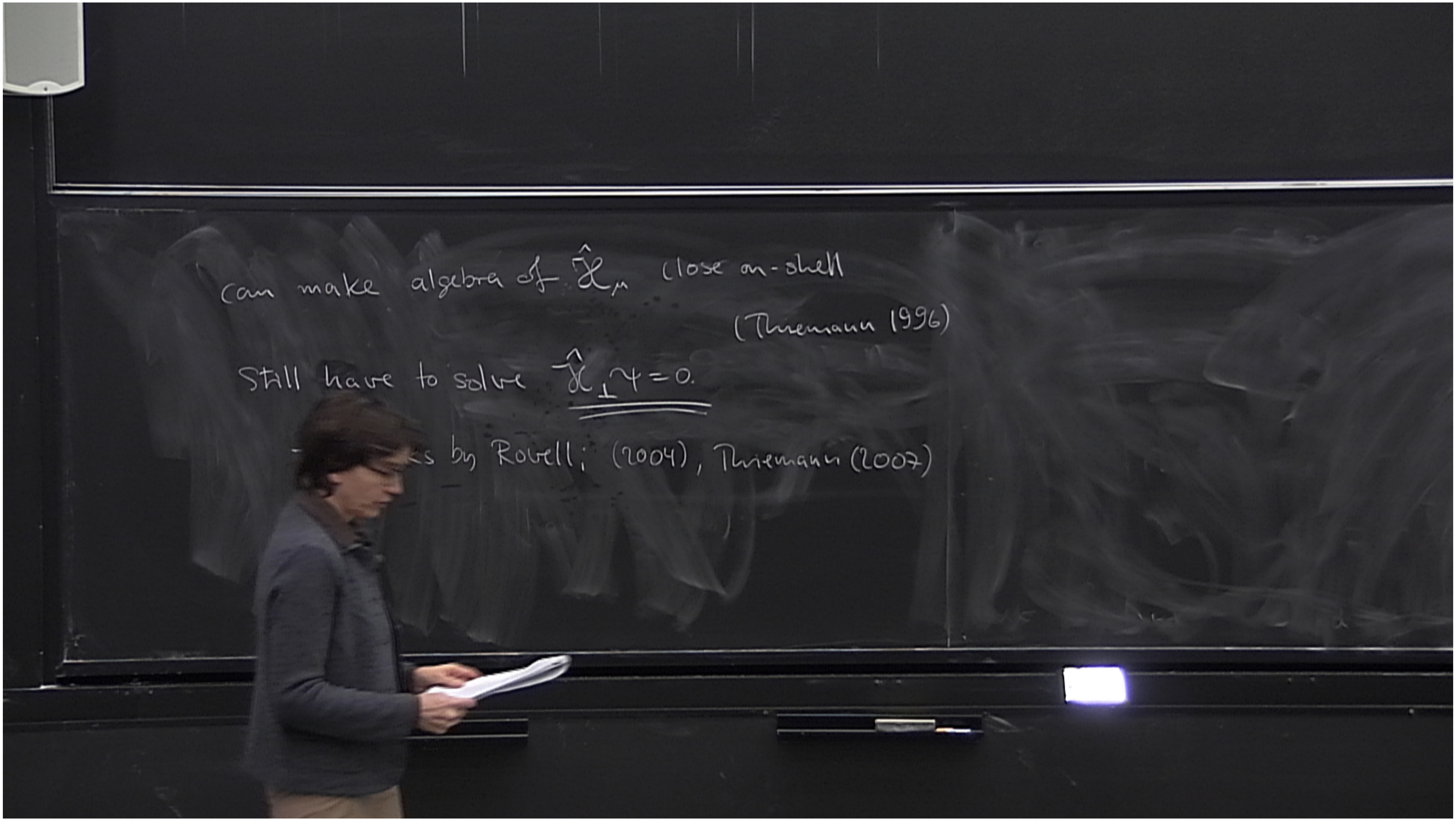
Title: Quantum Gravity (Review) - Lecture 12

Date: Feb 07, 2012 10:15 AM

URL: http://pirsa.org/12020006

Abstract:


can make algebra of $\hat{\mathcal{H}}_\mu$ close on-shell
(Thiemann 1996)
Still have to solve $\hat{\mathcal{H}}_\perp \psi = 0$.
