CONCEPTS OF REALITY IN HINDUISM AND BUDDHISM FROM THE PERSPECTIVE OF A PHYSICIST

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Abstract: *Concepts of ultimate reality in Hinduism namely Brahman and in Buddhism namely Shunyata are discussed from the perspective of Modern Physics. We find that there is an astonishingly close parallelism between the two completely diverse fields. Some speculations are presented suggesting how this could happen. We also discuss universal consciousness as suggested by the two religions.* [1]

Introduction

Deep philosophical concepts of ultimate reality called Brahman, Shunya or Shunyata are integral parts of many Hindu and Buddhist scriptures. Brahman is the name given to the formless, shapeless, abstract, omnipresent, invisible, eternal, transcendental and immanent form of ultimate reality or God in Hinduism. The literal meanings of Shunya and Shunyata are zero and emptiness respectively. Buddhism, which arose in India, agrees to a large extent in essential details with the original Hindu religion of Vedas and Upanishads. [2] Mathematically, the Buddhist concept of Shunyata and Vedic concept of Brahman would correspond to zero and infinity respectively. But as we will see the two concepts have lot in common. In fact both Buddhist monks and Hindu Yogis try to realize Shunyata and Brahman respectively by emptying the mind during meditations. Amazingly, these concepts find strong parallels in areas of modern physics such as quantum physics and cosmology. [3] Founding fathers of quantum physics such as Bohr, Schrodinger and Heisenberg were deeply impressed with eastern religious philosophy. [4]

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[1] This article was presented (as an invited talk) at a conference in New Delhi, India (Dec. 9-10, 2016) on "Quantum Reality and Theory of Shunya". This conference is referred to as the New Delhi Conf. in the references.

[2] Hindu religion, in the form prescribed in the original scriptures ("Vedas and Upanishads") should be preferably called "Sanatana Dharma" meaning universal and eternal way of life or a set of responsibilities and obligations for the followers. The name Hindu came up as a distortion of the word "Sindhu" which is the name of a river (Indus) in North West Indian subcontinent. Persians called the people who lived on the banks of the river "Sindhu" as "Hindus"! Since the word Hindu has been universally adopted, unfortunately we have no choice but to continue using it!

[3] We will describe physics related ideas in a non-technical way as far as possible. More technical details can be found in my guest blog: http://motls.blogspot.com/2014/04/hinduism-for-physicists.html.

[4] Quotes about Vedanta and Buddhist Philosophy from three pioneer physicists: Niels Bohr: "I go to the Upanishad to ask questions"; "For a parallel to the lesson of atomic theory...[we must turn] to those kinds of epistemological problems with which already thinkers like the Buddha and Lao Tzu have been confronted, when trying to harmonize our position as spectators and actors in the great drama of existence." Erwin Schrodinger: "The unity and continuity of Vedanta are reflected in the unity and continuity of wave mechanics. This is entirely consistent with the Vedanta concept of All in One."; "The plurality that we perceive is

Pre-20th century physics is called classical physics. Its basis is the material world we experience with the help of eyes and other sense organs. Then, at the beginning of 20th century, physicists found several phenomena, especially in the study of atoms, which forced them to change their concepts of the structure and reality underlying the universe. This resulted in what is known as quantum physics. It took years and years of painstaking experimental, theoretical, and mathematical work to understand the new phenomena. When compared with experiments, quantum physics works to an astonishing accuracy of about one part per billion or better! But the meaning of the equations cannot be understood in terms of our everyday life experiences which are classical! Anyway, this resulted in complete change of physicists' world view of underlying reality.

The debate as to the real meaning of all these equations has been going on for more than 90 years without any consensus. But some ideas are becoming clear beyond any reasonable doubt. The difficulty physicists encounter in describing quantum physics in everyday language is very similar to the difficulty of expressing various ideas about Brahman or Shunyata from the eastern religious scriptures in everyday language. Hindu sages (called Rishis) say that the only way of understanding Brahman is by going the route of "Neti, Neti (not this, not this)".This says that when you discard everything in the world that you see, the remaining concept is Brahman! Buddhist concept of Shunyata is similar. In the following we will discuss the ideas of quantum physics and compare with the philosophical ideas of ancient Hindu and Buddhist scriptures. In this article, when 'quantum physics' is mentioned, we will include both the non-relativistic quantum mechanics as proposed by the pioneers mentioned above and the relativistic quantum field theory which developed later.

