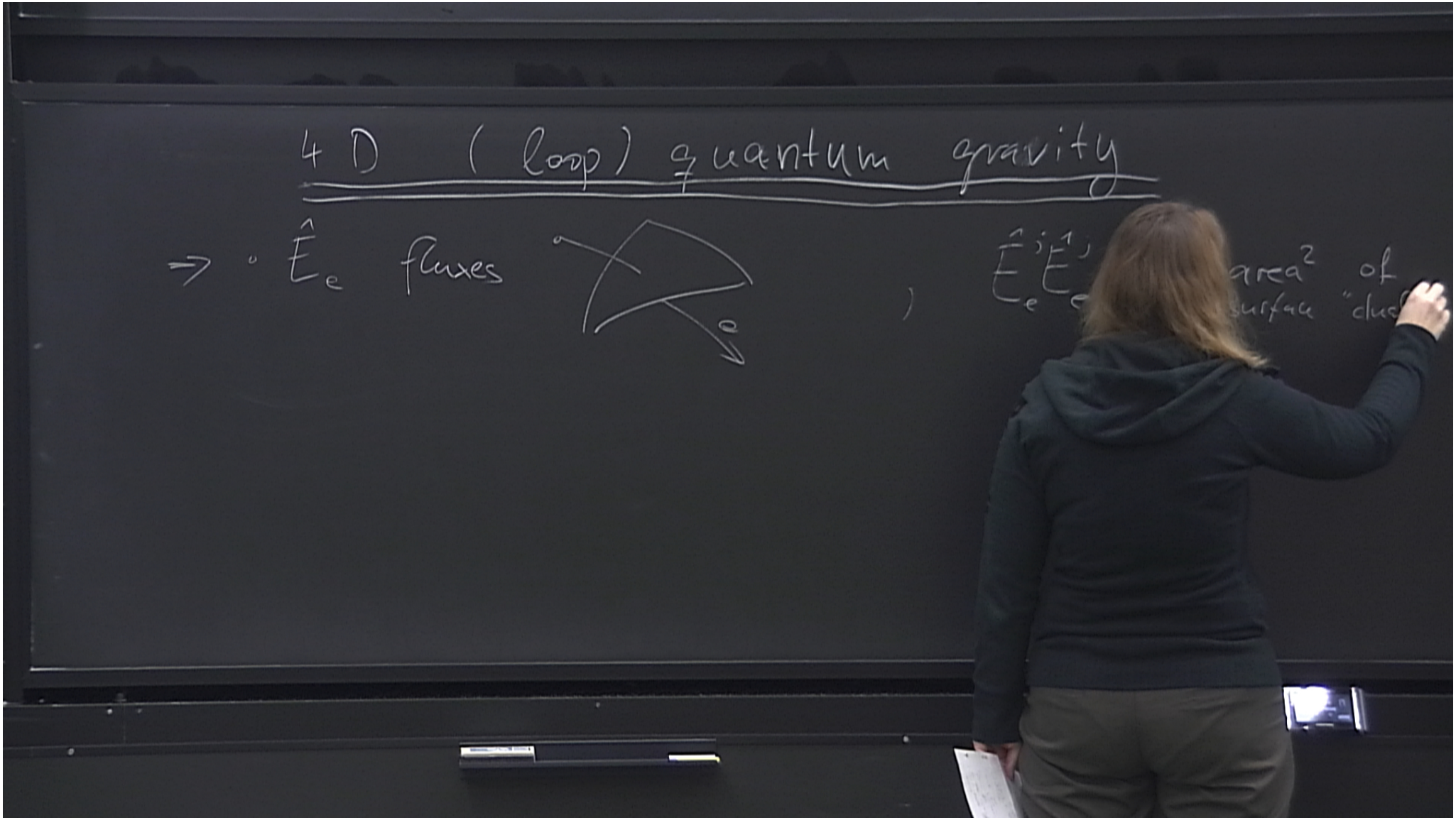
Title: Quantum Gravity Review-14

Date: Mar 06, 2015 10:15 AM

URL: http://www.pirsa.org/15030011

Abstract:

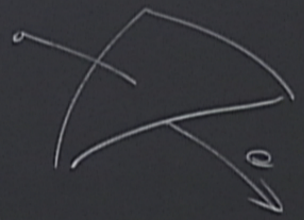
4D (loop) quantum gravity



4D (loop) quantum gravity

SU(2).

