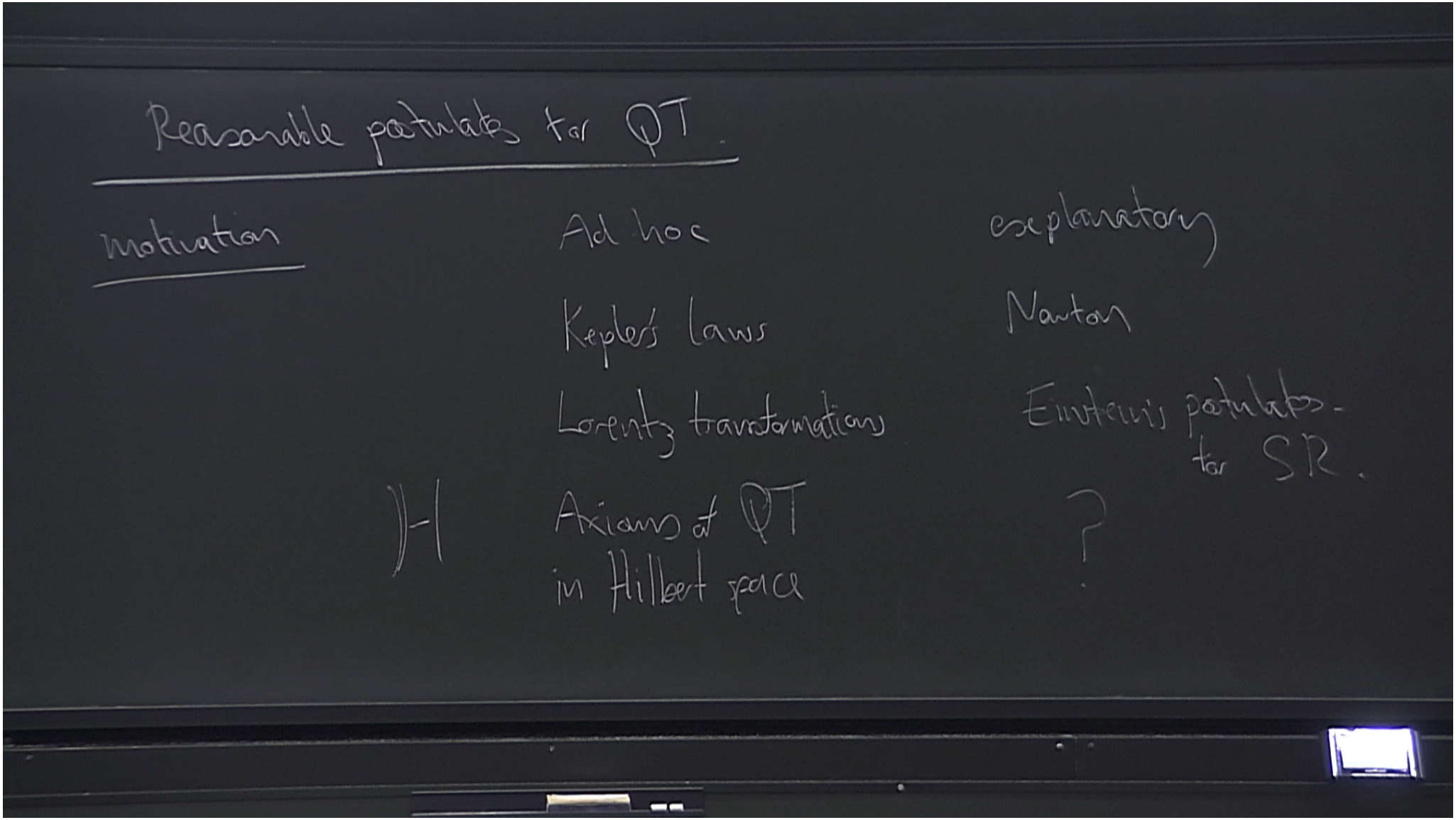
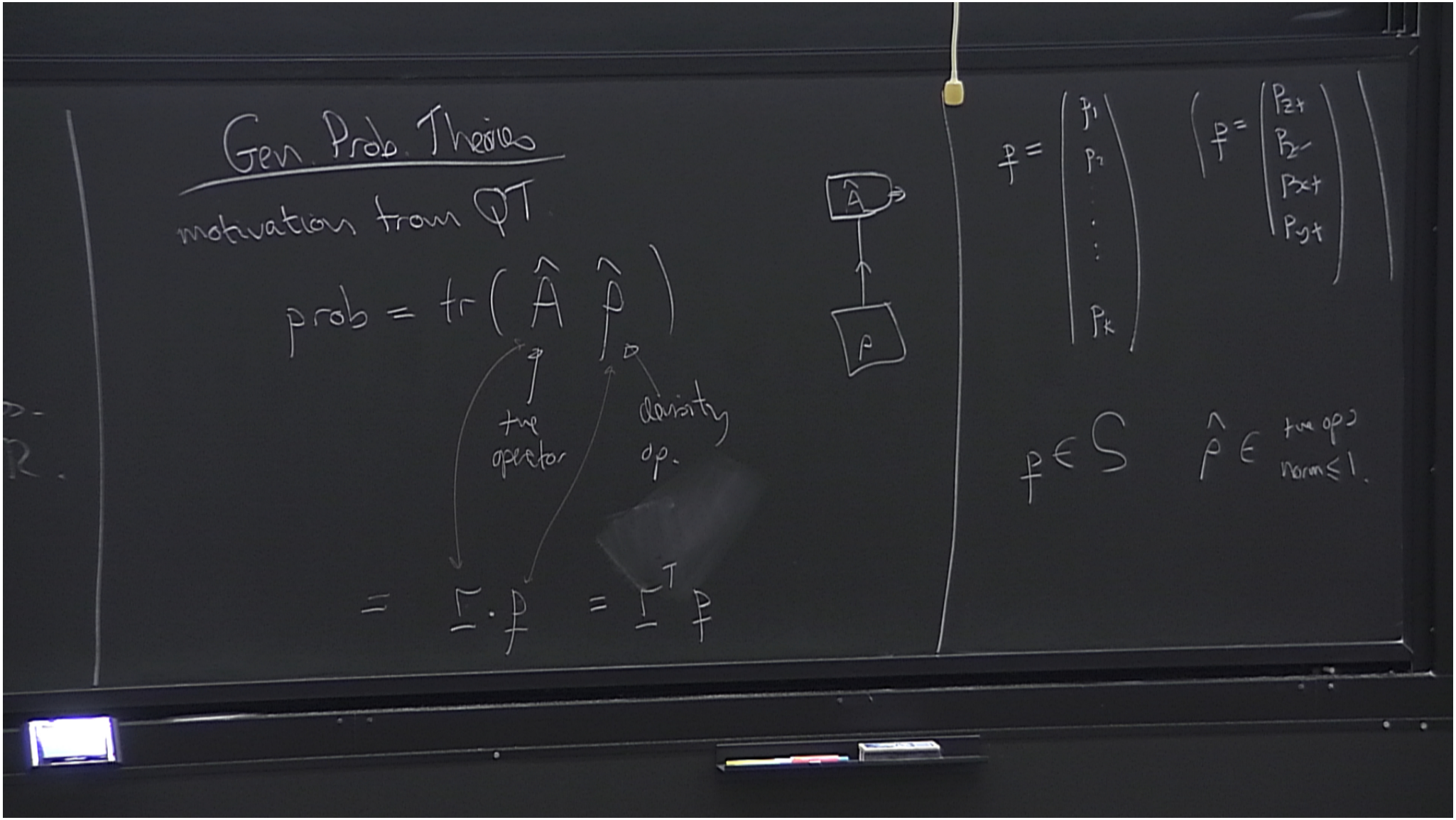
Title: Foundations of Quantum Mechanics-12

