

Title: PSI 2015/2016 Foundations of Quantum Mechanics - Lecture 8

Date: Jan 13, 2016 11:30 AM

URL: <http://pirsa.org/16010062>

Abstract:



The Many worlds interp. (Everett 1957)

The axioms.

- ① The ontic state at time t is given by $|\psi\rangle$.
- ② The wavefunction evolves according to the Schrödinger equation:
$$i\hbar \frac{\partial |\psi\rangle}{\partial t} = \hat{H} |\psi\rangle$$

57)

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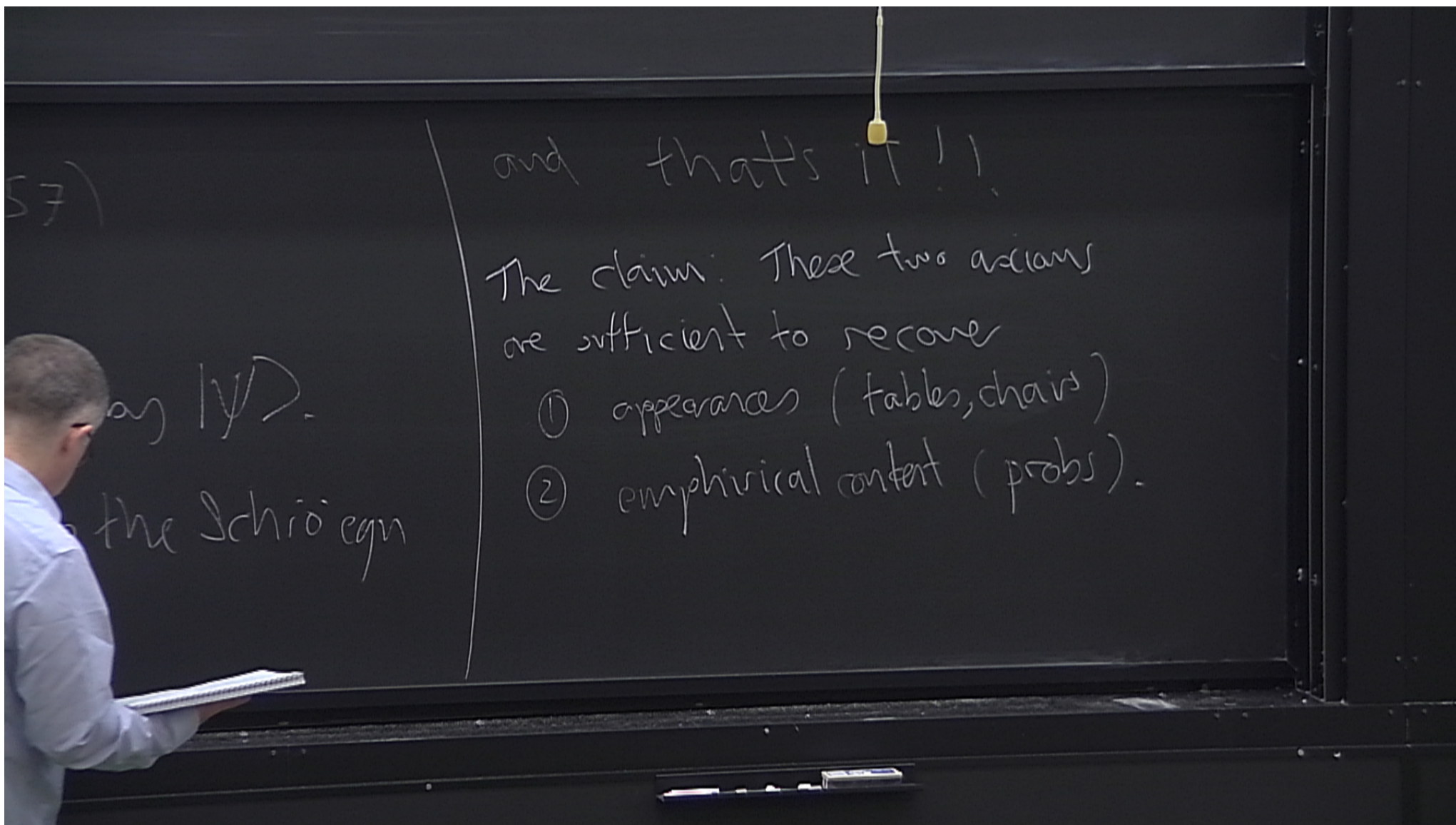
to the Schrödinger eqn

and that's it!!