- $\hat{E}_e$ fluxes

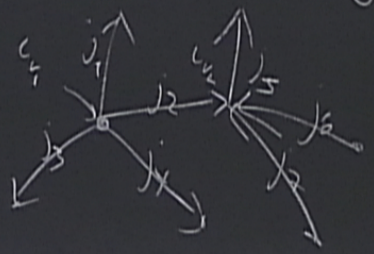


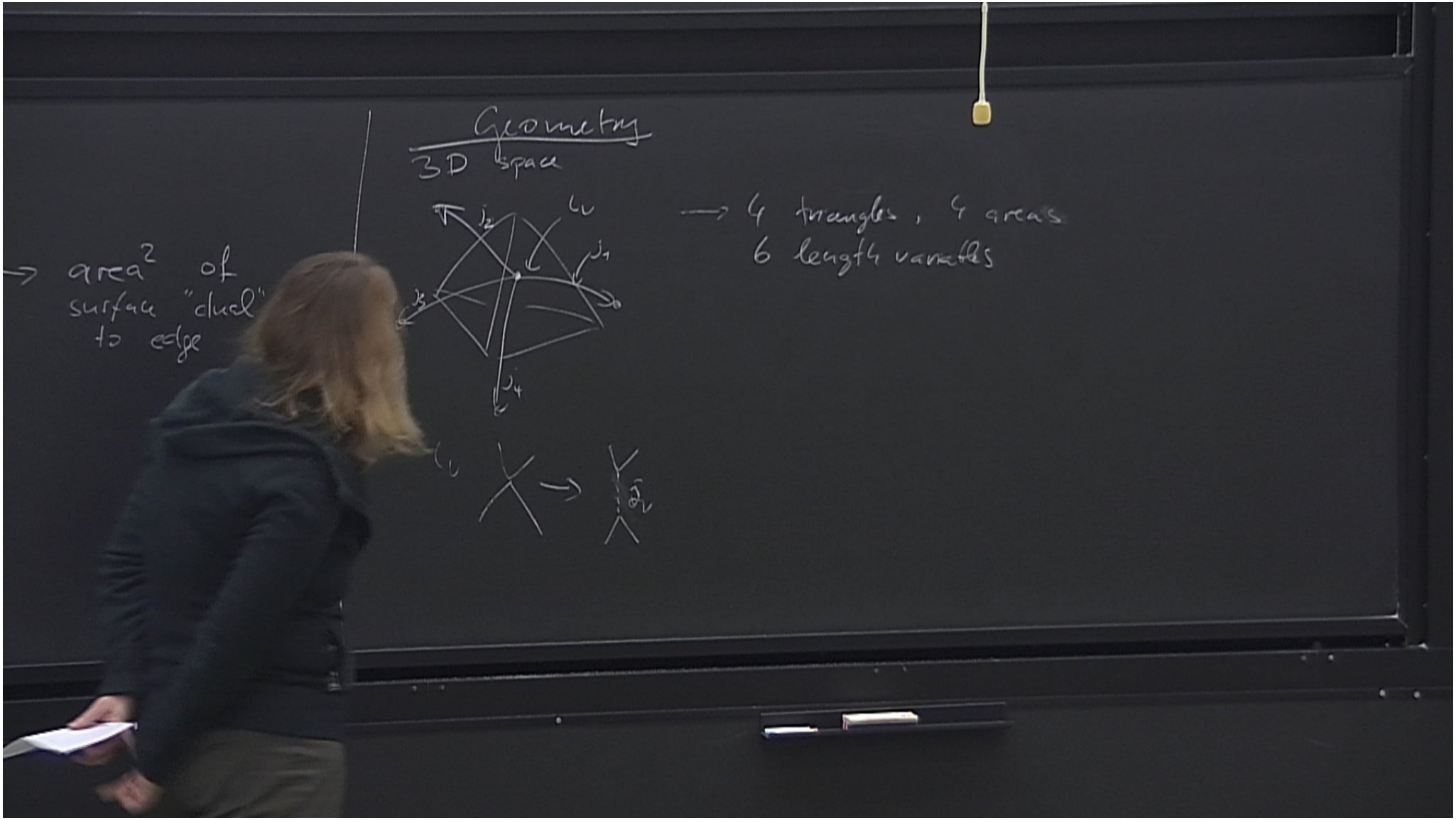
, $\hat{E}^i_e \hat{E}^j_e$ → area² of surface "dual" to edge

