Title: More on adiabatic quantum computation

Date: Feb 11, 2006 09:15 AM

URL: http://pirsa.org/06020022

Abstract:

How to Make the Quantum Adiabatic Algorithm Fail

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Poor choices lead to failure.

Algorithm fails if $\frac{T}{\sqrt{N}} \to 0$

N is Hilbert space size $N = 2^n$

$$H_p = \sum_{z=0}^{N-1} h(z)\,|z\rangle$$

$h(z)$ is the cost function

Want ground state of H_p.

$$H(t) = (1 - t/T)\,H_B + (t/T)\,H_p$$

$$i\frac{d}{dt}|\psi(t)\rangle = H(t)\,|\psi(t)\rangle$$

$|\psi(0)\rangle = |g_B\rangle$ ground state of H_B

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Hamiltonian Version of Grover

Grover $f(z) = \begin{cases} 1 & z \neq w \\ -1 & z = w \end{cases}$

$$0 \leq z \leq N-1$$

Find w

Classically N calls

Q.M. $N^{1/2}$ calls $\leftarrow$ Best possible

$$H_p = H_w = E\left(1 - |w\rangle\langle w|\right)$$

Can apply H_p but do not know w

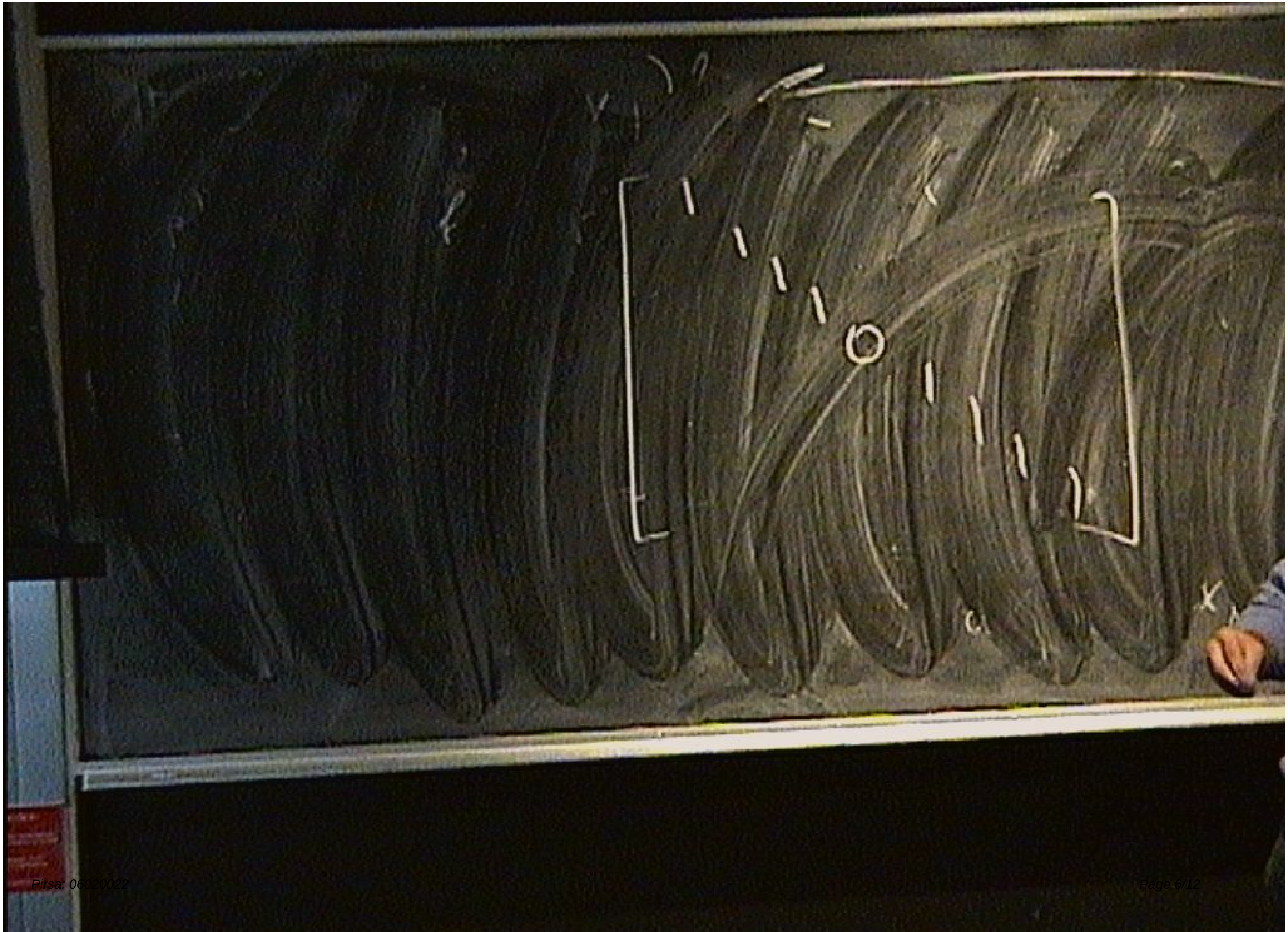
$$H(t) = H_D(t) + H_w$$

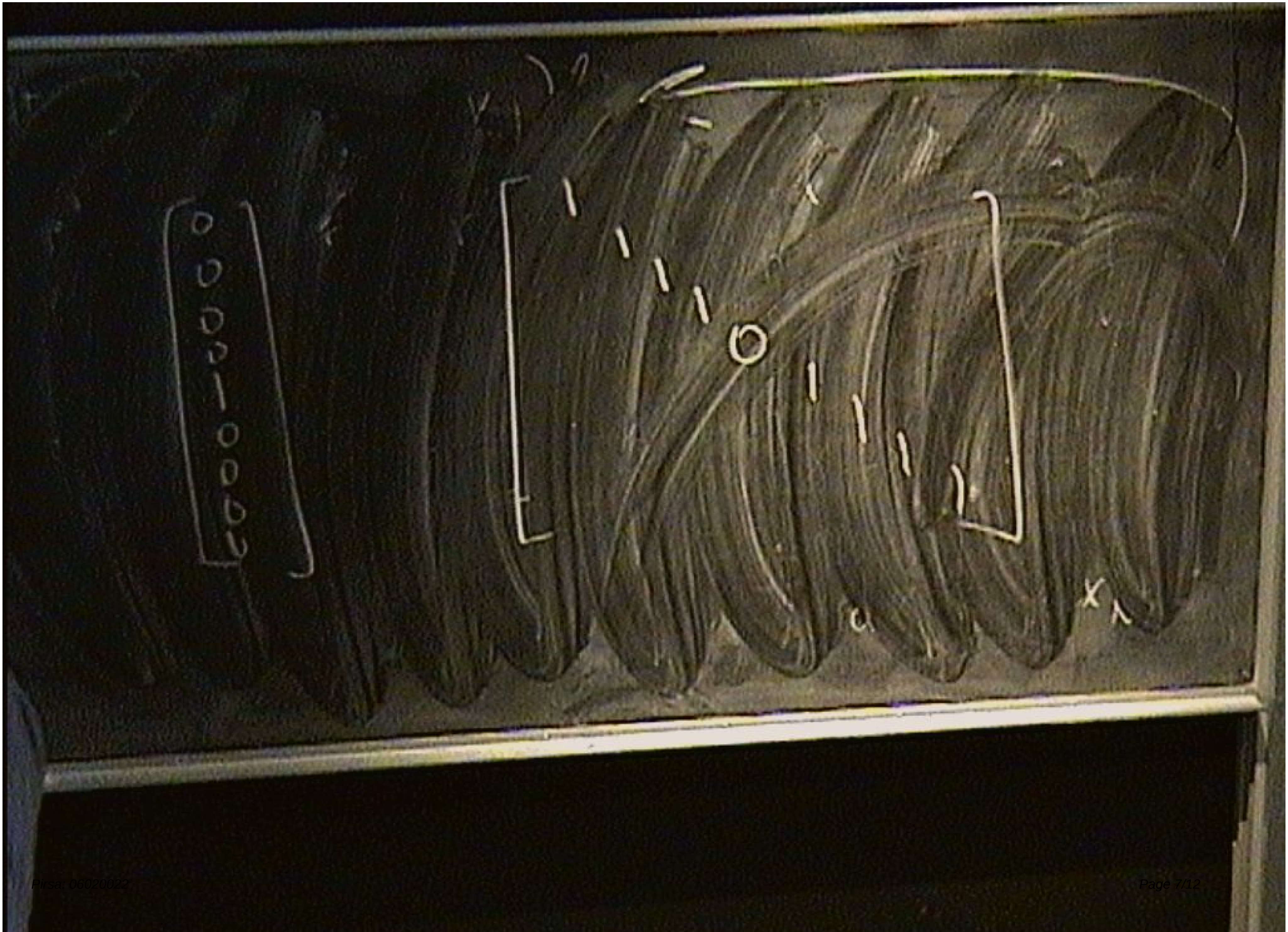
$\uparrow$ You design this

Want $|\psi(T)\rangle = |w\rangle$

$$T \geq \frac{\sqrt{N}}{2E}$$

E.F.
S. Gutmann

