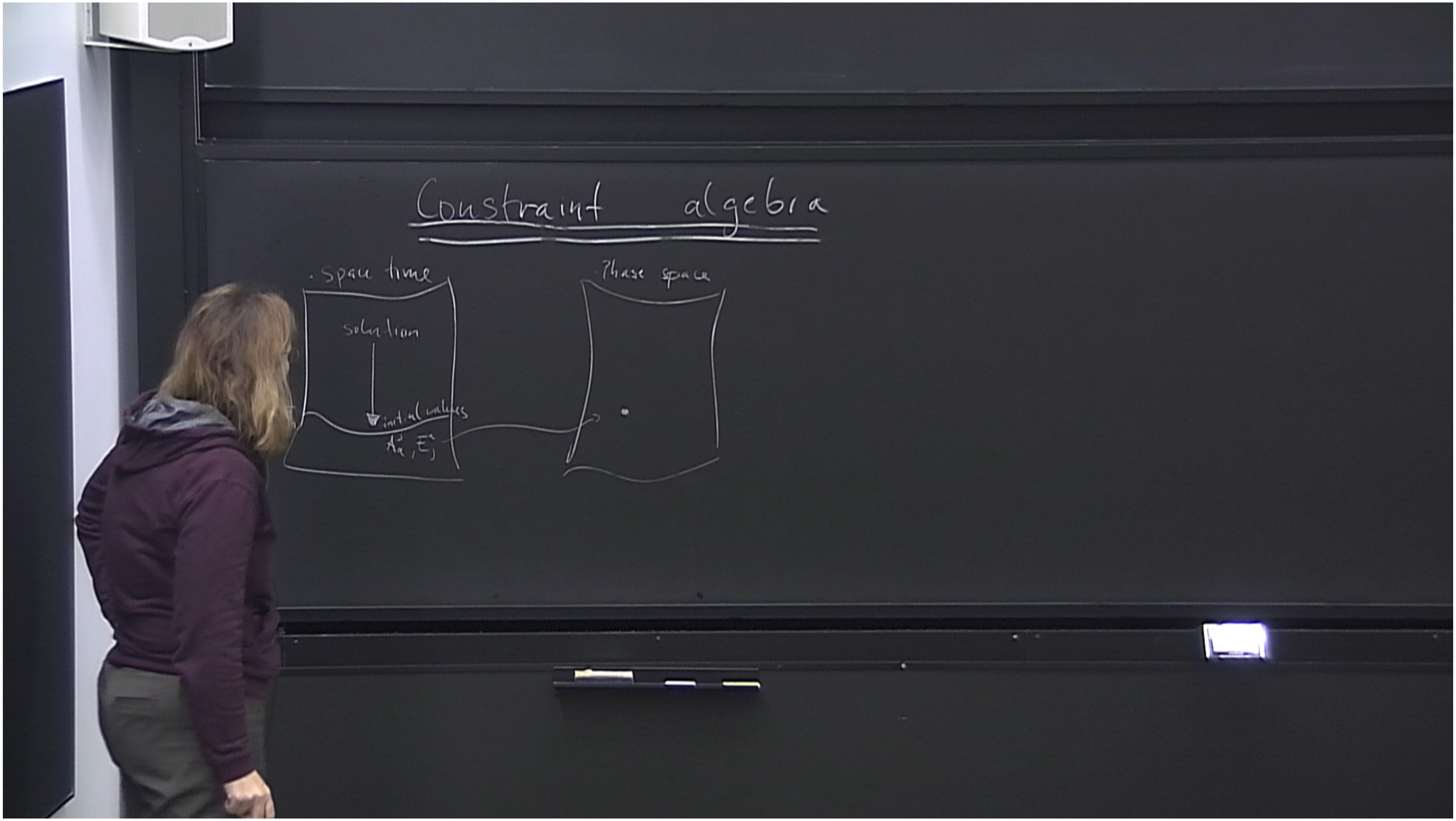
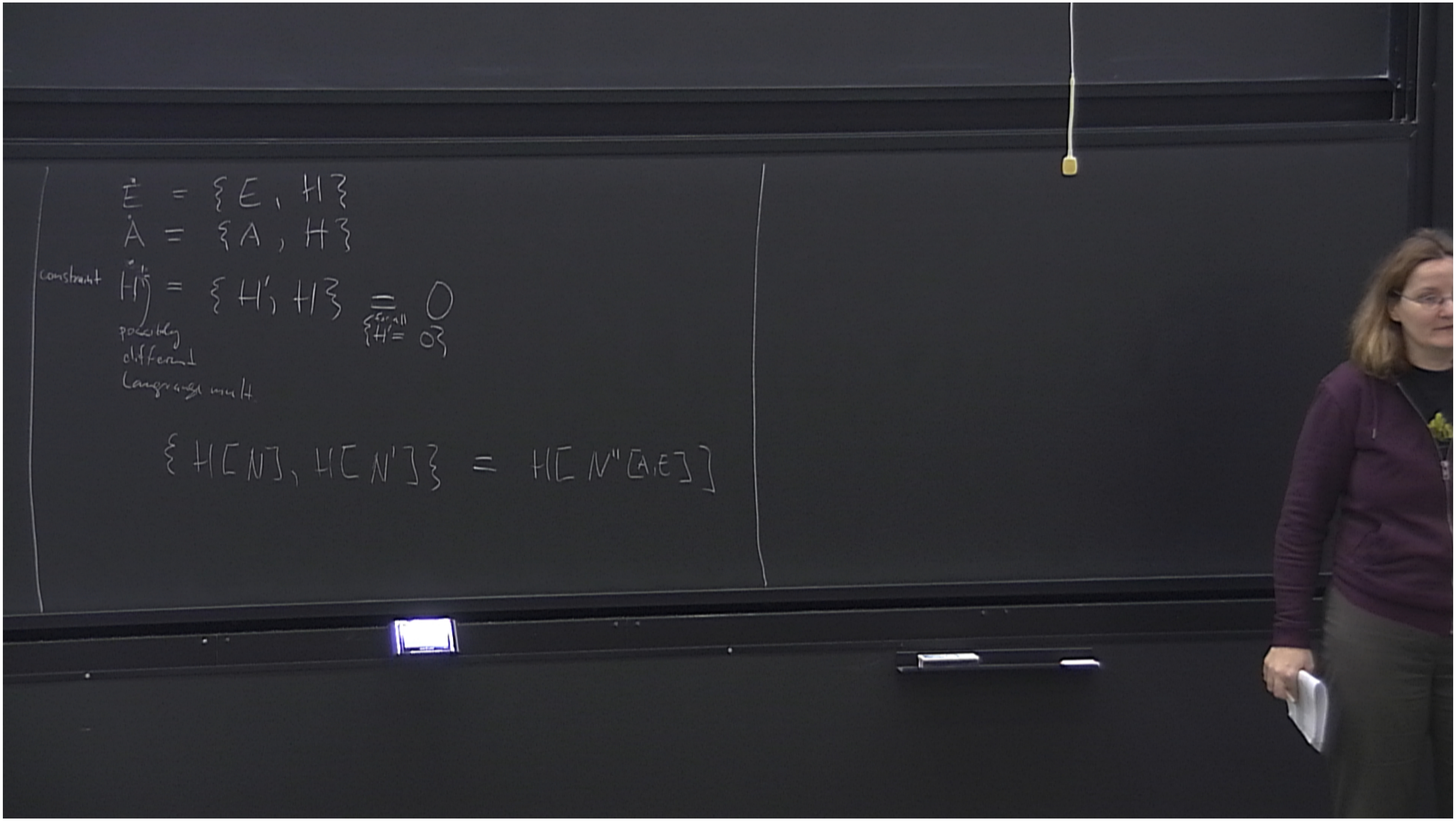
Title: Quantum Gravity Review-5