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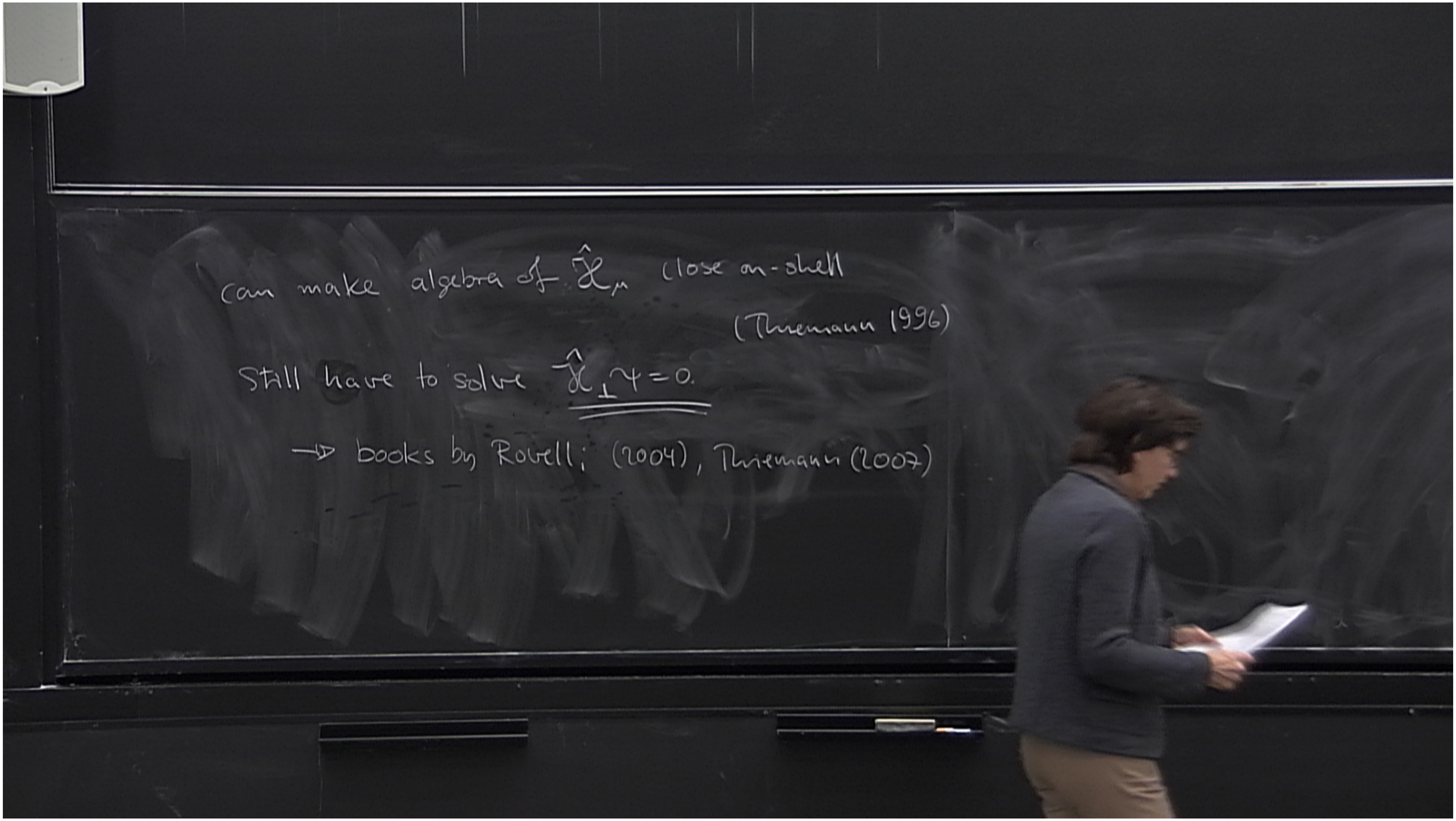
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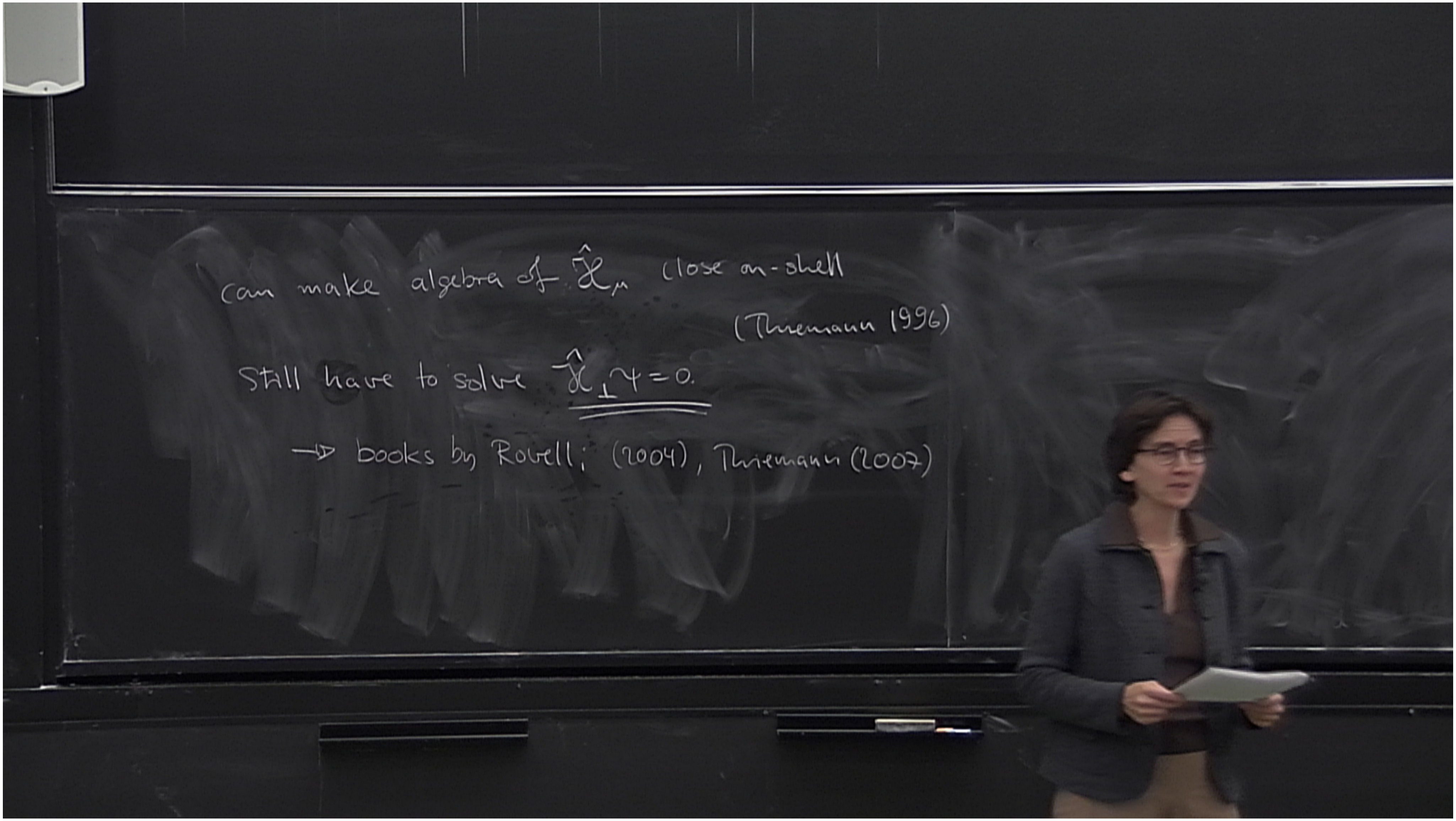
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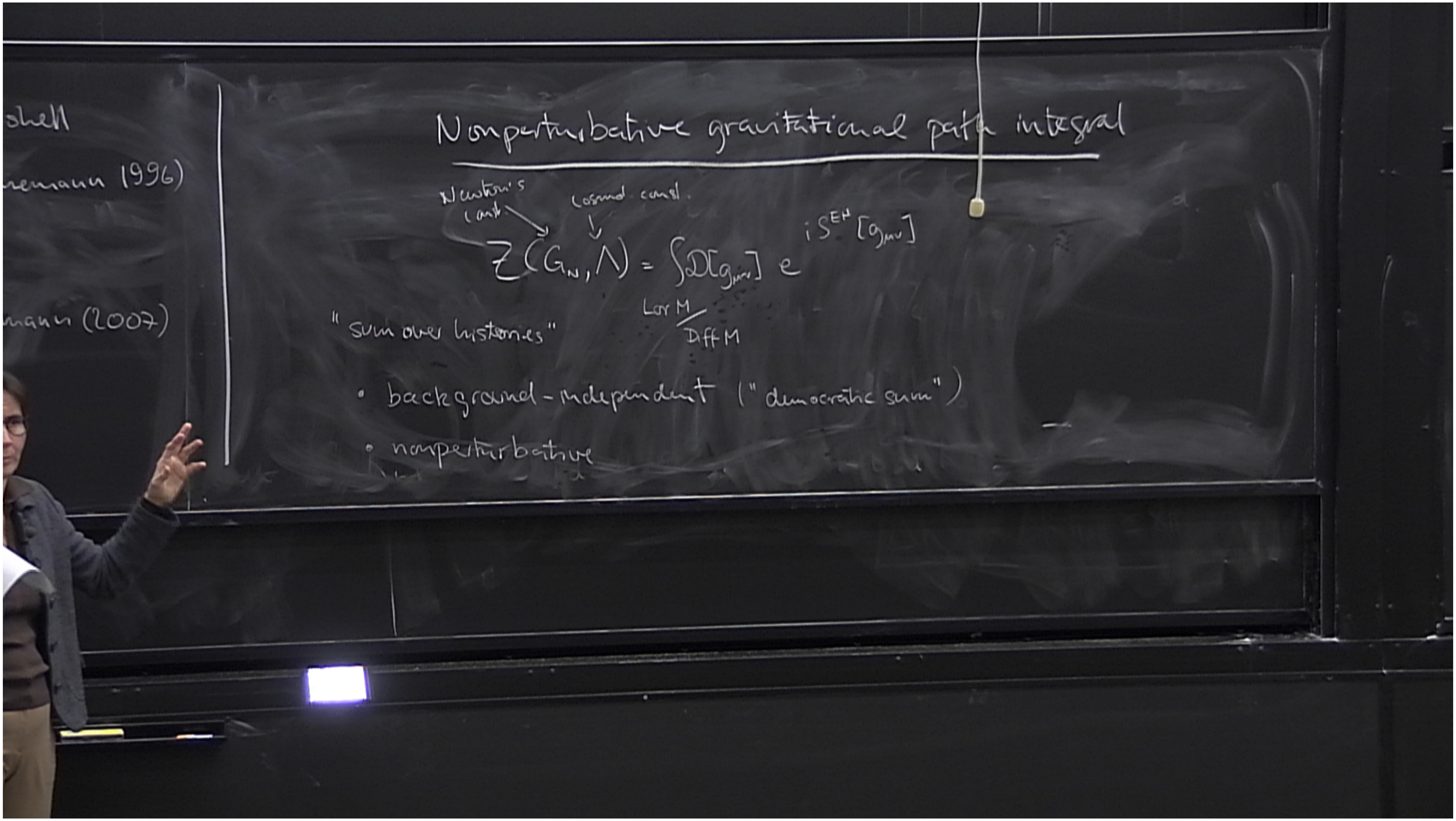
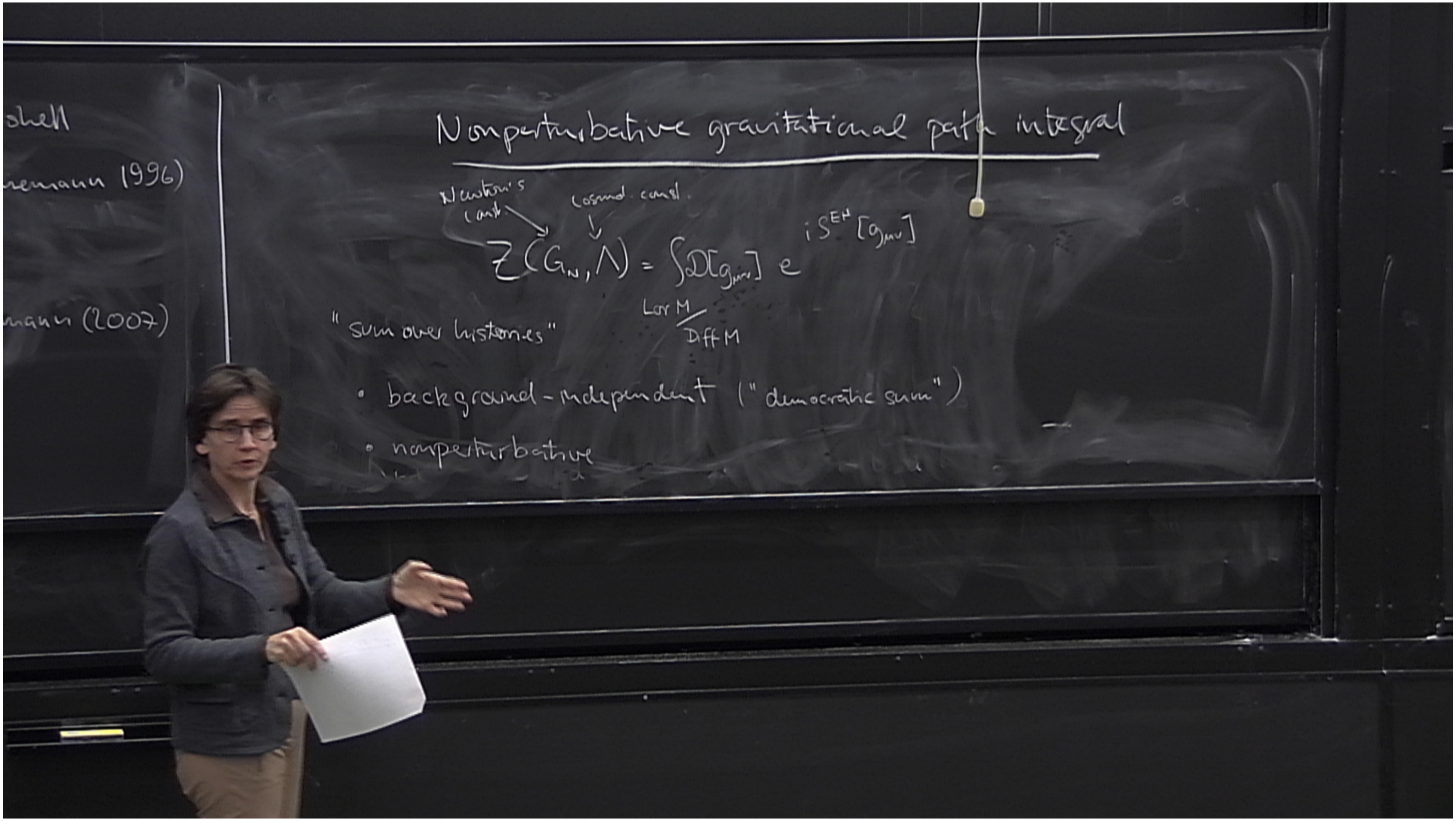

