Re: Layman Q: wave funtion and measurement

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From: Fernando Cacciola (*fernando_cacciola_at_hotmail.com*)
Date: 09/07/04

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Date: Tue, 7 Sep 2004 11:57:46 −0300
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"Edward Green" <spamspamspam3@netzero.com> escribió en el mensaje
news:eca320d0.0409061734.49be01b9@posting.google.com...
> "Fernando Cacciola" <fernando_cacciola@hotmail.com> wrote in message
news:<2q1b4fFqjseqU1@uni−berlin.de>...
> > "Edward Green" <spamspamspam3@netzero.com> escribió en el mensaje
> > news:eca320d0.0409051117.300e4b45@posting.google.com...
>
> <...>
>
> > OK.
> > I definitely see that what I said was not this.
> > I stand corrected.
>
> I'm speechless: it's obvious you're a neophyte on Usenet! ;−)
>

:−) Well, I'm a computer programmer... we're wrong all the time
...whenever we intended for our software to do something, it does something
else, and we don't know why...
even though it really does exactly as we told

> <...>
>
> > Still, I guess at this point of my slow and personal training I'm bound
to
> > follow Bell's steps and require those hidden variables anyway to allow
my
> > mind to make any sense out of QM (well, the little I know of QM really)
>
> > If I got your right, the wave function says that a system is in a state
> > being a linear combination of eigenstates.
> > But how can an objective entity be in a combined state?
>
> It happens all the time, even to the nicest classical entities. ;−)
>
> Say a classical particle at time t1 has velocity v1, east at 1 m/s.
> And say at time t2 this particle has velocity v2, north at 1 m/s.

> Finally at time t3 the particle has velocity v3, northeast at sqrt(2)
> m/s.
>
> Since v3 = v1 + v2, I guess we have at t3 a "combined state"?
>
> To complete the quantum mechanical analogy, imagine that just after t3
> we pass the particle through a forked passage which ejects it moving
> either due east or due north, with probabilities 1/2,1/2.
>

Very interesting analogy.
What puzzles me is the fact that upon observation we see either v1 or v2.
Perhaps it is as if we could view this system only thorugh an orthogonal
window frame aligned with v1 and v2
so that we only see it moving in those directions while it is really moving
in both.
But my analogy breaks because in this setup we'll see some non−zero value
for v1 _and_ some non−zero value for v2; no collapse here.

> > How can a particle
> > be "a litte here and a lot there" at any given time?
>
> Quantum mechanical states are examples of _vectors_, as you have
> probably read by now. The words of power are "vectors in a Hilbert
> space", which is a space populated by a special breed of vectors; but
> they are still vectors, just as bull−mastiffs are still dogs.
>
> Now one property of vectors is that if X is a vector and Y is a
> vector, then so is Z = aX + bY, and in the same space. Z is every bit
> as good a vector as X and Y, in no way inferior for being the result
> of a combination. We could as well have found some fourth vector W =
> cX + dY and, so long as Z and W were not colinear, written: X = a'W +
> b'Z ; Y = c'W + d'Z . Which are the pure vectors, and which the
> combinations now?
>
> _Any_ vector in our space can be written as a linear combination of
> other vectors in our space in an indefinite number of ways, so there
> is no sense in which some vectors are pure and some others mere
> combinations: this situation obtains for example in (classical)
> displacements, velocities and accelerations; in the electric and
> magnetic field; and in quantum mechanical states. The state of the
> system is always some single vector in our space, regardless of
> whether we happen to express that single vector as linear combination
> of other vectors in our space.
>

OK
I can easly see that in the case of the 3D euclidean space, that we can
choose a basis for it doesn't mean that such basis cannot itself
be generated by some other (I can choose any 3 orthogonal unit vectors as a
basis). All vectors in our space are linearly dependent.
You're saying that the same happens with the "vectors" used to describe
states in QM.

> But what about the "eigenvectors", you may ask? Isn't there something
> special about them, compared to just any old vector?
>
> Yes and no.
>
> There is nothing special about a vector styling itslef an
> "eigenvector" compared to other vectors when nobody else is around,
> but there _is_ something special about them whan a particular quantum
> mechanical _observable_ is around. Observables, as you have probably
> seen by now, correspond to particular kinds of operators (objects
> which send one vector to another vector) on our vector space, and the
> eigenvectors (== eigenstates) of that operator have the particular
> property of returning the corresponding eigenvalue with certainty
> under an appropriate measurement.
>
Yes, I 've seen this in the Shrodinger eq....

> > And worst, unless I'm mistaken, if we measure it, we never get to see it
in
> > a combined state.. we get to see it entirely in |X>, |Y> or whatever.
>
*> > *I* tend to see this as impling that there is no such combined state*
after
> > all (that it is an artifact of the artificial wave function).
>
> Possibly when you expressed agreement with me above, this may have
> been a little premature. You seem to have seized upon an insight for
> a moment, but are at risk of back−sliding.
>
Well, it happens all the time to me, specialy in this field. :−)
Whenever I think I finally grasped something I read more and find out I got it wrong.

> Let me emphasize again: in the minimalist interpretation (if we want
> to name the assumption free understanding of the formalism) the state
> of the system prior to the measurement determines

I guess you meant "the wave function of a system..."

> the probability of
> various measurement outcomes (via the weights when the state vector is
> decomposed into a linear combination of the eigenvectors appropriate
> to the observation contemplated), but in no way should bias us as to
> _what_ it is about the state which determines these probabilities.
>
oh, well, let me try again:

The "state" of a system is a magnitude that expresses what is knowldegble about it.
It is not a direct account of the objective reality of the system butan account for what is observable about it.

For example, the "state" of a person's mood can be "happy" or "irritated",
yet this in the sense that the person is seen as such regarless of how he
really feels.
To measure the state of a system is to acquire such "potential" knowledge.
In the mood example, is to see how the person reacts and determine if he's
"showing" happy or irritated (but without interpreting this as inndication
of how he _is_ feeling)

What I'm trying to say here is that *I* signify "state" as an intrisic value
of the system.. like the way someone feels, while it seems that you (the
physisits) use "state" to mean what is observable regardless of what it
actually is, like the way someone reacts rather and how he really feels
(which is usually related by not neccesarily)

> *To return to the warren: a rabbit in a eigenstate of the Hole*
> *observable apparently has his mind made up ahead of time which hole he*
> *is going to bolt down when startled. But this doesn't mean he is*
> *_already_ down that hole, even before we startle him! Similarly, if a*
> *second rabbit's mental state determines ahead of time that he has a*
> *50% probability of vanishing down hole 1, 50% of vanishing down hole*
> *2, this doesn't mean that prior to stamping our foot he _is_ 50% down*
> *hole 1 and 50% down hole 2!*
>
OK, I'm relief.. I wouldn't understad how could it be half in each hole.

Given the characterization of "state" I made above, saying that the system
is "in a combined state" is merely telling something about what it will look
like if looked upon; but nothing about what really _is_ in itself.

> > *However, I believe that the initial interpretation (Copenhauen) says*
that
> > *measuremt itsef has the side effect of actually chanching the system to*
> > *collapse it to one of the basis states (and as you said, we assume the*
> > *system to be free to go back to the combined state right after we stop*
> > *looking).*
>
> *Did I say that? I think I admitted it was a possibility, unless we*
> *explicitly added this collapse as an additional postulate.*
>
Oh, I got you wrong.
Le me see: you say that we need the addition of the collapse postulate to
explain
why if we make another measure inmeditely we see the same outcome.
(without the postulate the system could rerandomize inmediately)
Right?

Thanks

Fernando Cacciola