

Re: Layman's Guide to Quantum Entanglement

Source: <http://sci.tech-archive.net/Archive/sci.physics/2004-07/10018.html>

From: Brent (nasulikid_at_yahoo.com)

Date: 07/31/04

Date: 30 Jul 2004 17:53:16 -0700

Dave,

Your post caught my eye because quantum entanglement was the topic of the senior seminar I gave for my undergrad in physics last semester. I have read your article thoroughly, and I am afraid that this will be a rather lengthy reply. Overall, I think you did a good job. But there are a few points where I think I need to comment.

Electrons in an atom DO NOT orbit the nucleus like planets around the sun. Their travel around the nucleus is best described as a fuzzy cloud. Although there is a "shell" that corresponds to energy level, the distance of the electron from the nucleus (unlike the planetary orbits) can be defined only in terms of probability, and there is even a finite probability of the electron being hundreds of miles away at any given time. Of course, this puts a twist in your simple explanation.

In the third paragraph of section 5, you seem to confuse photon spin and polarization. Left-handed and right-handed is spin and has nothing to do with polarization. The polarization of a photon is actually undefined until you observe it, and then it is forced to decide what polarization it will take. So if a photon comes to a vertical polarizing filter, it then decides whether it will pass through or not. But if it does, then (by nature of the entanglement) its entangled photon will not because the moment photon 1 decides it is polarized vertically, photon 2 becomes polarized horizontally. THIS is the very heart of entanglement.

I have most often read of photons being entangled with respect to polarization and have seen virtually nothing of them being spin-entangled. Atoms, on the other hand, I have always read of being spin-entangled. I suppose that photon spins could be entangled, but I do not know how one would set up an experiment to test this.

I am not well enough versed in quantum computation to be of much help on that part.

sci.physics: Re: Layman's Guide to Quantum Entanglement

I assume the sub-section on quantum teleportation is yet to be written since there is only a heading.

FAQ #2 about particles moving in a magnetic field: I'm not sure why you say they do not move when your own figure 4.2 shows that they do. Also, they will move in or out of the computer screen (as I look at the figure) if they are charged, which is precisely why we use neutrally charged atoms for this experiment. Or maybe the question was about *photons* moving in a magnetic field?

FAQ #3 implies that all spin-1 particles travel at the speed of light, which of course is not true. What you said about the orientation of the spin in the direction of motion is absolutely right for a photon, but a photon is not the only spin-1 particle.

In section 8, in your definition of quanta, you mention that "quantum" is plural. Actually, "quantum" is singular and "quanta" is plural.

I have no more than a BA in physics and have not even begun to understand all the complexities of quantum physics. Of course, the leading experts could say the same, since quantum theory makes our common sense into nonsense. But nonetheless, I hope that I have been of at least a little bit of help.

Brent Schumacher