Bijective Epistemology and "Time from Quantum Entanglement"

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Abstract

Idea that time can have origin in entanglement is based on the preposition that "internal observer", "external observer", "coordinate time" and "proper time" are theoretical models of the world which have counterpart in physical universe. Bijective epistemology based on bijective function of set theory confirms these models have no counterpart in physical universe; they are pure theoretical inventions on which we cannot build a consistent scientific theory. Idea that time could have origin in entanglement has no enough theoretical and experimental basis to be taken seriously as an adequate model of physical world.

Key words: Special Relativity, GPS system, time, entanglement

1. Introduction

In Special Relativity (SR) we have a famous example with train which is passing the station. We have two observers, observer 1 is on the station, observer 2 is on the train. When train is passing the station observer 1 and observer 2 adjust their clocks. Common interpretation is that clock 2 will run slower for observer 1 and clock 1 will run faster for observer 2. In this case observer 1 is "external observer" for the clock 2 and observer 2 is "external observer" for the clock 1. Both observers move in "coordinate time", in their inertial systems are running "proper times" which are not valid for both observers. Clock 2 run slower only or the observer 1 and clock 1 run faster only for the observer 2.

This common interpretation in SR is not confirmed by GPS system which confirms that clocks because of the SR effect run slower on the satellites than on the surface of the earth for all observers independently they are on the surface of the earth, on the airplane, in car, on the boat or on the satellite.

In GPS system clocks run slower because of SR effect for 7 microseconds and because of GR effect clocks run faster for 45 microseconds. The combination of these two relativistic effects means that the clocks on-board each satellite should tick faster than identical clocks on the ground by about 38 microseconds per day (45-7=38)! This sounds small, but the high-precision required of the GPS system requires nanosecond accuracy, and 38 microseconds is 38,000 nanoseconds [1].

This experimental fact of GPS which we use in our daily life put under the question existence of theoretical models "internal observer", "external observer", "coordinate time", "proper time".

Results of our research confirm clocks run only in space and not in time which is merely a numerical order of material changes, i.e. motion which run in space [2].

2. Bijective epistemology, internal observer, external observer, coordinate time and proper time

Observer perceives in physical universe five fundamental elements: space, energy, matter, changes and time. In order to build an adequate fundamental model of the universe observer uses bijective function of set theory in which each observed element in the universe set X corresponds exactly one element in the model of the universe set Y :

$$X:\{O_x,\mathrm{C}_x,T_x,M_x,E_x,S_x\}$$
$$\mathrm{Y}:\{O_Y,\mathrm{C}_Y,T_Y,M_Y,E_Y,S_Y\}$$

O_x - observer (which observes other 5 elements), C_x - change, T_x - time, M_x - matter, E_x - energy, S_x - space

O_y - model of the observer, C_y - model of change, T_y - model of time, M_y - model of matter, E_y - model of energy, S_y - model of space [3].

According to bijective epistemology observer and time as elements of "set model" Y have "bijective correspondence" in the "set universe" X which means that elements "observer" and "time" of theoretical model correspond exactly to the observer and time the physical universe. Bijective epistemology does not predict existence of an "internal observer", existence of an "external observer", existence of a "coordinate

time" and "proper time" which seems have no counterpart in physical universe and on them cannot be build a theoretical model which would correspond physical reality.

Moreva and others publish a paper with a proposal that time has origin in quantum entanglement. This proposal is build on the preposition that "internal observer", "external observer", "coordinate time" and "proper time" have physical existence:

"The "problem of time" [2–6] in essence stems from the fact that a canonical quantization of general relativity yields the Wheeler-De Witt equation [7, 8] predicting a static state of the universe, contrary to obvious everyday evidence. A solution was proposed by Page and Wootters [9, 10]: thanks to quantum entanglement, a static system may describe an evolving "universe" from the point of view of the internal observers. Energy-entanglement between a "clock" system and the rest of the universe can yield a stationary state for an (hypothetical) external observer that is able to test the entanglement vs. abstract coordinate time. The same state will be, instead, evolving for internal observers that test the correlations between the clock and the rest [9–14]. Thus, time would be an emergent property of subsystems of the universe deriving from their entangled nature: an extremely elegant but controversial idea [2, 15]. Here we want to demystify it by showing experimentally that it can be naturally embedded into (small) subsystems of the universe, where Page and Wootters' mechanism (and Gambini et al. subsequent refinements [12, 16]) can be easily studied. We show how a static, entangled state of two photons can be seen as evolving by an observer that uses one of the two photons as a clock to gauge the time-evolution of the other photon. However, an external observer can show that the global entangled state does not evolve"[4].

In this article is shown that idea of time from quantum entanglement has no enough theoretical background to be seriously taken in consideration as a promising theory which can enrich physics.

3. Time has only a mathematical existence

$$X_4 = ict \quad (1)$$

Formalism (1) confirms the fourth coordinate of Minkowski manifold is not time, 4th coordinate is spatial too. Interpretation of time being 4th dimension of space is one of the main misunderstandings of physics of20th century. In formalism (1) time t is merely numerical order of photon motion in space. In generally time is a numerical order of material changes which run in space. Changes do not run in time, numerical order of changes is fundamental time which when is measured by the observer turns in duration which is emergent time [2].

4. Time and Entanglement

Experimental data confirm entanglement is an immediate phenomenon which has no numerical order, means no time. Time is characteristic for phenomena which has certain numerical order as for example motion of photon in space. Each Planck distance photon passes corresponds exactly one Planck time. The sum of Planck times is the duration of the photon from the point A to the point B in the space as is shown in formalism (2):

$$t = t_{P1} + t_{P2} .... + \mathrm{t}_{PN} = \sum_{i=1}^{N} t_{Pi} \quad (2)\ [2].$$

Our research confirms entanglement is a nonlocal phenomenon in which space itself is an immediate medium between quanta [5]. Time as numerical order is characteristic for material changes which run in space and are local phenomena. Thinking that time could have origin in entanglement seems not appropriate.

5. Conclusions

Validity of a given theoretical model depends on the level of its epistemological correspondence with physical reality. Bijective function of set theory is a helpful mathematical toll to verify level of epistemological correspondence. In this paper is shown theoretical elements "internal observer", "external observer", "coordinate time" and "proper time" have no counterpart in physical world. That's why make sense to outline that this theoretical elements are not sufficient theoretical basis for the idea that time could have origin in quantum entanglement.

References:

1. Real-World Relativity: The GPS Navigation System, http://www.astronomy.ohio-state.edu/~pogge/Ast162/Unit5/gps.html
2. Fiscaletti,D. and Sorli, A.: Perspectives of the Numerical Order of Material Changes in Timeless Approaches in Physics, Foundations of Physics, February 2015, Volume 45, Issue 2, pp 105-133
3. Fiscaletti, D. and Sorli, A.: "Bijective Epistemology and Space-Time", Foundations of Science, published online 11. december 2014.
4. Moreva, E., Brida, G., Gramegna, M., Giovannetti, V., Maccone, L. and Genovese, M.: "Time from quantum entanglement: An experimental illustration", *Physical Review A* **89**, 052122 (2014)
5. Fiscaletti, D., Sorli, A.: "Three-dimensional space as a medium of quantum entanglement", *Annales UMCS, Sectio AAA: Physica* **LXVII**, 47-72 (2012).