SECTION 10

Resolving the Problems of Locality and Entanglement

THE PROBLEM

Locality states that an object is only directly influenced by its immediate surroundings. For an action at one location to have an influence at another non-contiguous location, something in the space between the locations must mediate the spatial separation.

Entanglement is a joint state of two or more particles where one particle instantly "knows" what happens to and what is the state of the other and appears to be able to force a change in the state of the other, even though there appears to be no means for such communication between the particles, which may be separated by arbitrarily large distances.

Clearly the two are opposed. One claims that the spatially separate have no interaction unless something intervenes to mediate the separation. The other claims that the spatially separate can significantly interact without any intervening mediation. Either one or the other might be valid but both cannot be simultaneously valid. Which is it?

Quantum Mechanics cites the EPR Paradox type experiments as proof of Entanglement.

THE EPR PARADOX.

The EPR Paradox (or Experiment) is so named because it was a thought experiment devised by Einstein, Boris Podolsky and Nathan Rosen in 1934-1935. In 1976 and subsequently the experiment has been physically run. The results have always been interpreted as favoring 'non-locality', the opposite of classical ‘locality’.

In the experiment a pair of protons, for example, associated with one another in a singlet state will always have a total angular momentum of zero, as they each have equal and opposite amounts of spin.

According to Quantum Mechanics, for each of the protons its probability wave will not collapse and its specific spin be decided until it has been measured (observed). If one measures the spin of one proton, according to quantum theory, the other proton instantly “knows” and adopts the opposite spin its probability wave having simultaneously likewise collapsed.

Separating the particles in opposite directions and measuring one of them for spin has been carried out over a distance of 10 km. The instant it is measured and the spin determined, the other particle apparently adopts the opposite spin. The time interval is zero, instantaneous.

It would appear that something is communicating between the particles and at light speed or faster. But, what and how ? We must identify and understand the mechanism producing the observed quantum entanglement effects or else find and demonstrate that the effects are not real and only apparent. Otherwise, failing those two, the observed quantum entanglement effects are real as observed and interpreted but have no cause, no mechanism and, therefore, are, by definition, ***supernatural magic*** which is scientifically unacceptable.

ANALYSIS OF ENTANGLED QUANTUM EFFECTS COMMUNICATION

Entanglement is defined by the following: If two particles are in a state such that there is a matching correlation between two canonically conjugate dynamical quantities, they are termed as being "entangled". Such entangled behavior has been noted in instances, for example, of particle angular momentum and of photon polarization.

The correlation means that there is "coherence" among the entangled particles. When the coherence is lost the particles are "decoherred".

According to Quantum Mechanics any measurement of a property of a particle causes an irreversible collapse of its wave function to the just measured quantum state of the particle. In the case of entangled particles, the effect of such a measurement will be on the entangled system as a whole.

Requirements for Entanglement Mechanism

For the entangled "matching" to be maintained there must be a communication among the entangled particles, there must be something flowing from each to all of the others so that each has the necessary information to determine what its specific matched correlated state must be.

Because the entangled particles are continuously in motion, curvilinear or oscillatory about a location, directing the communicating flow from particle to particle is impractical because the location to which to send the outgoing communication is indeterminate. Therefore, it cannot be directed to solely those of the entanglement. The only alternative is that the communication must be generally broadcast.

Because any particle might be called on to participate in an entanglement, every particle, all particles, must be continuously broadcasting their quantum state so that a means is required to leave non-entangled particles unaffected by the operating of the entanglement matching action..

In order for the communicated enforcement to affect only the entangled particles, when two or more particles are entangled there must be some kind of entanglement identification mark or notation on each entangled particle, the mark identifying each as part of a system of entangled particles and in that role in its part in the "matching correlation between the conjugate dynamical quantities" of its entanglement being maintained.

Lacking that identifying mark a particle is not involved in a "matching correlation" and is not entangled.

Furthermore there must be something enforcing the maintenance of the correlation at each entangled particle. For example in the case of entangled particles "A" and "B", upon a change in the state of "A" a communication must be sent to "B" and: either [a] that communication itself from "A" received at "B" has a mechanism to cause or force "B" to change its state to the new correlation, or [b] the entangled "B" itself has such a mechanism to cause or

force itself to change its state to the new correlation that "B" mechanism being triggered into action by the received communication from "A ".

Either that mechanism is inherent in every particle or else it must be placed into each particle upon initiation of the entanglement and removed upon each decoherence.

In summary entanglement involves the following requirements:

1 - Every particle must be broadcasting information as to its current quantum state;

2 - Each entangled particle must have an identification to that effect;

3 - For each entangled pair there must be mechanism that enforces "matching correlation".

There is, in fact a communicating flow from every particle to every other particle in the universe. That flow, developed in the earlier sections 6 and 7 is described as follows.

The Flow from Particle Centers-of-Oscillation

In Section 6 it is found that there is a spherically outward flow of oscillatory *Medi*um wave from every particle. That existing flow is the only possible candidate for the communicating flow to be the mechanism for entanglement because it already exists. [That *Propagated Outward Flow* has a primary role in the mass of particles and in the action of Coulomb's Law and Ampere's Law, see Reference [2]. A second universally broadcast such flow in addition is not possible because it would interfere with the existing *Propagated Outward Flow*.]

