Exploration

On Nesteruk's Universe as Communion & Cosmological Entanglement

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Abstract

This article is intended to offer a new insight on instantaneous action based on a recent observation called *cosmological entanglement*. We argue that the Universe is a communion shared between God and His creations, including human being in this Earth.

Keywords: Universe, communion, cosmological entanglement, electromagnetic interaction, instantaneous.

Introduction

In the last century, the understanding of the nature of electromagnetic phenomena was taking place with a constant rivalry between two concepts of interaction, i.e. Newton's instantaneous action at a distance (IAAAD) and Faraday-Maxwell's short-range interaction. The discovery of Faraday's law of induction and the experimental observation of electromagnetic waves seemed to confirm the short-range interaction. Nevertheless, the idea of instantaneous action still has many supporters. Among the physicists developed some theories based on this concept were Tetrode and Fokker, Frenkel and Dirac, Wheeler and Feynman, and Hoyle and Narlikar. This interest in the concept of instantaneous action is explained by the fact that classical theory of electromagnetism is, to some, an unsatisfactory theory, and so there have been many attempts to modify either the Maxwell equations or the principal ideas of electromagnetism.

In a book review, Augusto Garrido wrote [6]:

> On the other hand, the famous article "*Can Quantum-Mechanical Description of Physical Reality Be Considered Complete?*" by Einstein, Rosen and Podolsky published in Physical Review in 1935 revived this discussion in a new panorama. In this article Einstein made public his position against the Copenhagen interpretation of the quantum mechanics. The controversy unleashed since then made this article a very popular one for its implications in our physical and philosophical understanding of the physical

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> reality. The main objective of this article was to demonstrate that the quantum mechanics, the same way the Newtonian mechanics was for the relativistic mechanics, is an incomplete theory, and therefore, transitory of reality. For that reason Einstein made evident what is now known as the EPR paradox. According to EPR quantum mechanics is no local theory, that is to say, it permits action at a distance and, that is forbidden by the relativity theory, instantaneous action at a distance.
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> Unfortunately for Einstein, and for common sense the experiment performed by Aspect seems to indicate that the IAAAD following from quantum mechanics exists. As a consequence of this confusion, physicists are divided in two big groups according their position about IAAAD. These disputants are the quantum physicists and the relativists, who, almost after a century, have not been able to answer the old question whether the subject of their studies is a complete and integrated Universe – a physical Universe in its own right – or simply a assemblage of locally interacting parts. This argument is not banal due to our understanding of the fundamental concepts of space and time depends drastically on which of these two positions is correct. After so many years of dwelling on this problem, without having obtained an accepted solution by the scientific community, it is logical to expect that the discussion has arrived to a conceptual deadlock and for that reason, partly, hopelessness has settled in the minds of young people who want to study this field of human knowledge. For young people wanting to understand the world, this particular field of science seems to provide only philosophically disorganized bits of knowledge, that constitute in its majority means of destroying ourselves entangled in the web of intellectual confusion. Because of this, what began as a *Natural Philosophy* has been losing its essence and has slowly transformed into a practical science against what was initially expected of it.

This article is intended to offer a new insight on IAAAD based on a recent observation called cosmological entanglement. It turns out that this observation gives support to the recent work by Nesteruk and the second author herein.

Nesteruk's Universe as Communion

For theologians who try to understand or get a grasp on the various progress in science, he/she has to start with one of the following assumptions: (a) there is *conflict* between science and theology (biblical teaching), (b) there is mutual separation between science and theology, or (c) there is *dialogue* between science and theology; in other words there could be a hope for reconciliation (see for instance Peirce's distinction: deduction, induction, abduction).

The authors took the third approach in this article, in tune with Kulikovsky and Alister McGrath [16]. In one of his book, McGrath states upfront:

> It is the contention of this work that the relationship of Christian theology to the natural sciences is that of two fundamentally related disciplines, whose working methods

> reflect this common grounding in responding to a reality which lies beyond them, of which they are bound to give an ordered account' (p. xviii).

In a somewhat similar tune with McGrath, a monograph by Alexei Nesteruk, a senior lecturer in mathematics at the University of Portsmouth and a deacon in the Russian Orthodox Church, represents a distinctive approach to the science–religion debates. He describes the aim of his book as an existential exploration of the *dialogue between theology and science* and argues that this dialogue is only possible if scientific knowledge and faith are treated as two activities of human subjectivity.

This approach is familiar to the Orthodox tradition which did not, according to Nesteruk, experience a clash between science and religion like their counterparts in the West. The fact that Eastern Christianity had a different experience of the relation between religion and science is the platform from which Nesteruk departs and it is from this platform that he wants to shed new light on the contemporary debate [17].

