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Advaita Vedanta and the Modern Cosmology

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Introduction: In the history of mankind there has never been a civilization, however primitive or sophisticated, that did not speculate on the origin of the universe. While the objective of the modern cosmogony is to unravel the mystery of how the universe came to its present state and what might happen to it in the future, the ancient cosmogonies were in general preoccupied with speculating the origin of man and his possible relationship with the earth.

The literature on cosmogony provides us with evidence of a number of ancient cosmogonies such as the Egyptian, Babylonian, Sumerian, Greek and quite a few others. The people of these ancient civilizations did not have any means, scientific or otherwise, to verify their ideas and imaginations. Hence their speculations on the origin of the universe, compared to modern ideas, are considered as mythical in nature. For instance, in the Sumerian cosmogony 'the myth begins with water *Nammu*, to whom the Heaven and the Earth were born as twins. At first they were united but later separated by the wind *Enlil*, who forced himself between the Heaven and the Earth (1)'.

The other ancient cosmogonies, although differ in descriptive content, are nevertheless similar in approach to that of the Sumerian mythology. The Biblical description of how the universe came into existence has given us a different perspective. According to the Irish Clergyman John Usher the world was created by God at 0900 hours on 26th October in 4004 BCE. The modern science, however, can't be as certain as the Irish Bishop even though it has provided near precise figures for the age of many stars and planets.

Vedanta is not mythology nor does it represent dogmatic religious beliefs. Vedanta, especially Advaita Vedanta, is something unique in the realm of religion. It represents philosophy that delves deep into the working of nature. Its main objective is to unfold the mysteries of nature and the universe. It has given the entire humanity explanation and a philosophical understanding of the origin, working and the natural sustenance of the universe.

Cosmological Theories

Nature is a perfect scientific entity. The propagation of light, the flow of wind, the ocean current, the change of seasons, the motion of stars and planets – all obey laws of science. All elements of nature, whether they are sentient or insentient, work in a scientific manner. The sustenance of the whole universe is based on laws of science. Since the beginning of time these laws are responsible to hold all the elements of nature, indeed of the universe, together.

Based on the principle of these laws a number of theoretical models have been advanced to unravel the mystery of the origin of the universe. They may be classified as the de Sitter Universe, the Friedmann model, the Radiation Universe, the Big-Bang Model, the Steady State Universe, and a few

others. However, the models that have attracted universal attention are the Big-Bang model and the Steady State universe.

Big-bang Universe

This model is based on two assumptions. First, the gravitational interaction between all objects, however small or large, is correctly described by the general theory of relativity. Second, the observer's view of the universe is fully independent of (a) his position in it and (b) the direction in which he looks. This is known as the 'cosmological principle'.

Based on these assumptions, the theory of the Big-bang model has predicted a state of "singularity" of matter, i.e. an infinitely compressed state of matter in which a cataclysmic explosion took place about 10 to 20 billion years ago heralding the beginning of the universe. Since then the universe has been expanding from that primordial state of singularity.

The natural consequences of such an explosion are the recession of galaxies from one another, formation of certain light elements a few seconds after the event and the emission of microwave radiation as a result of the explosion. Since these consequences have been experimentally verified, this theory is now considered to be the standard model for the origin of the universe.

Objections to the Big-bang model

Although the existence of the Cosmic Microwave Background Radiation has been proved to be an indisputable fact relating to the origin of the universe, "its interpretation as relic radiation is neither proved, nor is it free of intrinsic faults. In particular, the background is amazingly smooth in its distribution across the sky. If it had been generated at an initial Big Bang, the later information of clusters of galaxies should have left an observable irregular signature on it. Such a signature has been looked for with great care but has not been found. The implication is that the background has been smoothed and perhaps generated, not at an origin of the universe, but subsequent to the condensation of galaxies". (2)

The gravity is always attractive. This implies the universe must either expand or contract. Therefore, a time will eventually come when the expanding universe will cool down sufficiently for it to start contracting. This will lead to what is called 'big crunch' which, according to the general theory of relativity, will result in another singularity. (3)

According to this model big bang was the beginning of time and big crunch will be the end of time (4). This conclusion may be correct in so far as the 'the universe as it exists now' is concerned. The big bang could not have taken place had there been no singularity in the first place. Similarly, after the big crunch presumably the singularity will continue to exist. Since all laws of physics break down at the singularity, it is not possible to predict what the state of singularity was before the big bang and what it would be like after the big crunch. And how did the singularity come to exist in the first place?

