

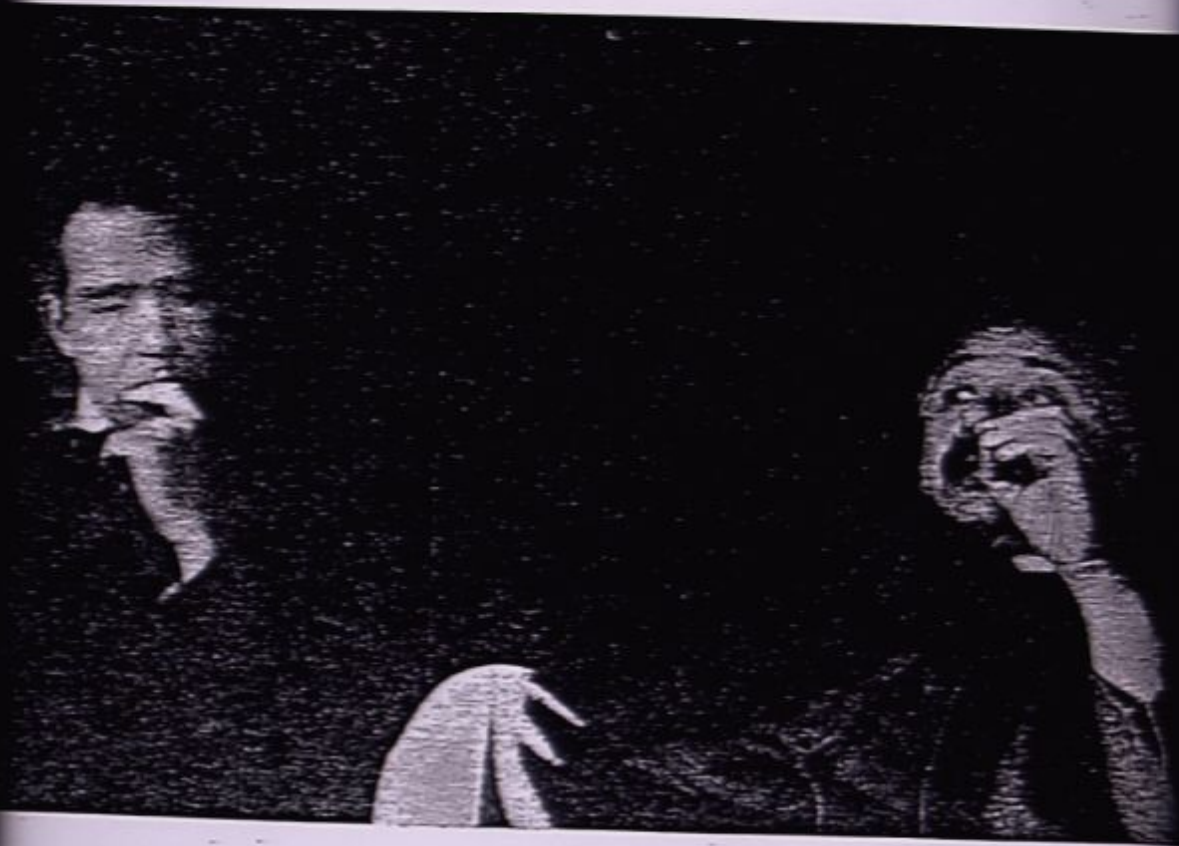
Title: Introduction to quantum foundations (Part 1A)

Date: Aug 27, 2007 09:15 AM

URL: <http://pirsa.org/07080038>

Abstract:





4 historical periods: empiric, 3rd 1960s → 1980s.

