

## A Conceptual Framework to Explain the Entanglement Phenomenon

By

Barry Wolfson, Ph.D.

### ABSTRACT

Of all the mysteries that have confronted physicists in the past century surely entanglement must rank amongst the most perplexing. Not only does this phenomenon express itself over apparently arbitrarily large distances and barriers between two particles but it also expresses itself across time<sup>1</sup>! I propose a model using higher dimensional space which conceptually can reconcile the apparent problems presented by entanglement – that of communicating faster than the speed of light and even communicating into the future.

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Of all the mysteries that have confronted physicists in the past century surely entanglement must rank amongst the most perplexing. This phenomenon is not perplexing because of some large scale measurement which does not seem consistent with other observable phenomenon. Often in situations of this nature there is some question about the measurement procedure and whether or not the actual critical issue is being measured appropriately. With entanglement we have the “ball squarely in our lap”. We can observe and measure the atomic particles to enough accuracy that nobody questions the experimental results. What is so inexplicable is how two apparently independent particles act as though they are (mysteriously) communicating with one another. Depending on certain properties or behavior of one particle, the properties or behavior of the other particle is determined. Not only does this phenomenon express itself over apparently arbitrarily large distances and barriers between the two particles but it also expresses itself into the future! In an experiment led by N.Gisin at the University of Geneva, Switzerland<sup>1</sup> with amazing results, he created two entangled particles and was able to shift the time clock on both particles so that each was time-wise ahead of the other particle. How, he reasoned, under this scenario could it be possible, even if somehow the particles could communicate, that they could act entangled? Each particle got to the threshold first so there is no way it could “know”, even if it could communicate, what the other particle was going to do! To everyone’s amazement the two particles acted as “one”. If you knew what one particle did you knew what the other one did – 100% of the time with no exceptions. So strange and inexplicable are these results that one well know physicist said that this phenomenon has no explanation within our current model of physics.

Perhaps the scientific starting point for the idea presented here in a very superficial way comes from string theory. While this theory has a long way to go before becoming a specific model, one common aspect of its various versions is the higher dimensional space of which we are a (very small) part. A priori, we start out thinking that we live in 3 dimensional space plus time. Some of us wonder if there are perhaps more dimensions “out there” that we are unaware of. String theorists assert this as an integral part of their theory and of reality. The idea I am presenting here has very little to do with string theory other than the higher dimensional space that string theory suggests we live in.

The key problem with entanglement is that we have two particles which “ought” to be independent yet they act like they are tied together. So, I asked myself could we be looking at particles which “look” like two particles but are really somehow tied together? The tentative answer I came up with is yes and a good way of envisioning this is by analogy. Consider a projection from 3 dimensional space into 2 dimensional space. Consider say a ball with two light sources projecting 2 shadows (2

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1 <http://arxiv.org/abs/quant-ph/0002031v3>

dimensional objects) on a surface. Now our flattened out friend who lives on this surface will see what looks like 2 objects. They can be very far apart and can be made to move in what looks like very different paths suggesting they are two independent objects. Alas, you and I (higher dimensional beings) know better. We know that no matter what you do to these projections ultimately they are representations of the same object. Ultimately they belong to one object and presumably you could say these images are "entangled". Furthermore you could even shift the photon trajectories so that each image reaches a certain threshold before the other one does and they ultimately will end up doing the "same thing" regardless of the time shift since they are both coming from the same object. Now, to carry this analogy back to our problem, when we create two entangled atomic particles we (flattened out beings in a higher dimensional reality) are really looking at the projections of a single higher dimensional object. We see what looks like two (or more) apparently independent objects. Alas, our higher dimensional friends (whom we have yet to meet) know better. While they may see the projections, more importantly they also see the single higher dimensional object from which these projections come. Now we humans intrigue ourselves by directing these projections in all sorts of directions and by even shifting their time clocks. But from this point of view, all these experiments are really nothing more than looking at a single object from different points of view and of course they will act entangled because they are representations of a single object.

Well, as the title of this paper states, this is intended only as a conceptual framework for explaining how entanglement might work. There is a huge amount of work that is left to be done in the way of specific mathematical physics that applies to the higher dimensional space and that corroborates the experimental results.

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