QUANTUM ENTANGLEMENT

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Abstract

The phenomenon of quantum entanglement involving two particles has puzzled us for a long time. This article presents some possible solutions.

Entangled Particles

Quantum entanglement is a phenomenon wherein the quantum properties of two particles become codependent, with the properties of one being instantaneously affected by measurements conducted on the other.

Entangled systems need special preparation, e.g., a pair of electrons having opposite spins, as is specified by the Pauli exclusion principle, has to be created, with the actual spin of each particle remaining in a state of quantum uncertainty (a situation described as "entanglement of the wavefunction" by Erwin Schrodinger) On the separation of the pair of particles, even by a huge distance, and on measuring one particle's spin the other particle's spin will automatically resolve itself in the other direction. This effect occurs instantaneously, apparently breaching the velocity of light and the rules of relativity, a phenomenon that Einstein referred to as "spooky action at a distance".

In quantum teleportation, a pair of entangled particles are used to transmit information about a third object instantaneously from one place to another. The original particle with information to be teleported is scanned. The scanning process disrupts the original particle and modifies both the entangled particles, which are separated by a large distance, instantaneously. The treatment process recreates the properties of the original particle. A "teleported" replica is thus formed.

Possible Explanations

There are several possible interpretations or explanations for the behaviour of entangled particles, which are as follows:-

First Interpretation

The two entangled particles may be linked by some kind of electromagnetic "force/link", the analog of which is the mechanical system of two similar physical objects, e.g., two similar balls or two similar wheels, linked by a rod. For instance, one of these two similar objects, e.g., two similar balls, is directly joint, connected, to one end of the rod while the other object (ball) is joint to the other end of the rod through two similar interlocking gears which are mechanically arranged in such a way that the turning of one of these objects (balls) at one end of the rod by a certain fraction of a revolution in one direction would result in the object (ball) at the other end of the rod turning by the same fraction of a revolution in the opposite direction at the same instant (i.e., instantaneously). What happens is that turning, e.g., the first object (ball) joint or connected directly to (one end of) the rod would turn the rod in the same

direction by the same fraction of a revolution at the same instant, the rod would turn the first gear joint to it at its other end in the same direction by the same fraction of a revolution at the same instant, this gear would turn the similar gear interlocked with it in the opposite direction by the same fraction of a revolution at the same instant, and, as the other object (ball) is joint to this second gear that turns in the opposite direction the other object (ball) itself also turns in the opposite direction by the same fraction of a revolution at the same instant (all these various actions taking place at the same time, all at once, simultaneously). On the other hand, if the second object (ball) joint to the second interlocked gear were turned instead it would cause the first object (ball) joint directly to the rod at the other end to turn in the opposite direction by the same fraction of a revolution at the same instant. This analogous mechanical principle might apply to the behaviour of the two entangled particles, whose "spooky action at a distance" is however abstract and invisible to the eyes unlike the above-described mechanical action which is visible to the eyes.

The following describes how the above-stated mechanical principle might apply to the behaviour of the two entangled particles. Any spin motion (measured) in one of the particles may theoretically cause instantaneous motion (e.g., spin or vibratory) in the electromagnetic "force/link" that links this particle to the other particle (as per the case of the first object (ball) and the rod in the above-described mechanical example). This instantaneous motion of the electromagnetic "force/link" may theoretically effect instantaneous motion in the other particle (as per the case of the rod and the second object (ball) in the above-described mechanical example) which may spin in the opposite direction (as it has been conditioned to do so through the entanglement process in accordance with the Pauli exclusion principle). (Note Carefully: The motions of the two entangled particles and the electromagnetic "force/link" may theoretically take place simultaneously, at the same instant or instantaneously (as is in the case of the moving objects/parts in the above-described mechanical example)).

Second Interpretation

The two entangled particles may theoretically be simultaneously controlled by a "brain" or "controller". This "brain/controller" may theoretically issue a signal to both particles at the same instant causing them to act as they do at the same instant. This is comparable, e.g., to a computer issuing a command to two printers (or other equipment) at the same instant causing the two printers to print at the same instant (parallel processing comes to mind), with the two printers programmed to respond differently to the same command at the same instant (e.g., one printer prints blue ink in response to a command while the other printer prints red ink in response to the same command at the same instant).

Third Interpretation

Information from one of the two entangled particles may theoretically be carried to the other particle by an extremely fast carrier wave that travels faster than the velocity of light causing the other particle to act with an opposite spin at practically the same instant. (Note: Since the speed of this carrier wave theoretically exceeds the velocity of light and light may be required to detect it, it may be undetectable.)

Fourth Interpretation

There may theoretically be an unknown influence, a mysterious undiscovered force, at work.

Programming

Equipment controlled by computers such as robots have to be programmed to get them to work in a certain way, e.g., one programming method involves walking the robot through the operating sequence to "teach" it the operating sequence. Entanglement of two particles is rather similar to the programming of an equipment with a computer resulting in the two particles acting the way they are expected or "programmed" to.

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