Date: Jan 19, 2015 02:00 PM

URL: http://pirsa.org/15010053

Abstract:


Reasonable postulates for QT
Motivation
Ad hoc
explanatory
Kepler's laws
Newton
Lorentz transformations
Einstein's postulates for SR.
Axioms of QT in Hilbert space
?

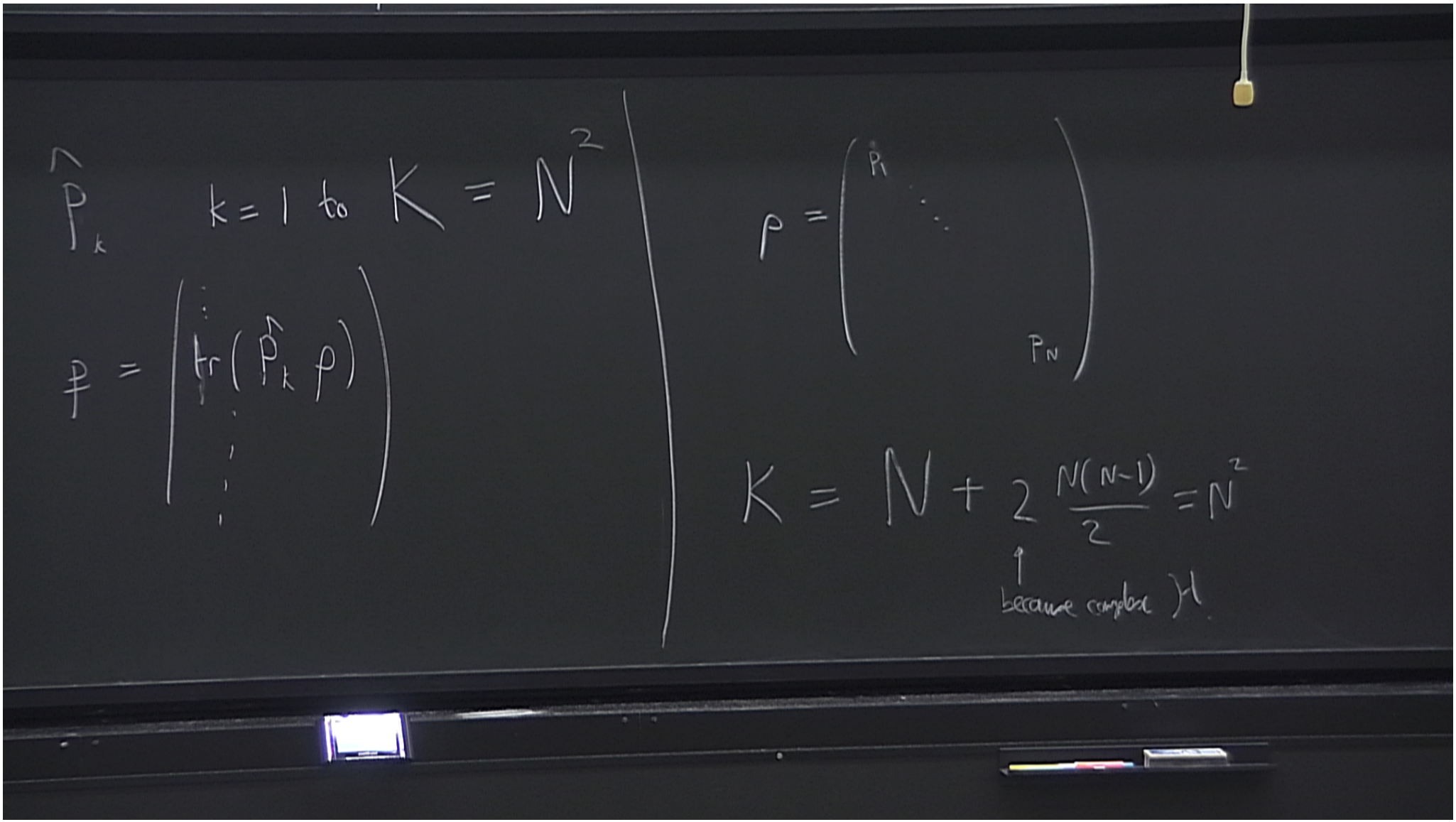

Gen. Prob. Theories
motivation from QT
prob = tr(Â ρ̂)
the operator
density op.
Â
ρ
p =
p = (Pz+ Pz− Px+ Py+)
p ∈ S
ρ̂ ∈ true ops norm ≤ 1.
= Γ · p = Γ^T p