Steady-state Universe

The Steady-state theory stipulates that the average density of matter is the same everywhere in the universe and



never change with time. The theory is based on what is called 'perfect cosmological principle' that guarantees such an isotropic and homogeneous structure. Also, it predicts that the universe is an open universe that expands continually with time. Therefore, matter has to be created to maintain the constant average density required by the theory. The rate of creation of matter is estimated to be 4.5×10^{-45} kg per cubic metre per second (5).

The question is: Where does matter continually come from? It appears to violate the laws of conservation of energy and conservation of matter. The discrepancy in the theory is accounted for by imagining the existence of a C-field that is supposed to be a negative energy reservoir. 'Technically, the C-field has no mass, no charge and no spin. It comes into effect only at the time when particles (matter) are created. Whenever a particle with certain energy is created, a C-field of equal but negative energy is radiated. The overall energy is therefore conserved'. (6)

Objections to the Steady-state theory

Eternal existence of an isotropic and homogeneous universe may be a viable proposition; however, the stipulation that such a universe must also continue to expand ad infinitum while at the same time creating matter to maintain the invariance of its density is based on a rather shaky ground. The problem lies with the imaginary negative energy reservoir, the so-called C-field. It may be a grand name for such an imaginary source of energy converting to matter but realistically what is the probability for such a source reservoir to have practical existence? It appears to be more a belief rather than a scientific entity. However, it is possible to argue if the concept of imaginary numbers is accepted, there may also be imaginary reservoir of negative energy in the universe. But, without direct experimental evidence it is a difficult paradox to resolve.

When we look at a star or a galaxy we observe an event that occurred a long time ago, for light takes time to reach us from these objects. The interpretation of such an event using the existing laws of physics assumes that they don't change with time. Herman Bondi and Thomas Gold have argued that the only situation in which such an assumption can be safely applied is the universe that does not change with time. This is the basis of the perfect cosmological principle. It is an intellectually appealing concept, for it gives equal weight to both space and time. However, because of the lack of experimental verification and observational evidence it has not received approval of the relevant scientific community. The discovery of the cosmic microwave background radiation in 1965 was the final nail in the coffin of this theory. Still it remains in the background as an interesting, intellectually stimulating and philosophically important speculation.

Limitations of mathematical models

The Big-bang model and the Steady-state theory are mathematical models based on their originators' perception of the universe. The former is preferred over the latter, for its conclusions are partly supported by observational evidence. A mathematical model, by definition, is an approximate solution of a practical problem or a scientific phenomenon. It is not meant to be a solution fully capable of replacing the real-

ity; however, in certain cases its prediction may come very close to matching the real situation.

Then, there are cases in which our imagination and understanding fall far short of providing an adequate answer to a natural phenomenon. Take, for example, the case of developing the theory of the nature of light. There was a time when light was believed to be particles. The discovery of interference, diffraction and polarization of light replaced this idea with the concept that light is propagation of wave. The advent of quantum physics has proved that light is both particles and wave. This is also the message of the Einstein's mass energy relation $E = mc^2$, since wave is energy.

Singularity is defined to be a state that is beyond the realm of all laws of physics. If it is not subject to natural laws it is more a belief than a scientific entity. At big bang, singularity comes to an abrupt end and gives rise to the order and discipline that the universe exhibits. How can such a state that is beyond human knowledge and understanding can suddenly reveal itself to be full of mysteries and truth that can be investigated, systematised and put into an ordered form? And where did the original state of singularity come from. The modern cosmology has remained completely silent about all of them. In addition, the cause of the big bang has to be fully explained. So long as such an explanation is not forthcoming the concepts of big bang and the steady state theory, despite their sophistication, will always remain incomplete.

Following the arguments and reasons as given above it is possible to envisage a universe that incorporates the characteristics of both the big-bang and steady-state models. Whether a mathematical model can be developed on this line that is comprehensive enough to provide an accurate description of the possible scenario is another matter, for such a model will have almost unlimited scope and is likely to face the problem of interpreting the state of singularity. The laws of physics we now have are not comprehensive and adequate to deal with this situation. This is where one can see the importance of Vedanta, for it represents a holistic approach incorporating matter and spirit, the dual aspects of the universe.

