Essay

Theory of Evolution of the Universe & Cosmic Consciousness: Scientific & Spiritual Viewpoints

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Abstract

Theories on the evolution of the universe have been well established. But the subject of cosmic consciousness along with it has not been discussed, because the latter is considered purely metaphysical or spiritual and not in the domain of physical sciences. But, it appears that there is a very close connection between these two. Metaphysics meets physics at some point. This would appear more relevant, if we understand that our universe is a quantum universe and our mind is a quantum mind, a manifestation of the same. Moreover, nature knows no imperfection, and there exists an absolute symmetry in it. Even physicists are trying to find out what the symmetries are. According to quantum science, even God plays dice. But what kind of dice is it? Has he used beautiful mathematics in creating this universe? This article discusses the theory of evolution of universe as understood by physicists and cosmologists. Theory of proton decay and its relationship with cosmos is discussed. Hawking's view of the universe is discussed next, and finally an attempt is made to understand the concept of the all-pervading Cosmic Consciousness in relation to known scientific ideas and the limitations thereof.

Keywords: Consciousness, cosmology, evolution, proton decay, Vedanta.

1. The Universe and Its Beginning

We initiate our discussion with the philosophic thoughts of Danish physicist Niels Bohr, who said '*it is wrong to think that the task of physics is to find out how nature is. Physics concerns with what we can say about nature'*[1]. The universe is mainly 'empty space', but not so empty as well. '*No point is more central than this, that empty space is not empty. It is the seat of the most violent physics'*, said John A. Wheeler. The old classical idea of vacuum, that it is empty space of 'nothingness', has gone through dramatic changes over a period of time, especially after the invention of 'relativistic quantum theory' during the late 1930's and 1940's. Our theoretical physicists have finally realized that empty space is rather a 'plenum'. It probably consists of particles and anti-particles that are being created and annihilated spontaneously. All the quanta that physicists have discovered or will ever discover are being created and destroyed in this so-called vacuum. And all this takes place in very short time periods and distances.

Once our minds are willing to accept the mutability of matter and the new concepts of empty space or nothingness, it may be worthwhile speculating on the origins of the largest things, which humanity knows as the universe. How did the universe begin? Maybe it sprang up into existence out of nothingness – an absolute gigantic vacuum fluctuation, popularly known as the

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'big bang' during these days. Physicists say that this possibility is allowed by modern physics. The Greek philosopher Aristotle had a view that the universe has existed for ever; probably meaning that it had no beginning and no end. But another thinker, Aquinas, did not agree with this view. Aquinas considered the universe to be a 'creatio ex nihilo' – a creation out of nothing. The entire universe probably could be a representation of nothingness.

Nineteenth century science was dominated by Ernst Mach's philosophy of physics. Mach said that physics is a science of measurable objects and events. He further reasserted that physicists should remove all theoretical concepts from their minds that do not correspond to observable entities. Einstein initially was a Machian, but later on disagreed strongly with the classical views of Mach. Once Einstein wrote to one of his philosopher friends, Solovine, while describing the thought process that went into the invention of general relativity, '*the mere collection of recorded phenomenon never suffices. There must always be added a free invention of human mind…'.* He totally rejected Mach's strict view of physical reality. Einstein went on to say, '*theoretical physicists must be prepared to make an intuitional leap from the experimental data and set up an absolute postulate which itself could not be directly tested but from which one could logically deduce testable consequences.' [5,6]* This was a beautiful philosophical concept of thought. Einstein also said, '*but the creative principle resides in mathematics. In a certain sense, therefore, I hold it true that the pure thought can grasp reality, as the ancients dreamed'.* Humanity now knows well how his concept of general relativity changed the whole world view of space-time and gravity. He had difficulty accepting the concept of quantum world – of uncertainty – but then that is a different matter altogether. He was, after all, the last 'classical physicist'.

It appears that Einstein had some knowledge of our ancient 'scriptures' and some of the concepts of reality described therein. If it is considered that the universe had a beginning – out of nothingness, then it has to have an end – to nothingness. The scriptures say, 'anything that begins has to end'. In addition, therefore, some intuitional thought process has to go in while investigating this phenomenon. Therefore, at first instance we could assume that this universe, as known to us today, may end one day, though it is presently expanding continuously at a phenomenal rate as confirmed by red shift theory. Russian physicist Alexander Friedman was the first to solve the equations of Einstein's theory of general relativity, landing at surprising results that the universe is changing, that it could not be static. Furthermore, he asserted that the universe is in a state of rapid expansion, which was first affirmed by Georges Lemaitre, a professor of relativity and the history of science at University of Lourain, France in 1933. It was also realized over a period of time that most of the universe is not bright; the bulk of the matter that it contains is dark, invisible and is of unknown composition.

Even, if we look at it mathematically, the probability wave function as per quantum theory,

$$U(X) = + U(-X) \qquad (1)$$

and also,

$$U(X) = - U(-X) \qquad (2)$$

and both of these choices will satisfy,

$$\left[U(X)^2\right] = U\left(\left[-X\right]^2\right) \qquad (3)$$

The above mathematical expressions indicate symmetry in nature. We may not like to enter into further mathematical treatment of the subject, but it may be worthwhile to quote C.N.Yang, who said in his Nobel Prize lecture [14],

"Nature seems to take advantage of the simple mathematical representations of the symmetry laws. When one pauses to consider the elegance and the beautiful perfection of the mathematical reasoning involved and contrast it with the complex and far reaching physical consequences, a deep sense of respect for the power of the symmetry laws never fails to develop.

Interestingly, Max Born once remarked, "If God has made the world a perfect mechanism, He has at least conceded so much to our imperfect intellect that in order to predict little parts of it, we need not solve innumerable differential equations, but can use dice with fair success".

So, we could probably conjecture that the universe may have to end exactly symmetrically in the same way that it evolved. Once we accept this postulate, further discussions may be more meaningful. Let us first look into the 'evolution of the universe' with the eye of a physicist.