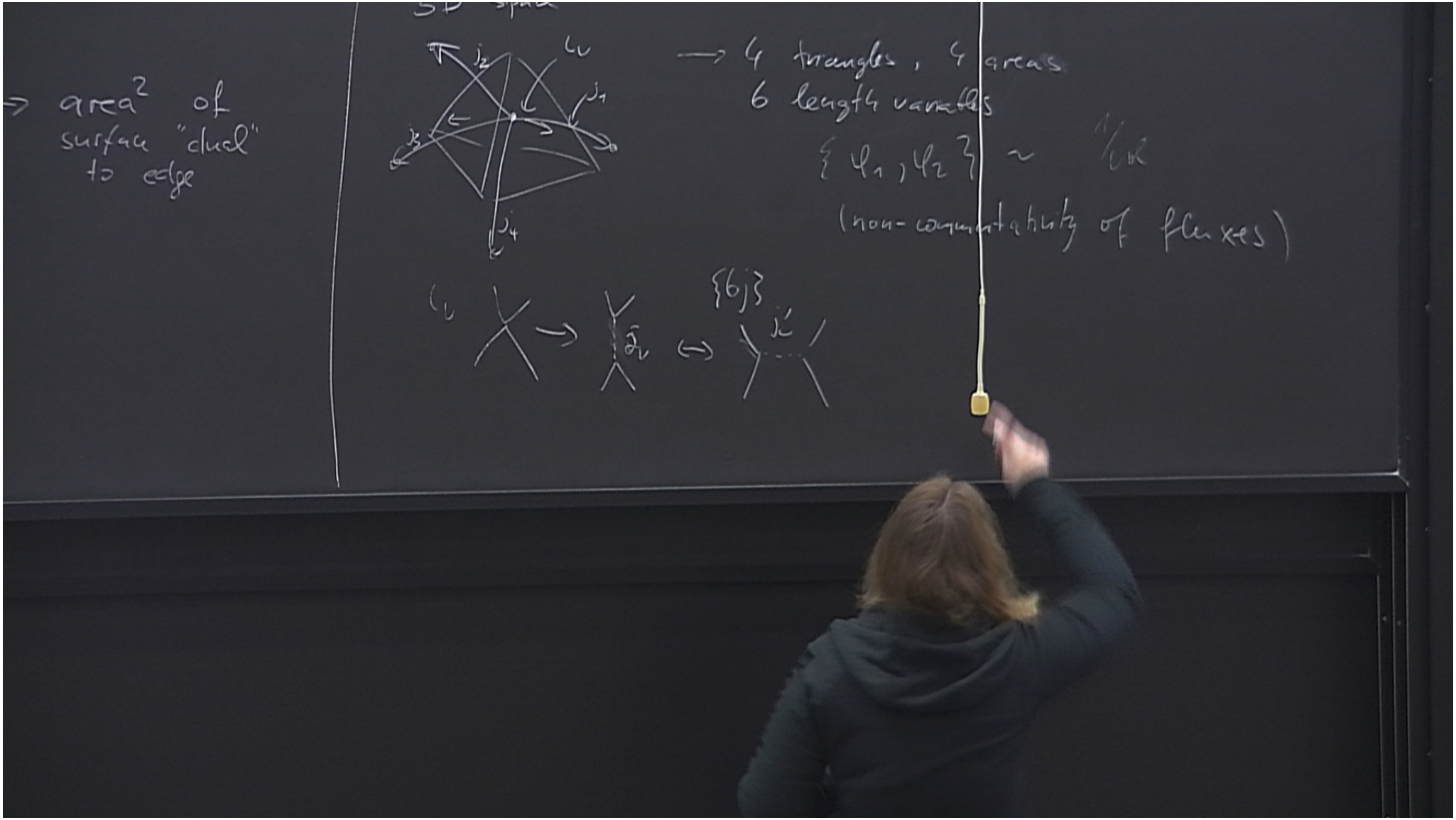
- $\hat{h}_e$ holonomy

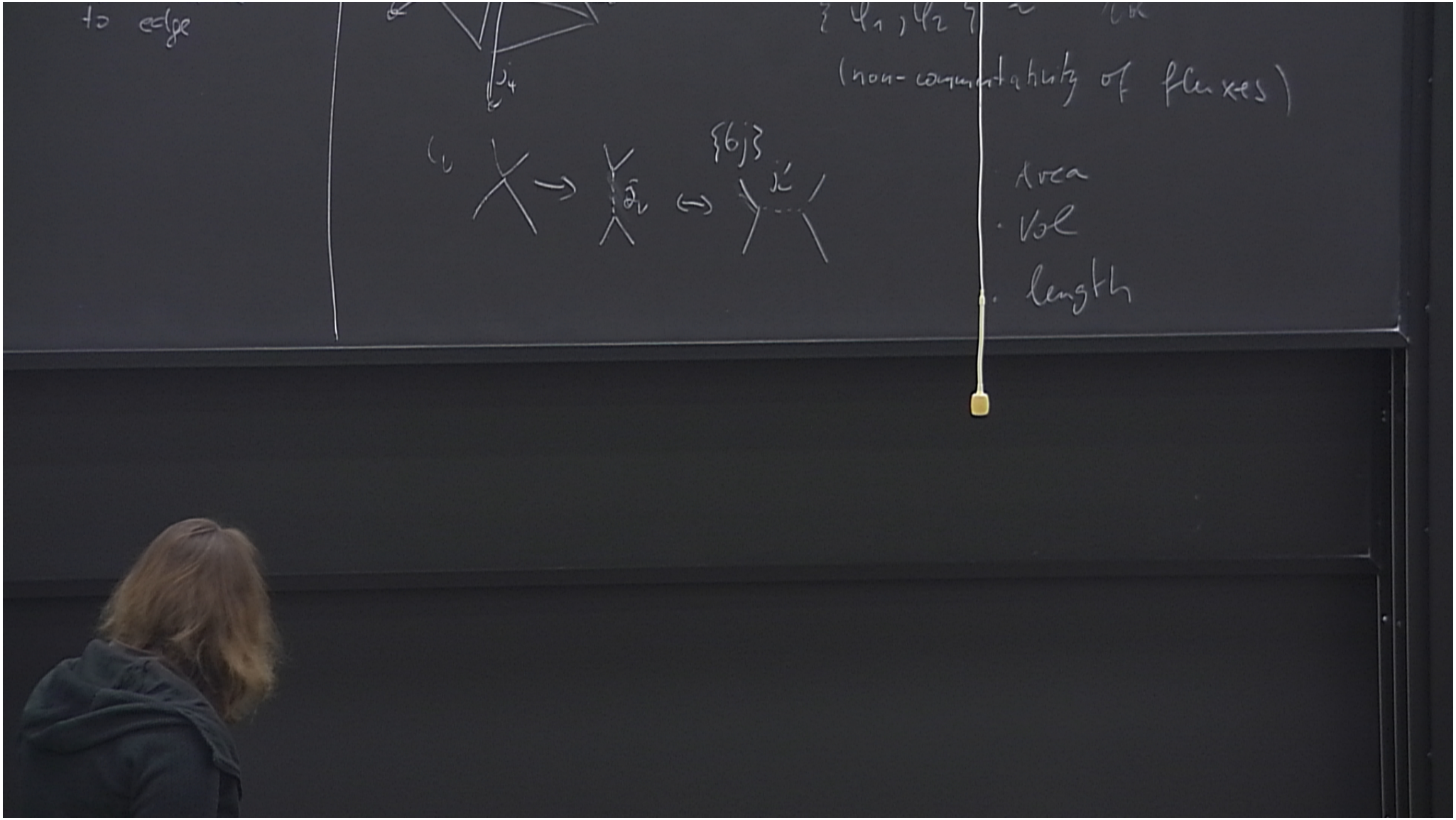


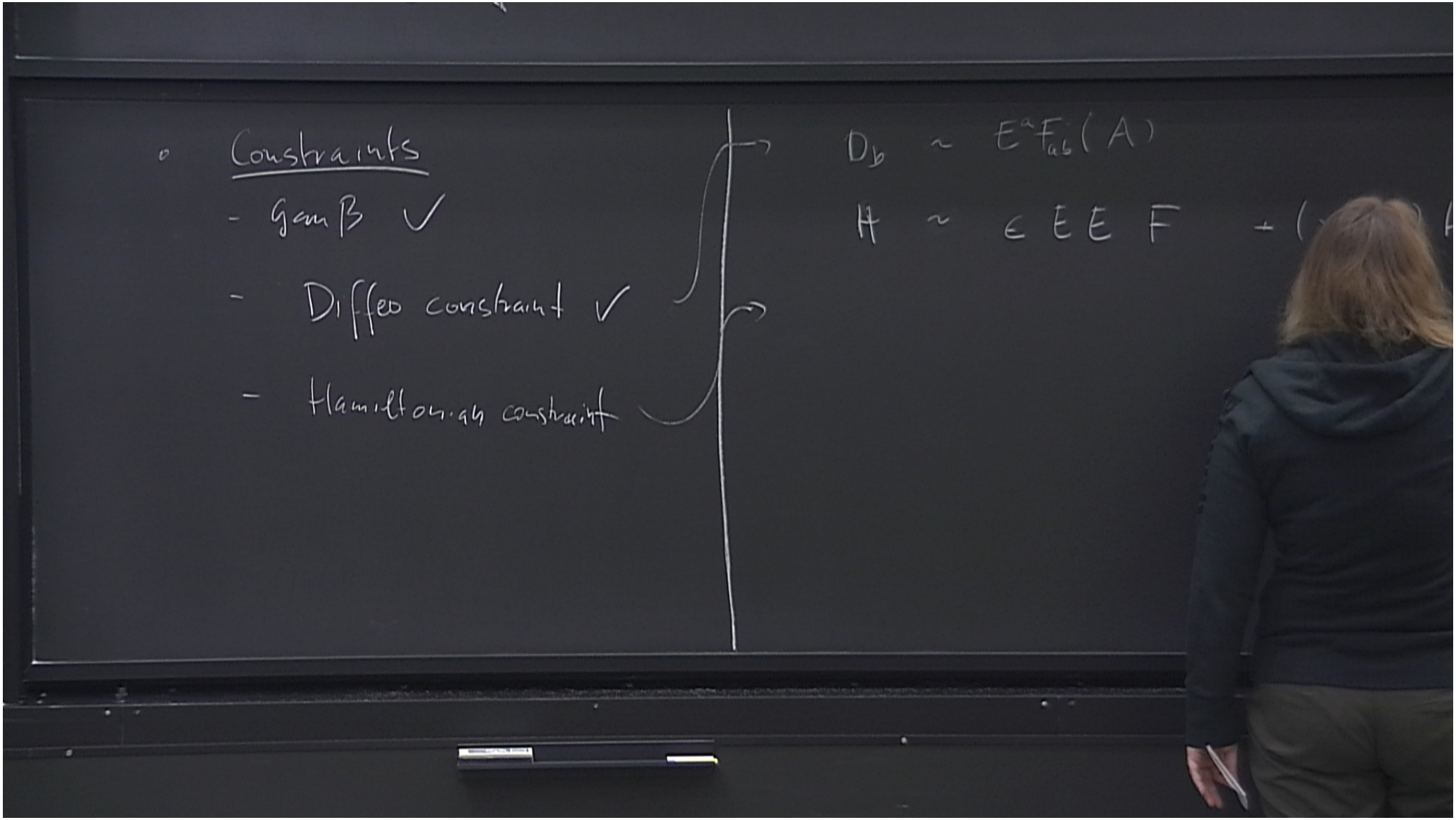
- SNW:




Geometry
3D space
→ area² of surface "dual" to edge
→ 4 triangles, 4 areas
6 length variables


area² of surface "dual" to edge
→ 4 triangles, 4 areas
6 length variables
(non-commutativity of fluxes)
{6j}


to edge
(non-commutativity of fluxes)
Area
Vol
length


Constraints
- Gauß ✓
- Diffeo constraint ✓
- Hamiltonian constraint
$D_b \sim E^a F_{ab}(A)$
$H \sim \epsilon E E F$

$$D_b \sim E^a F_{ab}(A)$$

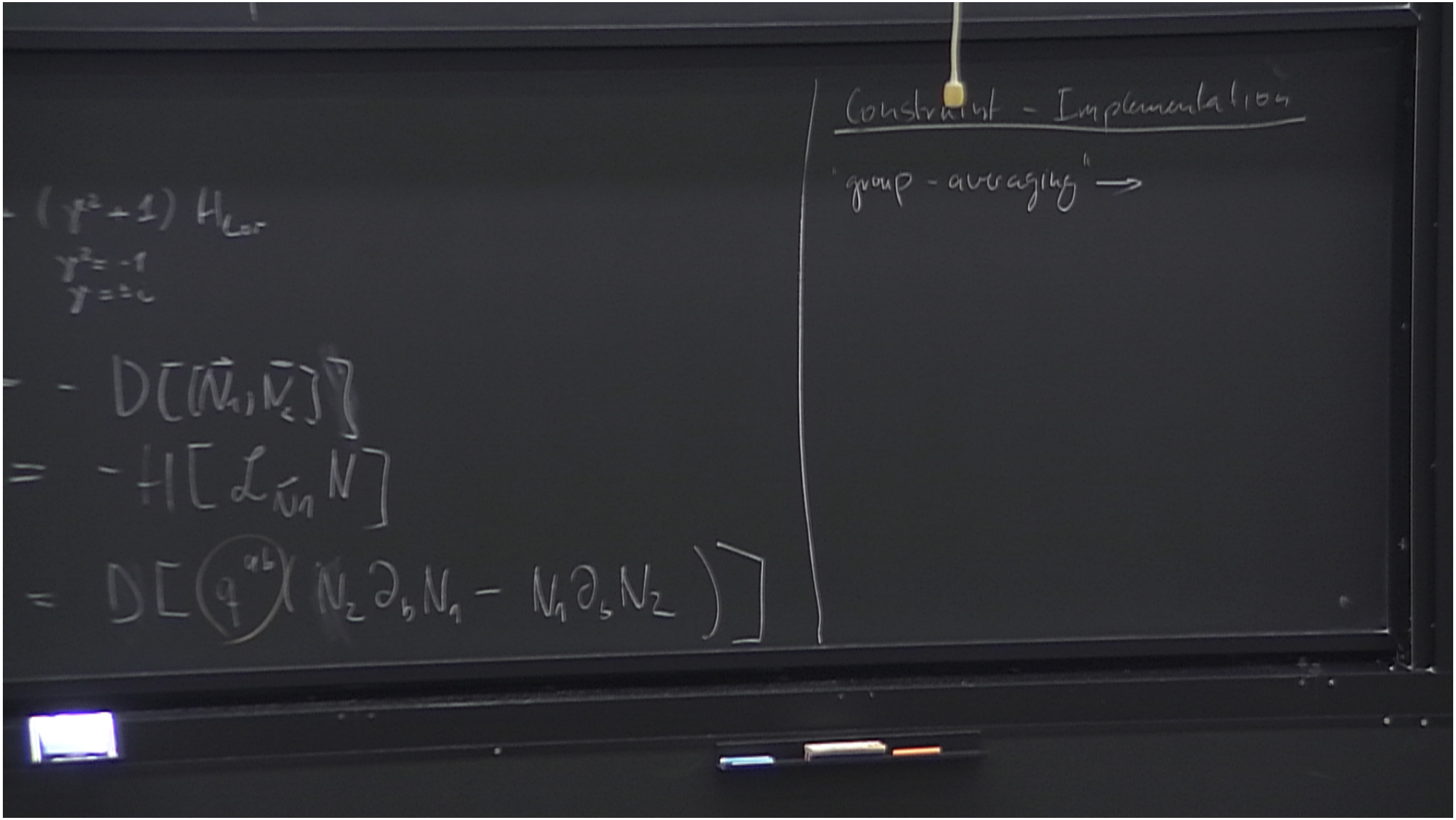
$$H \sim \frac{1}{\sqrt{q}} \epsilon^{ijk} E^a_i E^b_j F^{ab}_k + (\gamma^2+1) H_{Lor}$$

