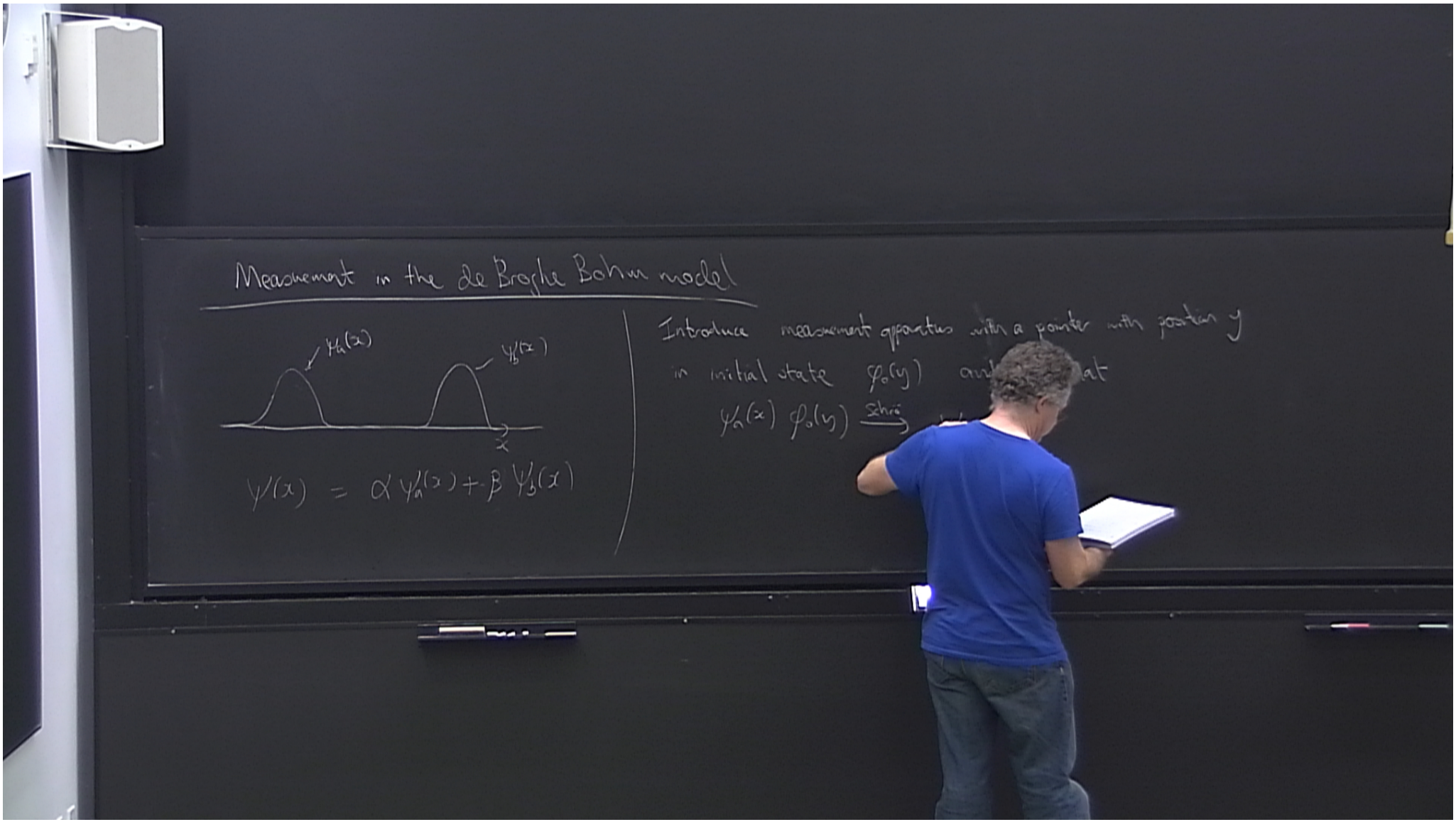
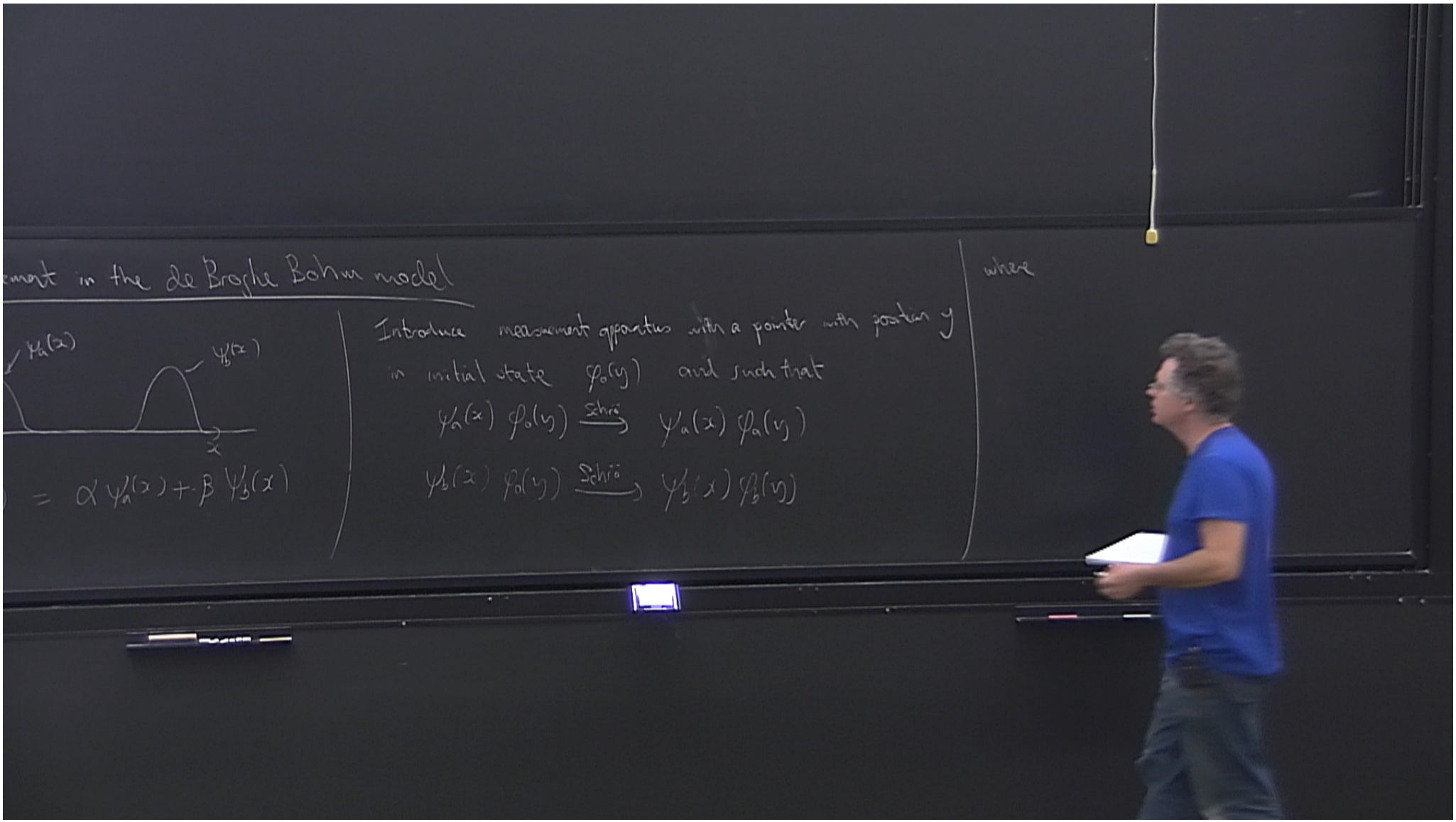
Title: Foundations of Quantum Mechanics-6

Date: Jan 12, 2015 11:30 AM

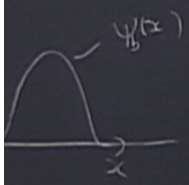
URL: http://pirsa.org/15010045

Abstract:


Measurement in the de Broglie Bohm model
$\psi_a(x)$
$\psi_b(x)$
x
$\psi(x) = \alpha\,\psi_a(x) + \beta\,\psi_b(x)$
Introduce measurement apparatus with a pointer with position y
in initial state $\phi_0(y)$
$\psi_a(x)\,\phi_0(y) \xrightarrow{\text{Schrö}}$


ement in the de Broglie Bohm model
$\psi_a(x)$
$\psi_b(x)$
x
$= \alpha\, \psi_a(x) + \beta\, \psi_b(x)$
Introduce measurement apparatus with a pointer with position y
in initial state $\varphi_0(y)$ and such that
$\psi_a(x)\, \varphi_0(y) \xrightarrow{\text{Schrö}} \psi_a(x)\, \varphi_a(y)$
$\psi_b(x)\, \varphi_0(y) \xrightarrow{\text{Schrö}} \psi_b(x)\, \varphi_b(y)$
where

de Broglie Bohm model



$x) + \beta\, \psi_b(x)$

Introduce measurement apparatus with a pointer with position y in initial state $\varphi_0(y)$ and such that

$$\psi_a(x)\, \varphi_0(y) \xrightarrow{\text{Schrö}} \psi_a(x)\, \varphi_a(y)$$

$$\psi_b(x)\, \varphi_0(y) \xrightarrow{\text{Schrö}} \psi_b(x)\, \varphi_b(y)$$

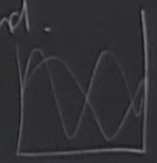
where

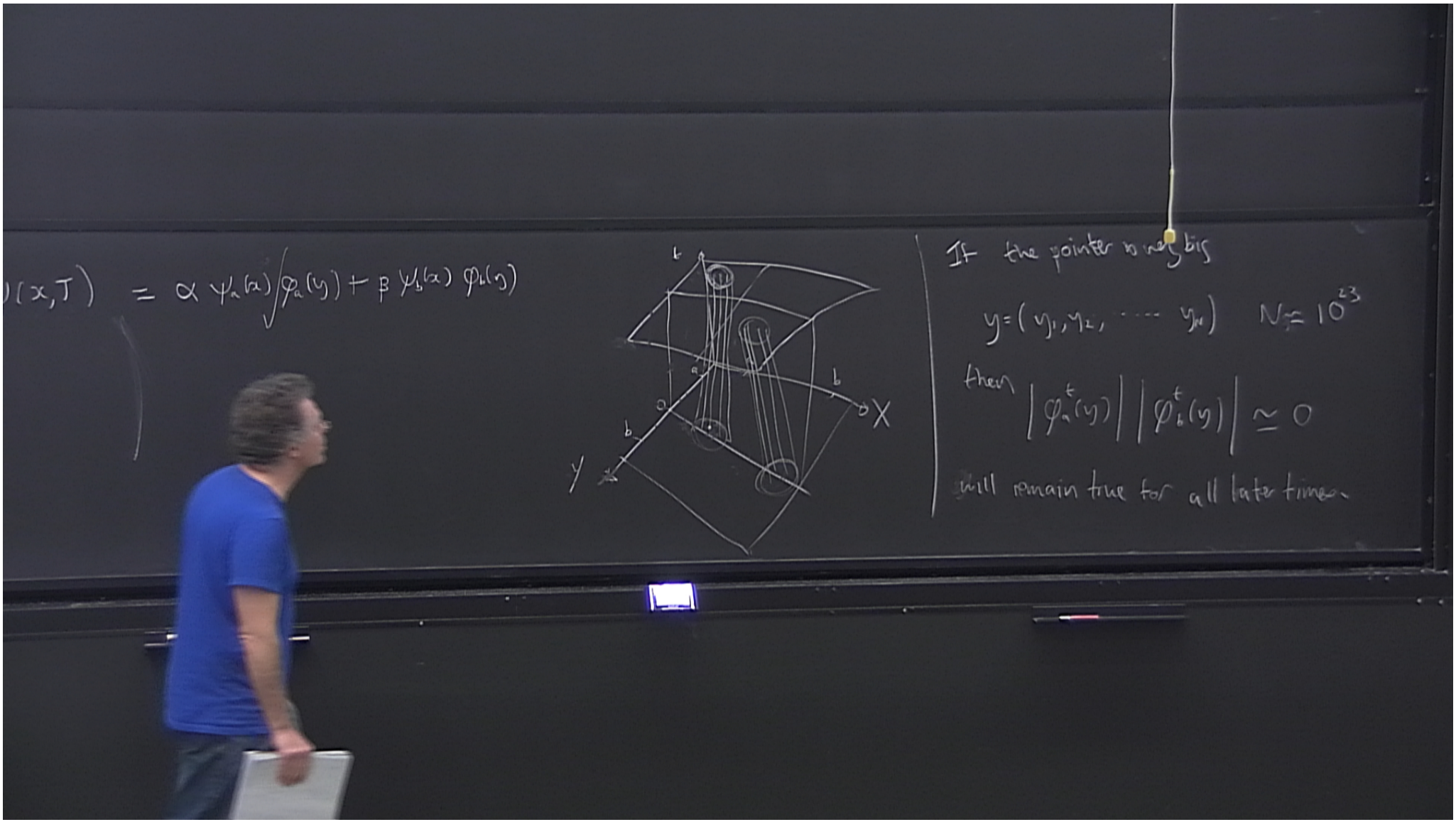
$$|\varphi_a(y)|\,|\varphi_b(y)| \simeq 0 \quad \forall y$$

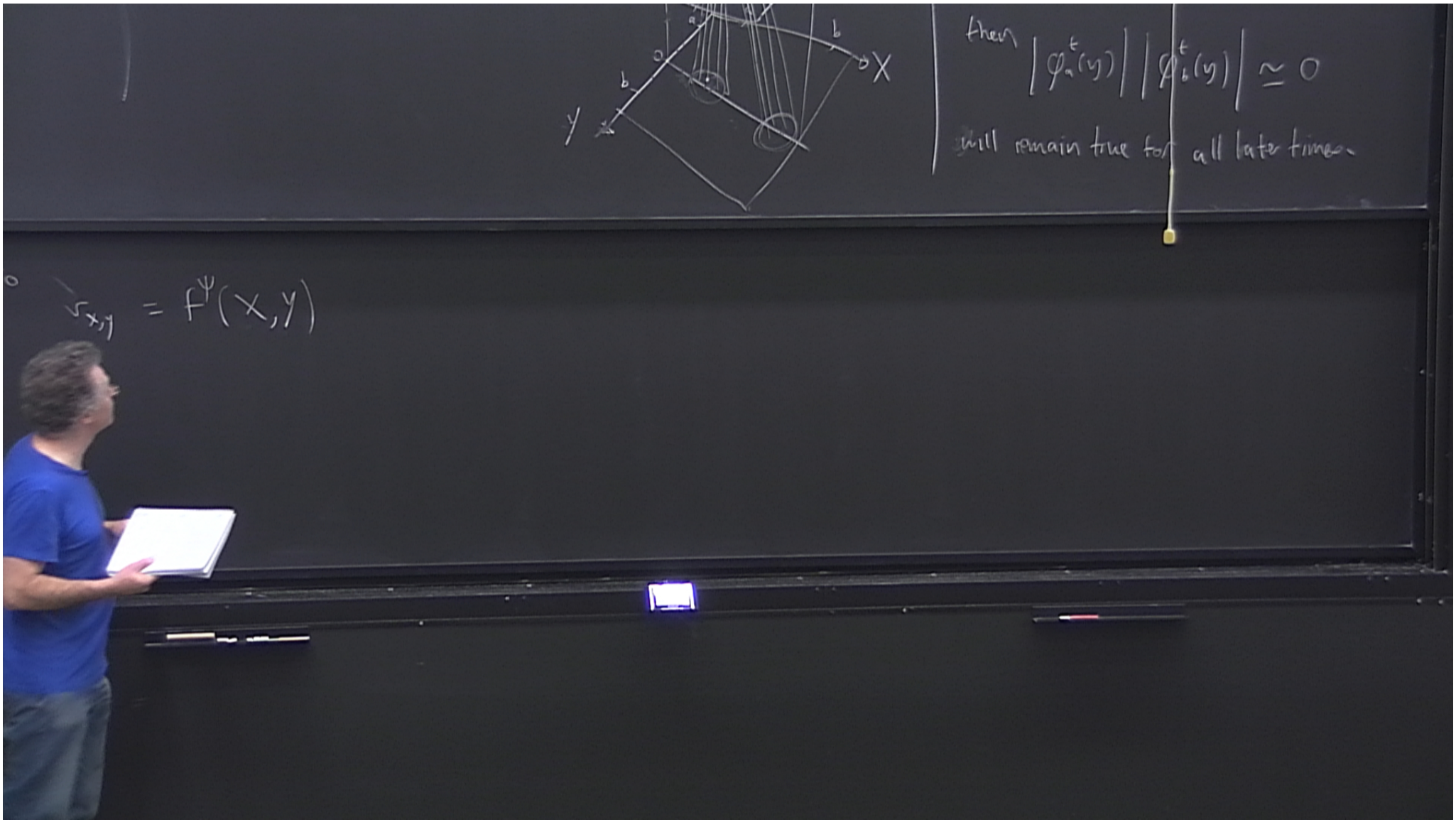
i.e. non-overlapping in y space.