2. The Physicist's View of the Evolution of the Universe

It is an accepted scientific view that the universe evolved as a 'big bang'. Physics cannot account for the conditions before 10^{-43} seconds (or 5.3912×10^{-44} seconds to be precise, which is Planck's time). At this time, the universe was 10^{-28} cm in diameter and inconceivably hot at 10^{32} k (it would be 1.417×10^{32} k precisely. This is Planck's temperature). But it was cooling as it expanded. Very interestingly, at this juncture, the expansion rate of the universe appears to be almost equal to the phenomenal velocity of square of velocity of light (c^2) in numerical value. It is a universe of perfect symmetry. This was all initiated 13.8 billion years ago. And it was initiated with the primordial sound 'Om' *(this c^2 may be the velocity at which cells in the human body interact through quantum fields of 'thought wave signals' [4]).* Another crucial feature of this initial condition was that 'gravity' had just broken free from the single 'unified force', which was presumed to exist at the 'big bang' ('gravity' is the weakest force, and hence it is getting difficult to evolve a 'unified field theory').

The next period is of utmost importance. It starts at 10^{-35} seconds, when the temperature has now come down to 10^{28} k. This has been called the beginning of the 'inflationary epoch'. The observable universe has now grown to 10^{-24} cm in diameter and is cooling further. At this period of beginning of the 'inflationary epoch', the velocity of expansion of universe is also phenomenal, almost at c.

The inflationary universe theory was propounded by Alan Guth of MIT, USA. Essentially all the matter and energy in our universe was created during those inflationary moments. This period, beginning at 10^{-35} seconds is of great significance because in this state, an interesting condition

of 'negative gravity' was created by a condition of 'negative pressure'. In fact, 'negative pressures' could be real. Such pressure may be created by 'quantum fields' under certain circumstances. Those pressures ought to be produced by the fields that exist in vacuum. This inflated the universe rather exponentially. Towards the end of this split-seconds epoch that is closer to 10^{-32} seconds, the universe was reheated as the 'strong' and 'electro weak' forces began to take on independent identities. 'Energy' now began to congeal into particles of matter such as quarks and electrons. Their mirror image 'anti-matter' was also formed during this period. Anti-matter is considered matter quite identical to matter but with opposite charge. The universe had now inflated to the size of softball. During this period, the universe increased in size by a factor of 10^{25} or even more, almost at a velocity of c^4. *(This is the highest velocity at which the universe expanded during the 'inflationary epoch'. This could also be the velocity of 'thought waves').*

The inflationary epoch ends at 10^{-32} seconds having a temperature on the order of 10^{27} k. The universe was now reasonably smooth and almost homogeneous. At this juncture, matter, antimatter and the radiation formed a bubbling opaque stew. The universe was finely tuned at the end of 10^{-32} seconds.

After this 'inflationary epoch', while the universe had expanded almost at velocity c^3 at around 10^{-6} seconds, it had grown to the size of our 'solar system' with a temperature of 10^{13} k. At this lower temperature, 'quarks' had bound themselves into 'protons' and 'neutrons'. Matter and antimatter had annihilated each other. Fortunately, some matter was left after this process of annihilation. And this excess matter is the matter that comprises of universe today.

[This expansion of the 'universe' in the beginning at such a phenomenal rate may appear to violate 'general relativity', which dictates that nothing can move faster than the 'velocity of light', but that speed limit does not apply to the 'expansion of space' itself [19] (this is affirmed by Stephen Hawking in his book 'The Grand Design'). Secondly, at the beginning of creation, the universe evolved with probably 11 dimensions (could be even more) as per 'string theory / m-theory. General relativity does not apply to more than four dimensions of space-time. The other seven dimensions were curled up quickly and are not visible. Thirdly, 'photons' were still not free, and it took long time before 'light' could travel through space and see 'the light of the day'. Hence, the concept of expansion of the 'universe' at a velocity, which could be compared with 'c', the velocity of light, is purely conceptual, just for understanding the magnitude of it.]

Until now, this model has been quite 'speculative'. However, at the instant of 10^{-2} seconds, astrophysicists and cosmologists have constructed a model that they think they understand better and can support with more certainty. At this time, the temperature was around 10^{11} k. The universe now consisted mainly of electrons, positrons, photons, neutrinos and anti-neutrinos. These particles were continually being created and destroyed as they interacted with each other. Then there was some small contamination of 'protons' and 'neutrons', about 10^{-9} times the number of photons. This small speck is finally what formed the 'galaxies', the stars and ultimately even our earth.

At around 10^{-1} seconds, the universe had cooled down to 10^{10} k, after fourteen seconds, it had cooled even further to close to 10^9 k. This was cool enough to take electrons and positrons out of equilibrium with photons and neutrinos. And now, if positrons got annihilated, they would not be

created and what would be left would be electrons, neutrons and photons. After 3 minutes of creation, while the temperature has come down below 10^9 k, 'protons' and 'neutrons' have fused into 'atomic nuclei'. 'Electrons', however, are still too energetic to be bound in atoms - they are still free. Hydrogen and helium nuclei have now appeared. The amount of helium made in the 'big bang' is about 27 percent of the matter in the universe.

After only 10^5 years, while the temperature of universe has come down to 3000 k, 'electrons' now join 'nuclei' to form 'atoms'. At this juncture, photons, the energetic particles of light and other forms of electromagnetic radiation were freed from the long bondage with matter. Great clouds of atomic matter begin to condense into galaxies and stars. Light could also now travel through space. After 1 billion years, when the universe had acquired a temperature of 15k, 'quasars' formed and the observable universe assumed its familiar appearance for the most part. There are now bright points of light in the sky.

Today, the universe is about 15 billion years old (sometimes it is said 13.8 billion years). Our own planet earth is only about 4 to 5 billion years old and the life on earth is merely two and a half billion years old. This is the history of the universe as accepted and agreed to by theoretical physicists and cosmologists, all the way back to a mere 10^{-43} seconds after the 'big bang'.