Date: Feb 23, 2015 10:15 AM

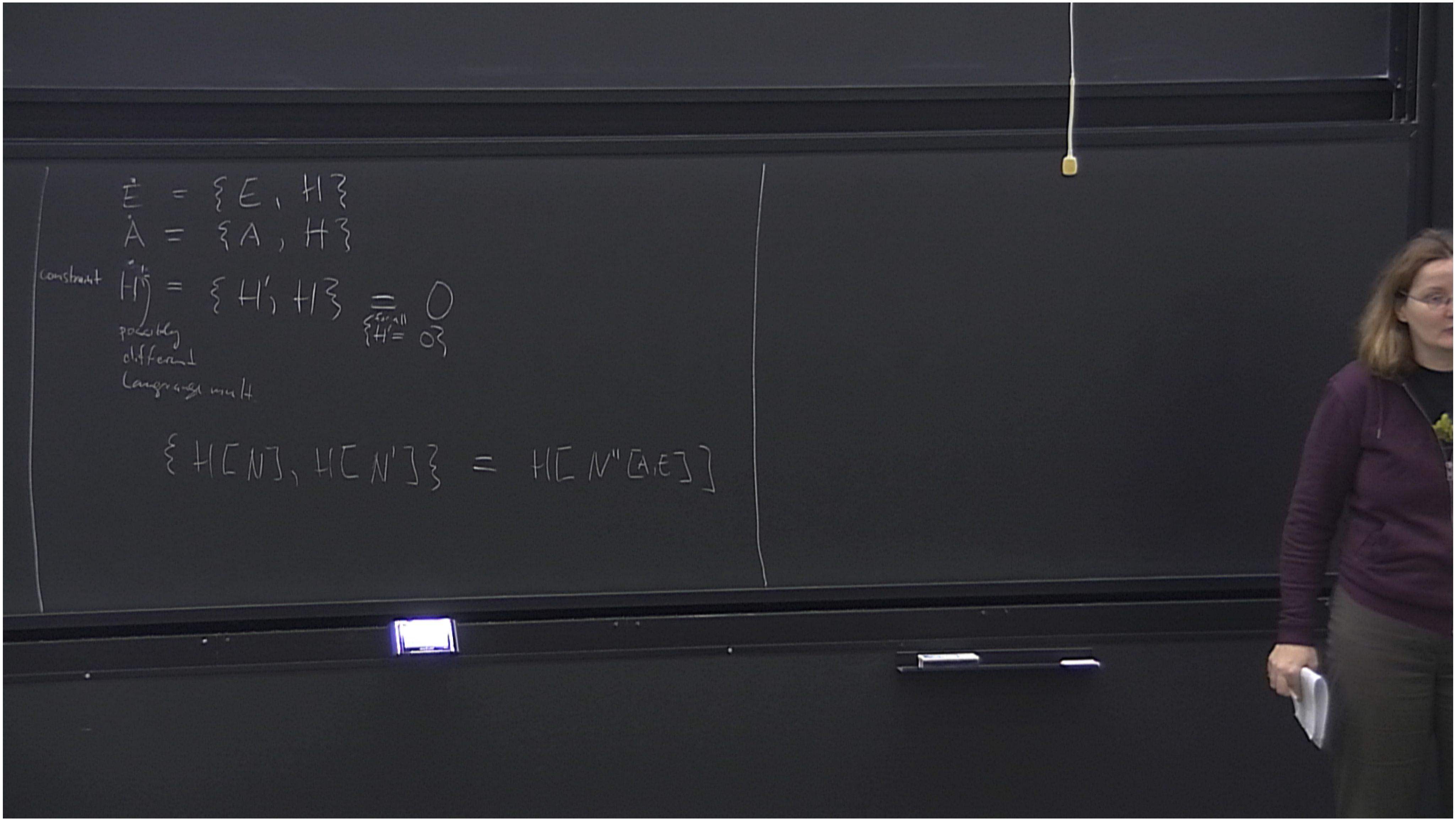
