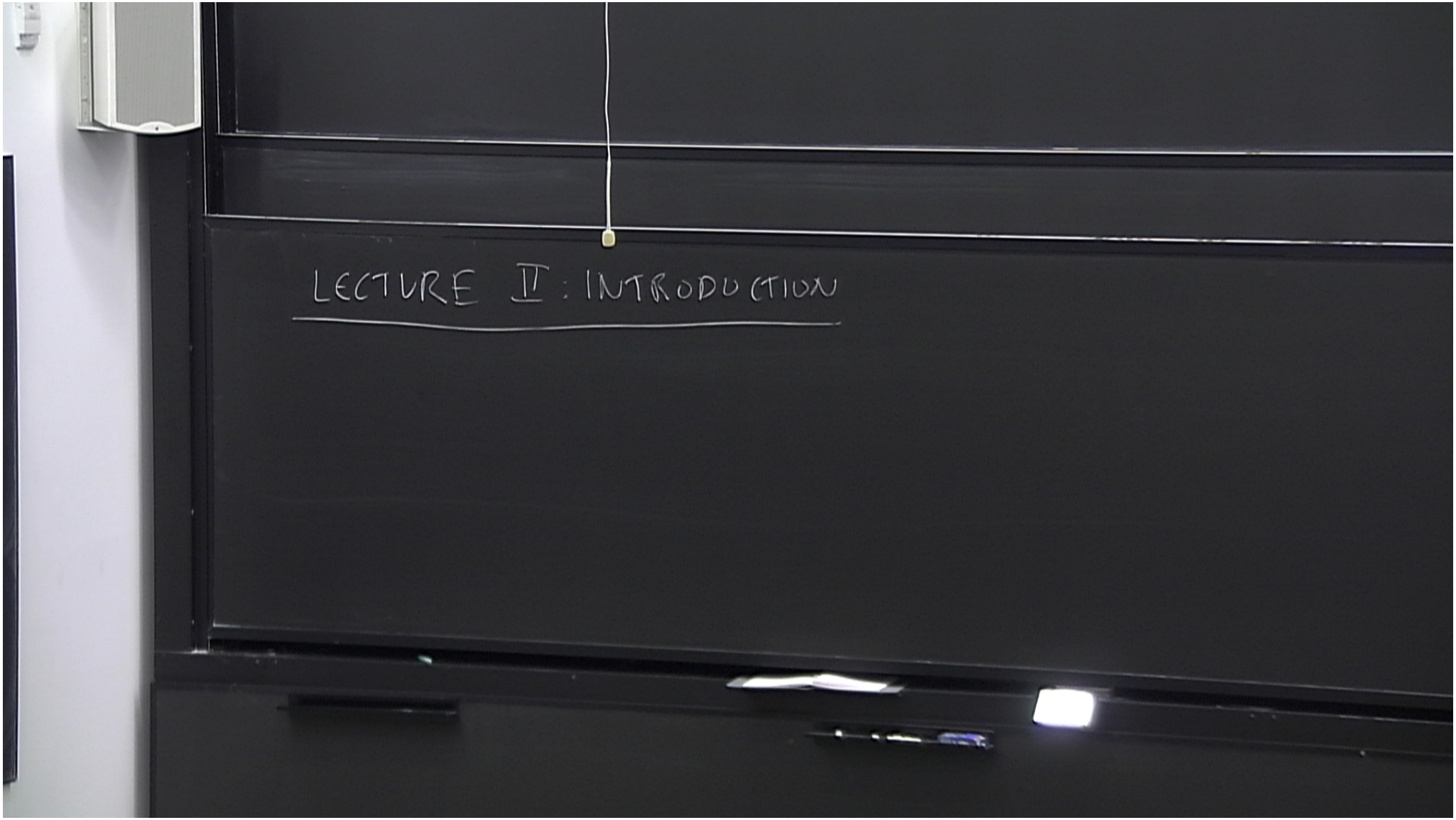
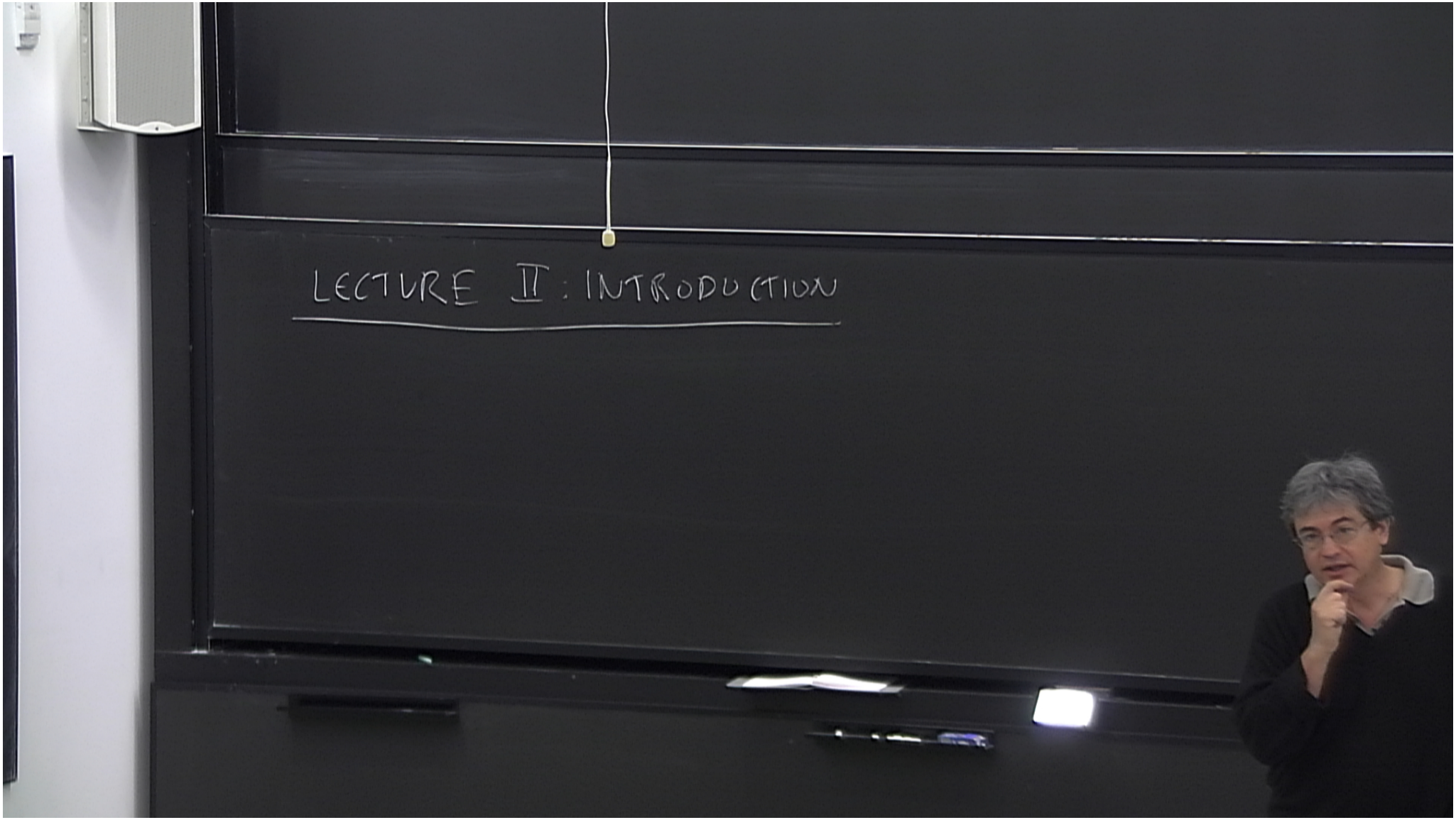
Title: Explorations in Quantum Gravity - Lecture 2

Date: Apr 03, 2012 10:15 AM

URL: http://pirsa.org/12040020

Abstract:


LECTURE II: INTRODUCTION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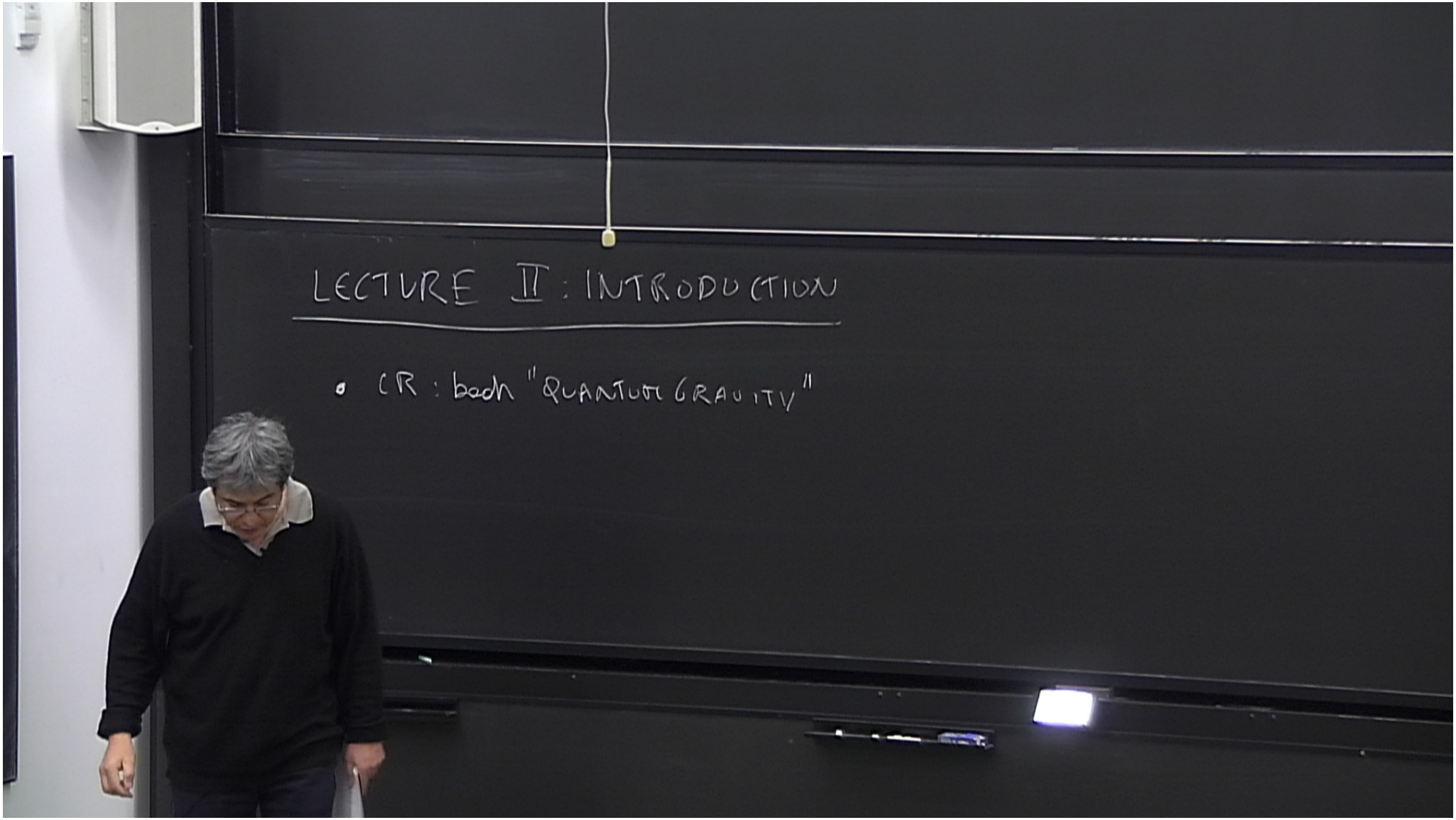
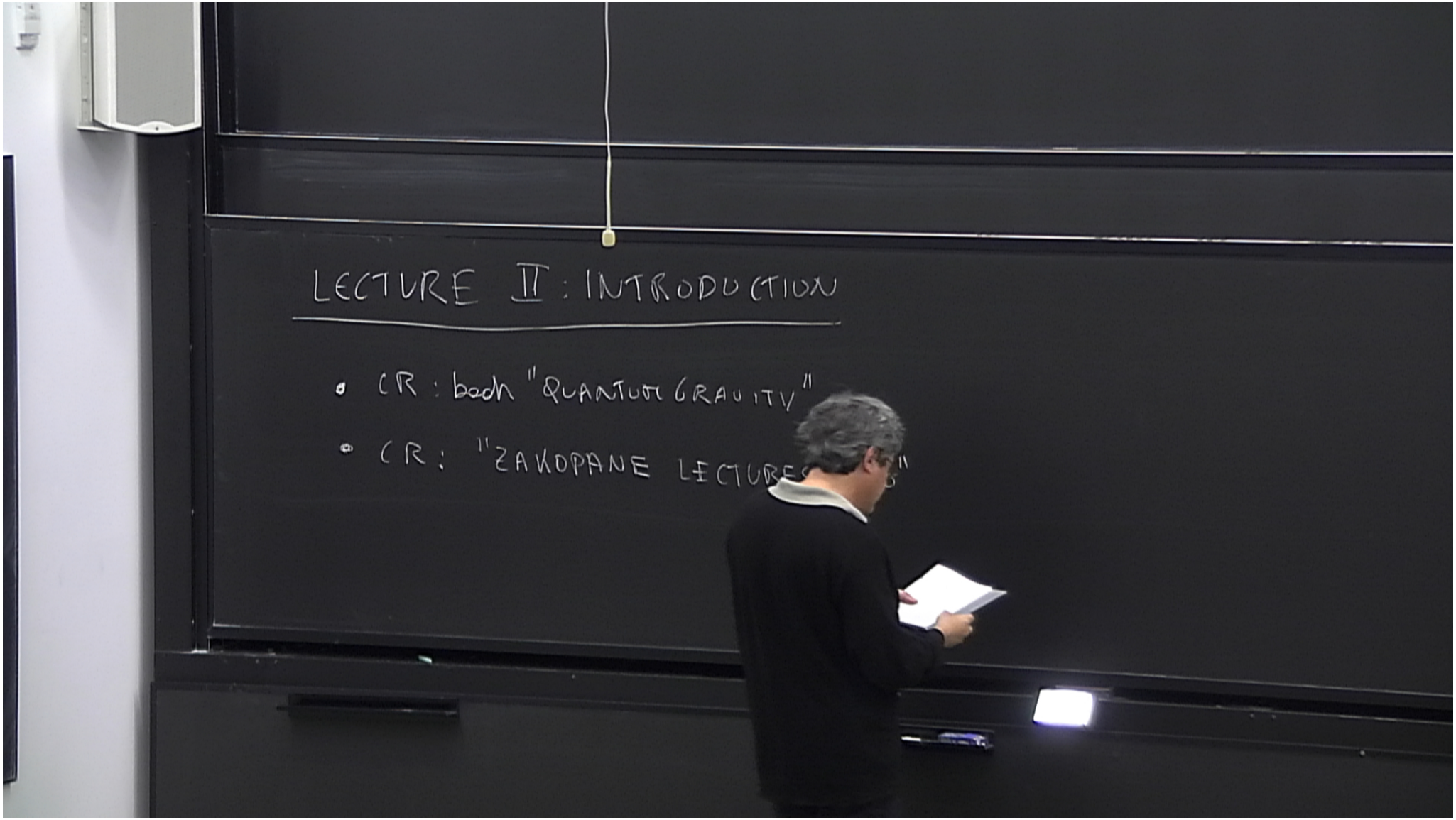
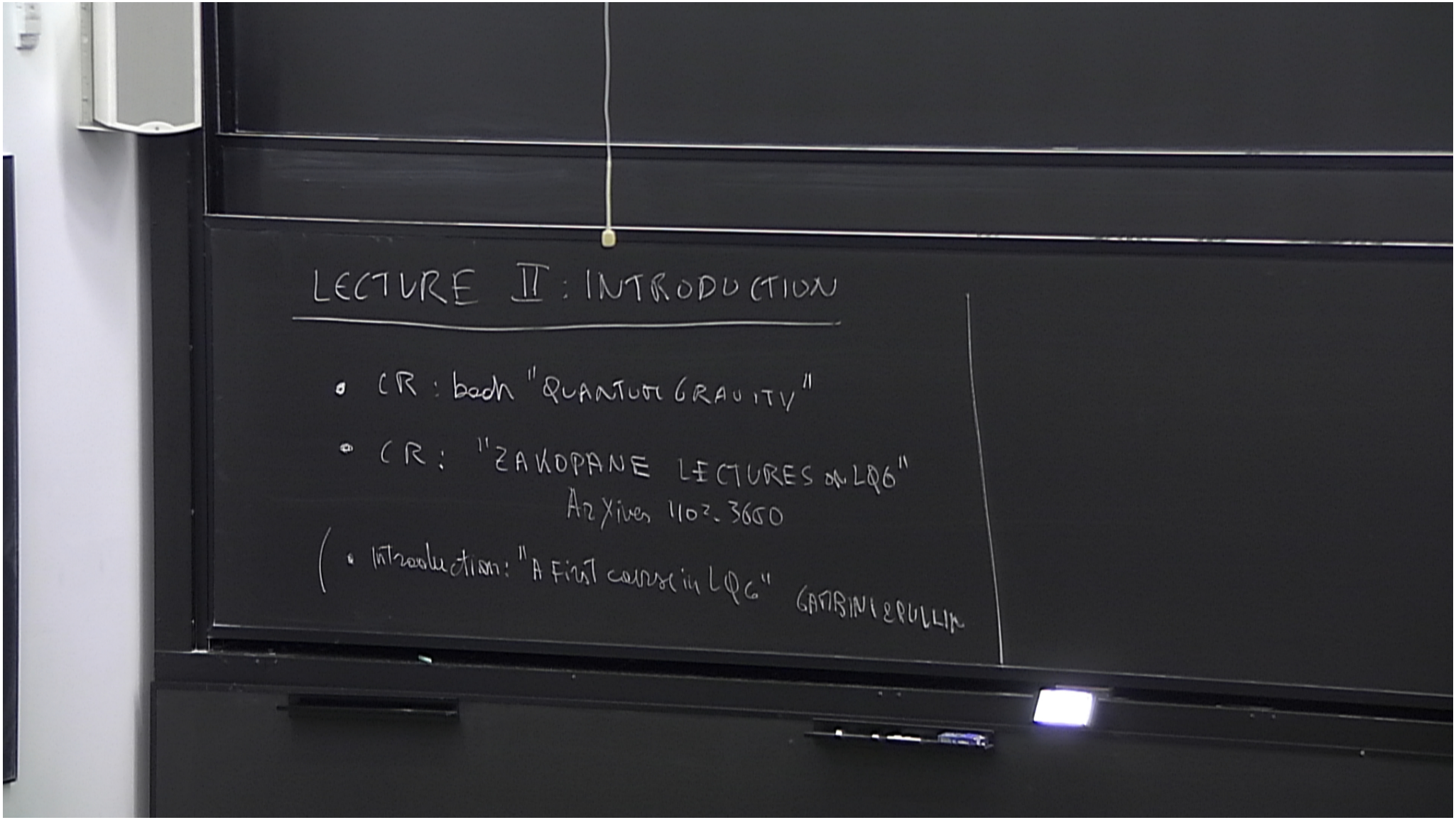
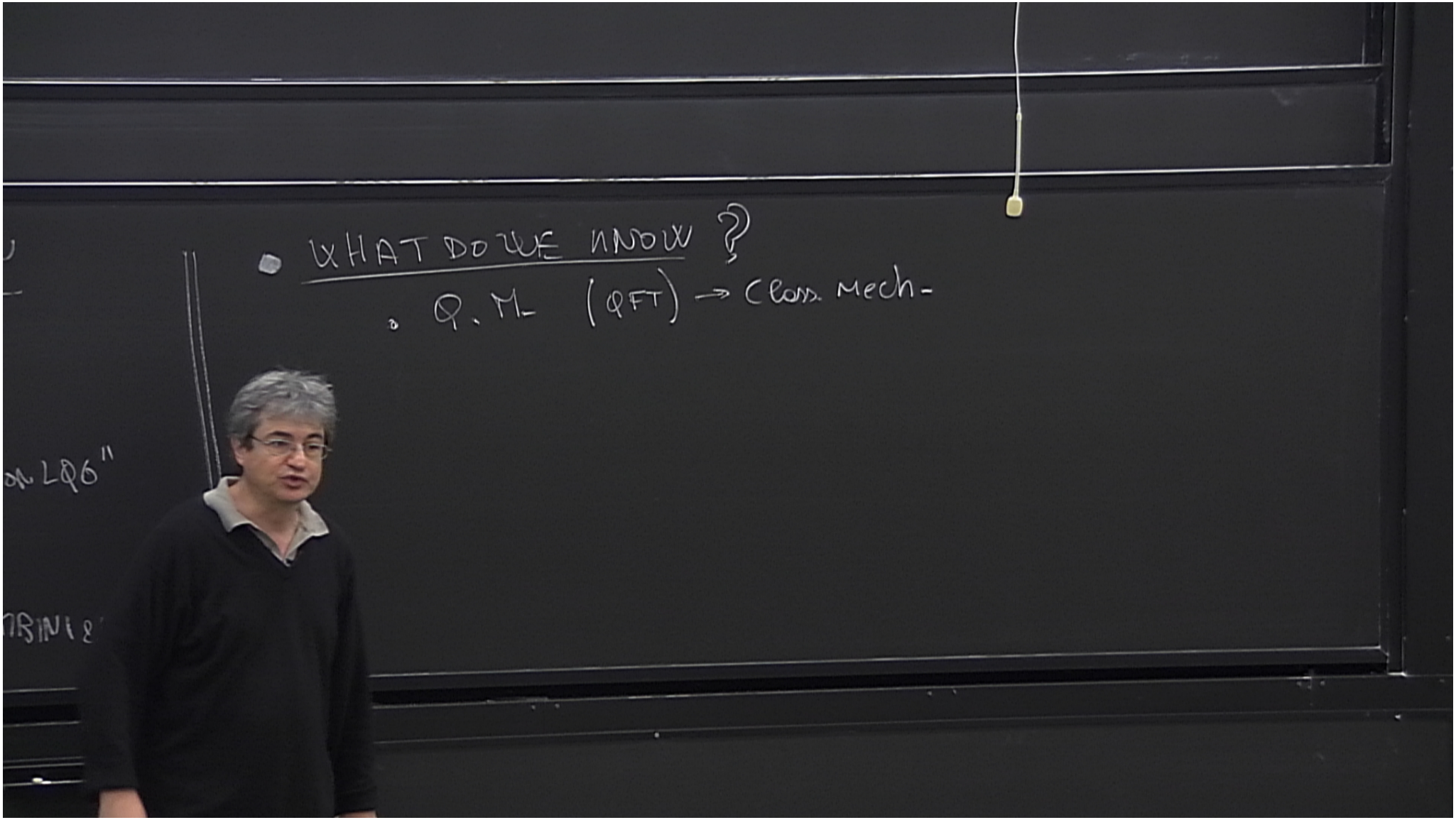
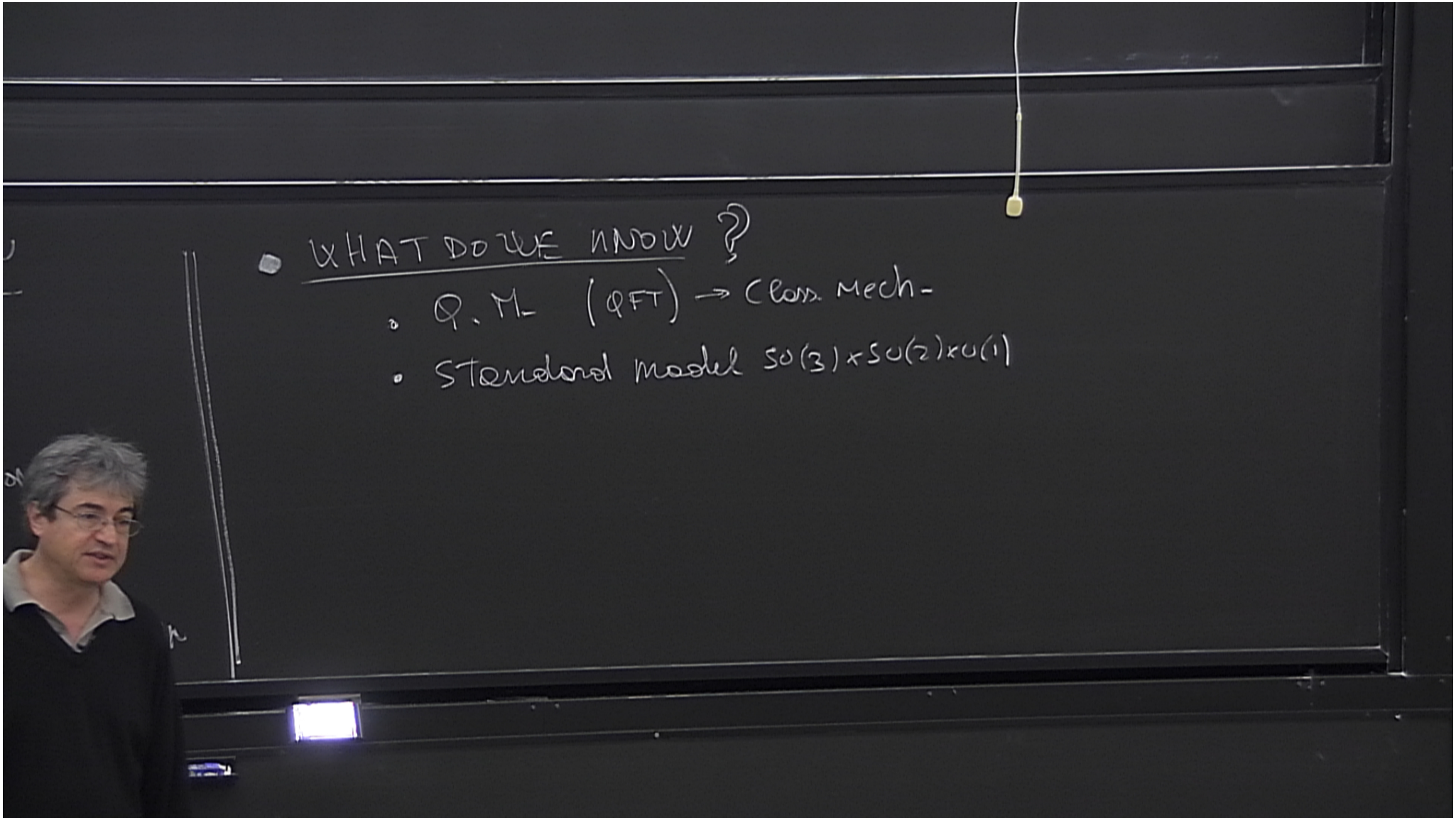

LECTURE II: INTRODUCTION
• CR: book "QUANTUM GRAVITY"


LECTURE II: INTRODUCTION
CR: book "QUANTUM GRAVITY"
CR: "ZAKOPANE LECTURES"


LECTURE II : INTRODUCTION
• CR : book "QUANTUM GRAVITY"
• CR : "ZAKOPANE LECTURES on LQG"
ArXiv 1102.3660
• Introduction : "A First course in LQG" GAMBINI & PULLIN


