

Ed-Op Article

Thinking Outside the Box II

The Origin, Implications and Applications of Gravity and Its Role in Consciousness

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Abstract

Although theories and speculations abound, there is no consensus on the origin or cause of gravity. Presumably, this status of affair is due to the lack of any experimental guidance. In this paper, we will discuss its ontological origin, implications and potential applications by thinking outside the mainstream notions of general relativity and quantum gravity. We argue that gravity originates from the primordial spin processes in non-spatial and non-temporal pre-spacetime, is the manifestation of quantum entanglement, and implies genuine instantaneous interconnectedness of all matters in the universe. That is, we advocate the principle of non-local action. To certain degree, our view is a reductionist expression of Newton's instantaneous universal gravity and Mach's Principle with important consequences. We also discuss the role of gravity in consciousness from this new perspective. Indeed, if spin is the primordial self-referential cause of everything, it should also be the cause of gravity.

Key Words: gravity, quantum entanglement, instantaneity, Interconnectedness, spin, consciousness

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We dedicate this article to the memories of Isaac Newton and Ernst Mach – Our humble attempt at truth is only possible by standing on the shoulders of these and other unnamed giants.

All things by immortal power,
Near and Far,
Hiddenly
To each other linked are,
That thou canst not stir a flower
Without troubling of a star

A Poem by Francis Thompson

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I. Introduction

This paper is an extension of our earlier papers advocating a holistic and unified theme of reality in which spin is the primordial self-referential process driving quantum mechanics, spacetime dynamics and consciousness (Hu & Wu, 2002, 2002a & b, 2006a, b & c). Briefly, we have proposed a spin-mediated consciousness theory in which spin is the mind-pixel (Hu & Wu, 2002, 2004a), outlined a unified theme of reality based on spin (Hu & Wu, 2004b), offered our views on the essence and implications of quantum entanglement (Hu & Wu, 2006a), and conducted experiments which indeed support our propositions (Hu & Wu, 2006b & c). In particular, our experiments show that (a) biologically/chemically meaningful information can be transmitted through quantum entanglement; (b) both classical and quantum information can be transmitted between locations of arbitrary distances through quantum entanglement; (c) instantaneous signaling is physically real; and (d) brain processes such as perception and other biological processes likely involve quantum information and nuclear and/or electronic spins are likely play important roles in these processes.

While our primary focus at the present is till experimental studies, we would like to offer our view on the origin, implications and potential applications of gravity. The connection between quantum entanglement and Newton's instantaneous universal gravity and Mach's Principle is natural. To certain degree, our view is a reductionist expression of this connection with important consequences. Readers are again advised that our propositions are outside mainstream physics and other authors may hold similar views on some of the points we shall make. Some readers are further advised to treat this paper as an Ed-Op piece so as to avoid being offended. However, we are

deadly serious about our propositions and put our money where our mouth is.

Microscopically gravity is assumed to be fable and negligible and macroscopically it is ubiquitous and pervasive. It seems to penetrate everything and cannot be shielded. However, there is no consensus as to its cause despite of the efforts of many people. Presumably, this status of affair is due to the lack of any experimental guidance. There are many general and technical papers written on the subject. So cutting to the chase, we shall immediately outline our propositions and then discuss each in some detail with reference to existing literatures whenever possible. Our propositions are as follows:

1. Gravity originates from the primordial spin processes in non-spatial and non-temporal pre-spacetime and is the macroscopic manifestation of quantum entanglement.

2. Thus, gravity is nonlocal and instantaneous, as Newton reluctantly assumed and Mach suggested. It implies that all matters in the universe are instantaneously interconnected and many anomalous effects in astronomy such as red shift, dark energy, dark mass and Pioneer effect may be resolved from this perspective.

3. Potentially, gravity can be harnessed, tamed and developed into revolutionary technologies to serve the mankind in many areas such as instantaneous communication, spacetime engineering and space travel

II. The Origin and Nature of Gravity

The idea of instantaneous gravity is nothing new. Newton's law of universal gravitation implies instantaneous "action at a distance" which he felt deeply uncomfortable with, but Newton was not able to find a cause of gravity (Newton, 1999 edition). Later Mach suggested that "[t]he investigator must feel the need of... knowledge of the immediate connections, say, of the masses of the universe...[t]here will

hover before him as an ideal insight into the principles of the whole matter, from which accelerated and inertial motions will result in the same way" (Mach, 1960 edition). Ontologically, Mach's above suggestion is a form of holism and implies that gravity is relational and instantaneous.