Le Roux wrote [17]:

> Any attempt to proclaim the ultimate and objective sense through abstraction from acts of human subjectivity represents a distortion of the natural order. According to the phenomenological approach, the understanding of nature originates from human existence. Knowledge of an objective reality, which exists outside and independent of human insight is, as such, a fallacy. In accordance with Husserl, Nesteruk refers to the ultimate paradox of being. The fact that humans are part of the world, but at the same time constitute the consciousness of the world, is a dichotomy that must be accepted as a given, as the primary existential reality. This human element brings something unique to existence, which natural science cannot identify. Science is not sufficient to understand what it means to be human.
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> With this subjective element in mind, the act of knowing becomes much more personal. The word *communion* is Nesteruk's way of acknowledging how knowing someone or something, even the universe, involves a personal act of acknowledgement. Scientific knowledge, just like faith, is a mode of communion and is always an act of a particular person. The personal act of knowing and experience is unique to every person and it is in the personhood of an individual that the reconciliation between the two modes of communion takes place…

To arrive at more coherent view with Nesteruk (see also Nesteruk's article in [17a]), we suggest a similar approach to cosmology: i.e. the Universe is already a communion shared between God and His creations, including us –human being in this Earth. God's intent to share is started by His act of creationing the Universe. We also shared the same communion with all living and non-living beings in this planet. But, some people may take a long breath at this point: *are there scientific arguments supporting such a proposition?*

We would argue in the following section that such arguments are indeed available, especially in a recent development called "*cosmological entanglement*" observation, which seems to bring us to far reaching implications, much more than Aspect's experiments.

Observational Finding on Cosmological Entanglement

With regards to Nesteruk's hypothesis of *Universe as communion*, interestingly there is a recent report from MIT suggesting that ancient quasars support such quantum entanglement at large scale phenomena. In an article it is reported about possibility of cosmological entanglement, which can be paraphrased as follows [12]:

> In 2014, Kaiser and two people of the contemporary group, Jason Gallicchio and Andrew Friedman, proposed a test to deliver trapped photons on Earth — a strategy that is entirely elegant in research of quantum mechanics. They wanted to shoot each individual from the ensnared pair in opposite ways, towards gentle indicators that would furthermore make an estimation of each photon the utilization of a polarizer. Analysts would quantify the polarization, or direction, of each approaching photon's electric fueled field, with the guide of putting the polarizer at a lot points and watching whether the photons outperformed through—a result for every photon that specialists should contrast with choose whether the particles confirmed the trademark relationships expected by utilizing quantum mechanics. The group conveyed a unique advance to the proposed test, which used to be to utilize gentle from old, far away galactic sources, for example, stars and quasars, to choose the disposition at which to set each individual polarizer.
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> As each entrapped photon was once in flight, heading towards its identifier at the speed of light, analysts would utilize a telescope put at each locator site to quantify the frequency of a quasar's approaching light. In the event that that light used to be redder than some reference frequency, the polarizer would tilt at a specific point of view to make a specific size of the approaching snared photon — a size want that was once dictated by methods for the quasar. In the event that the quasar's mellow was once bluer than the reference frequency, the polarizer would tilt at an extraordinary point, playing out an exceptional estimation of the trapped photon. In their former analysis, the group utilized little open air telescopes to gauge the light from stars as shut as 600 light years away. In their new investigation, the analysts utilized significantly bigger, more noteworthy effective telescopes to hold onto the approaching mellow from considerably more prominent old, far away astrophysical sources: quasars whose light has been going towards the Earth for at any rate 7.8 billion years — objects that are moderately far away but are glowing to such an extent that their gentle can be situated from Earth.
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> On Jan. 11, 2018, "the clock had recently ticked past evening time neighborhood time," as Kaiser reviews, when around twelve people of the group accumulated on a peak in the Canary Islands and began gathering data from two huge, 4-meter-wide telescopes: the William Herschel Telescope and the Telescopio Nazionale Galileo, both situated on

> the equivalent mountain and isolated by means of about a kilometer. One telescope concentrated on a specific quasar, while the different telescope showed up at each other quasar in a specific fix of the evening time sky. Then, scientists at a station situated between the two telescopes made sets of ensnared photons and shot particles from each pair in opposite ways toward each telescope. In the part of a second prior to each snared photon arrived at its locator, the instrumentation decided if a solitary photon showing up from the quasar used to be additional pink or blue, a measurement that at that point precisely balanced the edge of a polarizer that finally got and distinguished the approaching entrapped photon.

Therefore such a discovery has opened up a new way to look at the Universe: an *entangled Cosmos* [13-14].

Is Cosmological Entanglement a Verifiable Concept?

a. Wave mechanics

The wave mechanics models of the Universe were known even since 70s, with various names such as Wheeler-De Witt equation, Hawking-Vilenkin equation, and also Gell-Mann-Hartle equation. Unfortunately, none of the above terms corresponds in a good agreement with astronomical observation [1]. This makes sense to the point that seemingly no serious cosmologist will argue in favor to wave model of the Universe.

