the general science journal

The EPR experiment explained

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A satisfactory explanation of the EPR experiment has eluded Scientists for many years. The experiment provides evidence of the quantum entanglement of two particles that occurs when the two particles have the same genesis.

The usually encountered experiment involves a photon that is split into two equal but opposite photons (i.e photons of the same frequency that travel in exactly opposite directions) which then travel across the experimental apparatus to two identical half-silvered mirrors. Each photon is then either transmitted or reflected by a half-silvered mirror and photon detectors determine which path each of the photons has taken.

The interesting part of the experiment is that when the half-silvered mirrors are set to exactly 45 degrees of angle (giving an equal chance of transmission/reflection) there exists a correlation between the results on each side of the experiment. So in other words, if photon A is transmitted, then photon B is more likely to be transmitted also, despite the distance between each of the half-silvered mirrors being greater than the distance light could possibly travel during the time of the experiment. This experimental setup therefore suggests one of two possibilities:

1. There is a communication between the two particles that occurs at a speed much greater than light, allowing the correlation of results to be established.

2. There are some 'hidden variables' that exist in the experiment that explain the correlation.

I have an explanation for the correlation that exists in the experiment by means of (2). The explanation goes like this:

Particles are waveforms that extend to infinity - particles of condensed matter are standing waves, and photons are travelling wave packets. This being the case, when a particle moves through space there will be a flow of wave activity along the line of that motion. Thus one moving particle can affect another particle a great distance away, as the waveforms overlap.

In the EPR experiment, the two photons (it also works with condensed matter particles incidentally) are created at the same time, and travel in exactly opposite directions. Thus there exist, essentially two beams of wave activity (like miniature laser beams) travelling through one another in exactly opposite directions. This means that the waves can interfere with one another.

The outcome of the interaction of a photon with a half-silvered mirror will depend on the minute details of the wave activity that exists where the waves of the photon and the waves comprising the mirror, meet one another. Thus the outcome of the essentially random decision of whether to transmit or reflect will depend on the sum of all the wave activity of every particle in the causally connected part of the Universe at the point (and moment in time) where the photon meets the half-silvered mirror.

This means that photon B that is travelling in exactly the opposite direction to photon A, will be flowing through photon A in a precisely aligned way and interfering with it. The outcome of the interaction (transmission/reflection) will be affected by this interference of the two wave trains. Moreover, the effect that this interference has on one photon will be the same as it is on the other photon, due to the precisely symmetrical nature of the setup.

Thus, if the interference causes transmission to occur rather than reflection, then both photons will be transmitted rather than reflected. There will still be exceptions to this outcome, however (not 100% correlation) if there is other wave activity in the space of the interaction that is not precisely the same on either side of the experiment.

If some change was made to the experiment such that one photon is bounced off an additional mirror prior to reaching the half-silvered mirror, then the quantum entanglement is destroyed, and no correlation in outcomes is observed. This is easily explained as the precisely aligned and symmetrical interference of one photon on the other will be lost.

As the amplitude of the wave train will diminish with distance along the line of motion of the photon, then if this explanation is correct, one would expect the correlation between outcomes of photon A and B to become less with the increasing separation between the two half-silvered mirrors. To date I know of no experiment that has been performed to investigate this possibility.