I. Cosmology, Quantum Physics, Shunya, Shunyata and Brahman

It is well known that the idea of Shunya as zero in the number system originated in India. This development of the decimal place system containing zero was of fundamental importance in the advancement of science in the western world. These ideas had obviously some connotation with the philosophical ideas of Shunya and Shunyata.

Next, we discuss the concept of Shunya and Shunyata in detail. Initially we will take the literal meaning as zero, emptiness, void, or vacuum, although philosophers have attached deeper meanings to these such as the totality of reality. The Buddhist philosopher Nagarjuna [5] had deeply contemplated on the meaning of Shunyata or emptiness. In his opinion everything in the universe is empty in the ultimate analysis. To Nagarjuna the entire universe came up from Shunyata!

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only an appearance; it is not real. Vedantic Philosophy ... has sought to clarify it by a number of analogies, one of the most attractive being the many-faceted crystal which, while showing hundreds of little pictures of what is in reality a single existent object, does not really multiply that object..."; "The multiplicity is only apparent. This is the doctrine of the Upanishads. The mystical experience of the union with God regularly leads to this view, unless strong prejudices stand in the West."

[5] For a comprehensive article describing Nagarjuna's philosophy and references to his works, see for example, http://www.iep.utm.edu/nagarjun/.

We will see that this meaning finds parallels in modern physics. Modern cosmologists believe that our known universe started as an extremely small patch of vacuum some 13.8 Billion years back. It did not have any material particles in it. We can call it Shunyata. But it is not right to say that it means that something came up from nothing! The quantum vacuum is not a true emptiness or nothingness or absence of everything! It has a very complex structure involving fluctuating quantum fields in it. The present material world had origin in quantum fluctuations of this vacuum. There were no particles initially and because of absence of light it must have been dark.

Now let us compare this modern cosmology picture with the astonishing description of origin of universe from Vayupuran [6], a Hindu scripture:

> In the beginning, there was nothing in the universe. The Brahman (the divine essence) alone was everywhere. The Brahman had neither color nor scent; it could not be felt or touched. It had no origin, no beginning or no end. The Brahman was constant and it was the origin of everything that was destined to be in the universe and the universe was shrouded in darkness.

This is very impressive! They realized that it must have been dark because visible light was not created yet! Nasadiya Sukta [7], another Hindu cosmological verse also says that it was dark before the universe was created! An excerpt from Rig-Veda [8], one of the four original Hindu scriptures, called Vedas, says:

> The universe is brought about by the collapse of fullness in the transcendental field in which reside all the laws of nature responsible for the creation of the entire manifest universe. How is the transcendental level functioning? It is functioning from its unbounded nature to point to itself. He who does not know that initial pure consciousness state, ultimate reality, what can the laws of nature accomplish for him? He who knows it, remains established in evenness, unity, wholeness of life.

Since Brahman was by itself, it is clear that it interacted with itself i.e. self-referral and eventually manifested in every particle of the universe. In an interesting parallel, according to modern cosmology, a particle or quantum field called *inflaton* may be the origin of everything in the universe. Strictly speaking the word "manifestation" rather than "creation" is used in Vedic cosmology with a subtle meaning. They allude that Brahman did not create the world but it manifested itself in a world that was somehow implied *in* Brahman. It should be emphasized that physicists built up the model for universe arising from quantum vacuum after centuries of wrong concepts and models. It is an astonishing testimony to the ancient Rishis that the scriptures had this idea without having recourse to the experimental or mathematical methods used in modern times!

