beam
θ
θ


Syms. and Asyms at Hadron
- Intro
- Tevatron A_{FB}
- $A_{FB}^{t\bar{t}}$ — Models for $A^{t\bar{t}}$
- $A_{FB}^{b\bar{b},c\bar{c}}$
- excluding models w/ $A_C^{t\bar{t}}$ at LHC
beam


Syms. and Asym
lliders
Tevatron
CP
LHC
- Intro
. Tevatron A
Models for
- excluding models w/ A
beam
e⁻
e⁺


Asyms at Hadron Colliders
Tevatron
LHC
CP, ℓ, P
beam
beam


u ū
Z
d d̄
q q̄ → Z → ℓ ℓ̄
q
θ
e⁻
beam
e⁺
Syms. and Asyms at H
- Intro
- Tevatron A_FB
- A_FB^tt̄
- A_FB^tt̄,cc̄ — Models for A^tt̄
- excluding models w/ A_C at LHC
CP, ℓ, P
σ = σ̄, dσ/dθ + dσ̄/dθ
CP, ℓ, P
beam
θ
dσ/dθ



Asyms. at Hadron Colliders

A_{FB}

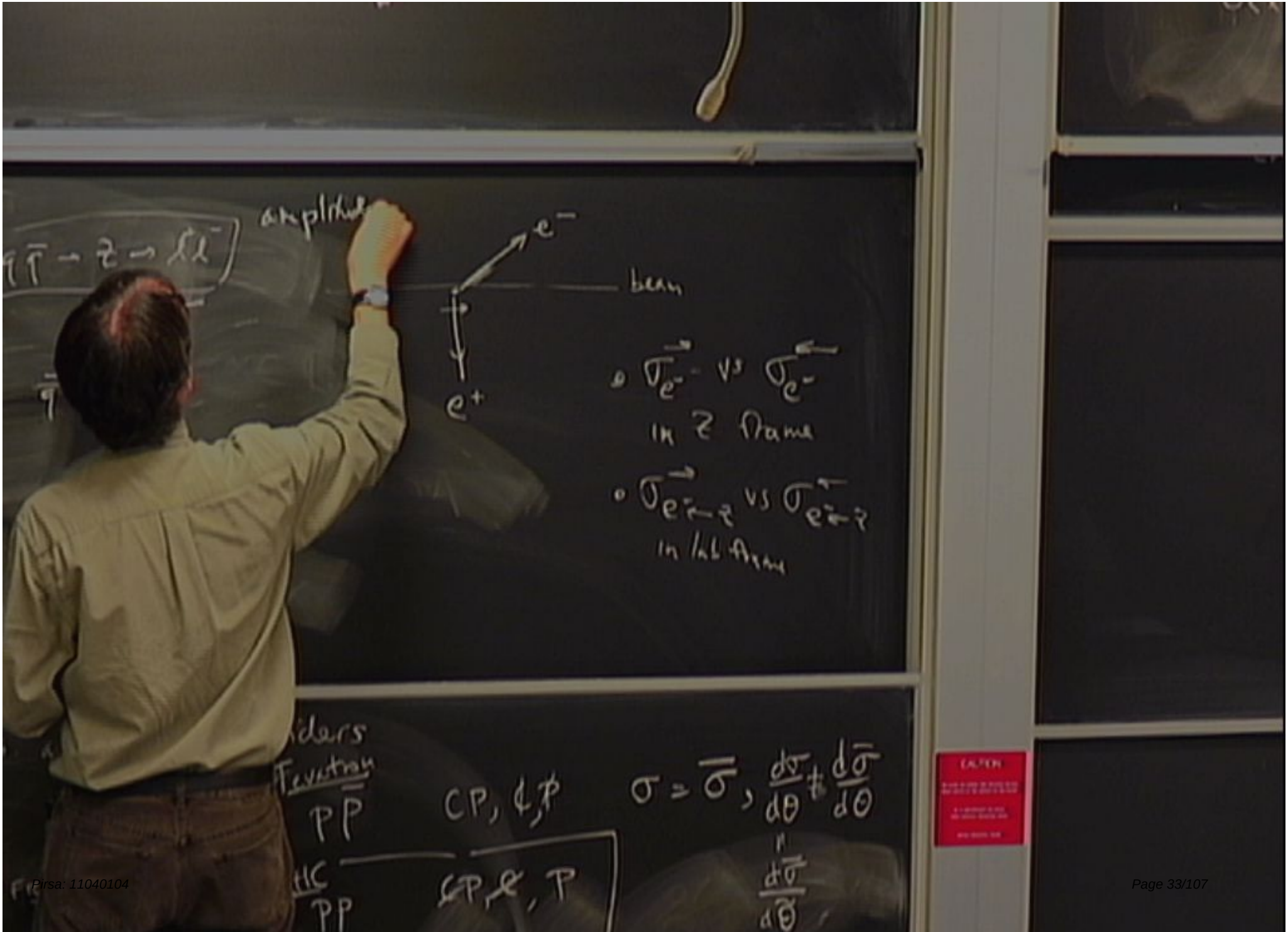
Tevatron
$p\bar{p}$ CP, ¢, P

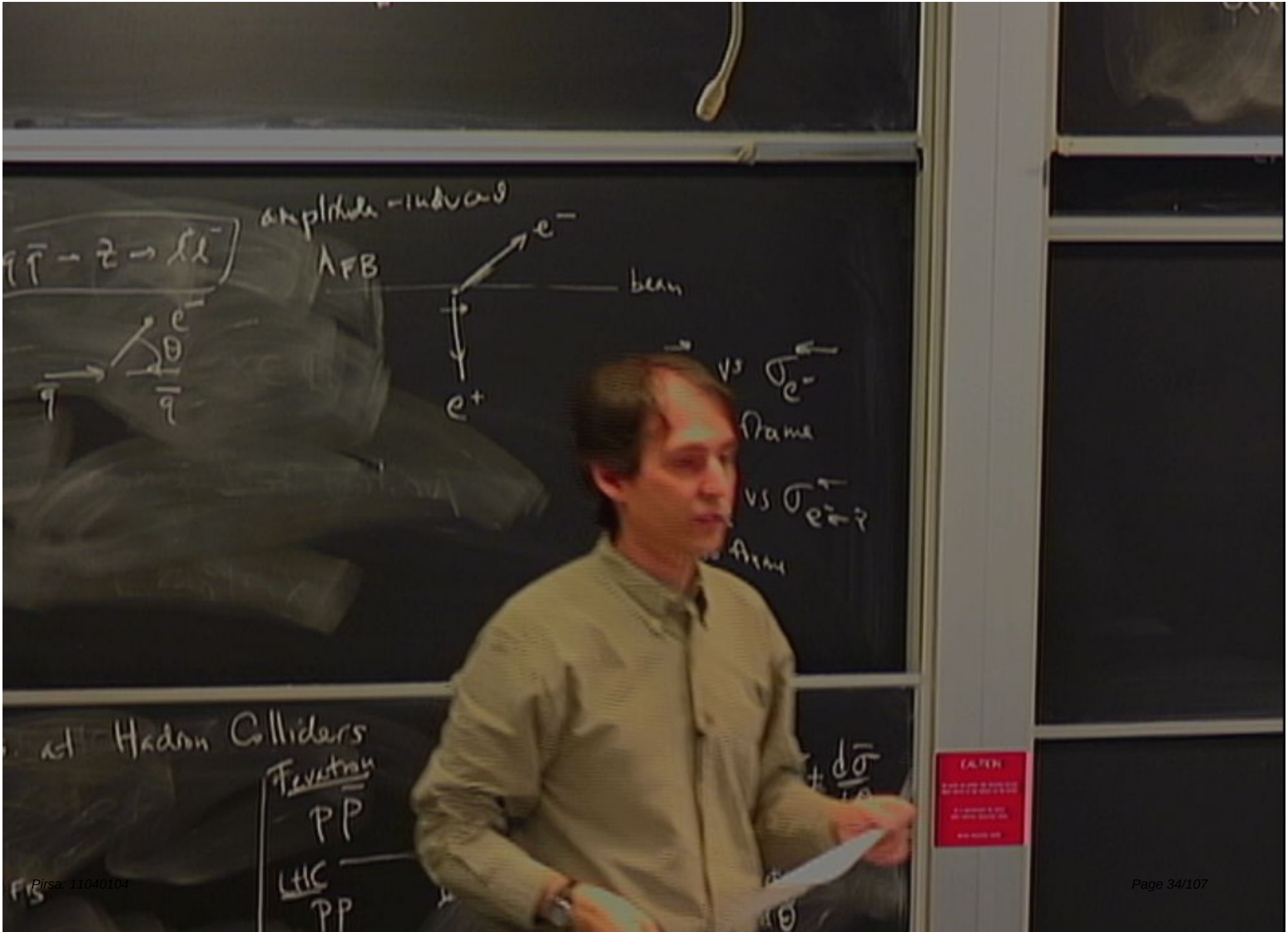
LHC
pp CP, ¢, P

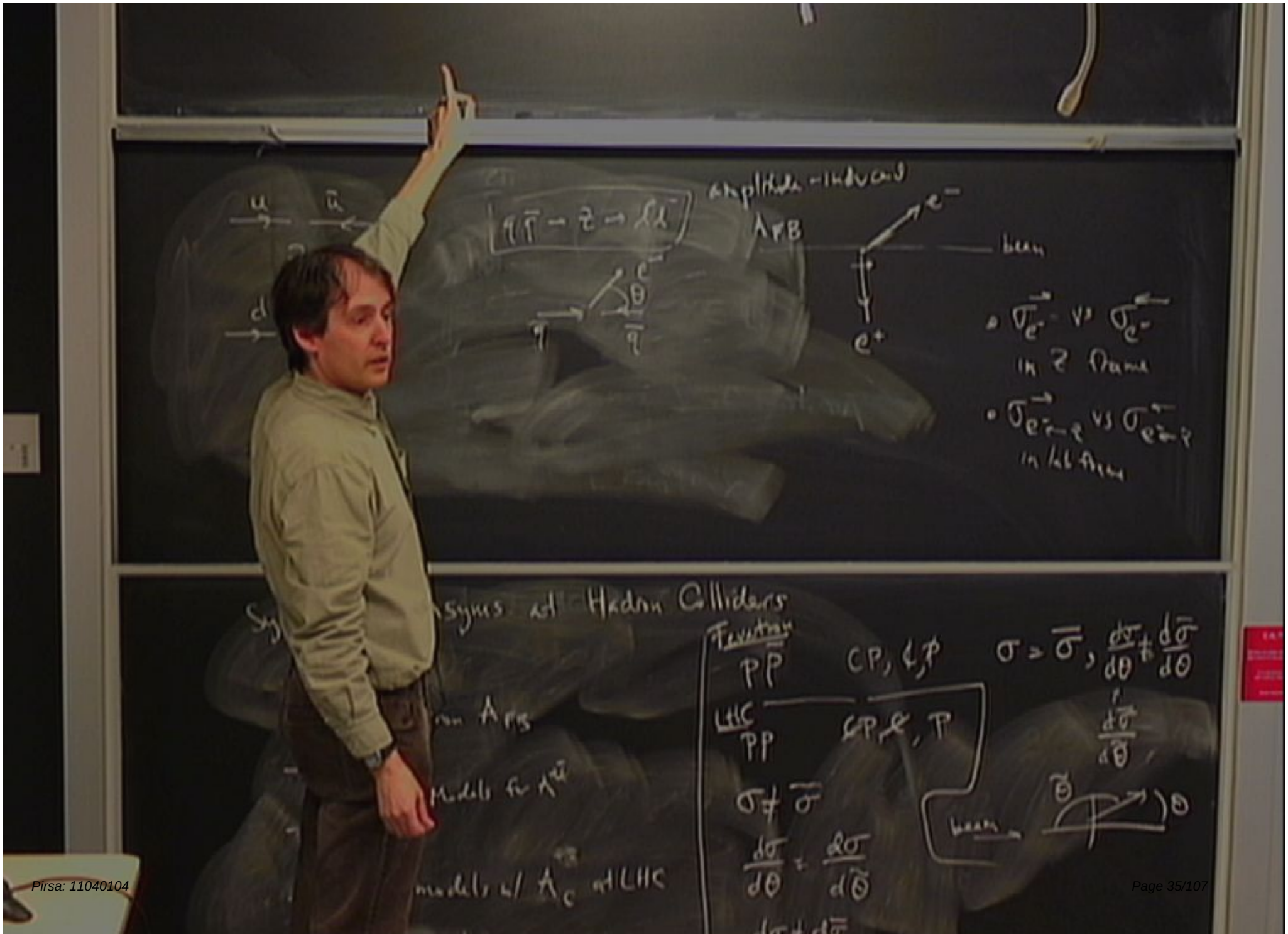
$\sigma = \bar{\sigma}$, $\frac{d\sigma}{d\theta} \neq \frac{d\bar{\sigma}}{d\theta}$

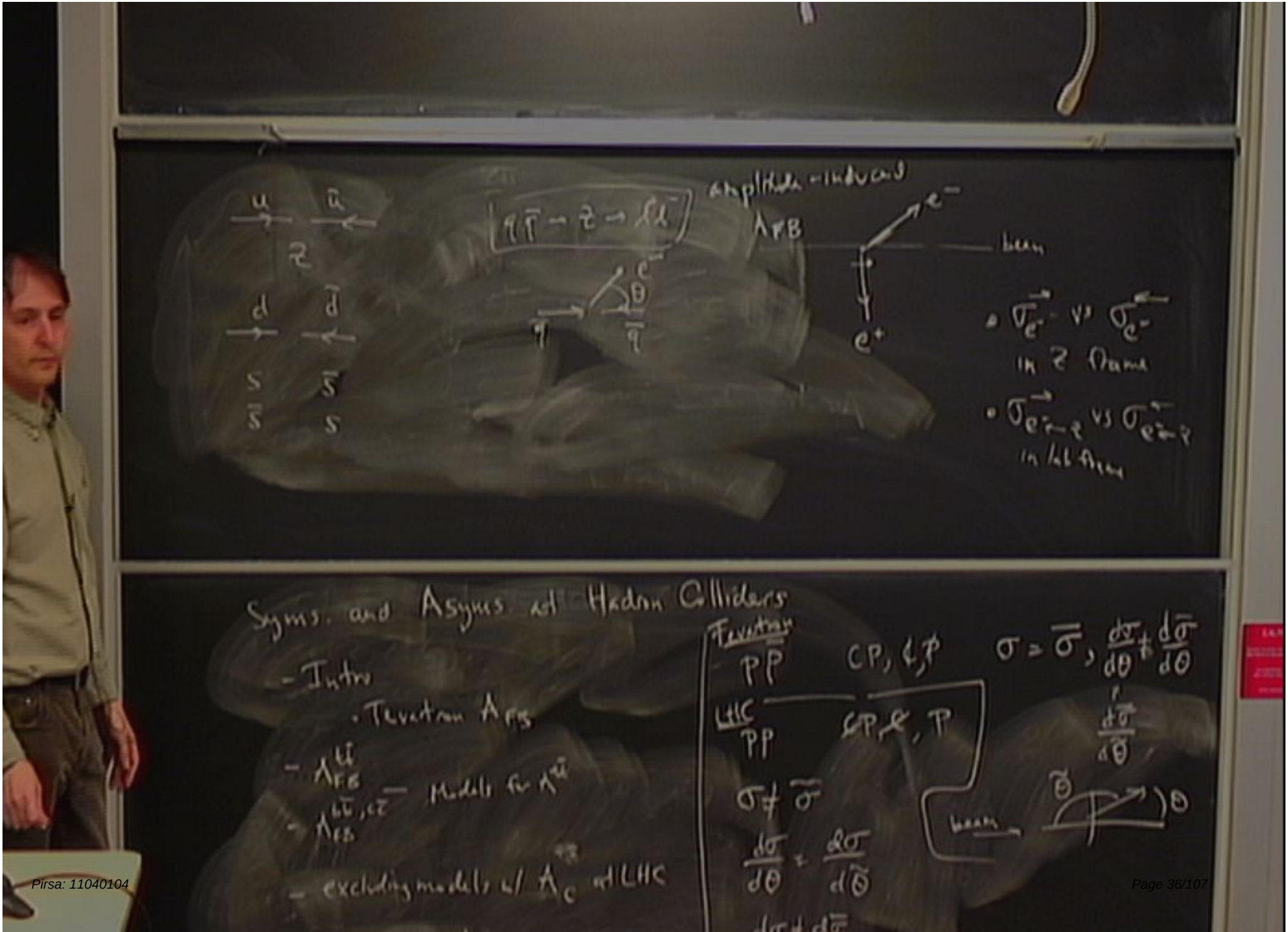
$\frac{d\sigma}{d\theta} = \frac{d\bar{\sigma}}{d\theta}$

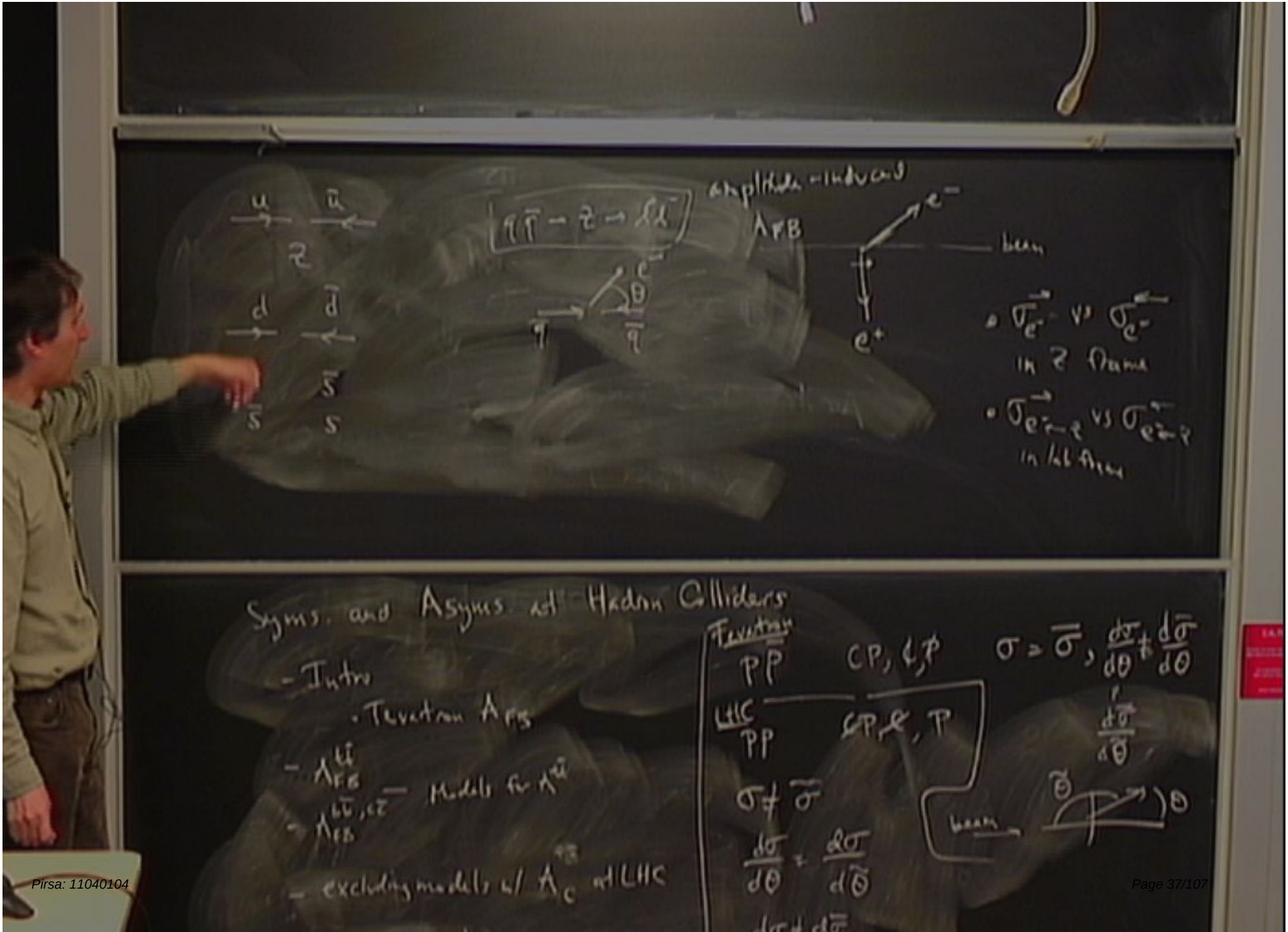
$\sigma \neq \bar{\sigma}$

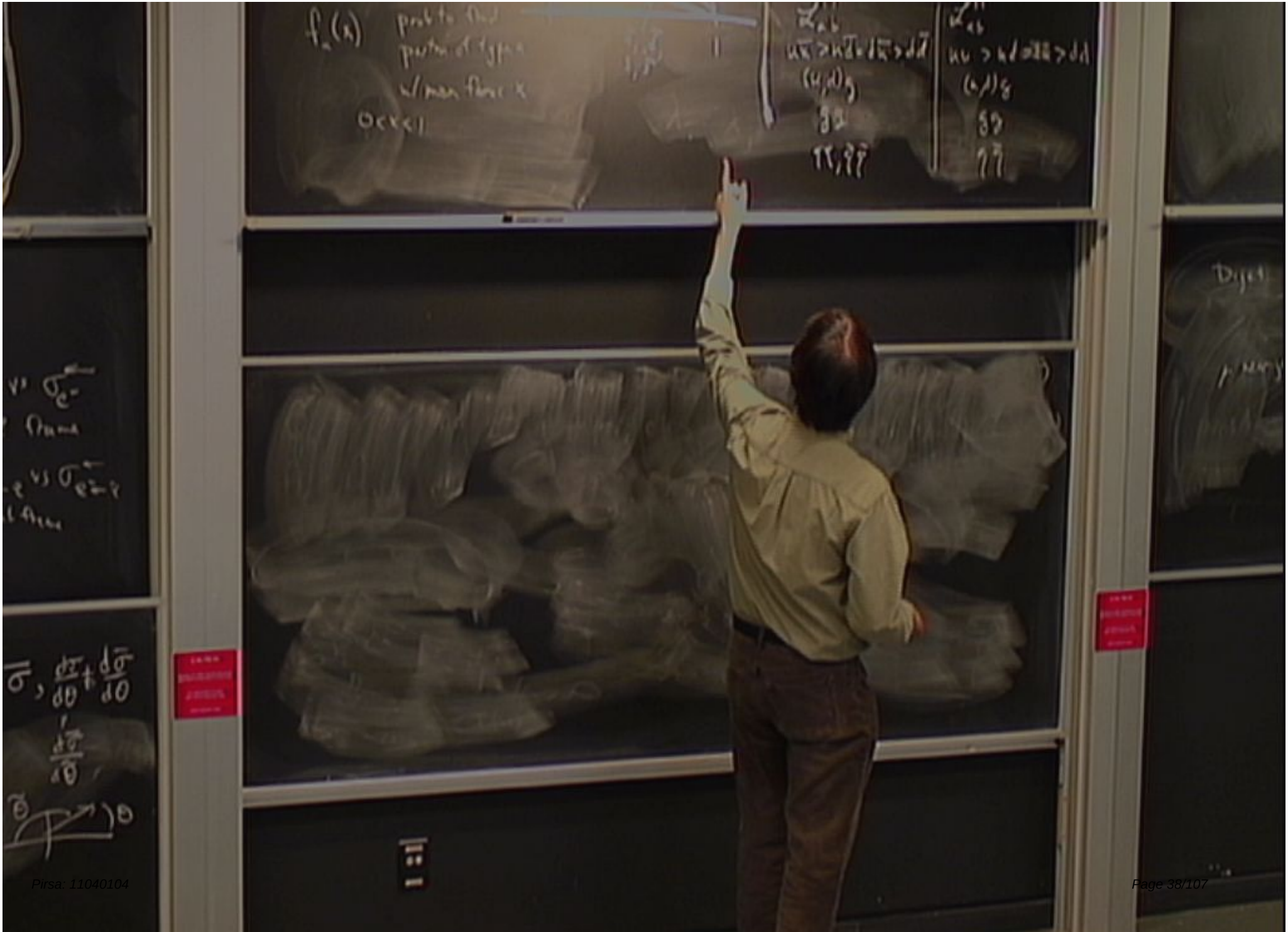

amplitude
e^-
beam
e^+
$\sigma_{e^-} \neq \sigma_{e^-}$
in Z frame
$\sigma_{e^- \leftarrow z} \neq \sigma_{e^- \leftarrow z}$
in lab frame
CP, $\not{C}\not{P}$
$\sigma = \bar{\sigma}$, $\frac{d\sigma}{d\theta} \neq \frac{d\bar{\sigma}}{d\theta}$
$\not{C}P, \not{C}, P$
$\frac{d\sigma}{d\theta} = \frac{d\bar{\sigma}}{d\theta}$

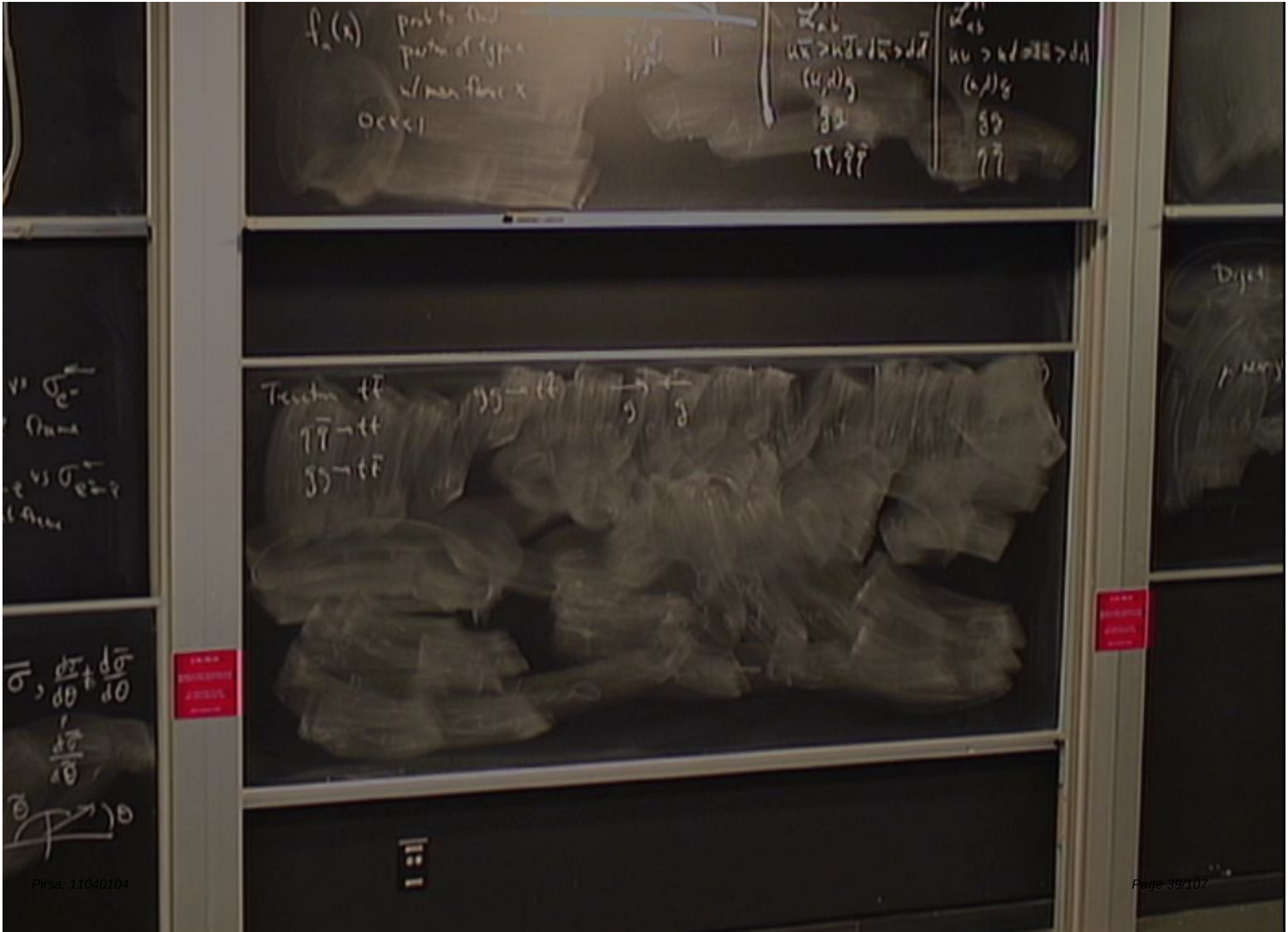

amplitude - induced
A_{FB}
beam
e^-
e^+
θ
q
$\bar{q}$
Hadron Colliders
Tevatron
$p\bar{p}$
LHC
pp

