

# Re: A Look at Quantum "Spookiness"

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  - *Date:* 4 Mar 2006 08:47:12 -0800
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Tao wrote:

"Erops" <[erops@xxxxxxx](mailto:erops@xxxxxxx)> wrote in message  
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A Look at Quantum "Spookiness"

The results of quantum theory were described as "spooky" by Drs. Einstein, Podolsky, and Rosen because quantum theory seemed to reject "objective reality". They believed that all observed effects must be produced by "local" causality. Their conclusion resulted from their firm belief that information could not travel faster than the velocity of light. Indeed, if this were the case, quantum theory would indeed be "spooky". Quantum theory required, for example, that "paired photons" maintain polarizations which were opposite in direction. If the polarization angle of one of the "paired photons" were changed, the polarization angle of the other photon of the pair must instantaneously change to match.

Actually this is not a very accurate description of the situation. It is about determining the polarization, not changing it. The key thing is that one can measure the polarization in two directions which are incompatible observables in quantum mechanics, so the results cannot be explained merely by the states the particles started off in. Which direction to measure can be chosen by a central controller communicating simultaneously with each end of the experiment.

If you read the papers about Aspect's experiment (which verified Bell's theorem empirically), as I have, you will see Bell's result is only visible in the statistics, not in any individual measurement. No-one has found any way to use this effect to communicate faster than light, and very few people expect this to ever happen.

Although, they have proven conclusively that the aforementioned effect is real. Not by statistics, but by concrete mathematics. Instead of coupling two photons, they used three photons, and the math became

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"Always" (Quantum Spookiness) or "Never" (Einstein Hidden Variables).  
Turns out its "Always"

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