Contributions to the New Energy Foundation

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Superluminal Signaling Seems Unphysical

Quantum entanglement is undeniable. Bell's Theorem correlation tests confirm this to extraordinary experimental certainty—over 46 standard deviations in the Alain Aspect experiments.[1] Modern experiments[2] have tried to measure the speed of the influence in coincidence counting experiments and reckoned that it is at least 10,000*c*. Recently it has been proven that remote measurement can affect distant wave-function collapse.[3,4]

However, one may find all this "spooky." I'll give an example that has been bothering me for some time: imagine I have a length of fiber optic cable, say many kilometers long, down which we have the superluminal communication scheme. Sure, changes at one end present almost instantaneously and it seems that quantum particles have a "connection." Now place the ends of the cable close to each other—same result. How does it know where the ends of the cable are to perform this miracle? There is no spatio-temporal differential equation (a wave equation) to guide it through space as the speed of propagation is infinite. The infinite quantity decouples the time and space components rendering the process "unphysical" or "spooky." The distribution of the matter is irrelevant; it magically knows where to make the changes!

We understand physics as the interplay between matter and energy, the interactions communicating the configuration of the matter in space and in God's wisdom, at a finite speed spread out over a time dimension, so it doesn't all happen at once and the result is a complex Universe capable of great order and beauty, rather than a heap of "stuff"!

A way out of this unphysical action may be to introduce another time dimension, τ, not normally visible to us and perfectly orthogonal to our "real time" so we'd have a wave equation thus:

$$\frac{\delta^2 u}{\delta t^2} = c^2 \nabla^2 u$$

That way all the spatial distribution of matter would com-

municate to this quantum signal in a physical way but would appear in our time dimension as instantaneous.

It would be hard to test such a concept: I could have two synchronized experiments with different runs of cable lengths running from point A to B—one many hundreds of kilometers long, the other, a few meters. As the signal is superluminal we would perceive no difference in our time dimension. We'd need a physical, causal process happening in the τ dimension. I am thinking about this along the lines of a series of way-stations which would be visited sequentially by the "influence" in the τ dimension. However since the dimensions are perfectly orthogonal $\Delta\tau/\infty = 0$ this would seem to thwart us. The commonality between the two time dimensions is the same spatial dimension and this may offer a way of spacing the way-stations such that normal finite speed signals in our domain would indicate the sequential visitations and hence causality, a time dimension, in the other.

What I am saying, in this scenario of the fiber optic cable, is that to insure a physical, mechanistic coupling between the two entangled photons at the end of the cable, perhaps the wave equation guides the "influence" in another time dimension—a snapshot of 3D space at an instant gives the configuration of the matter. The trouble with this is if the middle of the cable is destroyed as the two (finite speed) photons exit the ends. What would guide the "influence" in the other dimension with no cable present? Straightaway the idea is in trouble.

Does the "influence" have a finite speed? Well no, on two counts (at least): the same problem of a break in the cable exists with there being no cable when the two extremities lose entanglement; the 'influence' is linked to the cable exists with there being no cable when the two extremities lose entanglement; the "influence" is linked to the conservation of probability as seen in my first paper—it has to have infinite speed.

Maybe then an even more exotic "association space" where concepts of the indistinguishably of particles is replaced with unique (or labeled) particles, entangled particle pairs or n-tuple entangled particles in a "space" devoid of spatial concepts (similar to Bohm's Hidden Variables Theory). This space would form some kind of accounting ledger of the interactions. Easy enough for a programmer to act like God and program this "law of physics" in a virtual reality simulation—some data structure or array would do it, but is it physical?

Perhaps another shift would be to give up on the idea of particles being point-like (or at least very small) and allow them to have macroscopic extent. This would solve all difficulties in one fell swoop. The "particle" really is a wave and we think of it as small and localized when it collapses. Take a spherical source of electrons or photons—correctly, the sphere as it propagates is the particle's wave-function, be that light years across. It is only when a measurement is performed that the wave-function collapses and it becomes localized. We understand a particle as that sufficiently fundamental or even non-composite, that its existence becomes axiomatic. Why shouldn't a quantum of matter or energy, *i.e.* its wave-function, potentially fill the whole Universe if it has the probability to be anywhere? It scatters locally and has a tiny cross-section and behaves as a particle, but that is different than its wave-function.

What about our feelings of compactness/parsimony of such a mechanism or even Occam's Razor? As far as I know, the mechanisms of physics don't require complicated or even "intelligent machinery." Concepts such as an inverse square law fall out quite naturally from the idea of a flux and three dimensional space, to name one; the machinery is mathematics which seems to exist in a Platonic realm.

One can fall back on one's comfort blanket and say such things as coincidence-counting and entangled communication are impossible. I draw the reader to the references below. Yes, it's disturbing.

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References

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