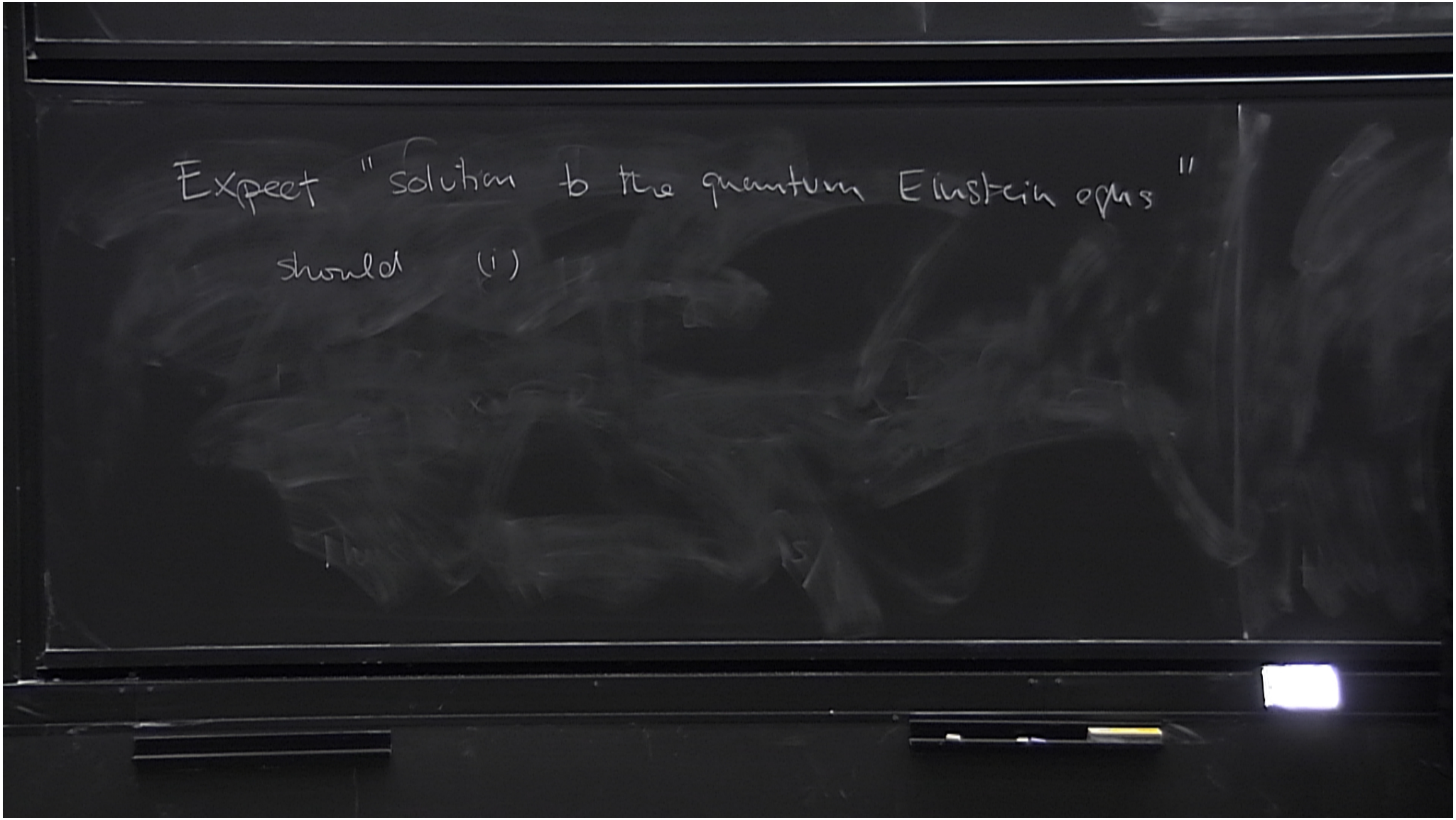
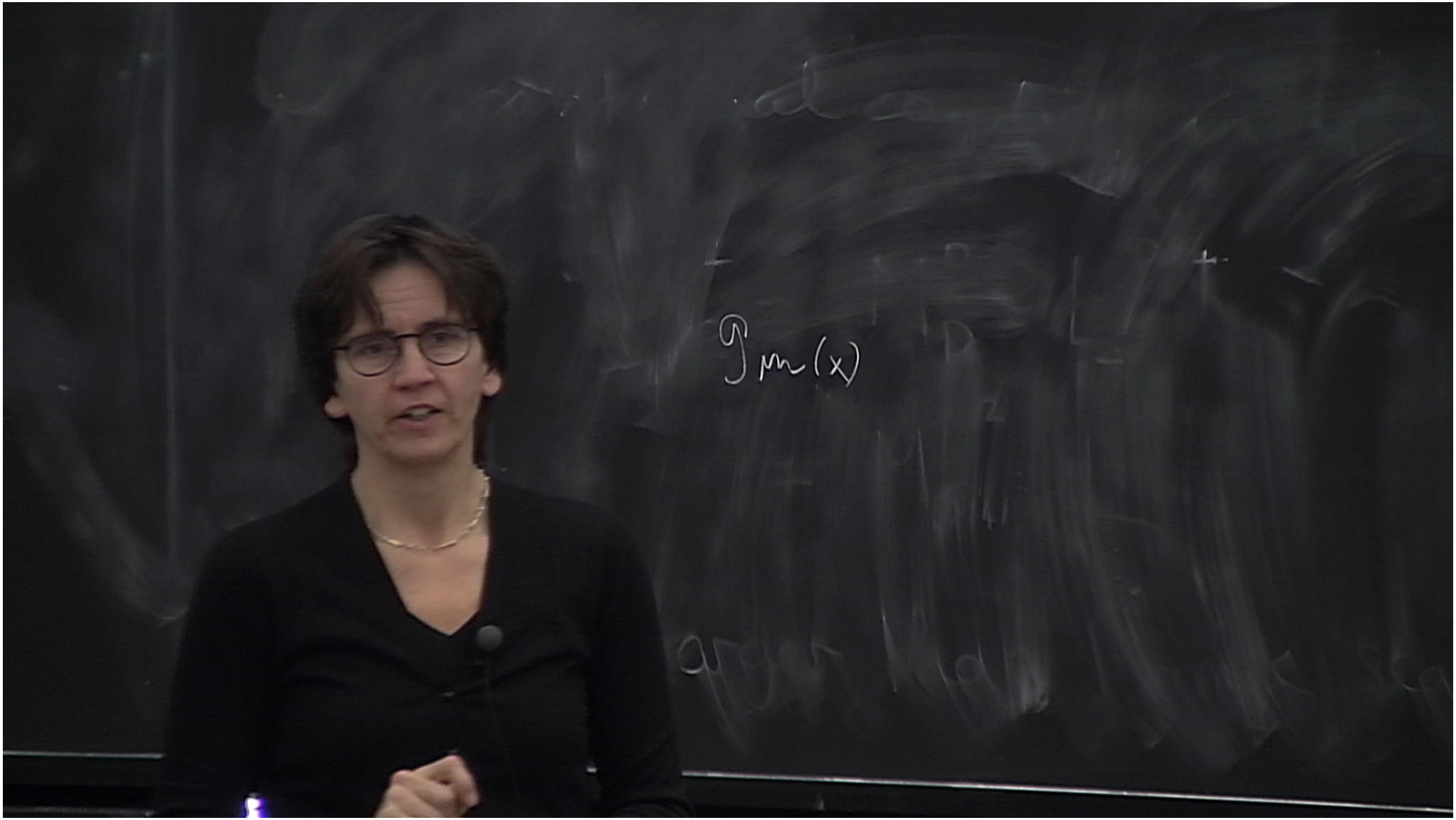
Title: Quantum Gravity (Review) - Lecture 14