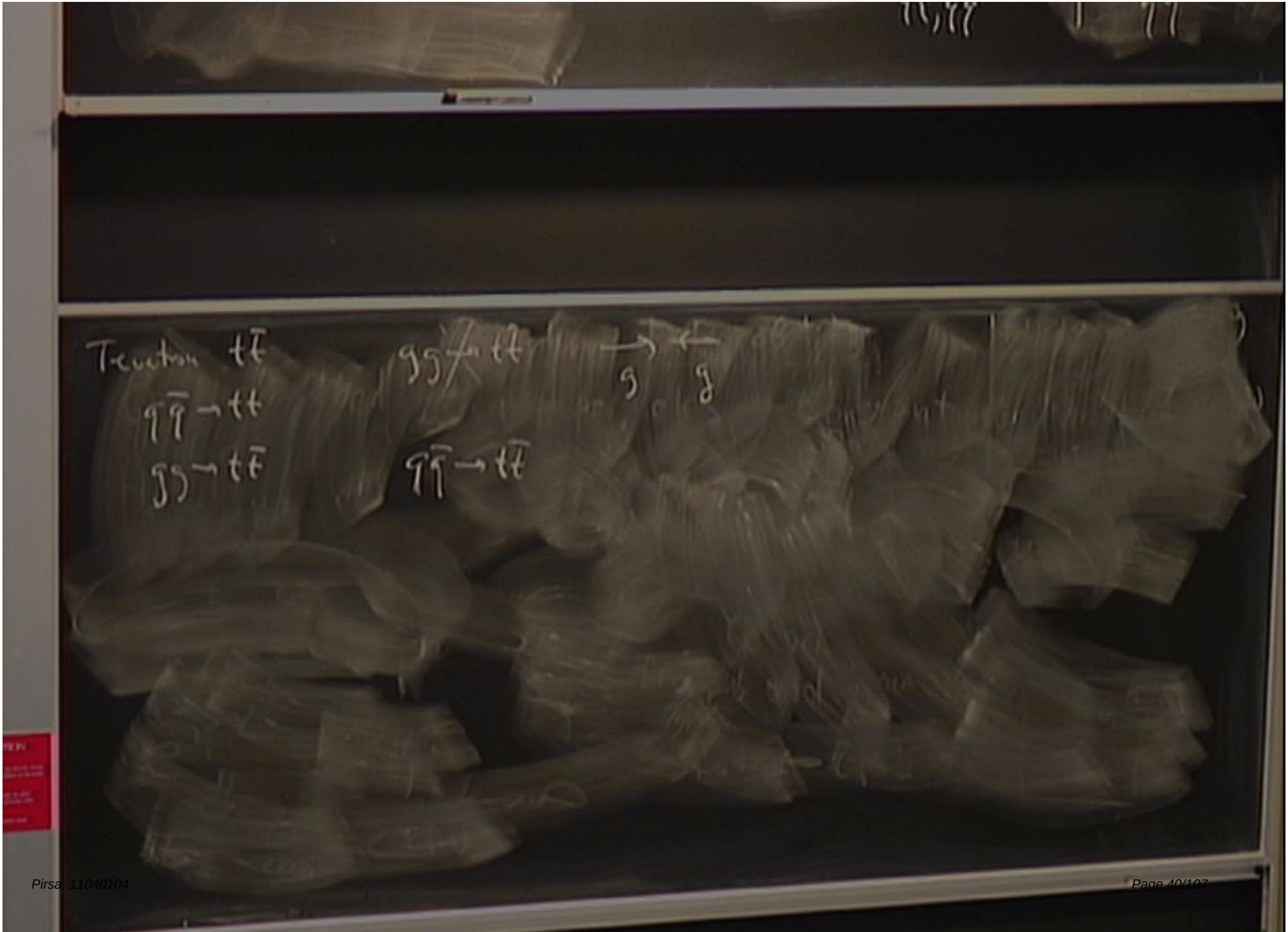

Hadron Colliders
Tevatron
LHC
beam
beam

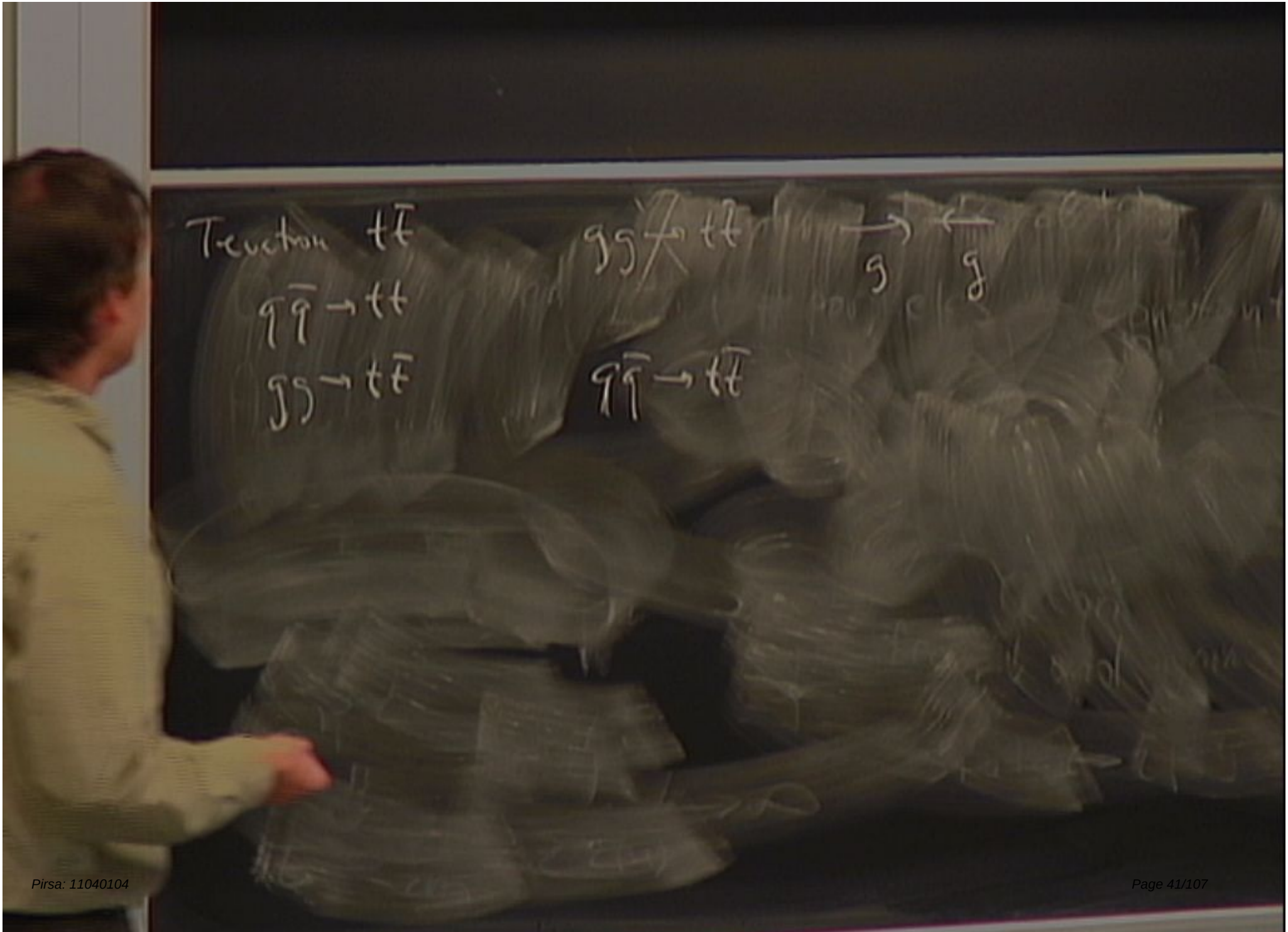

Syms. and Asyms at Hadron Colliders
- Intro
• Tevatron A_{FB}
- A_{FB}^{ll}
- $A_{FB}^{t\bar{t},z\bar{z}}$ — Models for $A^{t\bar{t}}$
- excluding models w/ $A_C^{t\bar{t}}$ at LHC
Tevatron
$p\bar{p}$ CP, ℓ,P $\sigma = \bar{\sigma}$, $\frac{d\sigma}{d\theta} + \frac{d\bar{\sigma}}{d\theta}$
LHC
pp CP, ℓ, P
$\sigma \neq \bar{\sigma}$
$\frac{d\sigma}{d\theta} \neq \frac{d\bar{\sigma}}{d\bar{\theta}}$
$\frac{d\sigma}{d\theta}$
$\frac{d\bar{\sigma}}{d\bar{\theta}}$
beam
θ
$\bar{\theta}$
$q\bar{q} \to Z \to \ell\bar{\ell}$
amplitude-induced
A_{FB}
beam
e^-
e^+
θ
$\bar{q}$
q
• σ_{e^-} vs σ_{e^-} in Z frame
• $\sigma_{e^- \to Z}$ vs $\sigma_{e^- \to Z}$ in lab frame

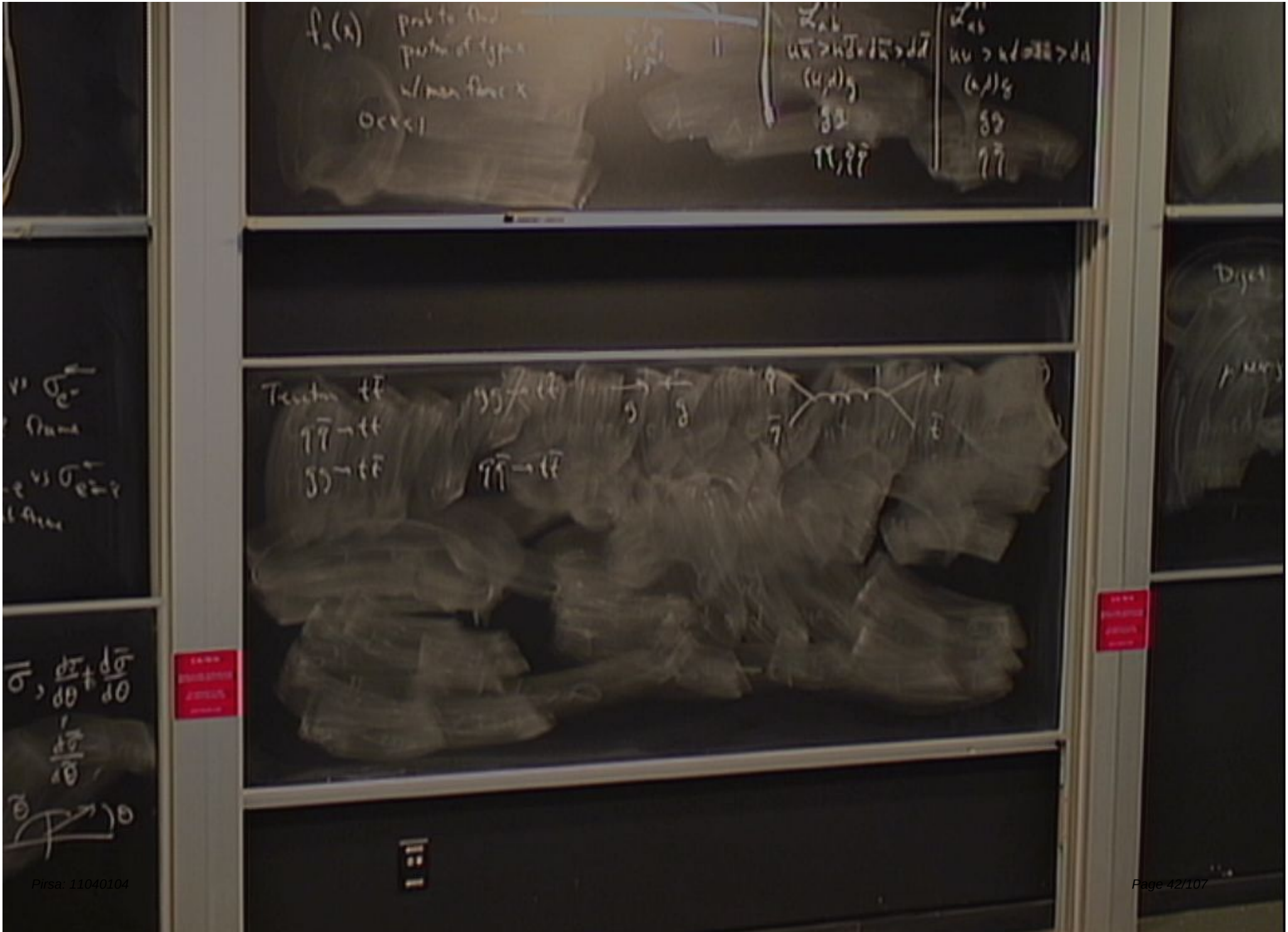

Syms. and Asyms. at Hadron Colliders
- Intro
• Tevatron A_{FB}
- $A_{FB}^{t\bar{t}}$
- $A_{FB}^{t\bar{t},tZ}$ — Models for $A^{t\bar{t}}$
- excluding models w/ $A_C^{t\bar{t}}$ at LHC
Tevatron
$p\bar{p}$ CP, $\not{C}\not{P}$ $\sigma = \bar{\sigma}$, $\frac{d\sigma}{d\theta} \neq \frac{d\bar{\sigma}}{d\theta}$
LHC
pp $\not{C}\not{P}, \not{C}, \not{P}$
$\sigma \neq \bar{\sigma}$
$\frac{d\sigma}{d\theta} \neq \frac{d\bar{\sigma}}{d\bar{\theta}}$
beam
θ
$\bar{\theta}$
$q\bar{q} \to Z \to \ell\bar{\ell}$
amplitude-induced
A_{FB}
beam
e^-
e^+
θ
q
$\bar{q}$
u $\bar{u}$
Z
d $\bar{d}$
$\bar{s}$
$\bar{s}$ s
• σ_{e^-} vs σ_{e^-} in Z frame
• $\sigma_{e^- \to Z}$ vs $\sigma_{e^- \to Z}$ in lab frame

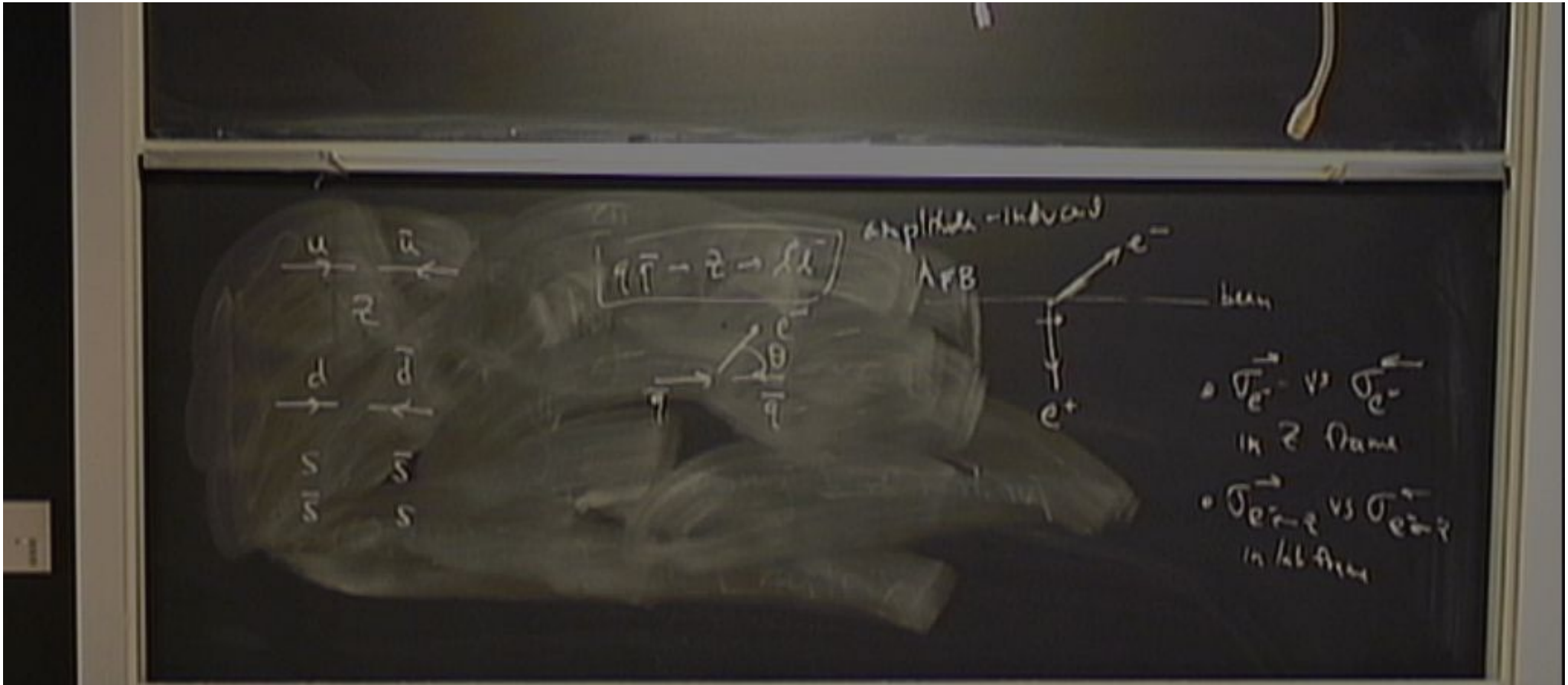



Tevatron
$q\bar{q} \to t\bar{t}$
$gg \to t\bar{t}$


T-ouction $t\bar{t}$
$q\bar{q} \to t\bar{t}$
$gg \to t\bar{t}$
$gg \not\to t\bar{t}$
$q\bar{q} \to t\bar{t}$


T-ection $t\bar{t}$
$q\bar{q} \to t\bar{t}$
$gg \to t\bar{t}$
$gg \to t\bar{t}$
g g
$q\bar{q} \to t\bar{t}$

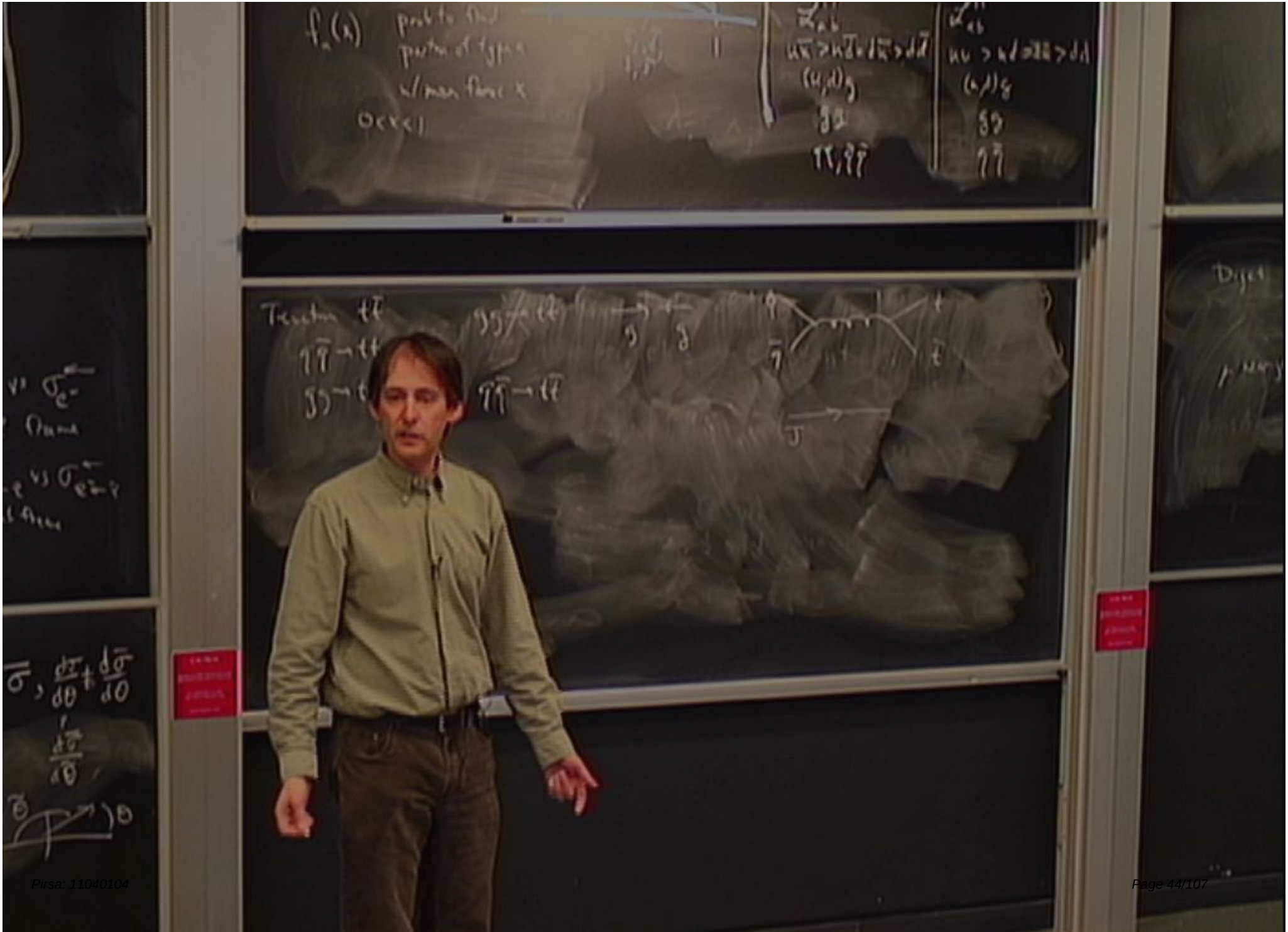

Tevatron $t\bar{t}$
$q\bar{q} \to t\bar{t}$
$gg \to t\bar{t}$
$q\bar{q} \to t\bar{t}$
$\frac{d\sigma}{d\theta} + \frac{d\bar{\sigma}}{d\theta}$
$\frac{d\sigma}{d\theta}$

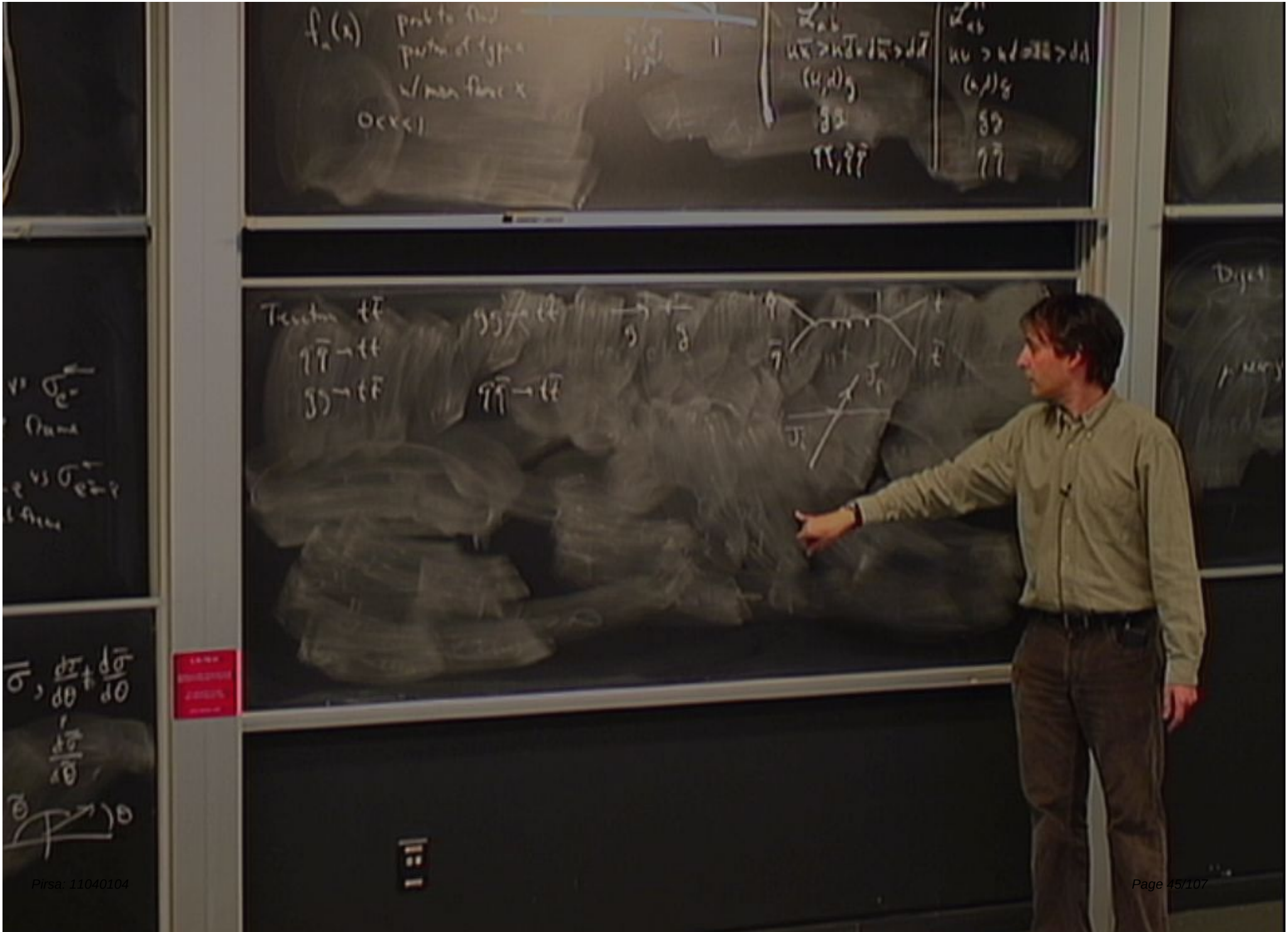


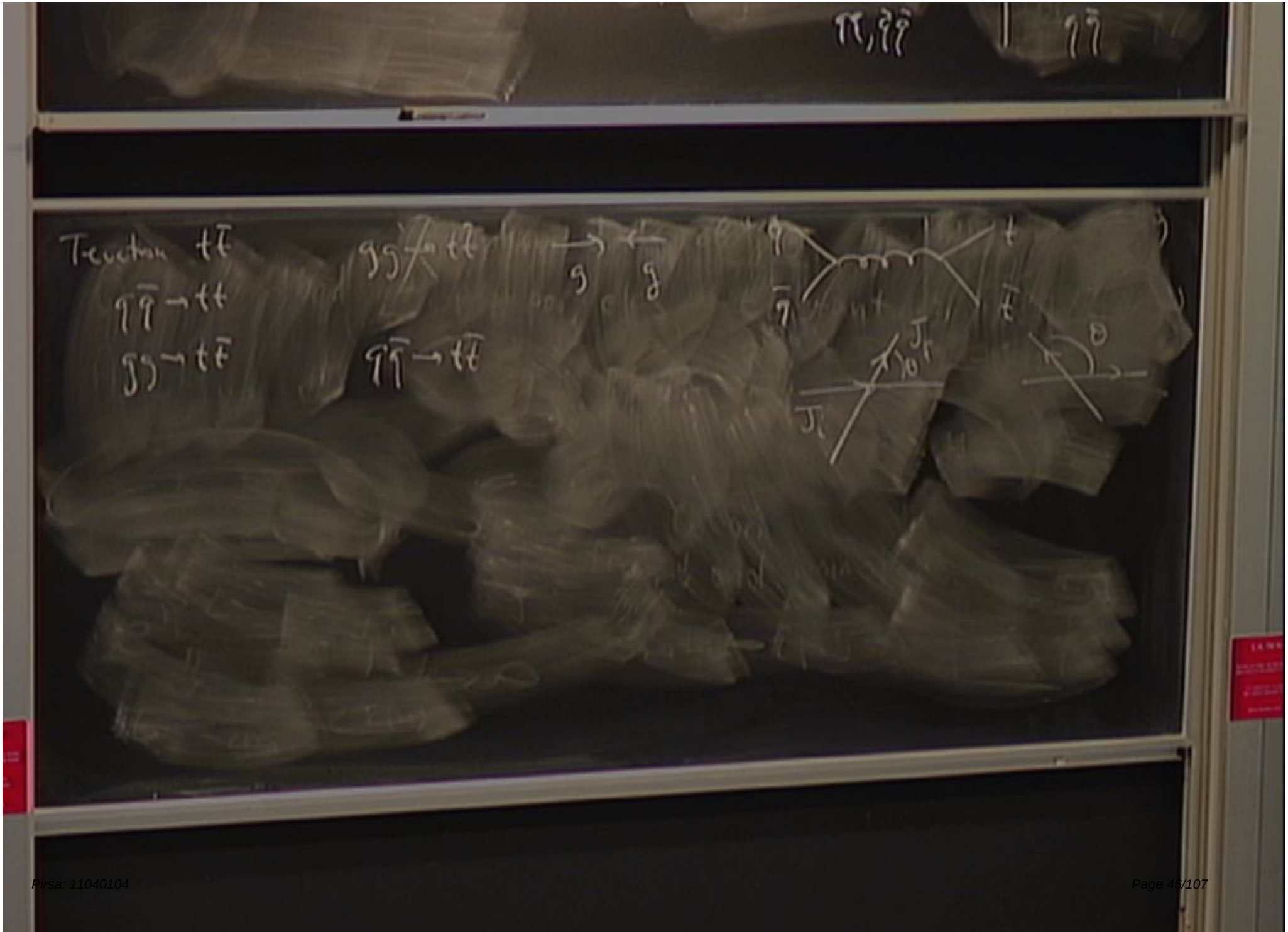
Syms. and Asyms. at Hadron Colliders

- Intro
  - Tevatron A_{FB}
  - A_{FB}^{ll} — Models for A^{ll}
  - $A_{FB}^{bb̄, cc̄}$
  - excluding models w/ $A_C^{tt̄}$ at LHC

Tevatron		
$p\bar{p}$	CP, ℓ, P	$\sigma = \bar{\sigma}$, $\frac{d\sigma}{d\theta} \neq \frac{d\bar{\sigma}}{d\theta}$
LHC		$\frac{d\sigma}{d\theta}$
pp	CP, ℓ, P	
$\sigma \neq \bar{\sigma}$		
$\frac{d\sigma}{d\theta} \neq \frac{d\bar{\sigma}}{d\theta}$		






T-cuction $t\bar{t}$
$q\bar{q} \to t\bar{t}$
$gg \to t\bar{t}$
$q\bar{q} \to t\bar{t}$
$gg \to t\bar{t}$
$\pi, q\bar{q}$
$q\bar{q}$
θ

