

Re: Quantum Ph. Vs. Relativity

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- *From:* Eugene Stefanovich <eugenev@xxxxxxxxxxxxxx>
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Gregory L. Hansen wrote:

In article <[dbff58\\$7nr\\$1@xxxxxxxxxxxxxxxxxxxxxxxx](mailto:dbff58$7nr$1@xxxxxxxxxxxxxxxxxxxxxxxx)>, Siddhartha <gtg669y@xxxxxxxxxxxxxxxxxxxx> wrote:

Thank you all for your helpful comments. If I might impose on your generosity with one more question: Has the difficulty with Quantum Entanglement (which was discussed in the EPR paper) been resolved? That is, Relativists were averse to the "instantaneous communication" that could apparently take place between entangled electrons even when separated by large distances. Since this is now accepted as a very real phenomenon, I was wondering whether the Relativists have found some way of reconciling this idea with the principles of Relativity. Again, I would be very grateful for any input on this.

Here's how I think of quantum entanglement.

Suppose a red ball and a blue ball are placed in an urn. One drawn at random, sealed in a small box, and sent by express delivery to Stan in New York, the other packed and sent to Vladimir in Moscow. When Vladimir opens his package and sees the color of the ball, he immediately knows which color ball Stan got. And vice versa when Stan opens his package. There is no need to communicate, except knowing what the possible results are.

When you turn that into a quantum mechanical problem, the wavefunction will be something like

$$|\psi\rangle = (|\text{Stan has red and Vladimir has blue}\rangle$$

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+ $|\text{Stan has blue and Vladimir has red}\rangle/\sqrt{2}$

The quantum mechanical problem is no different from the classical problem in the sense that when Vladimir knows which color he got, he immediately knows which color Stan got because Stan will get whatever color Vladimir doesn't. No communication required.

Selecting which possible result actually occurs is the million dollar question (how much is the Nobel worth these days?), and there are about a dozen interpretations of quantum mechanics with no real agreement. But it's the same million dollar question that applies to a single observer.

Great explanation!

I totally agree. The only mystery is quantum indeterminism, i.e., why Stan sometimes gets a red ball and sometimes the blue one. However, in more than 100 years of quantum physics nobody has given even a shred of explanation for quantum probabilities. I doubt that such an explanation exists: quantum events are just unpredictable. There is no point to seek the explanation. That's the beauty of QM.

Eugene.

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