WHAT DO WE KNOW ?
. Q. M. (QFT) → Class. Mech.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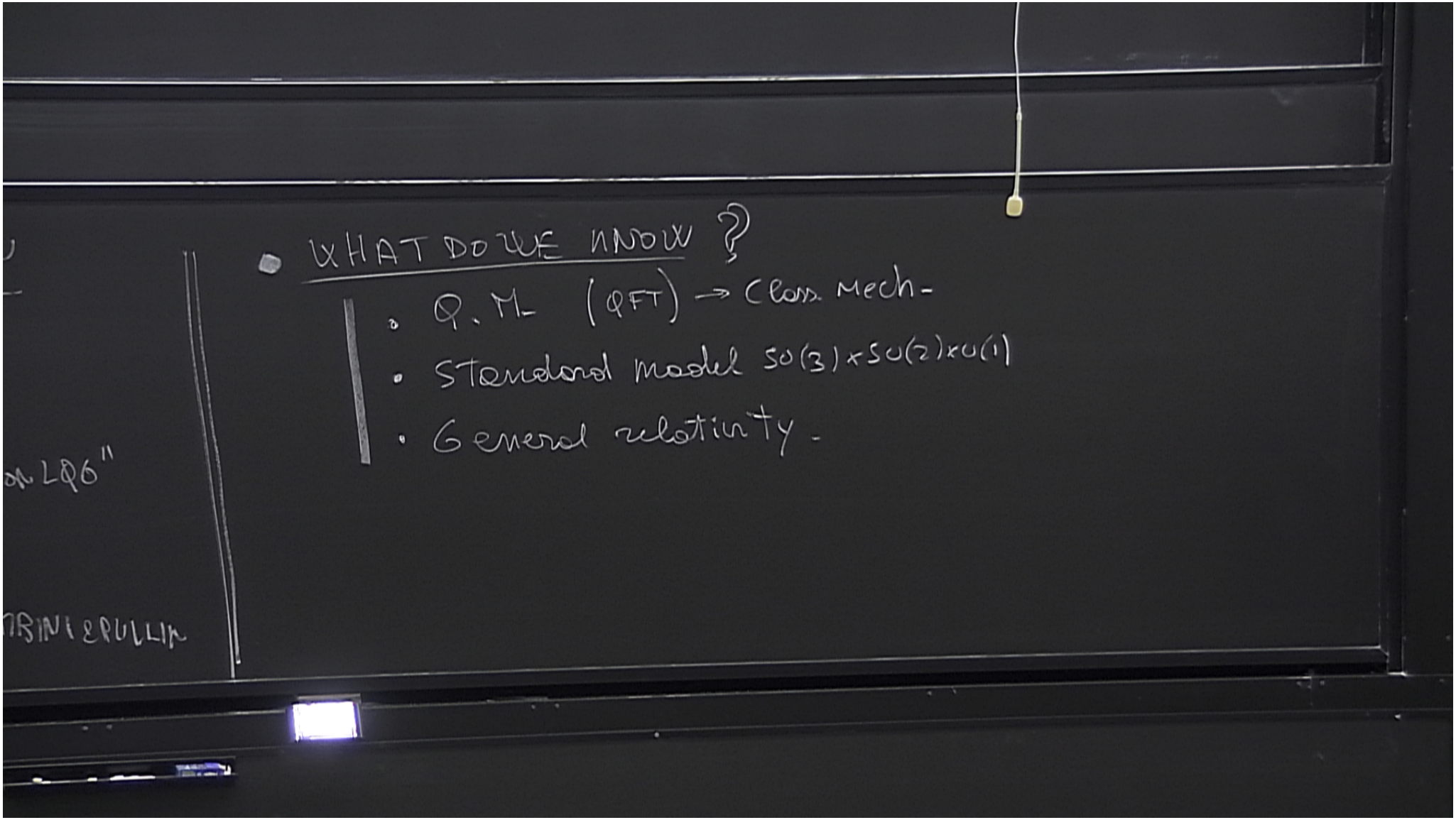
Standard model SU(3)×SU(2)×U(1)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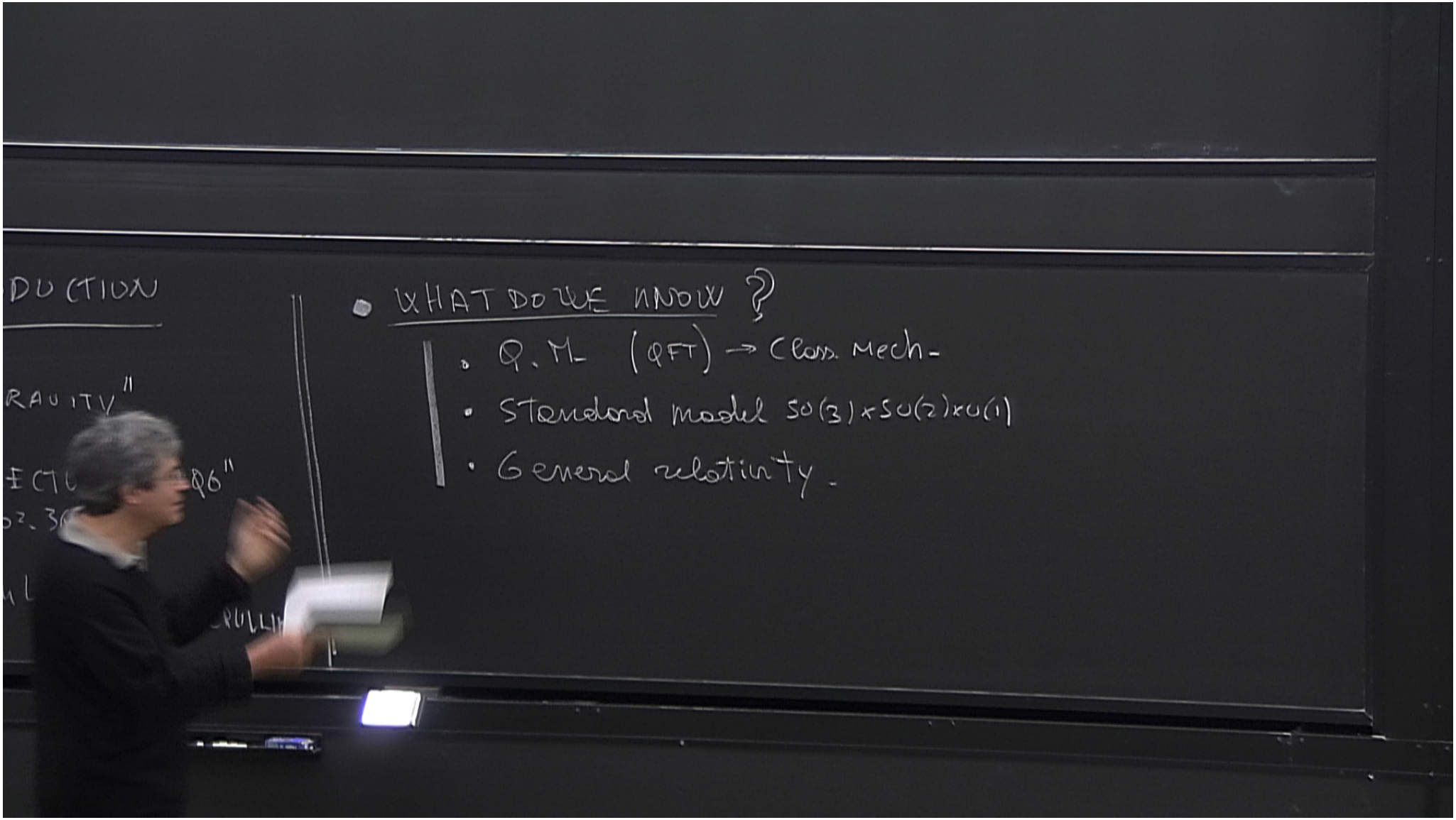
. Standard model SU(3)×SU(2)×U(1)
. General relativity.


