

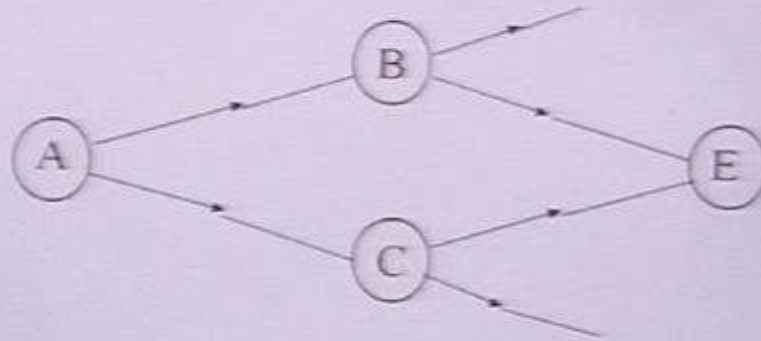
Title: The quantum realization paradox: theoretical considerations and experimental input (Part 1A)

Date: Aug 31, 2007 09:15 AM

URL: <http://pirsa.org/07080054>

Abstract:

## INTERFERENCE OF AMPLITUDES IN QM



MEASURE:  $P_{A \rightarrow B \rightarrow E}$  (shut off channel C)  
 $P_{A \rightarrow C \rightarrow E}$  (shut off channel B)  
 $P_{A \rightarrow E}^{\text{tot}}$  (both channels open)

EXPTL. FACT:

$$P_{A \rightarrow E}^{\text{tot}} \neq P_{A \rightarrow B \rightarrow E} + P_{A \rightarrow C \rightarrow E}$$

QM ACCOUNT:

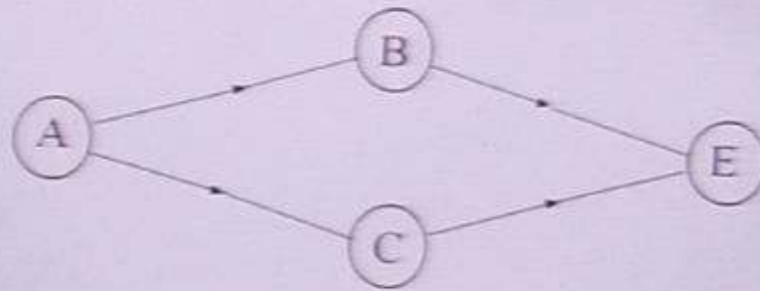
$$P_{A \rightarrow E}^{\text{tot}} = \left| \sum_{\text{paths}} A_{A \rightarrow E}(\text{path}) \right|^2$$

vanishes unless  
both A's nonzero

$$= P_{A \rightarrow B \rightarrow E} + P_{A \rightarrow C \rightarrow E} + 2\text{Re}(A_{A \rightarrow B \rightarrow E} \cdot A_{A \rightarrow C \rightarrow E}^*)$$

$\Rightarrow$  amplitude must be nonzero for each of two paths, not just for ensemble but for each member of it

And yet....



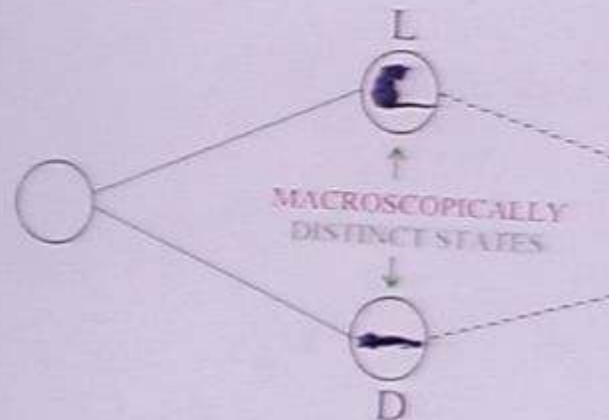
At microlevel:

Directly observed phenomenon of interference

⇒ simultaneous "existence" of amplitudes for two alternative paths for each individual member of ensemble

⇒ neither outcome "definitely realized"

Now, extrapolate formalism to macrolevel (Schrödinger):



Is each cat of ensemble either in state L or in state D?

## POSSIBLE HYPOTHESES:

- A. QM is the complete truth about the world, at both the microscopic ( $\mu$ ) and macroscopic (M) levels.

Then:

Do QM amplitudes correspond to anything "out there"?

<u>Interpretation</u>	<u><math>\mu</math> level</u>	<u>M level</u>
statistical	no	no
relative-state ("many-worlds") } }	yes	yes
orthodox ("decoherence") } }	yes	no

DOES THE VANISHING OF THE EVIDENCE PERMIT RE-INTERPRETATION OF THE MEANING OF THE QM FORMALISM?

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- B. QM is not the complete truth about the world: at M level other (non-QM) principles enter.

$\Rightarrow$  superpositions of macroscopically distinct states do not (necessarily) exist (Ex: GRWP)

("MACROREALISM")

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(“MACROREALISM”)