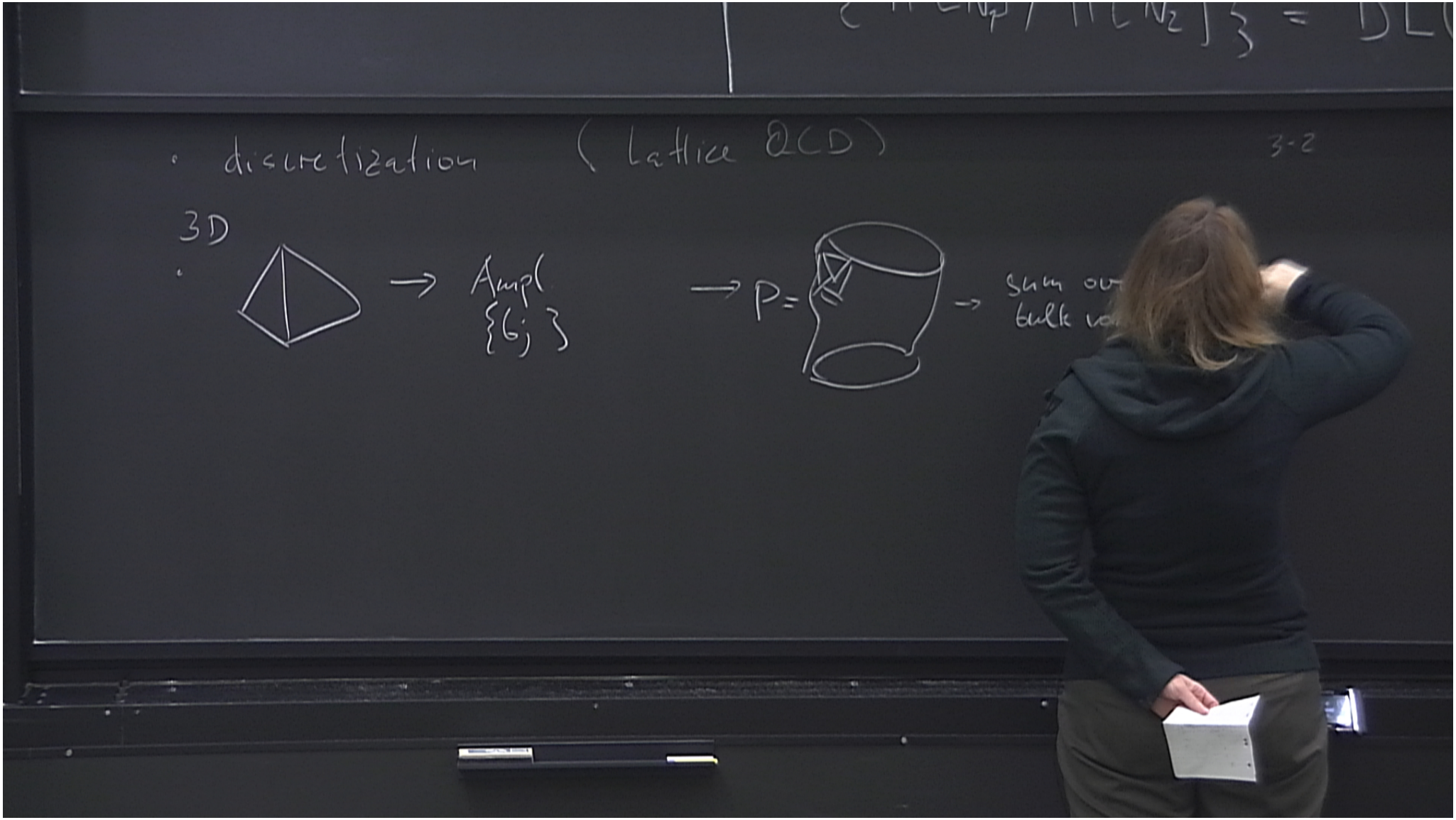
$\gamma^2 = -1$
$\gamma = \pm i$

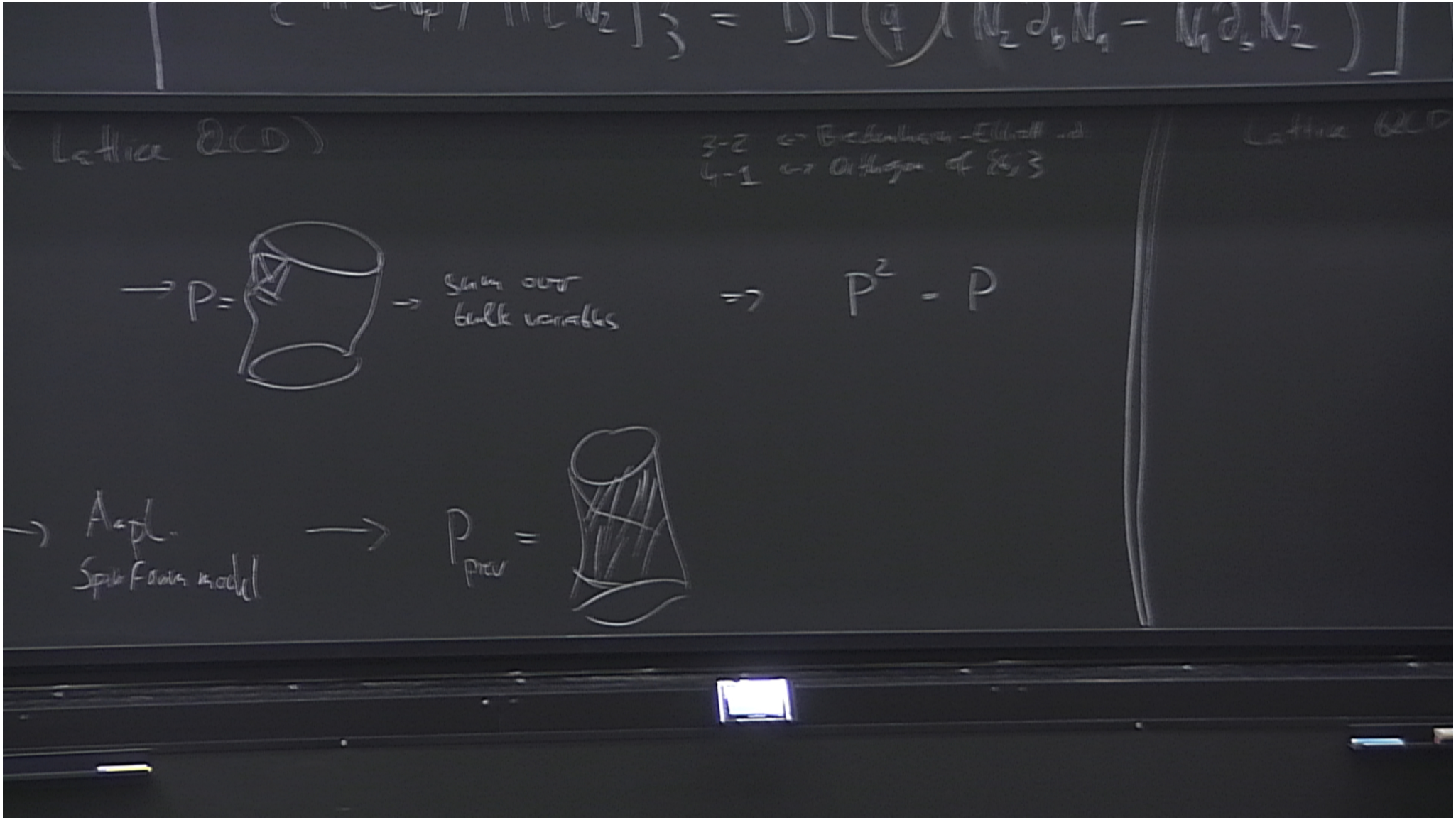
$$\{ D[\vec{N}_1], D[\vec{N}_2] \} = - D[[\vec{N}_1, \vec{N}_2]]$$