It was Einstein who fulfilled Mach's "relational" suggestion of gravity by inventing general relativity (Einstein, 1915). He also coined the phrase Mach's principle. However, such fulfillment is at the sacrifice of Mach's "immediate connections" by assuming that the speed of gravity is the speed of light. Einstein's general relativity is now the mainstream theory of gravity, but it is in conflict with quantum mechanics – the most successful theory of the 20th century which Einstein himself helped to build. Einstein called quantum entanglement "spooky action at a distance" in the famous EPR debate (Einstein, 1935). However, it seems that Einstein's camp is on the losing side of the debate today as many recent experiments have shown that quantum entanglement is physically real (e.g., Julsgaard, B. et al, 2001; Arnesen, M. C. et al., 2001). We suggest that a theory of gravity, which includes general relativity as an approximation, be built from the properties of quantum entanglement.

Ontologically, we have argued that quantum entanglement arises from the primordial self-referential spin processes which are envisioned by us as the driving force behind quantum mechanics, spacetime dynamics and consciousness (Hu & Wu, 2004b). Pictorially, two interacting quantum entities such as two electrons get entangled with each other through the said spin processes in pre-spacetime. Such ontological interpretation is supported by existing literature as discussed previously (*id.*). Here we focus our discussion on spin as the primordial process driving space-time dynamics including gravity.

First, spin is deeply connected to the microscopic structure of spacetime as reflected by the Dirac equation for Dirac spinor field representing the fermions (Dirac, 1928). Indeed, Penrose had considered early on that spin might be more fundamental than spacetime and invented spinor and twistor algebras for a combinatorial description of spacetime geometry (Penrose, 1960, 1967). Bohm and Hiley generalized the twistor idea to Clifford algebra as a possible basis for describing Bohm's "implicit order" (Bohm & Hiley, 1984). Recently various spin foams have been formulated as extensions to Penrose's spin networks for the purpose of constructing a consistent theory of quantum gravity (see, e.g., Smolin, 2002). Many others have also study the nature of spin from both classical and quantum-mechanical perspectives. For example, Newman showed that spin might have a classical geometric origin. By treating the real Maxwell Field and real linearized Einstein equations as being embedded in complex Minkowski space, he was able to interpret spin-angular momentum as arising from a charge and "mass monopole" source moving along a complex world line (Newman, 2002).

Second, Sidharth has discussed the nature of spin within the context of quantized fractal spacetime and showed that spin is symptomatic of the non-commutative geometry of space-time at the Compton scale of a fermion and the three dimensionality of the space result from the spinorial behavior of fermions (Sidharth, 2001a&b). He showed that mathematically an imaginary shift of the spacetime coordinate in the Compton scale of a fermion introduces spin $\frac{1}{2}$ into general relativity and curvature to the fermion theory (Sidharth, 2001a). The reason why an imaginary shift is associated with spin is to be found in the quantum mechanical zitterbewegung within the Compton scale and the consequent

quantized fractal space-time (*id.*). Further, according to Sidharth, a fermion is like a Kerr-Newman black hole within the Compton scale of which causality and locality fails (Sidharth, 2001a&b).

Third, Burinskii has recently shown that in spite of the weakness of the local gravitational field, the gravity for a spin $\frac{1}{2}$ fermion as derived using the classical Kerr-Newman Kerr solution (Kerr's Gravity) has very strong stringy, topological and non-local action on the Compton distances of the fermion, polarizing the space-time and electromagnetic field and controlling the basic quantum properties of the fermions (e.g., Burinskii, 2006). Thus, Kerr's Gravity may suggest possibly deep connections between the mass-energy relationship of matter and the quantum properties of particles (*id.*).

Fourth, Makhlin has recently shown that the axial field component in the spin connections of the Dirac spinor field provides an effective mechanism of auto-localization of the Dirac spinor field into compact objects, presumably representing the fermions, and condition that the compact objects are stable leads to the Einstein's field equations (Makhlin, 2004). He suggested that the physical origin of the macroscopic forces of gravity between any two bodies is a trend of the global Dirac spinor field to concentrate around the microscopic domains where this field happens to be extremely localized (*id.*). He further suggested that the long distance effect of the axial field is indistinguishable from the Newton's gravity which according to him reveals the microscopic nature of gravity and the origin of the gravitational mass (*id.*).

Further, Penrose-Hameroff's self-organized objective reduction model of spacetime geometry also implies that the spacetime dynamics is driving by certain self-referential process (Hameroff & Penrose, 1996). In addition, Cahill's work on a

self-referentially limited neural-network model of reality supports the view of a primordial self-referential network underlying reality (e.g., Cahill, 2002).

