Re: Proof that macintosh is better than VMS

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- *From*: AEF <spamsink2001@xxxxxxxxx>
- *Date*: Sun, 16 Mar 2008 07:44:11 −0700 (PDT)

Hello,

Comments interspersed below. Sorry for the delay, but it took me a long time to write this. I have tried to be as clear as possible while still not spending too much time on it. The better thing to read is Feynman's The Character of Physical Law and his Lectures on Physics book.

Abstract: I'm showing how I'm basing my convictions on not just QM, but on the wave−particle duality, the de Broglie relation, the results of a vast array of experiments, one of which is described here in detail. Nevertheless, QM is so amazingly successful for such a huge range of phenomena, that there must be something very right about it. All this leads me to conclude that Nature, at the level of atoms and below, is intrinsically probabilistic, even if QM is eventually superseded by a better theory.

It's a little long. Please be patient as it takes a little while to explain it properly.

Enjoy.

AEF

On Mar 13, 11:01 am, davi...@xxxxxxxxxxxxxxxx wrote:

> In article <42e3bcd3−a7d0−4fd6−badf−bc7623f68...@xxxxxxxxxxxxxxxxxxxxxxxxxxxxx>,
> AEF <spamsink2...@xxxxxxxxx> writes:
>
>> On Mar 12, 8:11 am, davi...@xxxxxxxxxxxxxxxx wrote:
>>
>>> In article
>>> <d605f298−85d8−491f−aeb7−3ba58aa7a...@xxxxxxxxxxxxxxxxxxxxxxxxxxxxx>,
>>> AEF <spamsink2...@xxxxxxxxx> writes:
>>>
>>>> On Mar 11, 1:19 pm, billg...@xxxxxxxxxxx

(Bill Gunshannon) wrote:

> In article
> <ueEuesurz...@xxxxxxxxxxxxxxxxxxxxxxxxx>,
> koeh...@xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
> (Bob Koehler) writes:
>
> > In article
> > <960d254f−6ae7−4334−ab8e−e58e2b1ed...@xxxxxxxxxxxxxxxxxxx
> > Doug
> > Phillips
> > <dphil...@xxxxxxxxxxxx>
> > writes:
> >
> > > You are confusing quantum mechanics math with reality. If you mean that the mathematics of quantum mechanics is not concerned with resolving apparent randomness, then you are correct. You might want to look

into
the
de
Broglie−Bohm
theory,
more
recently
called
Bohmian
Mechanics.

Quantum
mechanics
math vs.
reality? You
think reality
differs?

I'll bet a lot of people do.
When science requires faith
than religion
in order to accept that which
can neither be observed nor
satisfactorily
proven I think more and
more people will see the
difference.

I assume you meant "When science requires
more faith..."

Scientists have faith in the scientific method
which requires
evidence. Religious people have what James
Randi calls "blind
faith"[1]. That makes all the difference in the
world.

[1]
Seehttp://www.randi.org/jr/072503.html(Mostlya
good article,

> but I disagree with his opinion of the Wizard
> of Oz.)
>
> As far as using local hidden variables to
> restore determinism that
> only "appears" probabilistic, the
> experimental evidence ruling these
> out is more compelling than ever. Many,
> many experiments have been
> done and QM always, always wins.

This is a strawman since there are non−local hidden variable theories.

> We're not talking about the
> possibility of experimental error clouding
> the results. The skeptics
> who complained that the early experiments
> could still allow local
> hidden variables because of events missed
> by detectors because said
> detectors were not 100% efficient. OK. But
> the efficiencies have been
> greatly improved and the room for
> determinism has been all but wiped
> out. Then there is the GHZ paradox which
> largely sidesteps the issue.
> There is simply no way to explain the results
> of GHZ experiments using
> local hidden variables.

These experiments rule out local realistic theories. This just leaves two choices

1) non−locality

or

2) non−realism

But what about Feynman's argument?

All these things combined (which includes stuff I don't have time to document here) leads me to believe that there is almost certainly no way out.

To my mind the latter doesn't actually make much sense. If the wave function

What makes sense is not as important as experimental results. See, you know the drill (Beginning of Chapter 6 and parts of Chapter 7).

doesn't actually have a physical existence and a particle doesn't have any
properties until you measure them then how are entangled particles actually
linked. (If the wave function does physically exist then it's collapse will be
a non−local effect so such versions of the Copenhagen interpretation are
non−local).

I think the realism quandary is a red herring. QM tells you what you will observe and that is what you observe.

The problem I have is that such an interpretation is just

"thats the way it is"

which to me isn't a scientific statement. With non−local interpretations there is at least some possibility that in the future it might be possible to explain the non−locality. If you just take it thats "thats the way it is" then you are in effect giving up on trying to find an explanation.

