

On the earliest stage of creation of universe

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Ideas of philosophers and mathematicians regarding creation of universe are discussed. The Big Bang model of the creation of universe is studied in detail. Study has been restricted much before generation of matter. Mathematical study, both deterministically and statistically about the said period has also been presented. In addition an attempt has been made to extend the Big Bang model to a hierarchy of smaller Big Bangs. Lastly, to develop a pre-Incarceration stage as a mirror image of post-Big Bang stage has been attempted.

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I. INTRODUCTION

A question that has been haunting man over ages is "who created this universe?". No answer is still available. I have started the present paper by discussing some of those attempts in chronological order; (i) ancient times, (ii) middle age and (iii) modern times. For the modern times I would give stress on the discussion of the Big Bang model, the most accepted model of today. Lastly, I would like to extend this modal to some extent and would also try to authenticate my ideas with the available knowledge.

A. Ancient times

As per the recorded history of human civilization we find a few cases where the then wise men tried to understand creation in their own way. These are Egyptian mythology [1], Norse mythology [2], Greek mythology[3] and Brahminical philosophy [4].

B. Middle ages

Aristotle, the great Greek philosopher was of the opinion that the universe exists for ever. He believed that something eternal is more perfect than something created. He avoided the question of creation. Immanuel Kant,[5] the great German philosopher also tried to discuss creation from logical viewpoint.

C. Modern times

Against the great development of science and technology, a great ignorance, probably the greatest, that man has been trying to efface, is regarding the Creator of the

universe. Man from all sections of life is trying to get an answer to it, till with no avail. Bypassing this question, mathematicians and physicists have been trying to build different models of universe, once it is initiated. Herein I would like to discuss two popular models.

1. Steady state model

Hoyle [6], and Narlikar [7] suggested the Steady State theory of creation of universe. According to this theory, as galaxies move apart, new galaxies are built. Building of newer and newer galaxies are supposed to be continually created throughout space. It meant that the universe is eternal and would look always same on statistical viewpoint. Results from observatory, however, did not support the model. It only reminds us of the idea of Aristotle about the eternity of the universe.

2. Big Bang model

Hawking and Penrose [8] worked on this problem and went on to prove their famous singularity theorem in line of the General Theory of Relativity. Observational evidence to confirm that the universe had a very dense beginning came in October 1965, a few month later than the development of singularity theorem. Much earlier Lemaitre [9-11] had suggested Big Bang model. He proposed that the universe started from a small packet. This initial packet exploded and spewed energy in all directions, which later formed stars/galaxies. This model has been found to comply with the Hubble's observatory data. Now Big Bang model is generally accepted. Big Bang model has been revised by Hawking himself in collaboration with Hertog [12]. Thereafter this model has been studied by many scientists [13-23] from different angles. In the present paper I have tried to study this model in greater detail.

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II. DETAILS OF BIG BANG MODEL OF CREATION

We would try to detail the process of creation by Creator by dividing it into three different stages; (i)pre-Incarceration stage, (ii)Sleeping stage and (iii)post- Big Bang stage. Besides having some idea about the third stage, authenticated by the outcome of Hubble's experiment, we do not have semblance of idea about the other two, even about the existence of those two stages. In this paper we are only extrapolate our present idea to some extent.

A. Post-Big Bang period revisited in detail

During the pre-Big Bang period energy was kept incarcerated in a small packet. It is not known when this incarceration started. During this period the movement inside the packet was almost zero. Since we have no law of physics, suitable to explain the situation, let us accept Einstein's mass energy relation for the time being and replace speed of light by near zero movement/speed inside the packet. Details of the relation may be neglected, since we are confining our study for the period, long before creation of mass. But if the speed of electromagnetic wave (or energy in the packet) is brought to near zero level, the whole mass of universe may be represented by a small amount of energy, kept incarcerated in a small packet. In other words, ultimately there may be the opportunity to envisage creation of the massive universes (observable and unobservable) from the packet-full of energy. The assumed construction of the primal packet may be explained with the help of fig.1.

Extending the above construction we assume that the primal packet contains enormous amount of energy in deep sleep without movement. For this type of situation we may have to assume very large frequency with zero wavelength. From now onward we would like to call the energy in sleep as the energy giant. How it slept and how it got up from sleep, by whose instruction are still a matter of search. Most humbly I am avoiding these questions.

B. Initiation of Big Bang

At a certain point of time (loosely used, because time might not have started before Big Bang) the primal energy giant slowly came out of sleep. Its restlessness vis-a-vis its velocity gradually grew. Big Bang occurred. The primal giant split into secondary, tertiary giants and lower order, possibly with simultaneous generation of good number of unsheathed energy corpuscles at every stage. We would like to assume that the smaller giants also gradually came out of sleep in succession. Whether the Big Bangs of smaller giants have already occurred, or are still going on in different parts of the universes is

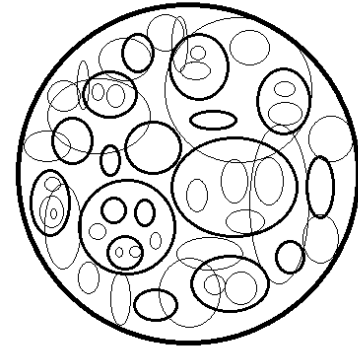


FIG. 1: A conceptual picture of the initial energy packet, enclosing sleeping energy corresponding to the mass of universes (observable and unobservable), in smaller and smaller packets.

another area of research. As per Hubble, we may assume three dimensional symmetrical distribution of matter after Big Bang. Hence it may not be out of place to assume that smaller giants, coming out of sleep with zero plus velocities, are also symmetrically distributed. This may indicate a queer picture of conglomeration of blasting giants within blasting giants, small spheres within bigger spheres.