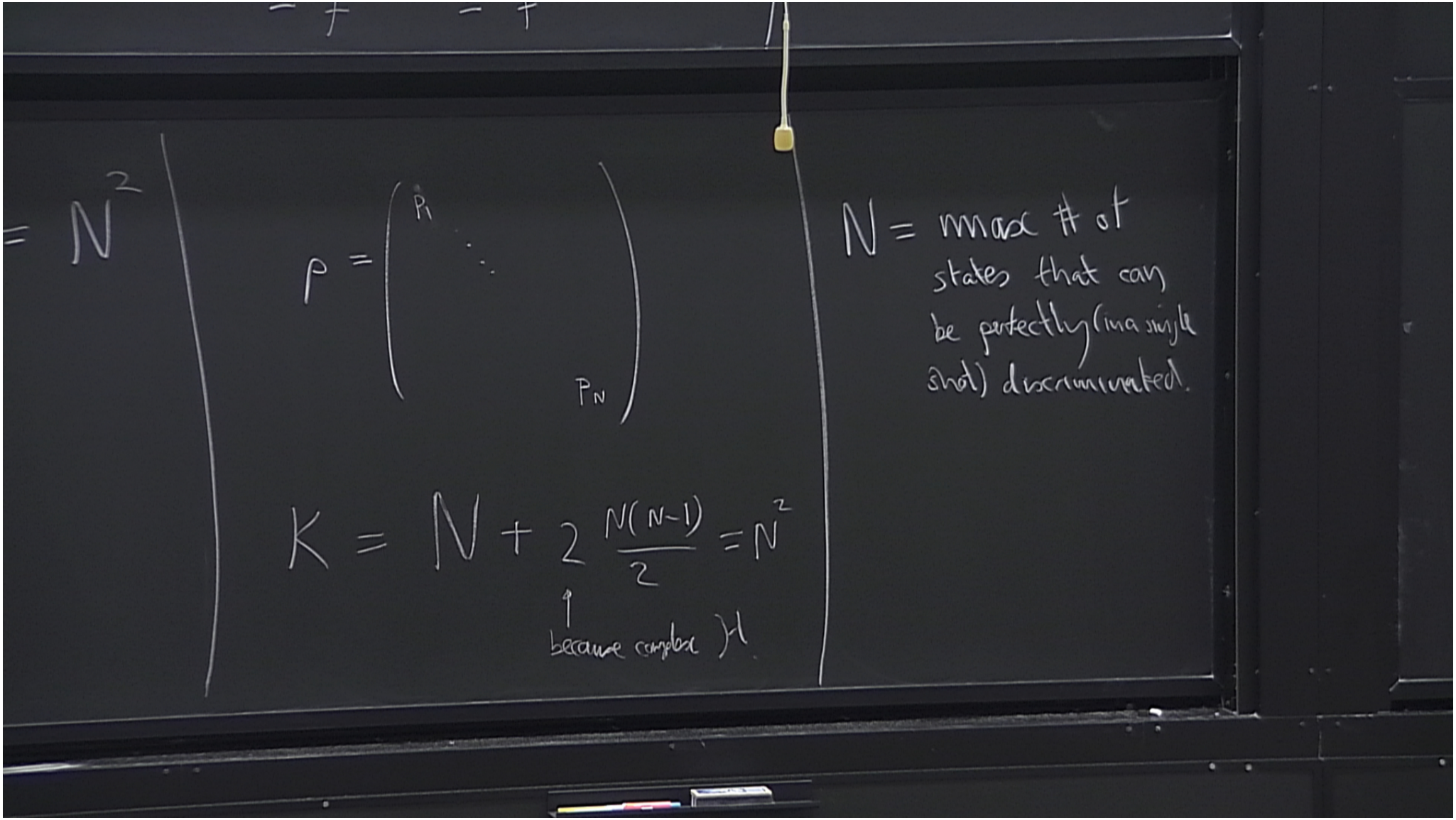
$$\hat{\rho} = \lambda \hat{\rho}_A + (1-\lambda)\hat{\rho}_B$$