As to what's "scientific", please read Chapter 6 of The Character of

Physical Law and get back to me. (Parts of Chapters 1 and 7 are also relevant.) You will find the answer to that in this book. Obviously I'm not going to quote entire chapters of the book. But I'll say this here: How does gravity work? Think about it. Any two masses, no matter how far apart, attract each other. Isn't that kind of amazing? You say there is a field that permeates all of space. Just what is this field made of and how is it generated by mass? How can it be like that? But we grow up with gravity from day 1 and it becomes so familiar we think of it as being totally normal. So what mechanism could be behind this? At the classical level, physics has indeed given up. In QM, it is thought that it is the exchange of virtual gravitons that causes the attraction, just like it is the exchange of virtual photons that carries the electromagnetic force. But these virtual photons −− or gravitons −− materialize out of nowhere, travel between particles to carry the force, and then disappear (thanks to a variation of the uncertainty principle, a violation of conservation of energy is allowed if it occurs over a short enough interval of time, and this allows virtual particles to have their fleeting existences). And you're still stuck with trying to find a mechanism for the virtual particles. Good luck. We don't grow up experiencing QM at all, so it seems really strange. But we are not to tell Nature how She's got to be. [Until we detect actual gravitons, the existence of virtual gravitons remains speculation. However, most physicists, AFAIK, believe they must exist.]

So you're always going to reach a point at which you say, "But what is that? What is the mechanism behind that?" I think with QM we've hit rock bottom.

> Note. All the interpretations agree on what you will observe so in that sense it doesn't matter. However interpretations can give insight into how to produce a more complete theory and as I have pointed out QM is not the final theory of everything.

[I'm not basing my claims solely on QM. I still think a more accurate theory will still not be able to get rid of the intrinsic probabilistic nature of things. See below.]

And how will you test it? As for QM being "final", I think certain aspects will survive. Note that Ehrenfest's theorem shows how quantum mechanics goes over into classical mechanics at the macroscopic level. This theorem gives an equation (derived from the QM equations) that looks strikingly like F=ma. When the uncertainty in x is small, you basically recover F=ma. In fact, this is related to "the correspondence principle which in essence states that classical physics results should be contained as limiting cases of quantum mechanical results"[1] (e.g., when quantum numbers are large). In fact, the correspondence principle was used in the early days of QM development as a guide to guess the correct QM equations. So classical mechanics not only survives, it is an essential part of QM in this respect. Similarly, I believe the probabilities and the particle−wave duality of nature will survive any future, better theory, as will the reality of atoms.

Furthermore, many facets of classical mechanics still hold in QM −− conservation of momentum, conservation of angular momentum, and conservation of energy, e.g. And this is not an approximation: these quantities are conserved in QM just as they are in CM (well, aside from temporary violations as in the creation and destruction of virtual particles −− and you cannot directly observe these violations, which is why the virtual particles are...well...virtual).

[1] Quantum Physics by Gasiorowitz

And I'm not basing my claims strictly on QM; I'm also basing them on all the wild and wacky experiments, all of which show that particles exhibit wave−like behavior and waves exhibit particle−like behavior. That's very unlikely to change even if QM is superseded by a better theory. (The fact that ordinary matter is made of atoms isn't likely to change either!) Note that you can have one particle at a time go through your apparatus and when you wait for enough statistics to accumulate you still get an interference pattern, a sure sign of waves, and strong evidence in favor of there being intrinsic probability in nature. As Merzbacher says, "The conclusion is almost inevitable that psi [the wave function] describes the behavior of single particles, but that it has an intrinsic _probabilistic_ meaning." [His emphasis.]

Also, I've been there, done that. I wrestled with this problem myself on and off over many years. I used to think it can't be "random" or probabilistic. I even tried to come up with a hidden variables theory to explain the spooky correlations seen in polarization experiments! (I failed, of course.) And I have come to the conclusion that the randomness (or as I prefer to put it, the probability) is almost certainly an intrinsic apsect of nature. I know you're saying, "But how can it be like that?" But as Feynman says, "No one knows how it can be like that". (Not only is Feynman a great teacher, he is strikingly honest, even about the shortcomings of physics.) I really can't imagine that anyone will ever find a way out.