URL: http://www.pirsa.org/15020056

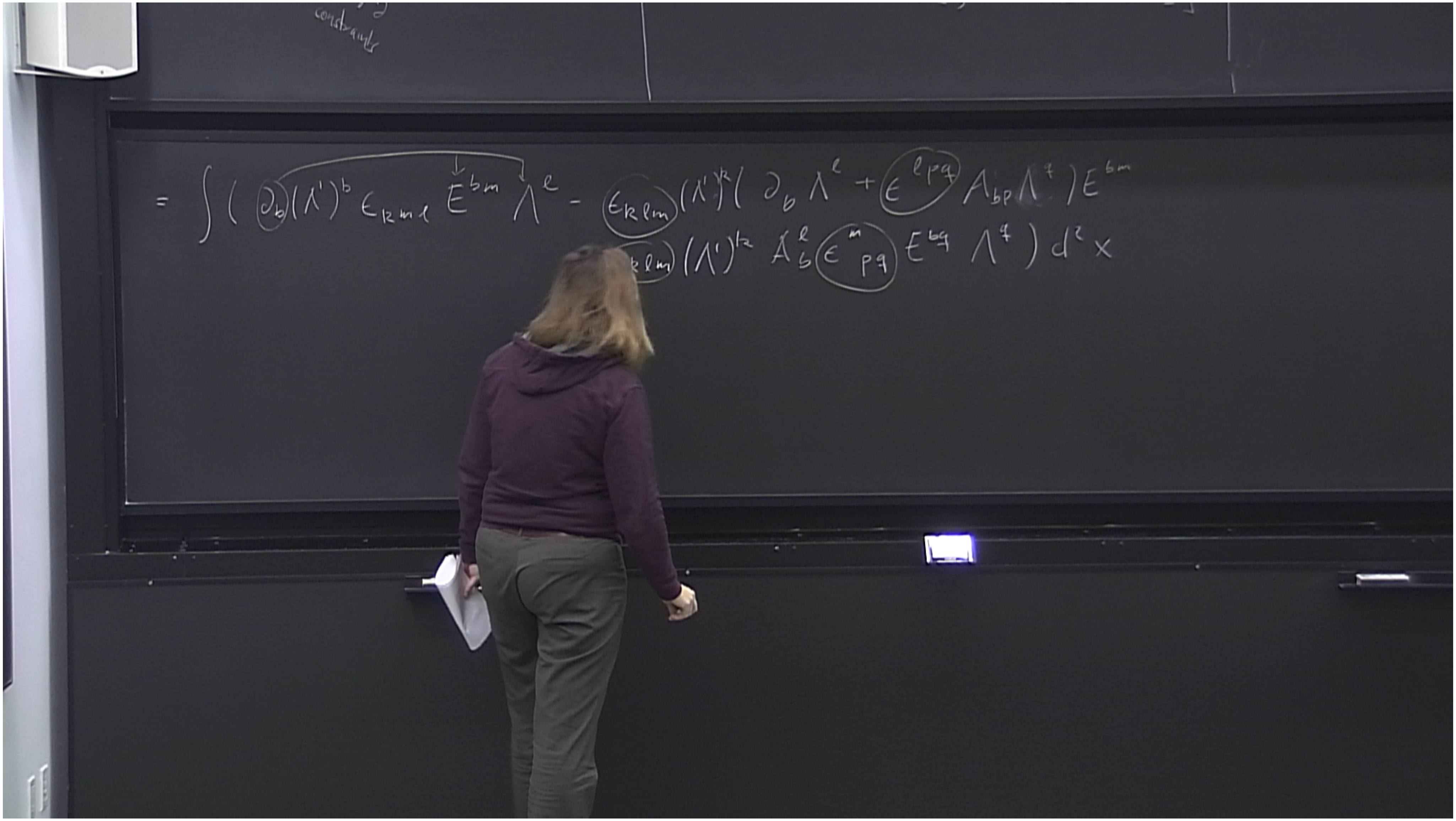
Abstract:


Constraint algebra
space time
solution
initial values
A^i_a, E^a_j
Phase space



$\dot{E} = \{E, H\}$
$\dot{A} = \{A, H\}$
constraint $\dot{H}' = \{H', H\} = 0$
possibly different Langrange mult
for all $\{H' = 0\}$
$\{H[N], H[N']\} = H[N''[A,E]]$


Ė = {E, H}
Ȧ = {A, H}
constraint
Ḣ' = {H', H} = 0
{for all H' = 0}
possibly different Langrange mult
{H[N], H[N']} = H[N''[A,E]]


constraints
$= \int (\partial_b (\Lambda')^b \epsilon_{kml} E^{bm} \Lambda^l - \epsilon_{klm} (\Lambda')^k (\partial_b \Lambda^l + \epsilon^{lpq} A_{bp} \Lambda^q) E^{bm}$
$\epsilon_{klm} (\Lambda')^k A^l_b \epsilon^m{}_{pq} E^{bq} \Lambda^q) d^2 x$

$$\ldots N], H[N]\} = H[N'[A,E]]$$

$$G[\Lambda]\}$$

$$\partial_b \Lambda^l + \epsilon^{lpq} A_{bp} \Lambda^q) E^{bm}$$

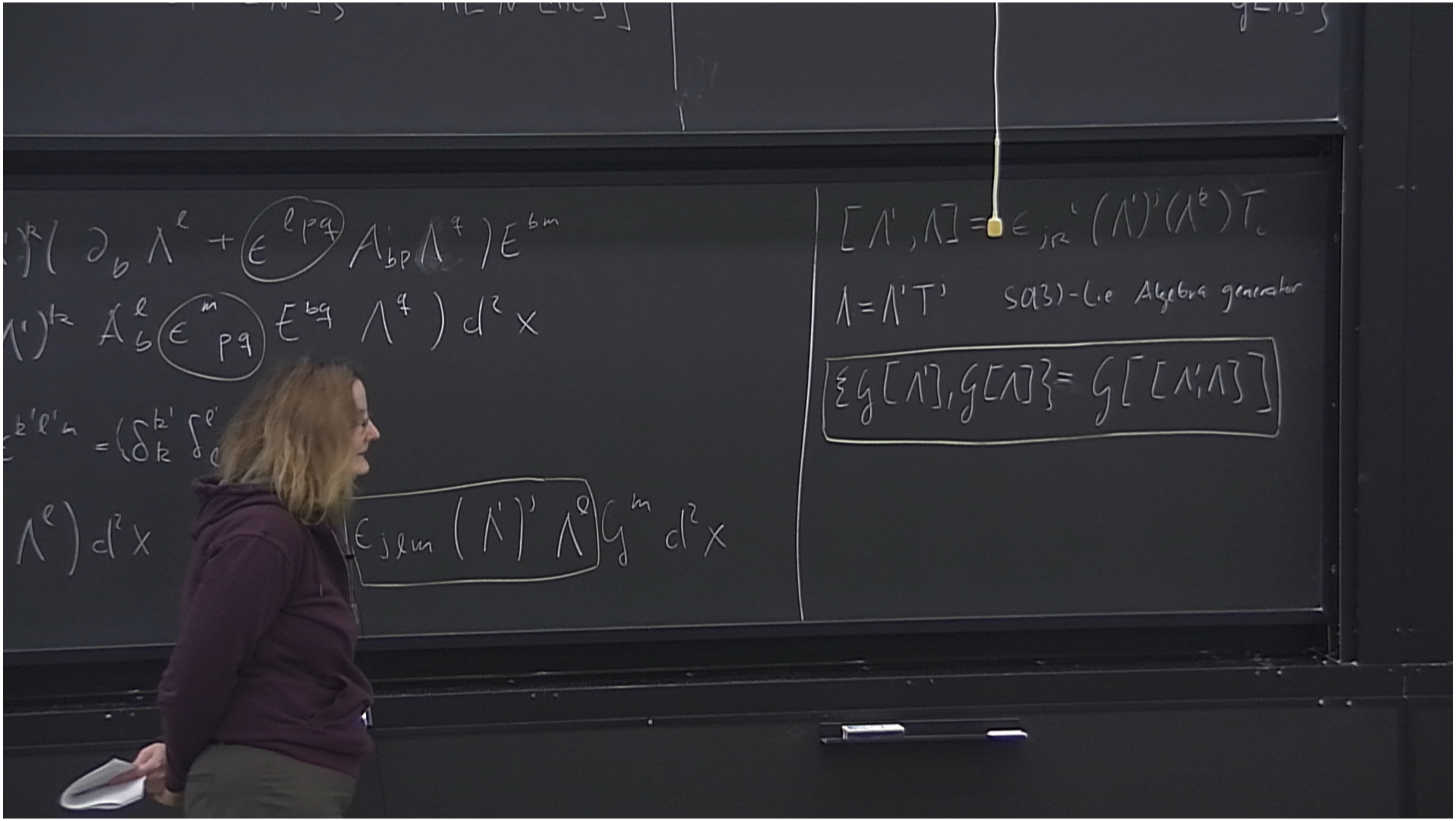
$$A^l_b \, \epsilon^m{}_{pq} E^{bq} \Lambda^q) \, d^2x$$