DUCTION
RAUITY"
ECTU
Q6"
WHAT DO WE KNOW ?
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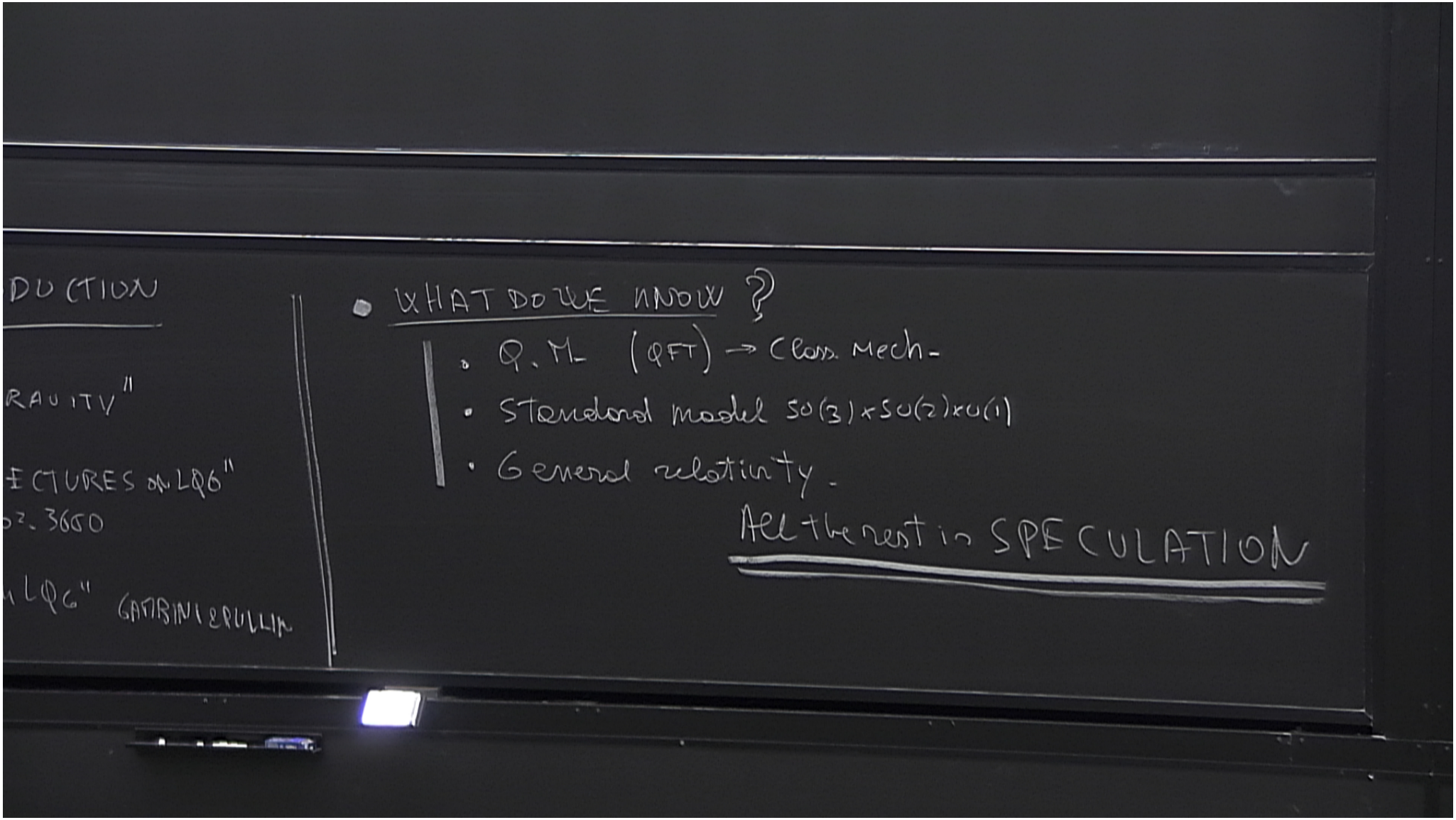
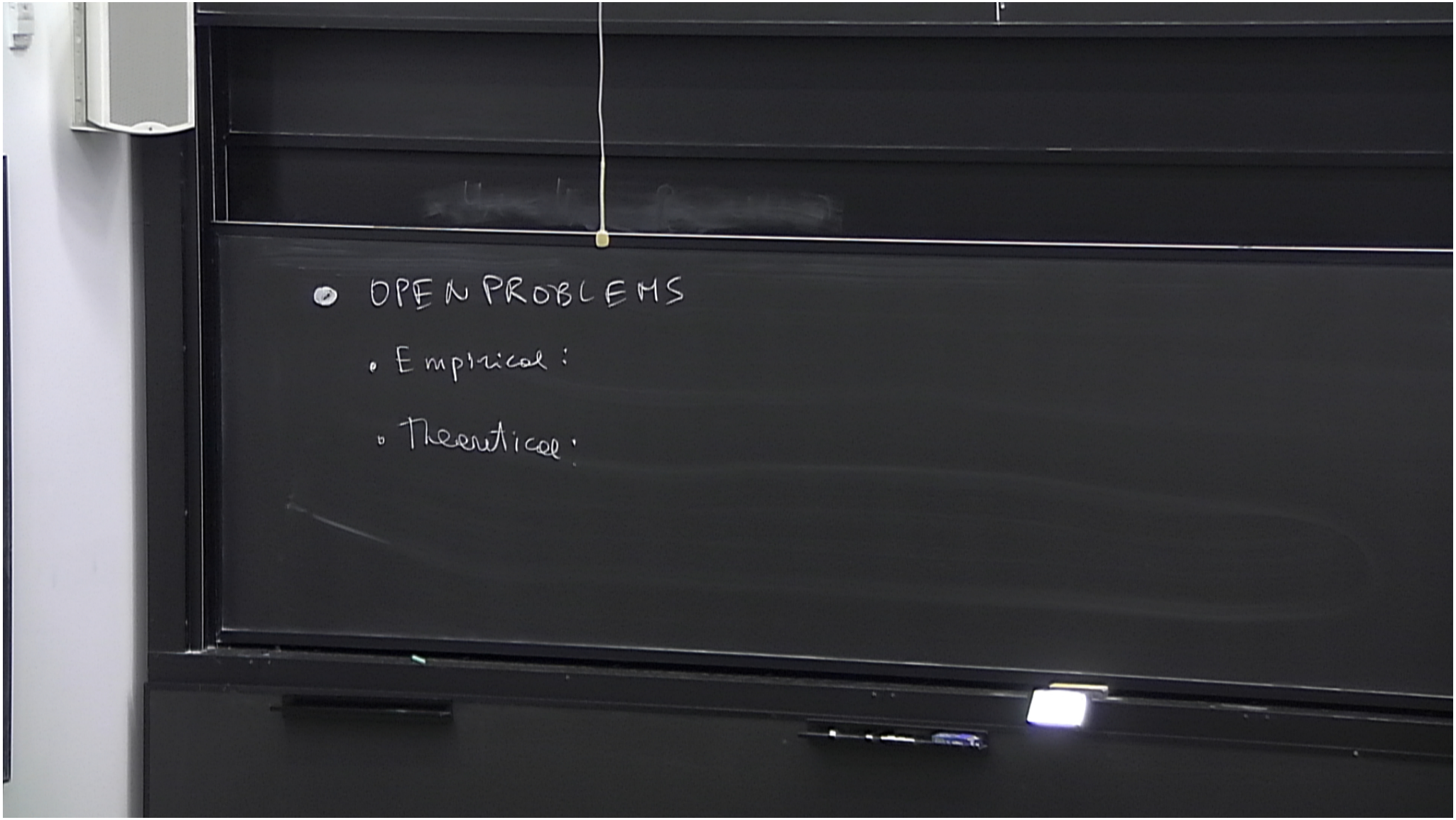
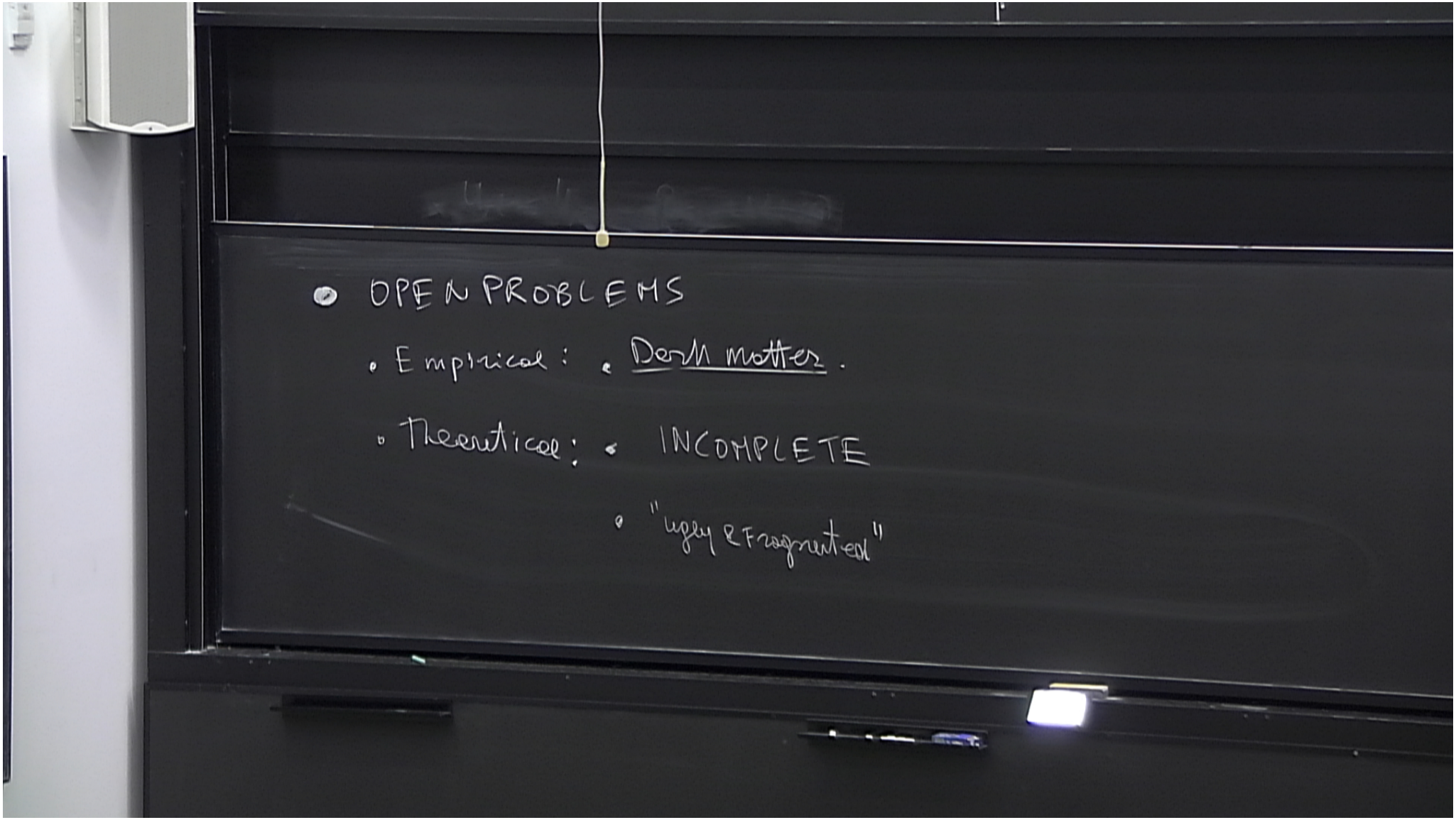
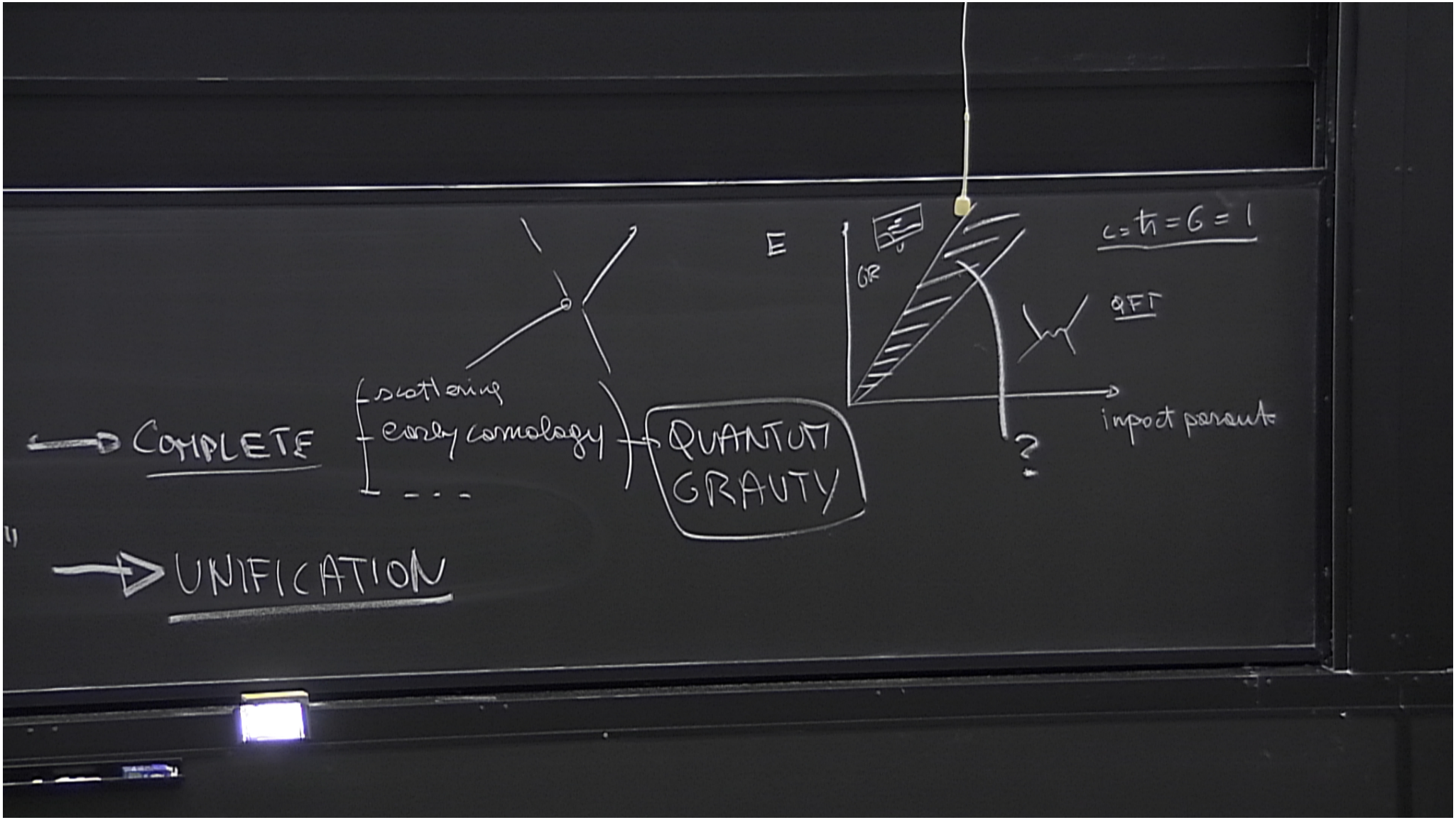
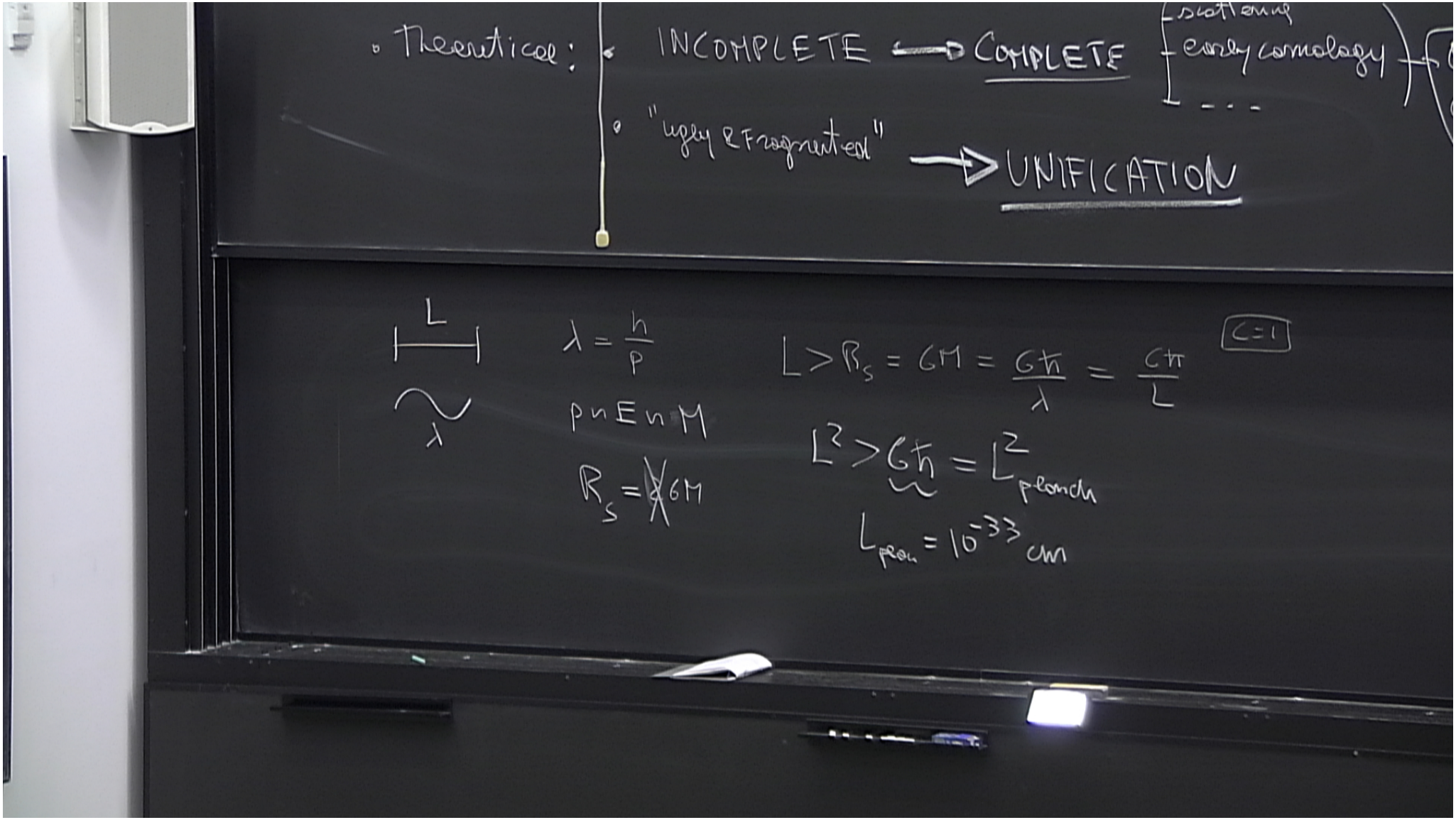
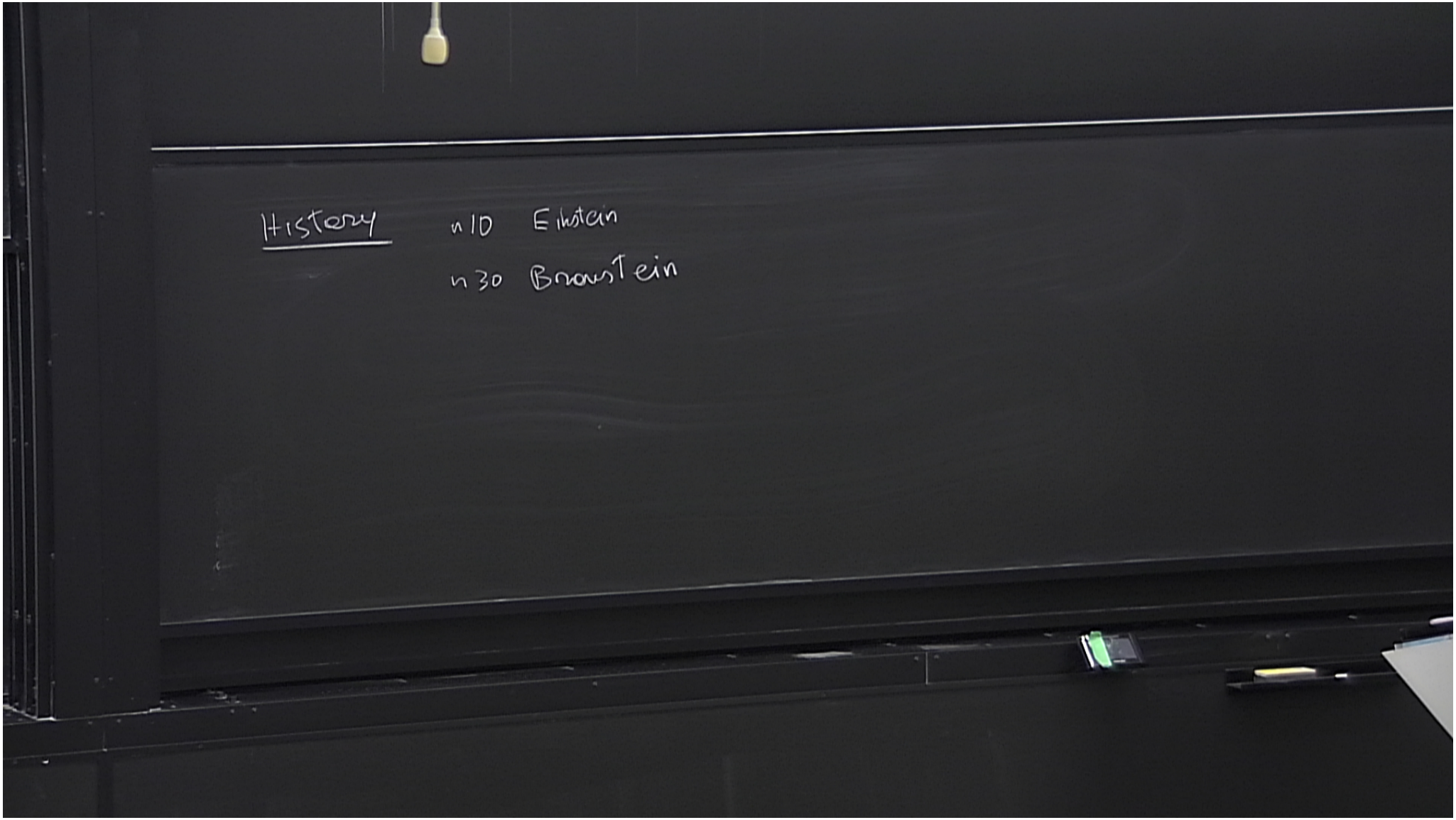

DUCTION
RAUITY"
ECTURES ON LQG"
2. 3650
LQG" GAMBINI & PULLIN
• WHAT DO WE KNOW ?
• Q. M. (QFT) → Class. Mech.
• Standard model SU(3)×SU(2)×U(1)
• General relativity.
All the rest is SPECULATION


OPEN PROBLEMS
Empirical:
Theoretical:


OPEN PROBLEMS
Empirical: Dark matter.
Theoretical: INCOMPLETE
"ugly & fragmented"


E
GR
QFT
$c = \hbar = G = 1$
impact parameter
?
scattering
early cosmology
...
QUANTUM GRAVITY
COMPLETE
UNIFICATION


Theoretical:
INCOMPLETE ⟶ COMPLETE
scattering
early cosmology
...
"highly fragmented"
⟶ UNIFICATION
L
λ
λ = h/p
pnEnM
R_s = GM
L > R_s = GM = Għ/λ = Għ/L
C=1
L² > Għ = L²_Planck
L_Plan = 10⁻³³ cm