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problem 2) mixtures, density matrices
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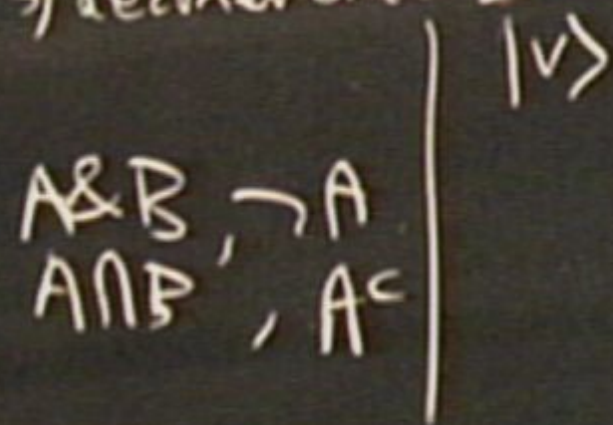
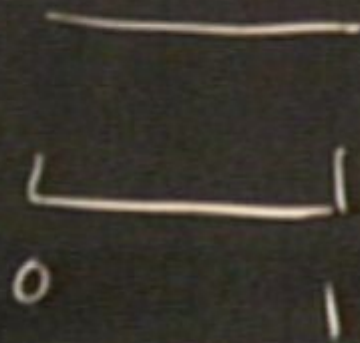
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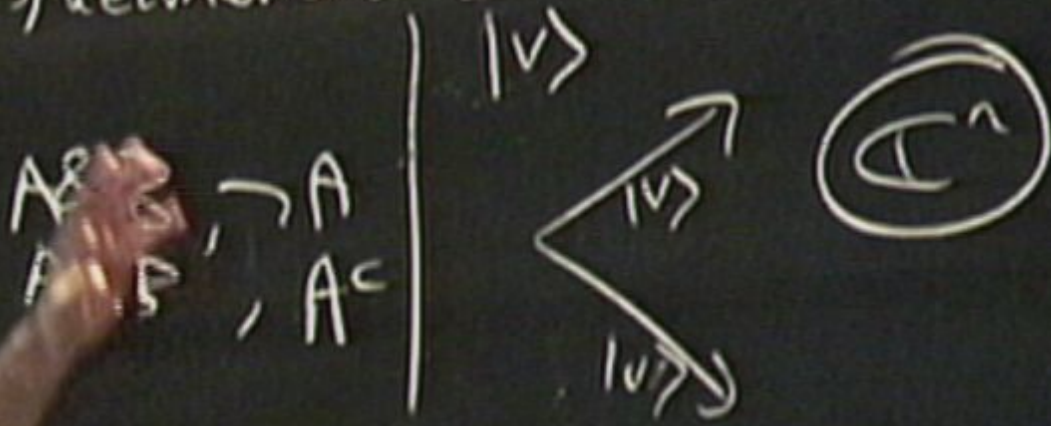


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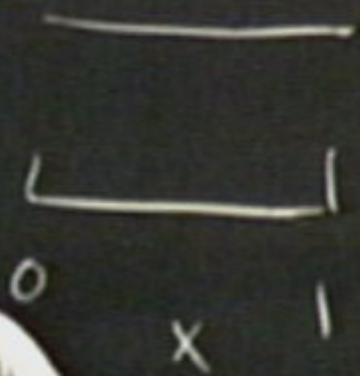


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3. The Measurement Problem

A quantum measurement on an electron in a superposition of two momentum eigenstates results in a definite value for the momentum, which is not predicted by the wave function.

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An apparatus, with 'ready state' $|r\rangle$, which reliably reads these eigenstates, in the sense

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Then an initial a superposition yields:

$$\{|1\rangle + |2\rangle\}|r\rangle \rightarrow |1\rangle|\text{reads '1'}\rangle + |2\rangle|\text{reads '2'}\rangle.$$

The final state is not an eigenstate of pointer position!

4. Decoherence?

The final state of the electron+pointer+environment determines for the pointer a more general kind of state, a *mixture* which is:

very close to a mixture of position eigenstates.

But this mixture is not interpretatively right: it is *improper*.

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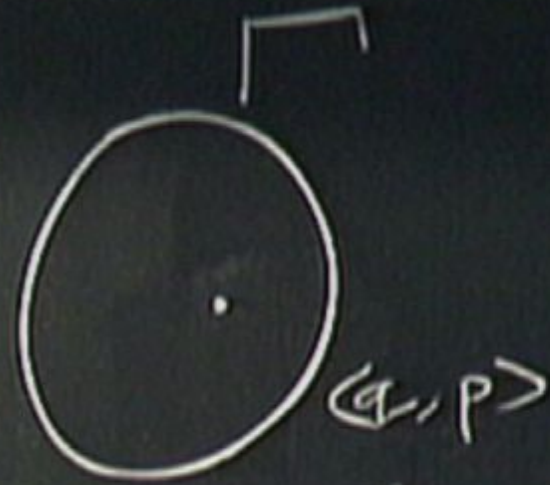
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$$\text{pr} : A \subset \Sigma \mapsto \text{pr}(A) \in [0, 1]$$

5. Two Choices Yield Four Strategies

We must choose between:

(Dynamics): We propose new dynamical laws that evolve a superposition into a (proper) mixture.

(ExtraValues) We ascribe to certain quantities values beyond those prescribed by the eigenvalue-eigenstate link.

“We only know the macrorealm *appears* definite” prompts another choice:

(DefMac): We secure a definite macrorealm; and expect a ‘classical psychophysics’ to account for experience.

(DefApp): We allow an indefinite macrorealm, but secure that it *appears* definite—and so expect some ‘quantum psychophysics’.