That Which is Flowing

- Contemporary particles are Big Bang successors of the original *[1 - Cosine]* oscillations with which the universe began. Thus the outward flow of the original oscillations is a property of present particles. That which is flowing is the same original primal *Medium*, the substance of the original oscillations, as at the beginning of the universe.

- Since it is flowing outward from each of the myriad particles of the universe simultaneously and since that flow is interacting with the myriad other flows of those particles without untoward interference, the *Medium* must be extremely intangible for all of that to take place. Any one particle's flow flowing largely freely through that of other particles, is as intangible as … well , "field".

The Oscillatory Medium Flow

- The initial medium supply of the universe, oscillating in *[1 - Cosine]* form, came into existence at the Big Bang. Therefore the initial medium supply of each particle, each being a direct "descendant" of the original oscillation at the universe's beginning, must be likewise oscillatory in form. Therefore the radially outward flow from each particle is likewise an oscillatory medium flow of the same *[1 - Cosine]* form.

- For such a flow to persist there must be a supply of that outward flowing substance in every particle. And, for that flow to have persisted the billions of years since the "Big Bang" that "supply" must be an extremely concentrated reservoir of that which flows outward [concentrated relative to the outward flow].

- The reservoir is the spherical "core" of radius δ, equation *(6-10)* at the center of all particles.

In Section 7 it is found that the flow from particles in motion is forced to be different in the forward, rearward, and sideward directions, see Reference [2]. Those differences overall carry information about the state of the particle including its direction, velocity, energy, frequency and mass. But particles encountering that flow experience only a very small portion of the total spherical wave front propagated by the particles, a sample that may be of its forward only, or sideward only, or rearward only, or whatever part of the total picture. Without reference to the overall wave front the minor sample in an actual encounter carries negligible information of use for the quantum entanglement problem.

Thus the actual communicating flow satisfies the quantum requirement #1 of broadcast communication but fails to satisfy requirements #2 and #3, entanglement identification and means to enforce the correlation of quantum states. Therefore, there is no flow satisfying the communication requirements for entanglement or there must be a second universal broadcast flow from all particles fulfilling the requirements.

However, any second universal flow would, by the presence of its own "core" interfere with the onmi-directional role of the earlier original "core". Consequently, there is no facility to perform the communication requirements for entanglement.

Conclusion of Analysis of Quantum Effects Communication

Having now found that there is no mechanism able to support or justify the Quantum Mechanics interpretation of entanglement effects it remains to investigate whether those effects are real or only apparent because science cannot accept their being real but lacking cause and mechanism, which is the definition of ***supernatural magic***.

ANALYSIS THAT THE ENTANGLED QUANTUM EFFECTS ARE NOT REAL

In terms of Quantum Mechanics, for example in the EPR paradox, before the measurement and consequent "collapse" where are the protons' angular momentums [spin angular momentums] located, or how are they expressed ? The only place available is in each proton's wave function because that is the only thing specifically related to each proton. The two protons don't specifically "exist" until their probability waves collapse. But, the wave function is non-material and cannot contain angular momentum, only probability. If the two particles' angular momentums do not exist somewhere before the measurement and its "collapse" they cannot exist afterward. The "collapse" cannot call them into existence from nothing.

Quantum Mechanics would argue that before the "collapse" the protons do exist "in a superposition of all possible states for them". But then, where is their angular momentum ?

- Is it in full in each of those superposed states ready for any one of them to be selected at the "collapse" ? Then how did only one protons worth of angular momentum get so enlarged ? And what of the left over angular momenta in the multitude of states not selected at the "collapse" ?

- Is it spread out allocated among the various possible superposed states ? How can, how does that happen ?

- Is it only in the state to which the superposition collapses ? But which state that is is not determined until the instant of collapse **…**

… and, if that state were earlier determined what point would there then be to the variety of other states in the superposition, states then with no function nor possibility of reality ?

Therefore the two protons must, and do, "pre-exist" with opposite spins in correlation as if already "collapsed" **before the first measurement**. Thus there is no probability wave to "collapse" because the state that results from collapse is already extant.

[It has already in the prior section been found that Realism is valid, particles exist independent of whether observed or not, and there is no "collapse of the wave function" to bring particles into existence.]

The problem of instantaneous communication goes away with the protons in "existence" and spinning oppositely in their correlated spins **before** the first measurement. Then measuring one and finding the other instantaneously correlated is assured because it was "pre-assured".

There is no question nor issue of "action at a distance" at all here because there is no actual "action". Being a contended example of entanglement, this experiment actually supports Locality and denies Entanglement. The above critical analysis applies as presented for protons, electrons, photons and all such atomic scale particles. [In the case of photons the entangled property is angle of polarization, not angular momentum.]

SUMMARY OF ANALYSIS

The previously above Section 9 conclusion of the problem of Realism has found that Realism is valid, particles do exist independently of whether observed or not, and there is no "collapse of the wave function" to bring particles into existence. That means that the wave function is only a mathematical invention and does not exist in material reality.

In the EPR experiment before any first particle measurement the entangled particles all "existed" and were each in its proper state correlated with the others. They were material particles not "wave functions". They did not need "collapse" to come into material existence and they would experience no "collapse" because there was no probability wave there to collapse. They all are in a set of correlated states after the measurements as before.

Consequently their separation distances were of no concern and there was no "spooky" action, no violation of Locality..