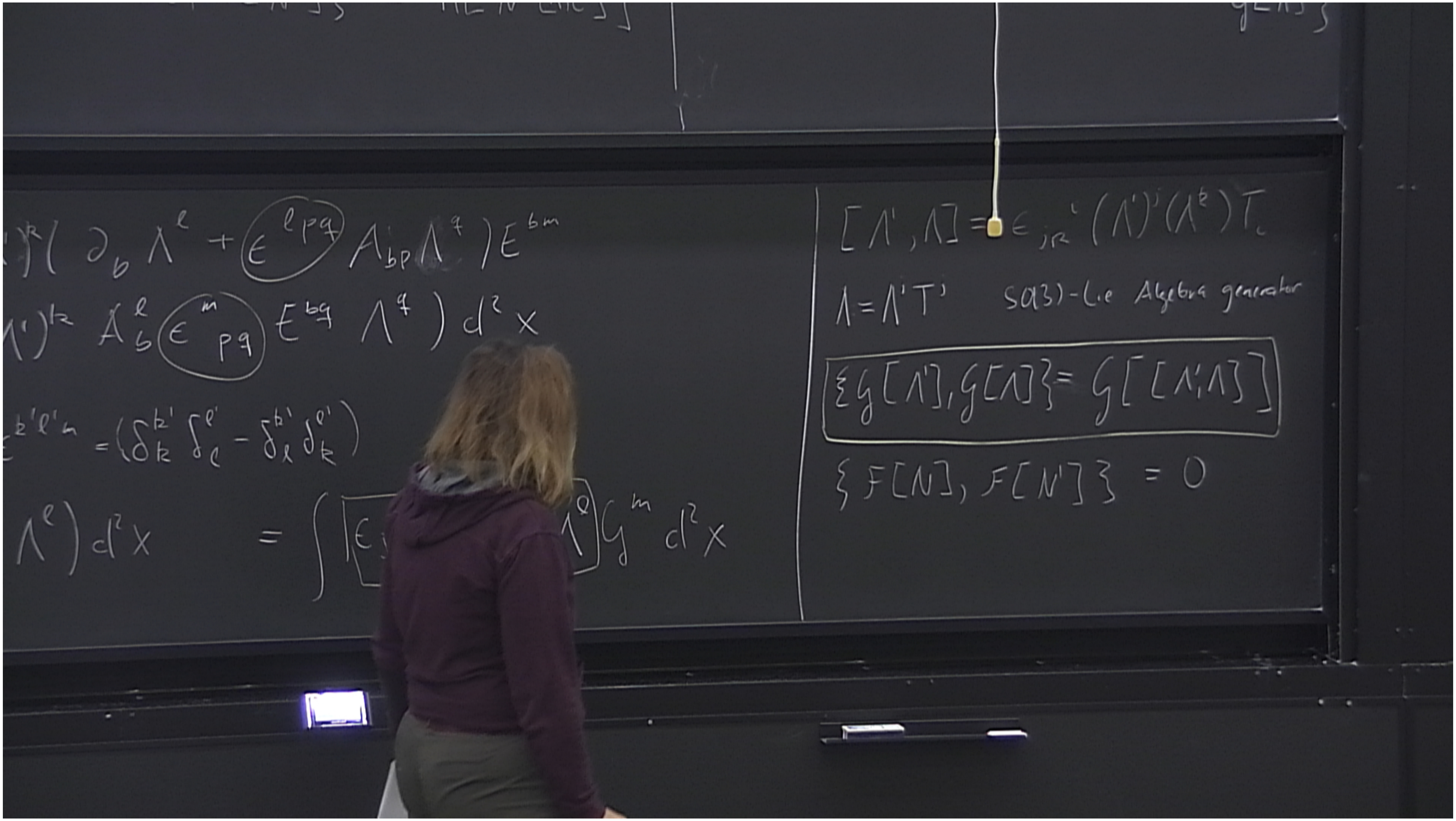
$$= (\delta^{k'}_k \delta^{l'}_l - \delta^{k'}_l \delta^{l'}_k)$$