It is now clear that the material world we see around is not really made out of rigid, solid brick like substance if you go to the sub microscopic scale. Physicists found that as you go deeper and deeper, there is vacuum and vacuum all the way

[6] See Hinduonline.co/Scriptures/Puranas/VayuPurana.html.
[7] See https://en.wikipedia.org/wiki/Nasadiya Sukta, Rigveda (10:129).
[8] See The Rig-Veda: [Rig-Veda I.164.39]. Several articles from Maharishi University of Management, Fairfield, Iowa, give similar translation of these Vedic verses.

down. Materials are made out of atoms which are in turn made out of nuclei and electrons with lot of empty space in between. As an analogy, if atom is of the size of a football stadium, the nucleus would be a football at the center, and most of the electrons will be spectators in the stadium with empty space in between. This emptiness continues as we go deeper and deeper until we get to the fundamental particles with whimsical names like quarks and gluons etc. According to quantum physics none of these has rigid, solid structure.

II. Quantum Reality, Absence of Objective Reality

From the beginning physicists found that the so called "particles" have a dual nature viz. waves and particles. Whether you see experimentally a wave or a particle depends on your method of observing. So the question: 'Does matter consist of waves or particles?' cannot be answered without context of the experiments and the mathematical machinery of quantum mechanics. The particles are in some sense both here and there at the same time and are described by a wave function, a superposition of mathematical functions with seemingly contradictory properties. Absolute Square of this function gives probability (not certainty) of observing various properties of the "particles". For example, one cannot say certainly that the particle is at a particular place. It's location at any place is given only in a probabilistic way. Such a description is very similar to the description of Brahman e.g. in the scripture Ishopanishad: "It moves and it moves not; it is far and it is near; it is within all this and it is also outside all this." [9]

Nasadiya Sukta [10] talks about neither existence nor non-existence at the beginning of universe which would be a superposition of contradictory concepts! Nagarjuna [11] also talks about simultaneously existence or non-existence, both or none!

Schrodinger, one of the founding fathers of quantum physics, had already noticed a peculiarity of combined wave function of two or more particles in certain situations. He realized that it cannot be factorized as a product of wave functions of each of the particles. He called this occurrence "entanglement". One consequence is that, for the entangled particles, measurement of an entangled property of one particle is enough to predict the properties of the other particles without actually measuring their properties. Einstein, Podolsky and Rosen [12] then argued that measurement of positions or momenta for the entangled particles would lead to contradictions with quantum theory if one insists on the particles having actual real properties before measurement, the reason being that these variables cannot be simultaneously determined because of uncertainty principle. To them this meant that quantum theory was incomplete since they believed that particles had real properties before measurement. This is known as EPR paradox [13]. Then, in a very interesting development, John Bell [14] analyzed cases in which particles would be produced in

[9] Ishopanishad: sanskrit.org/WordPress/wp-content/uploads/2015/10/IshaEnglish, text 5.
[10] See https://en.wikipedia.org/wiki/Nasadiya Sukta, Rigveda (10:129).
[11] For a comprehensive article describing Nagarjuna's philosophy and references to his works, see for example, http://www.iep.utm.edu/nagarjun/.
[12] See https://en.wikipedia.org/wiki/EPR_paradox.
[13] See https://en.wikipedia.org/wiki/EPR_paradox.
[14] See https://en.wikipedia.org/wiki/Bell's_theorem.

quantum entangled spin states (spins are correlated) and sent in different directions, including consideration of hidden variables which are unknown. Subsequently their spins in different (random) directions would be measured by two different observers. Based on classical logic, he derived a mathematical inequality.

A large amount of experimental data subsequently proved that Bell's inequality is very badly violated, and the results agree completely with quantum physics predictions. Moreover local hidden variables were also ruled out. Over the years the experiment has been repeated many times with similar results. Experiments have been also done with particles which were never in actual contact but have been in contact with other particles which were in contact (called entanglement swapping). These results prove that a particle does not have any definite real value of spin in a particular direction (or position or momentum) before it is measured! Once it is measured, it is found to be definitely correlated with the spins, positions and momenta of the other entangled particles!