$\Rightarrow$ stronger than orthog. cond.

$$\langle \varphi_a | \varphi_b \rangle \simeq 0$$




$\Psi(x,T) = \alpha\, \psi_a(x)\, \varphi_a(y) + \beta\, \psi_b(x)\, \varphi_b(y)$
X
Y
If the pointer is very big
$y = (y_1, y_2, \cdots y_N)$ $N \simeq 10^{23}$
then $|\varphi_a^t(y)|\,|\varphi_b^t(y)| \simeq 0$
will remain true for all later times.


a
b
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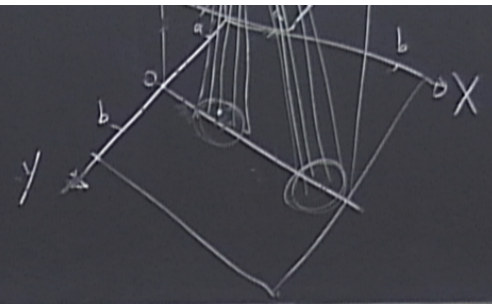
y
then $|\varphi_a^t(y)|\,|\varphi_b^t(y)| \simeq 0$
will remain true for all later times.
$v_{x,y} = f^{\psi}(x,y)$



then $\left|\varphi_a^t(y)\right| \left|\varphi_b^t(y)\right| \simeq 0$

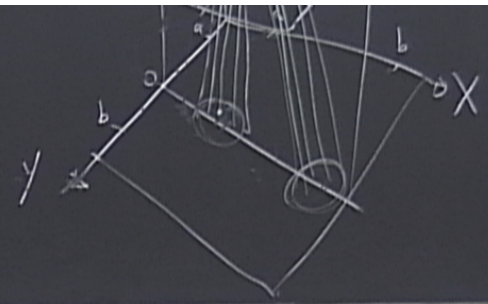
will remain true for all later times.

so $$r_{x,y} = f^{\psi}(x,y) \simeq f^{\psi_{eff}}(x,y)$$

where

$$\psi_{eff} = \begin{cases} \psi_a(x)\,\varphi_a(y) & \text{if } y \in \mathrm{Supp}(\varphi_a(y)) \\ \psi_b(x)\,\varphi_b(y) & \text{if } y \in \mathrm{Supp}(\varphi_b(y)) \end{cases}$$

$\Rightarrow$ the projection postulate is recovered.



then $\left|\varphi_a^t(y)\right| \left|\varphi_b^t(y)\right| \simeq 0$

will remain true for all later times.