The question, 'what existed before 10^{-43} seconds?' has often been asked. Physicists think that at that moment, our universe was merely condensed into a region much smaller than an atom; it was pure, pent-up, extremely hot energy. It seems that the very fabric of 'space and time' was just being fashioned then. This was probably the state of 'quantum fluctuation' from which this universe propped into existence. It is also believed that if it did so, there is no reason why the same process could not have taken place many times. There may be countless iterations like that; the universe that we see or know about may probably not be 'everything that exists'. There could be 'multiverses'. But no one knows for sure.

It is also speculated that the universe at one time might have been in a state of contraction. It might have become more and more compressed until a point was reached, where further compression could not have continued any longer. If so, that could have bounced back into a state of expansion at the point of time of 10^{-43} seconds. This is the universe, what we see today. But, nobody knows for sure because science cannot describe these events back in time when all known theories of physics break down. One cannot even speculate anything before Planck's time. Space-time itself might break down before it since it was subject to quantum fluctuation. *After all, one cannot say that fluctuations of time take place in time. It is a meaningless statement.* That is the difficulty with physicists.

Nevertheless, if we consider that the theory of general relativity is correct and we make reasonable mathematical assumptions, then it may be possible to prove theorems mathematically indicating that all matter and energy in the universe might have originally compressed into a 'singularity' of zero volume where the density of matter and energy could have originally been infinite. But these theorems are based on general relativity, which itself breaks down at Planck's time. Therefore, it is definitely possible to go back at least this far and safely conclude that at 10^{-43} seconds after the beginning, the universe must have been in a highly compressed state. From that state, it has been expanding ever since. It is an open universe.

However, in our universe today, there are four known forces. Those are gravity, the electromagnetic force, the strong force and the weak interaction. The strong force glues together particles within the nucleus of an atom while weak force causes radioactive decay of atomic nuclei. At ultra-high energies, it has been possible to unify electromagnetism, the strong force and weak interaction into a single unified force. It is suspected that gravity also belonged to that single dominant force before 10^{-43} seconds, while extreme high temperatures were prevailing in our tiny universe. But it seems that gravity is not well understood enough to make this ultimate unification. It is indeed getting difficult to break that barrier of 10^{-43} seconds. It also appears that gravitational energy in the universe is negative, and there seems to be just enough of it to balance out the positive contribution of mass[13].

Energy plays a very strange role in the theory of general relativity. It may appear that in an expanding universe, energy is not conserved. Mathematicians find it very difficult if an attempt is made to define the energy content of the universe. The open universe, which is spatially infinite, would also have to have infinite total energy. But that is not true. In reality, the total energy of the universe as per cosmological calculations is almost zero, but not actually zero, and physicists have been looking for the 'hidden mass' so that they can define the total energy of the universe to be totally zero. There are many places where this missing mass is hiding such as large invisible black holes at the core of galaxies. It could also be small neutrino mass. The universe is likely filled up with massive neutrinos. Though it is hard to tell, it is clear that some large mass energy has been overlooked, which would bring total energy of the universe to be zero[13].

All profound human creations are beautiful and physical theories are no exception. There has to be an appeal to aesthetics in the construction of a physical theory.

3. Proton Decay and the Cosmos

It has been established by physicists that the original inhabitants of this universe are quarks and leptons with interaction among them being mediated by gluons, which are quanta associated with a field that could be derived from gauge symmetry. Theories have been found to describe interaction of quarks, leptons and gluons. Weinberg – Salam theory unifies electromagnetic and weak interactions and quantum chromo-dynamics (QCD), the theory of colored quarks and gluons based on the gauge symmetry principle. Recently, physicists have been trying to find a grand unified theory (GUT) incorporating the Weinberg-Salam theory and QCD, unifying electromagnetic, weak and strong interactions. One group did find one based on single gauge symmetry[13].

However, this process of unifying all three interactions under the aegis of a single, spontaneously broken symmetry leads to the consequence of the existence of twelve new super heavy gluons that may never be detected. That being so, these super heavy gluons have interactions that will destabilize the proton – supposedly the main building block of the nucleus. Proton stability was always considered to be a basic principle of theoretical physics and it was thought that it could not disintegrate into lighter particles because the proton is the lightest baryon made out of three quarks and had to be stable because there is nothing lighter. Quarks could decay into the proton,

which is considered to be the final remnant of other baryon decays. Neutrons also eventually decay into protons.

However, a super heavy gluon could make one of the quarks in the proton change to a lepton and hence the proton could decay. These super heavy gluons are so heavy that the probability of such decay is extremely small, but it is not zero. The life time of a proton is 1000 times of 10^{28} years. Now here lies the crux of the matter. If unified field theory ideas are correct, physicists may observe proton decay one day, which has profound implications for cosmologists. Proton decay proof will be indicative of the death of the universe. If protons decay, the very substance the universe is made of will be rolling away. It is estimated that even if it happens, it may take 10^{21} times the present age of the universe. But, the fact remains that the universe will collapse[13].

Therefore, if physicists consider that the proton is unstable, it may be possible to think of matter-antimatter symmetry at the origin of the universe. The Russian physicist Sakharov said that this restores our sense of symmetry; a thought expressed by him even before grand unified gauge theories existed that could explain proton instability. Therefore, it can be safely concluded that if the proton is unstable, the proton can decay and the reversal process of the 'contraction of the universe' is possible. A proton could be built up out of other quanta. If some special conditions are met, more protons may have been synthesized than antiprotons during the 'big bang', accounting for the fact that the universe is what we see today and is mainly made from protons. Protons and antiprotons are not in equal quantity[13].

The work of Weinberg-Salam and the discovery of unified gauge theories of electromagnetic, weak and strong interactions have contributed a great deal to cosmology by giving a better understanding the first three minutes of the universe[20]. At ultra-high energies, the primordial fireball was just a mixture of all the quarks, leptons and gluons. There was no distinction among these three forces as these were all unified and had the same strength with absolute symmetry of interactions. But as that fireball expanded, the exact symmetry of interactions was spontaneously broken. In this process, the various different interactions became clear and included distinguishing super heavy gluons from ordinary weak gluons, which were again distinguished from massless photons and colored gluons. Only photons are reminiscent of a world of perfect symmetry. Symmetry breaking is like freezing out of various interactions as this explosion cooled. The universe we see today is the frozen fossil of that great event of explosion.

