

Re: Download a new book on quantum mechanics and relativity.

Source: <http://sci.tech-archive.net/Archive/sci.physics/2004-09/8944.html>

From: Bilge (*dubious_at_radioactivex.lebesque-al.net*)

Date: 09/23/04

Date: Thu, 23 Sep 2004 20:46:39 -0000

Eugene Stefanovich:

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>Bilge wrote:

>> Eugene Stefanovich:

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>> > I think you should read again about the difference between measurement

>> >(single act of observation, see subsection 3.2.1) and experiment

>>

>> I have thought about it. Your idea of observables and quantum mechanics

>> as a theory about ensembles is just plain wrong and contradicts every

>> quantum text I've ever seen. You don't connect theory to experiment

>> very well at all.

>

>Wave function is probability amplitude, right?

Right.

>How do you think the probability is measured if not in ensemble?

One doesn't measure a probability. One measures the outcome of a lot of trials, obtains a statistical result and then *_infers_* a probability for that result in each *_trial_*. Finally one compares that inferred result to the probability obtained from a *_calculation_* to see if the two agree. If they don't one doesn't adjust the wavefunction to match it. One declares the theory bad.

>By definition, the probability is the ratio of the number of
>desirable outcomes of measurements to the total number of
>measurements.

OK, then let me apply that to a test of quantum mechanics.
I prepare electrons with their spins along the x-direction.
I measure the z projection. Using your notion of quantum
mechanics, I can't know ahead of time what the probability

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of finding the spin along $+z$, so I say that the probability of $+z$ is P_{up} and $-z$ is P_{down} . I now count 25 particles with $+z$ and 75 particles with $-z$. According to you, I've just measured the wavefunction, so the wavefunction must be:

$$|x\rangle = 0.5 |z\rangle + 0.866 |-z\rangle$$

Therefore quantum mechanics tells me the right answer. Always. Does that sound very reasonable to you? I hope not.

Do you think perhaps that quantum mechanics might tell you the probability amplitude for the wavefunctions *_before_* the experiment, so that you are comparing the probability given by quantum mechanics to the *_statistics_* of an experiment?

Do you know the difference in a *_probabilistic_* theory and how it relates to a *_statistical_* experiment?

*>So, in order to
>have probability you need to have many (preferably infinite number
>of) measurements performed on identically prepared systems. You need
>to have an ensemble.*

Oh gee. You've just pointed out some real problems here. According to you, knowing the probability amplitude requires me to measure the probability amplitude. Does that mean the probability for the first particle to be in a given state depends upon the wavefunctions of each of the particles that come after it?