so

$$s_{x,y} = f^{\psi}(x,y) \simeq f^{\psi_{eff}}(x,y)$$

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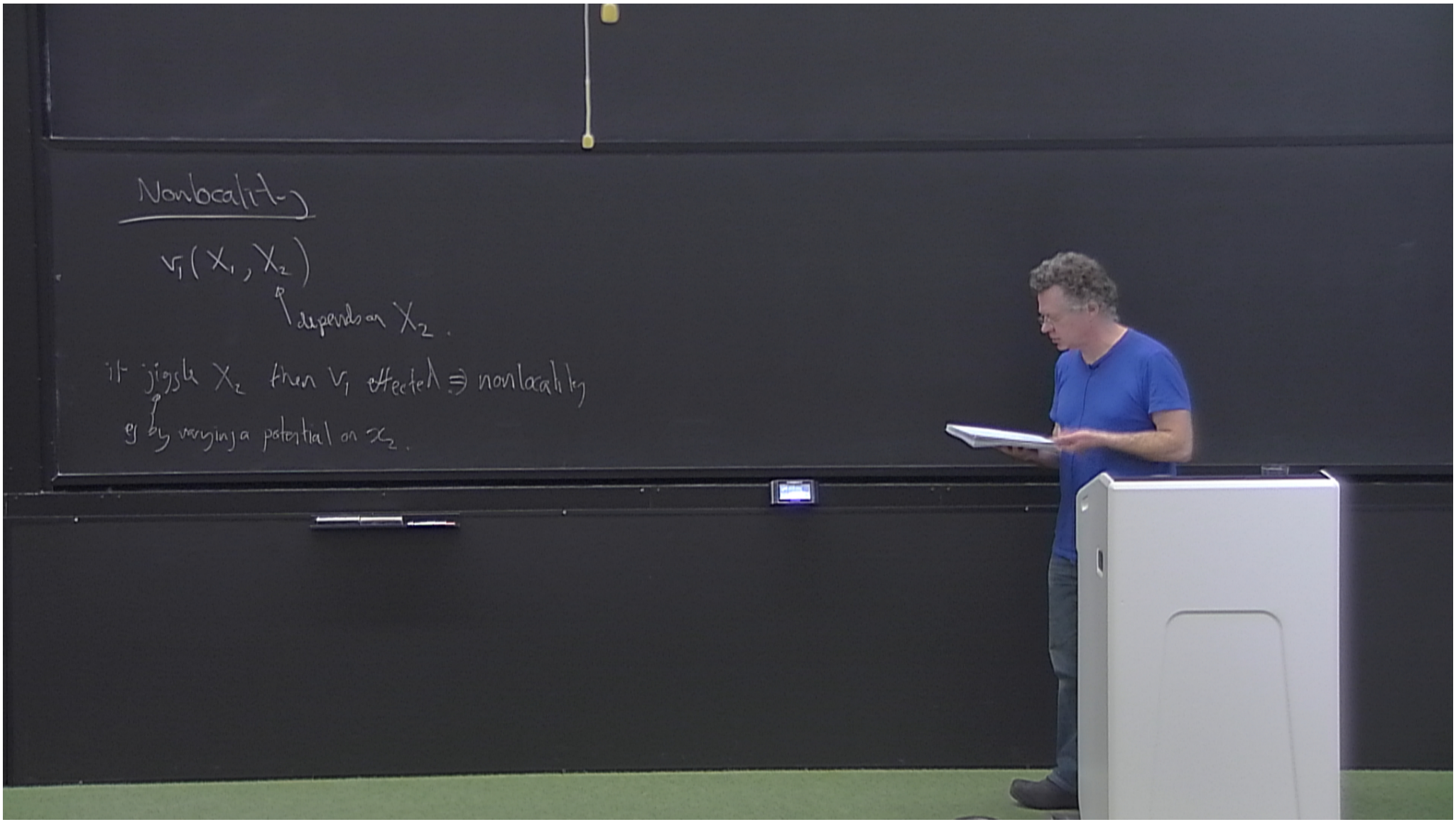
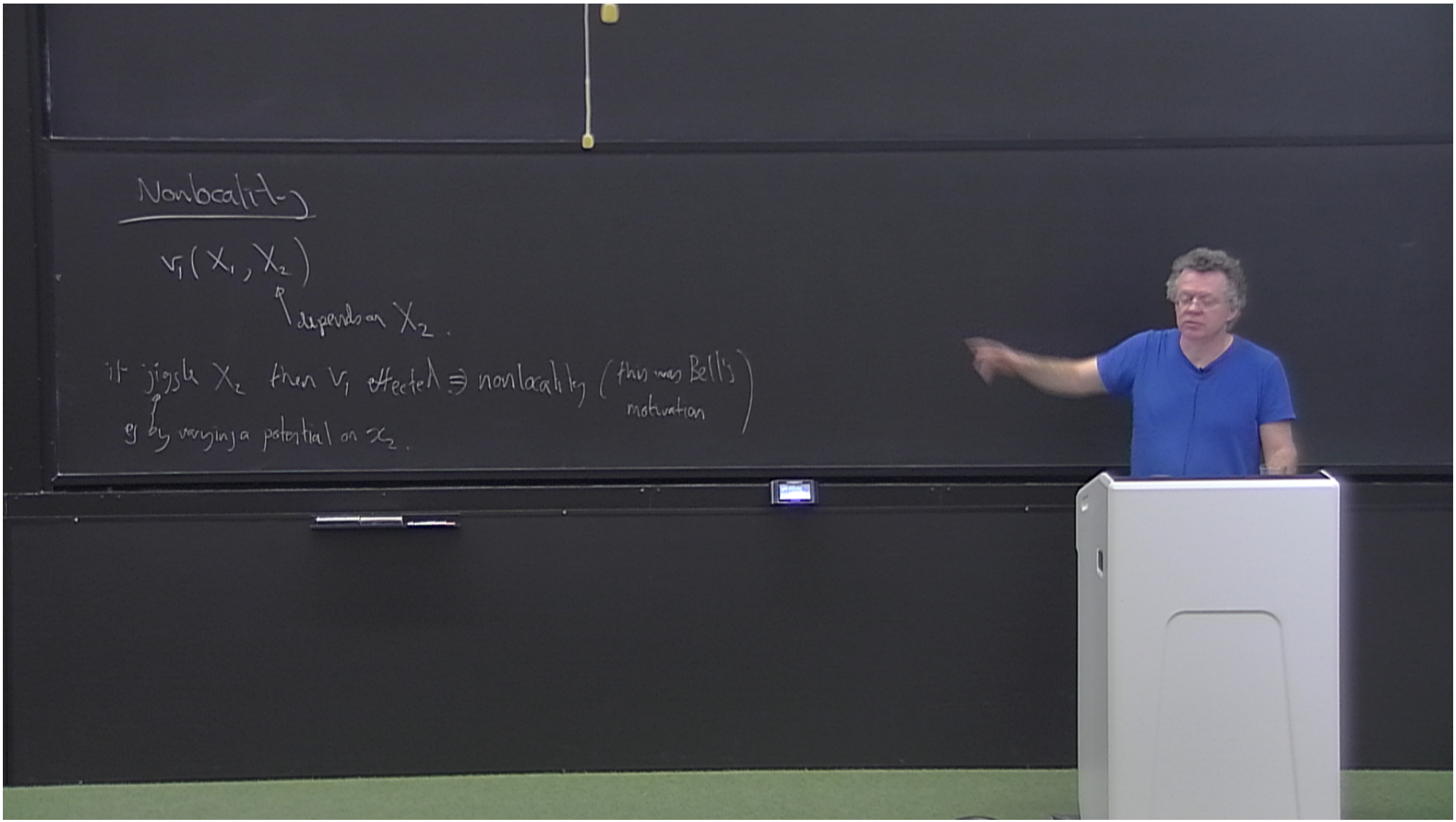
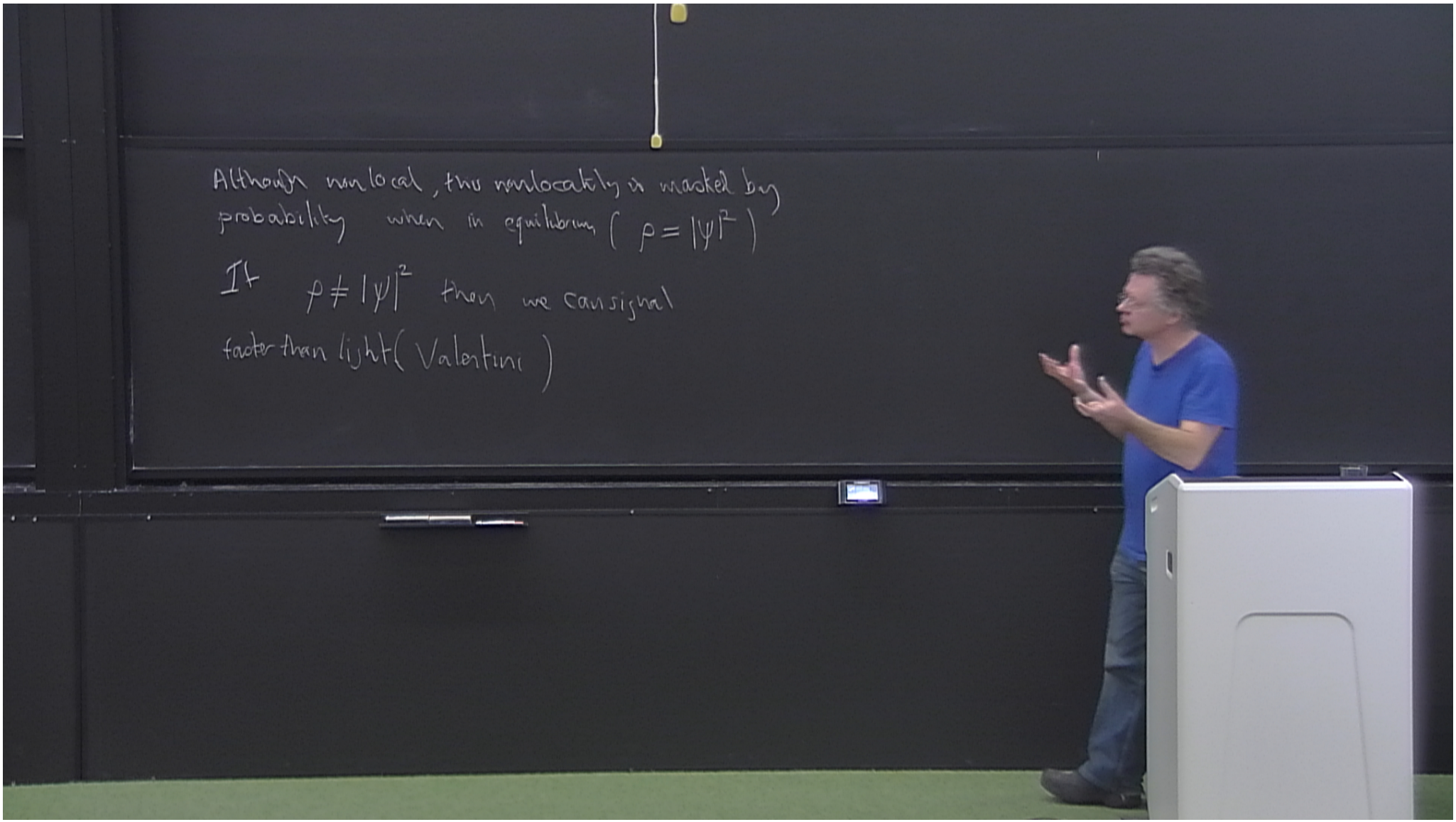
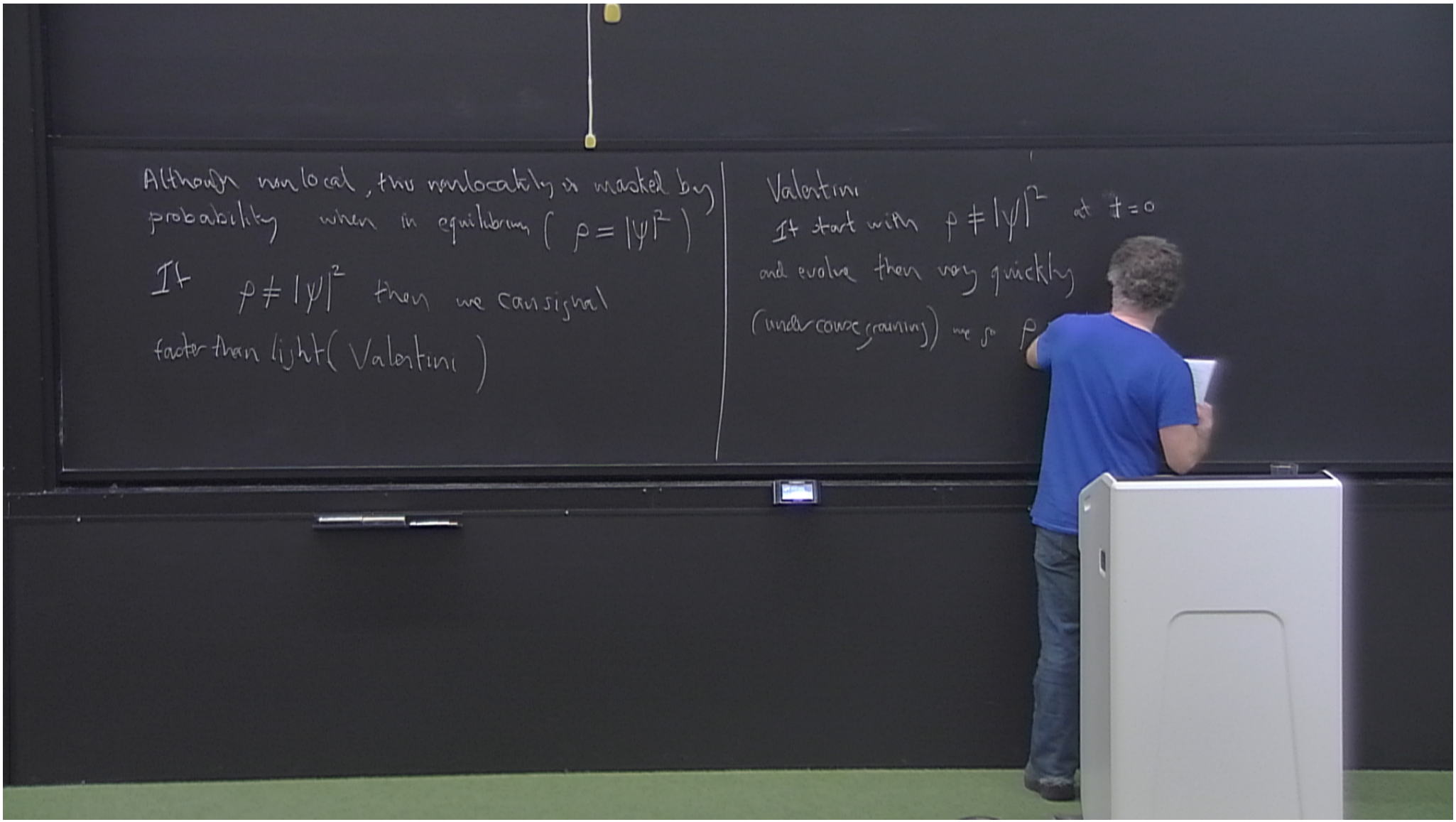

Nonlocality
$v_1(X_1, X_2)$
depends on X_2.
if jiggle X_2 then v_1 effected $\Rightarrow$ nonlocality
eg by varying a potential on x_2.


Nonlocality
$v_1(X_1, X_2)$
depends on X_2.
if jiggle X_2 then v_1 effected $\Rightarrow$ nonlocality (this was Bell's motivation)
eg by varying a potential on x_2.