The particles have some kind of suspended, unreal existence before measurement! This conclusion resolves the EPR paradox also. The fact of lack of real properties before measurement, matches very well with the Buddhist concept of Shunyata as absence of "Svabhava" (inherent or intrinsic nature). There is also a current theory that possibly the whole universe may be a web of entanglement, probably due to Schrodinger [15] . It would make our universe a holistic rather than a collection of totally independent entities. This would be consistent with the central message of Vedas and Upanishads also. It should be noted that realistic interpretation (with non-local hidden variables) of Bell's results such as Bohm's interpretation has been essentially ruled out. Bohm's concept of non-locality contradicts the main axiom of Einstein's special theory of relativity that no signal can be propagated faster than the velocity of light. Thus local non-realistic interpretation is the only one which has majority consensus.

This is the stark world of quantum reality. It reminds one of the ideas of Maya (loosely translated as illusion or delusion) covering the whole universe, as Adi Shankaracharya said "Brahma Satyam, Jagat Mithya": Brahman is the only truth; the world is a false illusion [16] . Maya, jagat, is the mistaken impression that appearances are real, like mistaking a rope in the dark for a snake. Quantum physics teaches us that it is a mistake to accept the world as we perceive it to be real. Instead, the appearances arise from something that is beyond our ability to intuit, much like the nature of Brahman. Now, just like us, Shankaracharya must have seen solid bodies, rigid walls, and trees etc. I believe he realized that all of this disintegrates and goes away. Then it cannot be fundamental reality. Thus, because of the covering of Maya, one does not see the underlying reality of Brahman. It would be similar to the fact that we do not see wave particle duality with our sense organs. Just as modern physics says that everything, living and non-living is made out of the same elementary particles, Hindu scriptures say that Brahman is present in everything. We can conclude that the ancient Indian culture came to this fundamental insight by its means just as we have arrived at the same insights in modern times by our means.

An important conclusion of quantum physics is that there is no observer-independent reality. Reality, whatever it is, is strictly subjective. In the West, this

[15] See S. Rammohan has pointed out that Yajurveda (one of the Vedas) (6.3.7), is in agreement with this theory. See New Delhi Conf. Proceedings.
[16] See https://en.wikipedia.org/wiki/Vivekachudamani.

position is called "idealism" and was long rejected by realists, but now, the evidence of quantum physics forces a type of idealism into science. As mentioned above, whether you see particle nature or wave nature depends on your subjective choice of experimental set up. The basic nature is modelled as probabilistic and each observer will get a different result. Only after a large number of observations, the results are found to be consistent in a statistical sense. Such a subjective implication is found in various Upanishads also. It is said that true Samadhi is achieved when the observer and the observed merge with each other. There is a theoretical concept in high energy physics that the usual four forces in nature, which look very different at low energy, would be unified at very high energy. The symmetry is broken at low energies and may be restored at very high energy. In this respect Samadhi may be like a mental particle accelerator and it goes up the energy scale and fuses the observer and the observed into a unified state. From this unified state, the reality of Brahman becomes accessible. Otherwise, the observer and the observed appear to be different to our minds. In a "meta-mind" the observer and the observed are unified.

In quantum physics there is a long standing unresolved debate whether ultimately, the observer has to be conscious or an inanimate machine can also be an observer! The main reason for this particular controversy is the Western (Abrahamic religious) concept that only humans have souls and consciousness. We will return to the discussion of consciousness later.

III. Everyday Logic, Modern Physics and Scriptures

Both the ideas of reality in quantum physics and Hindu and Buddhist scriptures defy not only our subjective intuitions of the world, but also the everyday logic with which we are familiar. As an example of violation of conventional logic, let me mention one situation. Consider a simple logical inference such as: if in a roomful of 200 people, 50 have brown eyes, then 150 do not have brown eyes. Bell's inequalities are based on such logical statements when applied to quantum objects. They are violated by experimental results on atomic systems. The conclusions from the quantum theory agree completely with the experiments. This means that the assumption in classical logic that the quantum objects have real permanent properties before measurement just like the eyes have permanent color before measurement is not valid!