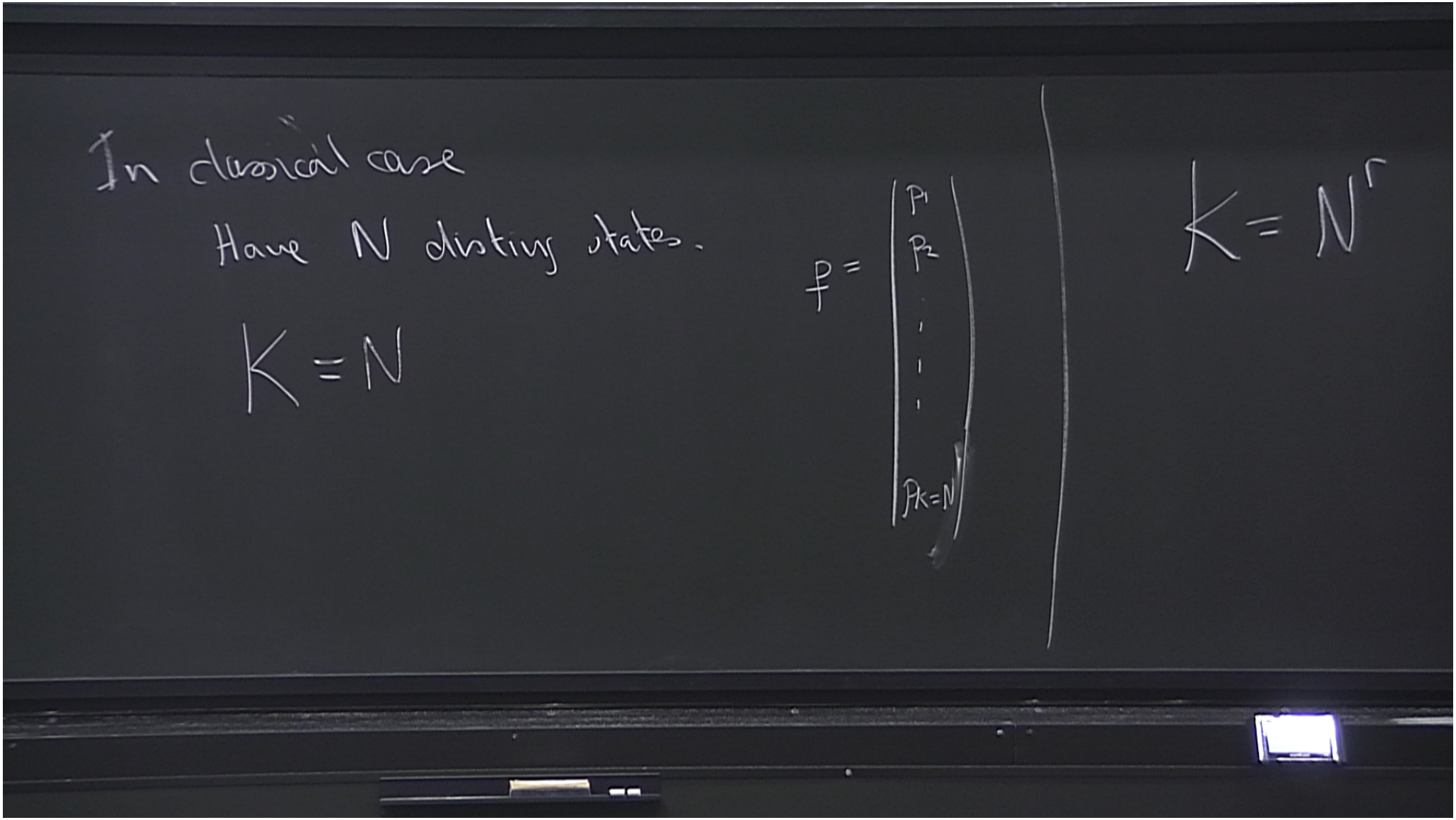
$$\Leftrightarrow \quad \vec{p} = \lambda \vec{p}_A + (1-\lambda)\vec{p}_B$$

$\hat{\rho}_k \qquad k = 1 \text{ to } K = N^2$

$$\vec{p} = \begin{pmatrix} \vdots \\ \mathrm{tr}(\hat{\rho}_k \rho) \\ \vdots \end{pmatrix}$$


$\hat{P}_k$ $k = 1$ to $K = N^2$
$\vec{p} = \begin{pmatrix} \vdots \\ \mathrm{tr}(\hat{P}_k \rho) \\ \vdots \end{pmatrix}$
$\rho = \begin{pmatrix} p_1 & & \\ & \ddots & \\ & & p_N \end{pmatrix}$
$K = N + 2\frac{N(N-1)}{2} = N^2$
because complex


$= N^2$
$\rho = \begin{pmatrix} p_1 & & \\ & \ddots & \\ & & p_N \end{pmatrix}$
$K = N + 2\frac{N(N-1)}{2} = N^2$
because complex
N = max # of states that can be perfectly (in a single shot) discriminated.