The Many worlds interp. (Everett 1957)

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- ① The ontic state at time t is given by $|\psi(t)\rangle$
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$$\frac{\partial F}{\partial T} = \frac{1}{T^2} \left(\frac{\partial F}{\partial \beta} \right)$$

Will follow David Wallace

Two problems

- ① where does the "world structure" come from
and in what basis

$$\frac{\partial F}{\partial t} = \frac{1}{2} \frac{d^2 F}{dt^2}$$

Will follow David Wallace

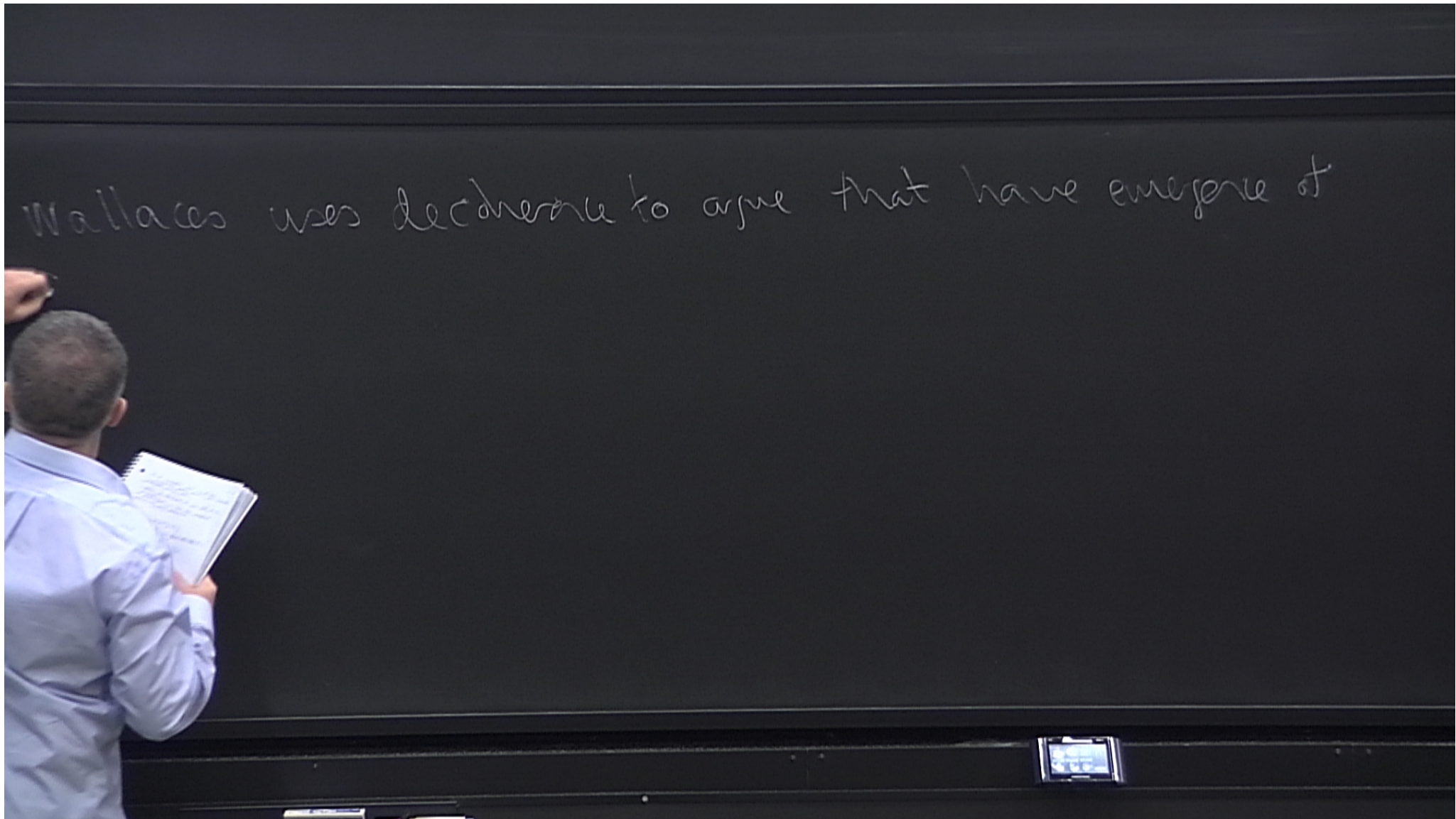
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) influenced by
S. Saunders

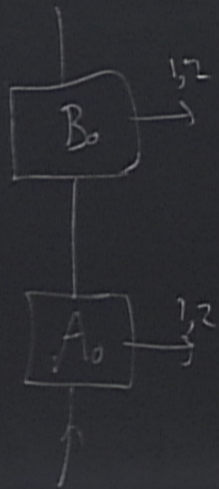
where does the Born rule come from?