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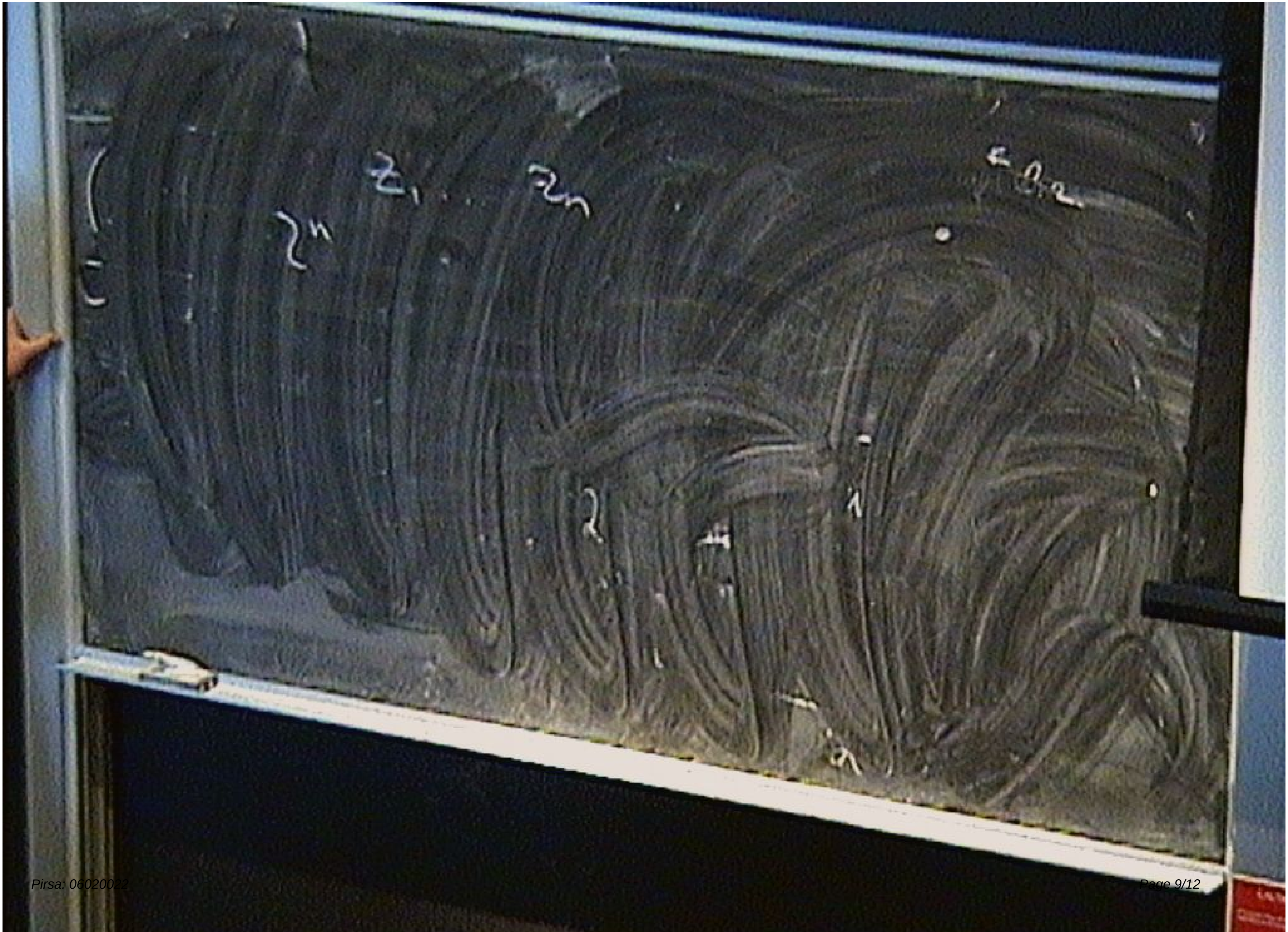
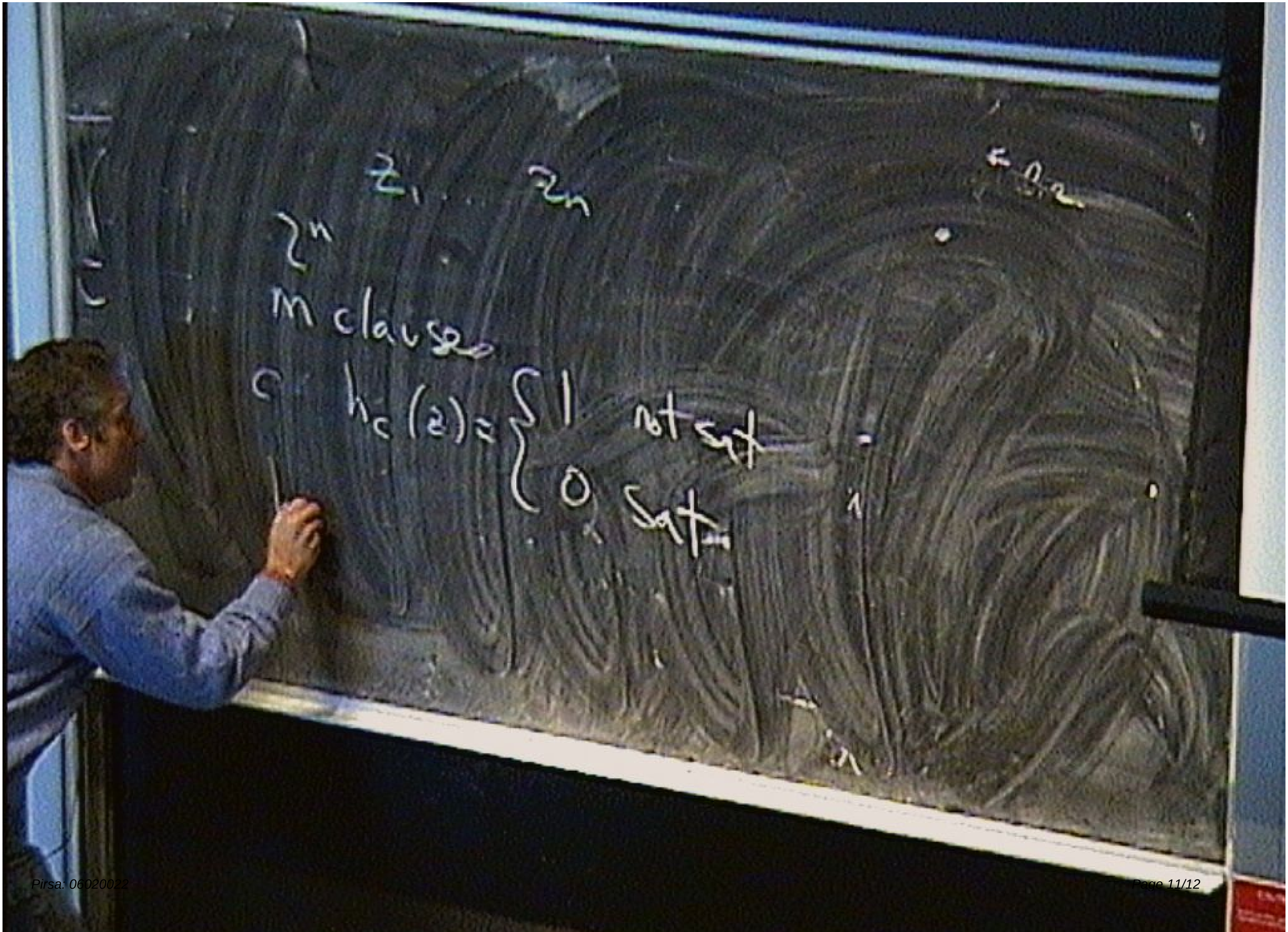


$z_1 \ldots z_n$

2^n

m clauses


z1 ... zn
2^n
m clauses
c hc(z) = { 1 not sat
0 sat

$\leftarrow 0.2$

$z_1 \ldots z_n$

2^n

m clauses

$c \qquad h_c(z) = \begin{cases} 1 & \text{not sat} \\ 0 & \text{sat} \end{cases}$

$h(z) \qquad h = \sum_c h_c(z)$