As we discussed above, though it has been possible to unify the three interactions, we have mostly been referring to one fundamental interaction – gravity. Gravity is still a mystery. Though physicists talk of a graviton – the quantum of gravity and a consequence of gauge symmetry, it has not been possible to find a realistic unified field theory including gravity. Einstein tried it in the 1930's and onwards but did not succeed and the problem is still unsolved. New fundamental concepts possibly have to be evolved to bring about the unification of all four interactions.

As per Stephen Hawking's view, "it could be that the physicist's traditional expectation of a single theory of 'nature' is untenable, and there exists no single formulation…the original hope of physicists to produce a single theory explaining the apparent laws of our universe as the unique possible consequence of a few simple assumptions may have to be abandoned." [19]

Understanding the very origin of the universe has continued to be and is the greatest intellectual challenge to physicists. The quantum world of elementary particles is very well organized according to complex and beautiful symmetry principles. The physicist's mind seeks symmetry. Once he finds it, he looks for a flaw in perfect symmetry. Rarely in nature are symmetries perfect because they are really broken symmetries in a symmetrical way.

4. Stephen Hawking's Universe

Stephen Hawking and Roger Penrose have shown that Einstein's general theory of relativity implied that the universe must have a 'beginning' at the 'big bang singularity' and possibly, an 'end' at the 'big crunch singularity' (if the whole universe collapsed). Hawking has put forward his marvelous ideas in many books he has written. It is indeed worthwhile to take a serious look at his concepts[16,17,18,19].

Hawking says that though Friedman found one, three different models obey his fundamental assumptions. In the first model, the universe is expanding sufficiently slowly that the gravitational attraction between different galaxies causes the expansion to slow down and eventually to stop. The galaxies then start moving toward each other and finally the universe begins to contract. In the second model, the universe is expanding so rapidly that gravitational attraction can never stop it, though it does allow it to slow down a bit. Finally, there is third model in which the universe is expanding only just fast enough to avoid collapse. Here, the speed at which the galaxies are moving apart gets smaller and smaller, although it never quite reaches zero.

Hawking comments that the remarkable feature of the first model is that the universe is not infinite in space, but space neither has any boundary. Gravity is so strong that space is bent round onto itself. He says that if we combine 'general relativity' and 'quantum mechanics', it is possible for both space and time to be finite without any boundaries. In the second model where the universe expands forever, space is bent the other way, therefore, space is infinite. Finally, having just the critical rate of expansion in the third model, space is flat and therefore, infinite. He says that present evidence suggests that the universe will probably expand forever. But, we cannot exclude the possibility that there might be some other form of matter, distributed almost uniformly throughout the universe, that has not yet been detailed and that might still raise the average density of the universe to the critical value needed to halt the expansion[16].

According to Hawking, the solutions of Friedman have a feature that at some time in the past, which we call the 'big bang', the density of the universe and the curvature of space-time would have been infinite. Furthermore, the 'general theory of relativity' predicts that this is a point in the universe where the theory itself breaks down, a point called a 'singularity'. That means that any event prior to the 'big bang' could not be predicted because 'predictability' breaks down at the 'big bang', hence we do not know what really happened before the 'big bang'. Hence, we say that time had a beginning only at the 'big bang'. However, many people do not like this idea of the beginning of time.

Two Russian scientists, Lifshitz and Khalatinikov in 1963 suggested that it is not surprising that at some time in the past, all galaxies were at the same place. They were not only moving directly away from each other, but they also had sideway velocities. Thus, in reality they need never have been exactly in the same place, only very close together. Perhaps then the current expanding universe resulted not from a 'big bang singularity' but from our earlier 'contracting phase' as the universe had collapsed. The particles in it might not have all collided but had flown past and then away from each other, providing the present expansion of the universe. They withdrew their claim in 1970 however, though this work was quite valuable for further investigations. This work showed that the universe could have had a singularity, a big bang, if the general theory of relativity was correct. But the question of the beginning of 'time' remained[16].

However, in 1965 Roger Penrose showed that a star collapsing under its own gravity is trapped in a region whose surface (and volume) eventually shrinks to a zero size. Subsequently, all the matter in the star will be compressed into a region of zero volume. Therefore, the density of the matter and the curvature of space-time become infinite. This singularity contained within a region of space-time is known as a 'black hole'. This is known as the 'Penrose theorem', which states that "a body undergoing gravitational collapse must eventually form a singularity". Hawking showed that if time is reversed in the Penrose theorem, the collapse became an expansion and his theorem would still hold true. This time-reversed argument showed that the expanding universe must have begun with a 'singularity'. In 1970, Hawking and Penrose proved that there must have been a 'big bang singularity' provided only that 'general relativity' is correct and the universe contains as much matter as we observe. However, later on Hawking was trying to assert that there was in fact no singularity at the beginning of the universe – it can disappear once quantum effects are taken into account. *Hawking has shown that general relativity is indeed an incomplete theory as it cannot really tell how the universe started off. He showed that quantum theory has to be taken into account if we have to really describe how the universe began; we need to develop a theory, a single 'quantum theory of gravity.'* [16,18]

Hawking then proved that if a black hole has entropy, it ought to have a temperature and if so, it must emit radiation at a certain rate. Black holes therefore should emit radiation to prevent the violation of the second law of thermodynamics. It has now been confirmed by many scientists that a black hole ought to emit particles and radiation as if it were a hot body with a temperature that depends on the mass of the black hole where the higher the mass, the lower the temperature. This is actually in accordance with 'quantum theory' as well. The particles do not come from within the black hole, but from the 'empty space' just outside the black hole's event horizon. That is why it is said that 'empty space' is not really empty, the fields are not exactly zero; there is a quantum fluctuation in the value of the field. When quantum effects are taken into account, it seems that the mass or energy of matter would eventually be returned to the rest of the universe, and that the black hole, along with any singularity inside it, would evaporate away and finally disappear. At the very early or later stages of the universe, when gravitational fields are quite strong, quantum effects cannot be ignored. The quantum theory of gravity needs to be evolved to discuss the very early stages of the universe. We don't have yet a complete and consistent theory to combine quantum mechanics and gravity, but we do know that the origin of the universe was a quantum event[16].