$$\{ H[N], D[\vec{N}_1] \} = - H[\mathcal{L}_{\vec{N}_1} N]$$

$$\{ H[N_1], H[N_2] \} = D[q^{ab}(N_2 \partial_b N_1 - N_1 \partial_b N_2)]$$


Constraint - Implementation
"group - averaging" →
$(\gamma^2 - 1) H_{Lor}$
$\gamma^2 = -1$
$\gamma = \pm i$
$= -D[[\vec{N}_1, \vec{N}_2]]$
$= -H[\mathcal{L}_{\vec{N}_1} N]$
$= D[q^{ab}(N_2 \partial_b N_1 - N_1 \partial_b N_2)]$


· discretization (lattice QCD)
3-2
3D
→ Ampl
{G_j}
→ P=
→ Sum ou
bulk

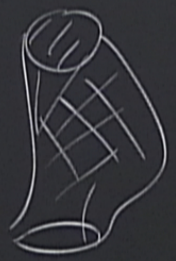

Lattice QCD
3-2 ↔
4-1 ↔
→ P=
→
$P^2 = P$
→ Asymptotic
Spin Foam model
→
P_{prev} =
Lattice QCD

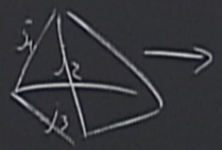
$N_2 \partial_b N_1 - N_1 \partial_b N_2 \Big) \Big]$