$\pi, \eta\bar{\eta}$ | $\eta\bar{\eta}$

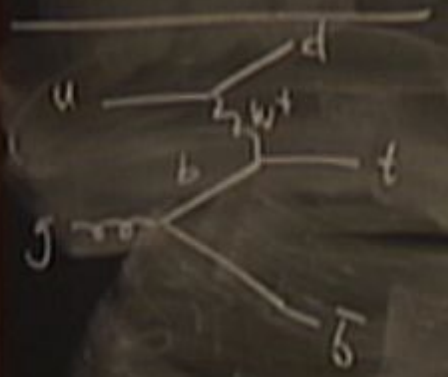
T-cuction $t\bar{t}$

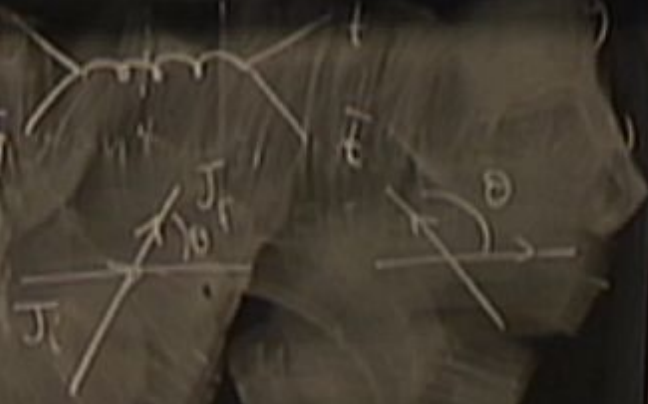
$q\bar{q} \to t\bar{t}$

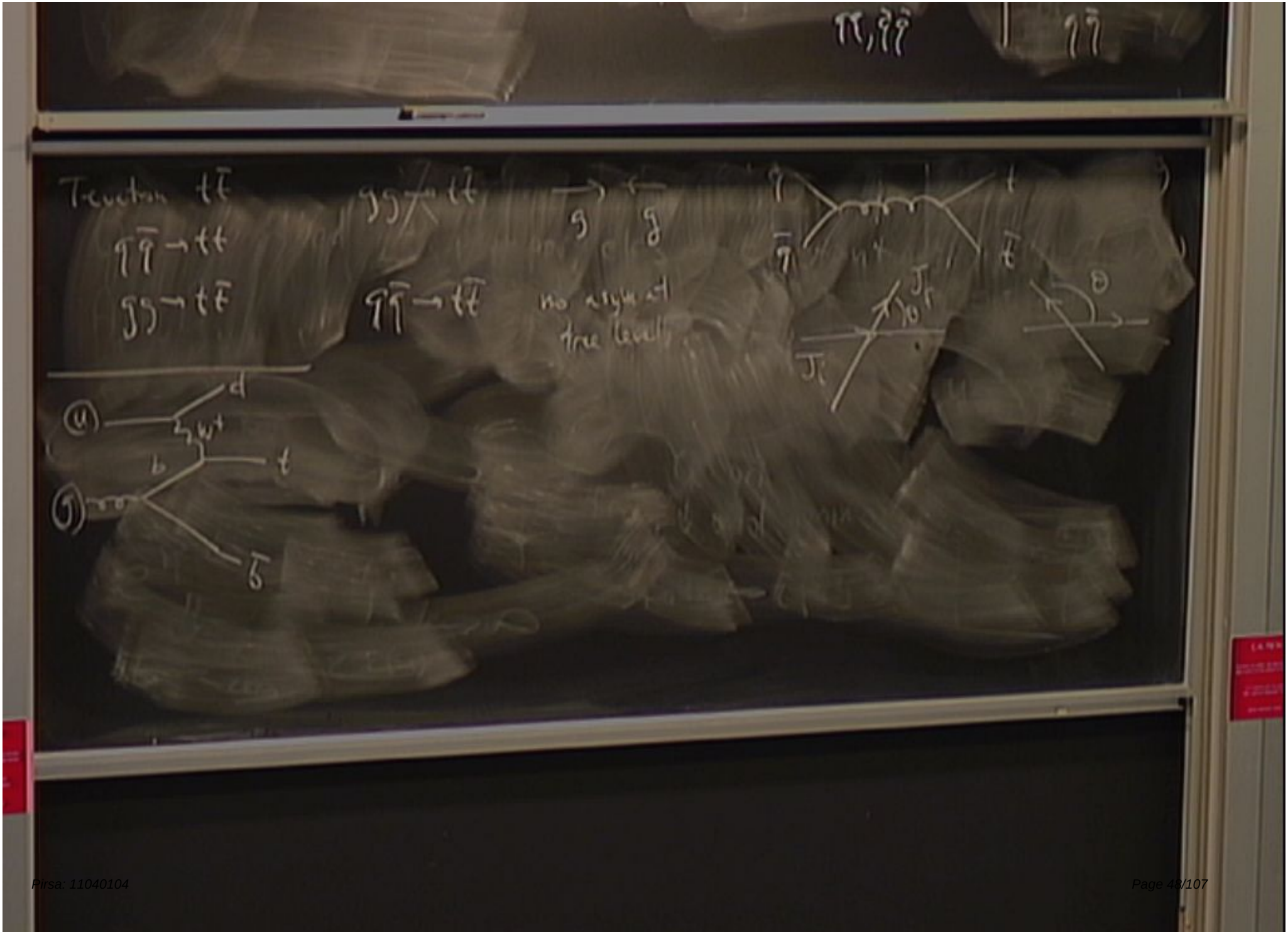
$gg \to t\bar{t}$

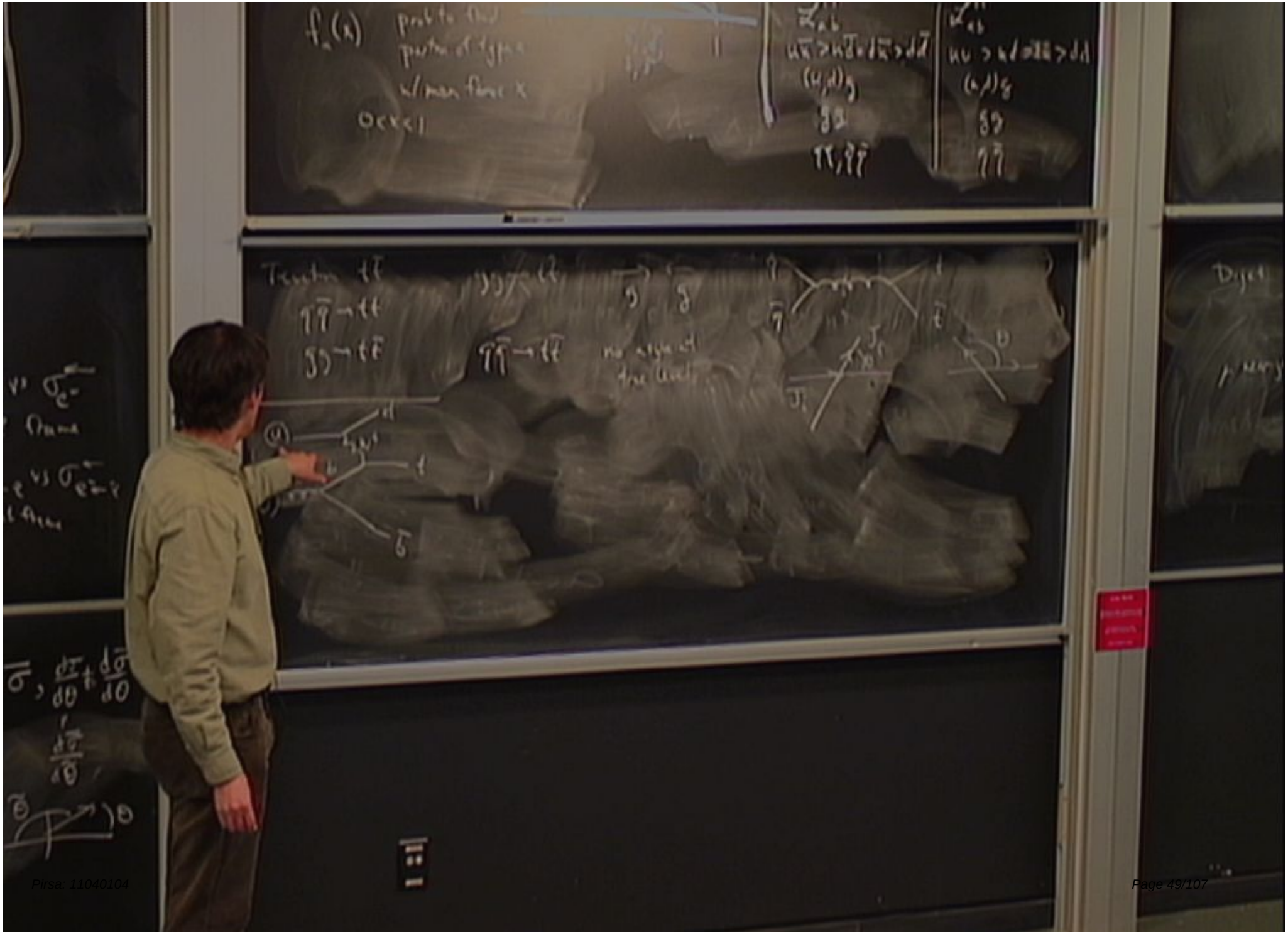
$gg \to t\bar{t}$ $\quad g \quad g$

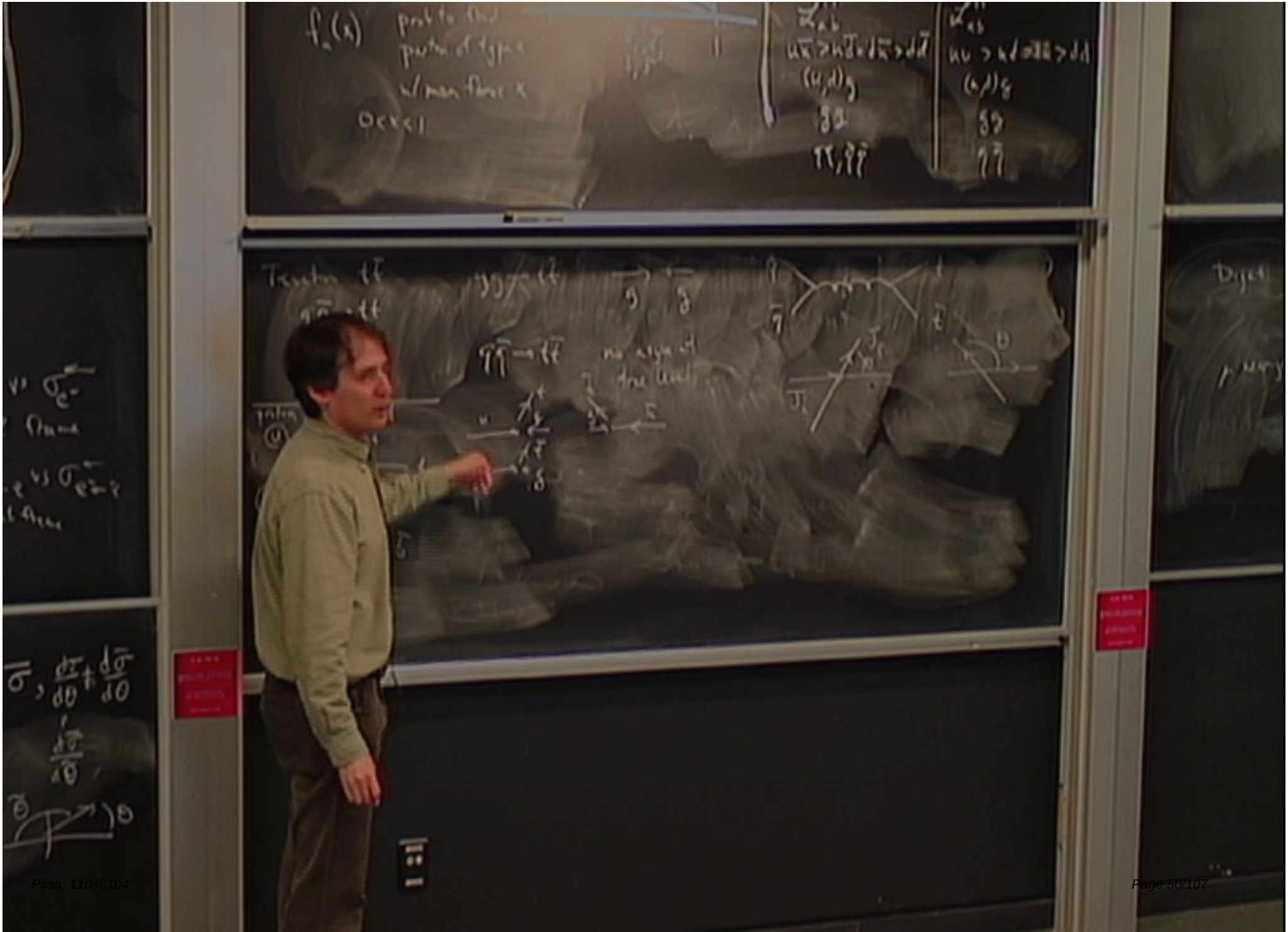
$q\bar{q} \to t\bar{t}$ no asym at tree level

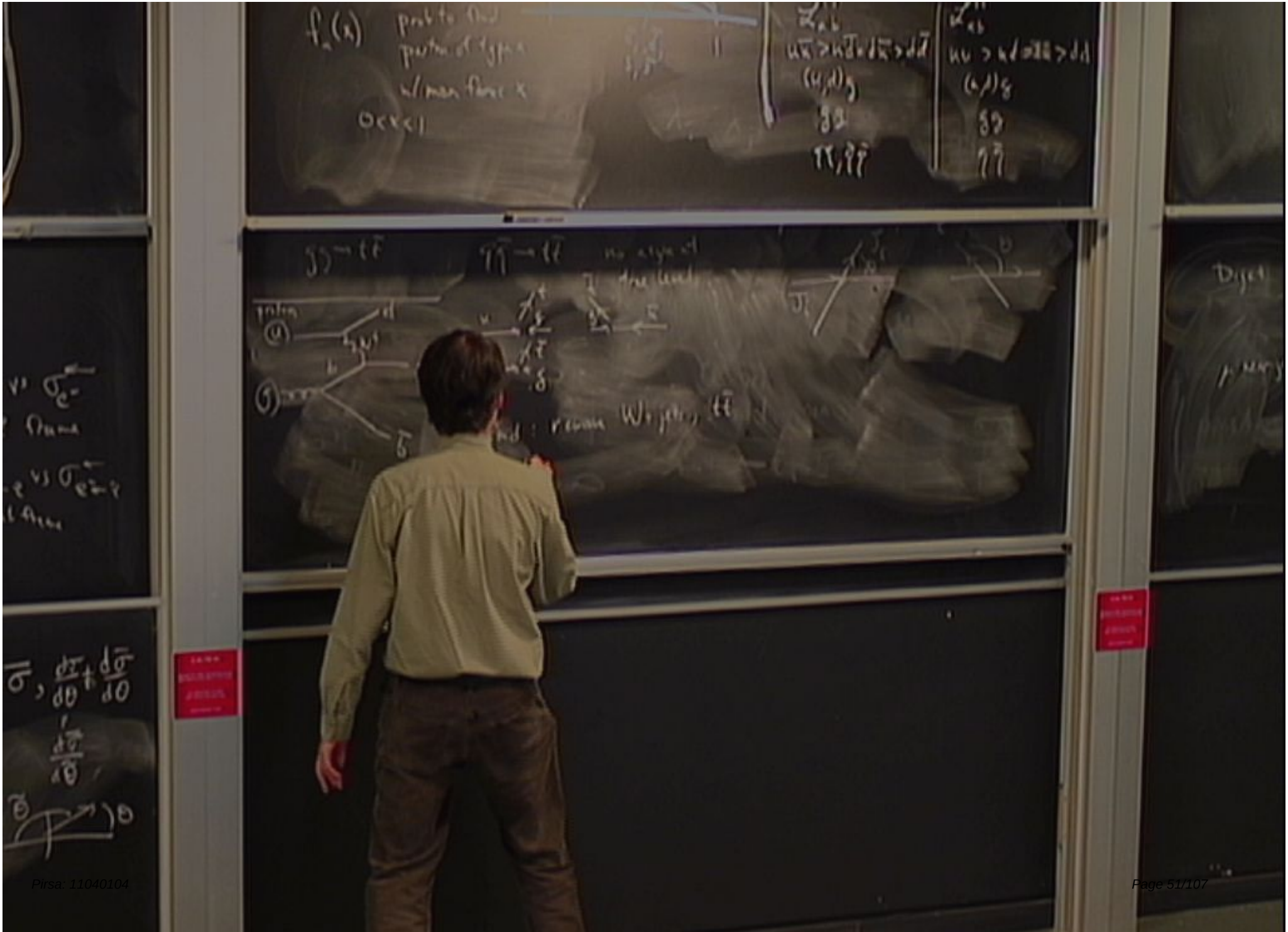


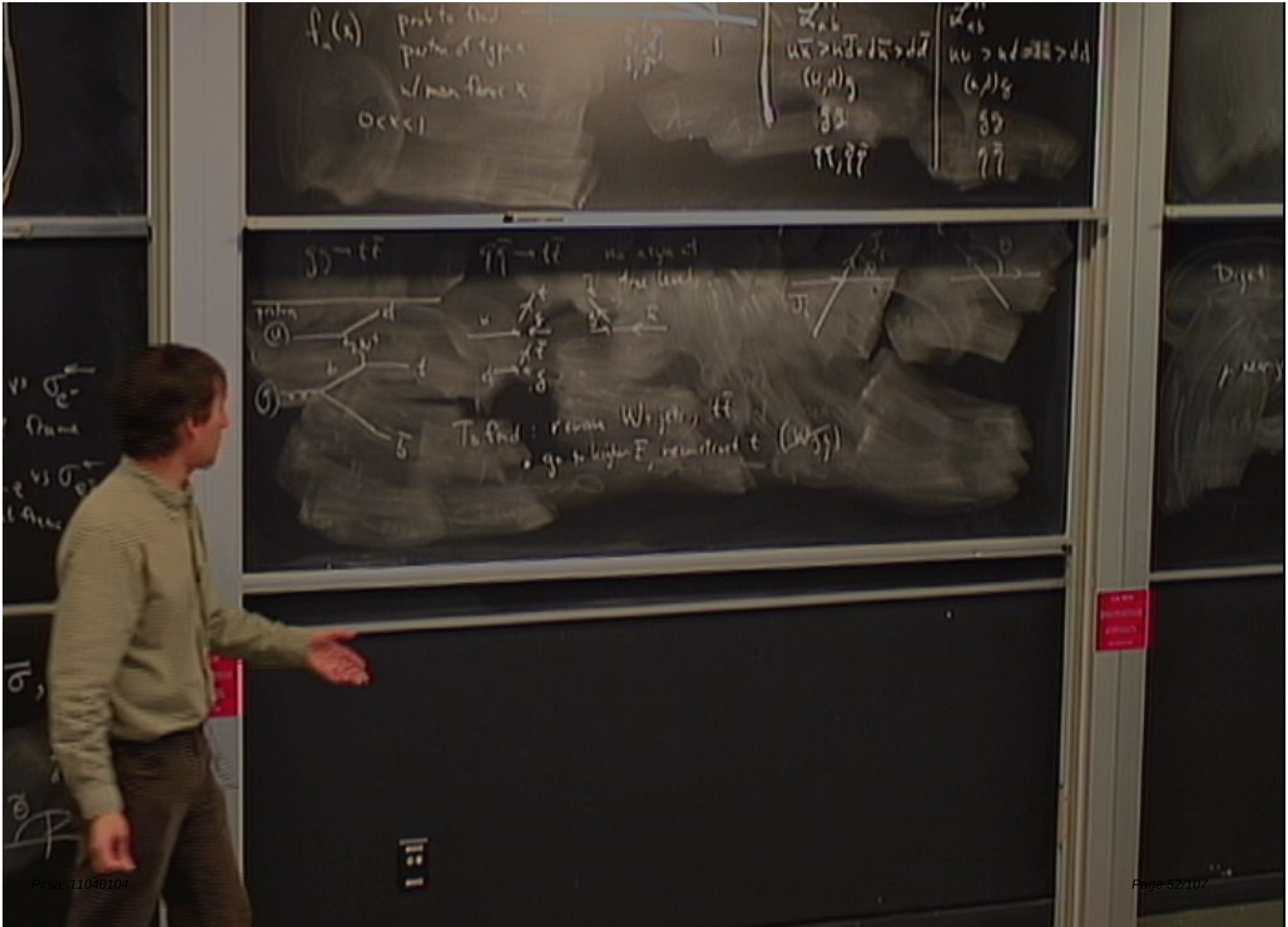


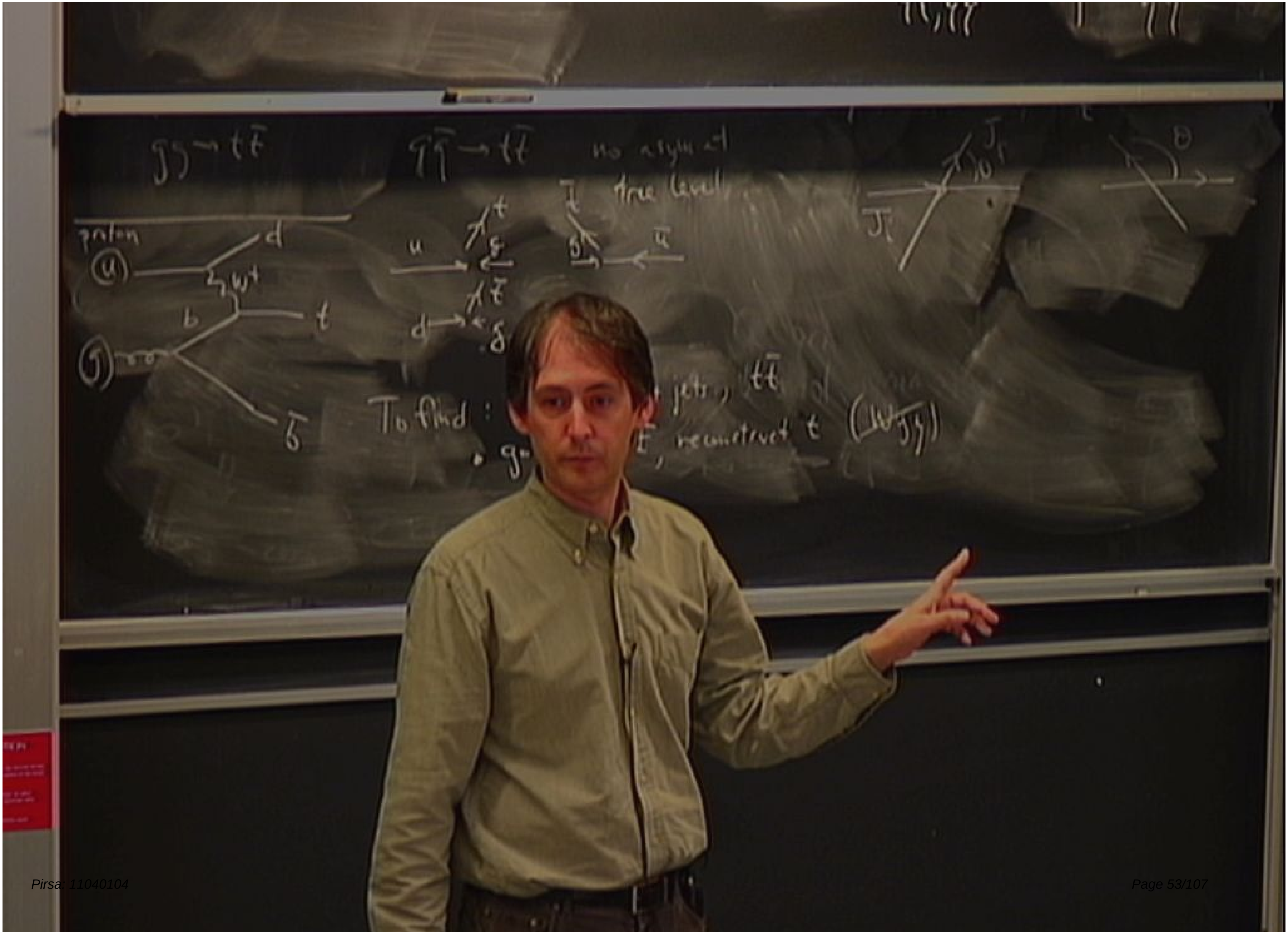

T-evolution $t\bar{t}$
$q\bar{q} \to t\bar{t}$
$gg \to t\bar{t}$
$gg \to t\bar{t}$
$q\bar{q} \to t\bar{t}$
no virtual at tree level
$\pi, q\bar{q}$
$l\bar{l}$
θ
d
W
b
t
$\bar{b}$

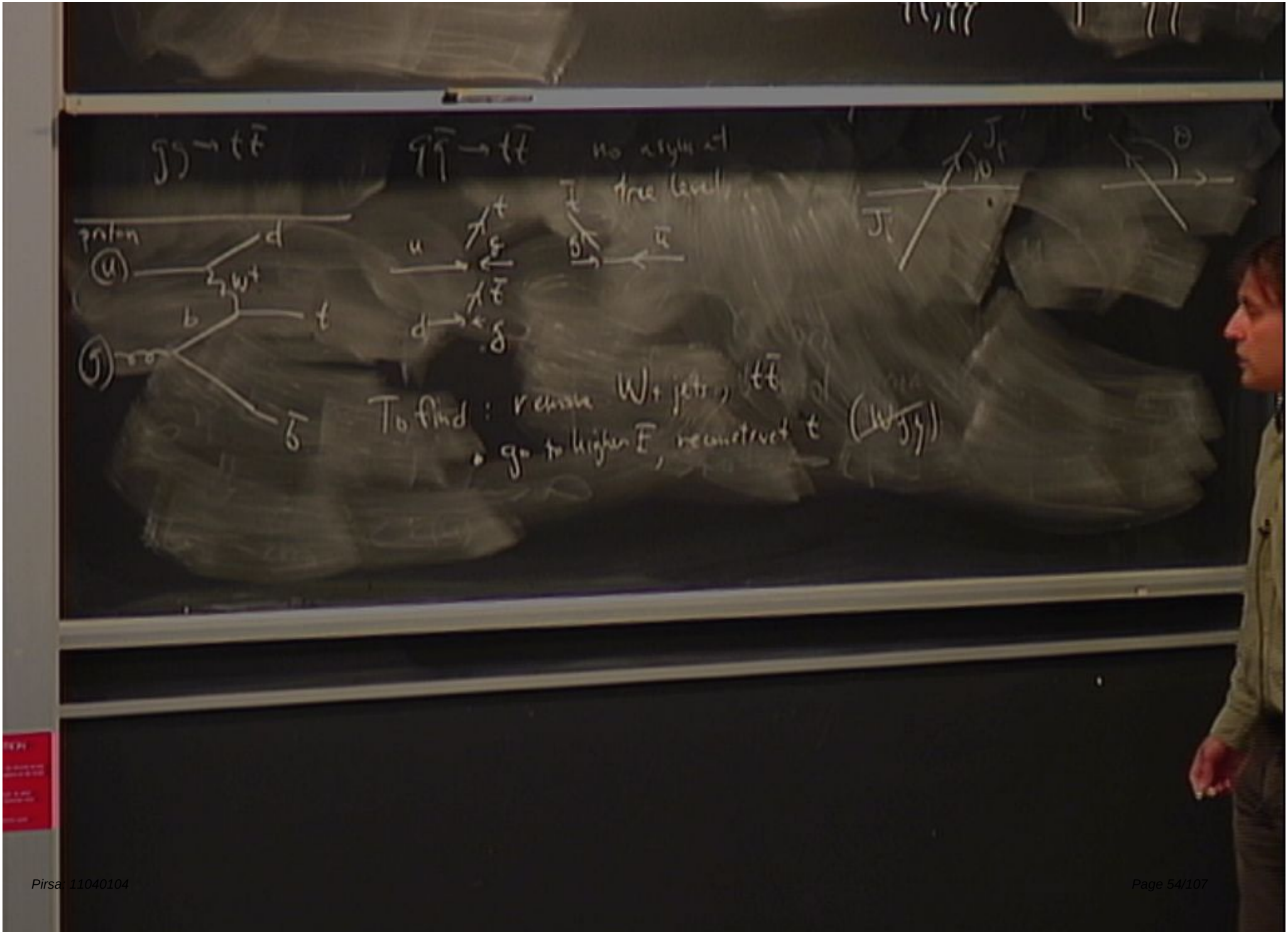


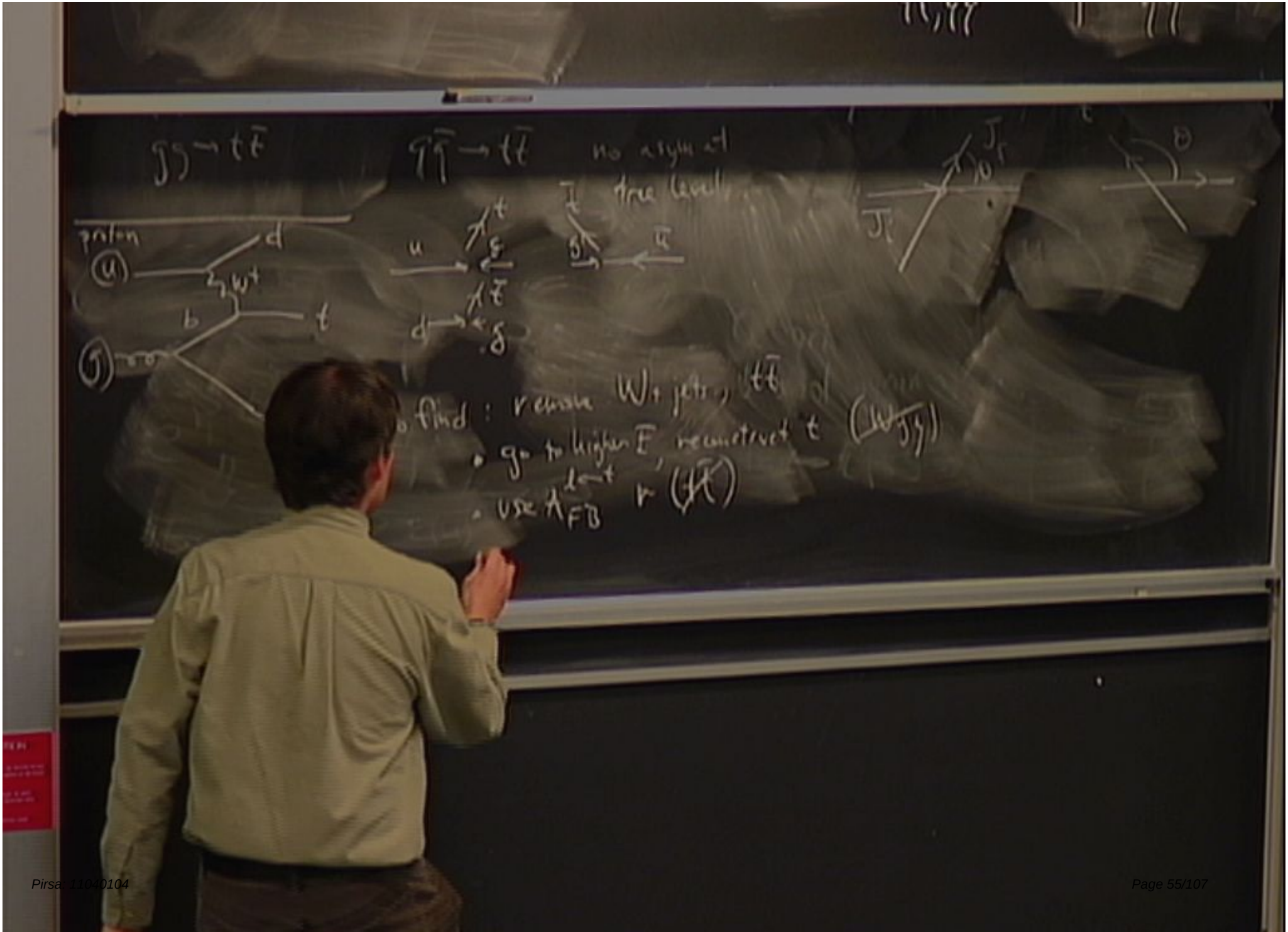


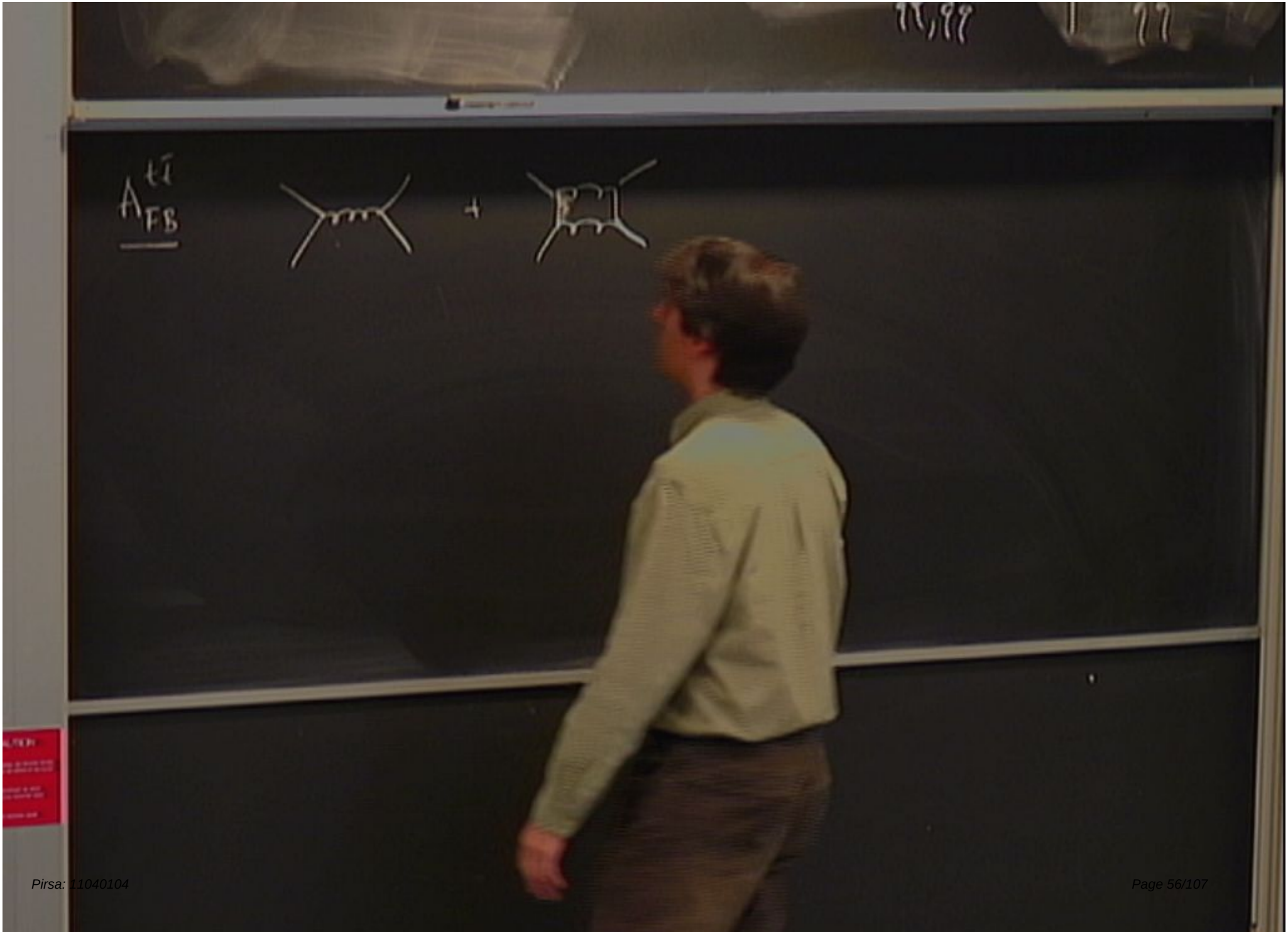





no asym at
tree level
proton
To find :
reconstruct t

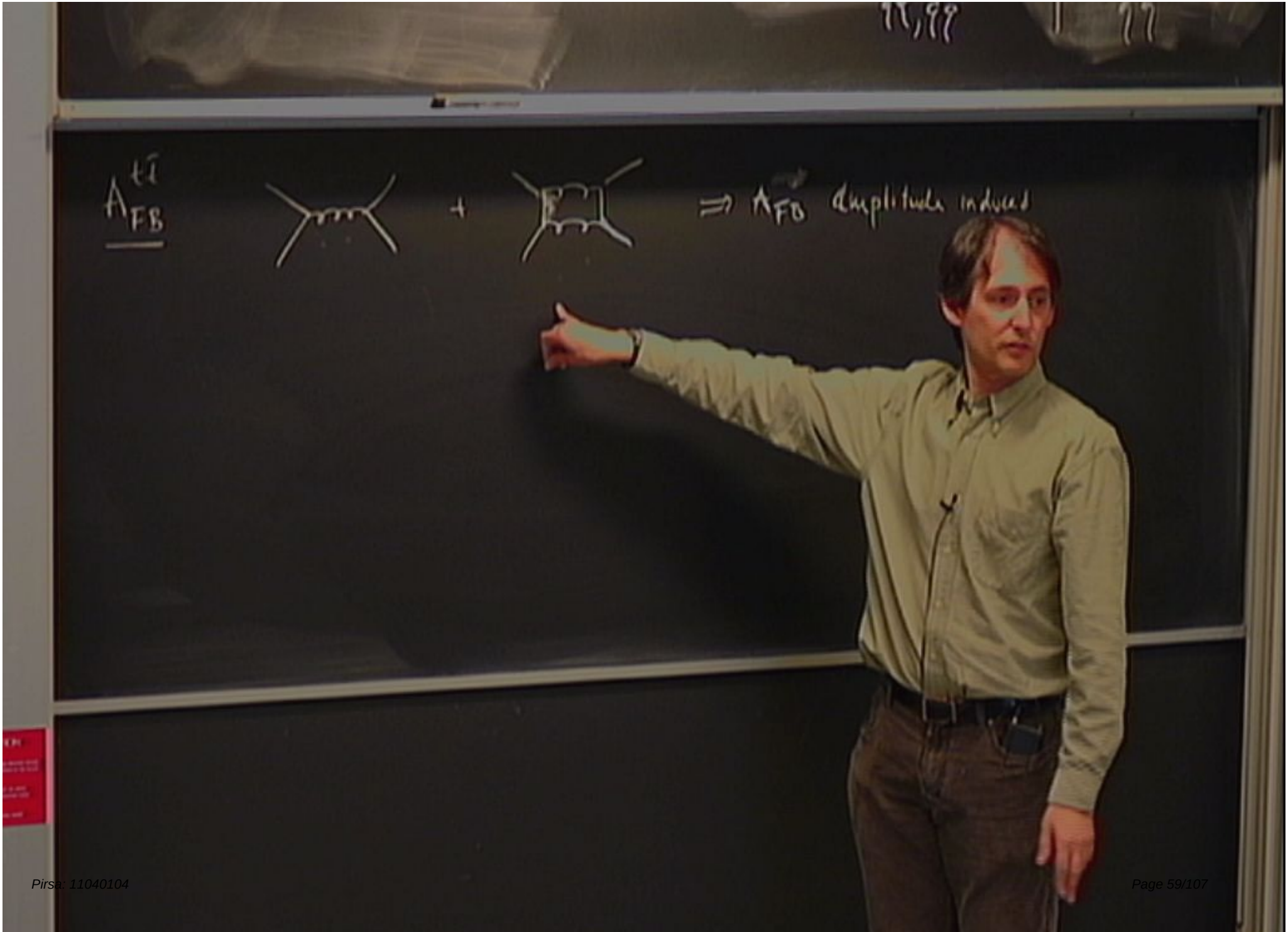

$gg \to t\bar{t}$
$q\bar{q} \to t\bar{t}$
no asym at tree level
proton
d
u
W+
b
t
g
$\bar{b}$
u
t
g
$\bar{t}$
d
g
d
$\bar{u}$
J_t
$J_{\bar{t}}$
To find: reduce W+ jets, $t\bar{t}$
• go to higher E, reconstruct t ($tW \to jjj$)