The concept of radiation from black holes was an example of the prediction that depended essentially on great theories of the twentieth century, general relativity and quantum mechanics. The existence of radiation from black holes seems to imply that gravitational collapse is not as final and irreversible as was thought earlier. Later on, a more powerful approach to 'quantum gravity' was developed based on the ideas of Richard Feynman through the 'sum over histories' approach. In this approach, a particle does not only have a single history. Instead, it is supposed to follow every possible path in 'space-time' and with each of these histories, a couple of numbers are associated, one representing the size of the wave and another position in the cycle. If one was an imaginary number, rather than the real one, the distinction between space-time disappears completely. In the quantum theory of gravity, there are many different possible quantum states for the universe. In this theory, there would be no boundary to space-time and hence no need to specify the behavior of the boundary. There would be no singularities and no edge of space-time. *'The boundary condition of the universe is that it has no boundary.'* [16,17] The universe would be completely self-contained and not affected by anything else. It would neither be created nor destroyed. It would just be.

Hawking says, "this might suggest that so-called imaginary time is really real time, and what we call real time is just a figment of our imagination. In real time, the universe has a beginning and an end of singularities that form a boundary to space-time and at which the laws of science break down. But, in imaginary time, there are no singularities or boundaries. So it might be that what we call imaginary time is really more basic and what we call real time is just an idea we invent to help us describe what we think the universe is like." He further says, **'***a scientific theory is just a mathematical model we make to describe our observations.' It exists only in our minds.'* So it is meaningless to ask: which is 'real' or 'imaginary' time? It is simply a matter of which is the more useful description.

Regarding the concept of time, Hawking says, '*our objective sense of direction of time, the psychological arrow of time, is therefore, determined within our brain by the thermodynamic arrow of time.'* Just like a computer, we must remember things in the order in which entropy increases. This makes the second law of thermodynamics almost trivial. Disorder increases with time because we measure time in the direction in which disorder increases. You can't have a safer bet than that, and the direction of time in which disorder increases is the same as that in which the universe expands" [16].

Regarding the collapsing of the universe, Hawking comments, *"no boundary condition does not require the contracting phase necessarily to be the time reverse of expanding phase …. The no boundary condition implied that disorder in fact continues to increase during contraction. The thermodynamics and psychological arrows of time would not increase when the universe begins to recontract or inside black holes."*

If one believes that the universe will expand and then contract again as the no boundary proposal seems to imply, this becomes a question of why we should be in an expanding phase rather than in the contracting phase. This is answered on the basis of a weak anthropic principle.

Intelligent life could thus not exist in the contracting phase of the universe. This is the explanation of why we observe that the thermodynamic and cosmological arrows of time point in

the same direction. It is not that the expansion of the universe causes disorder to increase. Rather, it is that the no boundary condition causes disorder to increase and the conditions to be suitable for intelligent life only in the expanding phase." [16]

Regarding the unification of forces, Hawking's views are quite clear. He says, "general relativity is the partial theory of gravity, and the partial theories govern the weak, the strong and the electromagnetic forces. The last three may be combined in[to] so[-]called grand unified theories (gut), which are not very satisfactory because they do not include gravity…. The main difficulty in finding a theory that unifies gravity with the other forces is that the [sic] general relativity is a "classical" theory, that is, it does not incorporate the uncertainty principle of quantum mechanics. On the other hand, the other partial theories depend on quantum mechanics in an essential way. A necessary first step, therefore, is to combine general relativity with the uncertainty principle….

String theory has been suggested as a solution, that also leads to infinities but they will all cancel out.…they seem to be consistent only if space has either ten or twenty-six dimensions, instead of [the] usual four!

The other dimensions are curled up into a space of very small size….but on the bigger scales, you don't see the curvature of extra dimensions."

Hawking further comments, "it seems clear then that life, at least as we know it, can exist only in regions of space-time, with one time and three space dimensions that are not curled up. This would mean that one could appeal to the weak anthropic principle, provided one could show that string theory does at least allow there to be such regions of the universe – and it seems that indeed string theory does." Hawking in his book, 'The Grand Design", says, "*....there seems to be no single mathematical model or a theory that can describe every aspect of the universe….the universe does not have just a single existence or history, but rather every possible version of the universe exists simultaneously in what is called a quantum super position….and our observations of its current state affects its past and determine the different histories of the universe."* [19]

On the concept of the unification of all forces, Hawking is very explicit. He says that the "*....physicist's traditional expectation of a single theory of nature is untenable, and there exists no single formulation….the original hope of the physicists to produce a single theory explaining the apparent laws of the universe as the unique possible consequences of few simple assumptions may have to be abandoned."* [19]

On the matter of the 'inflationary epoch' during the initial time of the universe as predicted by Guth's theory, Hawking says, "we are now confident that inflation really did happen….that may seem to violate relativity, which dictates that nothing can move faster than light, but that speed limit does not apply to the expansion of space itself.…a period of very rapid expansion, much faster than light speed, remedies that because there would have been enough time for the equalization to happen in the extremely tiny pre-inflationary early universe."

We are the product of quantum fluctuations in the very early universe. God really does play dice. According to Hawking, "we have a candidate for the ultimate theory of everything, if indeed one exists, called m-theory which is the only model that has all the properties. We think….m-theory predicts that a great many universes were created out of nothing.…the laws of m-theory allow for different universes with different apparent laws, depending on how the internal space is curled, perhaps as many as 10^{500} different universes.….according to m-theory, space-time has ten space dimensions and one time dimension. The seven of space dimensions are curled up so small that we don't notice them, leaving with us with illusion that we only have four dimensions we are familiar with." [19]

This 'grand design' is the work of some 'grand designer'.

