Bohmian Mechanics?!?!

24.111

First…about GRW…

- Question for you:
- Suppose we have a single-particle system, and that before a GRW collapse its wavefunction is
  - 1/2 |x> + sqrt(3)/2 |y>.
- What does Born's rule say is the probability that the post-collapse wavefunction is |x>?

“Q1: What, exactly, goes on in the Stern-Gerlach Experiment?”

(Reminder: tell them about “effective collapse”)

“Q2: tell me again—how does the theory validate the statistical algorithm for this experiment?”

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- Divide the region of space occupied, initially, by the wavefunction, into two subregions:

- R1 contains points of space with this property:
    - if the particle starts at one of them, then over time, the deterministic laws for the WF and the particle have the particle moving upward at the end.

- R2 contains the points that lead to the particle moving down.

- It follows from the BOHMIAN LAW OF INITIAL CONDITIONS that 1/2 the time, the particle starts in R1.

The bohmian law of initial conditions:

- At the beginning of time: for a given wavefunction W, the proportion of particles that have W as “their” wavefunction that are located inside some region of space R = the integral of |W|^2 over R.

“Q3: when you repeat a SG experiment at the same angle, you get the same result. How does that work in this theory?”

“Q4: Okay, now show me how the theory gets the right answer when the angles are different.”

“Q5: wait, in response to Q1 you said that after passing through the magnets there has been an “effective collapse” of the wavefunction. But the two-path experiment showed that passing through magnets DOESN’T collapse the wavefunction. What gives?”

“Q6: Go back to Q2. In just what sense does Bohmian Mechanics validate the statistical algorithm?”

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- Bohm: If you do a BUNCH of spin measurements, on electrons that all start with the same wavefunction, the PROPORTION of electrons that go up is CLOSE TO the probability the statistical algorithm assigns to the up outcome.

- “Q6, continued: but what’s to stop us from preparing a bunch of electrons so that they all have “0 up” wavefunctions, AND all the electrons are initially in the “will go up” region space?
- (maybe you should draw a diagram)
- Won’t these electron’s VIOLATE the statistical algorithm?
- So isn’t Bohmian mechanics FALSE?