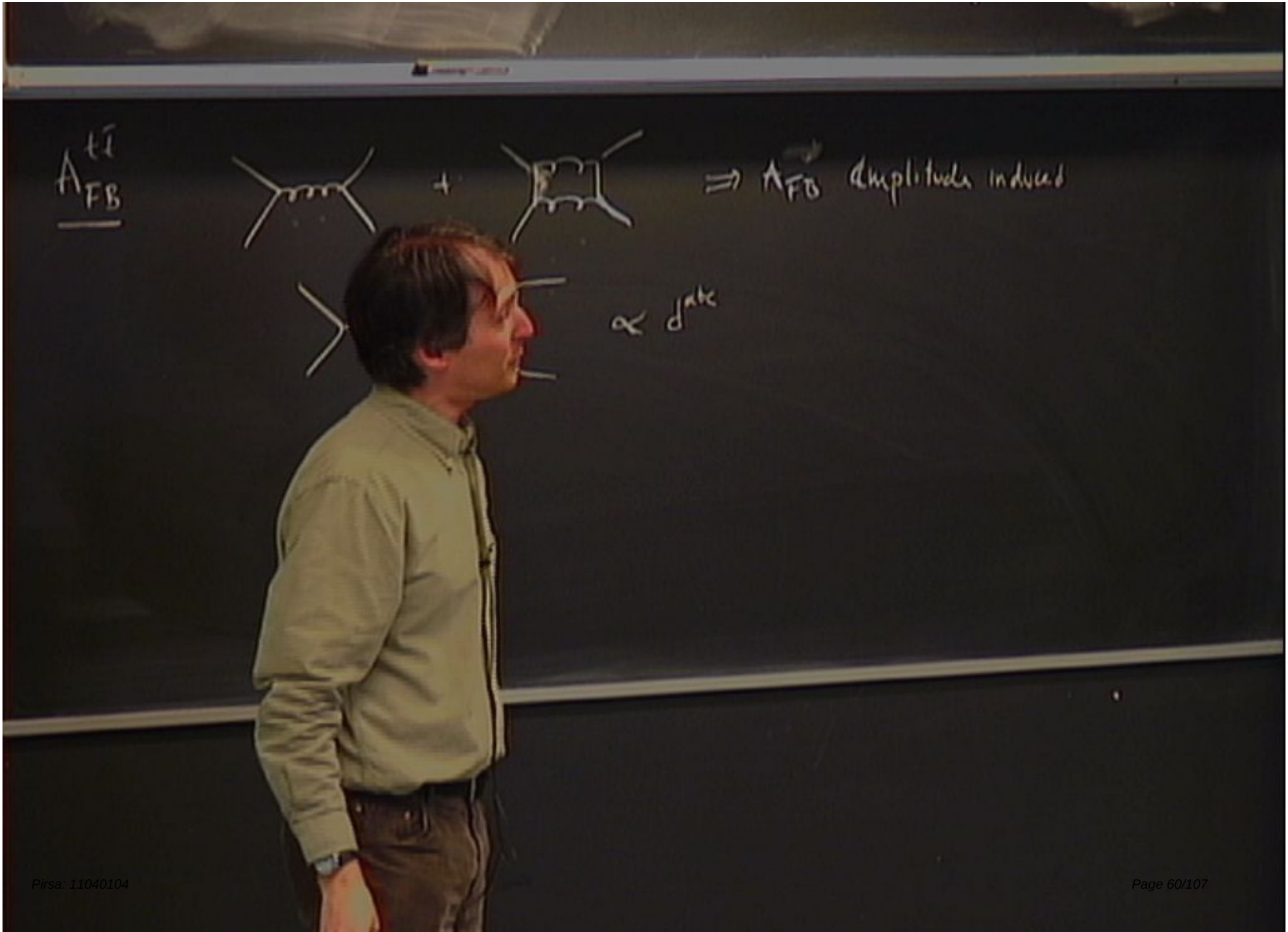

$gg \to t\bar{t}$
$q\bar{q} \to t\bar{t}$
no asym at
tree level
proton
u
d
W+
b
t
g
find : reduce W+ jets, $t\bar{t}$
• go to higher E, reconstruct t
• use A_{FB}^{l-t} for $(t\bar{t})$


A_{FB}^{tt}

A_{FB}^{tt} 

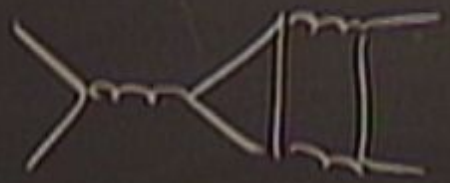
A_{FB}^{tt}  +  $\Rightarrow A_{FB}$ Amplitude induced


$A_{FB}^{t\bar{t}}$
+
$\Rightarrow A_{FB}$ amplitude induced

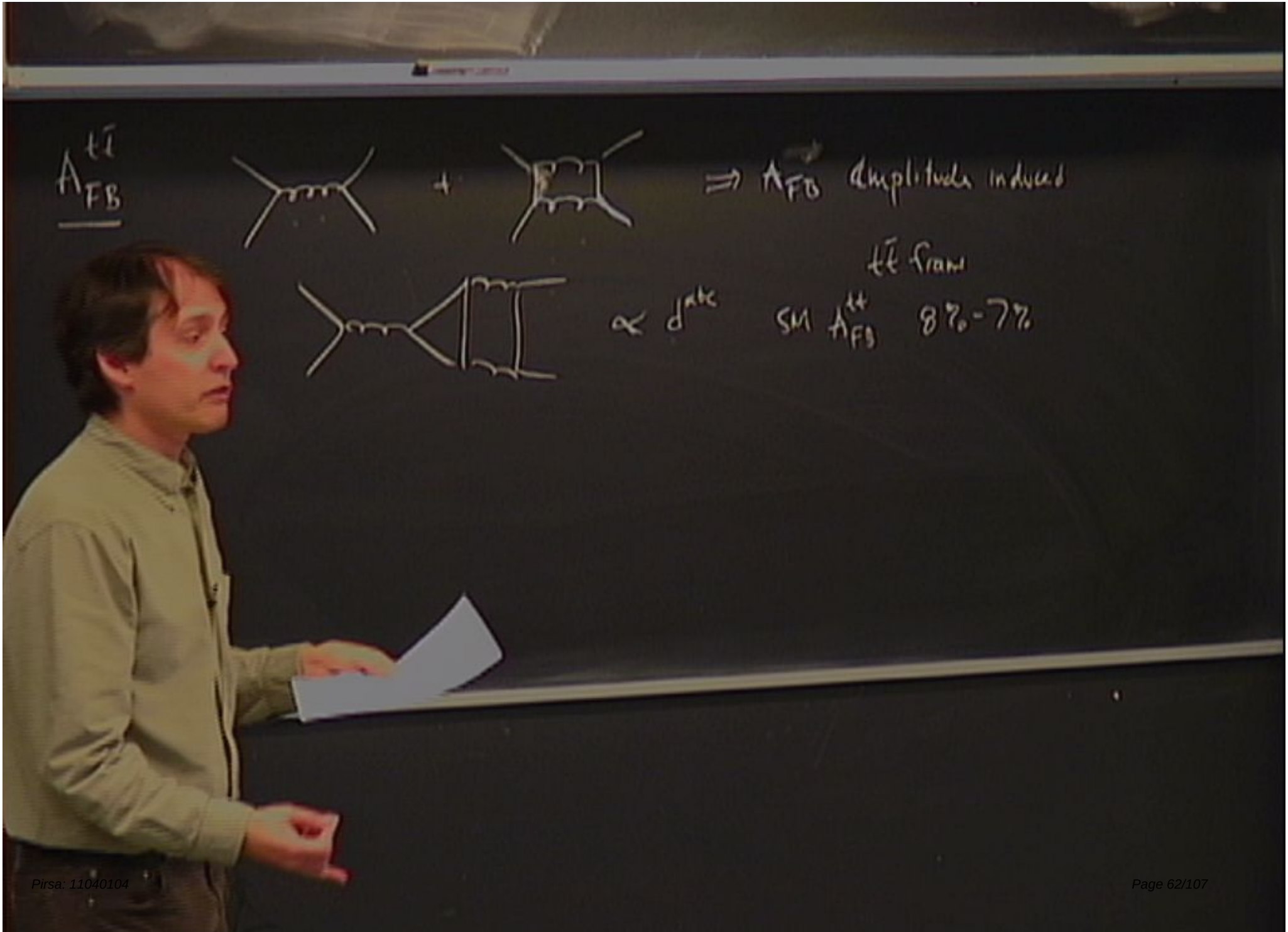

$A_{FB}^{t\bar{t}}$
+
$\Rightarrow A_{FB}^{t\bar{t}}$ amplitude induced
$\propto d^{abc}$

$A_{FB}^{t\bar{t}}$

$\Rightarrow A_{FB}$ amplitude induced

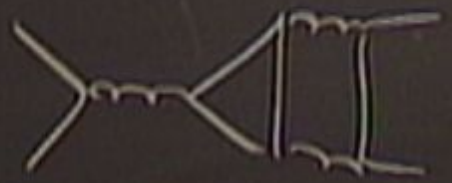


$\propto d^{abc}$


$A_{FB}^{t\bar{t}}$
+
$\Rightarrow A_{FB}$ amplitude induced
$t\bar{t}$ from
$\propto d^{abc}$
SM A_{FB}^{tt} 8%-7%

$A_{FB}^{t\bar{t}}$

$\Rightarrow A_{FB}$ amplitude induced

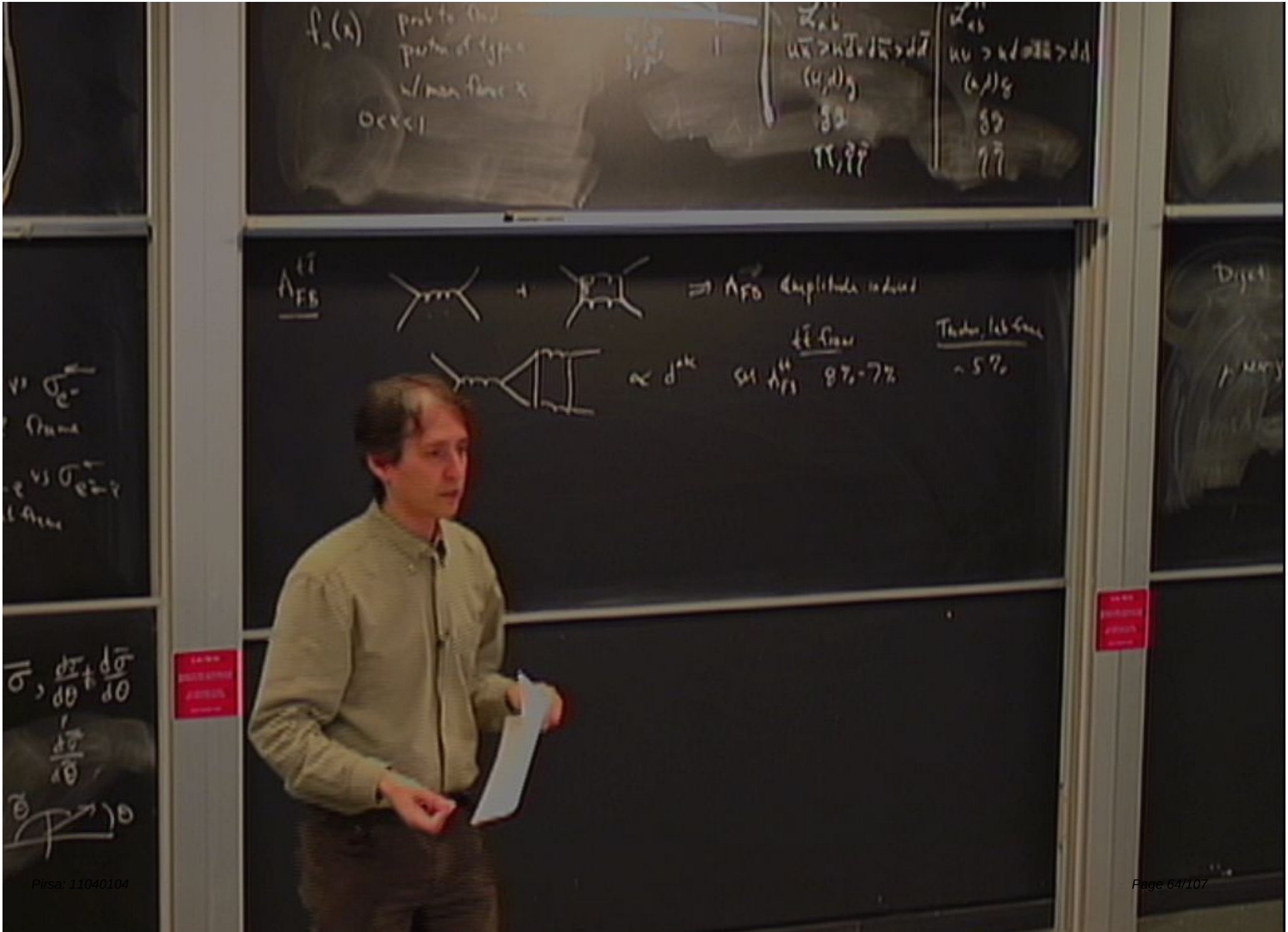


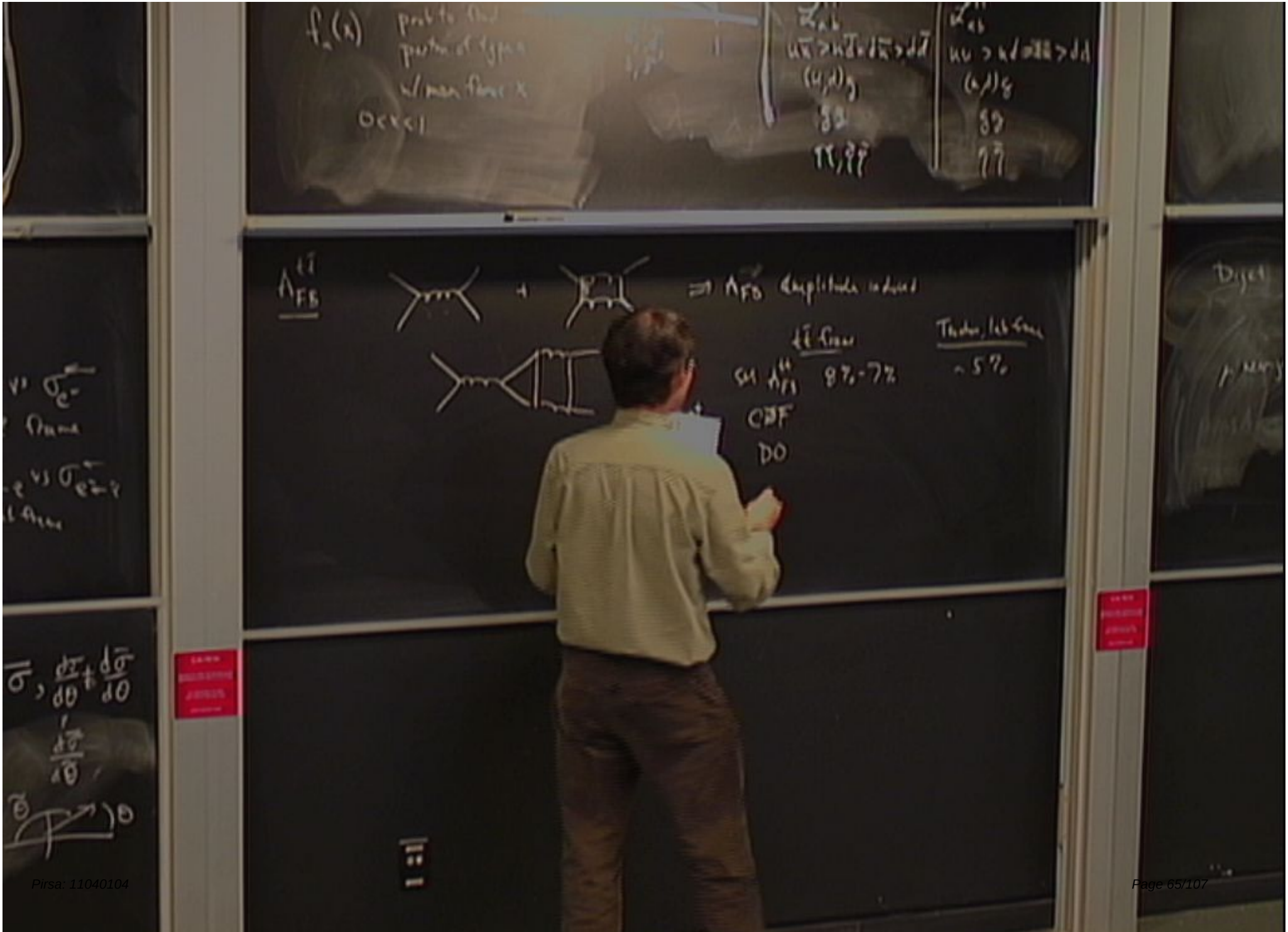
$\propto d^{abc}$

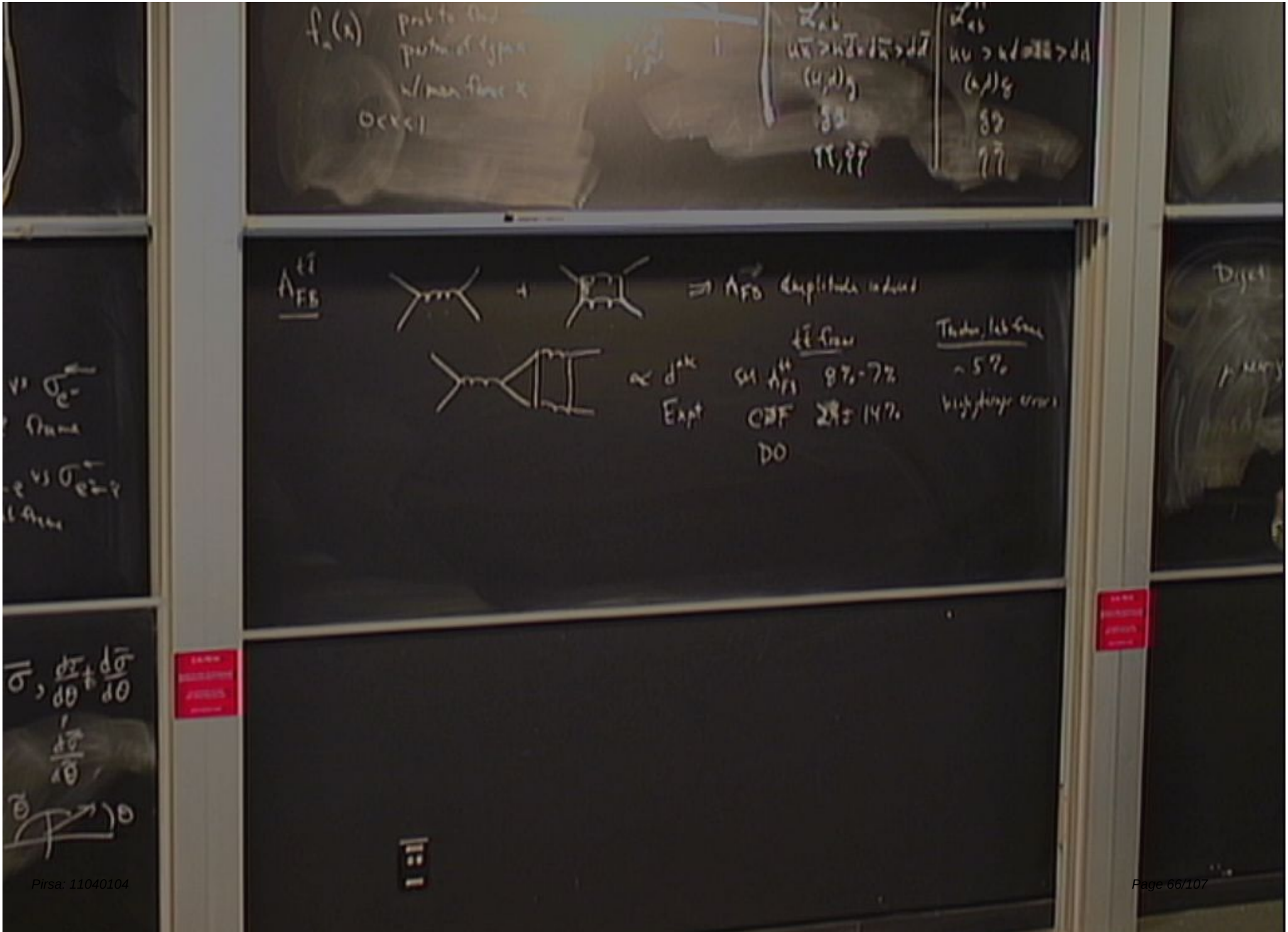
Tevatron, Lab-frame

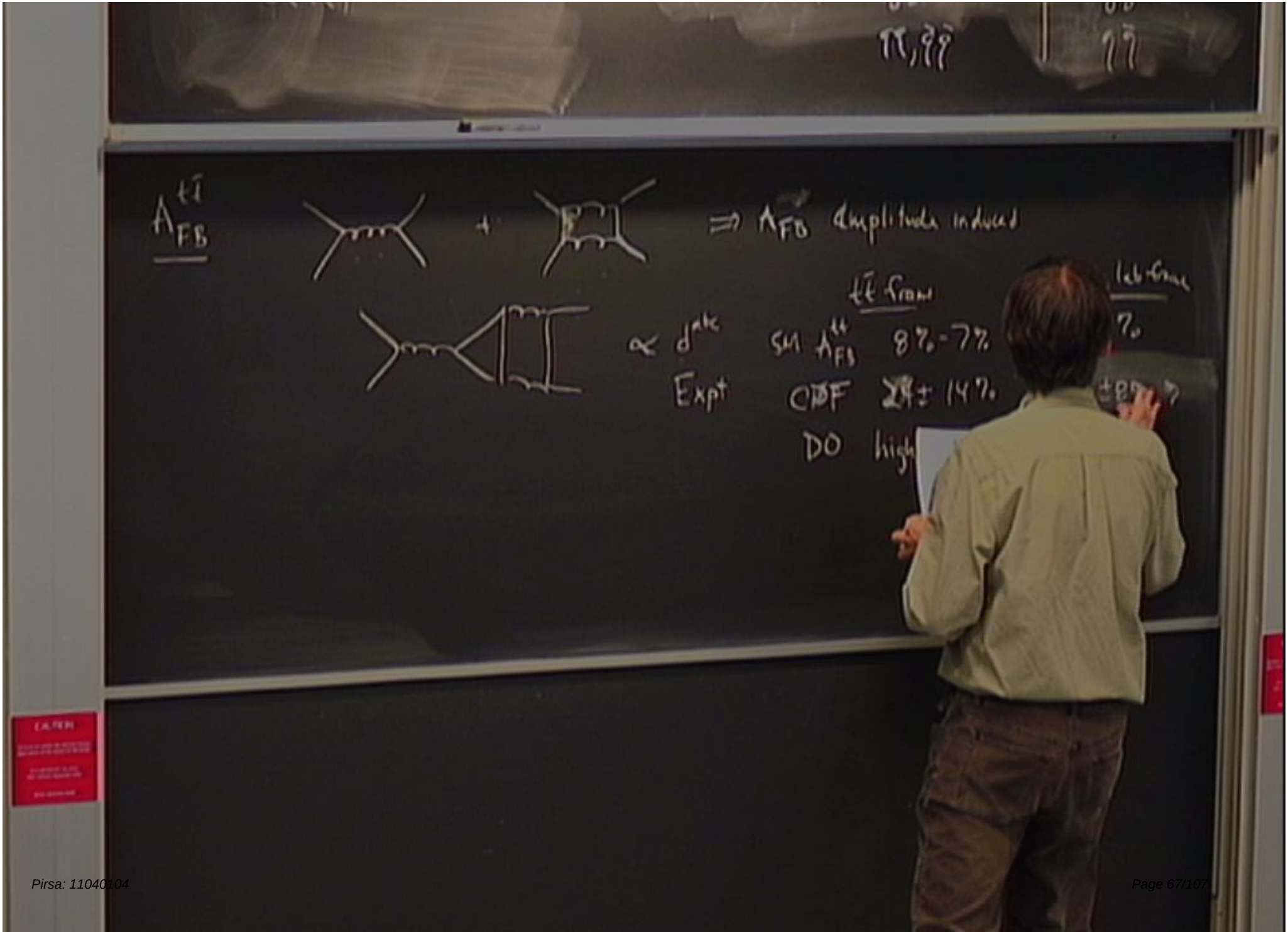
$t\bar{t}$ frame

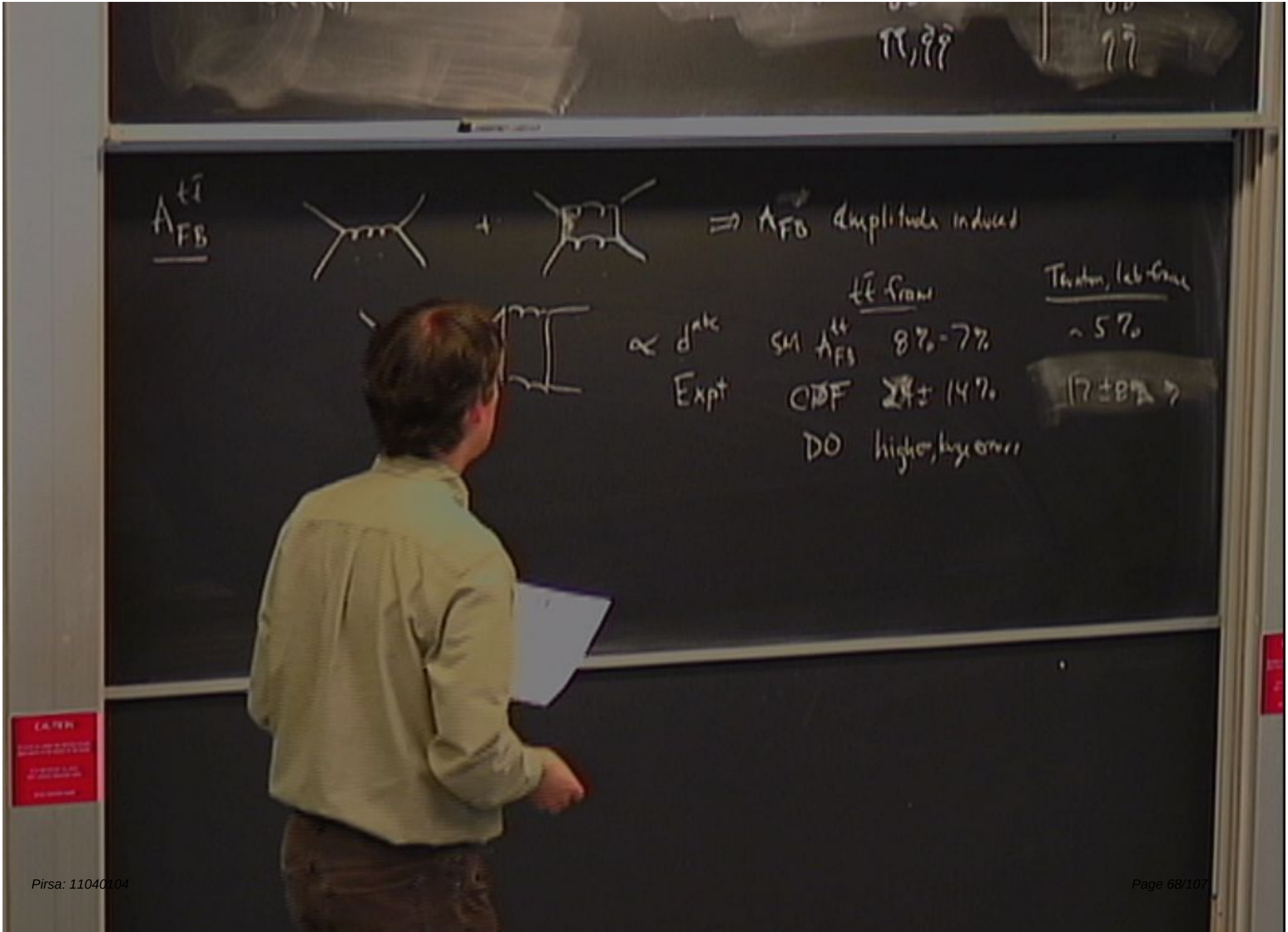
SM A_{FB}^{tt} 8%-7%


$A_{FB}^{t\bar{t}}$
$\propto d^{abc}$
$t\bar{t}$ flavor
Theory/Lab frame
~5%


CDF
DO


$A_{FB}^{t\bar{t}}$
$\propto d^{abc}$
SM $A_{FB}^{t\bar{t}}$ 8%-7%
Expt CDF 24 ± 14%
DO
$t\bar{t}$ theory
~5%


$A_{FB}^{t\bar{t}}$
$\Rightarrow A_{FB}$ amplitude induced
$\propto d^{abc}$
$t\bar{t}$ from
SM A_{FB}^{tt} 8%-7%
Expt CDF
DO high
lab frame
7%


$A_{FB}^{t\bar{t}}$
$\Rightarrow A_{FB}$ amplitude induced
$t\bar{t}$ from
Tevatron, lab-frame
$\propto d^{abc}$
SM A_{FB}^{tt} 8%-7%
~5%
Expt CDF 24 ± 14%
17 ± 8% ?
DO higher, but consist.