) influenced by
David Deutsch



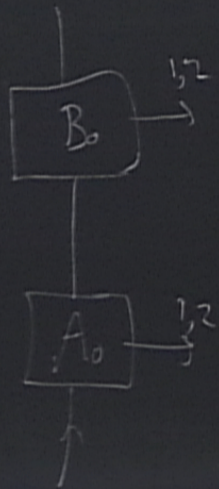
Wallace uses decoherence to argue that have emergence of
quasiclassical worlds

$$|\psi\rangle |A_0\rangle |B_0\rangle \rightarrow \alpha |a_1\rangle_s |A_1\rangle + \dots$$



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$$\rightarrow \alpha \gamma |b_1\rangle |A_1\rangle |B_1\rangle + \alpha \delta |b_2\rangle |A_1\rangle |B_2\rangle$$

$$+ \beta(-\delta) |b_1\rangle |A_2\rangle |B_1\rangle + \beta \gamma |b_2\rangle |A_2\rangle |B_2\rangle$$

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one of

$$|a_2\rangle|A_2\rangle|B_0\rangle$$

$$+ \alpha \delta |b_2\rangle|A_1\rangle|B_2\rangle$$

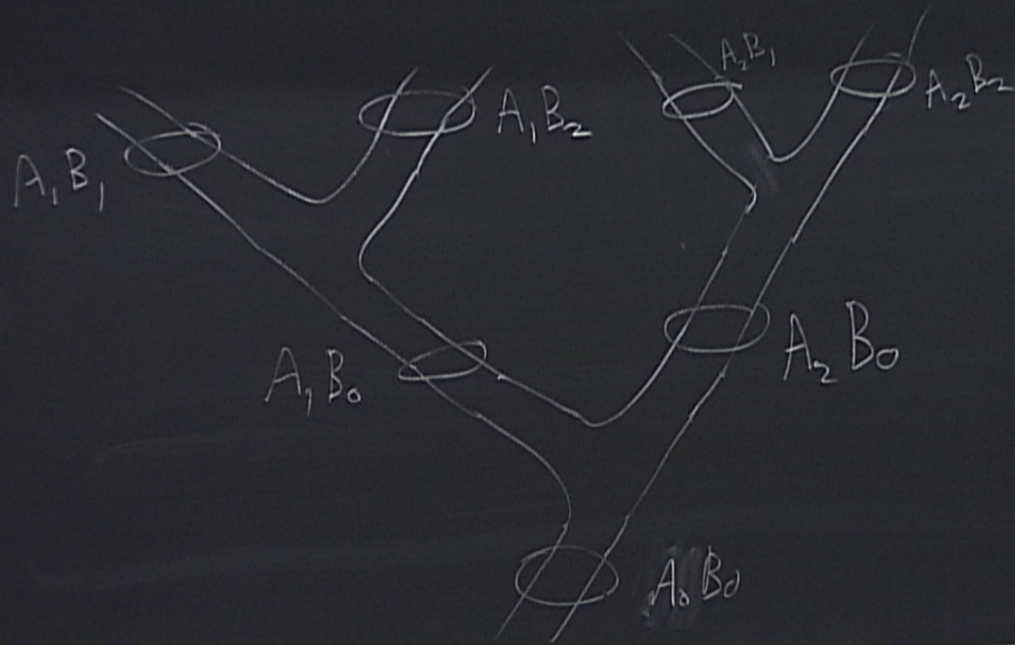