Such a situation would correspond to Upanishads' idea that Brahman cannot be understood by logic. As mentioned previously, it can be identified only by the words "Neti, Neti (not this, not this)". There is a story about two yogis. One meditated all day. The other one read scriptures all day. At the end of every day the second one always said "I do not understand. I do not understand". Then one day, to the great surprise of the first one, the second one said loudly, "I understand. I understand". The first yogi asked him with astonishment as to what suddenly happened. "Now you understand everything suddenly!" The second yogi replied "I now understand that this cannot be understood!"

As a related idea, one can consider Gödel's incompleteness theorems [17] . They say that "no consistent system of axioms whose theorems can be listed by an effective procedure (i.e., an algorithm) is capable of proving all truths about the arithmetic of the natural numbers" and "the system cannot demonstrate its own consistency." One runs into similar problems in considerations of quantum theory and ideas of Brahman

[17] See https://en.wikipedia.org/wiki/Godel's incompleteness theorems.

and Shunyata in that it may be impossible to understand them by using our everyday logic.

To me, it does not appear surprising that when one tries to put the mathematical ideas of modern physics in human languages, they look similar to the philosophical ideas of ancient Rishis and Buddhist monks obtained after deep meditations. In fact it would be shocking if they did not agree. Physicists and the Rishis (or Buddhist monks) would not agree if the world was described by classical physics. I think the nature of reality is such that both parties were led inevitably to adopt these ideas because it reflects the deeper truth of the nature of reality. As for Rishis (or Buddhist monks), it is not clear when the analog of the classical to quantum transition took place or indeed if such a transition even took place. Some parts of Vedas are full of worship of natural elements like wind, water, fire etc. and also picture Gods that look like human beings in the form of avatars. In some parts of Vedas and many Upanishads, we see clearly concept of abstract, omnipresent, invisible, eternal, transcendent and immanent Brahman who has qualities unfamiliar in our everyday life. Just as many things in everyday world are described by classical physics, concept of deities in the scriptures would correspond to classical concepts. There is nothing wrong with that. The concept of Brahman would correspond to the non-intuitive abstractions of quantum concept. Nonetheless, unlike the case with physics, the deeper abstractions of the nature of reality seem to have been present since the earliest origins of Hindu and Buddhist thought.

Both modern physics theorists and Rishis (or Buddhist monks) who presented their ideas in Hindu (or Buddhist) scriptures were using their thought processes in brain. Obviously, the human brain evolved as the human body evolved in nature. So one possibility is that some cognitive information about nature may be stored in the brain. A question for physics is that why mathematics works so well when our intuition based on everyday life fails. After all, mathematics is also a creation of our human minds. In fact, as I mentioned before, Bell's inequalities bring out in a superb way that conventional logic fails in quantum theory. Thus somehow mathematics describes systems which are outside our everyday experience. Similarly, why Rishis and Buddhist monks realized something in their meditations which went beyond their everyday intuitions? They were living in the classical world like everybody else in cottages, carrying out the usual human activities. In both cases the analysis looks irrational from the conventional logical point of view. Perhaps deep within our brain, there is some component which goes farther than experiences in everyday world. It is somehow sensing the so called "ultimate reality" which physicists have arrived at by using sensory experiments and mathematics and Rishis and Buddhist monks arrived at by deep meditations induced by the methods of yoga and Samadhi. The means are different, but the results are so overwhelmingly similar that something very fundamental must be going on.

Sometimes one hears the argument that internal world is different from external world. I was never convinced by that argument and what is discussed above paints a different picture. World is world. How can internal laws be different from external laws? My internal world is actually somebody else's external world! If we assume that the internal world cannot be independent of the external world, we have to conclude that this similarity in philosophical statements of modern physics and ancient Indian mysticism is not a coincidence. It must be the "ultimate reality" of nature. Most of the western scientists and some Indian scientists believe this to be merely coincidence without any significance. In fact some western scientists have

ridiculed such similarities as accidental and misleading. I have been myself wavering for a number of years about whether this is accidental and forced association or genuine. Now I am convinced that it is a real association. I suspect there is an all pervading holistic non-local layer which we may call Brahman or Shunyata. Part of our consciousness may draw on this. Alternatively, some have argued that our very consciousness is Brahman, the living light that brings not illumination, but being. The connection between the infinite being of consciousness (Brahman) and our individual lives as seemingly autonomous beings may be what is called Atman. Non-local entanglements of atoms may be also related to this layer. Local interactions which one sees in physics and also in everyday life may be superimposed on this. These are much more prevalent at our large scale made of innumerable countless quantum events. The main point of this article is that, somehow, the sensory and non-sensory aspects of the universe are in fundamental agreement. A complete answer to these puzzles will come when we understand consciousness and its relation to the nature at large.