Although nonlocal, this nonlocality is masked by
probability when in equilibrium ($\rho = |\psi|^2$)
If $\rho \neq |\psi|^2$ then we can signal
faster than light (Valentini)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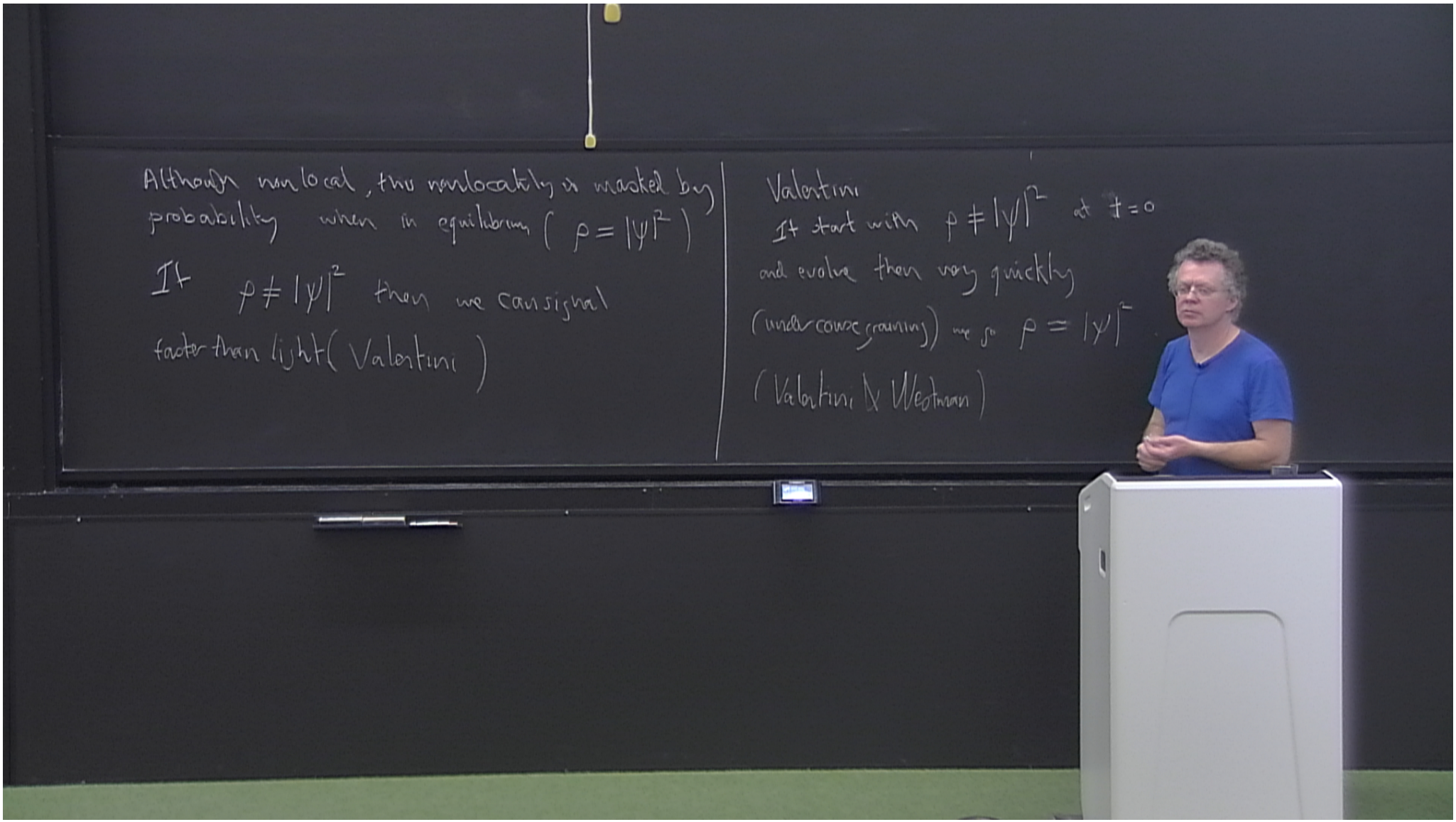
If start with $\rho \neq |\psi|^2$ at $t=0$
and evolve then very quickly
(under coarse graining) we go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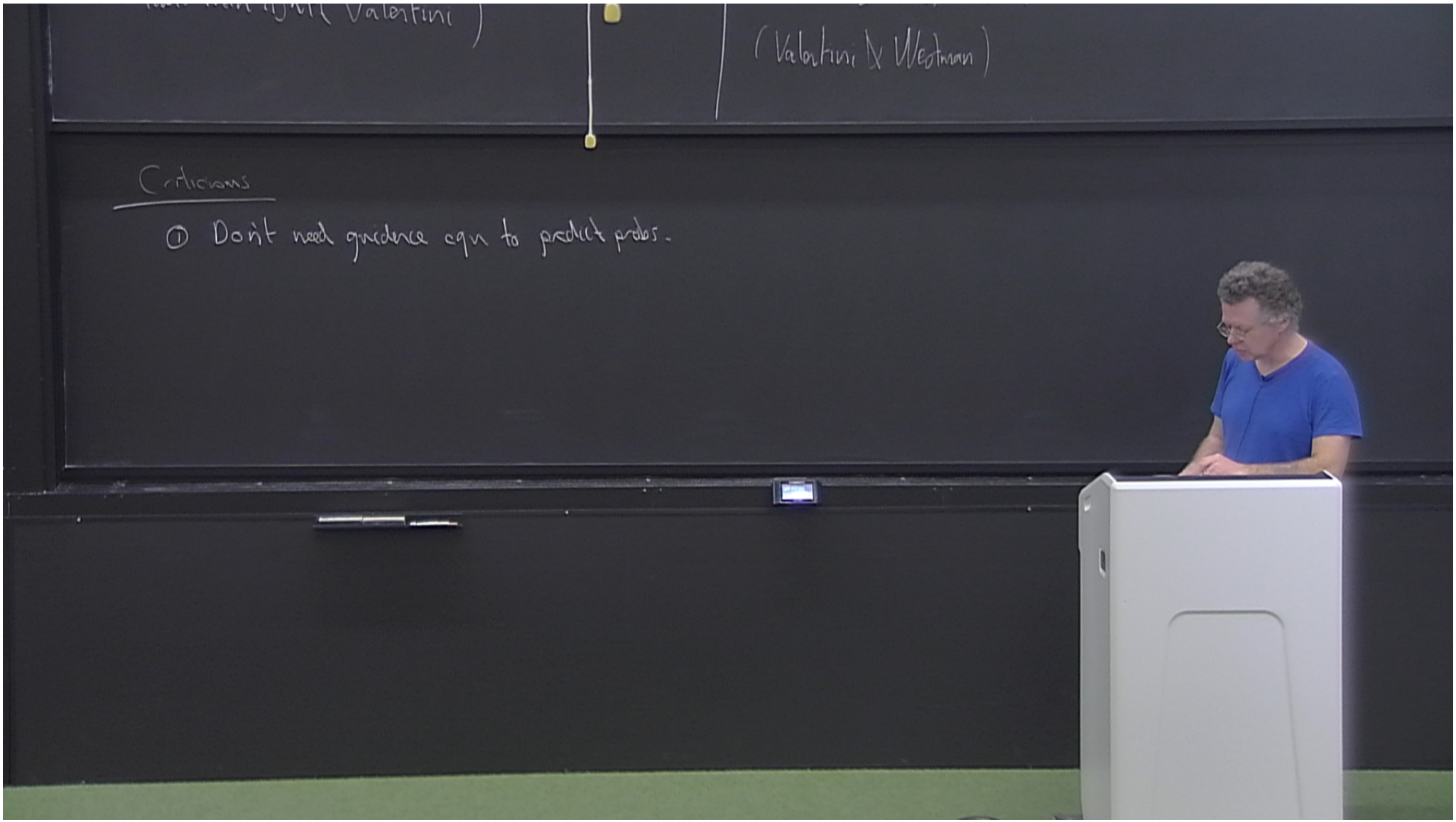
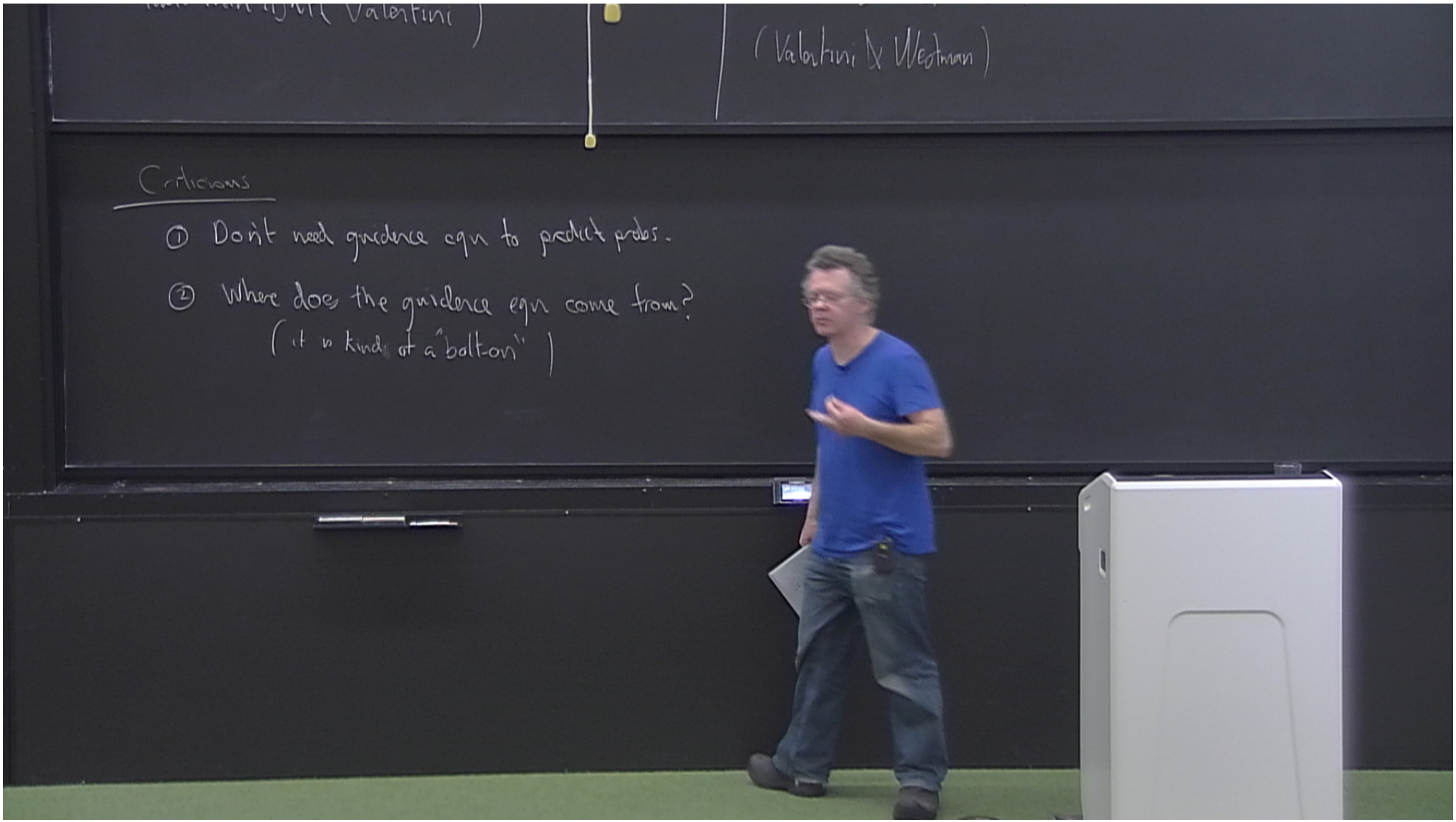
(under coarse graining) we get $\rho = |\psi|^2$
(Valentini & Westman)