C. Role of gravity-like inward thrust

Having discussed the issue of the primal energy giant slowly coming out of sleep, we would now try to understand the cause behind the grand sleep. We would like to argue that the incarcerated giant had always been trying to come out of the packet by radiating energy. It is a matter of great interest to understand what may prevent it from doing so.

Radiation of energy by the primal energy giant is an outwardly phenomenon. So to ensure sleep by restricting this outward movement some inward thrust might be needed. We have discussed the presence of inward thrust in pre-Big Bang period. From our standard knowledge of nature we entrust this type of job with gravity. We are not sure if that inward thrust and the gravitational force are same. Finding no other option, let us use the name gravity for the inward thrust. Hence the presence of enormously powerful gravity blanket may be held responsible for thwarting the burst of radiation and maintaining the grand sleep.

Let us study this point first. When the Big Bang occurred the then gravitational force was overcome by the outwardly expansion due to thermal force. Let us think in the reverse way. Let the universe collapse to the pri-

mal packet again. For that how big should be the gravitational force that would force all the masses to collapse into the primal packet? In brief the very strong primal gravity vis- a-vis the inward thrust should be many many times stronger than gravity of today, the weakest of all present forces. We would like to assume that the inward thrust, that made the energy giant sleep, degenerates gradually to the present day gravity, possibly after the creation of mass at a later stage.

1. The cases of smaller giants and zero times

Let us now replicate the case of the primal giant to the smaller giants. We presume that for each case outwardly expansion due to thermal force is thwarted by power of gravity. Smaller a the giant is, smaller amount of energy is in its coterie. So we assume that it may need weaker power of gravity for resisting its Big Bang. Then we may build a descending series of gravity starting from the initial gravity that kept the primal giant asleep.

We would like to detail the above statement. When the gravity blanket of the primal giant was torn apart, a large number of unsheathed corpuscles along with smaller giants were formed. Smaller giants might have suffered Big Bang later. Hence release of energy from different energy packets is likely to start at different times. This inspires us to assume that all stars/galaxies are not simultaneously created. This may be in the line of the present thought of different zero times for different galaxies.

Given the above model, a few outcomes may be envisaged.

1. The primal Big Bang may be followed by a succession of Big Bangs. The process may still be continuing.
2. There might be different zero times for different galaxies.

III. A MATHEMATICAL MODEL OF POST-BIG BANG PERIOD

I am not sure if any attempt has been made to study the post Big Bang period up to a point much before formation of matter. In this section I would try to build a mathematical model for this period. It would, however, be restricted to an arbitrarily chosen unsheathed energy corpuscle. Let us first discuss the background for our suggested model.

We have argued that just before the Big Bang all unsheathed energy corpuscles were incarcerated inside the primal packet with near zero speed vis-a-vis near-zero wavelength. After the Big Bang it gained greater and greater speed. Simultaneously, wavelength also is increasing. Corpuscles which had no movement when asleep, now gain speed and may gradually become infrared. Since from a corpuscle a galaxy/celestial body is likely to form, the mass equivalent of the intrinsic energy of the corpuscle remains unaltered. As a corpuscle

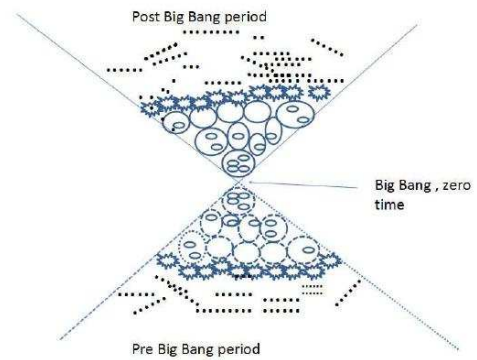


FIG. 2: A conceptual picture of the Post-Big Bang and Pre-Big Bang stages in smaller and smaller packets, with unsheathed corpuscles at every stage.

attains the speed of light, Einstein convention may be applied to the amount of mass, equivalent to the intrinsic energy of the corpuscle.

To build mathematical model we need some more details. We would like to assume that as the corpuscle sneaks out of the primal parcel, it is thrown like a projectile. Hence speed of the corpuscle is a function of time and space. In addition each corpuscle will grow in size. We assume that it has a spherical growth. We would like to divide the study as follows.