- Lattice QCD → avoid discret. artifacts
  lattice constant reasonably small

fixed
• QG: no lattice constant

j's can be huge



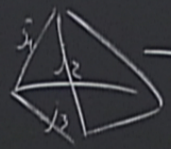


$N_2 \partial_b N_1 - N_1 \partial_b N_2)]$

- Lattice QCD → avoid discret. artifacts
  lattice constant reasonably small

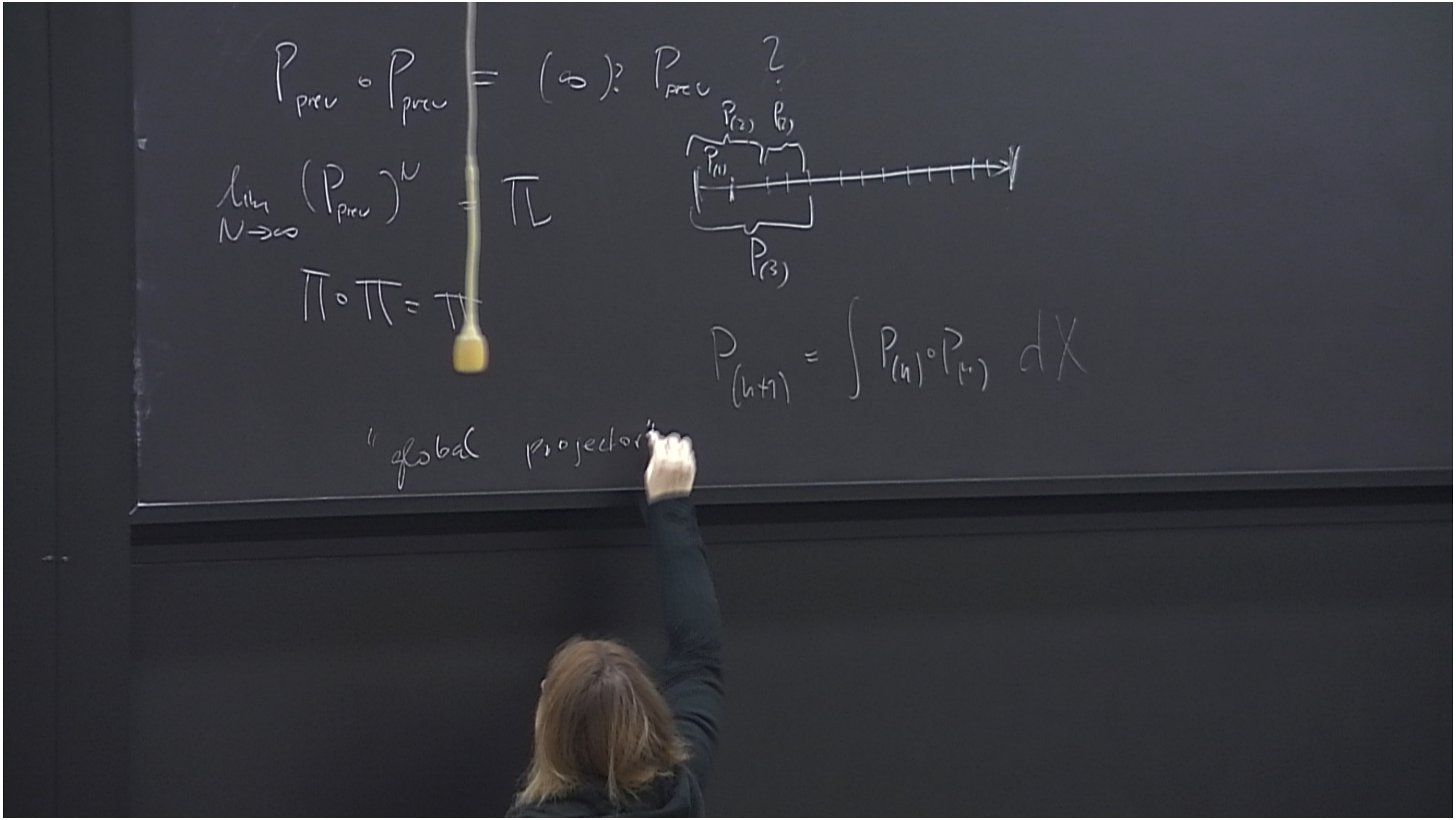
fixed
• QCD: no lattice constant

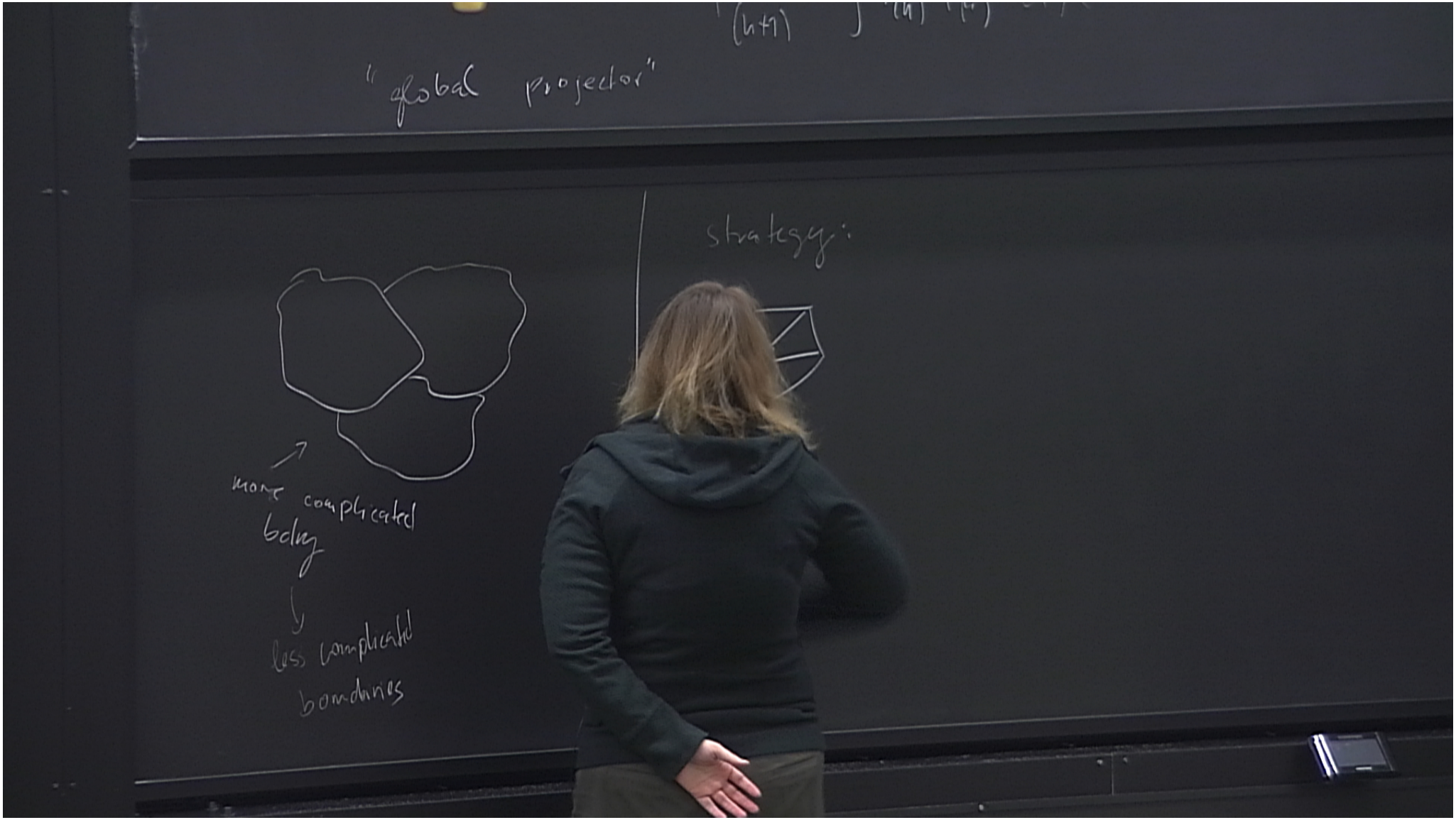


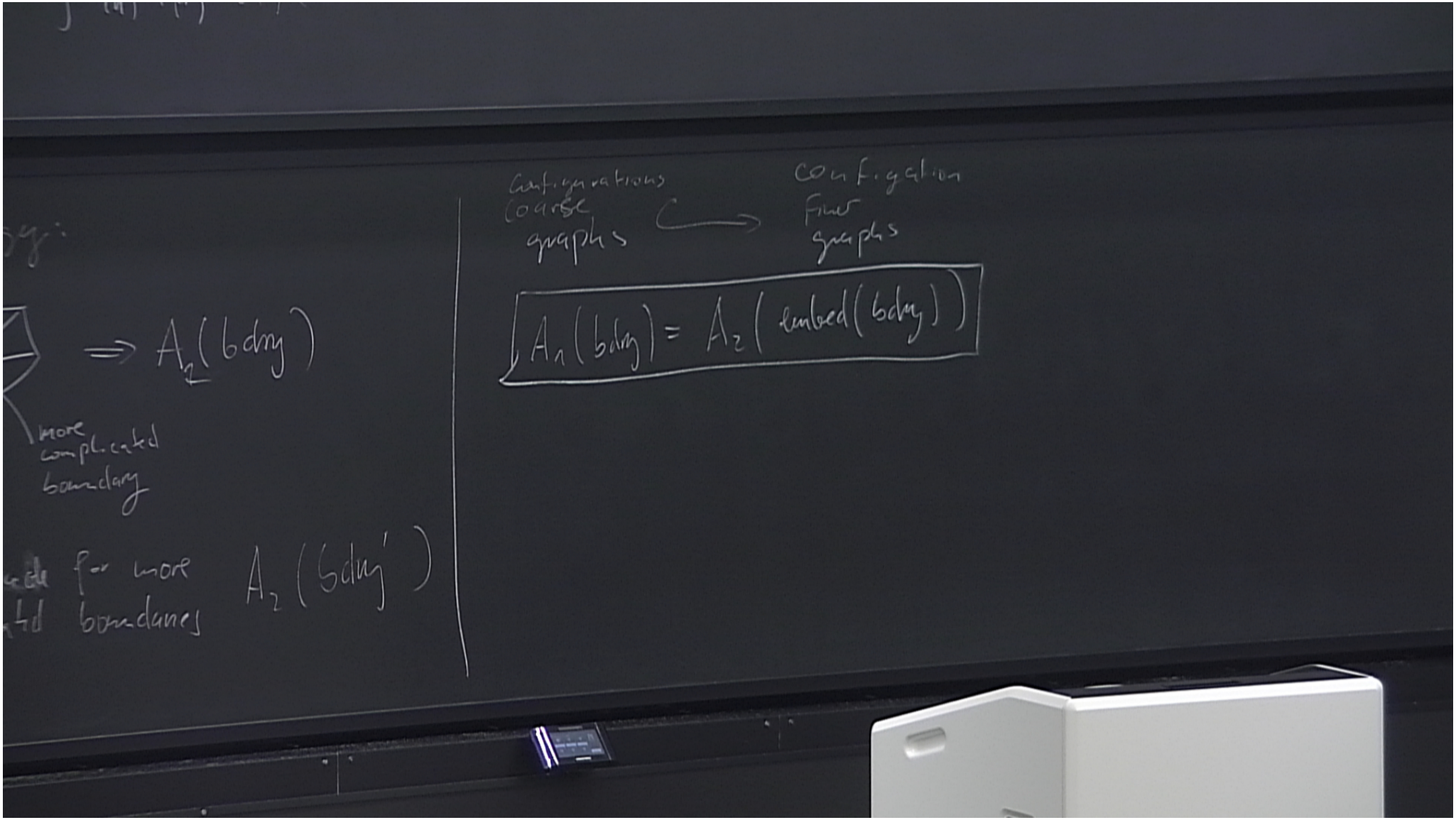


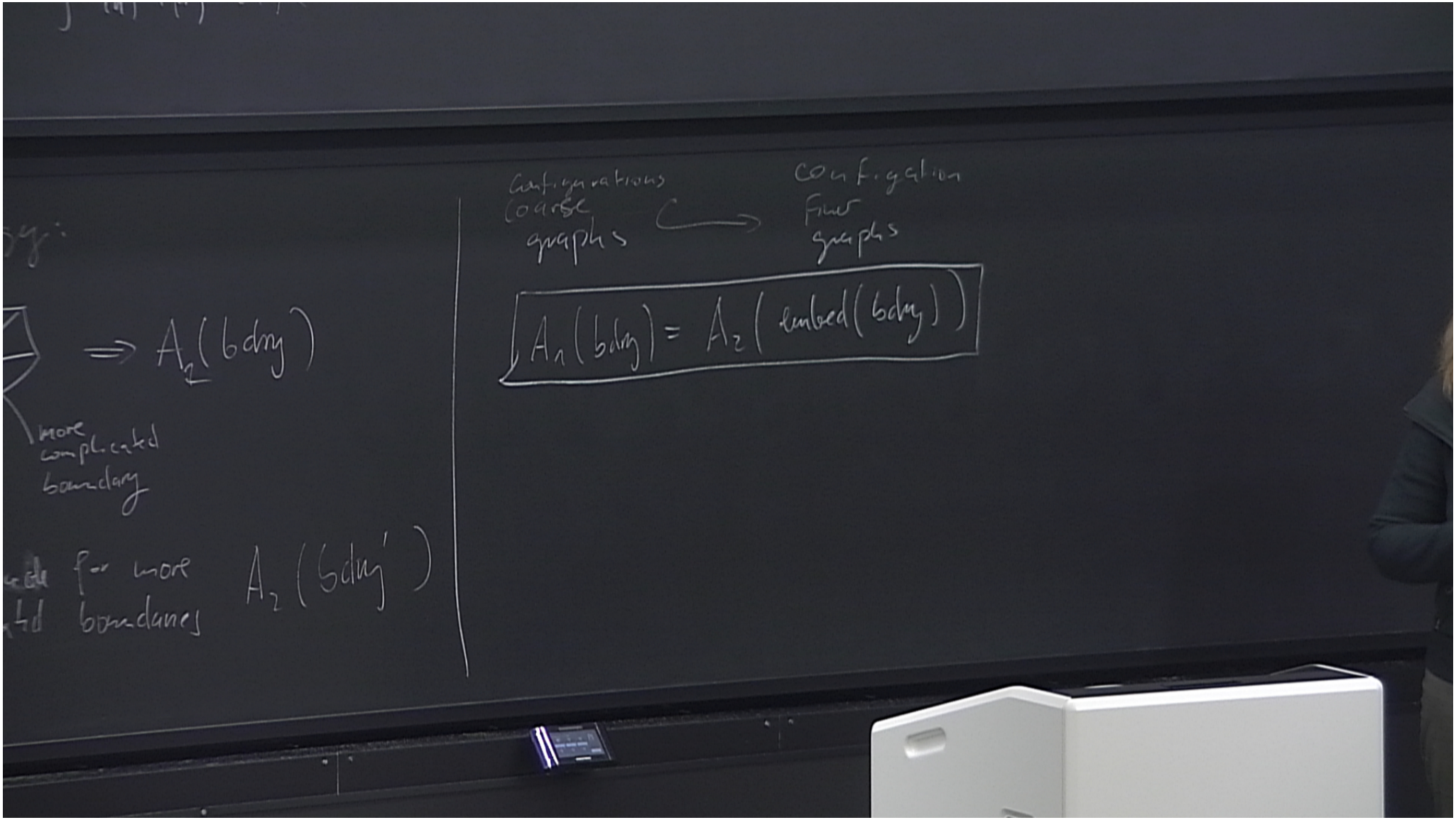
λ's can be huge

- need exact (perfect discretization) for all length scales at once


$P_{prev} \circ P_{prev} = (\infty)? P_{prev}$?
$\lim_{N\to\infty} (P_{prev})^N = \Pi$
$\Pi \circ \Pi = \Pi$
$P_{(2)}$ $P_{(1)}$
$P_{(1)}$
$P_{(3)}$
$P_{(n+1)} = \int P_{(n)} \circ P_{(1)}\, dX$
"global projector"


"global projector"
strategy:
more complicated bdry
less complicated boundaries


Configurations
Coarse
graphs
Configuration
Finer
graphs
$A_1(bdry) = A_2(\text{embed}(bdry))$
$\Rightarrow A_2(bdry)$
more
complicated
boundary
for more
tld boundaries
$A_2(bdry')$


Configurations
Coarse
graphs
Configuration
Finer
graphs
$A_1(\text{bdry}) = A_2(\text{embed}(\text{bdry}))$
$\Rightarrow A_2(\text{bdry})$
more
complicated
boundary
for more
boundaries
$A_2(\text{bdry}')$