(Valentini & Westman)
Criticisms
① Don't need guidance eqn to predict probs.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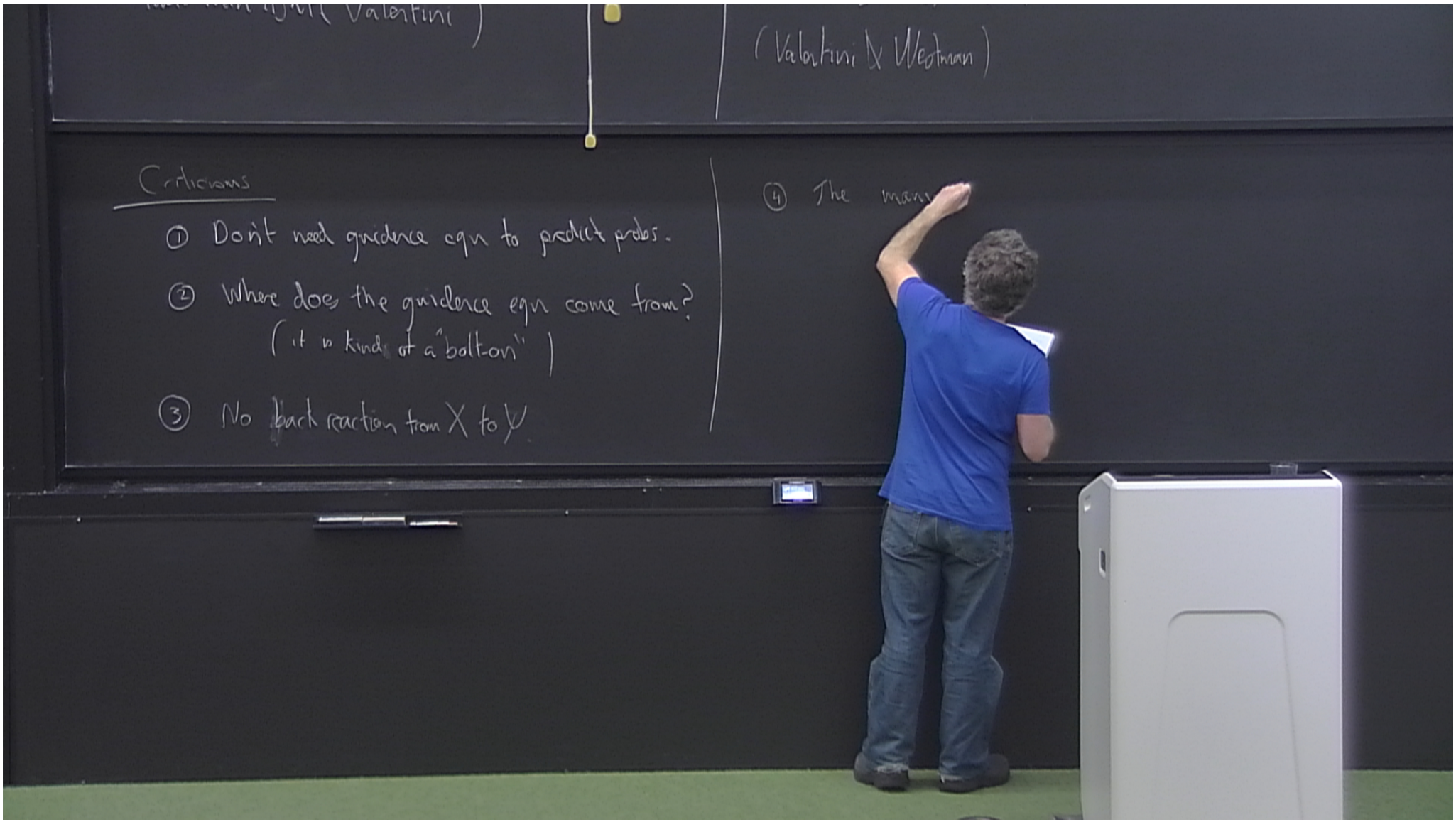
② Where does the guidance eqn come from?
(it is kind of a "bolt-on")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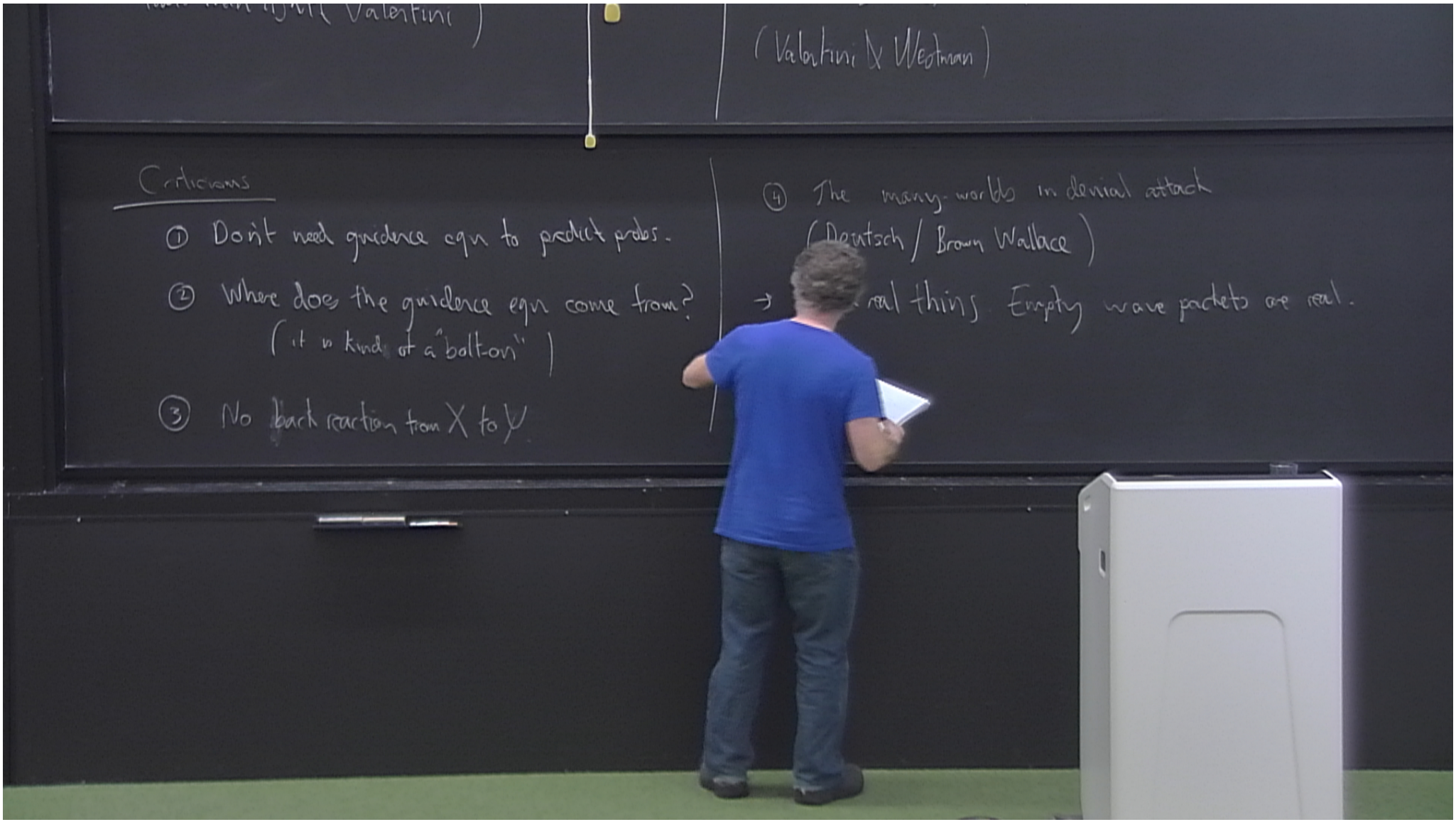
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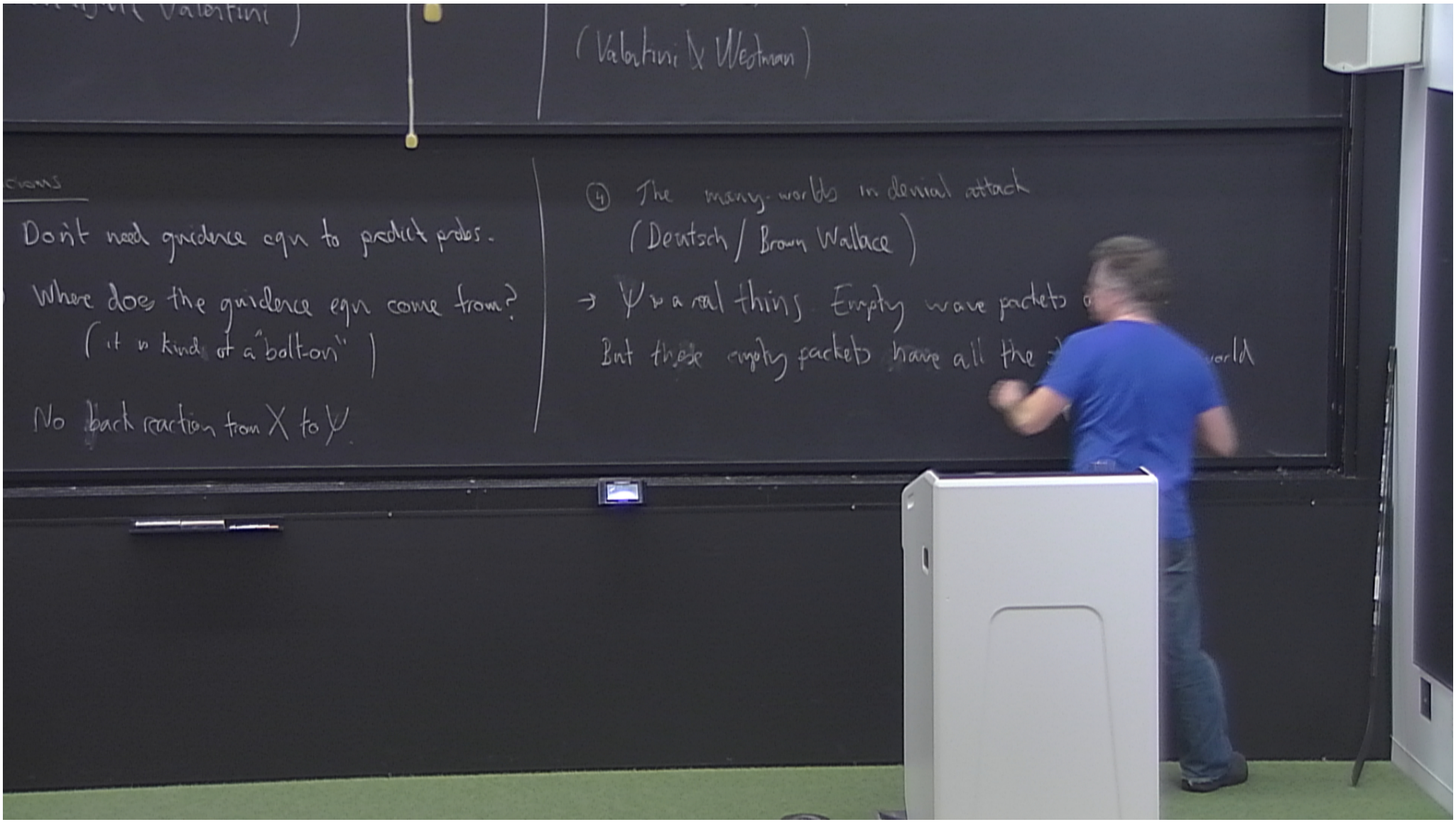
④ The many-worlds in denial attack
(Deutsch / Brown Wallace)
→ real things. Empty wave packets are real.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Don't need guidance eqn to predict probs.