$\pi, \eta\eta$ | $\gamma\gamma$

$A_{FB}^{t\bar{t}}$  $\Rightarrow A_{FB}$ amplitude induced

 $\propto d^{abc}$

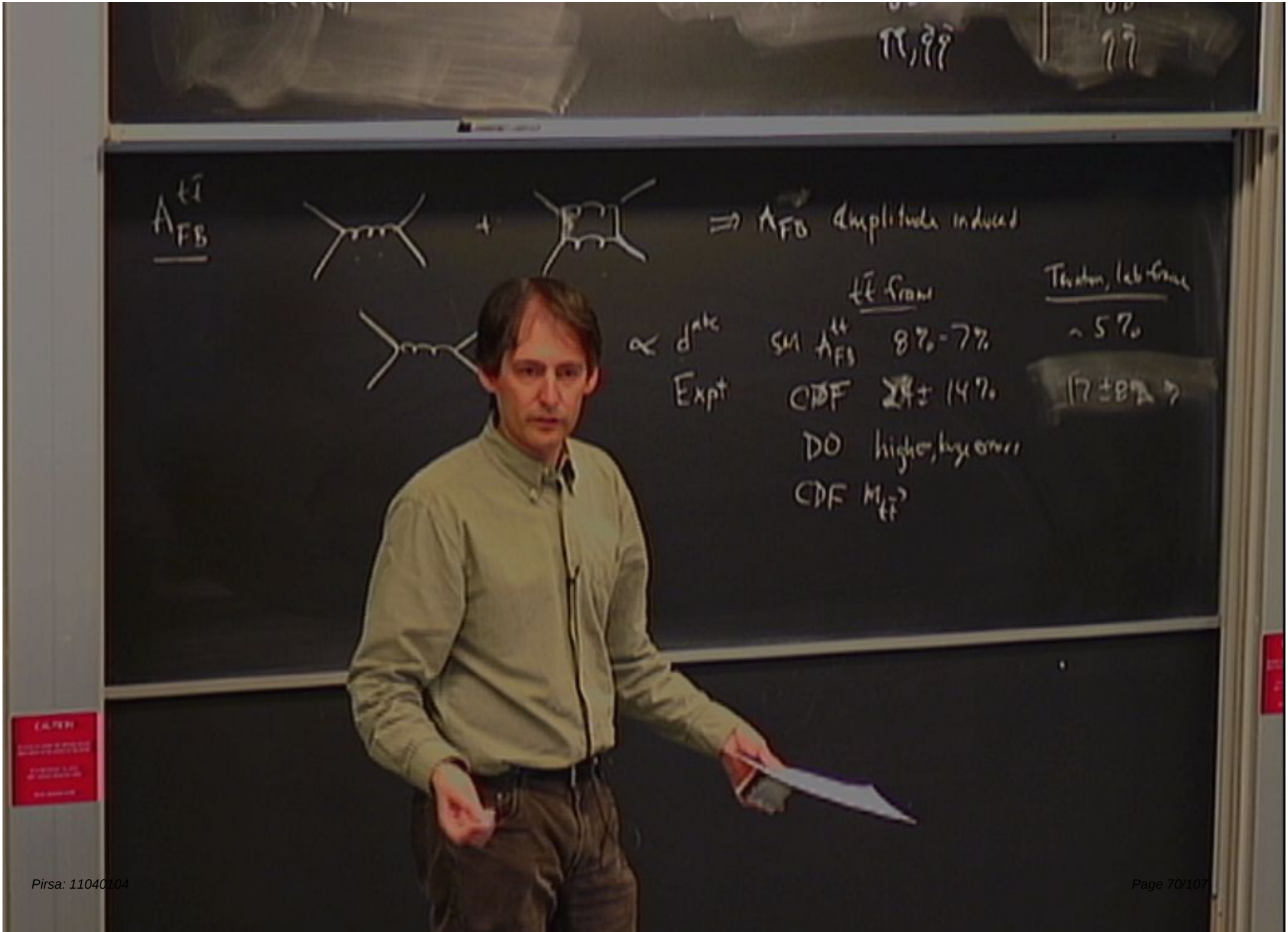
$t\bar{t}$ frame | Tevatron, lab frame

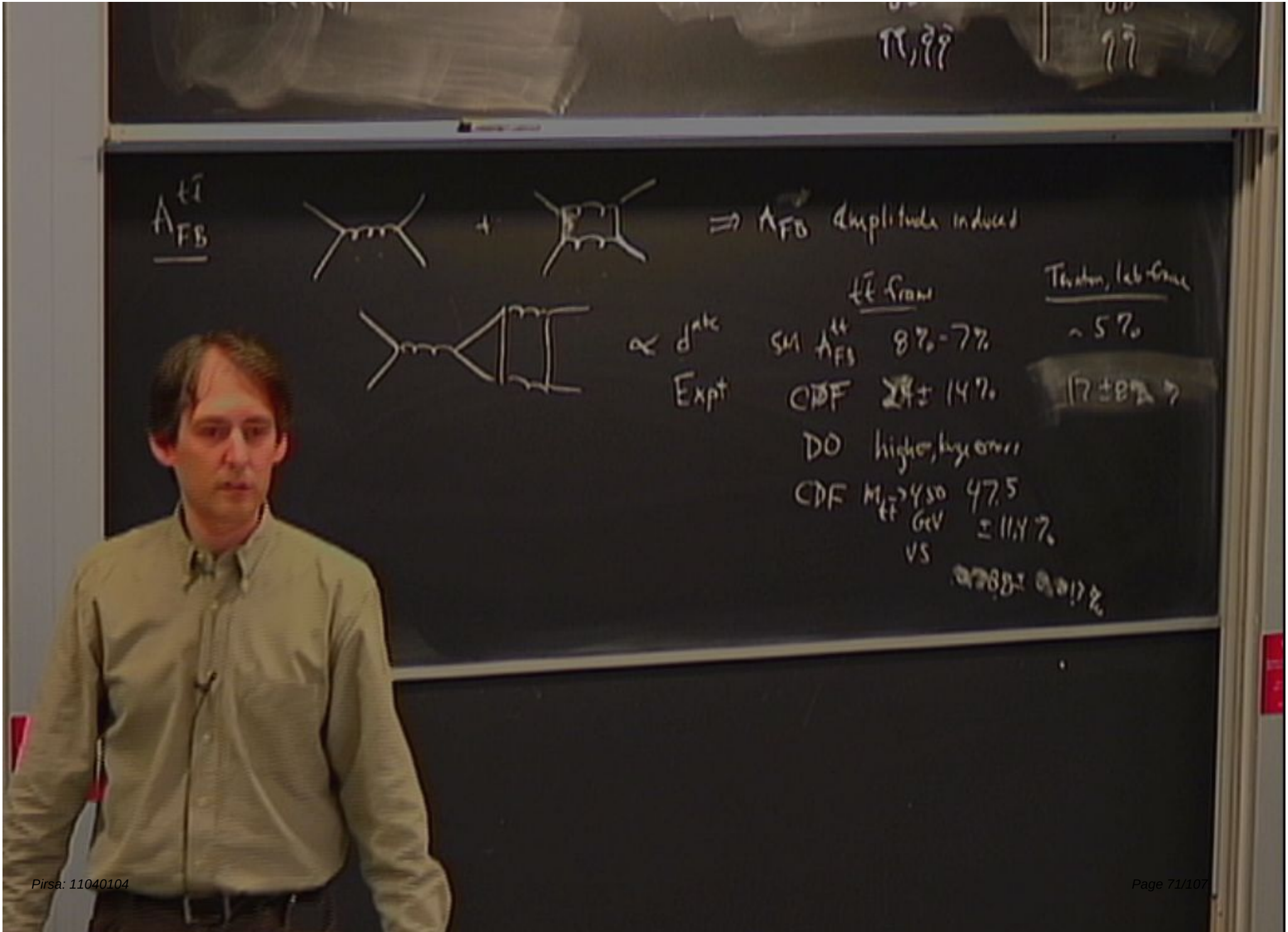
SM $A_{FB}^{t\bar{t}}$ 8%-7% | ~5%

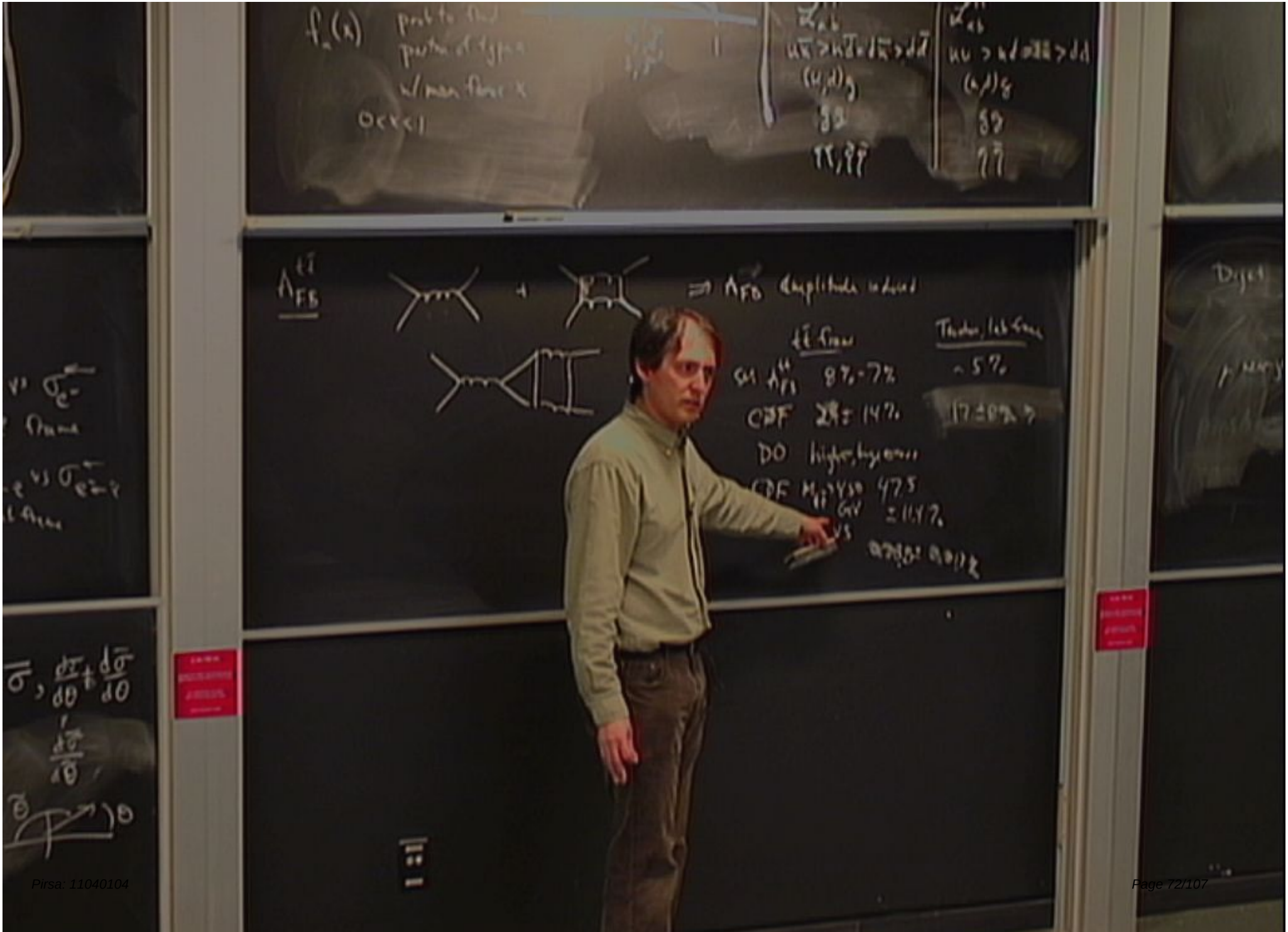
Expt CDF [illegible] ± 14% | 17 ± 8% ?

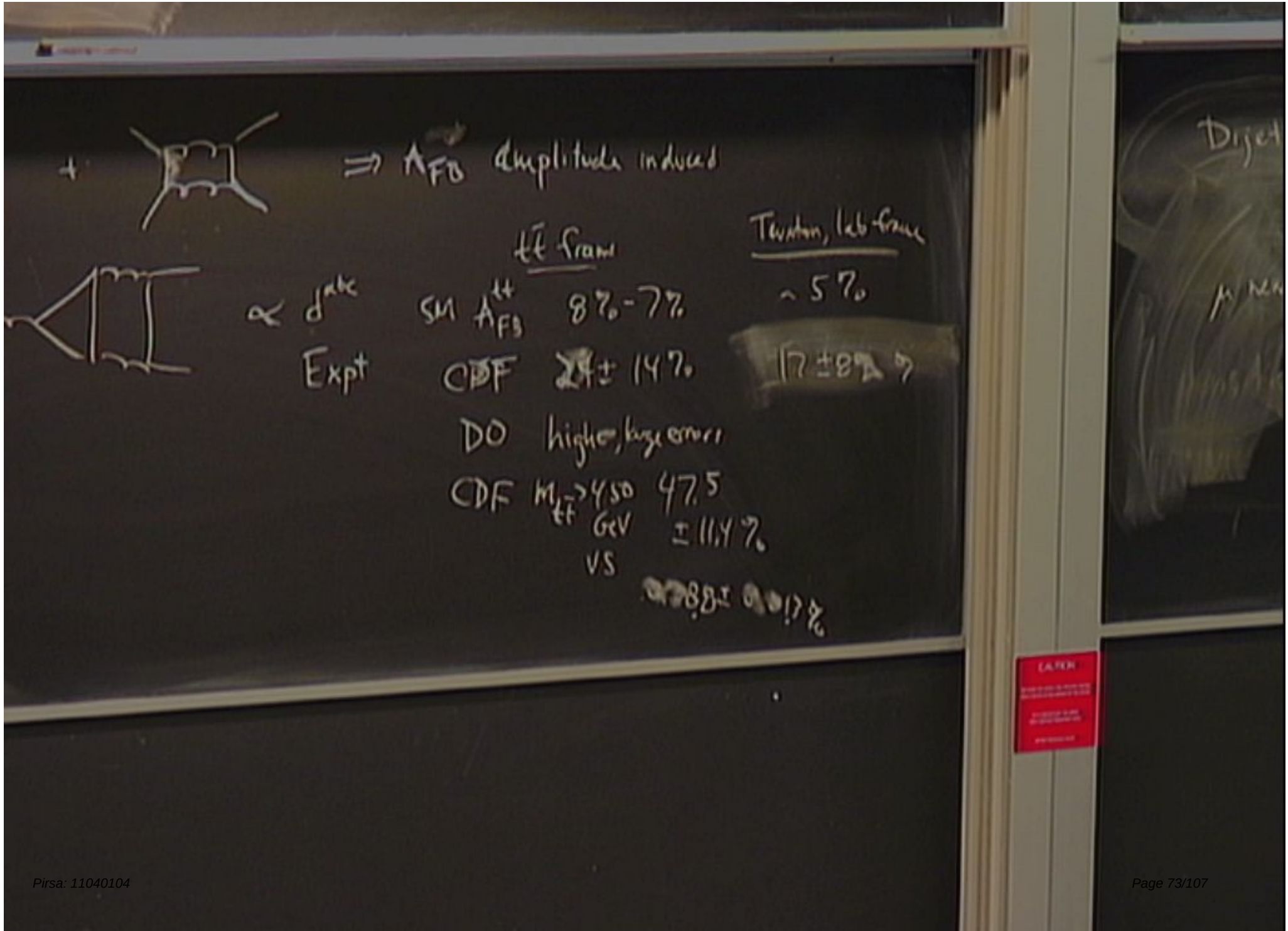
DO higher, high $\sigma_{t\bar{t}}$

CDF


$A_{FB}^{t\bar{t}}$
+
$\Rightarrow A_{FB}$ amplitude induced
$\propto d^{abc}$
$t\bar{t}$ from
SM A_{FB}^{tt} 8%-7%
Expt CDF 24 ± 14%
DO higher, but agrees
CDF $M_{t\bar{t}}$?
Tevatron, lab frame
~ 5%
17 ± 8% ?


$A_{FB}^{t\bar{t}}$
$\Rightarrow A_{FB}$ amplitude induced
$\propto d^{abc}$
$t\bar{t}$ from
Tevatron, Lab-frame
SM $A_{FB}^{t\bar{t}}$ 8%-7%
~5%
Expt
CDF
14%
DO higher, high error
CDF $M_{t\bar{t}} > 450$ GeV 47.5 ± 11.4%
vs


$A_{FB}^{t\bar{t}}$
$\Rightarrow A_{FB}$
$t\bar{t}$ theor.
SM $A_{FB}^{t\bar{t}}$ 8%-7%
CDF
DO
CDF
GeV
±11%


+
⇒ A_{FB} amplitudes induced
$t\bar{t}$ frame
Tevatron, lab-frame
$\propto d^{abc}$
SM A_{FB}^{tt} 8%-7%
~5%
Expt
CDF
14%
DO higher, huge errors
CDF $M_{t\bar{t}} > 450$ GeV
47.5 ± 11.4%
VS
8.8 ± 6.8%

$\Rightarrow A_{FB}$ amplitude induced

$t\bar{t}$ frame

Tevatron, lab frame

$\propto d^{abc}$

SM $A_{FB}^{t\bar{t}}$ 8%-7%

~5%

Expt CDF 24 ± 14%

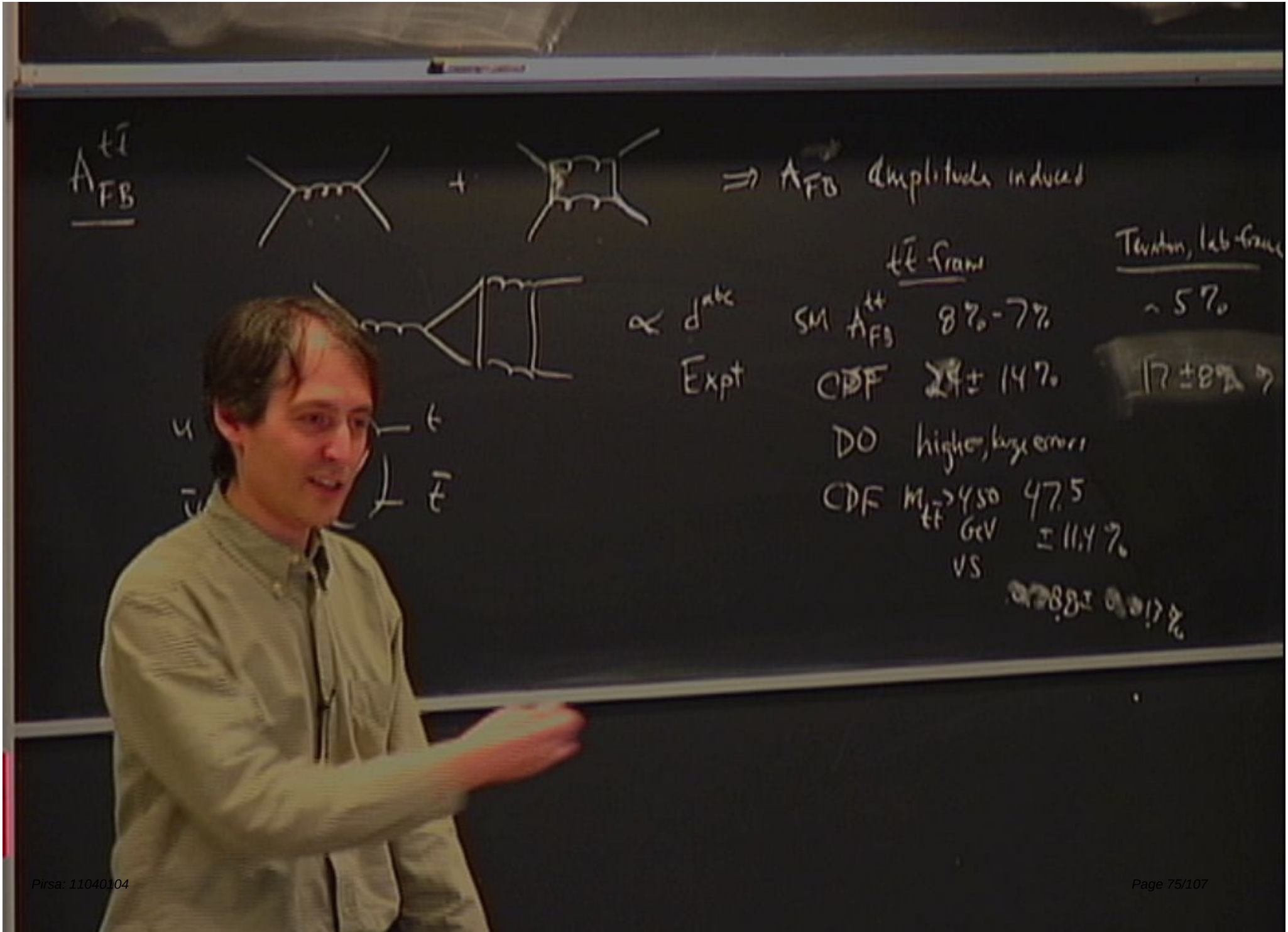
17 ± 8%

DO higher, large errors

CDF $M_{t\bar{t}} > 450$ GeV 47.5 ± 11.4%

VS

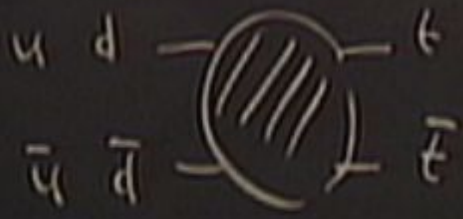
.88 ± .13%


$A_{FB}^{t\bar{t}}$
+
$\Rightarrow A_{FB}$ amplitude induced
$\propto d^{abc}$
$t\bar{t}$ frame
Tevatron, lab frame
SM A_{FB}^{tt} 8%-7%
~5%
Expt
CDF
14%
DO higher, large error
CDF $m_{t\bar{t}} > 450$ GeV 47.5 ± 11.4%
vs

$A_{FB}^{t\bar{t}}$

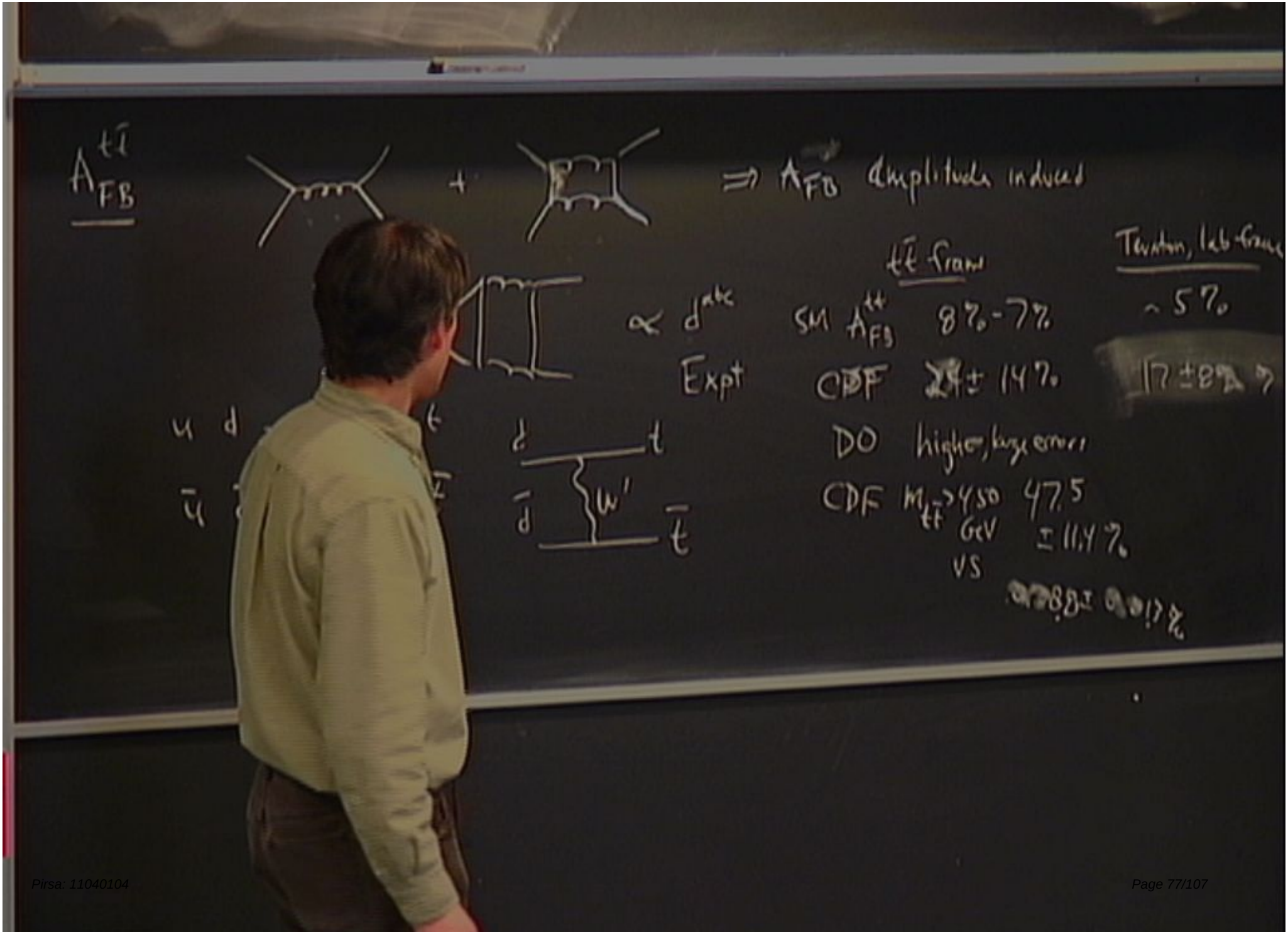
$\Rightarrow A_{FB}$ amplitude induced

$\propto d^{abc}$



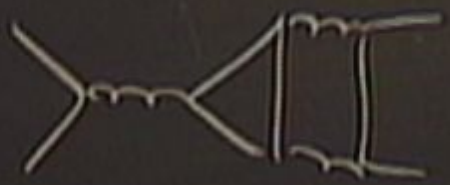
		$t\bar{t}$ frame	Tevatron, lab frame
SM	$A_{FB}^{t\bar{t}}$	8%-7%	~5%
Expt	CDF	[illegible] ± 14%	17 ± 8% ?
	DO	higher, large error	
	CDF	$M_{t\bar{t}} > 450$ GeV vs [illegible]	47.5 ± 11.4%

[illegible] ± 0.13%


$A_{FB}^{t\bar{t}}$
+
$\Rightarrow A_{FB}$ amplitudes induced
$\propto d^{abc}$
$t\bar{t}$ frame
Tevatron, lab frame
SM A_{FB}^{tt} 8%-7%
~5%
Expt
CDF ± 14%
17 ± 8%
DO higher, large error
CDF $m_{t\bar{t}}$ > 450 GeV 47.5 ± 11.4%
VS
u d
$\bar{u}$
t
$\bar{t}$
d
$\bar{d}$
W'

$A_{FB}^{t\bar{t}}$

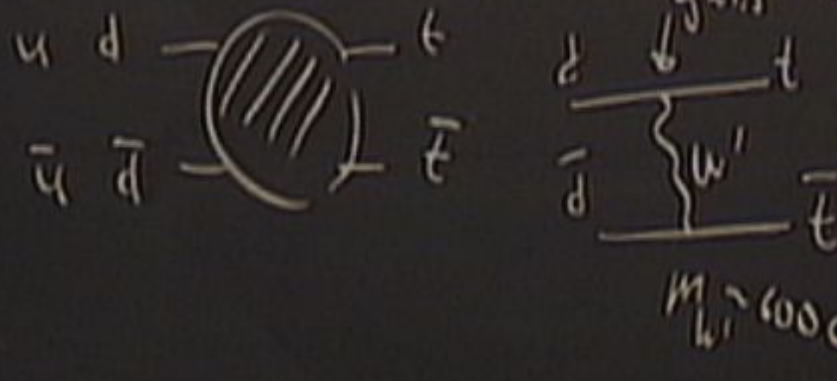
$\Rightarrow A_{FB}$ amplitude induced

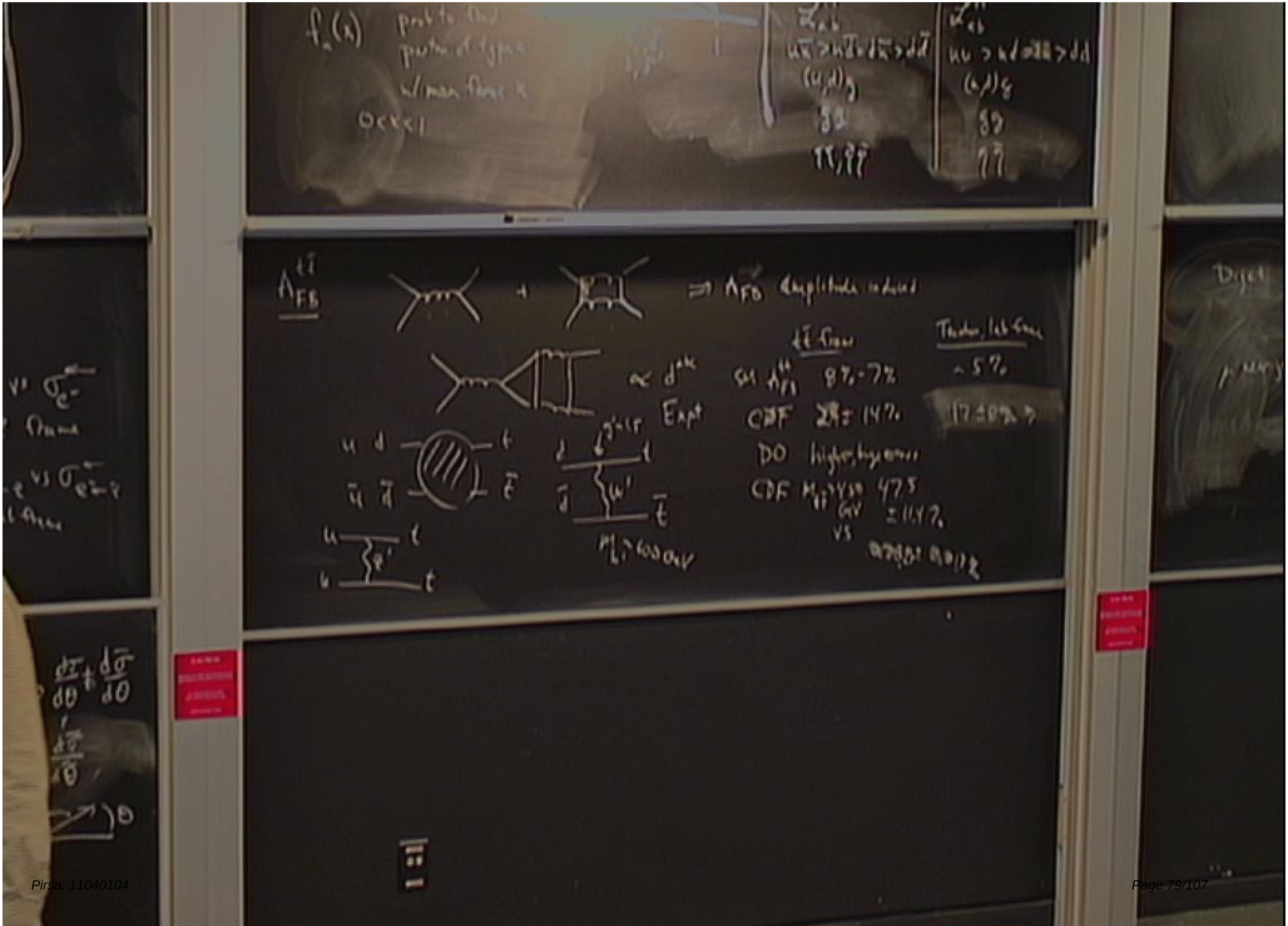


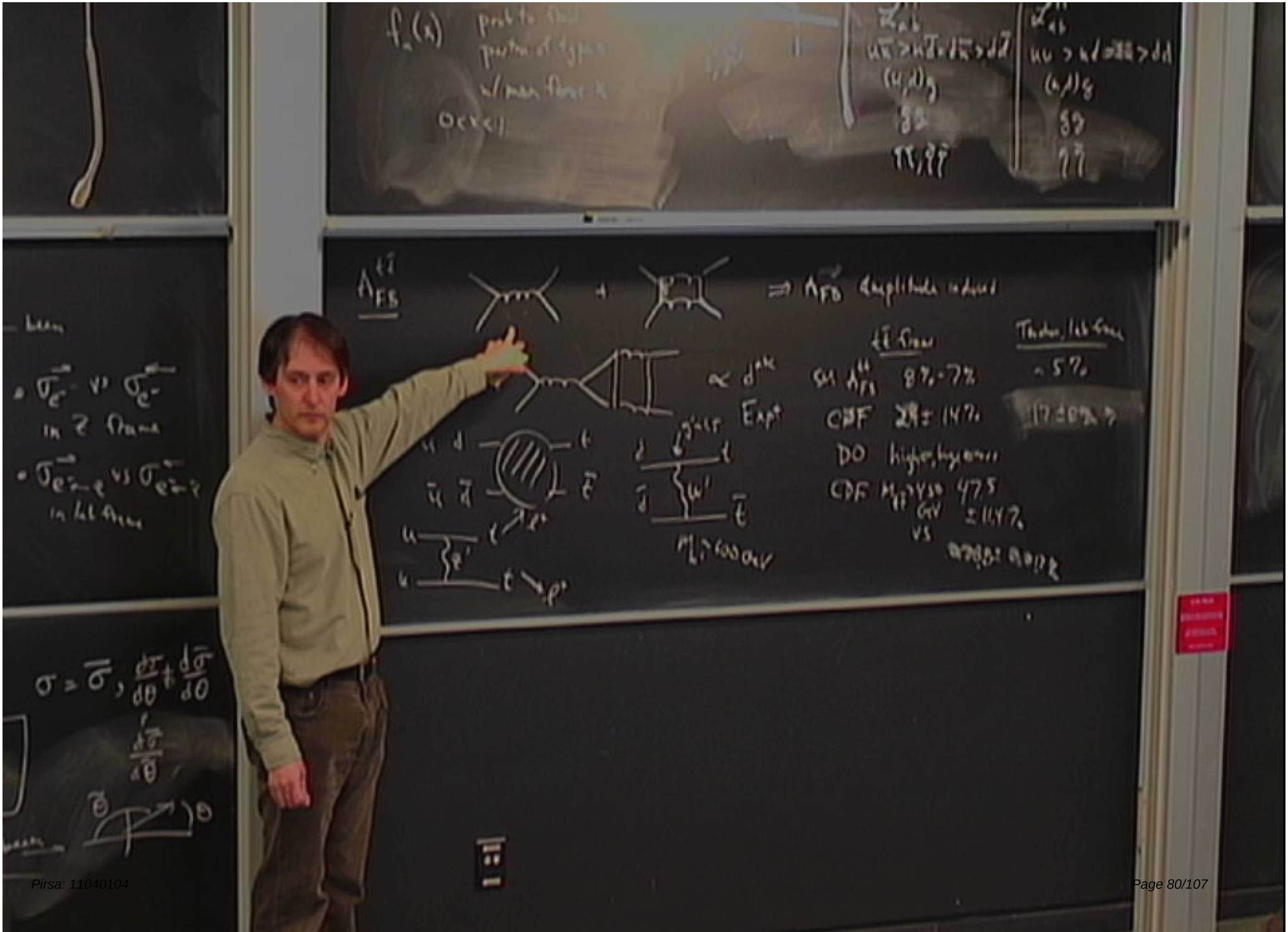
$\propto d^{abc}$

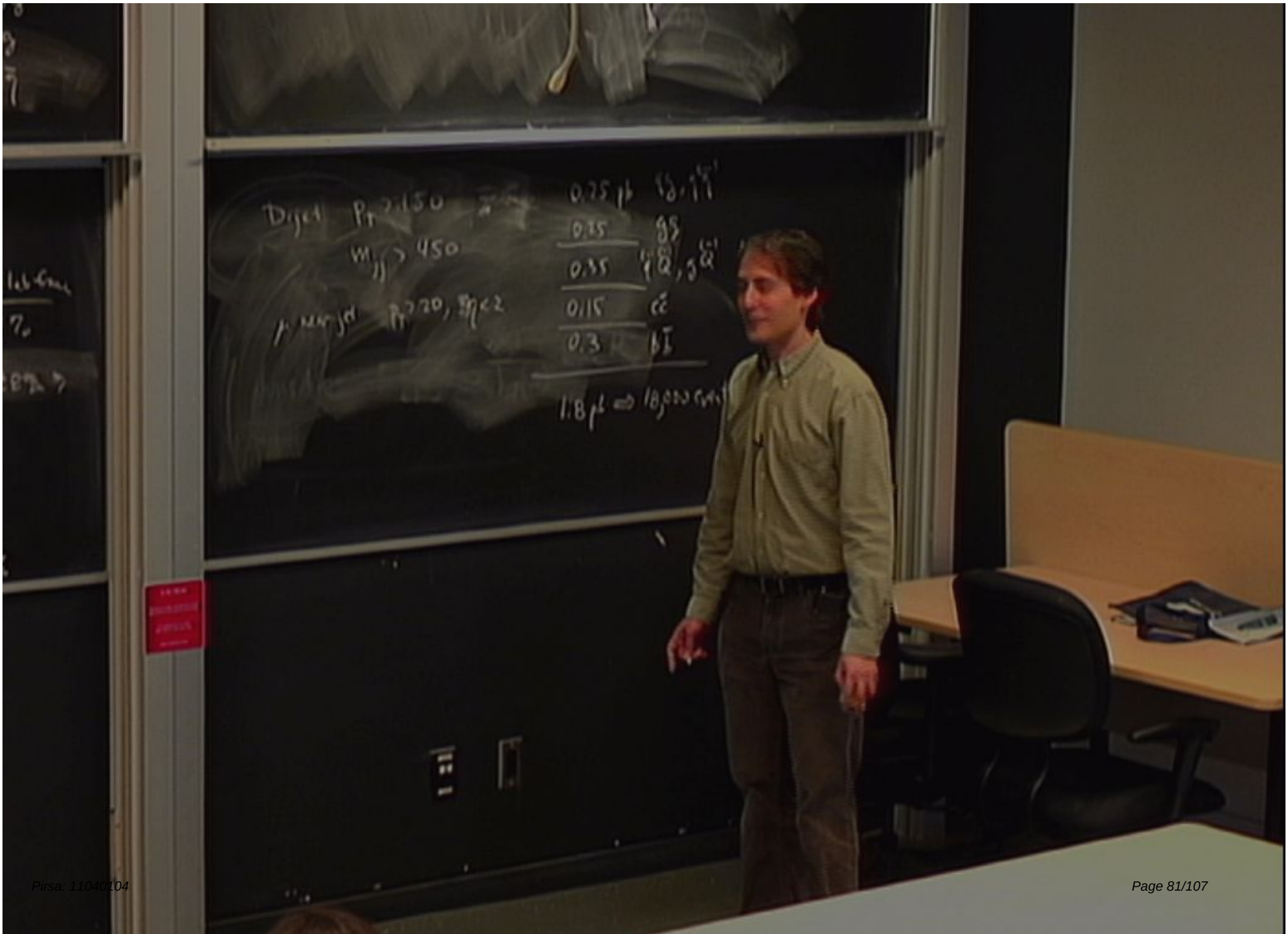
	$t\bar{t}$ frame	Tevatron, lab frame
SM A_{FB}^{tt}	8%-7%	~5%
CDF	[illegible] ± 14%	17 ± 8% ?
DO	higher, large error	
CDF	$M_{t\bar{t}} > 450$ GeV: 47.5 ± 11.4%	
	VS	
	[illegible]	