In classical case
Have N distinguishable states.
K = N
p =
p1
p2
pk=N
K = N^r

$= N^{\Gamma}$

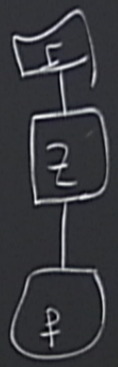
$\rho \in S$

$\Gamma \in R$

$\text{prob}(\hat{A} \$(\hat{\rho}))$

$= \Gamma^{T} Z \rho$

Z is a real matrix

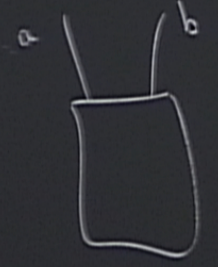


$Z \in \Gamma$

Composite systems

$$K_{ab} = K_a K_b$$

tomographic locality



$$N_{ab} = N_a N_b$$

information locality

true in CProbT QT

tomographic locality / true in CProbT and QT ≡ to iden can determine state by local measmt



information locality — true in CProbT: ✗, QT: ✓

If have into + tonos loc and

$$K_a = K(N_a)$$

and

$$K(N+1) > K(N)$$

and $N = 1$

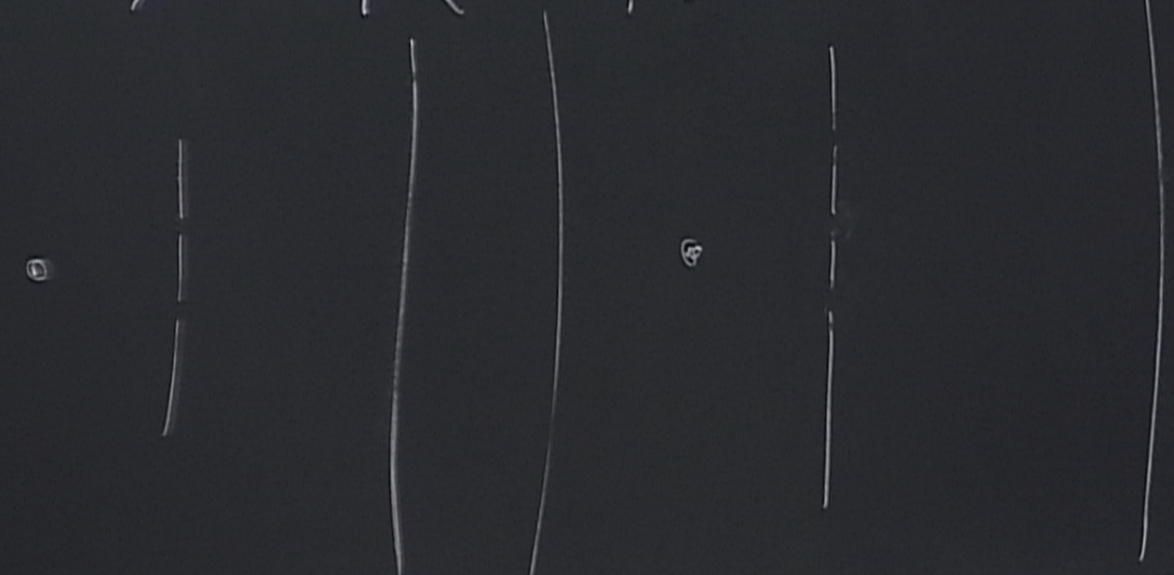
$\Rightarrow K$

and $N = 1, 2, 3, \ldots$

$\Rightarrow K = N^r \qquad r = 1, 2, 3, \ldots$