Where does the guidance eqn come from?
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No back reaction from X to ψ
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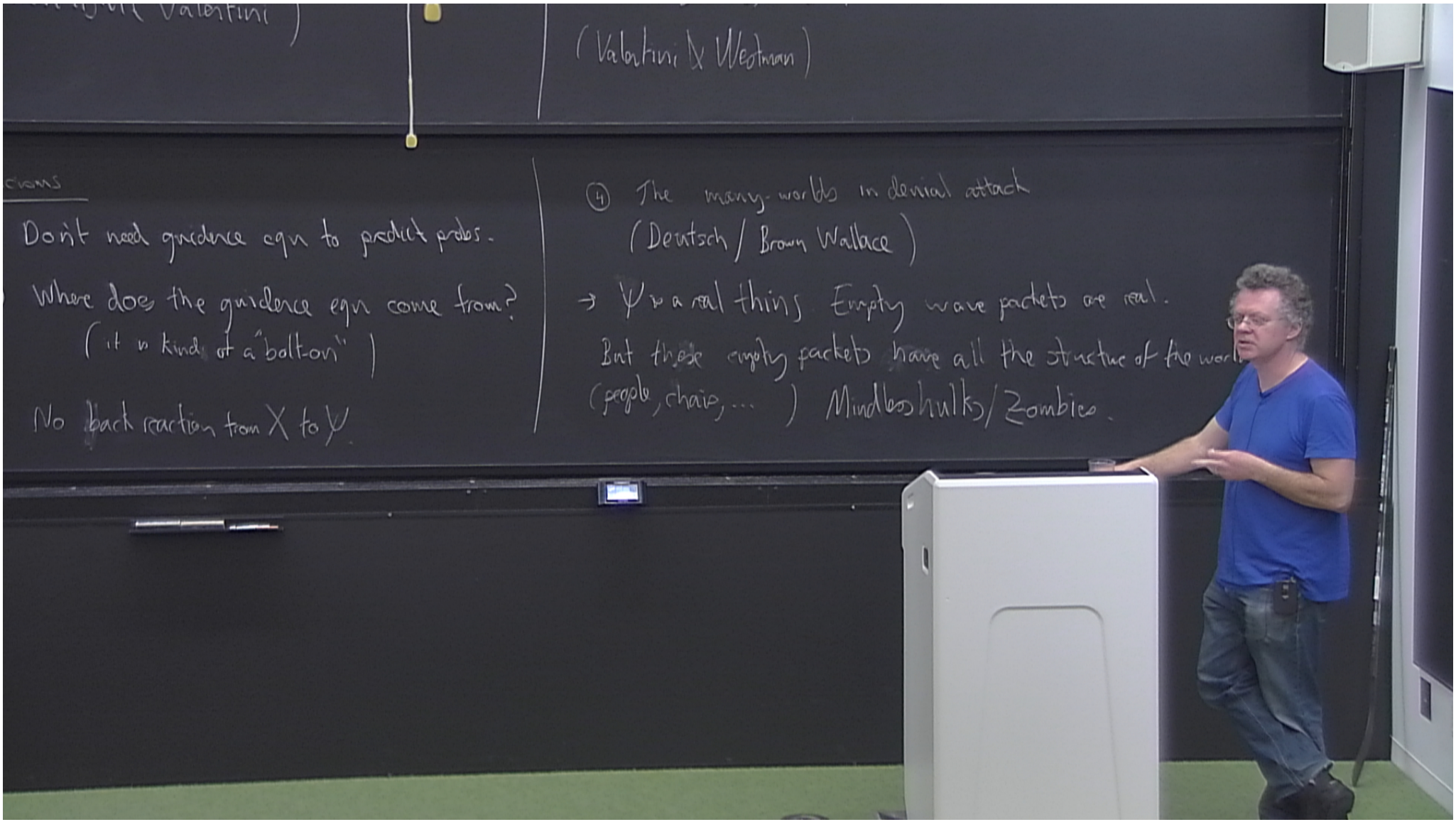
→ ψ is a real thing. Empty wave packets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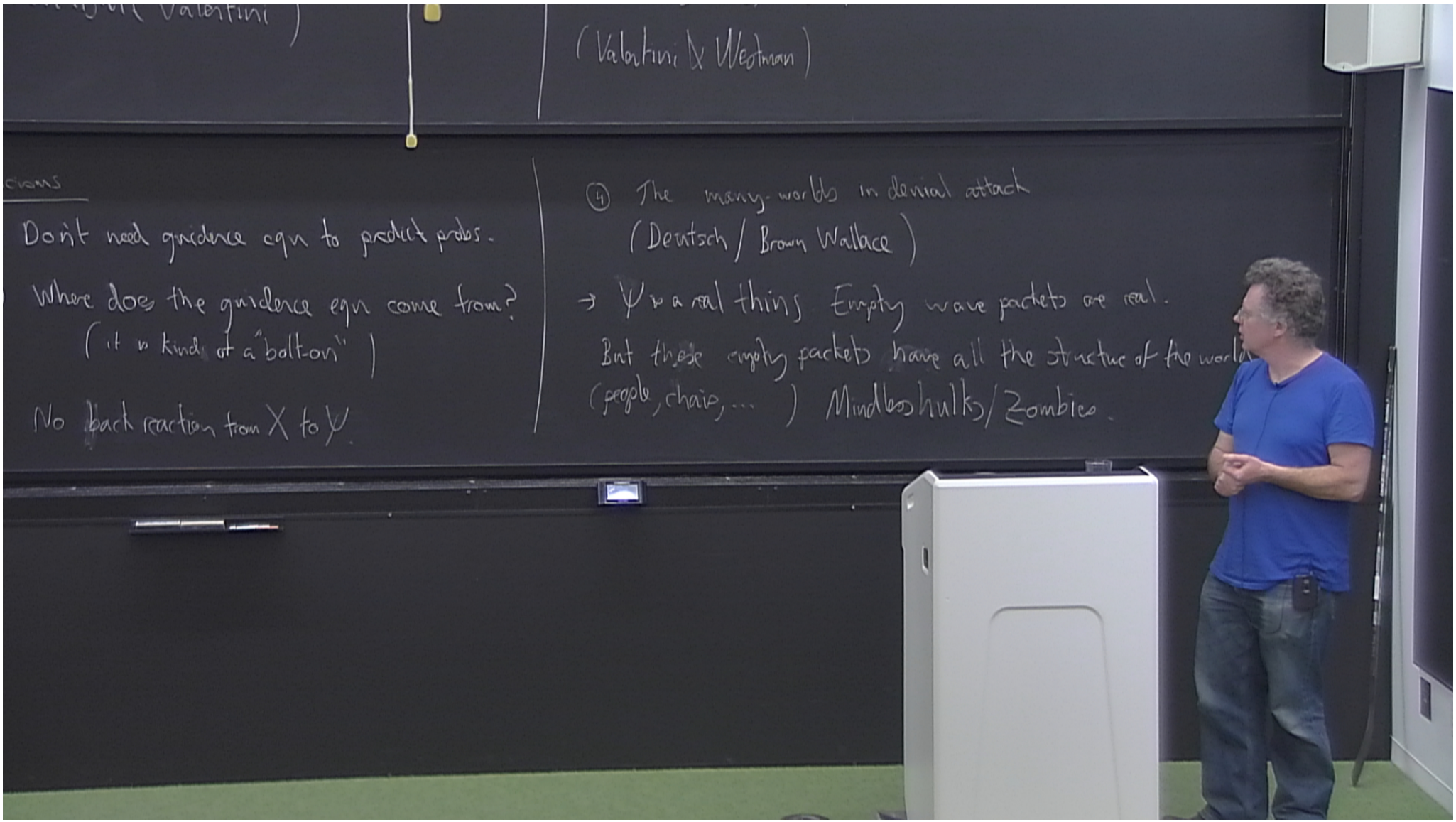
→ ψ is a real thing. Empty wave packets are real.
But those empty packets have all the structure of the world
(people, chairs, ...) Mindless hulks / Zombies.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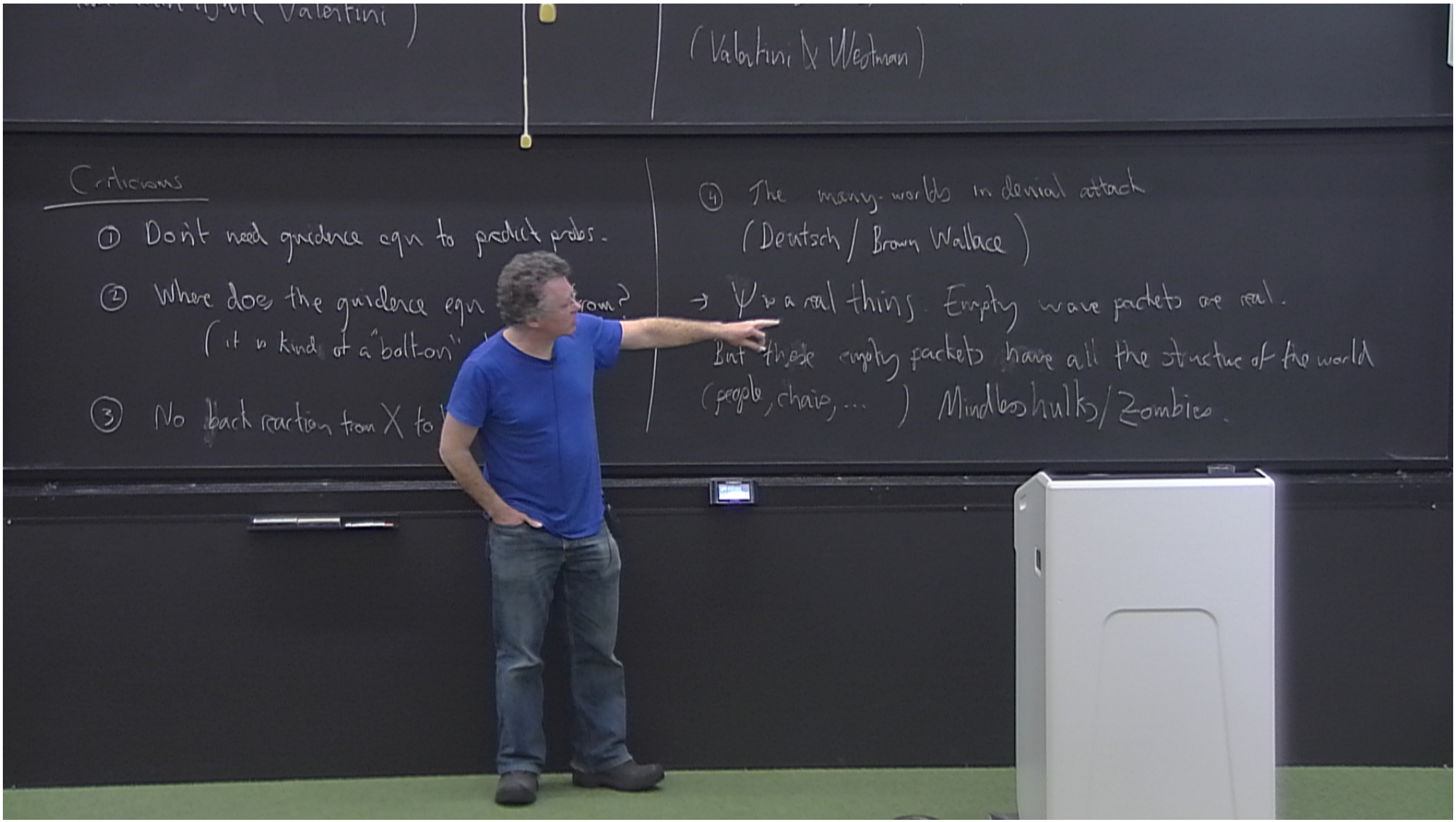
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