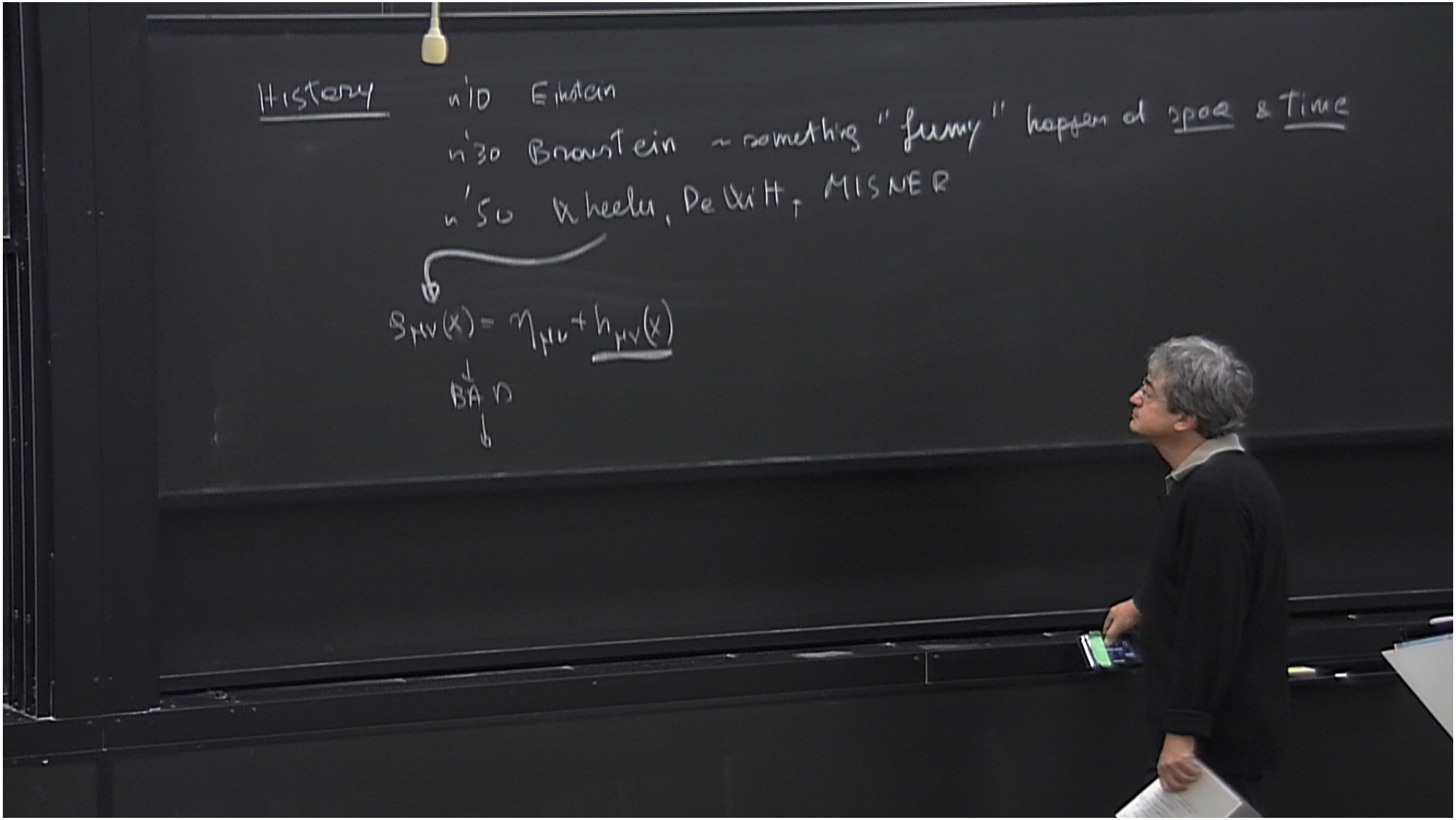

History
n 10 Einstein
n 30 Braunstein

History n'10 Einstein

n'30 Brownstein - something "funny" happen at space & time

n'50 Wheeler, DeWitt, MISNER

$g_{\mu\nu}(x) = \eta_{\mu\nu} + h_{\mu\nu}(x)$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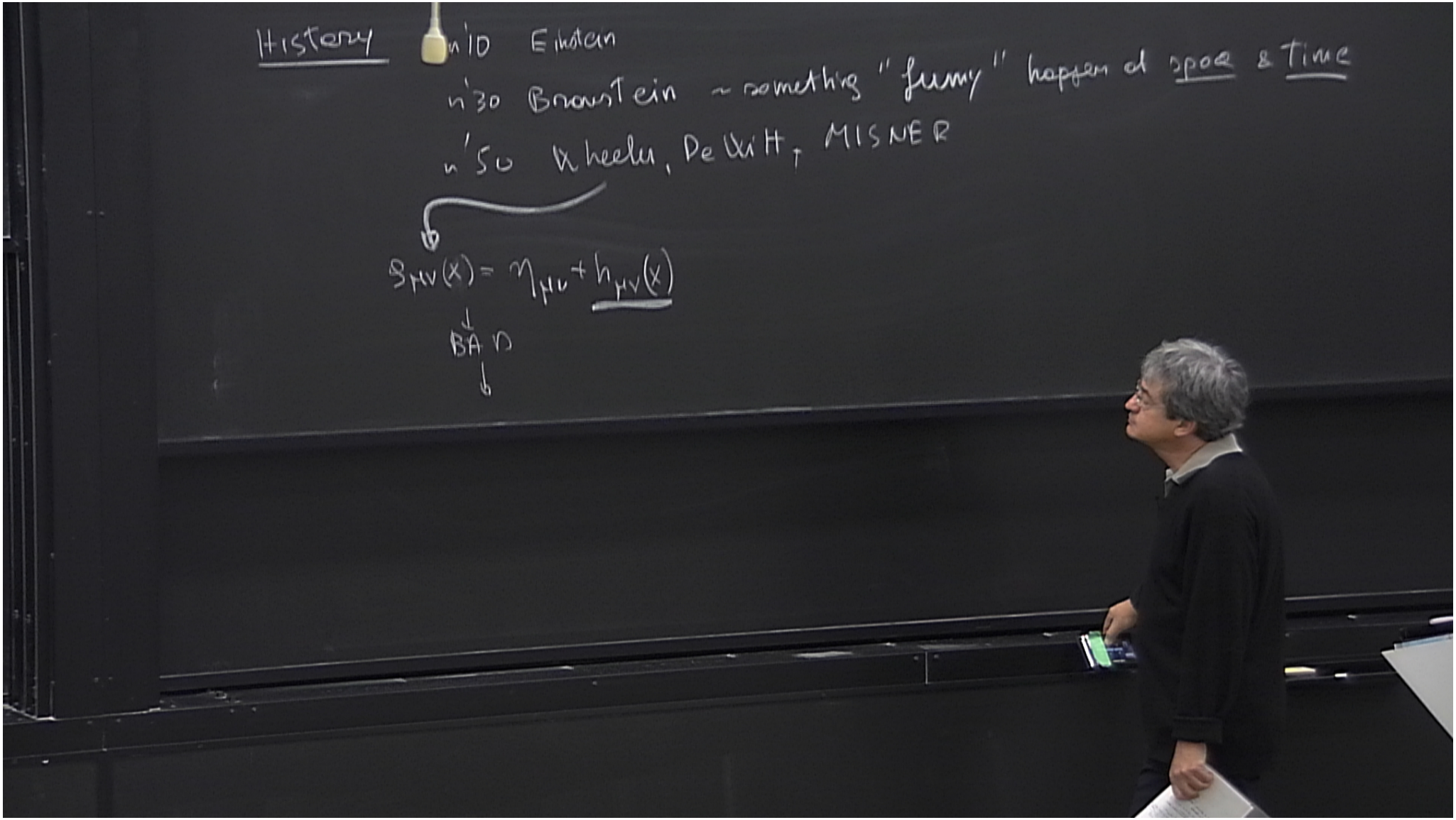
BAD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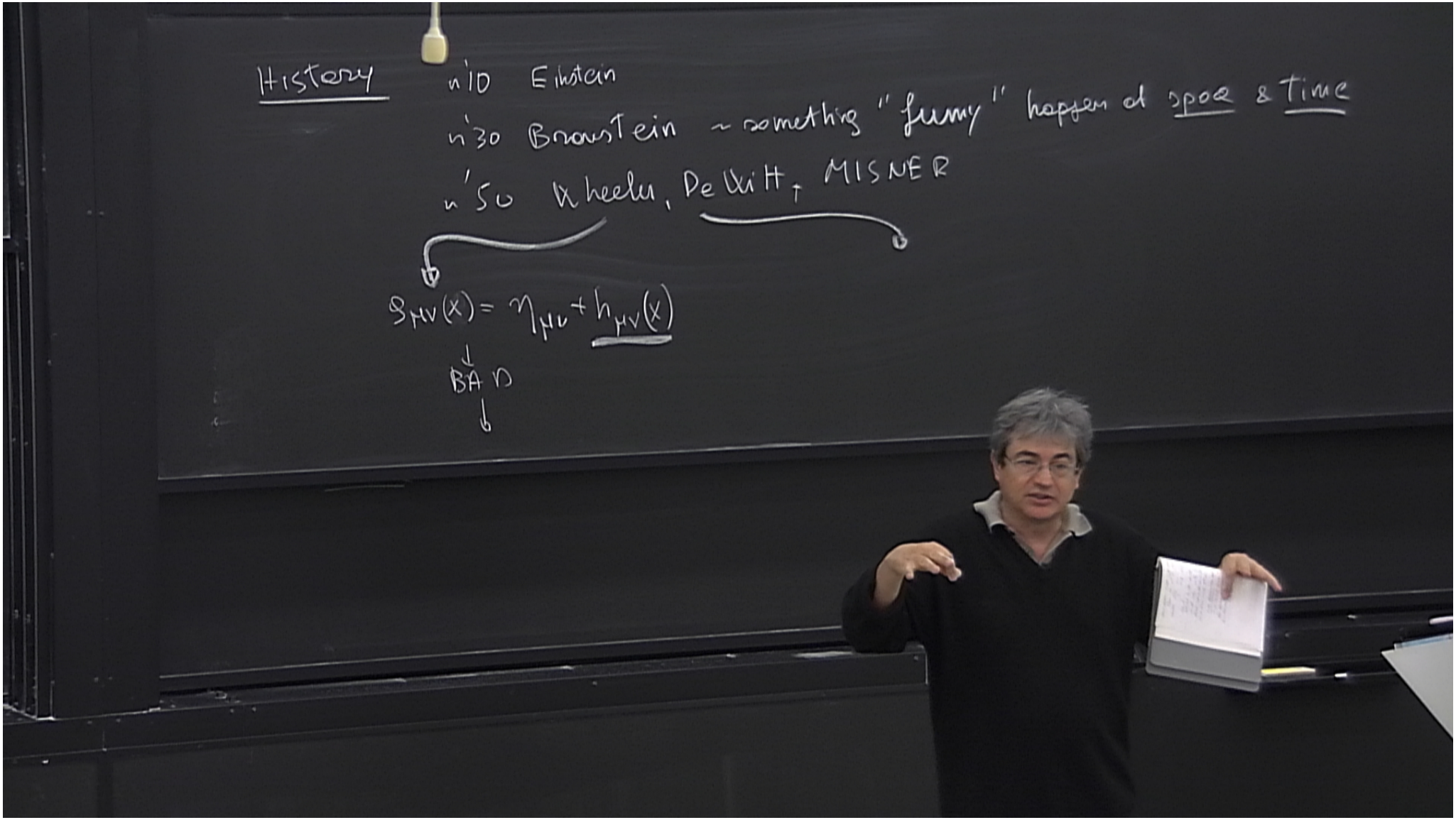
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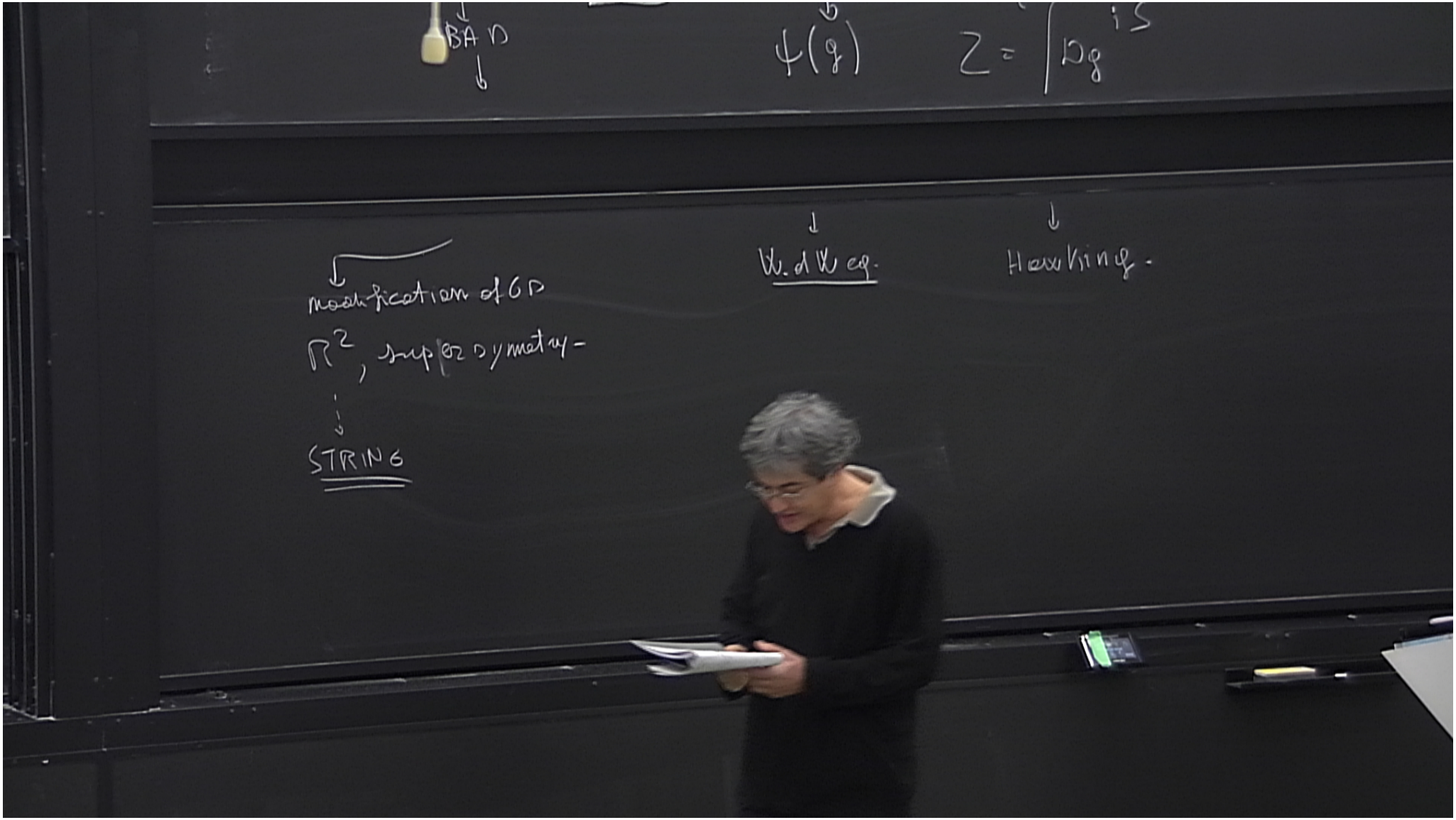
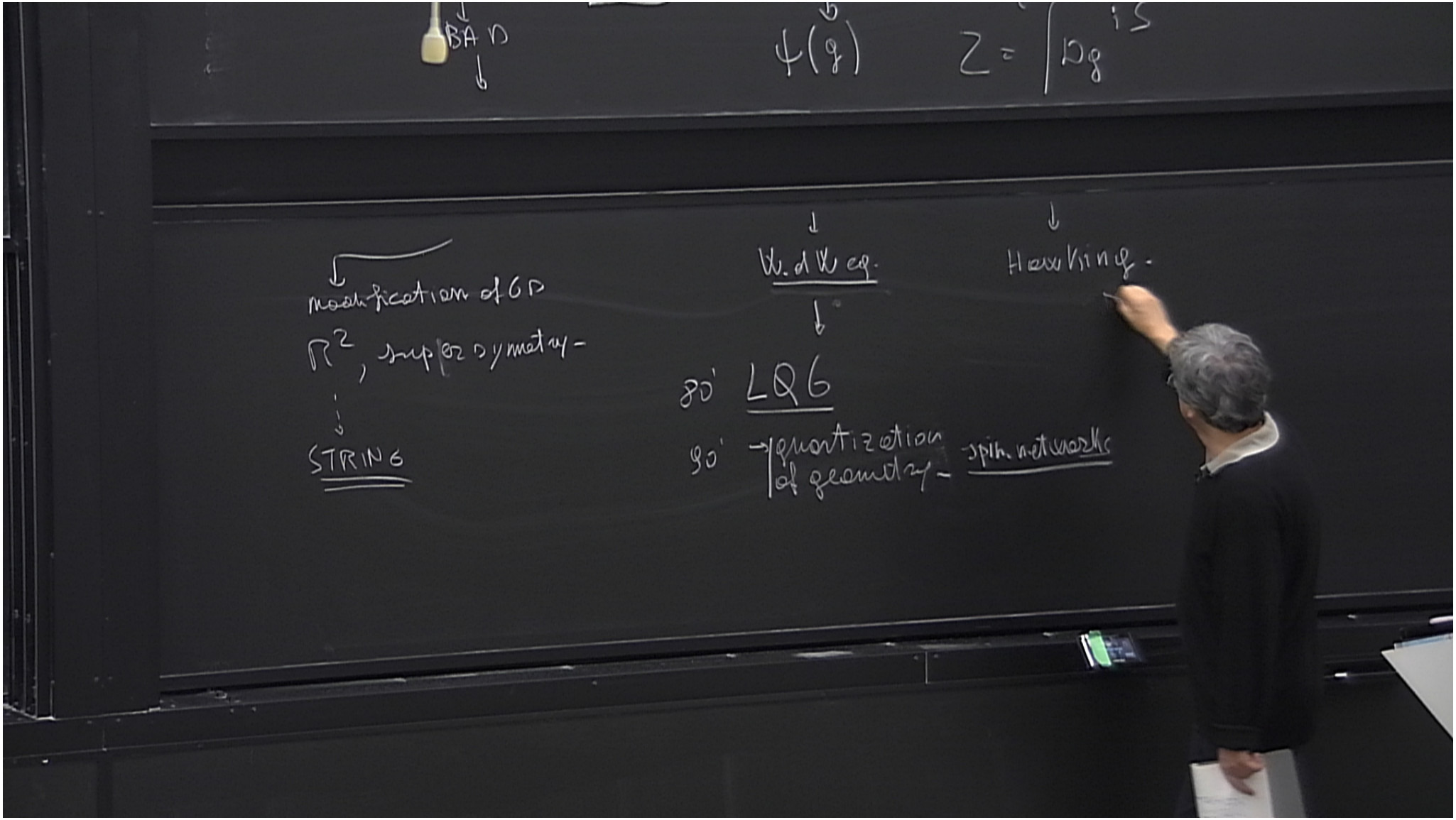