IV. Unsolved Problem of Consciousness

Physics (science in general) understands matter and energy very well. The great stumbling block is the understanding of consciousness. Despite years and years of efforts, science has not made much progress in understanding it. Here perhaps the ancient wisdom seems to be right. There is a saying in Vedas that consciousness is singular. Hindu scriptures suggest Brahman as a universal cosmic super consciousness- Pragnanam Brahman - Consciousness is Brahman [18] .The other well-known Vedic sayings express similar concept about individual and Brahman. *Ayam Atma Brahman* - This Self (Atman) is Brahman [19]. *Tat Tvam Asi* - That Thou art [20]. *Aham Brahmasmi-* I am Brahman [21]. Sarvam Khaluidam Brahman Tajjalān Iti Shānta Upāsita – "All this (collectively) is *Brahman*, indeed: what evolves from That, what dissolves in That, what breathes or functions in That, should be closely and calmly studied……." [22]. In a number of verses in the *Bhagavad-Gita*, it is mentioned that God (Brahman) is present in every animate and inanimate object [23]. So the source of consciousness appears to be external, yet is experienced as *the* internal reality. There is a universal cosmic consciousness and we are reflections of it as different faces of a single crystal would reflect multiple images of a single object. This may explain why consciousness per se is wholly uniform in its nature in spite of the fact that all of our bodies look different, and the contents (Vrittis) in consciousness vary from being to being. Our everyday sense of reality is drawn from our everyday experience which is undoubtedly approximated by classical physics. But fundamental reality has to be quantum.

[18] See Aitareya Upanishad 3.3 of the Rig Veda.
[19] See Mandukya Upanishad 1.2 of the Atharva Veda.
[20] See Chandogya Upanishad 6.8.7 of the Sama Veda.
[21] See rhadaranyaka Upanishad 1.4.10 of the Yajur Veda.
[22] See Chandogya Upanishad 3.14.1 of the Sama Veda.
[23] See Verse 10.39 and several other verses of the Bhagavad Gita.

There are some models [24] which consider processes in neurons in brain to be quantum mechanical. An interesting point mentioned by these authors (Ibid) is that consciousness may come in discrete number of flashes. According to them, the best known temporal correlate for consciousness is gamma synchrony EEG, 30 to 90 Hz (cycles/sec). They also mention that Buddhist monks in meditation know about such flashes coming as 40 to 80 times a second! In addition, there is some experimental support for resonant frequencies in neurons. More recently Matthew Fisher (unpublished) has proposed that the nuclear spins of phosphorus atoms could serve as rudimentary (entangled) "qubits" in the brain — which would essentially enable the brain to function like a quantum computer. A number of other authors have tried to get a quantum mechanical model of consciousness without looking at the parts of brain (e.g. Subhash Kak and collaborators [25] (who consider veiled reality and non-locality and Henry Stapp [26]). Hagelin [27] has introduced a concept of a unified field of consciousness. Such a field of consciousness is also discussed in the paper of Radhe Shyam Kaushal [28]. In addition, recently Tononi and colleagues [29] have developed an integrated information theory (IIT) which is a scientific theory of what consciousness is, how it can be measured, how it is correlated with brain states, and why it fades when we fall into dreamless sleep and returns when we dream. However, it is not clear if Tononi's theory is experimentally testable, or even calculable for real-life cases. Thus, almost 100 year of neuroscience research, while producing voluminous knowledge of brain structure and function, has taken us little beyond the correlations discovered between the brain and consciousness in the 1920s. The entire subject is full of controversies and it will be some time before various questions are resolved. It is likely that many questions pursued to link brain and consciousness will eventually resolve by being seen to be wrong questions as new knowledge accumulates giving us insights we cannot now imagine.