That is until a paper by Peter Coles on how such a wave mechanical treatment of large scale objects actually corresponds to fluid dynamics representation. His abstract goes as follows [2]:

> I review the basic "gravitational instability" model for the growth of structure in the expanding Universe. This model requires the existence of small initial irregularities in the density of a largely uniform universe. These grow through linear and non-linear stages to form a complex network of clusters, filaments and voids. The dynamical equations describing the evolution of a self-gravitating fluid can be rewritten in the form of a Schrodinger equation coupled to a Poisson equation determining the gravitational potential. …I argue that this approach has the potential to yield useful analytic insights into the dynamical growth of large-scale structure. As a particular example, I show that this approach yields an elegant reformulation of an idea due to Jones (1999) concerning the origin of lognormal intermittency in the galaxy distribution.

See also Johnston's article for a newer presentation [3].

b. Low temperature phenomena

We are used to thinking of the universe as a hot place, full of bright stars, quasars, gamma ray bursts and so on, emanating from a giant explosion - the big bang. However, the universe can

also be a surprisingly cool place. It is permeated by a background radiation with a temperature close to that of liquid helium [5]. See also [4].

c. Newtonian action at a distance and Smarandache's hypothesis

Smarandache's Hypothesis states that there is no speed limit of anything, including light and particles [9]. Eric Weisstein also wrote implications of Smarandache's Hypothesis [9a], which can be paraphrased as follows:

> ...the velocity of light c is no longer a maximum at which statistics can be transmitted and that arbitrary speeds of data or mass switch can occur. These assertions fly in the face of each idea and experiment, as they violate both Einstein's exceptional principle of relativity and causality and lack any experimental support. It is authentic that modern-day experiments have confirmed the existence of positive sorts of measurable superluminal phenomena. However, none of these experiments are in conflict with causality or distinct relativity, because no statistics or bodily object absolutely travels at speeds v large than c to produce the located phenomena (see [9a]).

While the idea is quite simple and based on known hypothesis of quantum mechanics, called Einstein-Podolski-Rosen paradox, in reality such a *superluminal physics* seems still hard to accept by majority of physicists. Since 2011, there was an apparent surprising result as announced by OPERA team. Nonetheless, few months later it was renounced, on the ground of errors in handling the measurement. The story was retold by Lukasz Glinka [11], which can be paraphrased as follows:

> Already in June 2012, the CERN Research Director Sergio Bertolucci, at the twenty fifth International Conference on Neutrino Physics and Astrophysics held in Kyoto, established the fallacious size due to the OPERA Collaboration.
>
> Moreover, it is worth stressing that the superluminal kingdom of affairs is regular in current astronomy when you consider that the early 1980s, when the faster-than-light movement had been advised in order to contradict the quasars having the cosmological distances. In the present-day situation, the experimental information exhibit that the superluminal travels are the phenomena which are very regularly met in radio galaxies, quasars and microquasars.

Allow us to make few comments on such an apparent failure to detect faster than light speed as follows: Despite those debates over OPERA results, we thought that a more convincing experiment has been done by Alain Aspect etc., who were able to show that quantum non-locality interaction is real. In 1980 Alain Aspect performed the first EPR experiment (Einstein-Podolski-Rosen) which proved the existence of space nonlocality (Aspect 1982). Alain Aspect and his team at Orsay, Paris, conducted three Bell tests using calcium cascade sources. The first

and last used the CH74 inequality. The second was the first application of the CHSH inequality [15].

The third (and most famous) was arranged such that the choice between the two settings on each side was made during the flight of the photons (as originally suggested by John Bell). Some experimenters have repeated this experiment and prove similar result until distance of more than 90km.

Therefore, the notion of "*spooky action at a distance*" is a real physical phenomenon. Moreover, action at a distance was already mentioned in Newton's *Principia Mathematica*. Despite apparently Einstein was trying to make all of Newton's expressions into nothing, our result suggests that the Maxwell equations in classical electrodynamics have "spooky action at a distance" type of interactions (as it has also been proven for Coulomb potential), which may be observed both at small scale experiments as well as in cosmological scale, as recent evidences show (see also [18]).

Conclusion

For theologians who try to understand or get a grasp on the various progress in science, he/she has to start with one of the following assumptions: (a) there is *conflict* between science and theology (biblical teaching), (b) there is mutual separation between science and theology, or (c) there is *dialogue* between science and theology; in other words there could be a hope for reconciliation.

In this regards, Nesteruk seems to take a somewhat similar approach with A. McGrath. We wish to put his arguments even further. To arrive at more coherent view with Nesteruk (see also Nesteruk's article in [17a]), we suggest a similar approach to cosmology, *i.e.*, the Universe is already a communion shared between God and His creations, including us –human being in this Earth. We also shared the same communion with all living and non-living beings in this planet. But, some people may take a long breath at this point: *are there scientific arguments supporting such a proposition?*

In this article, we have pointed out that such arguments are indeed available, especially in a recent development called "*cosmological entanglement*" observation, which seems to bring us to far reaching implications, much more than Aspect's experiments.

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