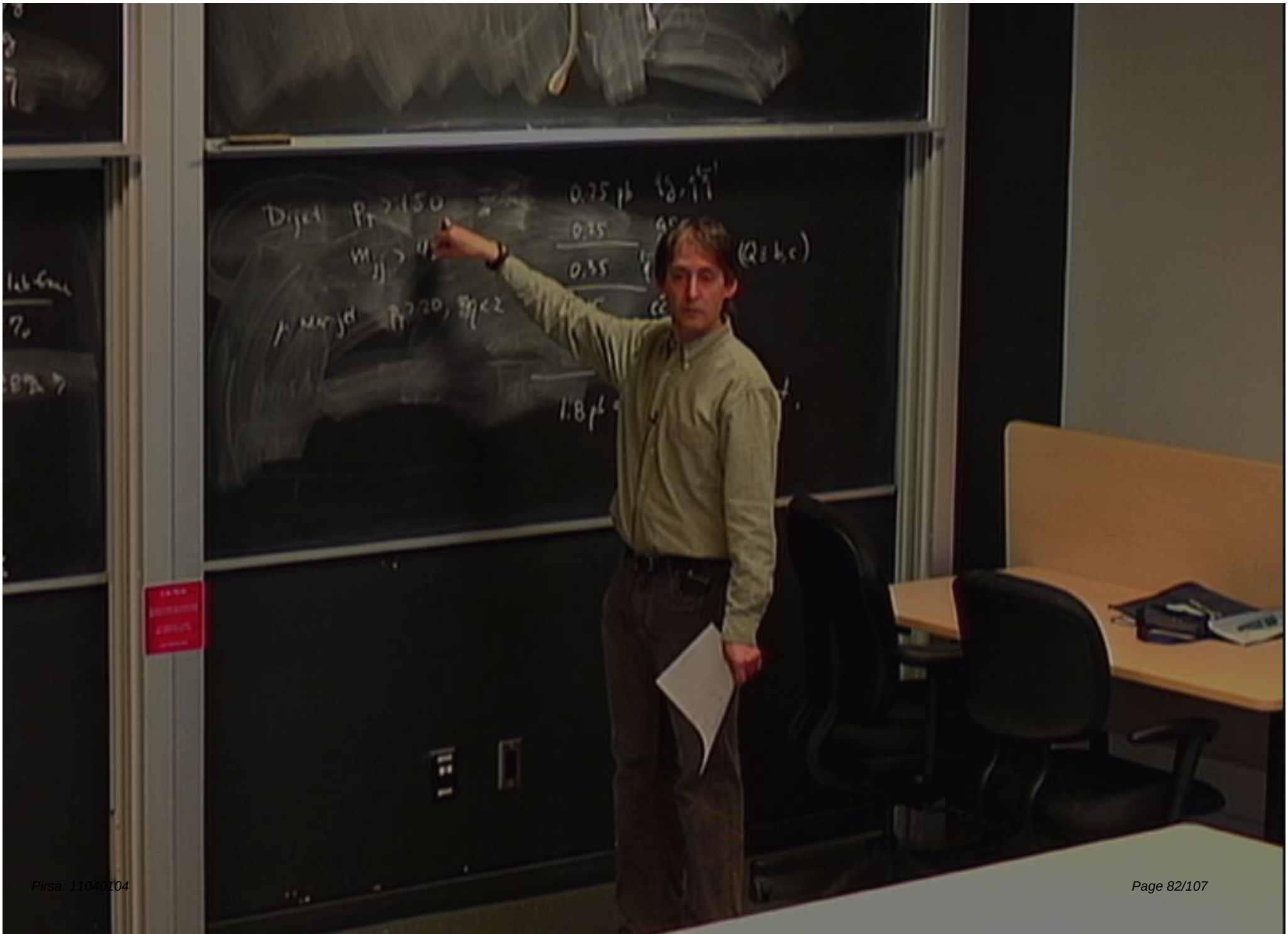
Expt

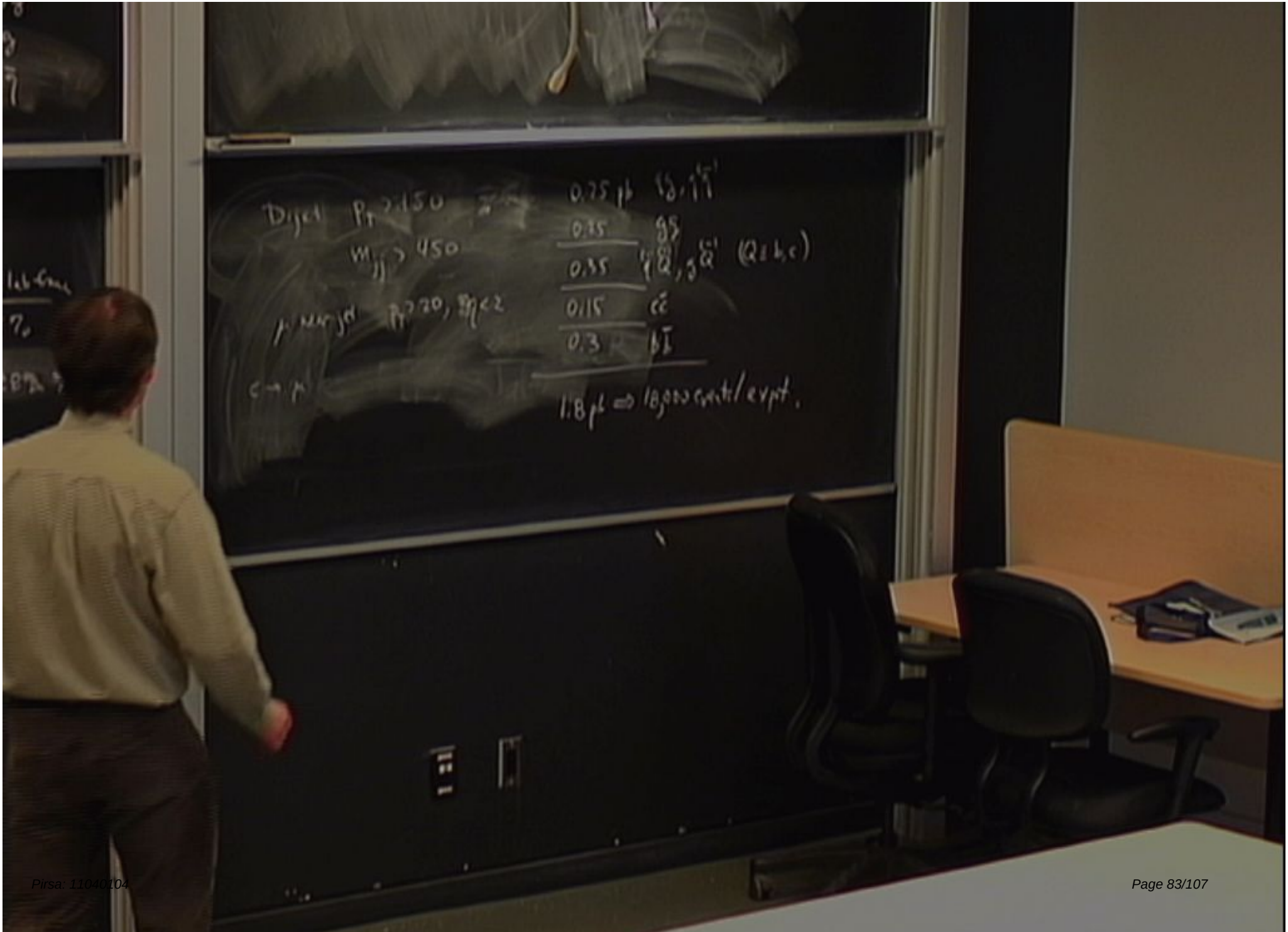



Expt
CDF
D0
CDF




Dijet
0.25 pb
0.15
0.35
0.15
0.3


0.75 pb
0.75
0.35


Dijet $P_T > 150$
$m_{jj} > 450$
0.75 pb
0.35
0.35
0.15
0.3
1.8 pb ⇒ 18,000 events/expt.

Dijet $P_T > 150$

$m_{jj} > 450$

μ near jet $P_T > 20$, $|\eta| < 2$

$c \to \mu^+$

$\bar{c} \to \mu^-$

0.75 pb $(g, \gamma^{(*)})$

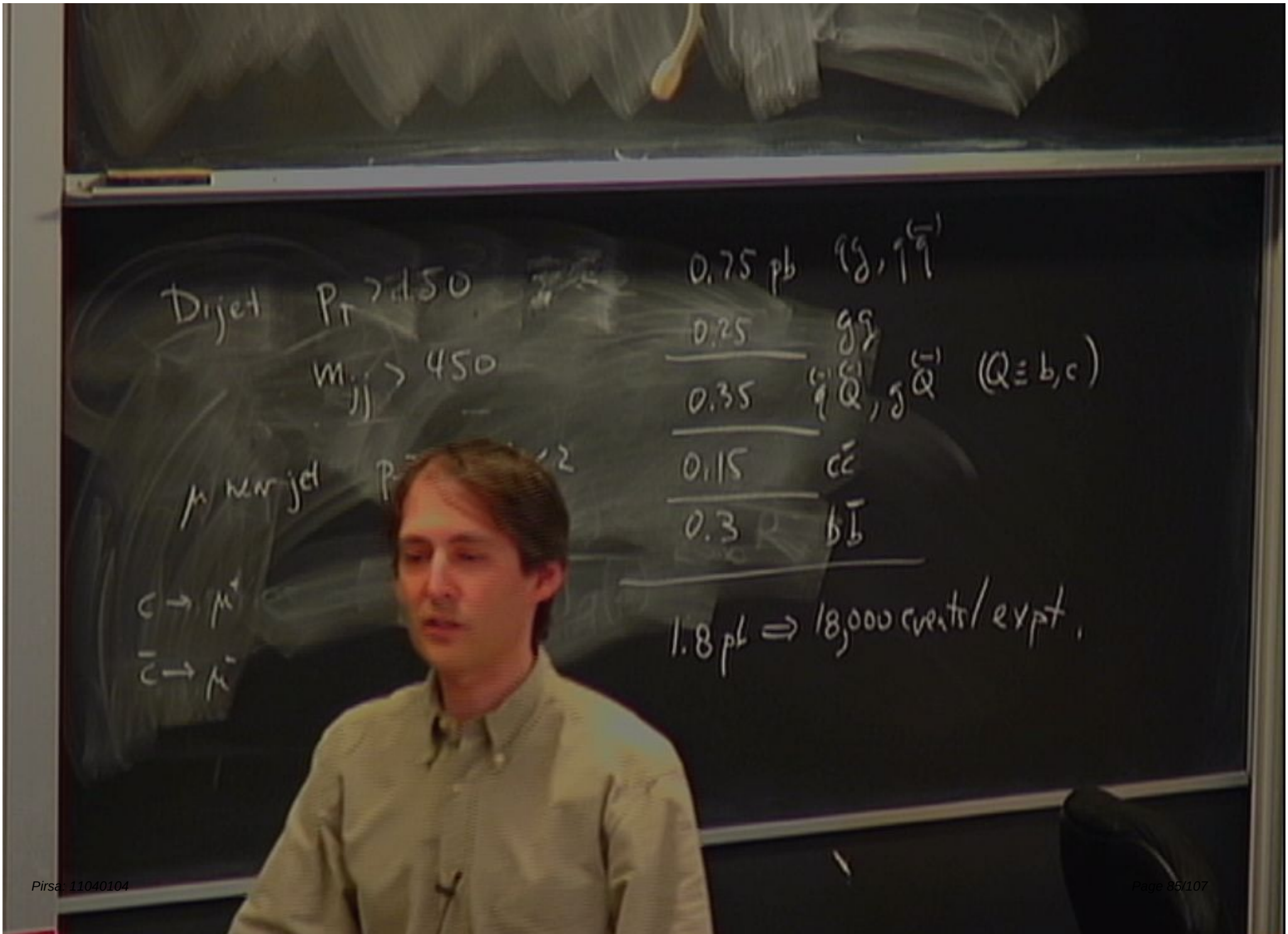
0.25 gg

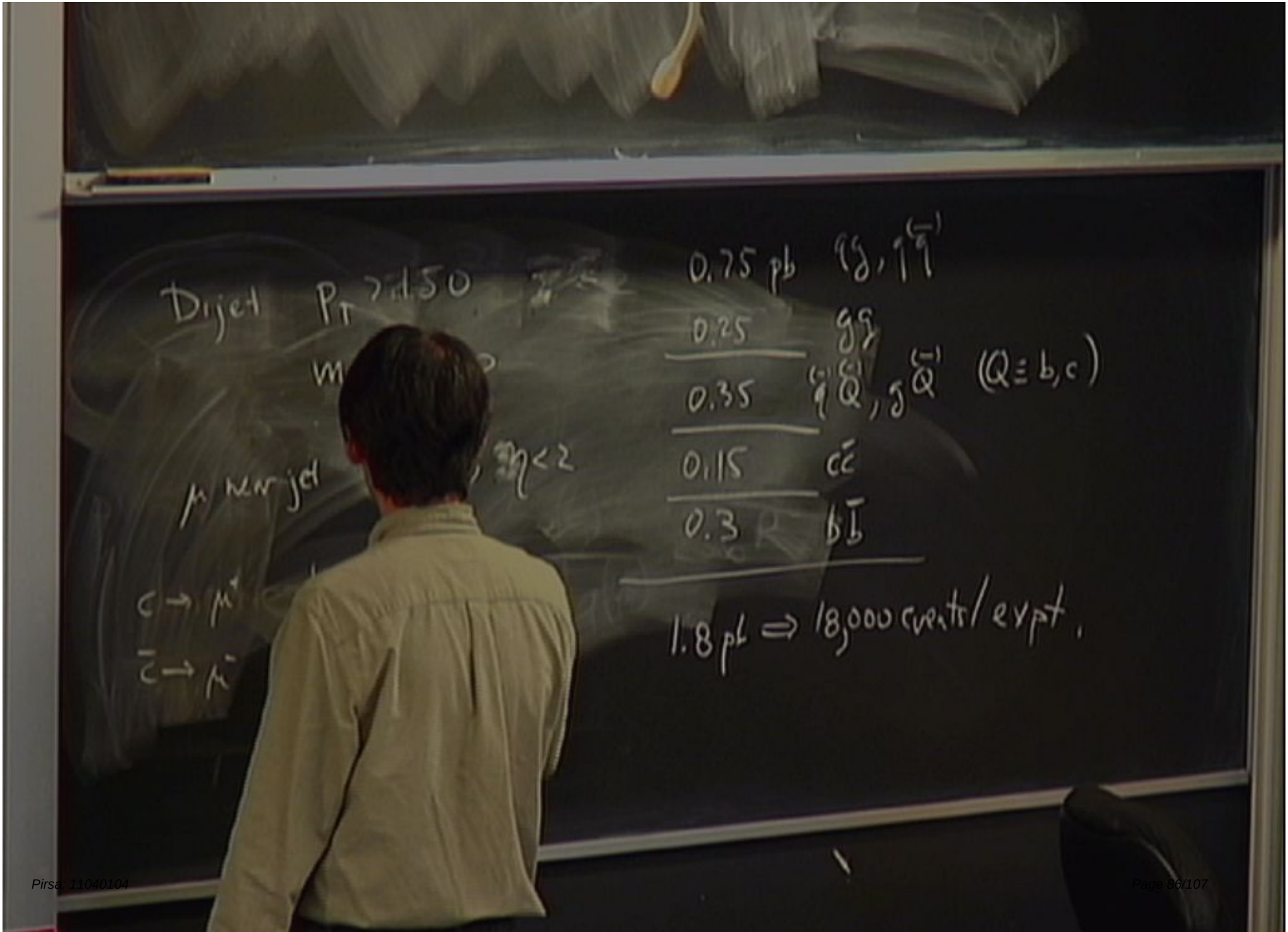
0.35 $(q, \bar{q}, g)\, Q\bar{Q}$ $(Q \equiv b, c)$

0.15 $c\bar{c}$

0.3 $b\bar{b}$

1.8 pb $\Rightarrow$ 18,000 events/expt.


Dijet $P_T > 150$
$m_{jj} > 450$
0.75 pb $g\gamma, \gamma\bar{\gamma}$
0.25 gg
0.35 $q\bar{Q}, g\bar{Q}$ $(Q \equiv b, c)$
0.15 $c\bar{c}$
0.3 $b\bar{b}$
1.8 pb ⇒ 18,000 events/expt.
$c \to \mu^+$
$\bar{c} \to \mu^-$


Dijet $P_T > 150$
μ near jet
$c \to \mu^+$
$\bar{c} \to \mu^-$
$\eta < 2$
0.75 pb $g\bar{g}, q\bar{q}$
0.25 gg
0.35 $q\bar{Q}, g\bar{Q}$ $(Q \equiv b, c)$
0.15 $c\bar{c}$
0.3 $b\bar{b}$
1.8 pb $\Rightarrow$ 18,000 events/expt.

Dijet $P_T > 150$

$m_{jj} > 450$

μ near jet $P_T > 20$, $|\eta| < 2$

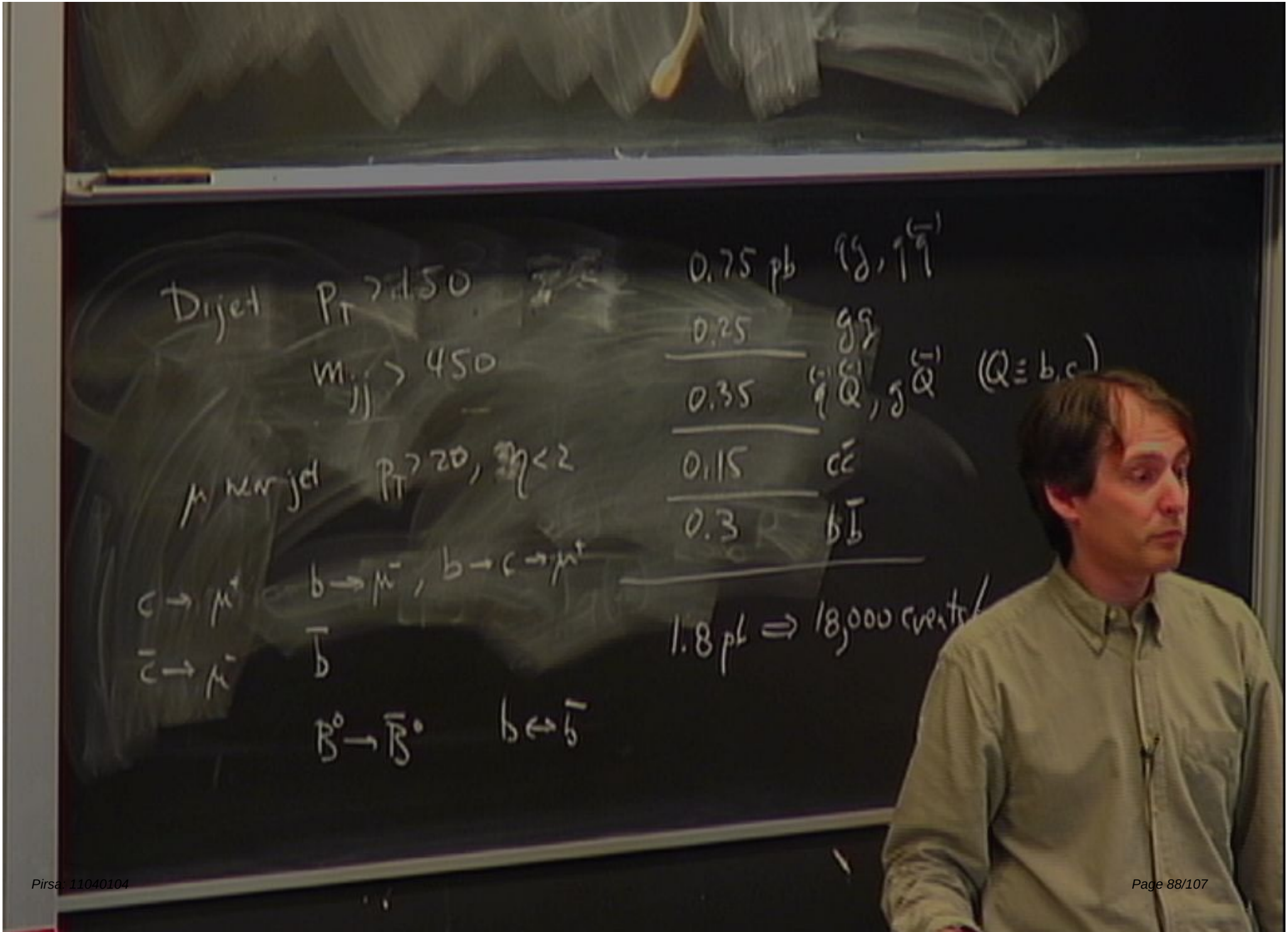
$c \to \mu^+$ $\quad b \to \mu^-$, $b \to c \to \mu^+$

$\bar{c} \to \mu^-$ $\quad \bar{b}$

$B^0 \to \bar{B}^0$

0.75 pb	$\gamma, \gamma\bar{\gamma}$
0.25	gg
0.35	$q\bar{Q}, g\bar{Q}$ $(Q \equiv b, c)$
0.15	$c\bar{c}$
0.3	$b\bar{b}$

1.8 pb $\Rightarrow$ 18,000 events/expt.

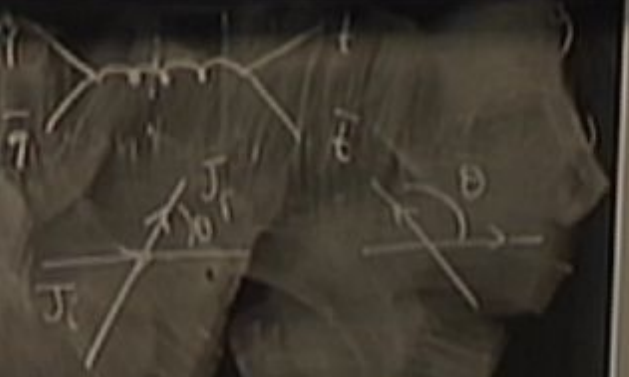

Dijet $P_T > 150$
$m_{jj} > 450$
μ near jet $P_T > 20$, $|\eta| < 2$
$c \to \mu^+$ $b \to \mu^-$, $b \to c \to \mu^+$
$\bar{c} \to \mu^-$ $\bar{b}$
$B^0 \to \bar{B}^0$ $b \leftrightarrow \bar{b}$
0.75 pb $(g, q\bar{q})$
0.25 gg
0.35 $(q, g)(Q\bar{Q})$ $(Q \equiv b, c)$
0.15 $c\bar{c}$
0.3 $b\bar{b}$
1.8 pb ⇒ 18,000 events

$0 < x < 1$

$\pi, \gamma\gamma$

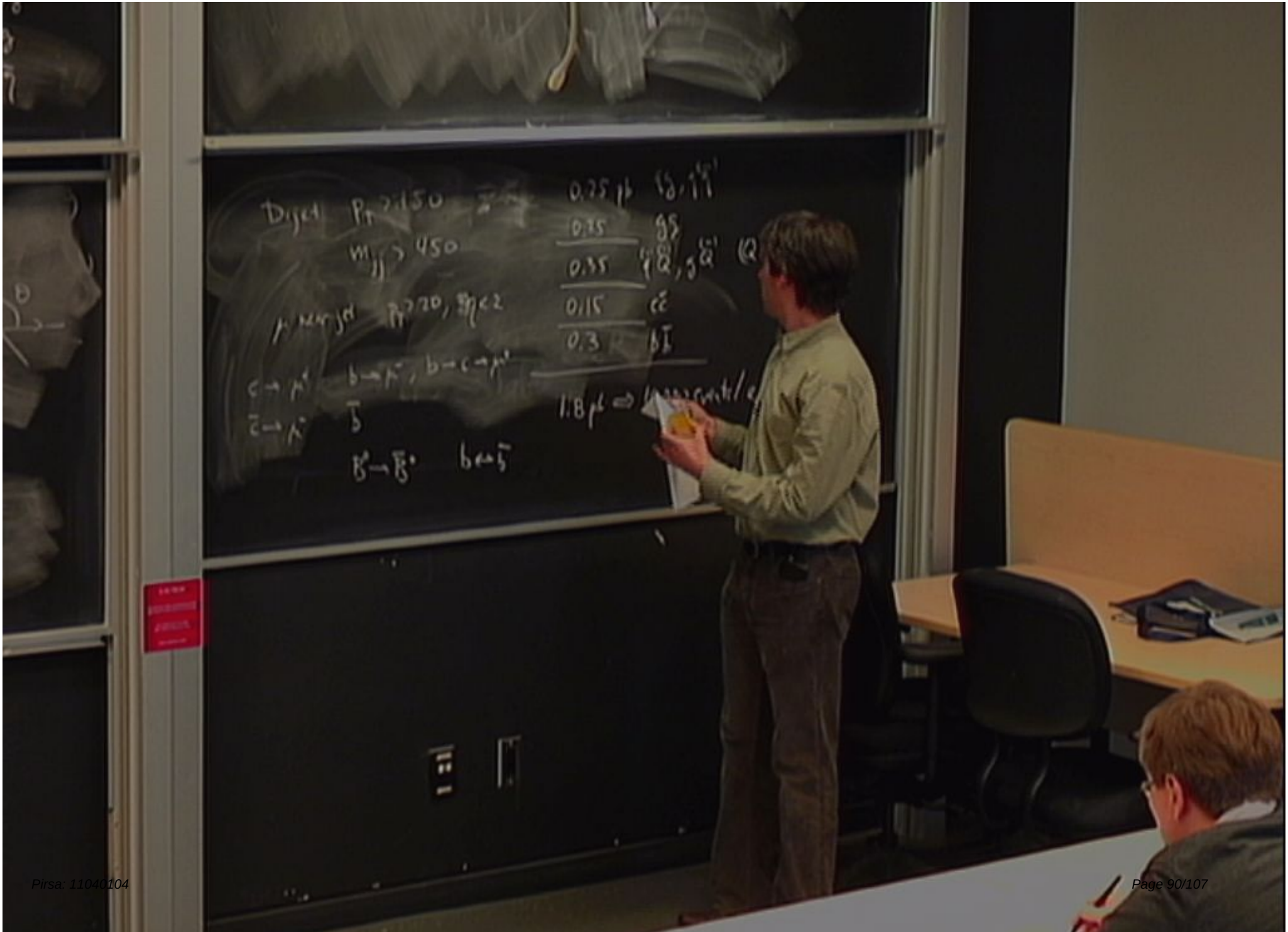
$\gamma\gamma$

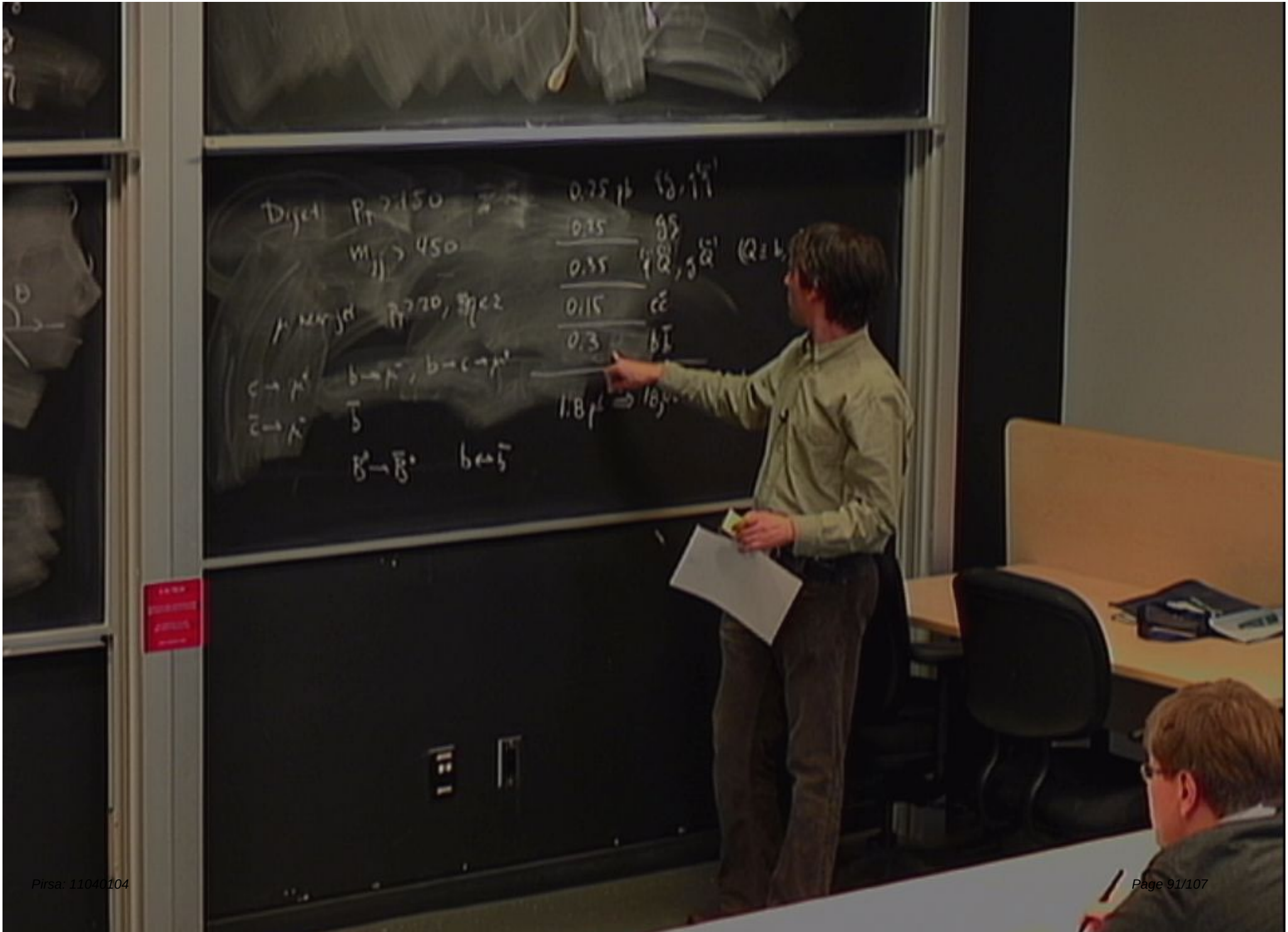
$A_{FB}^{\mu e \to j} = A_{FB}^{c\bar{c}} \sigma_{c\bar{c}\to\mu} \sim \frac{1}{3} A_{FB}^{t\bar{t}} \sigma_{t\bar{t}\to\mu}$