BA
ψ(g)
Z = ∫ Dg
is
modification of GR
R², supersymmetry
STRING
W. dW eq.
Hawking.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R², supersymmetry -
STRING
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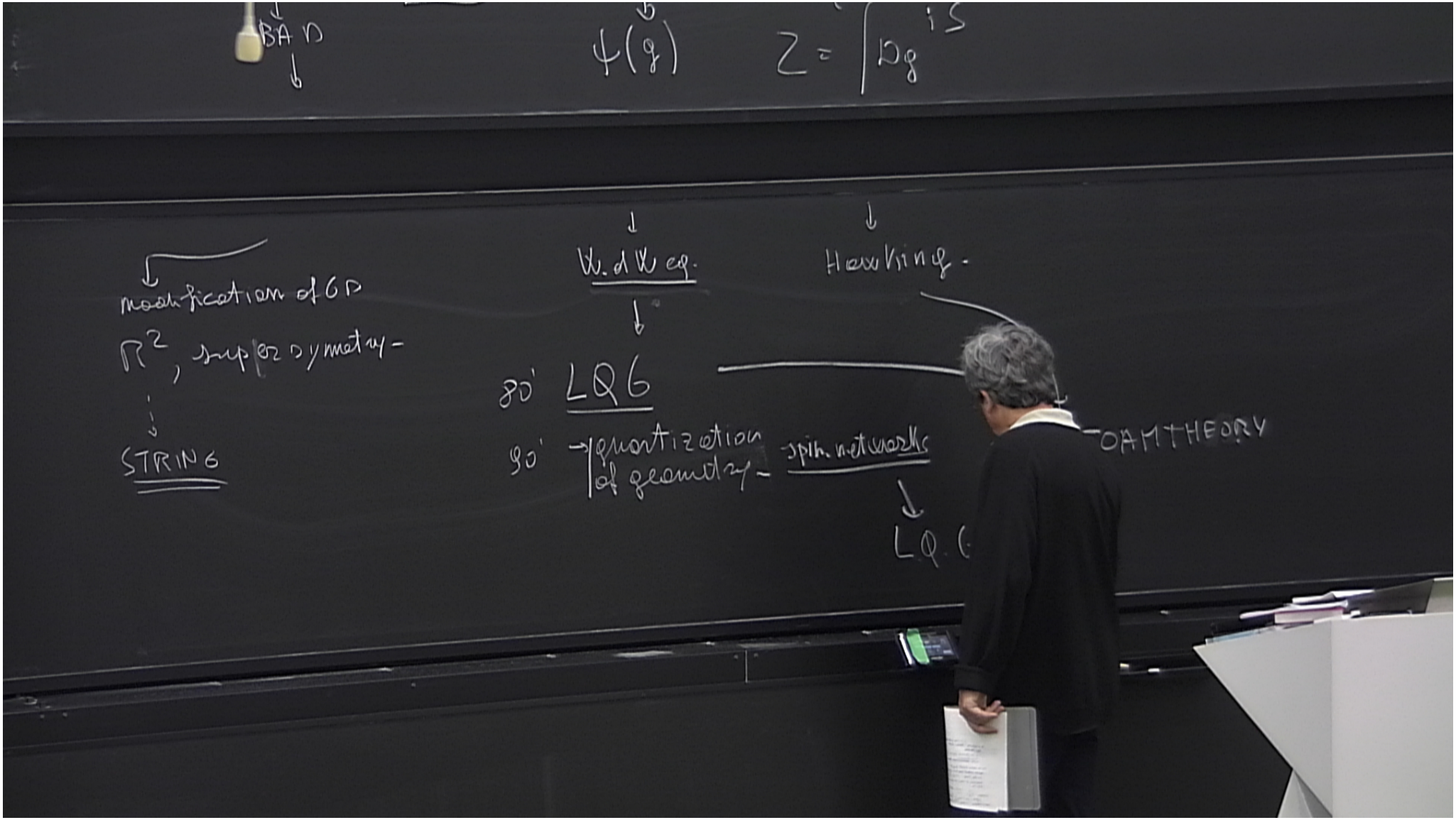
Hawking -
80' LQG
90' → quantization of geometry - spin. networks


BA n
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Z = ∫ Dg e^iS
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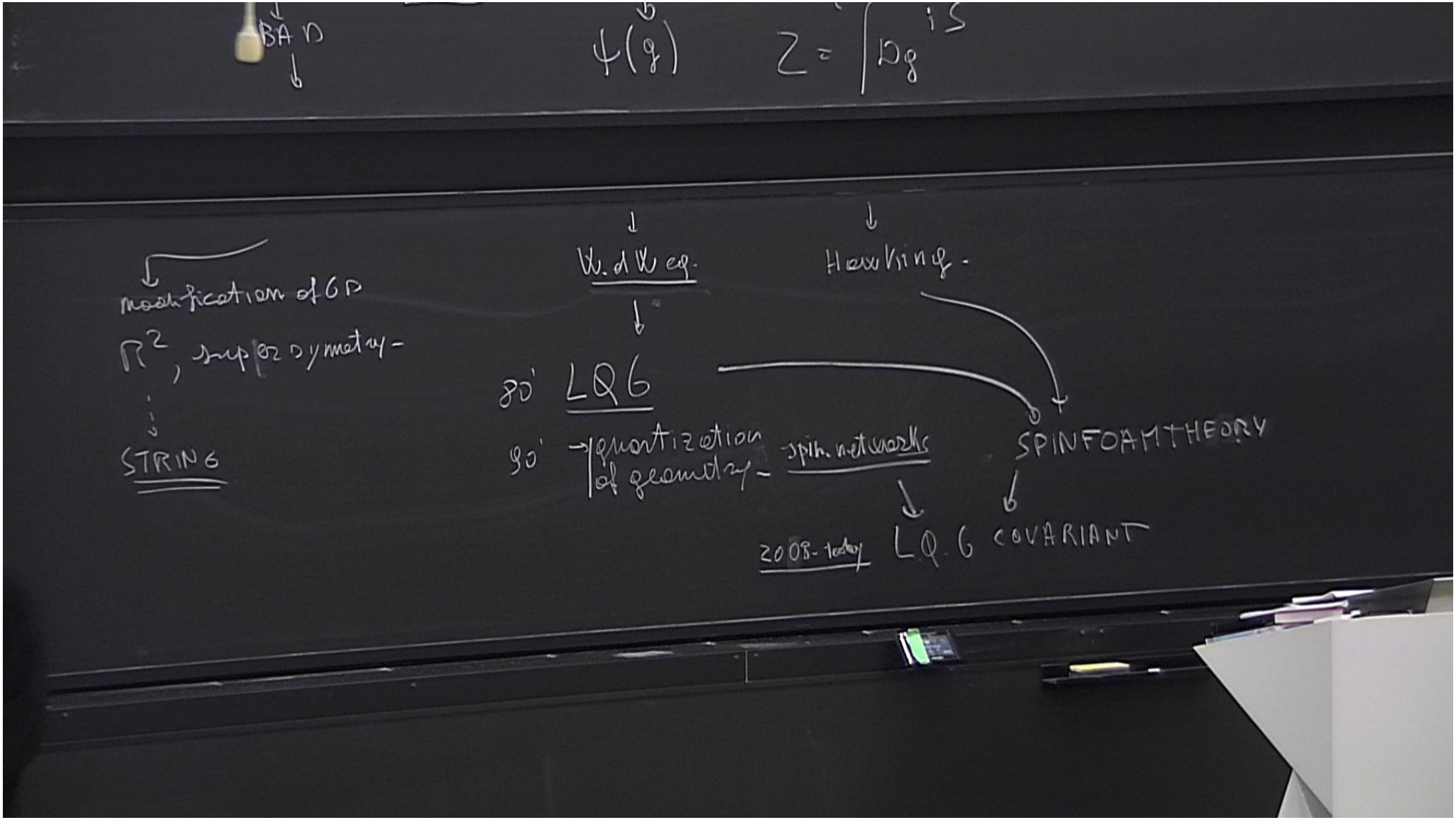
90' quantization of geometry - spin. networks
LQ. G
OAM THEORY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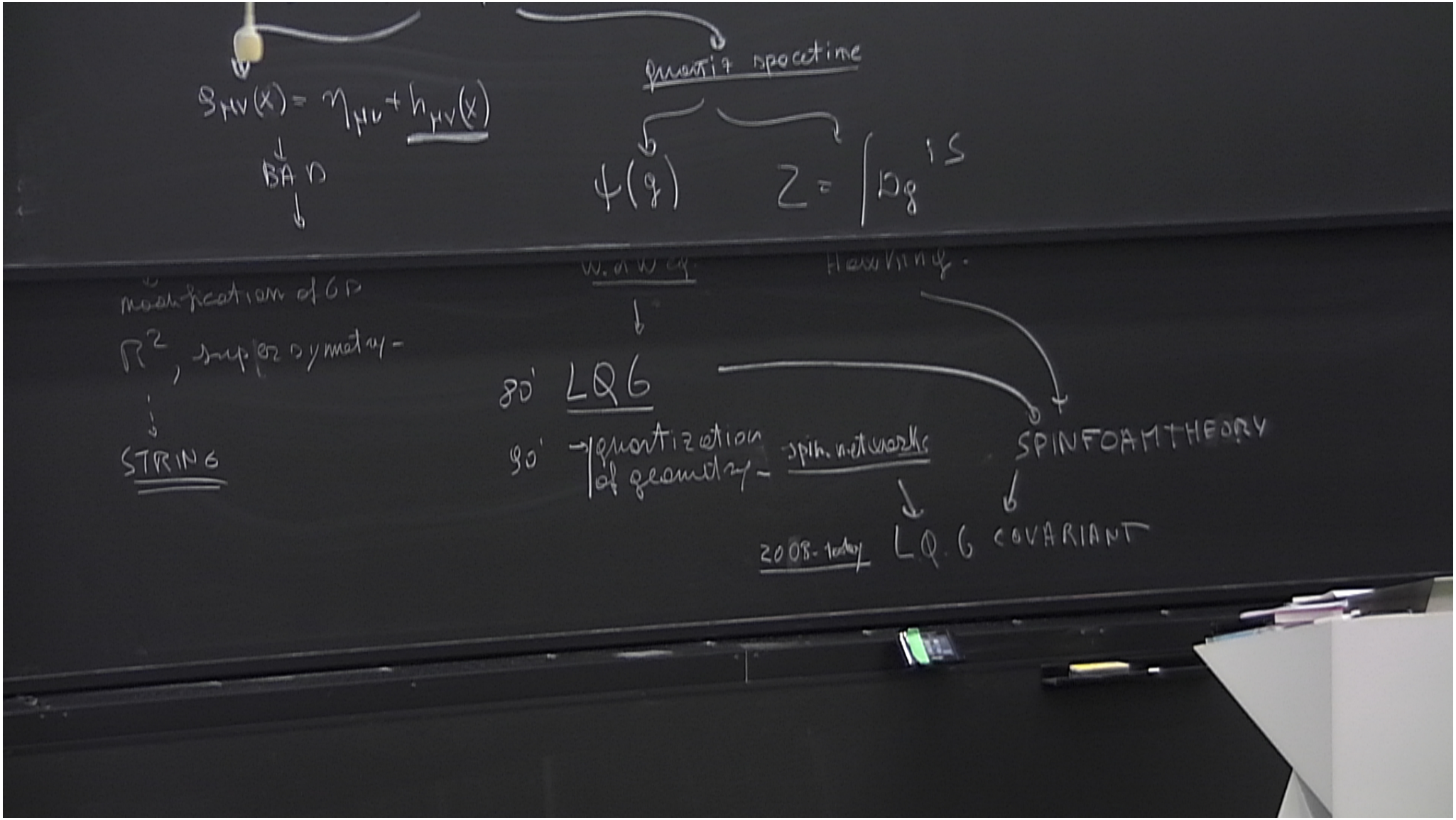
SPINFOAM THEORY
2008 - today LQG COVARIANT