Look at the situation. You have wave phenomena such as interference and diffraction of light. These things are strictly wave phenomena. Then you find that these light waves are actually "quantized" into little bundles of energy called photons. And the energy in each photon follows a very simple relation: E = h*f where h is Planck's constant and f is the frequency of the light (which is how many crests (or wavelengths) pass you per second). So if you have monochromatic light, all the photons have the same energy. There are no half−photons. They come in fixed−size "lumps". Experiment has shown over and over again that even when you reduce the intensity of the light so that only one

photon is traversing the apparatus at any given time, you STILL get interference patterns. Consider reflection. Approx. 4% of the light is reflected from clear glass. So if you have 100 photons striking the glass, you know that on average 4 photons will be reflected. But which photons? The same applies in the case of polarized light traveling through a polarizer oriented so that only some of the light gets through. A photon can either be absorbed or pass through. But which particular photons will get through? There is no way to tell. What any individual photon does in such situations (and more generally, what any individual particle of any kind does) is unpredictable, but the probabilities of the various possible outcomes are calculable via QM.
I don't see any way out of this other than intrinsic probability.

(See part 1 of the Feynman video at www.feynman.com (it's free!) for an excellent explanation of this in more detail. I'm just more or less summarizing here.)

Here's an excellent example to drive the point home. I saw a talk about this in graduate school in the late 1980's. Consider the following experimental set up:

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F A B

[−LASER−]−−−−−|−−−−−−−\−−−−−−−−−−−−−−−−\
| |
| |
| − LCD
| |
| |
\−−−−−−−−−−−−−−−−\

C D
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The laser beam is split by beam splitter A. It is reflected towards D by mirrors B and C. The beams are combined by the re−combiner D. When you put detectors around D you find that interference patterns are produced.

Next, put an LCD "switch" in the BD segment. If it is ON (opaque) you get some of the beam striking the LCD and the rest traversing ACD and giving no interference patterns. If it is OFF (transparent), you recover the interference because then the light then traverses two different paths and exhibits interference when the two beams recombine at D. OK. Everything seems okay so far. (Remember that interference results from two light beams overlapping.)

Now, the laser beam intensity can be reduced by filter F so low that only one photon traverses the apparatus at a time. If the LCD is ON, then the photon either travels along ACD and is detected at D or it strikes the LCD and is absorbed or reflected. The LCD then serves as a detector that tells us which way the photon went after it goes through

A. If the LCD is OFF (transparent) you *still* get an interference pattern after allowing many photons to individually traverse the apparatus. So it looks like each photon travels over both paths. How else can you get interference? But with the LCD on it travels only over one path or the other. How are you going to explain this without probability and the wave function of the photon being in a superposition of it traveling in one path with it traveling in the other? You cannot get interference without having two things "interfere", yet you never see a single photon in both paths. With the LCD on you always see it in one or the other, never both.

It gets better. The LCD can be switched ON or OFF rapidly enough so that it can be switched AFTER the photon passes through A but BEFORE the photon (if it's in the ABD path) reaches it (the LCD). You can guess what happens. If you switch the LCD from OFF to ON while the photon is in mid−flight, you lose the interference pattern. Some of the photons traverse path ACD, thereby striking the LCD, and some traverse the path ACD. No interference is observed. If you switch it from ON to OFF with the photon in mid−flight, you regain the interference patterns at D. So tell me how the photon, after being "split" by beam splitter A and is therefore "committed" to one path or the other or both, knows whether the experimenter is going to have the LCD ON or OFF by the time it reaches it? How does the photon when it is at A "know" whether it should randomly choose one path or the other vs. "splitting up" (which we know photons never do!) so it can produce the interference pattern? (Keen readers will notice that this is very similar to the two−slit experiment, except that here it is made painfully obvious that slit−1 photons and slit−2 photons are really in totally different paths because here the distance between them is so much greater, and we get the extra fun of the rapidly switching LCD detector which makes it clear that when you detect the photon in the two−slit experiment, you are doing so AFTER it has already gone through the beam splitter, or the two slits, and is therefore "committed" yet can't know in advance whether it will be detected before it hits the screen or not. Also, there is no significant overlap of the wave function between the two paths, unlike the two− slit experiment.)

The bottom line in all interference experiments is this: If it is possible, even in principle, to somehow determine which of the two interfering paths the photon takes, you lose the interference. If you see the interference, you cannot even in principle determine which path the photon took. And you can delay your observation until after the photon passes through the beam splitter A and therefore has to be "committed" to one path or the other or both, and somehow the result is the same. (How else could things be self−consistent?) It's still "spooky".