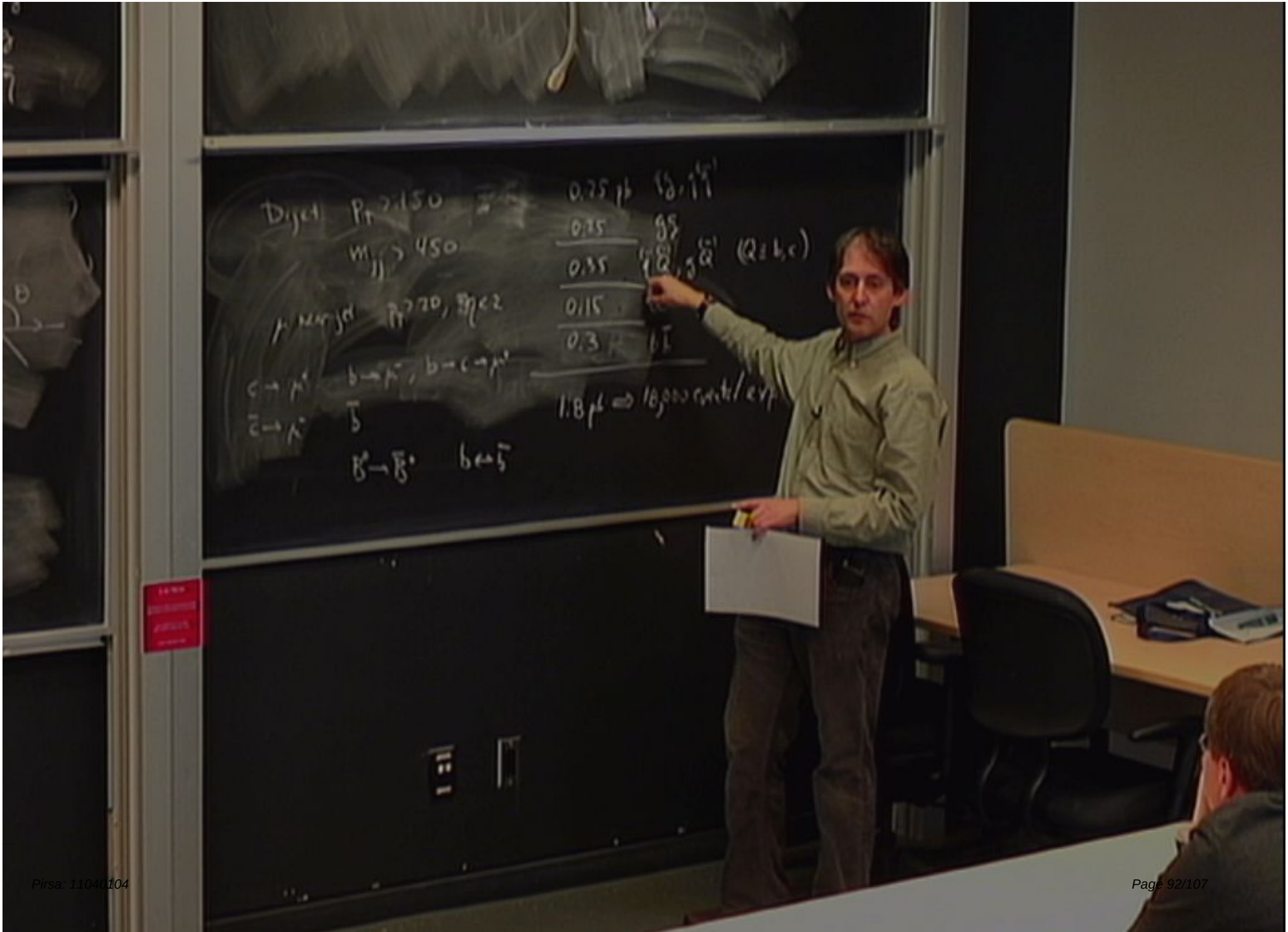


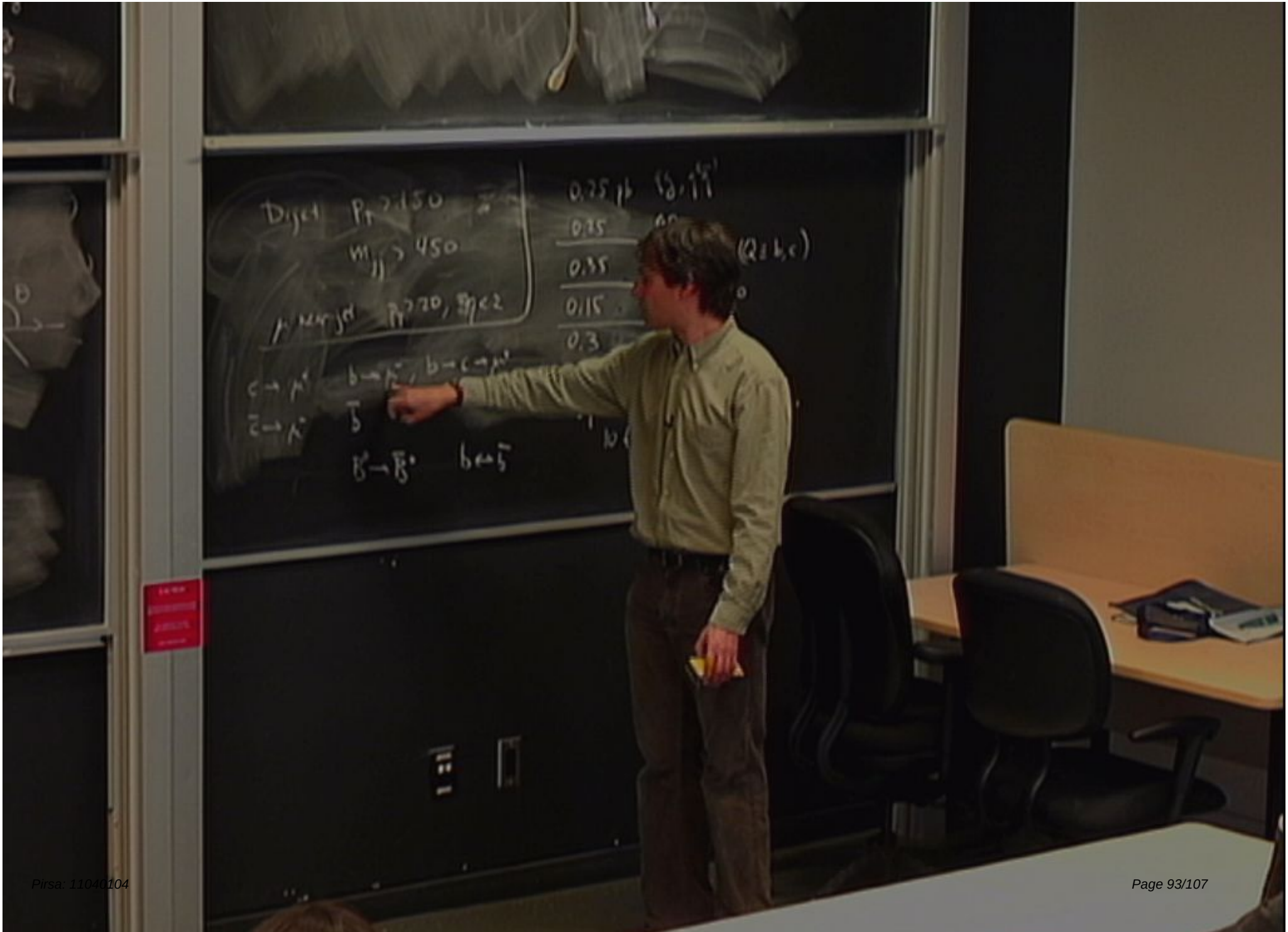
To find: reconstruct W+jets, $t\bar{t}$

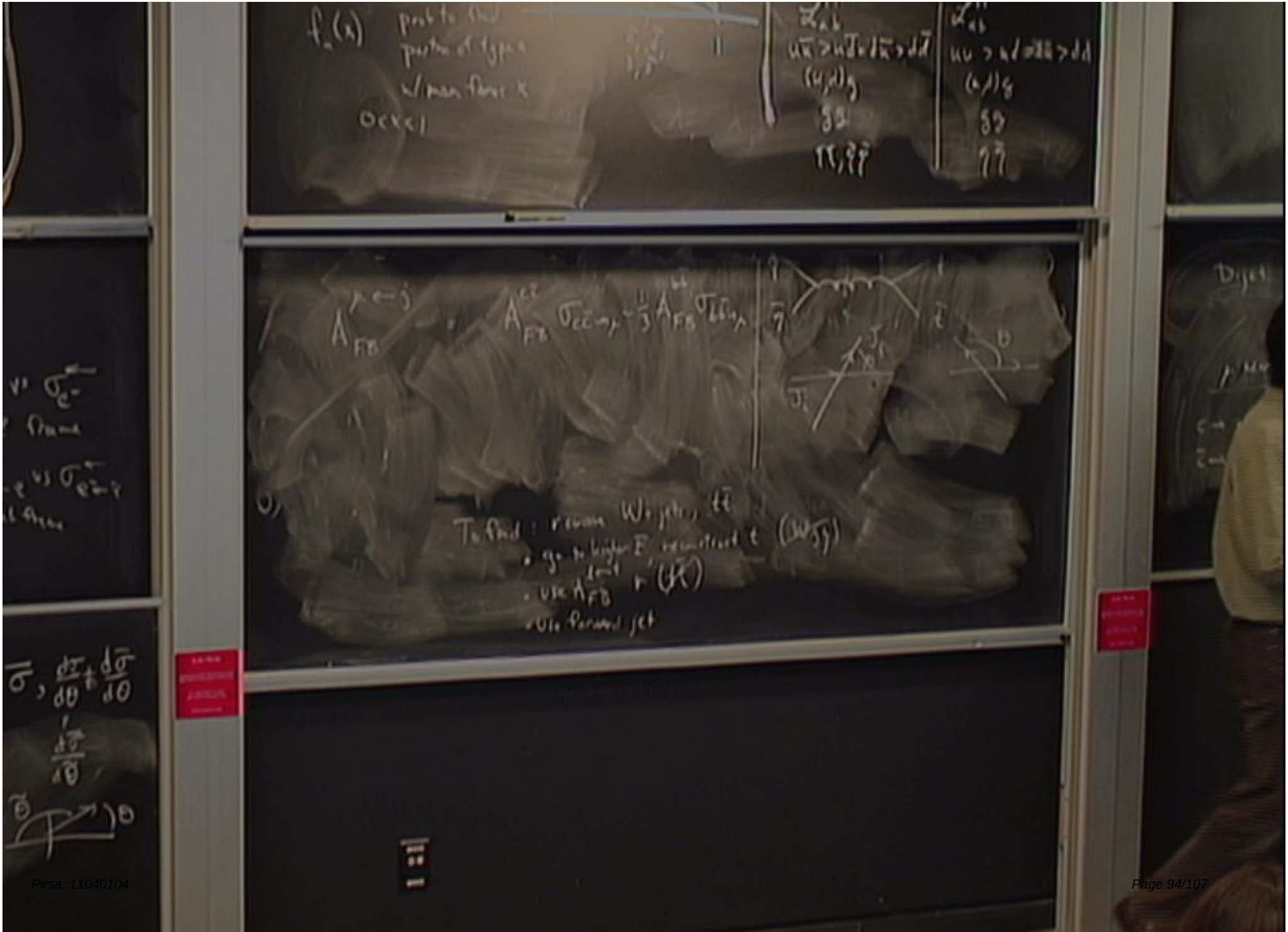
- go to higher $\bar{E}$, reconstruct t (Wjj)
- use $A_{FB}^{t\to t}$ or $(t\bar{t})$
- Use Forward jet

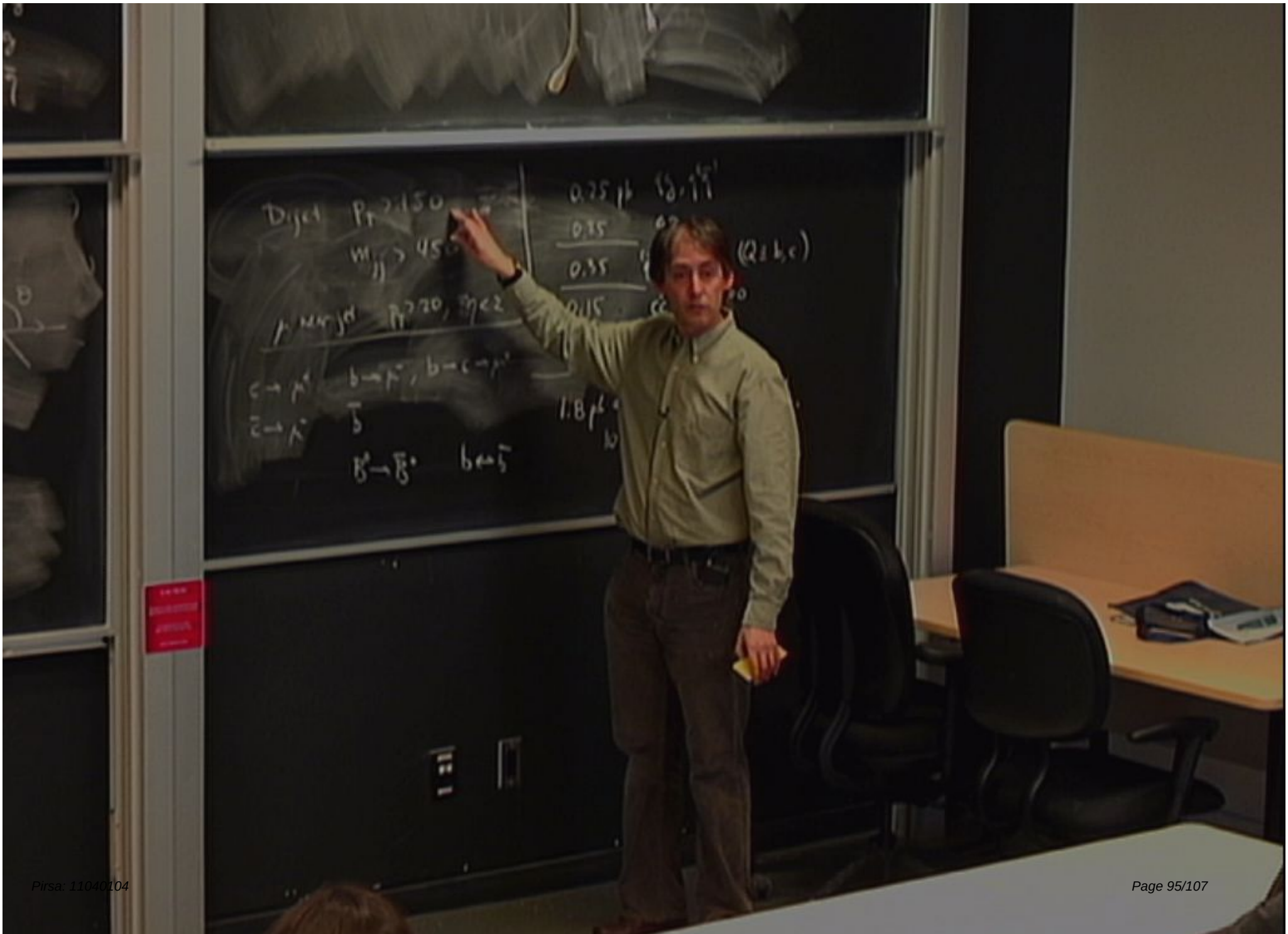

0.25 μ
0.15
0.35
0.15
0.3
1.8 μ

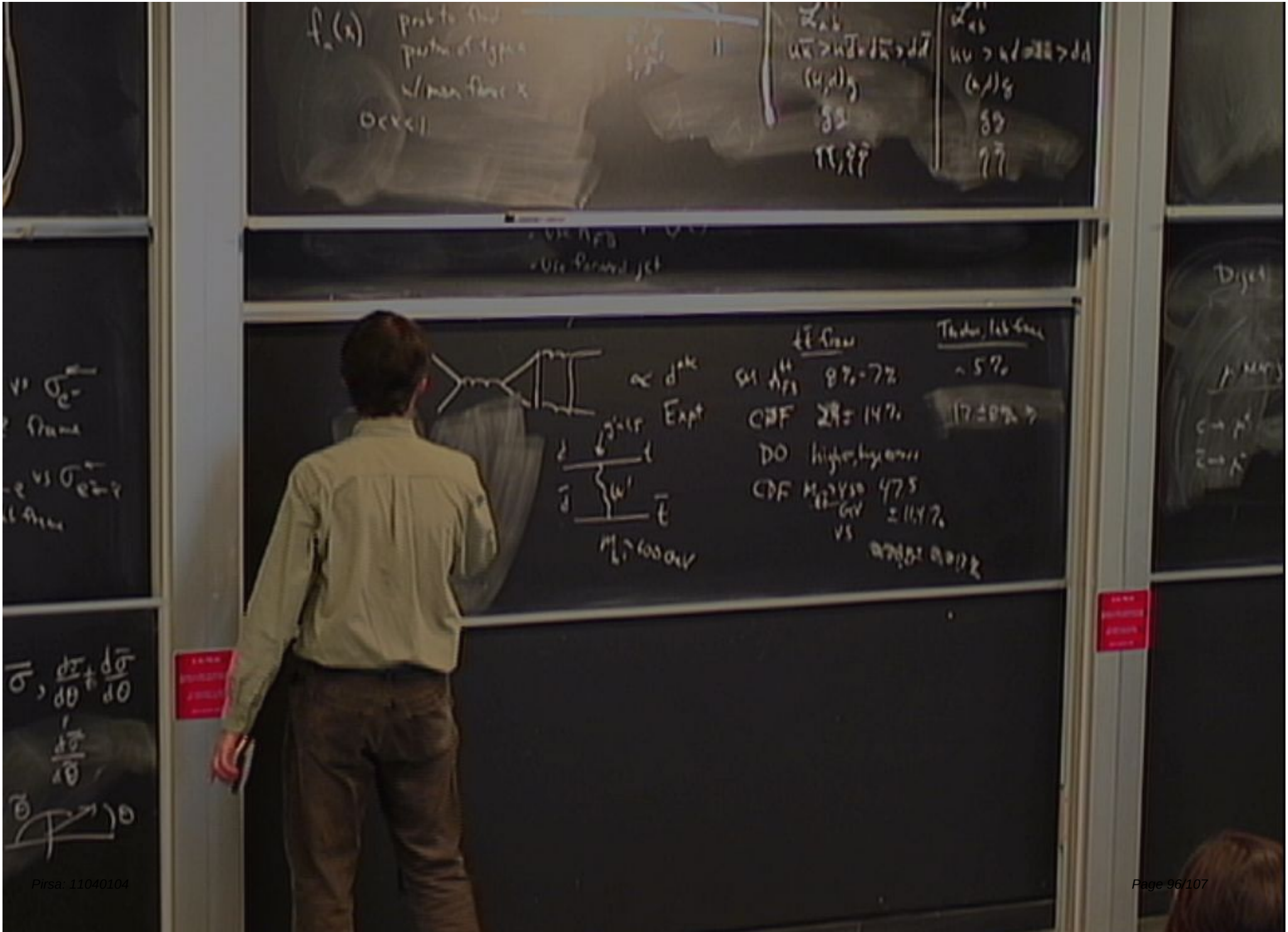

0.25
0.35
0.15
0.3

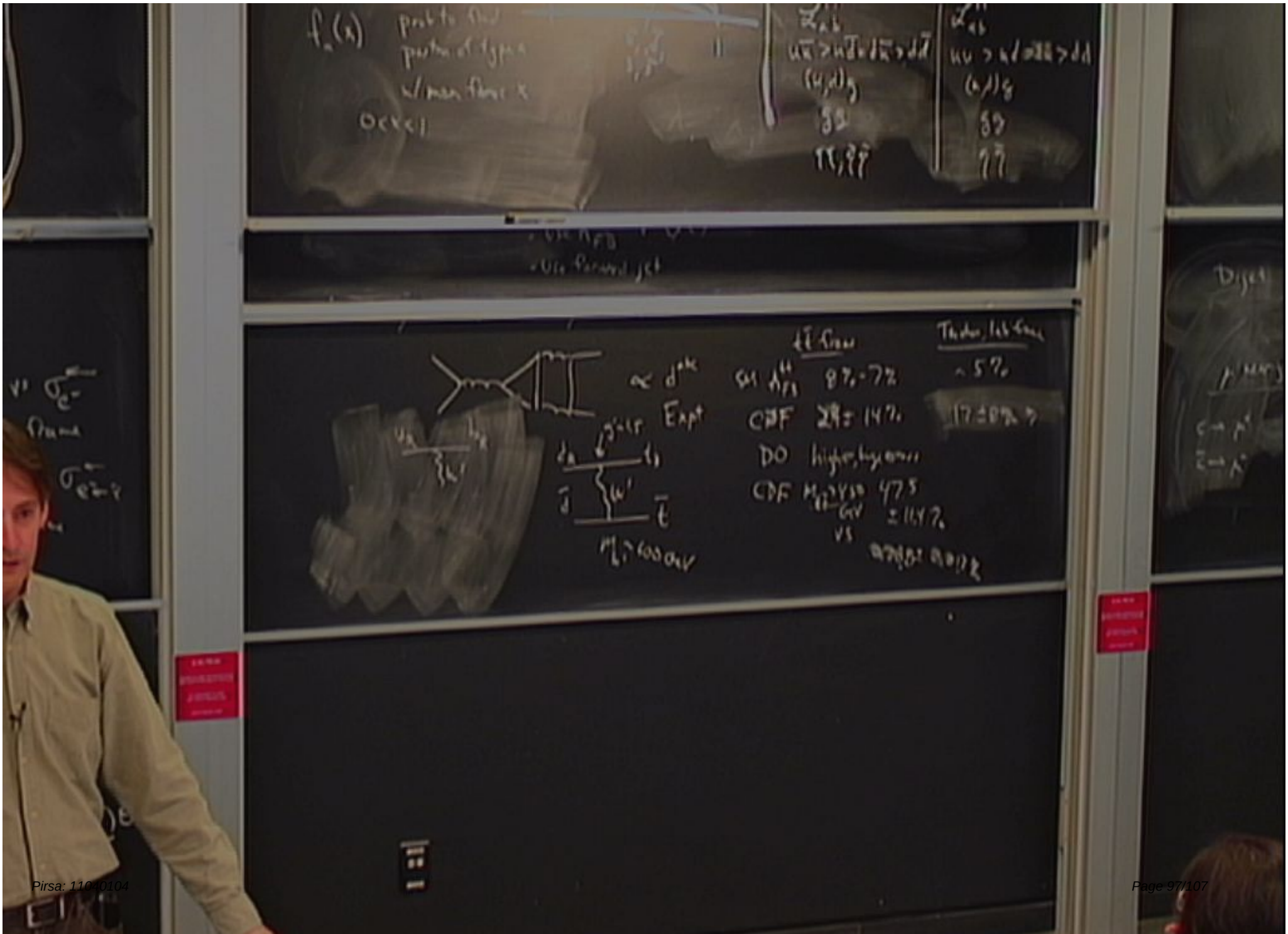

Dijet $P_T > 150$
$m_{jj} > 450$
0.75 pb
0.25
0.35
0.15
0.3
1.8 pb ⇒ 18,000 events/exp
$b \to \bar{b}$

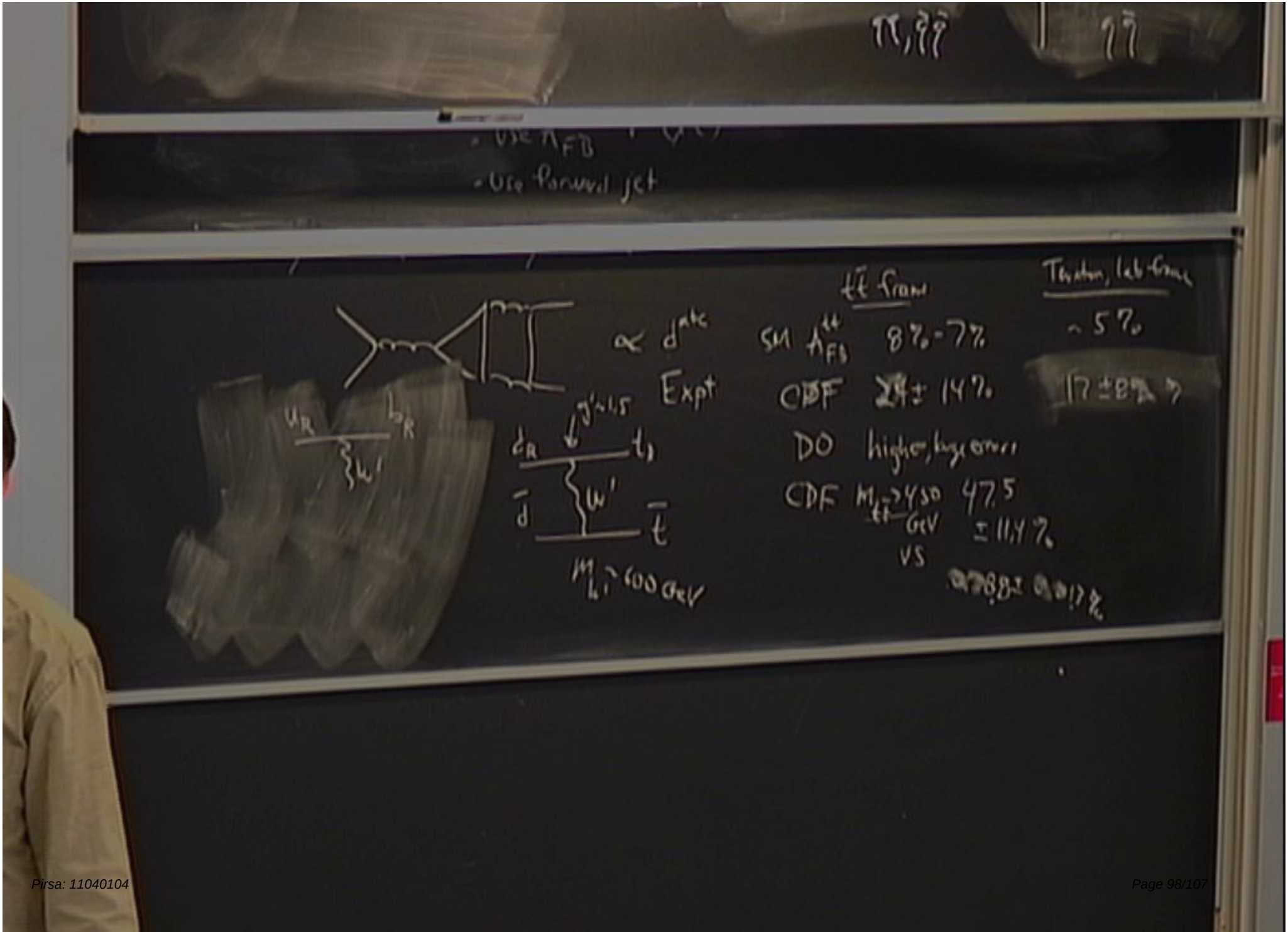

0.25 pb
0.35
0.15
0.3

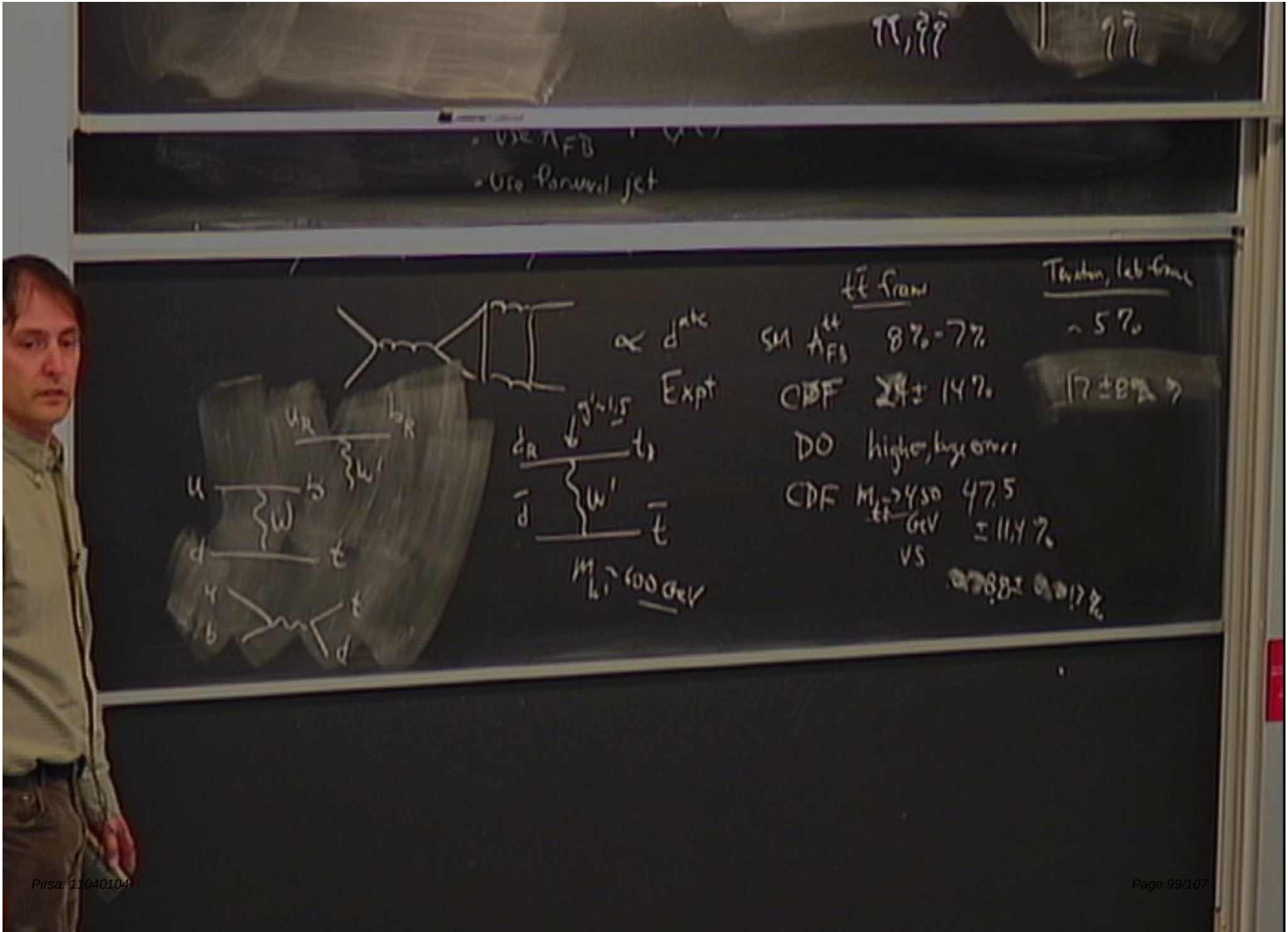

To find : reconstruct W, jets, tt
go to higher E, reconstruct t (Wbj)
use A_FB
use Forward jet