5. The All-Pervading 'Cosmic Consciousness'

Scientists normally do not wish to enter into the discussions of 'metaphysics' for reasons best known to them. They say that science and physical laws should be describable with 'reason' and should be expressible in mathematical terms. If it cannot be done, then discussion does not find any place in 'scientific thought'. Incidentally, science studies 'nature' and 'various laws governing nature'. Science also attempts to 'unfold' the glory of 'nature', and just concerns itself with 'what can be said about nature' rather than to find out 'how nature is' as Niels Bohr rightly said, and this governs the 'philosophy of science'.

However, according to Eastern scriptural and philosophic thoughts, 'nature' is considered a 'Divine creation', a creation out of 'Cosmic Consciousness', which is all-pervading in the universe. Therefore, let us indulge a bit 'subjectively' on the discussion, which is metaphysical in nature concerning this interesting creation of the 'Divine'. This has also been established beyond doubt by a variety of arguments that 'nature follows and loves symmetry', which can be proven mathematically as well. Whatever is observed in nature is not only symmetrical but is also repeated symmetrically. This line of thought can be sustained by various examples seen in the creation of nature such as birth and death, not only of humans, animals or plants but also of galaxies, stars and many other cosmic creations. Therefore, there is no reason to doubt that the way this universe has come into existence, had not come into existence many times earlier. It becomes apparent that if this universe has evolved, it will definitely go extinct one day. This process may have to be very systematically and symmetrically repeated. That is what nature follows.

Therefore, given that we know and understand reasonably well that this universe in which we live, it has been expanding ever since its evolution. It continues to expand at quite a phenomenal rate already established by 'red shift' theory. Nobody knows, for how long it will continue to expand. Physics neither knows nor can define it. But it probably does not matter for the time being to continue our argument further.

6. The Cosmic Dance of Destruction, the 'Rudra Tandava' of Lord Shiva

Therefore, following the laws of symmetry, this expansion of the universe must come to an end one day. Contraction may follow and it may follow quite symmetrically in the same way as it happened during expansion. The way the planets, galaxies and host of other things have been created in the universe will start moving to extinction mode in the same fashion. The cosmic dance of destruction of Lord Shiva, the 'Supreme Cosmic Consciousness' will have been initiated (the cosmic dance to sustain this cosmic creation has been going on for billions of years before the reversal process started). The dance will continue for quite long, possibly many billions of years - we cannot really be sure. We can only conjecture it to be so. Let us however, concentrate only on the last 3 minutes as we were keen to understand what happened in those interesting first three minutes of evolution.

During the contraction phase, if we look from the physicist's and cosmologist's point of view, the temperature of the universe will continue to increase. At about 3 minutes closer to complete extinction, while the temperature may be around 10^9 k or so, 'protons' and 'neutrons' will separate away from nuclei. 'Electrons' have been moving freely for quite some time. Hydrogen and helium nuclei have broken down. The cosmic dance of the dissolution of this physical universe is almost reaching its peak. At 10^{-6} seconds closer to extinction, while the universe is still as large as our solar system with the temperature of 10^{13} k or so, 'quarks' have become loosened from 'protons' and neutrons. 'Matter' and 'antimatter' has been separated, loosened free from the earlier annihilation process. The universe is highly dense.

Since we have accepted the 'inflationary epoch' of the universe during evolution process, let us think instead that it will be the 'deflationary epoch' of the universe. This initiates at 10^{-32} seconds near extinction where temperature is again about 10^{27} k. The cosmic dance of the 'Supreme Consciousness' is about to come to a halt after dissolving its own creation. The condition of 'positive pressure' or 'gravity' is created. The universe contracts at a phenomenal rate until 10^{-35} seconds. This is the state of '*absolute cosmic transcendental meditation'.* The 'Cosmic Consciousness', the Divine Lord Shiva (as viewed in our Eastern scriptural thoughts), after performing his 'Rudra Tandava' for billions of years (time felt on earth) is now entering into an '*absolute meditative state*' until 10^{-35} seconds and continues in this state (until the state of 'singularity' is reached). The universe has contracted by a factor of 10^{25} or more. During this short time, 'strong' and 'electro weak' forces have joined hands together. Particles of matter such as 'quarks' and 'electrons' are converting back to energy. Antimatter has dissolved. 'Matter' and 'energy' has completely fused into each other. There is only 'energy' now, no more 'matter'. Universe tuning as understood by physicists is completely disturbed. The temperature has gone up to 10^{28}k. The universe is now is as tiny as 10^{-24} cm in diameter. This deflation has occurred at phenomenally high velocity.

Now the universe is returning to 'Planck's era'. At about 10^{-43} seconds away from complete dissolution, the universe is once again as hot as 10^{32} k and only 10^{-28} cm in size. Gravity has also merged back with everything else. *At this juncture, the 'quantum consciousness' of the 'Supreme Divine' is moving towards the state of 'quantum fluctuation' in a highly compressed state. It is approaching 'singularity'. The 'Supreme Consciousness' has now dissolved itself into itself. The play of the 'Divine' has merged into 'singularity'. This 'singularity' is nothing but the embodiment of the 'Supreme Cosmic Consciousness' or infinite energy, which is all pervading.*

However, the 'Supreme Cosmic Consciousness' may not continue to be in this state at all. It will initiate its own emergence of creation once again. This phenomenon has happened during the period of 10^{-43} seconds in the direction of U(-x). Now at 10^{-43} seconds in the direction of U(+x), there is another 'big bang'. 'Creation' restarts once again with the primordial sound 'OM'. Since the 'Soul' or 'Consciousness' merges with the 'Supreme Cosmic Consciousness', it is this 'light' of 'infinite energy' that the 'Soul' experiences while merging itself into the 'Supreme Cosmic Consciousness'. The soul experiences moving in a sort of 'tunnel' towards an 'infinite light'. There is, after all, only one 'consciousness' and that is the 'Supreme / Cosmic Consciousness' or the 'Divine'. It is also 'Me'.