Vedic perception of the universe

Unlike the limitations of mathematical models the scope of the Vedic philosophy and speculation is wide and its approach holistic. The Vedic perception of the universe is almost similar to the unified model that incorporates both the big-bang and steady-state models. This is illustrated in the Invocation of Isopanishad.

Purnamadah. Purnamidam. Purnaam Purnam Udachvate Purnasva Purnamaadaaya Purnam eva Avashishvate (7).

'That (Brahman) is Purnam. This (universe) is Purnam. The universe is the manifestation of Brahman. Such a manifestation explains the eternal and all pervading existence of Brahman.'

According to Advaita Vedanta there is and there can be only one absolute Reality, Brahman. The term Purnam may be translated as infinite, complete, whole, etc. Brahman is eternally Purnam and so is the universe. When Brahman manifests into a visible entity it is universe. The separation between the two is only apparent. There must be an origin, a source from which the universe has emerged or been created. In Vedic parlance that source is Brahman. Therefore,



the Invocation is a statement of Advaita Vedanta, the philosophy of non-dualism between the creation and its creator.

The following verse of Bhagavad Gita has confirmed this view.

**Aham sarvasya prabhavo mattah sarvam pravartate
Iti matvaa bhajante maam budhaa bhaavasamanvitaah** (8).
'I am the origin of all that is and the whole creation proceeds from me'. The Taittiriya Upanishad has described the same concept in a much better way by considering what is normally observed in nature which is creation, continuation of physical existence and then the end of that existence. It says,
**Yato vaa imaani Bhutaani jaayante. Yen jaataani jivanti.
Yat prajantyavisamvishanti. Ta dvijijnasawa.**

Tad Brahmeti. (9).

'That from which beings are born, that by which, once born, they live and that into which, once dead, they enter' is Brahman. So, Brahman is the central point around which the three fundamental aspects of the universe namely the creation, continuation and dissolution revolve.

It appears there is a high degree of correlation between the prediction of big-bang model and concepts of Advaita Vedanta. In the big-bang model the universe emerges from a primeval egg of inexplicable singularity. In Advaitic parlance Brahman is beyond thought (*achinta*), beyond comprehension (*avodhya*) and in every way inexplicable. Brahman is beyond the laws of physics. Therefore, one may argue that the concept of the singularity in big-bang model is scientific confirmation of what Brahman stands for. In Vedanta Brahman is defined as *Satchchidanand*, i.e. Sat - material existence, Chit - Universal Consciousness and Anand - Divine bliss. Thus Brahman is the embodiment of both matter and consciousness having the power to project the universe from its Being that has an eternal existence. It is a concept that goes beyond the speculations of the modern cosmological models and explains how the origin of the universe could have been caused in the first place.

The universe, after its emergence, continues to exist until finally it undergoes the big crunch and return to the state of singularity. In this journey from the big bang to big crunch the totality of the universe with both sentient and insentient aspects, while expanding or contracting, remains the same. Philosophically, it is similar to saying *Tat tvam aasi* - thou art that and *Ishaa vashvam idam jagat* - Brahman pervades the whole universe. There is no duality between the creation and the cause of creation. The big bang is the means to bring the creation into material existence.

Cosmic Vision or Big Bang

In the history of mankind the eleventh chapter of Bhagavad Gita is a unique phenomenon, a phenomenon that is unlikely to be repeated again. Sceptics may not believe in the 'Cosmic Vision' that Arjuna was given the opportunity to experience. They may even reject the content of this chapter outright. Nevertheless, the vision of Vyasa that the universe actually proceeded from Sri Krishna is almost similar to the causation of big bang giving rise to the material universe. According to Einstein's mass-energy equivalence equation, if an explosion takes place, matter is converted into energy and as a result radiation is emitted. This is how the microwave background radiation emitted in the big bang has been perceived.

The following verse of Bhagavad Gita is an illustration of a similar phenomenon.

**Divi Suryasahasrasya bhaved yugapad utthitaa
Yadi bhaa sadrisi saa syaad bhaasas tasya**

mahaamanah (10).