$g_{\mu\nu}(x) = \eta_{\mu\nu} + h_{\mu\nu}(x)$
BACK
quantize spacetime
$\psi(g)$
$Z = \int Dg\, e^{iS}$
modification of GR
R^2, supersymmetry
STRING
W. of W. eq.
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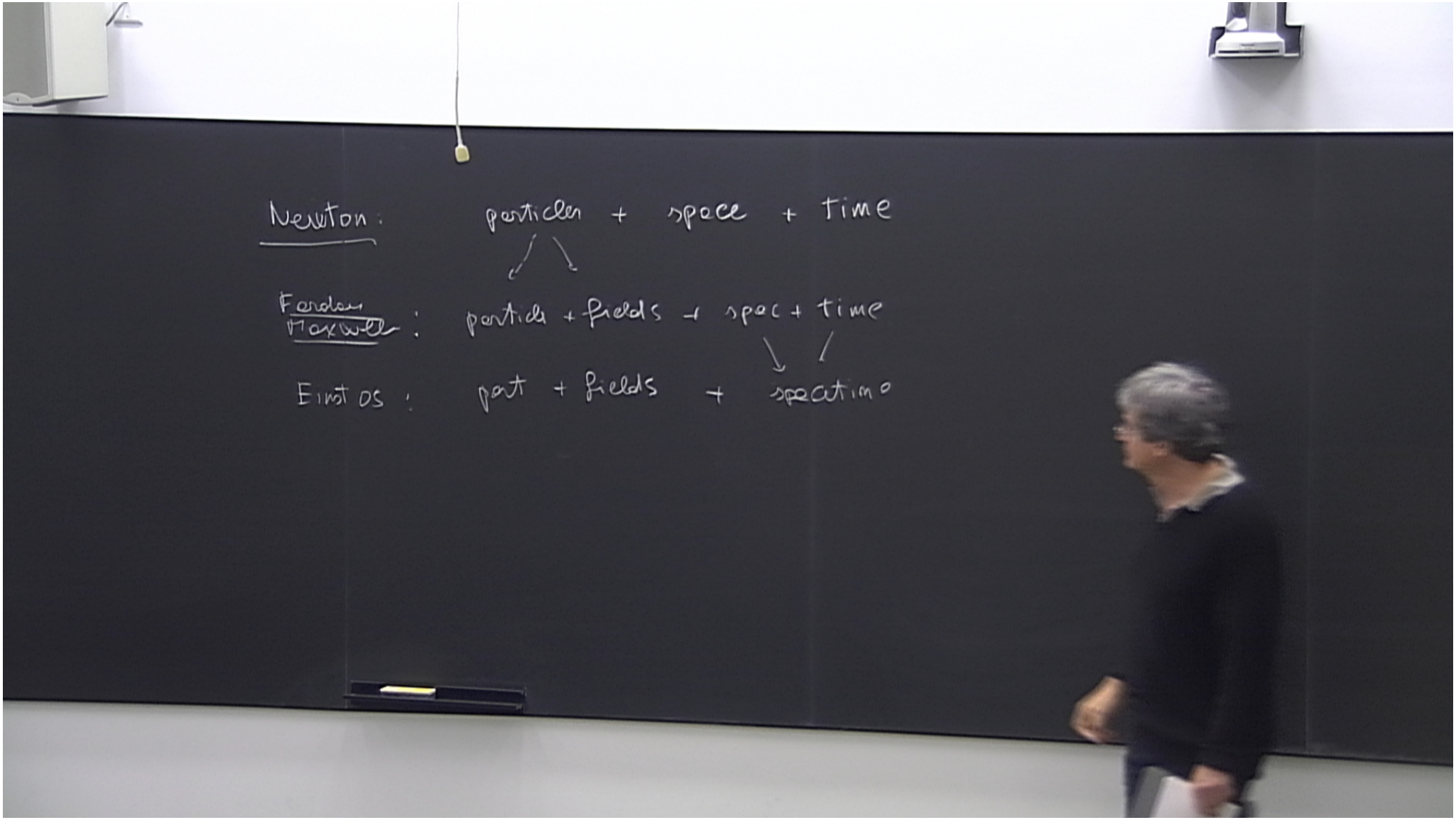
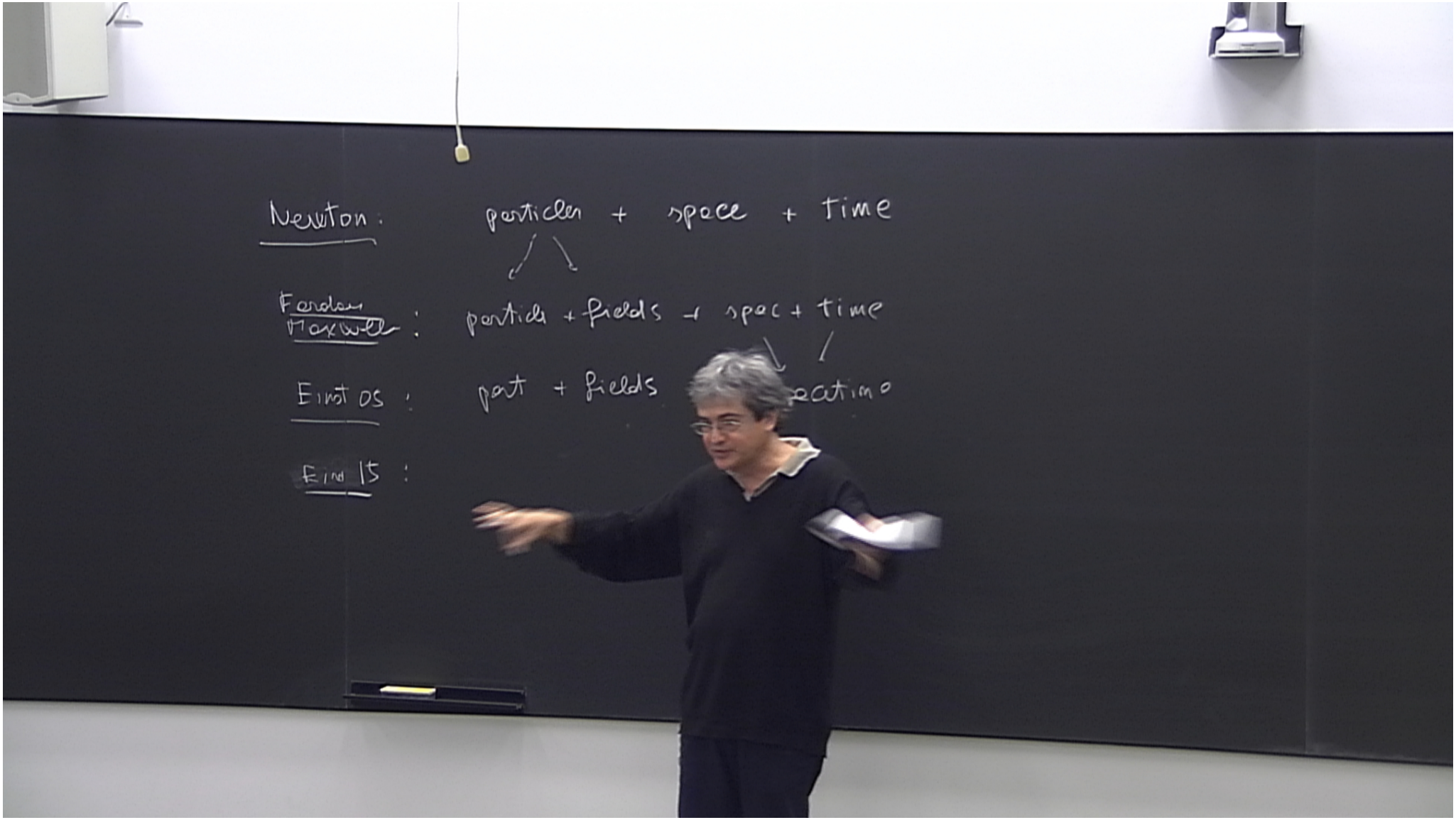

Newton:
particles + space + time
Faraday
Maxwell:
partic + fields + spac + time
Einstos:
part + fields + spacetime


Newton:
particles + space + time
Faraday Maxwell:
partic + fields + spac + time
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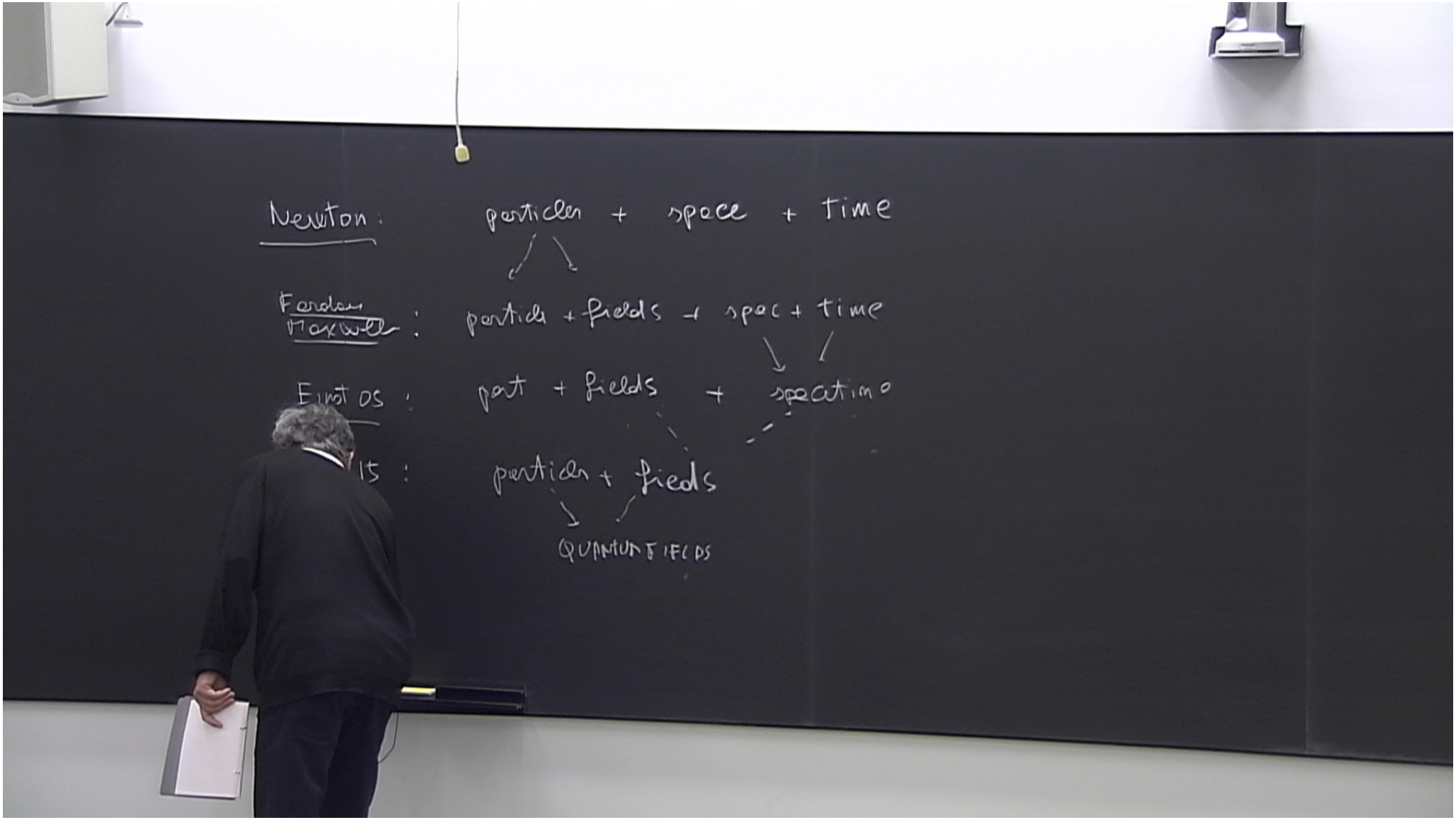
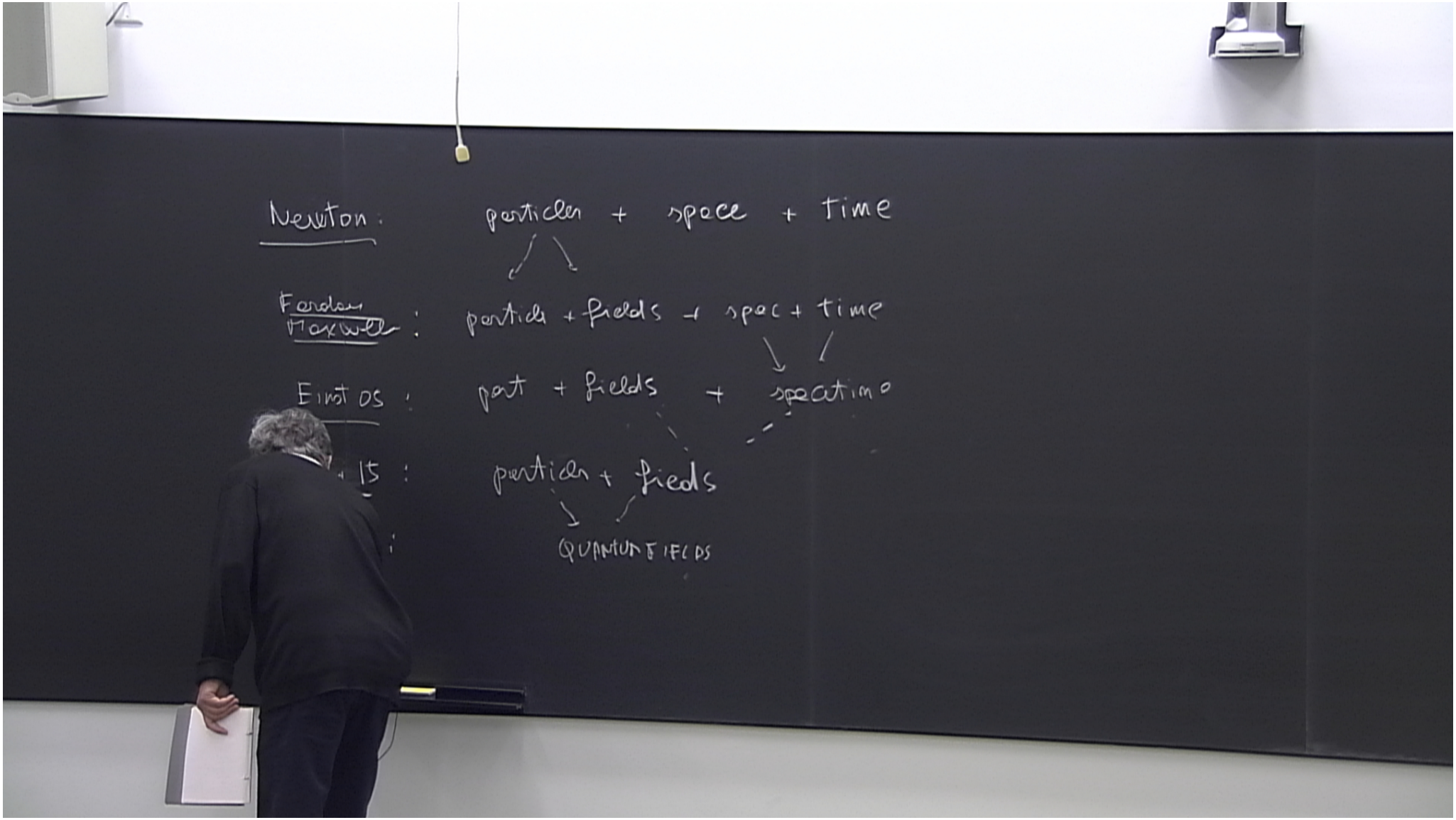
Einst:


Newton:
particles + space + time
Faraday
Maxwell:
partcls + fields + spac + time
Einstein:
part + fields + spacetime
QUANTUM FIELDS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Faraday Maxwell:
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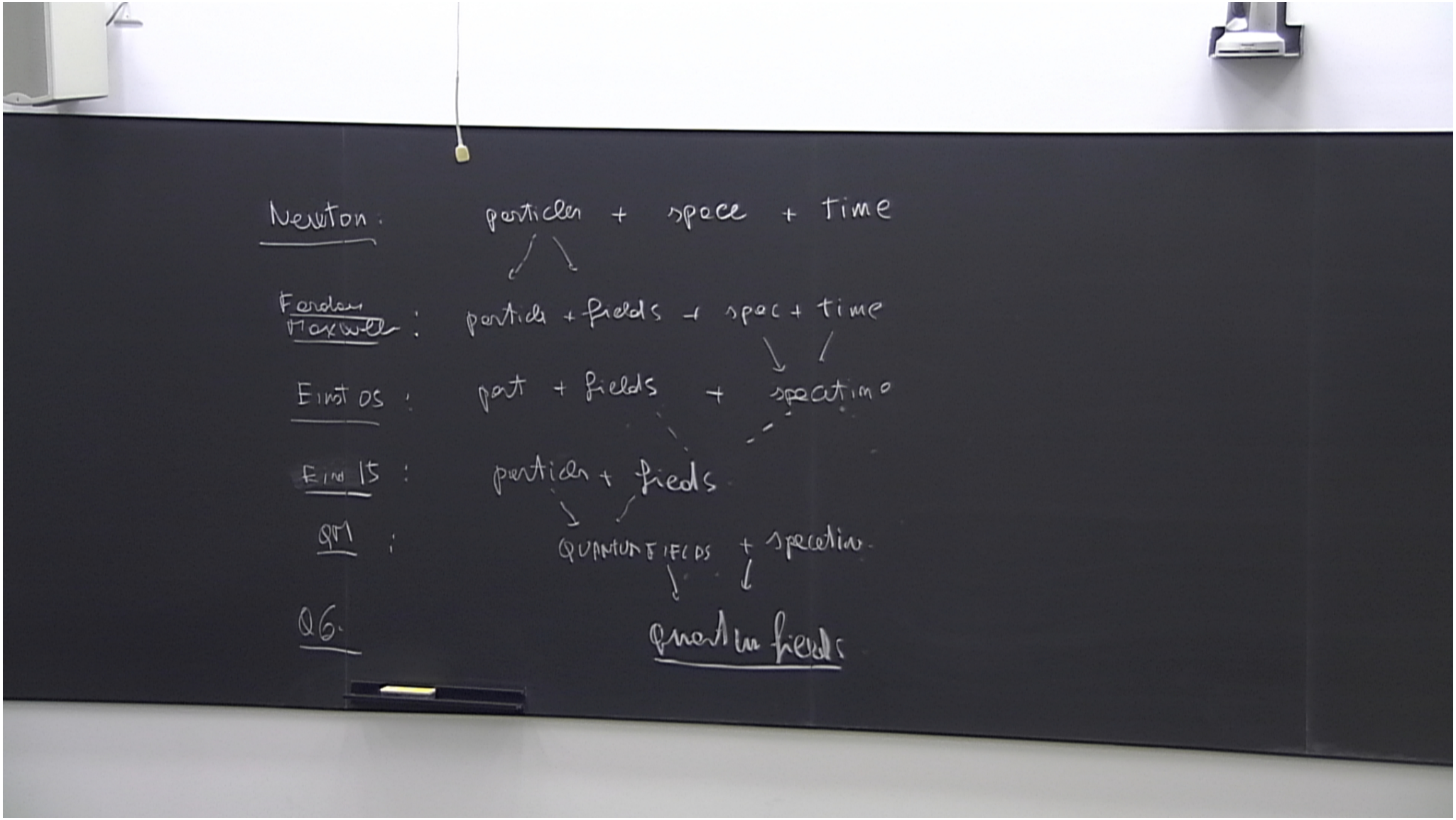
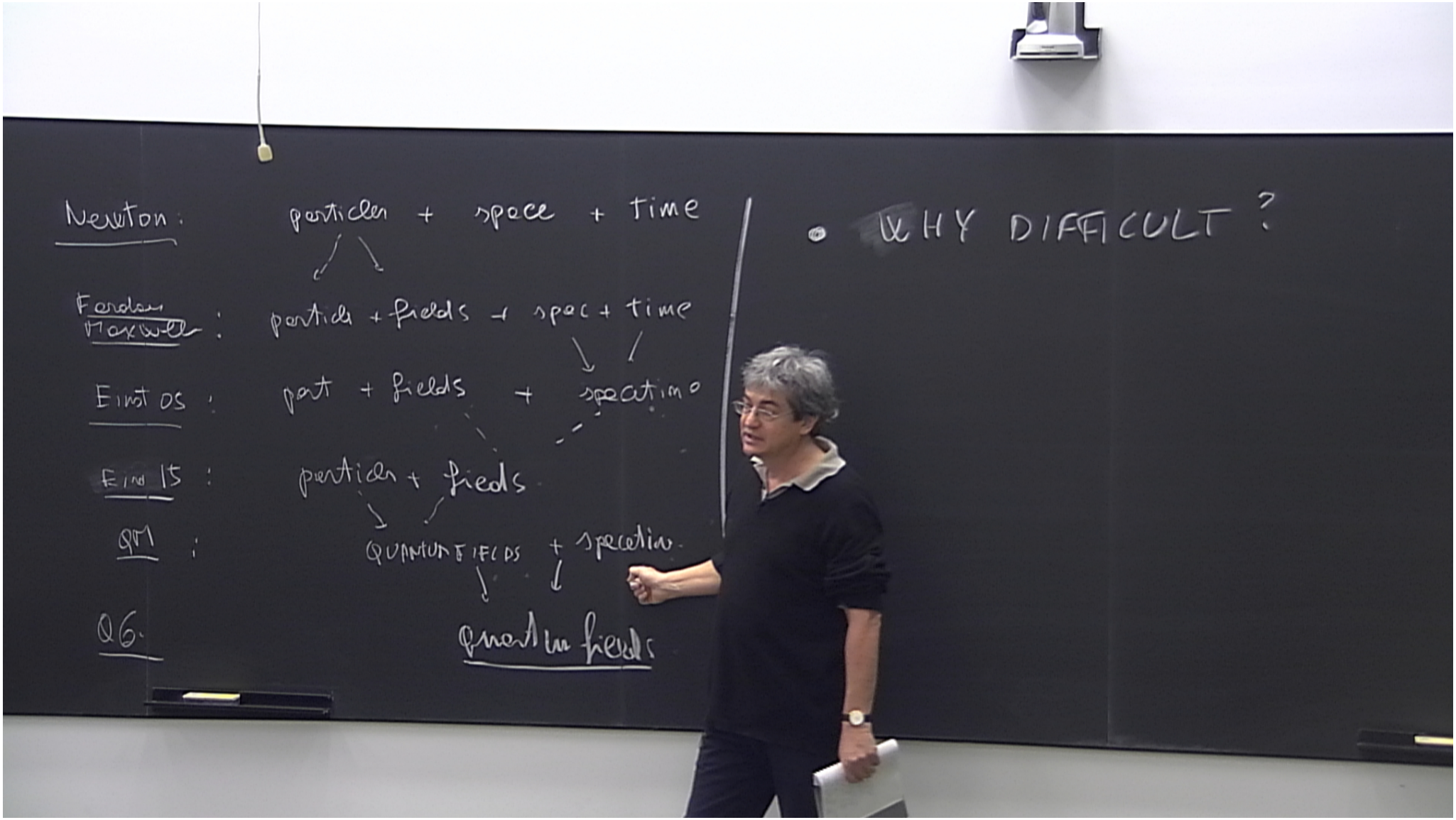
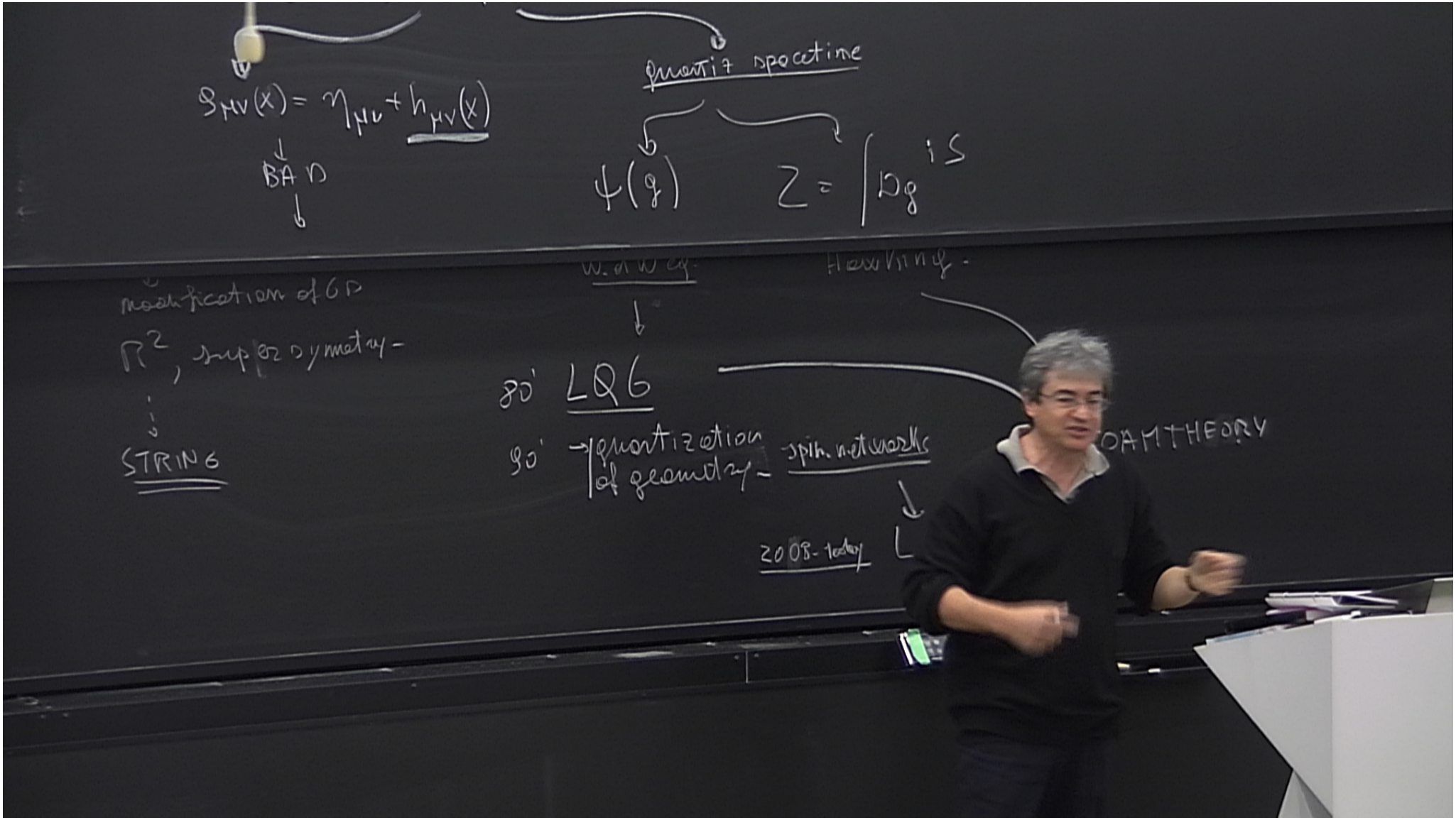
QUANTUM FIELDS


Newton: particles + space + time
Faraday Maxwell: particles + fields + space + time
Einstein: part + fields + spacetime
EinHS: particles + fields
QM: QUANTUM FIELDS + spacetime
QG: quantum fields


Newton: particles + space + time
Faraday Maxwell: particles + fields + space + time
Einstein: part + fields + spacetime
Feynman: particles + fields
QM: QUANTUM FIELDS + spacetime
QG: quantum fields
WHY DIFFICULT?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