'Aham Brahmasmi'. I am the 'Brahma'.
'Tattavam Asi'. You are also 'that'.

In this instance, it would be quite apt to quote from 'Geetopadesham'. In the tenth chapter on 'The Glorious Manifestations of the Lord', Lord Krishna tells Arjuna (shlokas 8-10)[15]:

'Aham Sarvashva prabhvo mattah Sarv pravartate ……..'.

"I am the origin of all; everything proceeds from me. Thinking thus, the wise, filled with the sentiment of devotion, devote themselves to me.

Their minds absorbed in me, their pranas entering into me, enlightening each other, narrating about me, they are even satisfied and ever delighted.

To them, who are ever joined in yoga, and those who devote themselves with pleasure and love, I confer that yoga of wisdom whereby they come close to me.

Dwelling in these inner self, to favor them, out of compassion,I destroy their darkness born of ignorance with the brilliant lamp of knowledge".

In chapter 11 of the Bhagwad Gita ('Yogic Vision'), the Lord finally shows his 'Vishwa Roop Dharshanam' to Arjun through the 'divine eye' given to him by His grace.

"If there were to rise the brilliance of a thousand suns in heaven, that would be similar to the brilliance of that grand souled one." (Shloka-12).

"I am time waxing, destroyer of the worlds, moving here to gather back the worlds. Even with you all these will cease to be". (Shloka-32).

Seeing this vision of Lord, Partha completely surrenders to the Lord.

7. Divine Dice in the 'Quantum Universe'

Now, let us deliberate on the most interesting question related to the quantum world. Everything in the world and the universe is absolutely 'in-deterministic'. Only the probabilities of incidence

could be discussed. Everything in existence is just a wave of 'probability'. Hence, it is now accepted even by physicists that 'God' also throws dice. He also knows only the 'odds'.

But the question of what kind of dice 'God plays' remains an interesting thought. The one 'dice' with limited possibilities is a human construct because humans do not conceptualize any other way of looking at adice. Perhaps 'God's' dice are very different. Maybe it is spherical. God's dice do appear to have a shape with infinite possibilities.

Now as we think more about this issue, it appears very convincing to us indeed that God's dice have infinite possibilities. Hence, 'He' not only throws dice, 'He' alone can decide the possibility of an incident happening. Finally, 'He' makes a choice, in which event 'He' wishes to make it occur at a particular instant. Is it the reason why it has been quite often said in our scriptures that, *"God only knows the truth."* While satisfying the principles of quantum science and the theory of probability, he may still say, 'I am throwing the dice but I can also decide its result'. The beauty of the 'Supreme Cosmic Consciousness' is simply amazing and probably beyond the perception of the human mind.

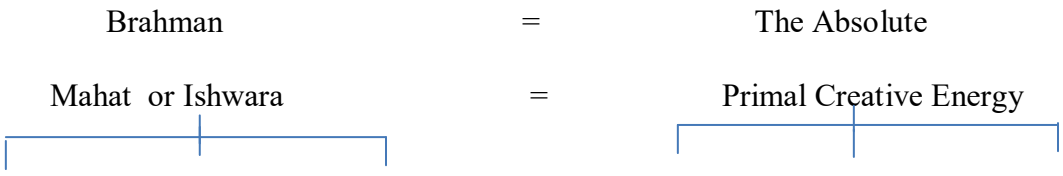
The 'Supreme Cosmic Consciousness' also says, 'I will not like to interfere in human efforts and affairs; you decide your life and existence according to your Karmas', another wonderful concept of 'Karmic theory' indeed. But He also says that you are 'Me' and you will finally merge into 'Me'. Geetopadesham talks of merging this consciousness into 'Braham' or 'Supreme Consciousness' by 'Bhakti Yog', 'Karm Yog' and 'Gyan Yog'. 'Karm Yog' has been talked of as the ideal way to achieve 'Brahm.' [15]

8. Swami Vivekanand's Views on Vedantic Cosmology

Swami Vivekanand was a great philosopher, thinker and a natural scientist. His thoughts have left deep impressions not only on the minds of we Indians, but on the minds of the entire world. It is interesting to look into his thought process.

In a letter [21, 22] written to his disciple from N.Y., USA in 1896, Swami Vivekanand wrote, "Mr.Tesla was charmed to hear about the Vedantic Prana and Akasha and the Kalpas, which according to him are the only theories modern science can entertain. Now both Akasha and Prana again are produced from the cosmic Mahat, the Universal Mind, the Brahma or Ishvara. Mr.Tesla thinks he can demonstrate mathematically that force and matter are reducible to potential energy.

In that case, the Vedantic cosmology will be placed on the surest of foundations. I am working a good deal now upon the cosmology and eschatology of the Vedanta. I clearly see their perfect unison with modern science, and the elucidation of the one will be followed by that of the other. Cosmology, shows the harmony between Vedantic theories and modern science.



Prana and Akasha = Force and Matter

Now on the Advaitic side, it is held that the soul neither comes nor goes, and that all these spheres or layers of the universe are only so many varying products of Akasha and Prana. That is to say, the lowest or most condensed layer is the solar sphere, consisting of the visible universe, in which Prana appears as physical force, and Akasha as sensible matter. The next layer is called the lunar sphere, which surrounds the solar sphere. This is not the moon at all, but the habitation of the gods, that is to say, Prana appears in it as psychic forces, and Akasha as Tanmatras, or fine particles. Beyond this is the electric sphere, that is to say, a condition in which the Prana is almost inseparable from Akasha, and you can hardly tell whether electricity is force or matter. Next is the Brahmaloka, where there is neither Prana nor Akasha, but both are merged in the mind-stuff, the primal energy. And here where there is neither Prana nor Akasha, the Jiva contemplates the whole universe as Samasthi, or the sum total of Mahat or mind. This appears as a Purusha, an abstract universal soul, yet not the absolute, for still there is multiplicity. From this, the Jiva finds at last the unity that is the end. Advaitism says that there are visions that rise in succession before the Jiva, who himself neither goes nor comes, and that in the same way this present vision has been projected. *The projection (Srishti) and dissolution must take place in the same order and there is only one means of going backward, the other path coming out.*

Now as each individual can only see his own universe, that universe is created with his bondage and goes away with his liberation although it remains for others who are in bondage. Now name and form constitute the universe. A wave in the ocean is a wave, only in so far as it is bound by name and form. This name and form is called Maya, and the water is Brahman. The wave was nothing but water all the time, yet as a wave it had a name and form. This name and form cannot remain separated from the wave for even one moment, although the wave as water can remain eternally separate from name and form. But because name and form can never be separated, they can never be said to exist. Yet they are not zero. This is called Maya.