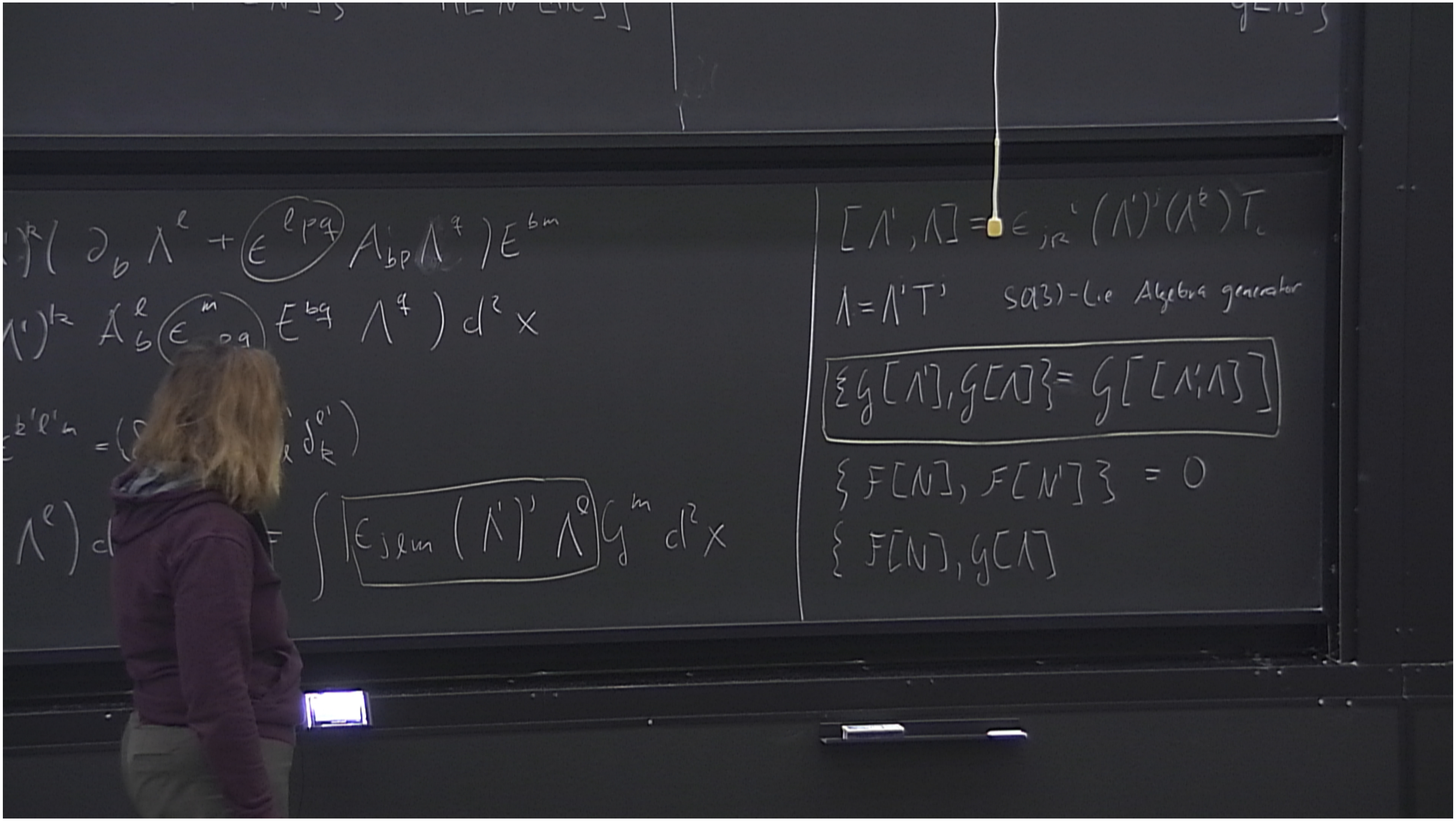
$$d^2x \quad = \int \boxed{\epsilon_{jlm} (\Lambda')^j \Lambda^l} G^m \, d^2x$$

$$[\Lambda', \Lambda] = \epsilon_{jk}{}^{i} (\Lambda')^j (\Lambda^k) T_i$$

$\Lambda = \Lambda^j T^j$ SO(3)-Lie Algebra generator


[Λ', Λ] = ε_{jk}^i (Λ')^j (Λ^k) T_i
Λ = Λ^i T^i
SO(3)-Lie Algebra generator
{G[Λ'], G[Λ]} = G[[Λ', Λ]]
ε_{jlm} (Λ')^j Λ^l G^m d^2x


Λ = Λ^i T^i   SO(3)-Lie Algebra generator
{G[Λ'], G[Λ]} = G[[Λ', Λ]]
{F[N], F[N']} = 0


[Λ', Λ] = ε_jk^i (Λ')^j (Λ^k) T_i
Λ = Λ^i T^i
SO(3)-Lie Algebra generator
{G[Λ'], G[Λ]} = G[[Λ', Λ]]
{F[N], F[N']} = 0
{F[N], G[Λ]

$$)^k \left(\partial_b \Lambda^l + \epsilon^{lpq} A_{bp} \Lambda^q \right) E^{bm}$$

$$(\Lambda')^k A_b^l \epsilon^{m}{}_{pq} E^{bq} \Lambda^q \,) \, d^2x$$

$$\epsilon^{k'l'm} = \left(\delta^{k'}_k \delta^{l'}_l - \delta^{k'}_l \delta^{l'}_k \right)$$

$$\Lambda^l) \, d^2x \quad = \int \boxed{\epsilon_{jlm} (\Lambda')^j \Lambda^l} \, G^m \, d^2x$$

