

A Proposed Experiment to Reveal A New Aspect of Entanglement

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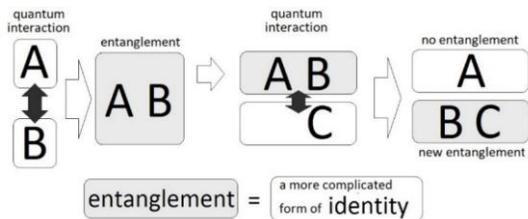
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Abstract

We understand without question that the universe is somehow an exhibit of logical rules applied to matter and energy ... and that those rules constitute a hierarchy of importance that allows some actions while disallowing others ... leading to the observable manifestation we call 'universe'. An experiment is proposed to show that entanglement is related to the definition of identity as it is instantiated in the observable (objective) universe. Does the logic of physics define a difference between complex and primary unitary objects ... a large rock or an electron?

The theory here is that interaction, at the quantum level, creates entanglement ... and subsequent interaction destroys that entanglement ... transferring it to another newly created entanglement. Entanglement simply means "identity" in the strictest logical sense. Entanglement is a qualitative process that can also be examined through experiments.

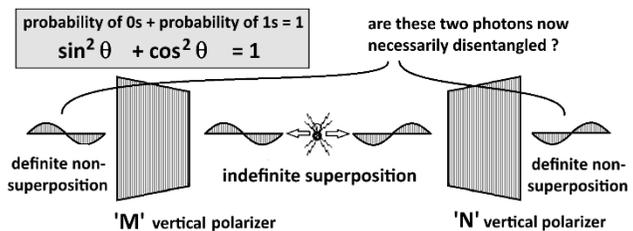
An interaction creates a pair of entities which together constitute a new identity, with an accompanying "identity field" having a theoretical transmission velocity of $\sim 10^{39}c$ (not germane or relevant to this article). Entanglement would then have the logical meaning of "identity". This conclusion can be put to an objective experimental test.



Entanglement, Superposition Experiments

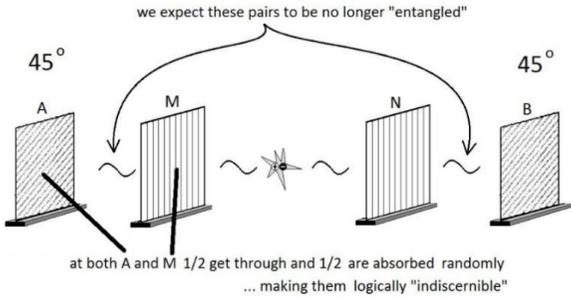
Some conjectured experiments can be used to examine entanglement and its relation to superposition. Let the state of the two emitted photons (Bell experiments) prior to interacting with polarized filters, be called "indefinite superposition", and the state of those photons having passed through polarized filters be called, "definite non-superposition".

That is, the state of the photon having passed through a filter, is altered to a single possible objective state of polarization, made from two superimposed parts relative to the next filter it is to encounter ... namely, the \cos^2 and \sin^2 of the angle between two filters.



A question that may then be posed is ... interaction with a filter destroys indefinite superposition (converting it into definite non-superposition), does this necessarily decouple the two previously entangled photons?

Experiment #1:



In this experimental set up, the electron-positron pair annihilates to form identically polarized photon pairs, randomly oriented relative to parallel filters M and N. From experimental evidence, the records of photons passing or being absorbed at M and N will be identical, though randomized individually. We

wish to send the photons that pass M and N on to the A and B filters which are parallel to one another but at a 45-degree angle relative to M and N.

The photons that get through M and N are necessarily polarized in the same plane as M and N, which can be proven by making A parallel to M, and by rotating B to anti-parallel with N. By experimental evidence, every photon arriving at A will pass through ... while every photon arriving at B will be absorbed.

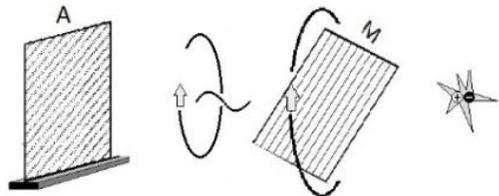
Returning filters, A and B to 45 degrees ... because both photons have been ostensibly "measured" by going through M and N, we expect them to no longer be quantum-mechanically entangled. However, they 'may be' in an indefinite superposition state because on arriving at A or B, half will pass, and half will be absorbed randomly at each filter ... which is indiscernible from the state of photons before they went through M and N. That is, in either case, half of the photons that arrive at A or B will go through, and half will be absorbed, just as photons did at M and N. The question here then is ... will the pass/fail records at A and B be totally uncorrelated? To be consistent with the current view there can be no correlation.