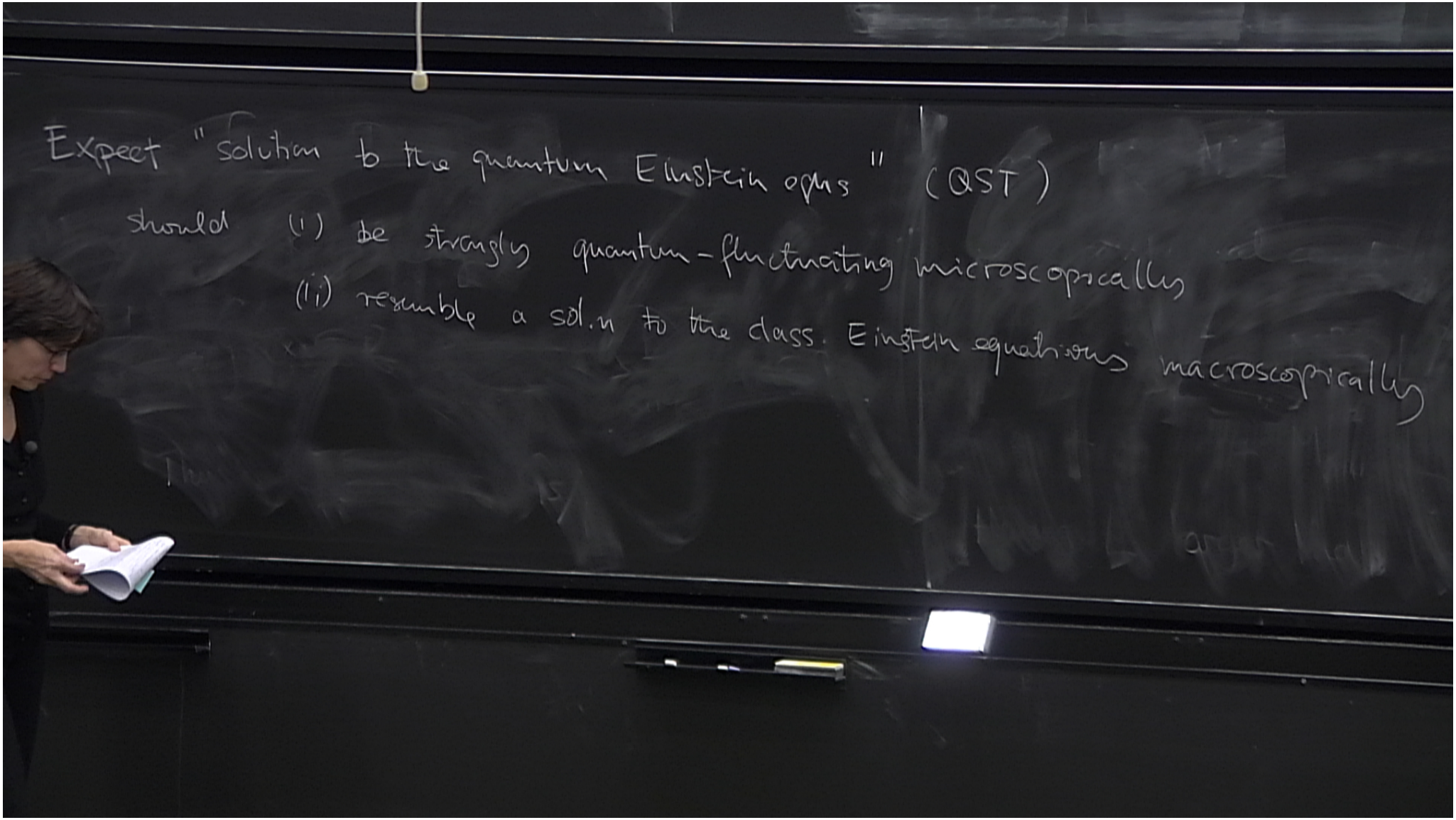
Date: Feb 09, 2012 10:15 AM

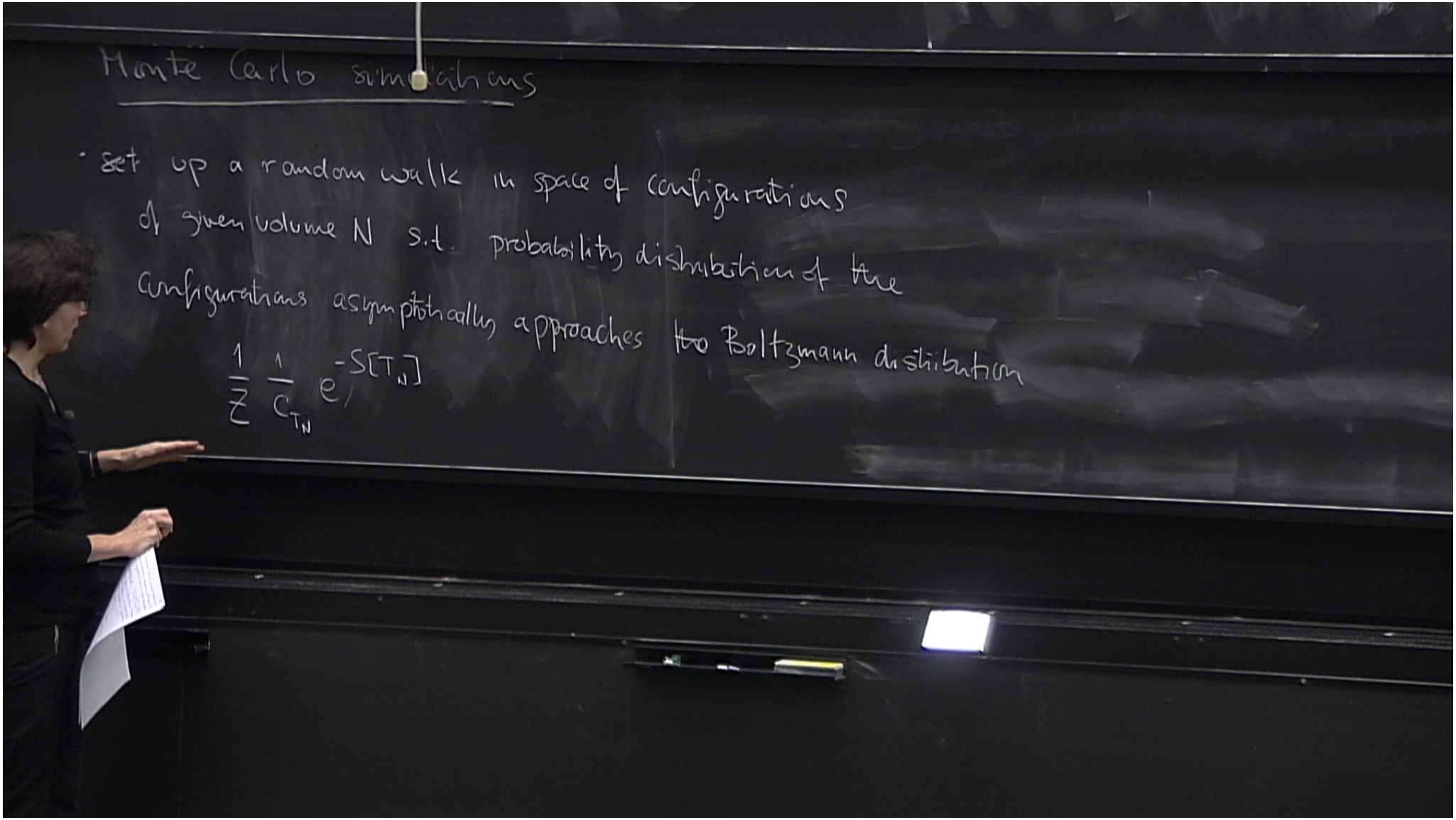
URL: http://pirsa.org/12020008

Abstract:


Expect "solution to the quantum Einstein eqns"
should (1)


$\mathcal{T}_{\mu\nu}(x)$


Expect "solution to the quantum Einstein eqns" (QST)
should (i) be strongly quantum-fluctuating microscopically
(ii) resemble a sol.n to the class. Einstein equations macroscopically


Monte Carlo simulations
· Set up a random walk in space of configurations of given volume N s.t. probability distribution of the configurations asymptotically approaches the Boltzmann distribution
$\frac{1}{Z}\frac{1}{C_{T_N}}e^{-S[T_N]}$

evaluate expectation values

$$\langle \hat{O} \rangle = \frac{1}{Z} \sum_T O(T) \frac{1}{C_T} e^{-S[T]}$$ through