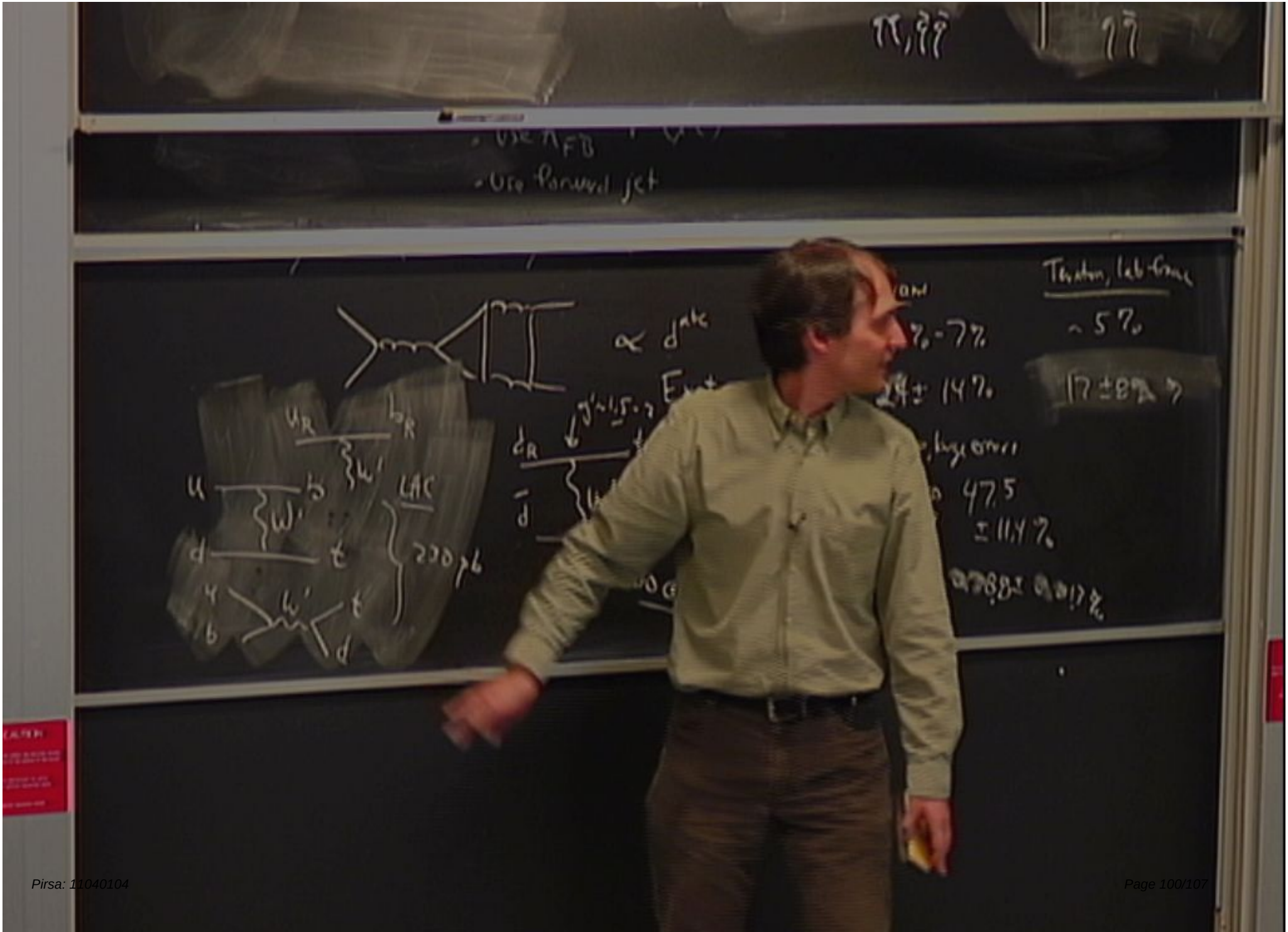


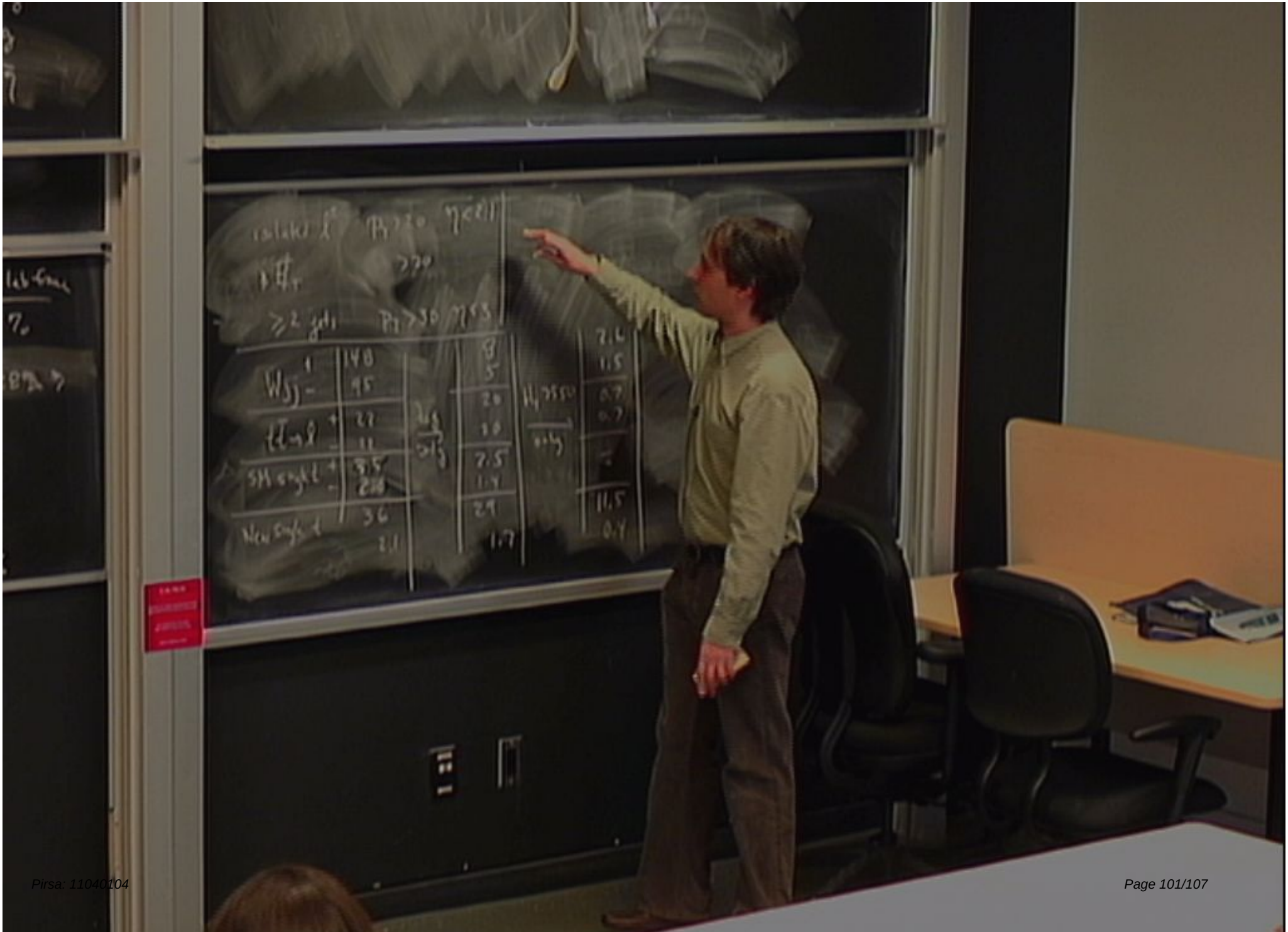

Theory/Lattice
~5%
CDF
DO
CDF

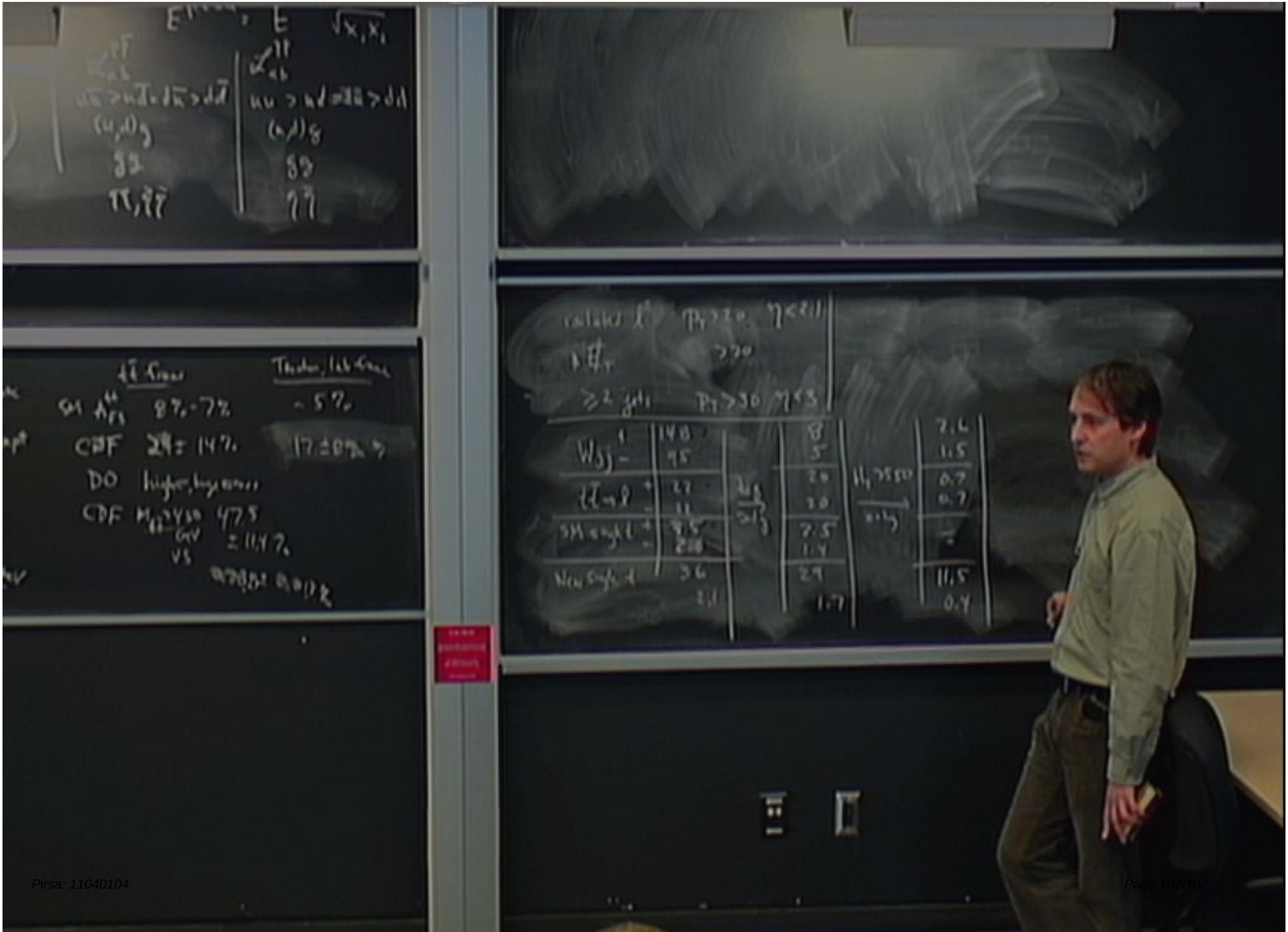

Theor. NLO
~5%
DO
CDF

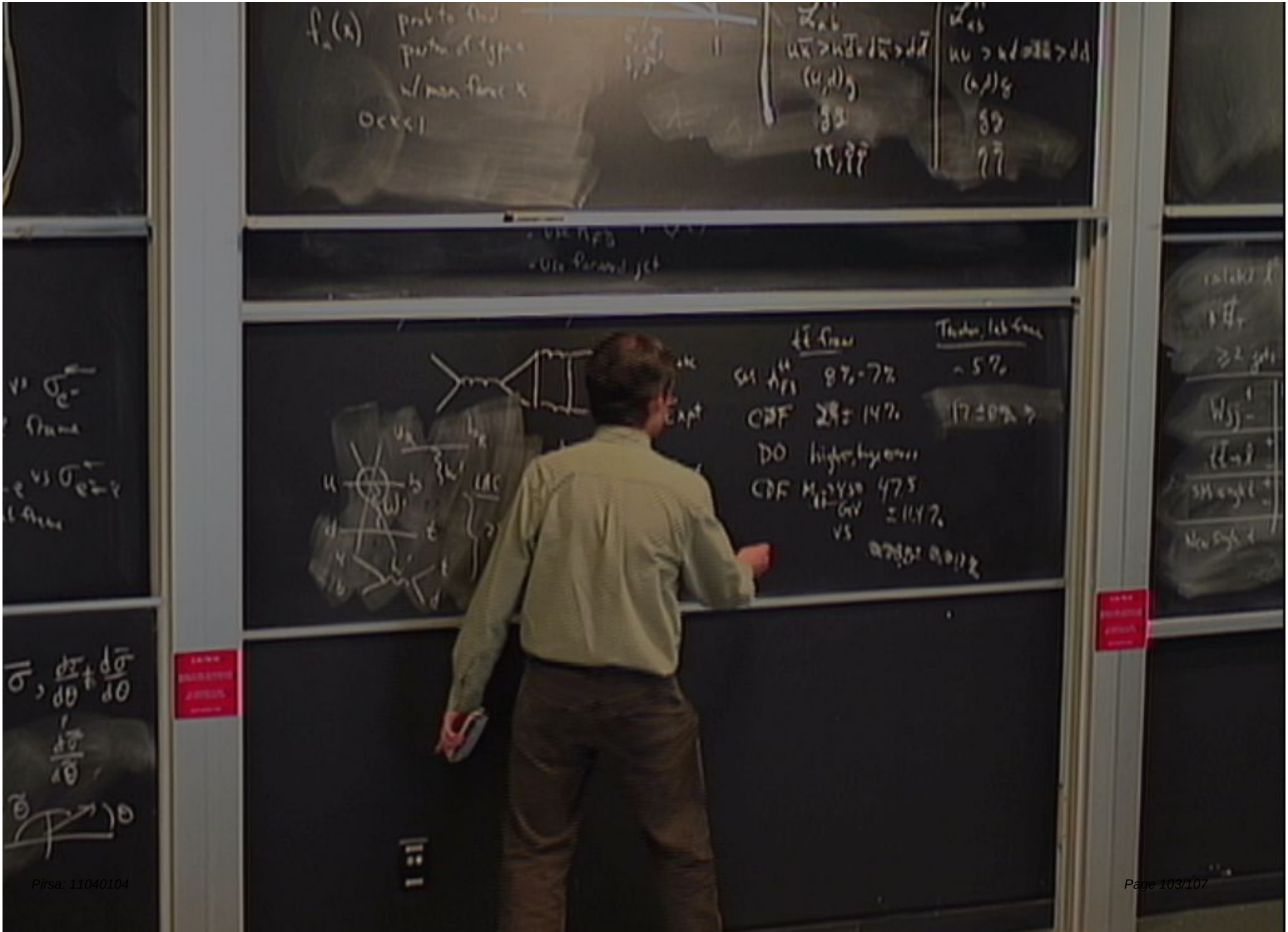

$\pi, \gamma\bar{\gamma}$
$\gamma\bar{\gamma}$
Use Parton jet
$t\bar{t}$ from
Tevatron, lab frame
$\propto d^{\alpha\alpha}$
SM A_{FB}^{tt} 8%-7%
~5%
Expt
CDF 24 ± 14%
17 ± 8%
DO higher, huge error
CDF $M_{t\bar{t}} > 450$ GeV 47.5 ± 11.4%
vs
$M_{t'} \sim 600$ GeV

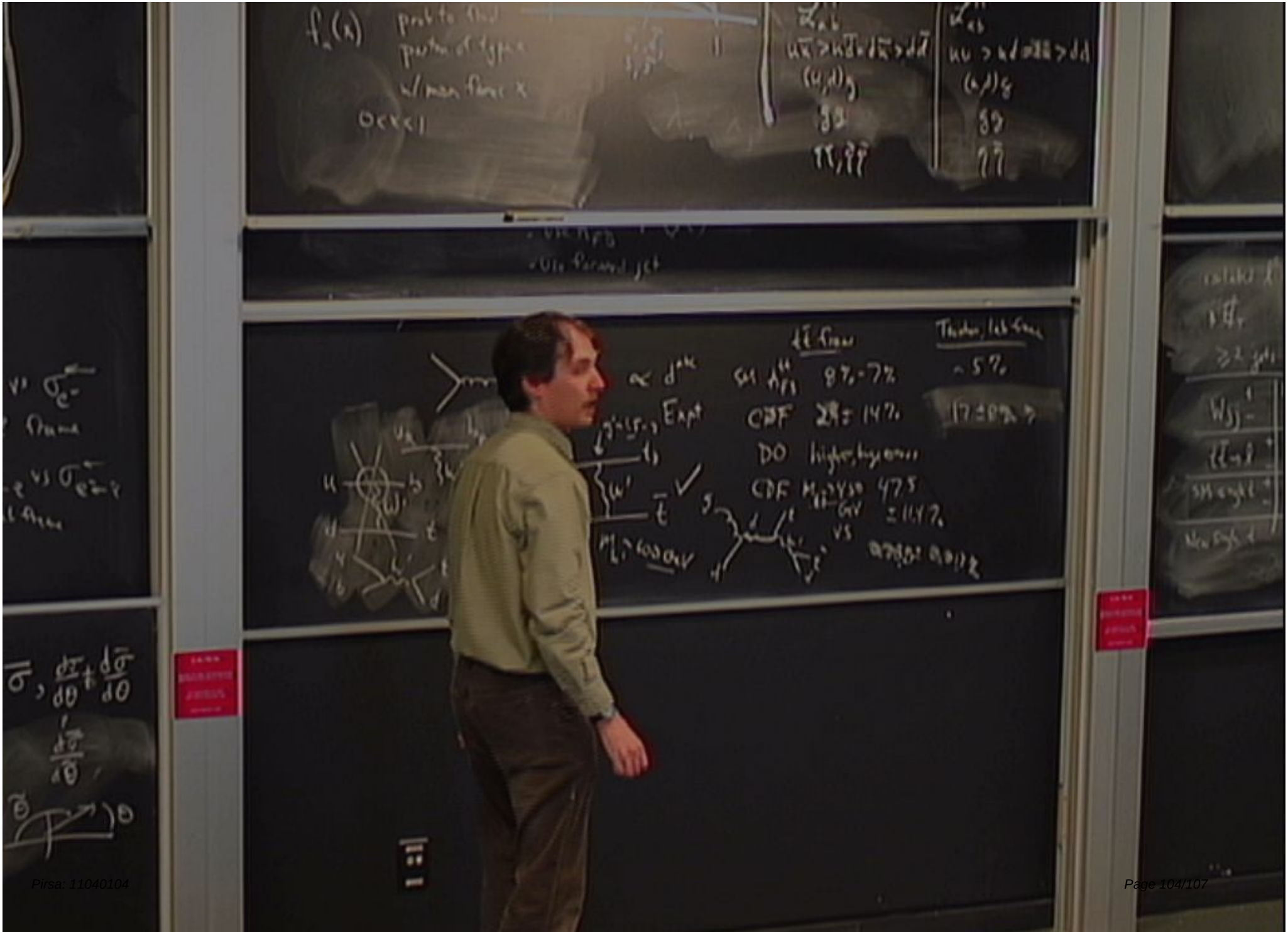

Use A_{FB}
Use Forward jet
$t\bar{t}$ from
Tevatron, Lab frame
SM A_{FB}^{tt} 8%-7%
~5%
Expt
CDF 24 ± 14%
17 ± 8%
DO higher, high M_{tt}
CDF $M_{tt} > 450$ GeV 47.5 ± 11.4%
vs
$M_{t'} \sim 600$ GeV

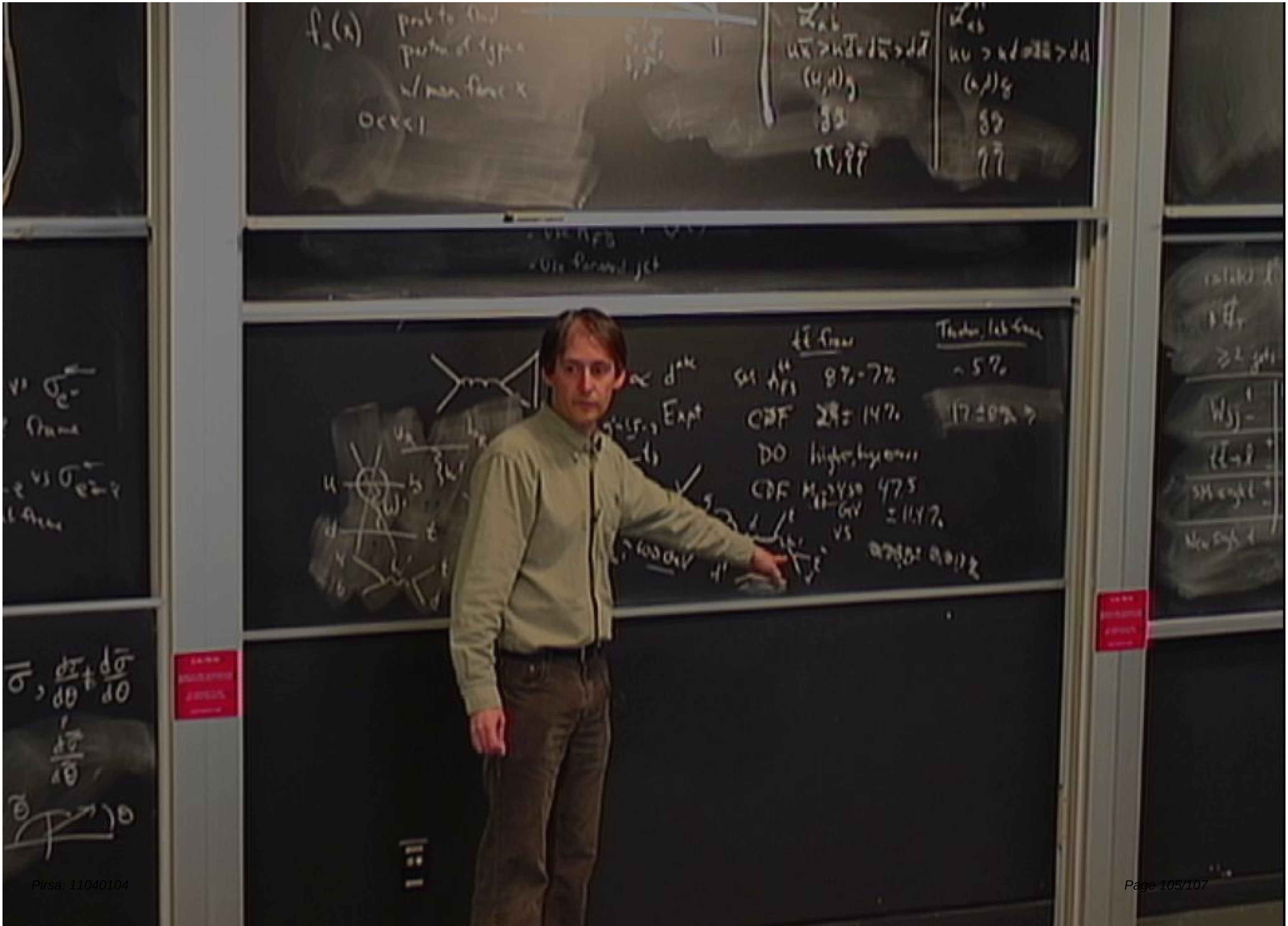

Tevatron, Lab-Group
~ 5%
LAC

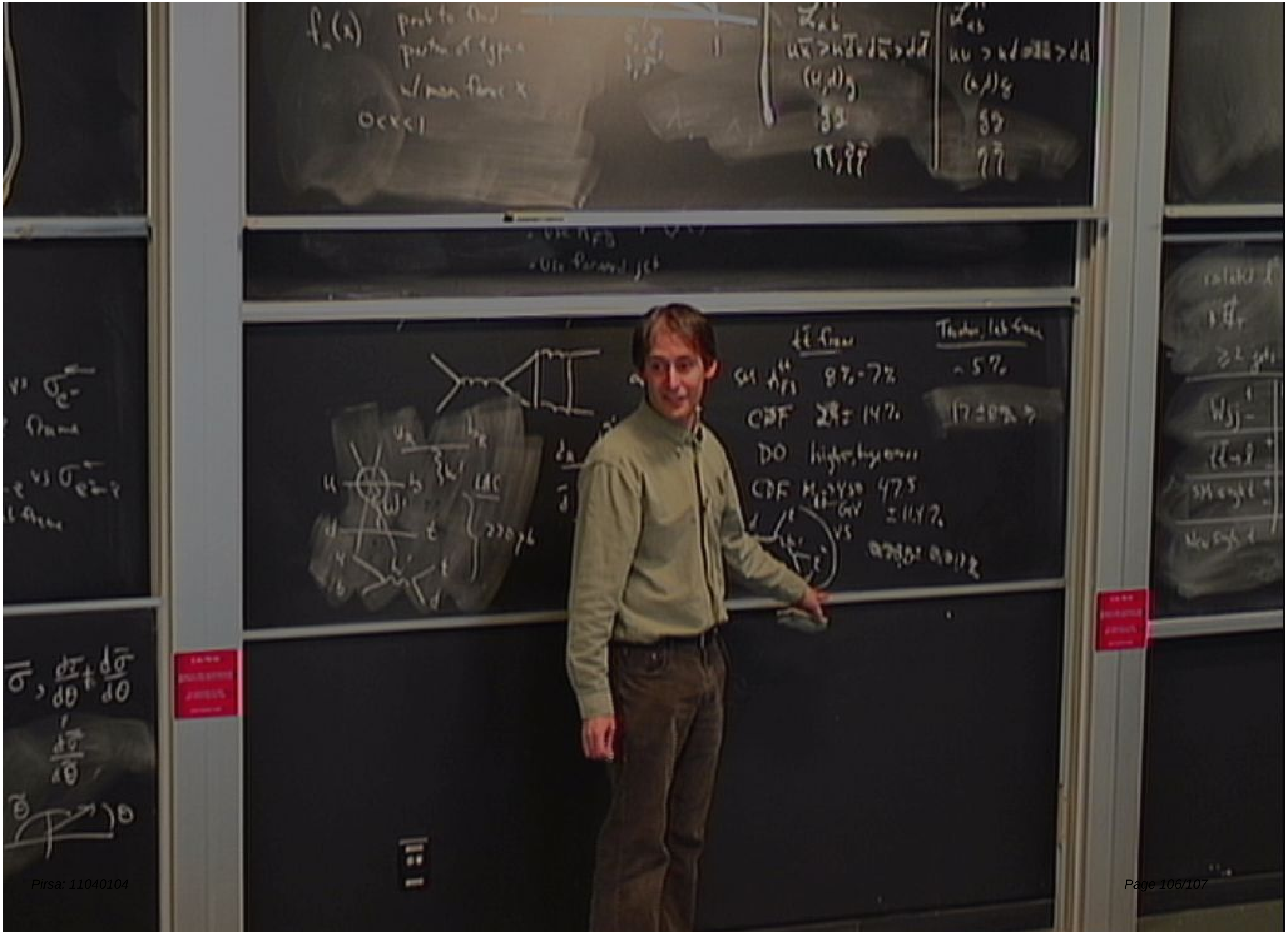


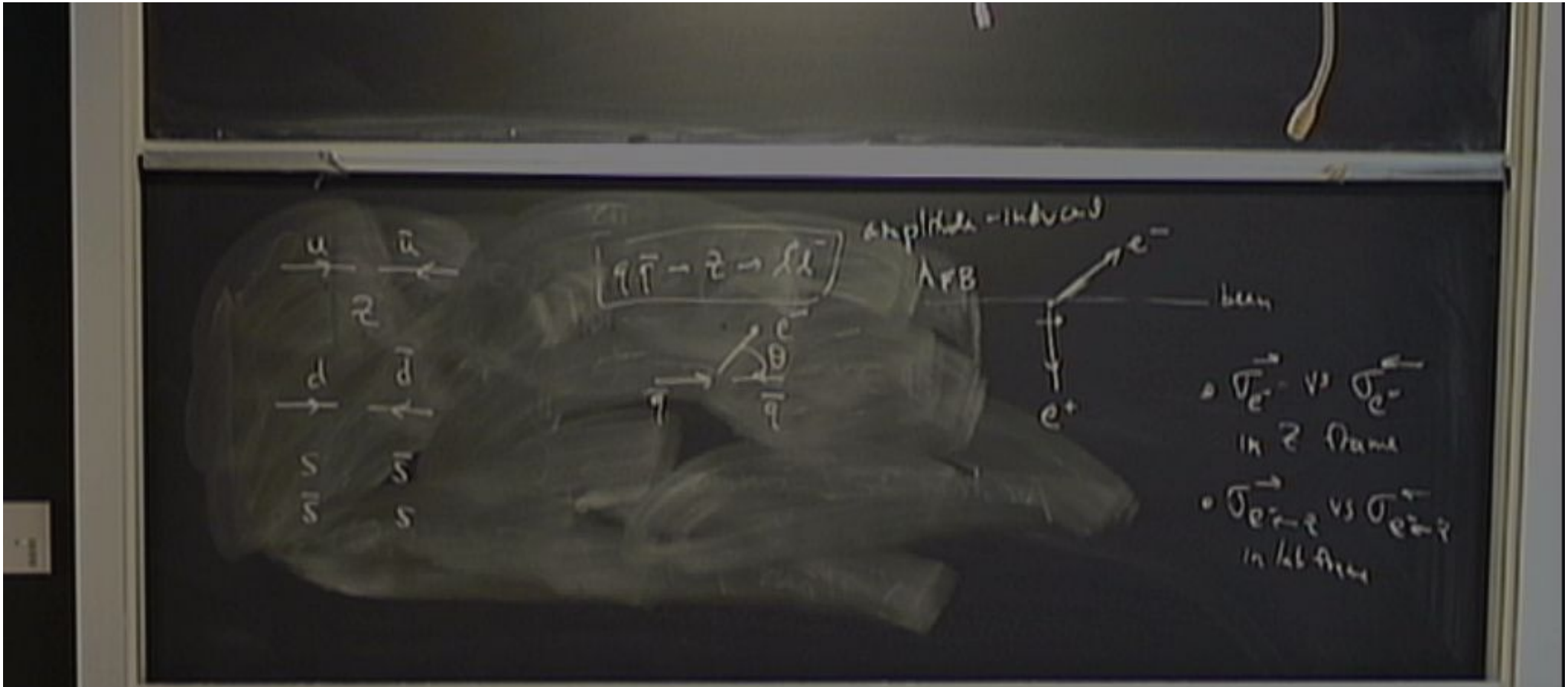


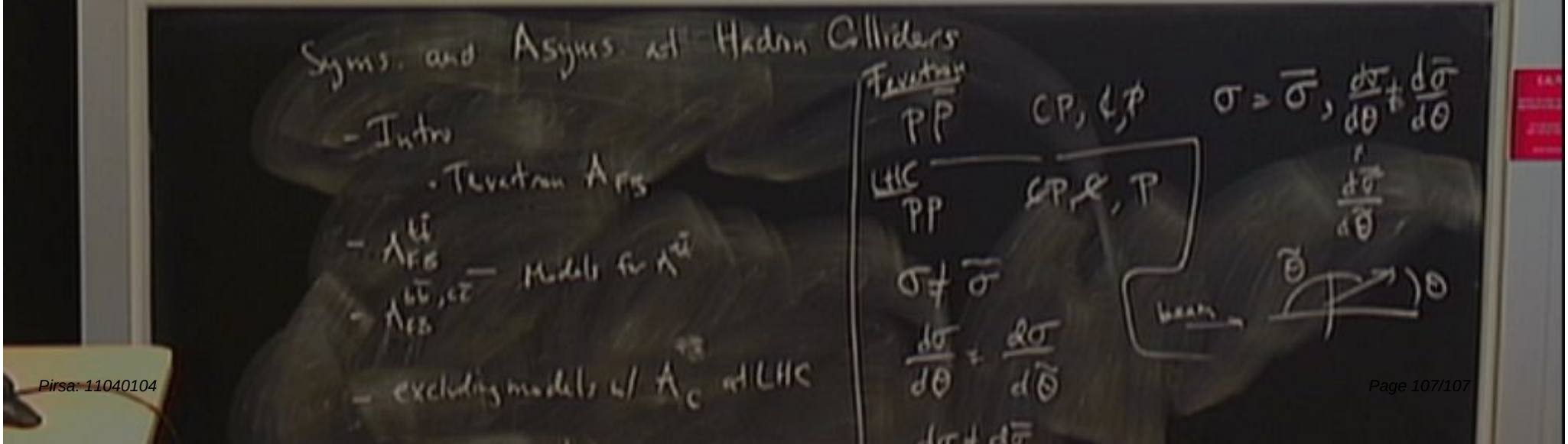

tt̄ cross
Theor, lab cross
CDF
DO
CDF


tt̄ Theor, lab
CDF
DO
CDF






u ū
Z
d d̄
s s̄
s̄ s
$q\bar{q} \to Z \to \ell\bar{\ell}$
θ
$\bar{q}$
amplitude - induced
A_{FB}
e^-
beam
e^+
• σ_{e^-} vs σ_{e^-} in Z Frame
• $\sigma_{e^- \to t}$ vs $\sigma_{e^- \to \bar{t}}$ in $t\bar{t}$ Frame


Syms. and Asyms at Hadron Colliders
- Intro
• Tevatron A_{FB}
- $A_{FB}^{u\bar{u}}$
- $A_{FB}^{t\bar{t}, ZZ}$ — Models for $A^{u\bar{u}}$
- excluding models w/ $A_C^{t\bar{t}}$ at LHC
Tevatron
$p\bar{p}$ CP, ¢P $\sigma = \bar{\sigma}$, $\frac{d\sigma}{d\theta} \neq \frac{d\bar{\sigma}}{d\theta}$
LHC
pp ¢P, ¢, P
$\sigma \neq \bar{\sigma}$
$\frac{d\sigma}{d\theta} \neq \frac{d\bar{\sigma}}{d\theta}$
$\frac{d\sigma}{d\theta}$
beam
θ
θ