If a thousand suns were to rise in the heavens at the same time, the blaze of their light may not be as bright as the splendour of the Supreme Lord. Eknath Easwaran, in explaining this verse said, "You and I cannot look directly at the sun without damage to our eyes; its power is so immense that a minute fraction of the energy it radiates into space, diffused over ninety-three million miles and tempered by our atmosphere, is enough to sustain all life on this planet. Now we are asked to imagine a thousand of these suns rising at the same time in the depths of Arjuna's consciousness; his whole being is flooded with light (11)". As we now know, when the first nuclear bomb was exploded this is the type of phenomenon observed at the time. To study the effect of emitted heat, light and radiation fallout a large number of soldiers were used as guinea pigs. They were given special sun glasses and protective clothing to wear. That such a protection is needed has also been confirmed in the Bhagavad Gita when Sri Krishna said, **Na tu maam sankyase drastum anenai'va svacaksusaa
Divyam dadaani te caksuh pasya me yogam aisvaram** (12). But these things cannot be seen with your physical eyes; therefore I give you spiritual vision to perceive my form as the Lord of the creation. An uncontrolled nuclear explosion is an atom bomb while a controlled nuclear reaction is a nuclear reactor that is used to generate electrical power. What Arjuna observed may be termed as 'controlled explosion' caused and controlled by divine power.

Cyclical universe

According to the Vedas the universe exists in limitless cycles of creation, preservation and dissolution. There is no absolute end to the universe neither is there a duality of God and the universe, only a unity.

Almost all Vedic literatures advocate cyclical model of the universe. For instance, the Bhagavad Gita states, **Ayaktaad vyaktayah sarvaah prabhavanty aharaagame
Raatryaagame praliyante tatrai' vaa vyaktasamjnake** (13). 'When that day (Brahma's day) comes, all the visible creation arises from the Invisible; and all creation disappears into the Invisible when the night of darkness comes'. It goes further on to declare,

**Bhootagraamah sa evaa'yam bhootvaapraliyate
Raatryaagame'vasah Paartha prabhavaty aharaagame** (14).

'Thus the infinite number of beings that live again and again, all powerlessly disappear when the night of darkness comes; and they return again at the rising of the day'.

The life of the universe may be taken as the time between creation and dissolution, going through a long period of preservation. This is exactly identical to the universe's life between the big bang and the big crunch. The Vedas claim that the universe is not limited to one life. It undergoes endless repetition like the periods of sine and cosine curves. In scientific parlance this is often referred to as 'oscillatory universe'. Although such a model appears to contradict the predictions of both the theoretical models; however, it should not be the reason for rejecting this model as a possible alternative to



explaining the origin and sustenance of the universe. Both the big-bang model and the steady-state theory are proved, both structurally and philosophically, to be inadequate to explain the origin of the universe. They cannot answer some of the questions they themselves have raised. Therefore, as stated in the previous section, a model that incorporates features of both of them may ultimately provide the answer we have been looking for.

The cyclical phenomenon is not something confined to the realm of mathematics; it is indeed the normal characteristic of nature. The order that nature exhibits is repetitive. And it is this repetition that characterises the very foundation of the universe's nature. The following examples are taken to illustrate this point.

Consider the life cycle of a water droplet. It is formed when water is evaporated from the ocean surface. Once detached from its source the droplet travels undergoing changes in form and shape until it finally returns to the source. That is not the end of its life cycle. It is a case of endless repetition.

The most obvious example of repetitive phenomenon is that of 'day and night'. It is so obvious that it is not normally considered in that way. The sunrise heralds the beginning of day and the world comes to life. As the night falls the world begins to rest and the life remains in a latent state. At the day breaks following the night, the world springs to life again. The cycle of day and night is repeated to form a week. Repetition of weeks forms a year and the cycle goes on and on.

The Vedic term for the primeval egg or atom in which the entire material of the universe is supposed to be concentrated is called *Brahmaanda* – the cosmic egg or Brahman egg. It is that entity in which Brahman, the whole universe with all its sentient and insentient aspects, is concentrated. In addition to this term the Vedas have given us another term called *Hiranyagarbha* – the cosmic womb, the source from which the universe has emerged. *Hiranyagarbha* should not be viewed as something being totally different from *Brahmaanda*. They explain the emergence of the universe from two different but complementary perspectives.