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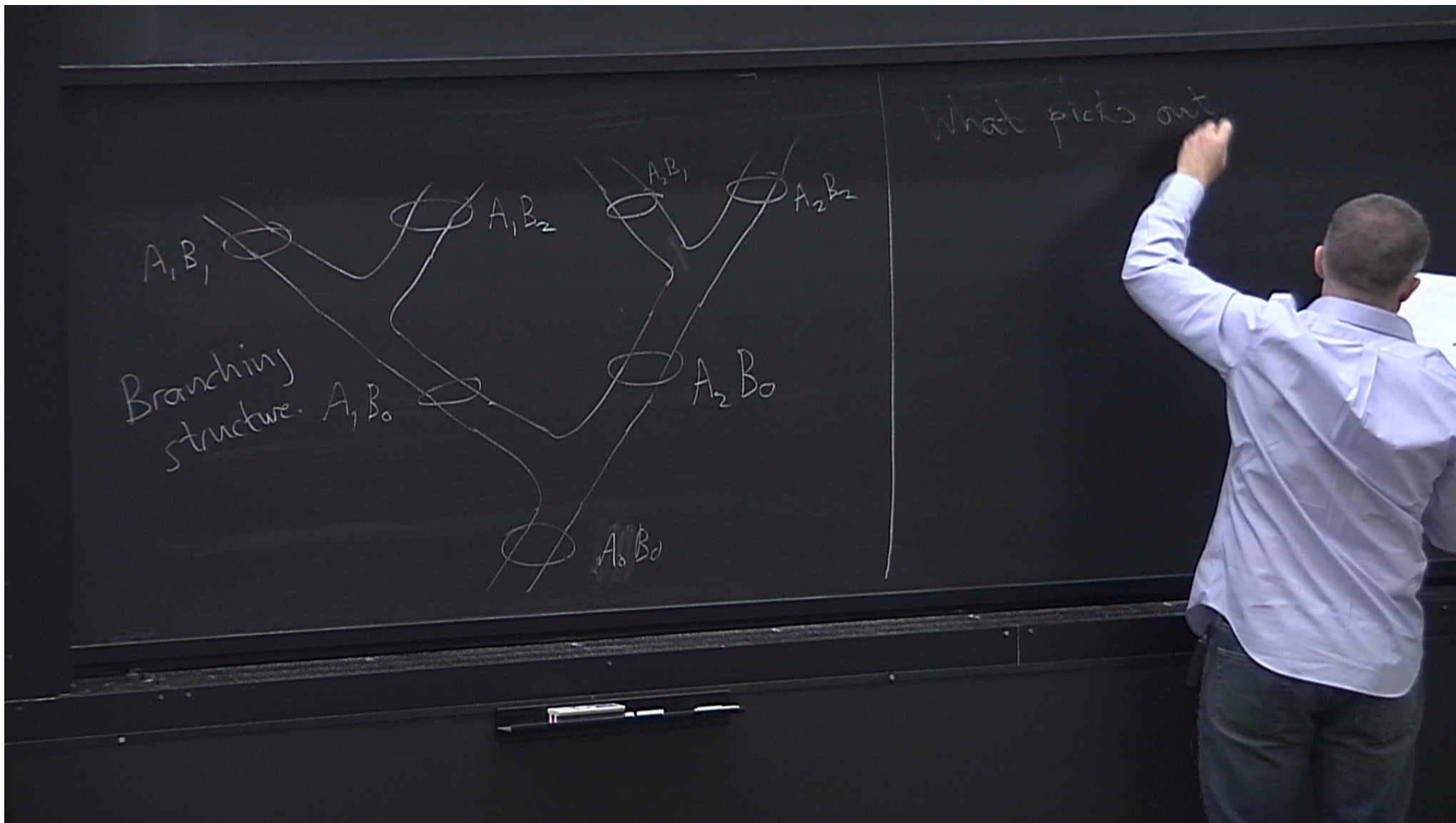
$$|a_1\rangle = \gamma |b_1\rangle + \delta |b_2\rangle$$

$$|a_2\rangle = -\delta^* |b_1\rangle + \gamma |b_2\rangle$$

$$\langle a_2 | a_1 \rangle$$

$$= -\delta\gamma + \delta\gamma = 0$$





Consider a "wrong" basis

e.s

$$\left(|A_1\rangle \pm |A_2\rangle \right) |E_0\rangle \rightarrow |A_1\rangle |E_1\rangle + |A_2\rangle |E_2\rangle$$

Consider a "wrong" basis

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Probabilities

Everything with non zero amplitude certainly happens

$$|\psi\rangle|A_0\rangle \rightarrow \alpha|a_1\rangle|A_1\rangle + \beta|a_2\rangle|A_2\rangle$$

what if $\beta = 10^{-100}$

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 $\text{prob} = |\beta|^2 = 10^{-200}$