Nonperturbative gravitational path integral
Newton's const
cosmol. const
$Z(G_N, \Lambda) = \int\limits_{\mathrm{Lor}\,M / \mathrm{Diff}\,M} \mathcal{D}[g_{\mu\nu}]\, e^{iS^{EH}[g_{\mu\nu}]}$
"sum over histories"
• background-independent ("democratic sum")
• nonperturbative
shell
…emann (1996)
…mann (2007)


Nonperturbative gravitational path integral
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Lor M / Diff M
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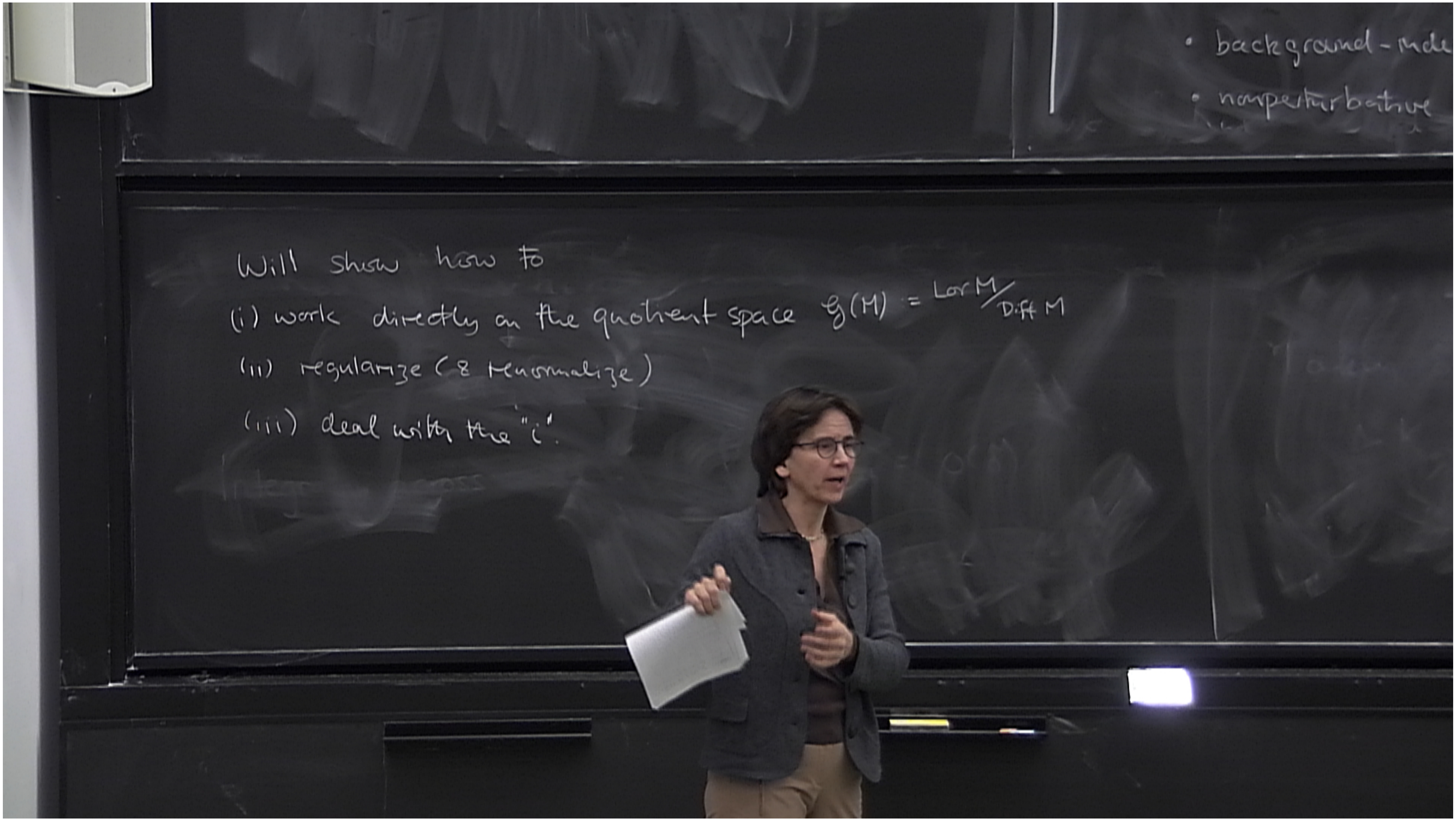
• nonperturbative
Will show how to
(i) work directly on the quotient space $\mathcal{G}(M) = \text{Lor}\,M / \text{Diff}\,M$
(ii) regularize (& renormalize)