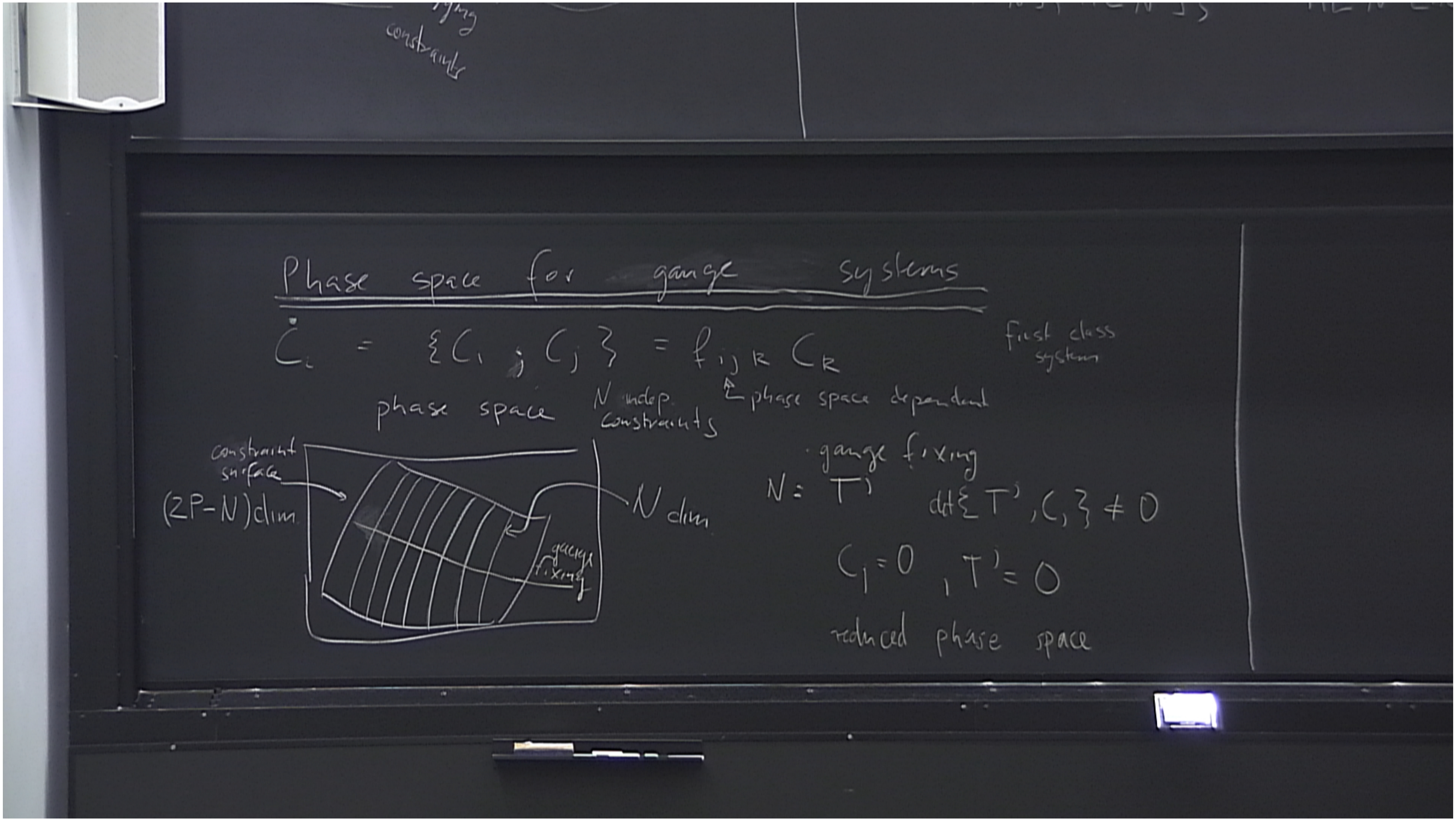
$$[\Lambda', \Lambda] = \epsilon_{jk}{}^{i} (\Lambda')^j (\Lambda^k) T_i$$