The physics of *Brahmaanda* may be taken as the same as that predicted by the big-bang model of the universe for primeval egg. However, there is a subtle difference in concept. The primeval egg is totally and utterly insentient while *Brahmaanda* is both sentient and insentient. In other words, it is by its very nature a conscious object with the ability of causing a change in itself, if and when required or desired. The violent explosion of the primeval egg is an effect. The big-bang theory has not predicted how the explosion was caused in the first place. There is no physical process known to man that can undergo even a very minor spontaneous explosion. The violent explosion of the magnitude of big-bang cannot take place without a cause.

According to the Taaittiriya Upanishad Brahman is the cause of creation of the universe. It states quite explicitly, "*Sokaamayate-bahu shvam prajaayeyete- It (Brahman) made a wish to manifest His being into many (15)*". To clarify the resolution further it said, "*Sachcha tvachchaa bhavat. Niruktvam cha aniruktam cha. Nilayanacha anilayanacha. Vijnananacha avijnananacha. Satyamcha anutamcha. Satyam Bhavat- The wish became reality and It (Brahman) became the formed and formless, the defined and undefined, the sustaining and non-sustain-*

ing, the sentient and the insentient, the true and the untrue (16)".

Vedanta has also given evidence of how Brahmanda was turned into the universe. The second verse of the Naasadiya Sukta reads, "*Amidavaatam Swadhayaa Tadeekam Tasmad dhyaanam nap rah kim cha naasa-That one without vibration began to vibrate by its own power, other than that there was nothing beyond (17)*". In the process of nuclear reaction first a compound nucleus is formed. It undergoes intense vibrations before it breaks into two new nuclei. Indeed, this is how the big bang is also perceived to have taken place. It is really astonishing what Vedic saints and seers imagined thousands of years ago have become a practical reality in the science of the modern world.

Being a mathematical model, the big-bang theory can't explain what would happen to the universe when it undergoes big crunch and after. Presumably it will form another 'primeval atom' and once formed it will exhibit all the physical properties of singularity. It should be obvious if the primeval atom can undergo big bang, the newly formed state of singularity can exhibit the same characteristics, for it will contain the same material having the properties of its previous life. So, the question is: How long after the big crunch will there be the next big bang?

Here the analogy of repetitive cycles, e.g. the period of sine and cosine curves, could be used. All repetitive cycles have two equal half cycles. The time between the peak and trough of a sine curve is the same as that between the following trough and peak. Similarly, it can be argued that the time between a big crunch and the next big bang would be the same as the one between the big bang and big crunch in the previous half cycle. The two together would form a cycle of the universe and it repeats ad infinitum. *This is the cyclical universe the Vedas have predicted. In Vedic terminology the time between the big bang and the big crunch is called a day of Brahma and that of the following half cycle between the big crunch and big bang is called the night of Brahma.*

One of the deficiencies of the big-bang model is that it can't shed any light on the history of primeval atom before the big bang nor can it predict its history after the big crunch. In this respect the steady-state theory is very specific. It has made a definite statement that the universe has an eternal existence. As discussed earlier in this paper this is an echo of the Vedantic view of the universe.

The big bang prediction that the universe, after big crunch, has an uncertain future or no future at all is unlikely to be a tenable hypothesis. The scenario that the universe after undergoing big crunch will suddenly blink for ever appears to be rather naïve in conception. The eternal existence of the universe is not only intellectually appealing but is based on sound scientific principles. Laws of physics permit transformation of matter into energy and vice versa but not their disappearance for ever.

In an expanding or contracting universe the density of the total quantity of matter that makes up the universe has to change with time. What, however, does not change is the 'counter part' of matter, the absolute 'consciousness' or Brahman or call it what you will. It always remains ever present as assumed in the steady-state theory, for Brahman is eternal. It is not affected by expansion or contraction that matter



undergoes. While the matter constituting the universe undergoes cyclical process, Brahman is always there in a steady state.

Conclusions:

The predictions of the big-bang and steady-state theories, especially that of the latter are found to be inadequate to explain the creation (or origin), sustenance and dissolution of the universe. The universe is both sentient and insentient. Any theory that ignores the sentient aspect of the universe cannot successfully explain all these aspects. The holistic approach of Advaita Vedanta, however, has brought these two competing theories together to predict a cyclical universe that is eternal and permits it to undergo continual expansion and contraction in each cycle.

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