If, of all AB pairs, 25% are (1,1), 25% are (1,0), 25% are (0,0) and 25% are (0,1), all randomly mixed, we can assume complete non-correlation. We would therefore have proven that the entanglement of photon pairs was destroyed by going through M and N ... leaving only objective, definite non-superposition on arrival at A and B. If the records are identical to one another (having only AB pairs 1,1 and 0,0), then, the two photons are still entangled despite having gone through M and N. That is, they are still in indefinite superposition while in transit to A and B, and have not interacted with M or N, and are not in any definite state.

If the records are partially correlated, then, the photon pairs are still partly entangled. For instance, if the records show 2/3 of the A, B pairs are (1,1) and (0,0) while only 1/3 of the pairs are (0,1) or (1,0) ... this would constitute proof of partial correlation.

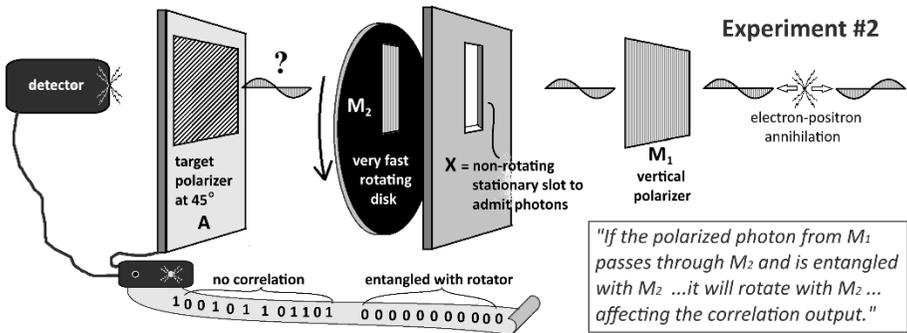
Experiment #2:

Another much more difficult experiment, leading to a possible strange result, would be to rotate M to parallel with A after the photon has passed M. That is, to rotate M while the photon is still in transit toward A.



A photon that passes M on its way to A, which is at 45° to M ... has a probability of 1/2 of passing or being absorbed at A, and is therefore indiscernible from a photon prior to passing M. Will its probability of passing A be changed if M is rotated relative to A, after the photon has passed M ... while the photon is still in transit toward A?

A more detailed setup ...



The conjecture is that if M₂ is rotated to parallel with A, the photon in transit between M₂ and A can be made to pass through A every time. And if M₂ is rotated to anti-parallel with A while the photon is in transit to A, it will be absorbed at A at every such trial. Here we would be assuming that the photon is entangled with the M₂ filter, through which it has passed, and has a definite superposition wholly dependent on the state of M₂. That is, the polarization of a photon which has passed M₂ is *definite* only in its relation to M₂ and can be changed in transit by rotating the M₂ filter through which that photon has already passed.

This would be a difficult experiment to perform due to the high angular velocities required ... but it is necessary to prove that the entanglement of the photon with its "other" is destroyed by measurement and not merely "transferred" to another body as is here conjectured. Any objective difference between a rotating M₂ and a non-rotating M₂ would constitute proof of "entanglement transference" rather than its complete destruction by measurement.

Conclusions

There is a problem with the difference between "measurement" and "interaction". A measurement should involve a change of state and subsequent change of energy (either it is lost by radiation or absorbed by an instrument used to take the measure (like a thermometer). But in entanglement measurements, no energy is seemingly involved. We get a change of state without energy deficit. How do we measure something without altering it? This is only possible if the supposed interaction/measurement is a strictly logical (qualitative interaction), i.e. no energy is transferred ... only information. This would be similar to consciousness in that it is definitely there ... but it is not part of physics at this point because no objective experiments are deemed possible.

If the outcome of this experiment shows that the photon arriving at 'A' is entangled with a rotating M₂ ... it would mean that the foundational actions of particles or even macroscopic objects are logical "wholes" in a physics sense and not just as a human construct of convenience. Each of us is then a "complex unitary object" wherein the parts of which we are made ... are in the deepest physical sense one logical entity. Existence then "sees" every identifiable complex object as unitary (in an entangled sense) that is in principle detectable by physical experiment.

References

- "Ex Nihilo – The Universe Derived from Nothing" - E. Beaubien (pgs.85-94)
 "Can Quantum-Mechanical Description of Physical Reality Be Considered Complete?", Physical Review, volume 47, May 15, 1935 - Einstein-Podolsky-Rosen (EPR) paper.