"sampling" $$\langle \hat{O} \rangle \simeq \frac{1}{n} \sum_{a=1}^{n} O(T_a)$$

$\{T_a\}$ ~ statistically indepl. configs. s

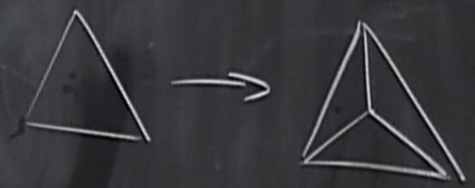
for sufficiently large n (~ sample size)

$\sum C_{T_N}$

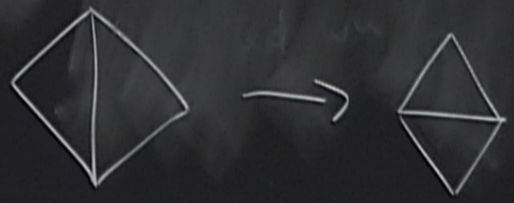
Needed : set of ergodic moves to go from any T to any other T' in a finite number of steps.

$N \to \infty$;

ex. 2d DT



subdivision move

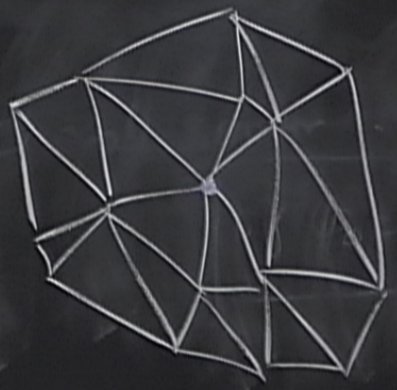


flip move

(and inverses)

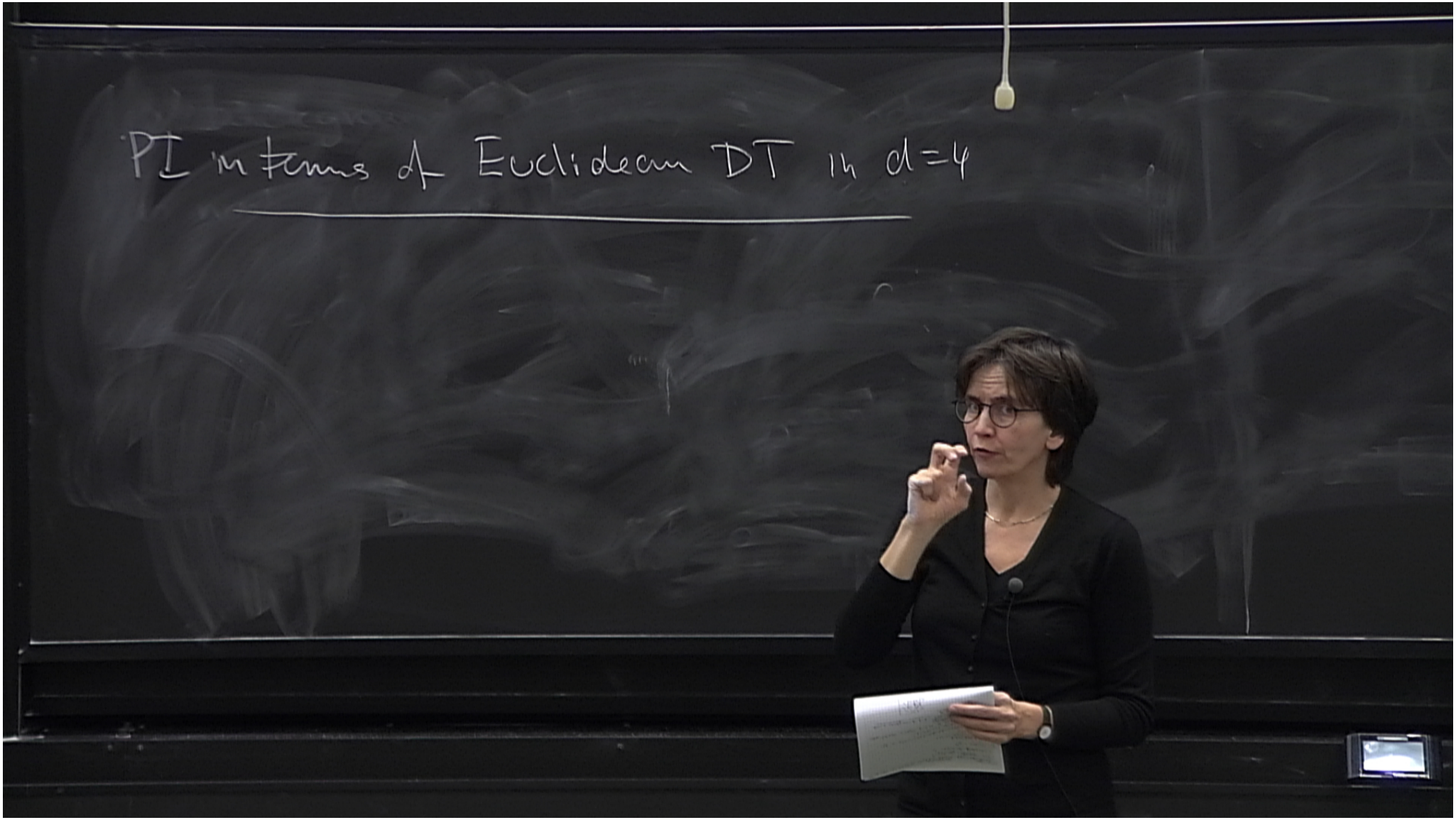
An observable characterizing "quantum geometry"
is the Hausdorff dimension d_H