(iii) deal with the "i".

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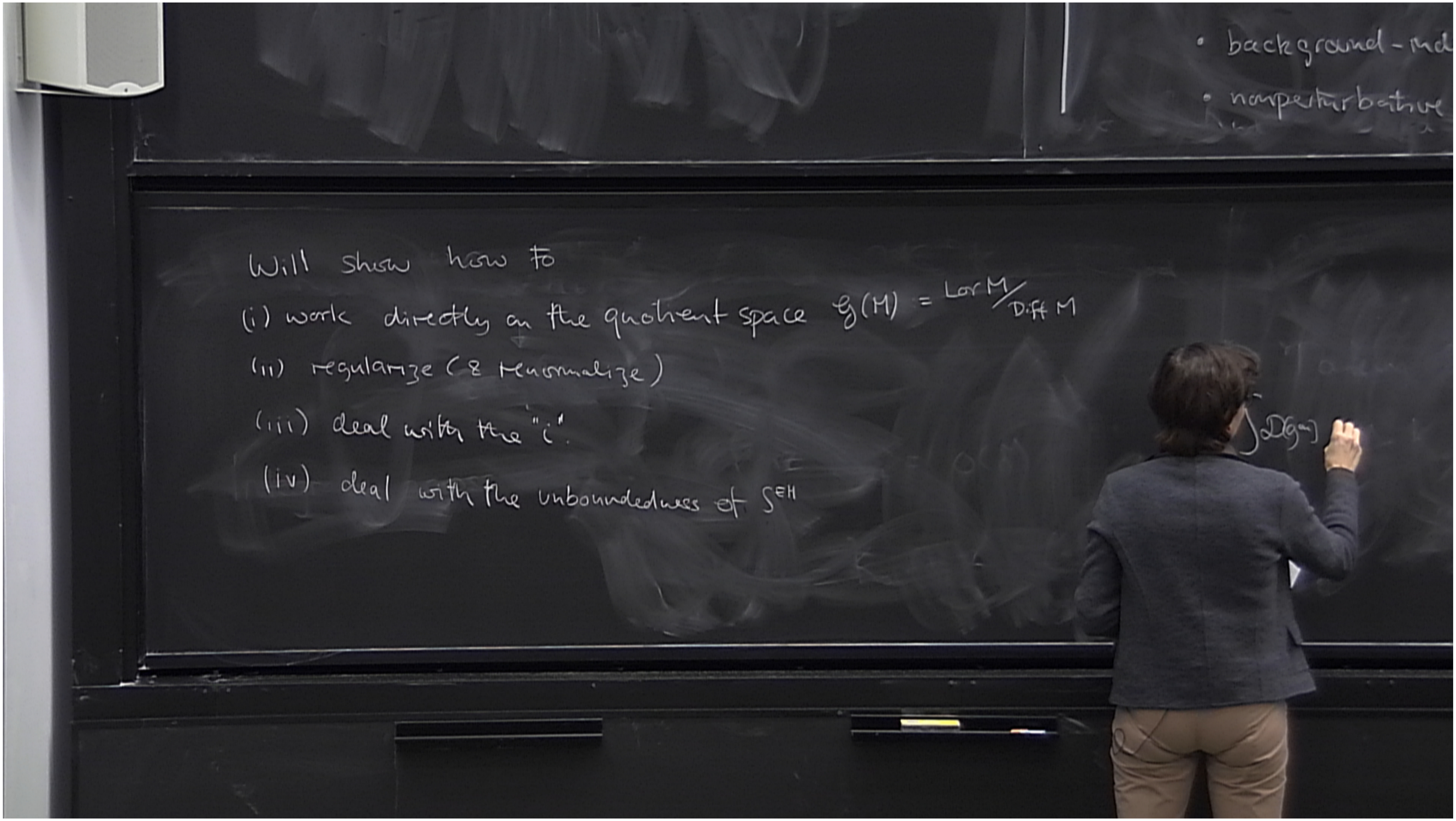
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(i) work directly on the quotient space G(M) = Lor M / Diff M
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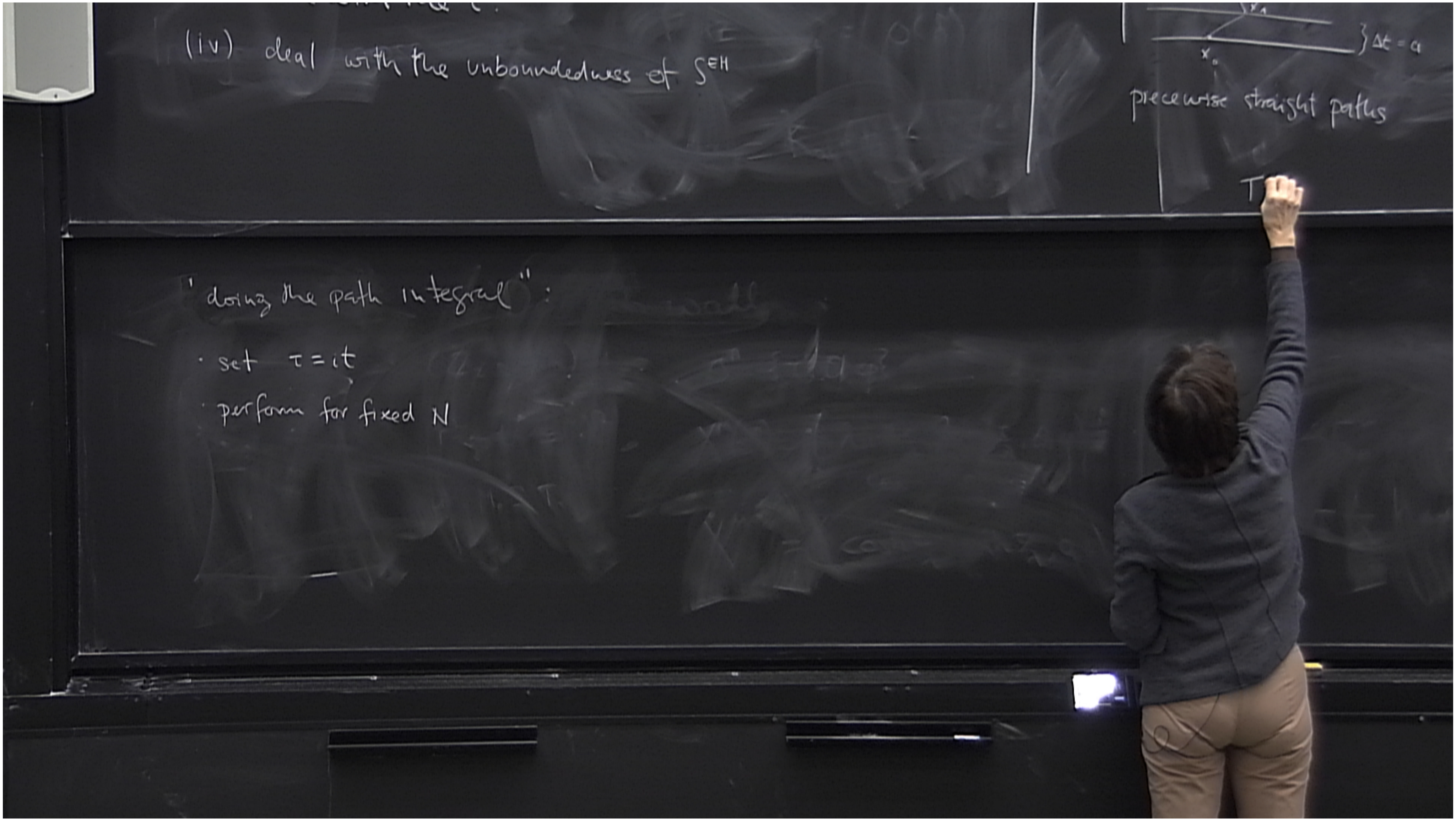