I want to work all this out carefully". ------ **Vivekananda**

From Rigved,

" Ekam Sat Vipra Bahuda Vadanti" (In Sanskrit) - Existence is One. Rig Ved - 1 – 164 – 146.

In the beginning, Brahaman who is one without a second alone existed. When darkness was rolling over darkness, there was existence only. Nobody knows how this universe came into being.

Atman alone exists. That Brahaman is the self within all beings. That Brahman is without cause and effect, without anything inside or outside. That Brahaman is an embodiment of wisdom, peace and bliss. It shines by itself.

To describe him is to deny him. How can a finite mind grasp the Infinite?

Atman is different from knowable. He is beyond the unknowable also. He is the only real living entity, the substratum of everything.

9. Conclusions

We have traced the history of scientific thoughts of the 'evolution of the universe' from ancient Greece to more than two millennium ago to the concepts of nineteenth century scientists of 'physicality' and then to the ideas of Planck, Einstein, Bohr and Heisenberg, quantum science and later. The physicist view of evolution from 'Planck's time' has been discussed. The universe was created with a 'big bang' along with the primordial sound of 'OM'. The universe has expanded at a phenomenal velocity of c^2 to c to c^4 to c^3 (numerically) to much lower than c. There seems to be some mathematical logic to it. It took 10^5 years before photons could dissociate themselves so that light could travel through space at a velocity of 3 x 10^5 km/second. It continues to expand today as predicted by Hubble's theory. It was as hot as 10^{32} K in the beginning and now it is as cold as 2.7 K today.

There could be countless 'universes' like this one. Hence, it is thought that there are 'multi verses'. Not only that, if it is so, it must have gone through a process of contraction exactly the way it had expanded; the conclusion is derived from the law of symmetry followed by nature. The theory of 'proton decay' confirms this idea. But nobody knows it for sure because physicists wish to see the evidence that should be qualified mathematically. They are searching for 'particles' that may take them close to 'the true nature of reality'. There are doubts that they will ever discover one. 'The true nature of reality' may be beyond the perceptive capabilities of the 'human mind'.

Then there is the 'Cosmic Consciousness', who plays His game. 'Human Consciousness' finally merges with 'Cosmic Consciousness' because both are finally the same. During the process of the destruction of the universe, the 'Cosmic Consciousness', Lord Shiva, plays his 'Rudra Tandava', finally merging 'Himself' into 'Himself' before initiating the process of creation once again. The glory of the lord is well described in 'Geetopadesham'. However, during the process of creation and its subsequent destruction, the 'Divine' continues to play 'dice'. But what kind of 'dice' does He play? His 'dice' are probably not normal dice with only limited possibilities, His are dice with infinite possibilities. He, the 'Divine' decides His choice as He wishes. And that is 'His' game, He is at liberty to play. It is said, "God only knows the truth".

References

1. (Bohr, Niels, 1958), *Atomic Physics and Human Knowledge*, New York, John Wiley & Sons
2. (Capra Fritjof , 1976), *The Tao of Physics*, Flamingo
3. (Deshpande Dhanajay, 2007), *Modern Sciences in Vedas*, Mumbai,Bhartiya Vidya Bhavan
4. (Dispenza Joe, 2014), *You are the Placebo – Making your Mind Matter*, Hay House, India

5. (Einstein Albert, 1954), *Ideas and Opinions*, New York, Crown Publishers
6. (Einstein Albert, Infeld Leopold, 1938), *The Evolution of Physics*, New York, Simon and Schuster
7. (Gamow George, 1947), *One Two Three – Infinity,* New York, The Viking Press
8. (Heisenberg Werner, 1971), *Physics and Beyond*, New York, Harper and Row
9. (Heisenberg Werner, 1961), *Physics and Philosophy*, New York, Harper and Row, 1961
10. (Klostermaier Klaus K., 2004), *The Nature of Nature – Exploration in Science, Philosophy and Religion*, Chennai, The Theosophical Publishing House
11. (Lidley David, 2008), *Uncertainty – Einstein, Heisenberg, Bohr, and the Struggle for the Soul of Science*, New York, Anchor Books, 2008
12. (Lipton Bruce H., 2010), *The Biology of Belief*, Hay House India
13. (Morris Richard, 1987), *The Nature of Reality – The Universe after Einstein*, New York, The Noonday Press
14. (Pagels Heinz R., 1982), *The Cosmic Code*, New York, Dover Publications
15. (Swami Rama, 1996), *Perennial Psychology of the Bhagavad Gita*, The Himalayan international Institute of Yoga Science and Philosophy
16. (Stephen Hawking, 1988), *A Brief History of Time*, Bantam Books
17. (Stephen Hawking, 2001), *The Universe in a Nutshell*, Bantam Books
18. (Stephen Hawking, 2008), *The Theory of Everything*, Phoenix Books
19. (Stephen Hawking, Mlodinow Leonard, 2010), *The Grand Design*, Bantam Books
20. (Weinberg, Steven, 1979), *The First Three Minutes*, New York, Bantam Books
21. (Vivekananda Swami, 1944), *Letters of Swami Vivekanand,* Advaita Ashrama, Page 281-283.
22.(Vivekananda Swami, *1994), Complete Works of Swami Vivekananda*, Advaita Ashrama, Vol: 8; Page 233.