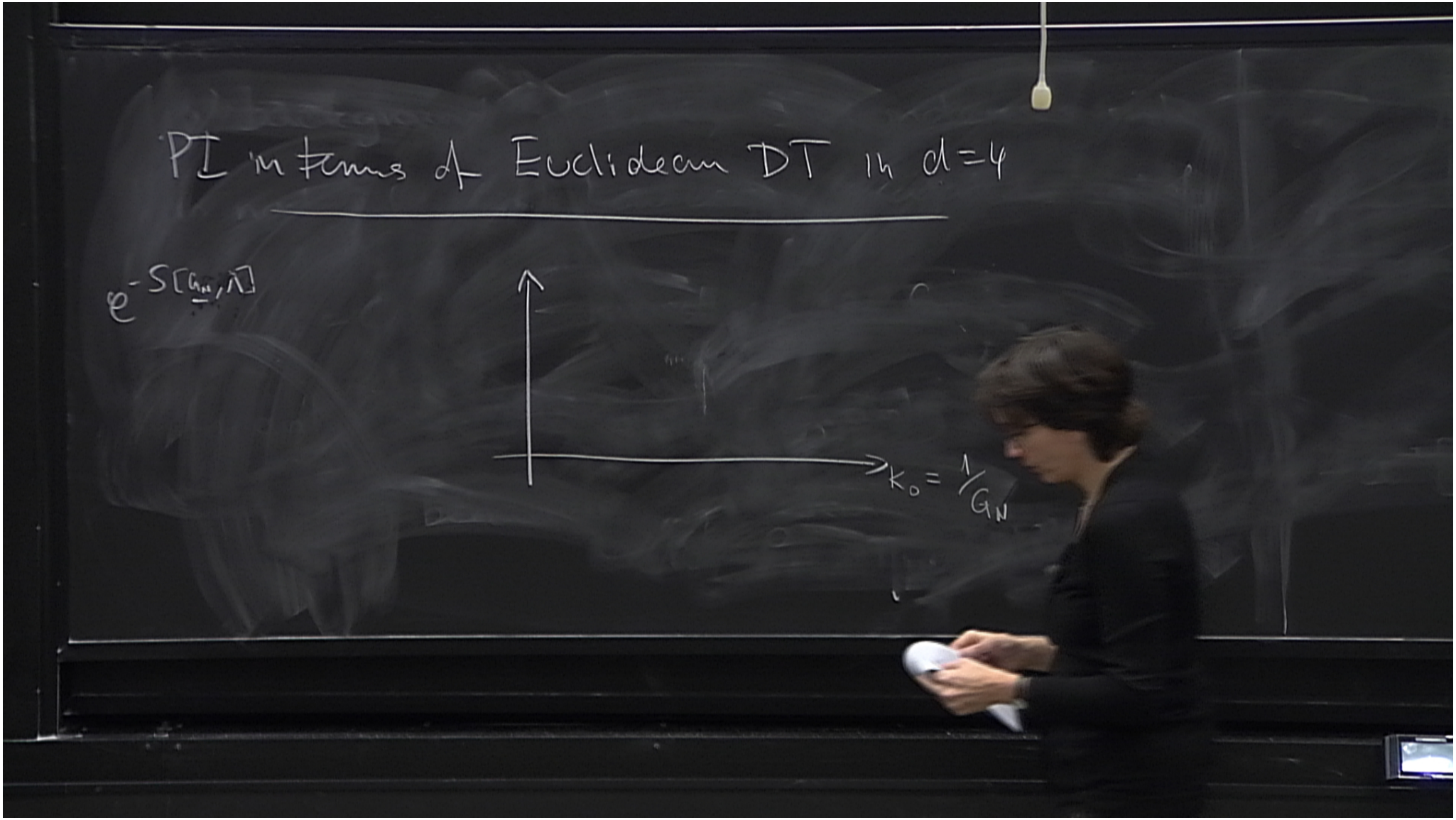
V



An observable characterizing "quantum geometry"
is the Hausdorff dimension d_H

$V(R)$


PI in terms of Euclidean DT in d=4

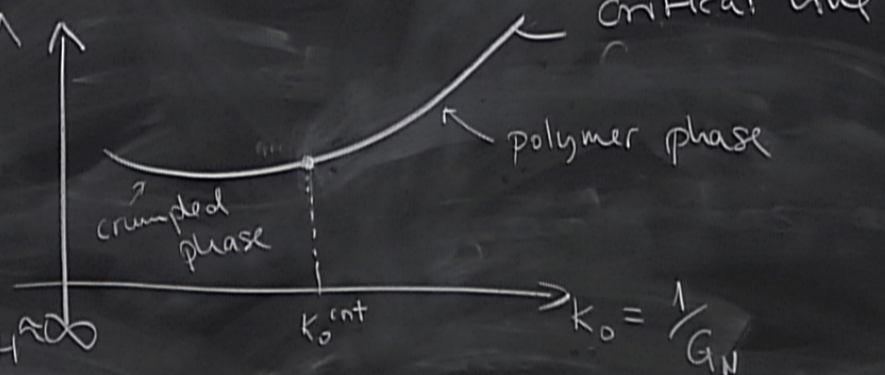

PI in terms of Euclidean DT in d=4
$e^{-S[g_{\mu\nu},\Lambda]}$
$k_0 = 1/G_N$

PI in terms of Euclidean DT in d=4
$e^{-S[g_{ab},\Lambda]}$