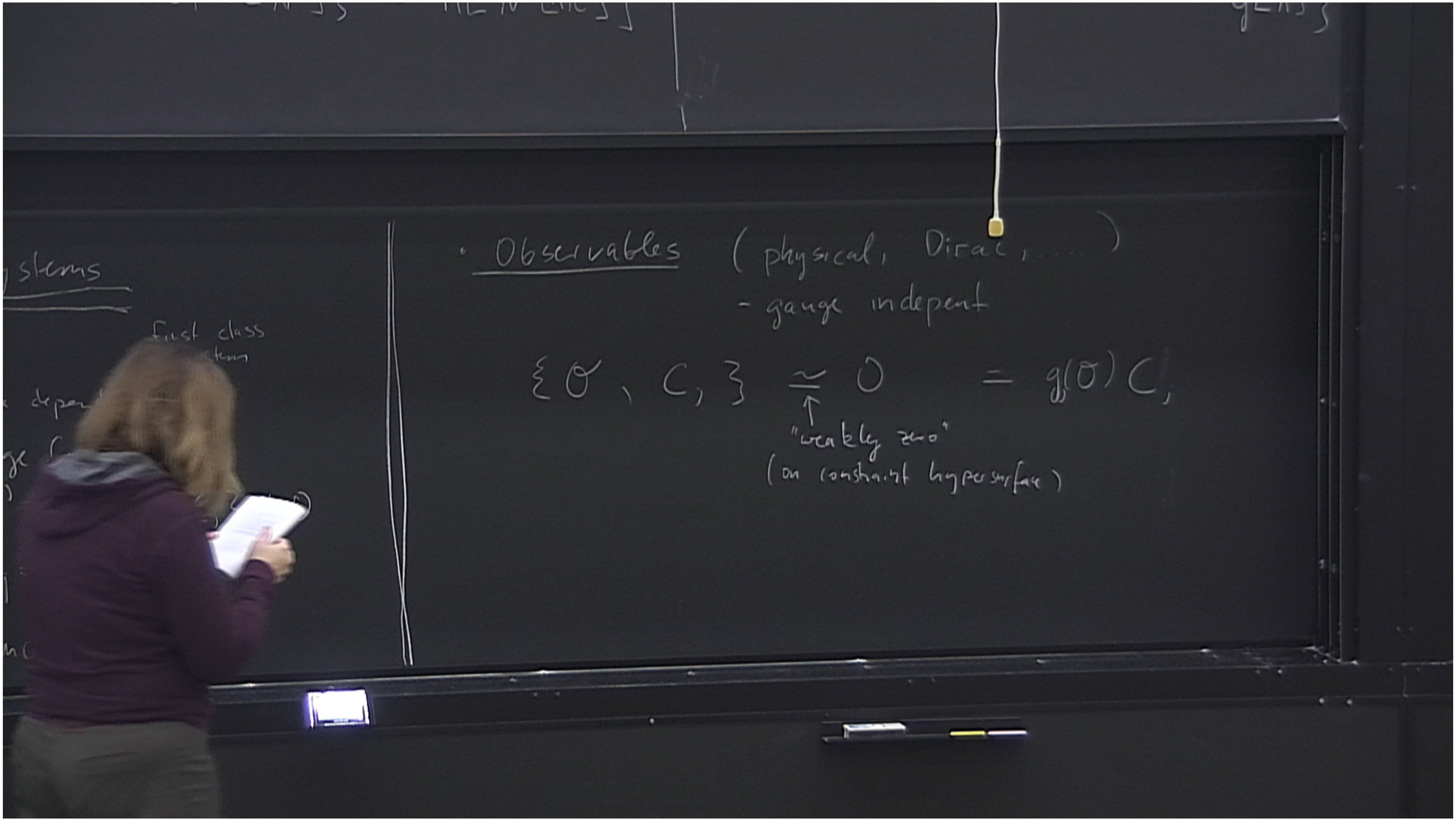
$\Lambda = \Lambda^i T^i$ SO(3)-Lie Algebra generator

$$\boxed{\{G[\Lambda'], G[\Lambda]\} = G[[\Lambda', \Lambda]]}$$

$$\{F[N], F[N']\} = 0$$

$$\{F[N], G[\Lambda]\} = F[[N, \Lambda]]$$


constraints
Phase space for gauge systems
Ċ_i = {C_i , C_j} = f_ijk C_k
first class system
phase space dependent
phase space
N indep. constraints
constraint surface
(2P−N) dim
N dim
gauge fixing
gauge fixing
N: T^j
det{T^j, C_i} ≠ 0
C_i = 0 , T^j = 0
reduced phase space



· Observables (physical, Dirac, ...)
- gauge indepent
{O, C_i} ≈ 0 = g(O) C_i
"weakly zero"
(on constraint hypersurface)
first class

ystems

first class system

dependent

ge fixing

$\det\{T^j, C_i\} \neq 0$

$= 0 \;,\; T^j = 0$

nced phase space

• Observables (physical, Dirac, ...)

- gauge indepent

$$\{\mathcal{O}, C_i\} \simeq 0 \qquad = g(\mathcal{O})\, C_i$$

"weakly zero"

(on constraint hypersurface)

4D Gravity : - None. Explicitly, for compact spatial mfd's

- 10 for asympt. flat

systems

first class system

-pendent

fixing

$\det\{T^j, C_i\} \neq 0$

$= 0 \quad , T^j = 0$

-ced phase space

• Observables (physical, Dirac, ...)

- gauge indepent

$$\{ \mathcal{O} , C_i \} \simeq 0 \quad = g(\mathcal{O})\, C_i$$

"weakly zero"

(on constraint hypersurface)

4D Gravity : - None. Explicitly, for compact spatial mfd's

- 10 for asymp. flat

- Thm (Torre): "non-local"