and $N = 1, 2, 3, \ldots$

$\Rightarrow K = N^r \qquad r = 1, 2, 3, \ldots$



$$K = x_1 N + x_2 \frac{1}{2} N(N-1) + x_3 \frac{N(N-1)(N-2)}{3!}$$

N	K_{RQT}	K_{EQT}	K_{DQT}
2	3	4	6
4	$10 > 3^2$	16	$28 < 6^2$

Five postulates for QT

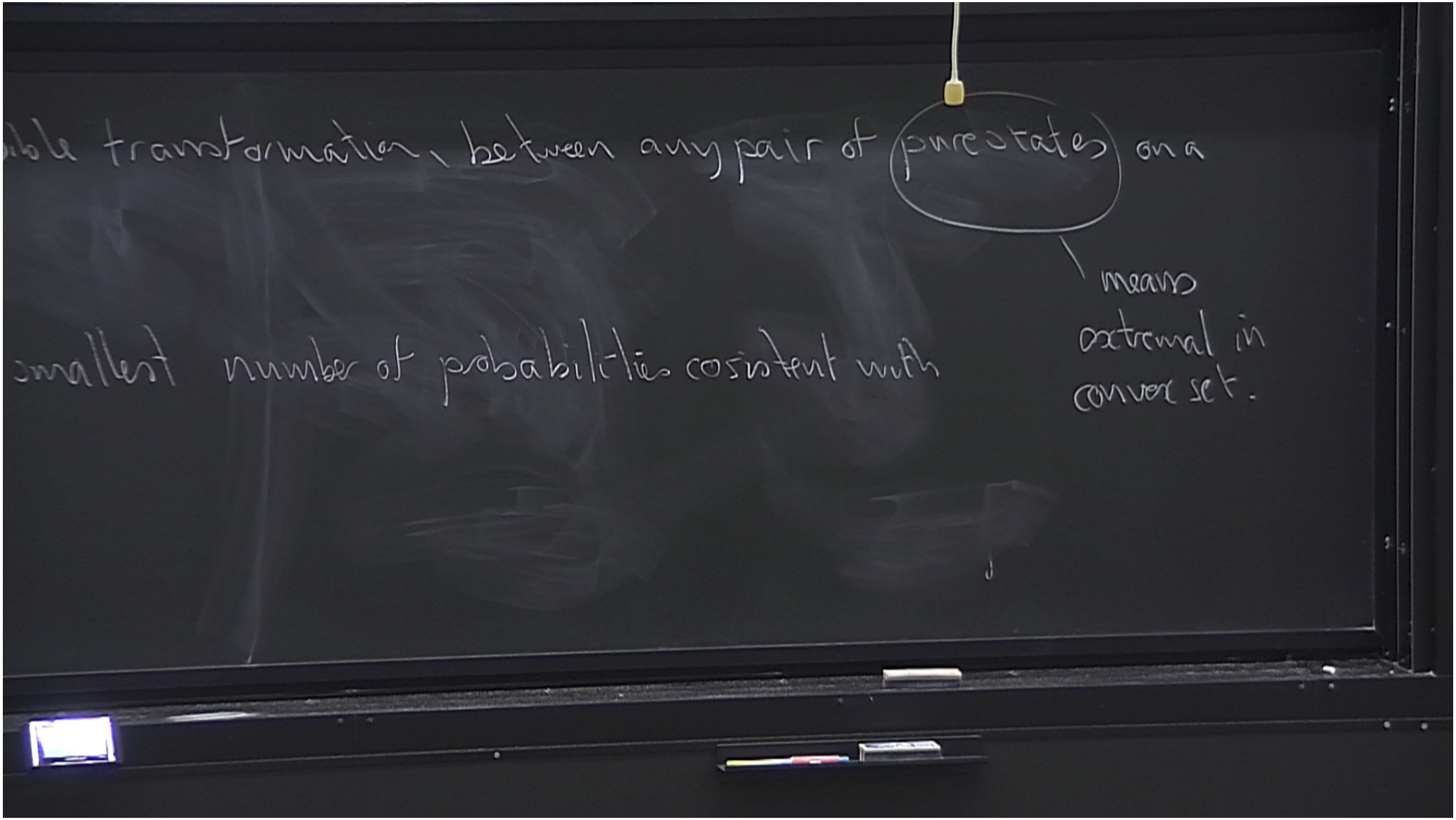
① Information — Systems having, or constrained to have a given information carrying capacity (N) have the same properties.

② Information Locality — $N_{ab} = N_a N_b$

③ Tomographic locality — $K_{ab} = K_a K_b$

④ Continuity — There exists a continuous reversible transformation ... given system

⑤ Simplicity — Systems are described by the smallest number of p... the other postulates.


able transformation, between any pair of pure states on a
means extremal in convex set.
smallest number of probabilities consistent with