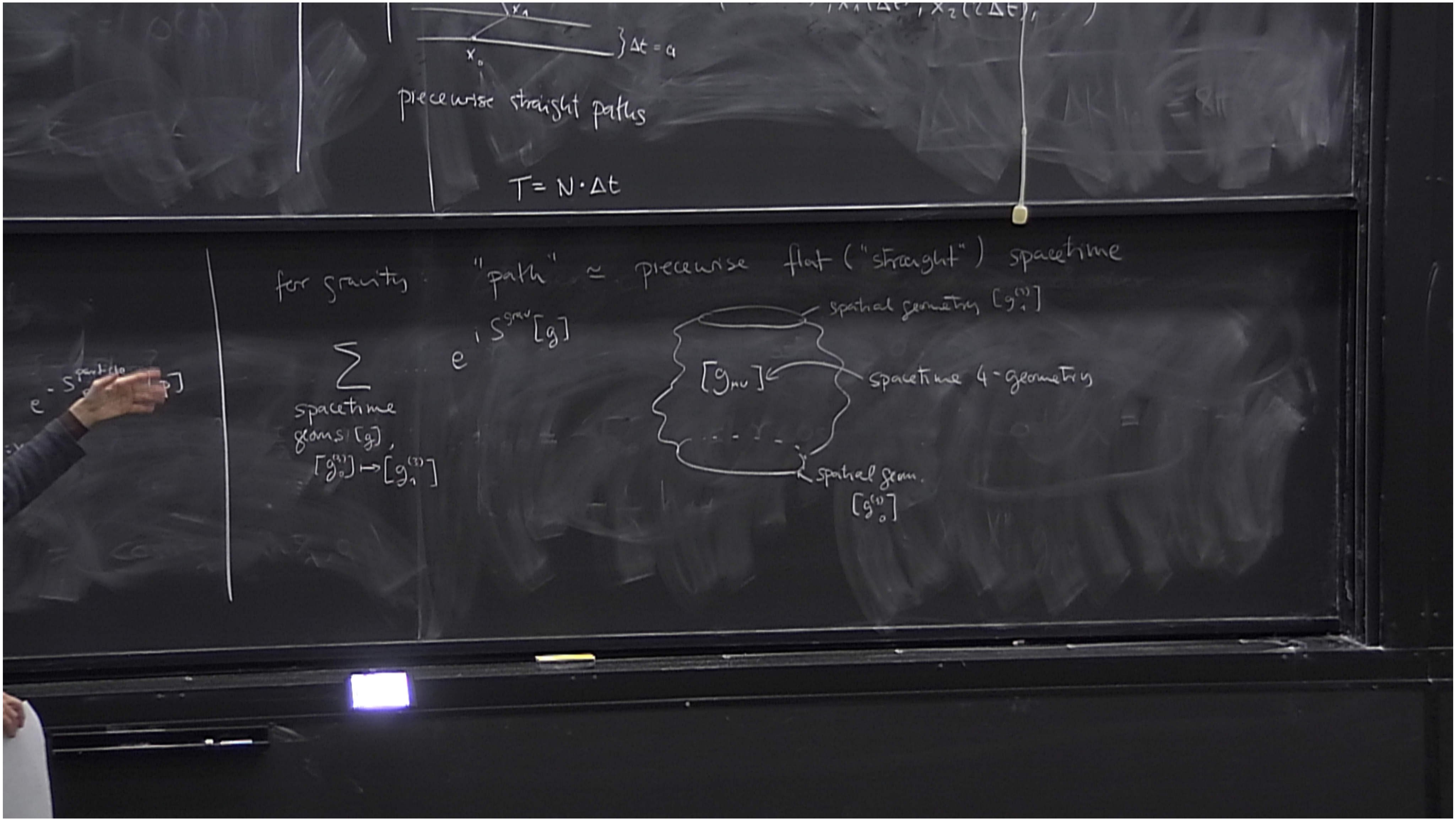
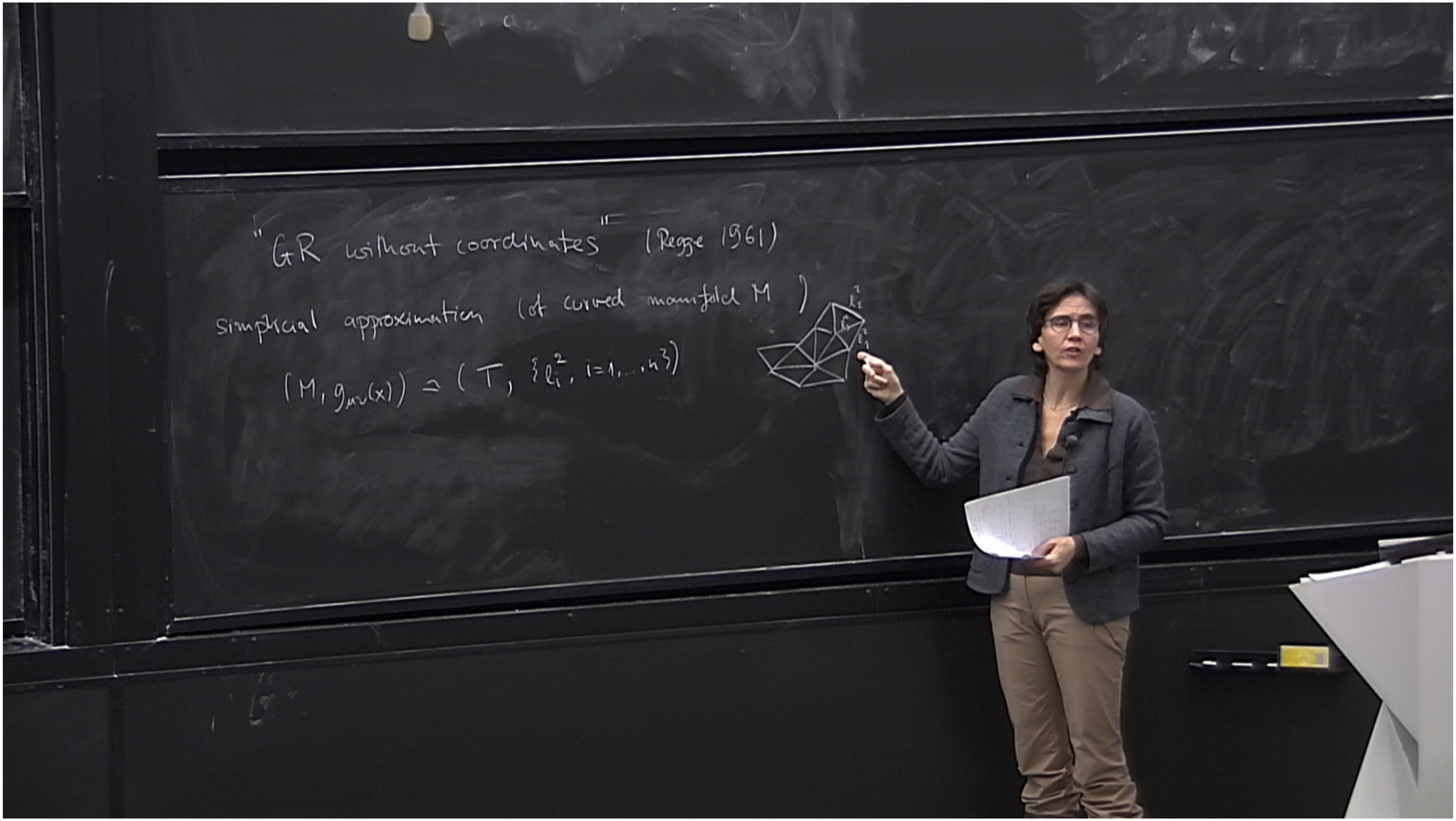
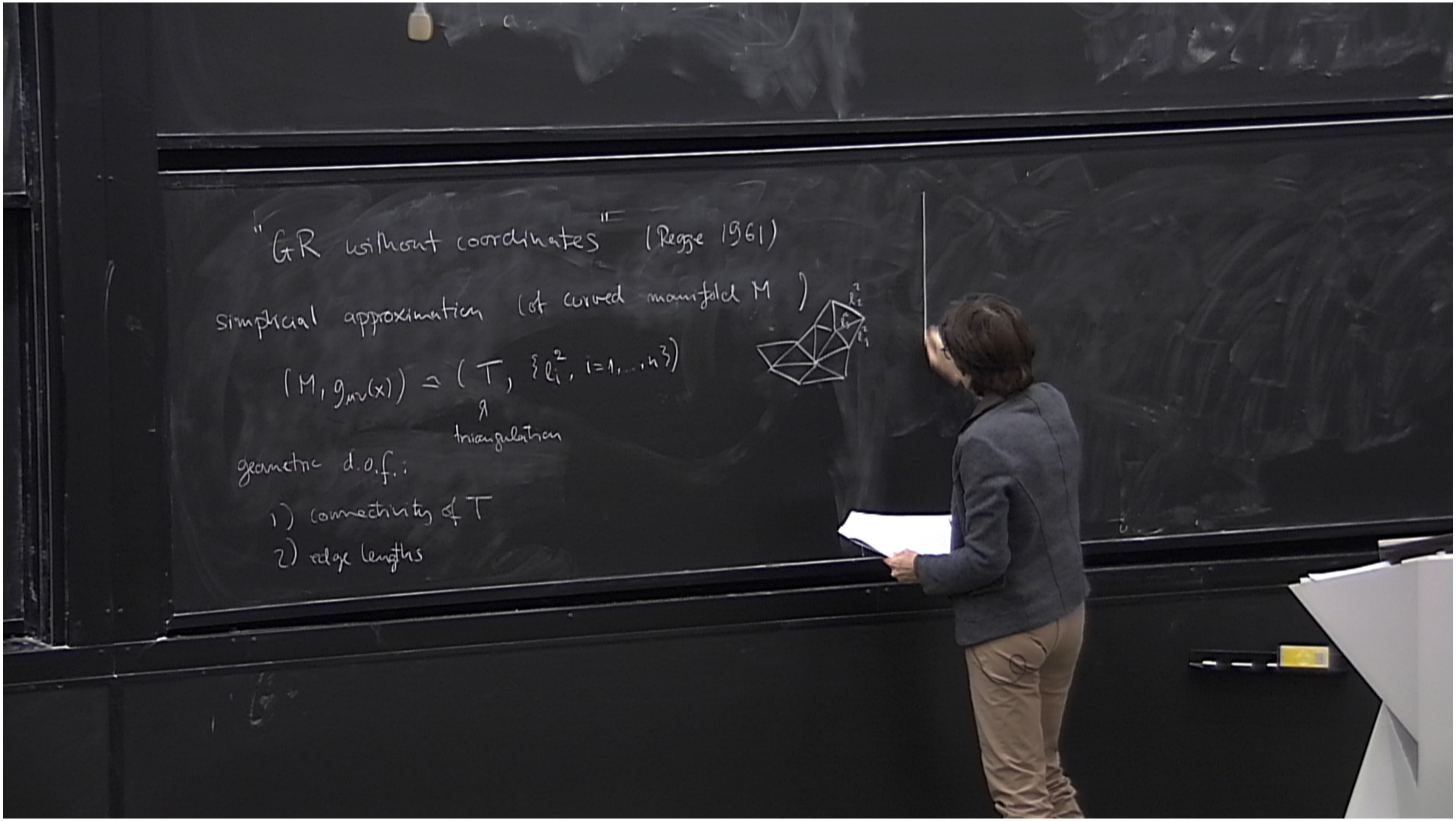
(iii) deal with the "i"
(iv) deal with the unboundedness of S^EH


(iv) deal with the unboundedness of S^{EH}
x_1
x_0
$\} \Delta t = a$
piecewise straight paths
T
"doing the path integral":
· set $\tau = it$
· perform for fixed N



x_0
$\} \Delta t = a$
piecewise straight paths
$T = N \cdot \Delta t$
for gravity "path" ≃ piecewise flat ("straight") spacetime
$\sum_{\text{spacetime geoms. } [g], \; [g_0^{(3)}] \mapsto [g_1^{(3)}]} e^{i S^{grav}[g]}$
spatial geometry $[g_1^{(3)}]$
$[g_{\mu\nu}]$
spacetime 4-geometry
spatial geom. $[g_0^{(3)}]$


"GR without coordinates" (Regge 1961)
simplicial approximation (of curved manifold M)
$(M, g_{\mu\nu}(x)) \simeq (T, \{l_i^2, i=1,\dots,n\})$


"GR without coordinates" (Regge 1961)
simplicial approximation (of curved manifold M)
(M, g_μν(x)) ≃ (T, {l_i^2, i=1,...,n})
triangulation
geometric d.o.f.:
1) connectivity of T
2) edge lengths