Re: I don't understand EPR

Source: http://sci.tech−archive.net/Archive/sci.physics.research/2004−07/0646.html

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From: Tom Trotter (*tom129_at_juno.com*)
Date: 07/28/04

Date: 28 Jul 2004 04:58:41 −0400

Oz <oz@farmeroz.port995.com> wrote in message
news:<j1QXlDYMhgBBFwRw@farmeroz.port995.com>...
> *Tom Trotter <tom129@juno.com> writes*
>
> *>The paired photons produced by Aspect via*
> *>atomic calcium cascades are moving in opposite*
> *>directions, have different wavelengths, and*
> *>opposite angular momenta. They're two different,*
> *>and separate, 'particles'.*
>
> *Oh. That makes it more complicated.*
> *Much more.*

Not really. The polarizers are just analyzing
a property that photon 1 and photon 2 have in
common, because according to the emission model
that common property is polarization. Whatever
the *emission−produced* polarization might be
(and it remains an unknown), it's the same
for photon 1 and photon 2.

>
> *>And, it's not necessary to be contemplating*
> *>how they can be 'communicating' with each*
> *>other. They aren't.*
>
> *Good. Everyone else says they are....*
> *Well, some do, anyway.*

If there is communication happening, then
it has to be instantaneous, and it's up to
those who hold that this instantaneous
communication is happening to demonstrate it.
This would entail being able to predict the
effect that changing the setting at polarizer
a would have on the detection attribute
recorded at detector B, and vice versa.

In the combined context, which includes
joint polarizer settings for paired photons,
the data streams at A and B aren't
independent. But, this doesn't mean
that A and B are 'communicating'. The
polarizers are simply analyzing a shared
property, an emission−produced relationship
between photon 1 and photon 2.

> That seems simple enough, so why the fuss?
>

It's just an interpretational issue. Why do
some people like the MWI of qm? I don't know
exactly. But I would suppose that a lot of
the fuss is due to misinterpretations of
Bell's 1964 paper. Experimental violations
of Bell inequalities really don't tell you
anything about the *existence*, or not,
of hidden variables, nor do they necessitate
the invention of unknown ftl 'signals' or
'influences', or instantaneous,
Einstein−causality−violating 'mechanisms'
in order to understand the results.

Experimental violations of Bell inequalities,
and Bell's pre−experiment analysis, *do* tell
you that, minimally, something is wrong
with the formulation on which such inequalities
are based −− that it includes terms and/or
operations that aren't *applicable* to the
experimental context.

> >Now, if you want to make a local hidden
> >variable theory work wrt the combined
> >context, then, as Bell noted, you'll need
> >some sort of mechanism whereby the two
> >ends of the experimental setup can
> >instantaneously communicate. But, that
> >would be a silly construction, since it's
> >already been shown that lambda (the
> >polarization of the photons) is irrelevant
> >to the determination of coincidental
> >detection.
>
> I've lost it there.
> As I read this its obvious.
> It can't be obvious or there wouldn't be a fuss.

Why not? The world is full of people who
believe all sorts of weird things. Bell's

stuff has been incorrectly talked about in
a certain way for so long that most people
just take it for granted that it has to do
with the existence of hidden variables and
the necessity of instantaneous 'influences'.

Here's a quote from Greenstein and Zajonc's,
The Quantum Challenge − Modern Research on the
Foundations of Quantum Mechanics (1997, p. 149).

"Turn now to an EPR experiment of the type we
have been describing. Two photons are emitted
at the outset; one travels toward Alice, the
other toward Bob. If their polarization analyzers
are oriented along the same direction, then every
time Alice and Bob perform measurements, they
get identical results. They never get opposite
polarizations. This is an 'EPR correlation' −−
and how are we to explain it?

"Prior to Bell's theorem and the experiments we
have just recounted, the explanation would have
been equally trivial. We simply would have
postulated that the photons heading toward
Alice and Bob had identical polarizations. If
they had started off with angular momentum zero,
and if angular momentum was conserved, then in
the absence of external torques we would find
the final angular momentum to be zero as well,
guaranteeing their polarizations to be identical.
But the polarizations of the two individual
photons are precisely what we mean by local
hidden variables −− and we know now that these
cannot exist."

Me again. In an otherwise really good book,
Greenstein and Zajonc have bought into the
mistaken idea that Bell's analysis has something
to do with the *existence* of hidden variables.

AFAIK, it's not disputed by anyone that hidden variables
exist in the context of individual measurements.
So, are we to suppose that these variables that
are relevant wrt determining individual data
streams simply cease to exist in the context
of considering both data streams.

Of course not. It's simply that, in the
combined context, a different parameter or
property of the unknown variable is relevant
wrt the determination of coincidental detection

than is relevant wrt the determination of
the individual results of a single data
stream. In the combined context, it's not
the polarization, per se, that determines
coincidental detection, but rather it has
to do with how photon 1 and photon 2 are
related wrt their emission−produced
polarizations.

Can 'supplementary parameters' exist and
still not be applicable wrt a certain
experimental context? Does the moon
exist when you're not looking at it? :−)

>
> >In the individual measurement context,
*> >the emission−produced *polarization* of*
> >a photon is (along with the orientation
> >of the polarizer that it is interacting
> >with) the determining factor.
> >
> >In the combined measurement context, the
*> >emission−produced *relationship* between*
> >paired photons is (along with the combined
> >orientations of the polarizers) the
> >determining factor.
> >
> >In the combined context, since the
*> >*relationship* between paired photons*
> >doesn't vary from pair to pair (only
> >the polarization does), the only variable
> >left to consider in determining rates
> >of coincidental detection is Theta, the
> >angular difference in polarizer settings.
> >
> >Does any of this make sense,
>
> Makes my head spin because it seems to say
> that the two particles are emitted in a certain
> relationship. Say with parallel spin.

Say with identical polarization.

>
> This means that if you detect one with a particular spin then you must
> detect the other with that particular spin. That's because they always
> had that spin from the start.

It means that if the separated polarizers are
aligned, then if you register a detection at
A you'll also register a detection at B −− and

if you don't register a detection at A, then
you also won't register a detection at B.
The probability of recording coincidental
(identical) detection attributes for paired
photons, with the polarizers aligned is, in the
ideal, 1.

As you rotate the polarizers to increase
the angle (Theta) between them, then the
probability of coincidental detection
decreases as a circular function of Theta.

>
> This doesn't gell terribly well though. If the particles are photons I
> can rotate (one of) the polarisations by a stepwise path through a
> series of polarisers. I was under the impression that if you did this
> then you still maintained the parallel spin on final detection. There
> are a variety of caveats one could bring to bear to overcome this, but I
> am in fact unclear of the expected result.

If you mean that the entanglement (ie., the emission
produced relationship between the polarizations
of photon 1 and photon 2) can be preserved, via
separated polarizers, I don't think so.

I'm not sure I understand what doesn't gell for you.

>
> I am also not 100% clear about spin, never having studied it.
> I currently crudely classify it as I would polarisation, although I know
> its a 3D thingy really.

I'm not sure I 'understand' spin either. But I don't
think of it as a 3D thingy. Polarization, which is
related to spin, is of course a 3D thingy really. At
least that's how I think of it (until corrected, if
necessary).

>
> >or do you
> >think we should continue to talk about
> >ftl or instantaneous communication between
> >particles or filters and/or detectors in
> >EPRBell experiments?
>
> If you wouldn't mind, I would appreciate it.

Ok. What?