We emphasize that pre-spacetime in this article means a non-spatial and non-temporal domain but it is not associated with an extra-dimension in the usual sense since there is no distance or time in such domain (Hu & Wu, 2004b, 206a). So pre-spacetime is a holistic domain located outside spacetime but connected through quantum entanglement to everywhere in spacetime enabling Newton's instantaneous universal gravity and Mach's "immediate connections." It has similarity to Bohm's concept of implicate order and other non-local hidden variable theories (Bohm & Hiley, 1993; Adler, 2002; Smolin, 2006). The said pre-spacetime is a "world" beyond Einstein's relativistic world through which quantum entanglement can be used to produce instantaneous signaling as we have demonstrated experimentally (Hu & Wu, 2004b, 206a).

In short, existing literatures cited above support the proposition that spin is the primordial process driving space-time dynamics. Since we have argued previously that quantum entanglement also originates from the primordial spin process, it is natural to link gravity to the property of quantum entanglement. Indeed, doing so will not only provide a cause to Newton's instantaneous universal gravity but also realize Mach's "immediate connections" discussed above. Therefore, we propose that gravity originates from the primordial spin processes in non-spatial and non-temporal pre-spacetime and is the macroscopic manifestation of quantum entanglement.

III. Implications of Gravity from This New Perspective

At the present we are contemplating a mathematical framework from which the primordial self-referential spin process produces everything including gravity. There are several exiting approaches which provide some hints as to the said mathematical forms. These approaches are all based non-local hidden variables, that is, the principle of non-local action. They include Bohmian mechanics (Bohm & Hiley, 1984, 1993), Adler's trace dynamics (Adler, 2002), Smolin's stochastic approach (Smolin, 2006) and Cahill's process physics (Cahill, 2002).

In additions, other existing alternative approaches on gravity may also provide some hints. For sample, Sakharov's induced gravity is a well known alternative theory of quantum gravity in which gravity emerges as a property of matter fields (Sakharov, 1968). In comparison, we advocate herein that gravity is a property of quantum entanglement.

The implication of this new perspective on gravity is far-reaching. It implies that gravity is non-local and instantaneous, as Newton reluctantly assumed and Mach suggested, all matters in the universe are instantaneously interconnected and, therefore, many anomalous effects in astronomy such as dark energy, dark mass and Pioneer effects may be resolved from this perspective and within a framework of non-local cosmology.

IV. Potential Applications of Gravity from This New Perspective

We are convinced that gravity, as the macroscopic manifestation of quantum entanglement, can be harnessed, tamed and developed into revolutionary technologies to serve the mankind in many areas.

For example, once harnessed, non-local gravity may be used to communicate between locations of arbitrary distances

instantaneously. Such technology would dramatically decrease the communication delay to spacecraft in outer space. For a second example, once tamed, powerful non-local gravity may be used to engineer the structures of spacetime and propel a new kind of spacecraft for advanced space travel.

Is this for real? You bet. We put our money where our mouth is and predict that the wonders of non-local gravity technologies will soon be widely utilize to serve the mankind and a new paradigm of science will be born in the near future.

V. The Role of Gravity in Consciousness

As manefestation of quantum entanglement, the role of gravity in consciousness is to achieve binding. In our spin-mediated consciousness theory, such role played by gravity is not hard to see, since spin is the seat of consciousness and the linchpin between mind and the brain, that is, spin is the mind-pixel (Hu & Wu, 2002, 2004a). According to our theory, the nuclear spins and possibly electron spins inside neural membranes and proteins form various entangled quantum states through action potential modulated nuclear spin interactions and paramagnetic O₂/NO driven activations and, in turn, the collective dynamics of the said entangled quantum states produces consciousness and influences the classical neural activities through spin chemistry (*id.*).

As with other quantum mind theories, decoherence is a major concern as pointed out by Tegmark (2000) but may not be insurmountable (Hagan *et al*, 2002). We are convinced that the solution lies with quantum entanglement. Indeed, our dualistic approach adopted earlier allows mind to utilize quantum entanglement to achieve the unity of mind in pre-spacetime (Hu & Wu, 2002, 2004a). The essential question is then how does mind process and harness the information from the

mind-pixels which form various entangled states so that it can have conscious experience. We have argued that contextual, irreversible and non-computable means within pre-spacetime are utilized by mind to do this (*id.*).

VI. Conclusion

In this paper we have discussed the ontological origin, implications and potential applications of gravity by thinking outside mainstream notions of general relativity and quantum gravity. We have proposed that gravity originates from the primordial self-referential spin processes in non-spatial and non-temporal pre-spacetime, is the macroscopic manifestation of quantum entanglement, implies instantaneous interconnectedness of all matters in the universe and, once better understood and harnessed, has far-reaching consequences and applications in many areas

such as instantaneous communication, spacetime engineering and space travel. We have also discussed the role of gravity in our spin-mediated consciousness theory from this new perspective. Finally, the principle of science dictates that a hypothesis/proposition should only achieve scientific legitimacy if it is experimentally verified. Thus, we have designed and carried out experiments to verify our propositions and the results will be reported separately.

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