Now the question becomes: can you predict which path the photon will take after passing through the beam splitter A with the LCD ON? Hidden variable theory says you could do this by observing something at or upstream of A. But if you could do that, then it makes no difference whether the LCD is ON or OFF. Anything you observe with the LCD ON you can observe with it OFF, and at the time of this observation, the state of the LCD when the photon gets to it is still unknown. And if you can successfully predict which path the photon will take, you can't ever get the interference pattern with the LCD OFF, because an interference pattern cannot be produced by photons traveling along a single path, and an interference pattern is completely different from what you would see if photons only traversed one path or the other. And there can't be any "secret communication" between the LCD and the source or beam splitter at A because you can change the state of the LCD AFTER the photon has passed through beam splitter A. Therefore, even with the LCD ON, there is no way to predict ahead of time which path the photon will take if the apparatus is set up in such a way that it can produce interference patterns with the LCD off. Please see Feynman's Chapter 6 of The Character of Physical Law (from which this explanation is borrowed) for the full story (well it's the full story at the layman's level −− if you know about how the wavelength of light affects resolution, and are comfortable with the de Broglie relation, you can go a little deeper, but the essential points are covered by the layman's version −− for the deeper version, see Feynman's Lectures on Physics. Also, Feynman's explanation is most likely clearer than mine!).

[Some progress has been made: It used to be thought that this comes about because any detector gives an unavoidably large enough impulse to the particle due to the uncertainty principle [for an explanation of this, see, e.g., Feynman's Lectures on Physics], but it has since be found that this is not always the case. Still, you cannot follow the path of a particle that has contributed to an interference pattern, and still, what any individual particle does is still unpredictable.]

Add to all this other "delayed−choice" experiments, variations of the Aspect experiment, the GHZ experiment, the recent results with quantum erasers, all of which always give the same results I have just described. So you end up banging your head against the wall until you start hemorraging. At that point, you might say to yourself that maybe nature really is intrinsically probabilistic and can then begin the healing process. But keep in mind that the probabilities have well−determined values that can be calculated using the formalism of QM.

It seems to me that this is the inevitable consequence of particles that come in fixed energies for any given wavelength (or frequency) acting statistically as waves do. It is that, and experiments like the ones I have described, more than QM itself, that leads me to my convictions. IOW, even if QM isn't "exactly right", you will still have everything being particles and waves with the energy given by E = h*f for light and the very similar de Broglie relation for the momentum of a particle of matter (which actually yields E = h*f for light) because this has been established by experiment aside from QM.

Even so, QM has been so spectacularly successful in describing such a humongous range of phenomena that there must be something very right about it.

What you have here, if you wish to keep with "realism", is that the photon splits up into two parts at A (even though you will never directly detect the photon in both paths: any attempt to do so will find it in either one path or the other) and interferes with itself at D if the LCD is OFF at the time the photon reaches it; or, if the LCD is ON when the photon reaches it, one "photon−half" somehow jumps across space to join its other half. I don't see how your going save the day with "realism", or save "realism" itself, in light of this.

There are many other experiments like this. There are the quantum eraser experiments, the GHZ experiments, and so on. They all produce the same results as I have already described.

And you're going to explain this with "realism"? Good luck.

I suppose with the Bohmian theory you can have the particle in one path with the "pilot wave" in both, but when the pilot wave strikes the LCD you have the pilot wave itself "collapsing", so what is gained? Nothing as I see it. And how is the pilot wave going to work when split up into two spatially distinct parts, only one of which has the photon? And how will it work at the re−combiner? It doesn't seem reasonable to me, though I can't explain why here. And what about the Aharonov−Bohm effect in which the interference patterns of electrons traveling around a fully contained magnetic field are shifted by varying the strength of the magnetic field, even though the electrons never travel THROUGH the field! How does Bohm's theory work with that? (Maybe it does, I just don't have the time to keep going, and this post is already long enough, no?!)

The Bohm theory seems (to me) to say that the particle is where it would be if you could observe it without disturbing it in any way, which to me doesn't say much. But I think it also gets into trouble with the GHZ experiment. You still must have collapse of the wave function, or, as Merzbacher puts it in his "Quantum Mechanics" textbook: "reduction of the state (or wave packet)".

> > As for the "collapse of the wave function" I think of it more as "altered". The experimenter becomes part of the system.

> But where is the boundary. If the experimenter becomes part of the system without the wave function collapsing then why not the whole Universe. I think you've just moved from the Copenhagen interpretation to the Many Worlds interpretation.

The wave function still collapses. You're talking about the wave function that includes both the system and the experimenter? I'm not prepared to comment on that at this time. I've already spent a lot of time on this post and I must stop and post it already.

I am NOT an adherent of the many−worlds interpretation. It seems to me that having entire universes created for every "collapse of a wave function" is vastly more unreasonable than Copenhagen. I like the phrase "shut up and calculate", but that's a bit overkill. Work is still being done on this question. Then there is the issue of locality and seperability for which there is landmark paper. But I'll save that for another post if needed.

> Anyway we have discussed this in the past ad−nauseum and as Doug Phillips said this is off topic for comp.os.vms.

But you posted again, so I responded. I mean really −− you're saying that you can have the last word because it's off−topic anyway. Sorry. And I did add some new stuff.

AEF

> David Webb
> Security team leader
> CCSS
> Middlesex University

[...]
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