Re: I don't understand EPR

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From: Tom Trotter (*tom129_at_juno.com*)
Date: 07/19/04

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Date: 19 Jul 2004 04:08:54 −0400
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Oz <oz@farmeroz.port995.com> wrote in message
news:<L1Rd1nA5A29AFww3@farmeroz.port995.com>...
> Tom Trotter <tom129@juno.com> writes
> >
> >Oz <oz@farmeroz.port995.com> wrote in message news:<8Kpg65ICw77AFwUX@farmeroz.p
> >o
> >rt995.com>...
> >> Tom Trotter <tom129@juno.com> writes
> >>
> >> >It's the "sameness" of polarization via emission that's
> >> >being measured (filtered through the separated polarizers).
> >> >
> >> >This is why LHV formulations (such as Bell's) where Lambda
> >> >is the "angle" of polarization of the photons following
> >> >emission and prior to polarization/detection don't work −−
> >> >that is, they produce inequalities that will be experimentally
> >> >violated.
> >>
> >> OK. You are getting near to explaining bells inequalities, which nobody
> >> has done here (simply) before.
> >
> >There's really nothing to explain wrt Bell inequalities.
> >They're just arithmetic relationships wrt quantities
> >of groups of things.
>
> <sigh>
>
> But which things ...

Any things. Let's say you have a number objects
that, among them, have three different, discernable
characteristics, or properties, or parameters,
A, B, and C.

Bell's inequality says that the number of objects
that have A but not B plus the number of objects
that have B but not C is greater than or equal

to the number of objects that have A but not C.

> *... and what does experiment show under what circumstances?*
> *Perhaps I should say 'what effect does the experimental results that*
> *test bells inequalities imply'.*

The experimental results support the qm formulation,
and the emission model, which says that paired photons
are entangled via the emission process

A violation of a Bell inequality tells you that the
inequality is based on a formulation (lhv) that isn't
applicable to the experimental context.

The lhv formulation is inapplicable because the
thing (lambda) that determines the results in individual
measurements isn't what determines the results in
combined contexts. Lambda refers to the angle of
polarization of the photons incident on the polarizers
at A and B. This angle of polarization is irrelevant
in the combined context. What is relevant is that
paired photons be polarized identically.

>
> *Something to do with 'hidden variables', but that's*
> *too broad a brush to gain any insight.*
>

The EPRBell tests reveal nothing about local hidden variables
except that formulations including them aren't applicable
to these experimental contexts.

The EPRBell tests don't reveal anything about 'reality',
or 'nonlocality' (in the sense that A and B are communicating
ftl or instantaneously), or determinism vs. indeterminism, or
whether lhv theories are, in general, possible.

Certainly, lhv formulations are *inapplicable* to certain
contexts.

> >> *Are you saying that bell assumed two particles leaving with a set angle*
> >> *lambda. That is one at lambda+pi/2 and one lambda−pi/2?*
> >
> >*In terms of light and photons, Bell's lambda is the property*
> >*of the light coming from the emitter, and incident on the*
> >*polarizers, a (at A) and b (at B), that, if it were known,*
> >*would allow more accurate predictions of individual results.*
>
> *Right. So in this example bell assumed that he did (in theory) know*
> *lambda and found this did NOT agree with experiment?*
>

The subtle but most relevant assumption associated with the inclusion of the lambda term in the formulation and combining it with polarizer orientations at a and b, is that knowing the polarization of the photons of a pair would allow for more accurate predictions of rates of coincidental detection, ie., that lambda is relevant in the combined context.

But lambda has nothing to do with determining rates of coincidental detection.

So, violations of Bell inequalities don't tell you that there's no lambda, but simply that the specific polarization of the photons is not the property of the photons that you need to know to accurately predict rates of coincidental detection.

The essential knowledge is that the photons of any given pair are polarized identically via emission. Since this *relationship* doesn't vary from pair to pair, then, effectively, you don't need to consider anything about the photons in calculating expectation values for rates of coincidental detection wrt varying mutual polarizer orientations.

You only need to consider the angular difference of mutual polarizer settings.

> >So, lambda effectively refers to the *polarization* of the
> >oppositely directed beams of light (in, say, the
> >Aspect experiment) via emission.
>
> So the assumption (falsely made) was that each particle left with a set
> lambda?

No, the problematic assumption is that lambda has something to do with determining rates of *coincidental* detection.

>
> >> From this he derived the appropriate statistics,
> >> which turned out *not* to agree with experiment?
> >
> >Bell's theorem is an arithmetic relationship which
> >must be satisfied if the relationship between lambda
> >and a and lambda and b is relevant to the determination
> >of coincidental detection.
>
> Is there such a thing as 'coincidental detection', given the many frames
> observers can be in?

Yes, as I've mentioned before, experimenters expend
great effort in trying to ensure that they're dealing
with photons emitted from the same atom in their
coincidence counting hardware.

>
> >Experiment shows that
> >it isn't. (But this can be deduced without
> >referring to experiments.) It's the relationship
> >between the emitted photons (that is, it's their
> >combined orientation, not their individual orientations)
> >wrt the polarizers that matters in determining
> >coincidental detection.
>
> OK. That's how I always read it.
>
> >This *relationship* is
> >a global or nonlocal parameter pertaining to
> >paired photons. It doesn't vary. The relationship
> >is that paired photons are polarized identically.
> >
> >In other words, the correlations in the combined
> >context don't depend on the same thing that
> >more accurate predictions of results of individual
> >measurements would depend on.
> >
> >The things that are happening to produce individual
> >results are still happening in the combined context.
> >They just aren't relevent when talking about the
> >combined context.
>
> Ok. So if we consider the pair as a single particle it must be
> inevitable that if (on 'decay' − ie detection of one) one is detected,
> then the other has defined characteristics.

I don't think it's a good approach to consider the pair
as a single particle. Photon 1 and photon 2 of any given pair
emitted by the same atom are distinctly separate photons.
They're of different wavelengths, travelling in different
directions, and not communicating in any way. They're
entangled because they're identically polarized due to
their common origins in the intermediate decay stages,
back to the ground state, of the electrons of the atom
from which they're emitted.

>
> That's it. Nothing else to it.
>
> So what's wrong with the following argument:
>
> 1) The particles are one particle until detected.

No, they're two, separate photons, entangled via an atomic
emission process.

> 2) Because they are separated (to the outside world) only one particle
> will be detected at any point in global (flat space, right) spacetime.

No, sometimes both photons from the same emission
process are detected.

> 3) We cannot force the properties of the detected particle, just measure
> if its up or down.

All you know is , in a detection/coincidence interval, whether
A registered a detection or not, and whether B registered
a detection or not. The emission polarization of photons
of a pair remains, effectively, unknown. But, because the
photons are polarized identically via emission, then you can
say something about the probability of coincidental detection
if you know the orientation of the polarizers wrt each other.

> 4) The waveform of the emitted (double) particle co−evolves. That is it
> constantly varies its lambda, with 'one half' being in antiphase with
> the other. This must be enforced, it seems to me.

I don't think this would be a good way of talking about
it. I don't have any really firm opinions about it.
Maybe lambda does vary between the emitter and the
polarizer. But, for the purposes of making accurate
predictions of rates of coincidental detection, it doesn't
matter. In any case, how would you go about finding
out?

> 5) We force a detection. We can only detect one particle of the
> 'combined pair' so the very detection process must break the
> entanglement. Note that the detector interacts with the 'combined pair'.

The detection process does break the entanglement, but sometimes
both photons of a pair are detected.