V. Summary and Speculations

In this article we have suggested that there is a strong parallelism between concepts of reality, Brahman and Shunyata in the eastern religious scriptures and modern physics. These scriptures describe Brahman as *the* universal cosmic consciousness. It is manifested in some form in every object of the universe. This concept is distinct from the concept of God in many other religions which assume that God is outside the universe and is creator of everything in the universe. Modern physics suggests that everything in the universe is composed of some fundamental particles and the

[24] See Hameroff, Stuart and Penrose, Roger. 2014. "Consciousness in the Universe: A Review of the 'Orch OR' Theory," *Phys Life Rev*, 2014; Mar 11(1): 39-78.
[25] See Kak, S. 2009. "The Universe, Quantum Physics, and Consciousness," *Journal of Cosmology*, vol. 3, pp. 500- 510, 2009; Kak, S. , Chopra, D. and Kafatos, M. 2014. Perceived Reality, Quantum Mechanics, and Consciousness, *Journal of Cosmology*, vol. 18, pp. 231-245, 2014.
[26] See https://en.wikipedia.org/wiki/Henry_Stapp.
[27] See Hagelin, J. 1987. "Is Consciousness the Unified Field? A Field Theorist's Perspective," *Modern Science and Vedic Science* 1, 1987, pp 29–87.
[28] See Radhe Shyam Kaushal, New Delhi Conf. Proceedings.
[29] See Tononi, G. 2012. *PHI: A Voyage from the Brain to the Soul*, Pantheon Books.

universe arose from some fundamental quantum field present at the beginning of the universe. It seems very likely that the two concepts are closely related.

If the concept of Brahman or Shunyata as universal cosmic consciousness present in everything in the universe is true, then an unavoidable consequence is that there is some degree of consciousness in every fundamental particle in the universe. This view is called "panpsychism" and goes back in the West as far as Leibniz' theory of monads circa 1700. From the point of view of physics, I would like to have a program to understand consciousness starting with atoms or fundamental particles i.e. a bottom up approach rather than a top down approach. Starting with fundamental particles, inanimate objects like rocks etc., then cells, plants, bacteria, animals and finally human beings would have progressively increasing consciousness. The ultimate Brahman would have infinite amount of consciousness. Consciousness in various forms of living and nonliving objects in the universe may arise in various amounts from this source. "Amount" may not be the right parameter, perhaps. It may be the complexity of the forms that consciousness can take. Nonetheless, the idea of a hierarchy of consciousness in all objects of the universe is gaining increasing scientific support, to the chagrin of realists and materialists. At our present level of understanding of consciousness from the Western scientific perspective, we are on somewhat speculative ground. But it is worth investigating. If the idea is fruitful, it will take science to an unbelievable level. It is tempting to draw a parallel from biology. Biologists know that genes can be turned on or off (gene expression). One can speculate that units of consciousness can be turned on or off in different systems. This could be a reason why we do not seem to see, or cannot appreciate the presence of consciousness in primitive living systems or nonliving entities.

We have previously discussed that Rishis and Buddhist monks found correct philosophical ideas about the universe by the yogic methods of meditation, i.e. non-sensory, purely mental means. On the other hand physicists came to these conclusions after performing experiments, making mathematical models and verifying by further experimentation i.e. basically by sensory means. So it seems that quantum physics may be a bridge between sensory and non-sensory parts of the universe. Future research will tell if these speculations are correct. In the mean time we can marvel at the astonishing similarities between the two completely diverse areas of human endeavor.

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[30] There are many non- technical popular books on Cosmology and Quantum Physics (Quantum Theory). The two with interesting historical accounts are: (I) Cosmos, Carl Sagan, Random House Inc. New York, 1980; (II) The Quantum Moment, Robert P. Crease and Alfred Scharff Goldhaber, W.W. Norton & Company New York, 2014.

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