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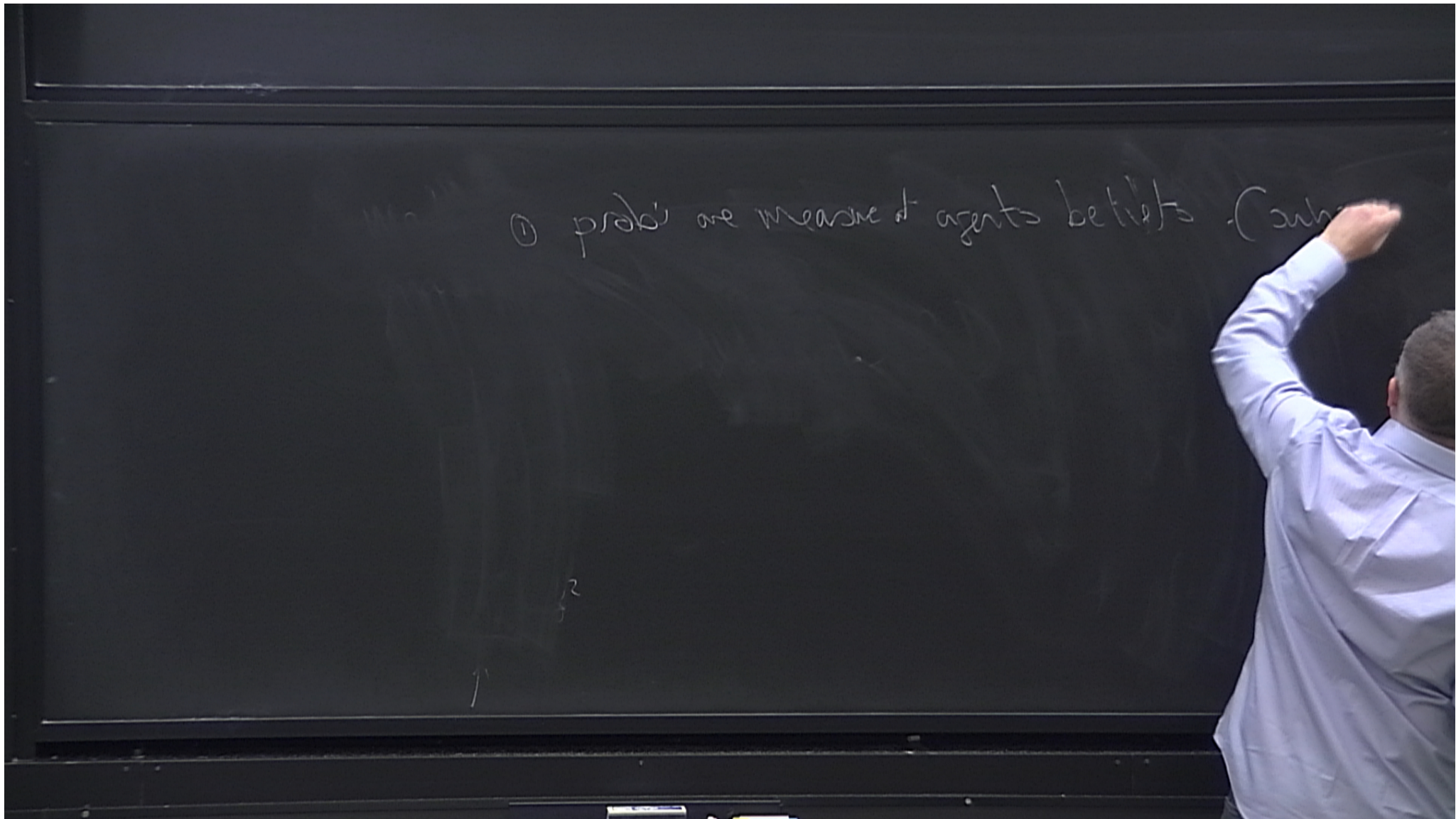
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① prob's are measure of agents beliefs. (subjective)

Decision theory.

states, s $\xrightarrow{\text{belts}}$ rewards, r .
(outcomes)

$b(s)$

e) Can impose certain principles of rationality

eg. $b_1 > b_2$ prefers bet 1 over bet 2

and $b_2 > b_3$

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Get theorems

$\exists$ unique $P_i(s)$ s.t. $\sum_s P_i(s) = 1$

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The Principle Principle.

A rational agent who knows
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