$N \to \infty$

PI in terms of Euclidean DT in $d=4$

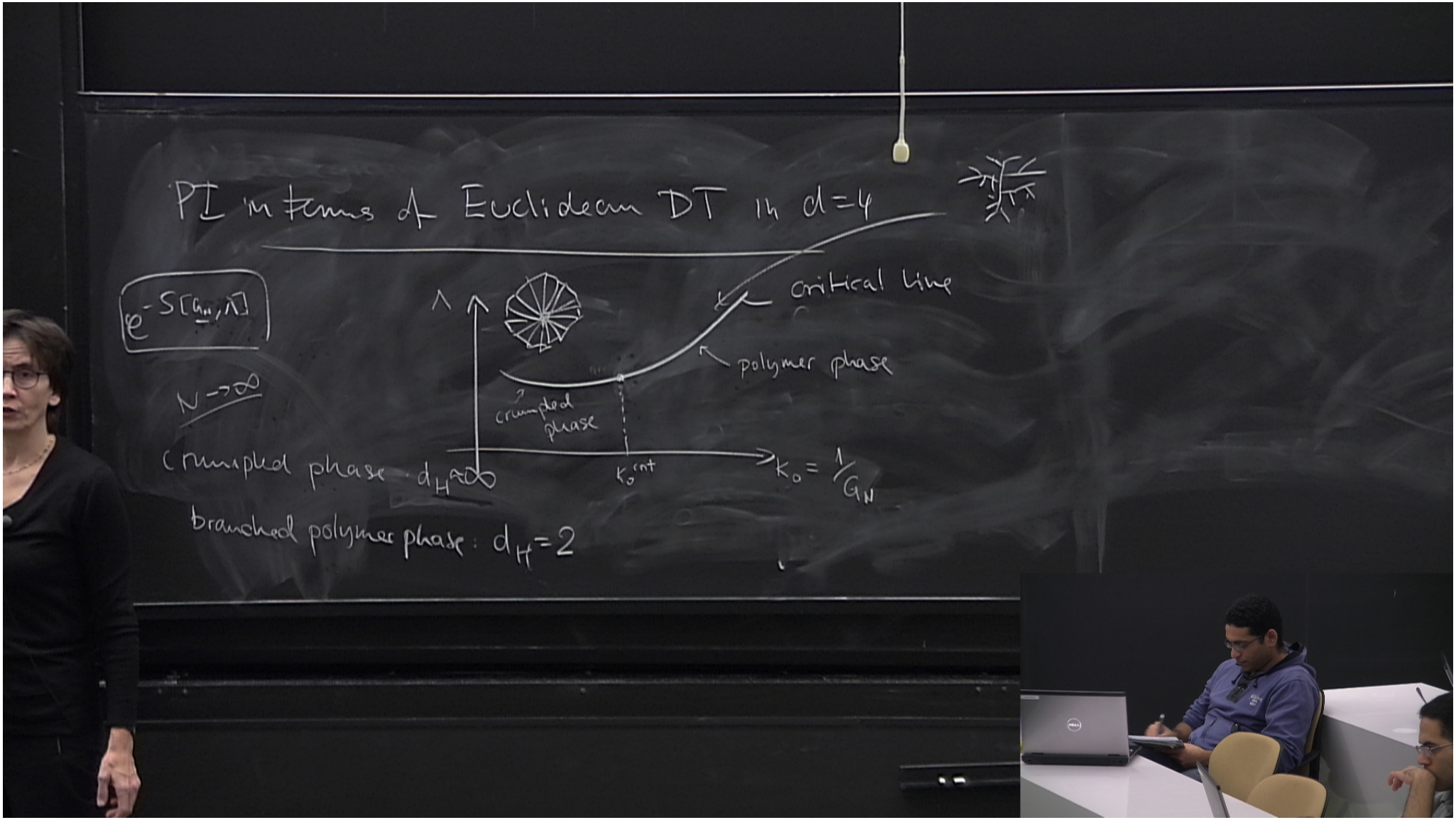
$e^{-S[G_N, \Lambda]}$

$N \to \infty$



crumpled phase : $d_H \to \infty$

branched polymer phase : $d_H = 2$

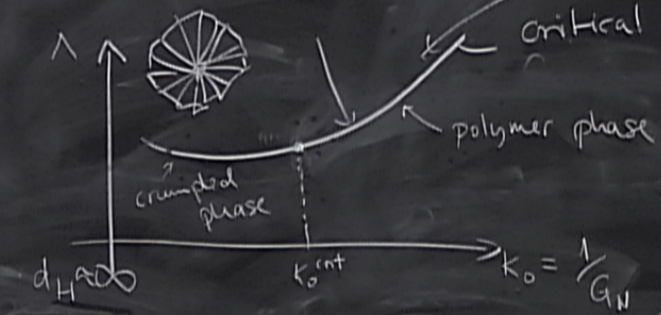

PI in terms of Euclidean DT in d=4
$e^{-S[G_N,\Lambda]}$
$N \to \infty$
critical line
polymer phase
crumpled phase
crumpled phase: $d_H \to \infty$
k_0^{crit}
$k_0 = 1/G_N$
branched polymer phase: $d_H = 2$

PI in terms of Euclidean DT in $d=4$

$S[T] = \Lambda N - \kappa R$

$e^{-S[G_N, \Lambda]}$

$N \to \infty$



$N \to \infty$: $\sum_T e^{-S[T]} = \sum_N e^{-\Lambda N} \sum_{T_N} e^{-S|_N}$

$e^{\$ N}$

branched polymer phase: $d_H = 2$