A. Energy vs speed

Having given the background, let us take the case of an unsheathed energy corpuscle that is likely to become a massive body M in due course. We have already assumed that Big Bang and birth of time are simultaneous events. We are going to study the case of the energy corpuscle reaching the maximum speed in its purest form i.e. without matter. So energy corpuscle starts its journey like a projectile from a near zero speed $v(0)$ and reaches a speed of $v(T) = vT$ at the end of the so called period.

In the earliest period after Big Bang we may assume that both energy and velocity were significantly low. In that period Einstein's mass energy relation is almost same as Newton's law. Mass equivalent of the energy capsule remaining unaltered all through this period, we would like to get the relation $E(t) = M v(t)^2$. Our present study is restricted to this period before creation of matter. The boundary conditions are $E_0 = E(t \rightarrow 0)$ and $v_0 = v(t \rightarrow 0)$. Since $v > 0$ the above relation may be represented by the upper half of a parabola. Vide the conceptual picture fig.2

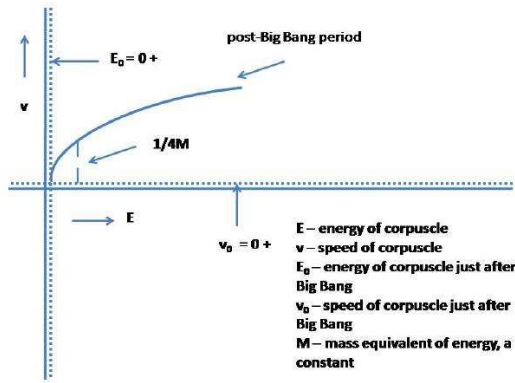


FIG. 3: A conceptual picture of the post-Big Bang period with initial energy packet, equivalent to the mass of universes (observable and unobservable).

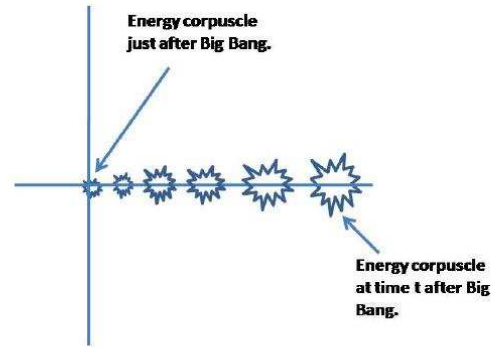


FIG. 4: Energy corpuscle moving away from source. An example.

B. Statistical development of energy corpuscle

After the earliest period there may be perceptible deviation from Newton’s law. Then GTR may be the suitable law [24]. We would not go that far. For our present study we need to keep the following aspects in mind. (1) Energy capsule is moving. (2) It is moving in a medium where many other capsules are likely to be present. With this in view let us write the differential equation.

$$\frac{DE}{Dt} = K \frac{\delta^2 E}{\delta r^2} \tag{1}$$

Since the corpuscles are moving with time we are using total derivative $\frac{D}{Dt} \simeq \frac{\delta}{\delta t} + \frac{\delta r}{\delta t} \frac{\delta}{\delta r}$. Hence we get

$$\frac{\delta E}{\delta t} + v \frac{\delta E}{\delta r} = K \frac{\delta^2 E}{\delta r^2} \tag{2}$$

Here we have used the following notation.

- E- energy of an arbitrarily chosen corpuscle at (r, t)
- t- time from ejection of corpuscle from Big Bang
- r- distance traveled by the energy corpuscle in time t
- $v = \frac{\delta r}{\delta t}$ - speed of the corpuscle after time t
- K- thermal diffusivity

Taking ensemble average of (2) over the corpuscles at a distance r at time t we get

$$\frac{\delta \bar{E}}{\delta t} + v \frac{\delta \bar{E}}{\delta r} = K \frac{\delta^2 \bar{E}}{\delta r^2} \tag{3}$$

Speed v is a function of (r, t). But it may be poorly correlated with $\frac{\delta E}{\delta r}$. Hence (2) may be written as

$$\frac{\delta \bar{E}}{\delta t} + v \frac{\delta \bar{E}}{\delta r} = K \frac{\delta^2 \bar{E}}{\delta r^2} \tag{4}$$

We shall now try to get a solution of (4) and for that we use moving coordinate $\xi = r + vt$. (3) becomes

$$2v \frac{\delta \bar{E}}{\delta \xi} = K \frac{\delta^2 \bar{E}}{\delta \xi^2} \tag{5}$$

It is possible to solve (5) with the boundary conditions, as (t = 0, r = 0), $\xi = 0$, and $E = E_0$. The solution is

$$\bar{E}(r, t) = E_0 + \frac{K}{2v} \left(\frac{\delta \bar{E}}{\delta r} \right) \Big|_{r \rightarrow 0} \left[e^{\frac{2v(r+vt)}{K}} - 1 \right] \tag{6}$$

C. Sleeping stage

We have not said anything about Sleeping stage. It is not possible to guess the length of this stage. It may only be assumed that time was kept in hibernation as long as this stage continues. There should be the two end points; beginning and end. We would now want to get answers of three questions; (i) how did this stage begin; (ii) how did it continue and (iii) how did the end come. The answer to the first question may be obtained from the pre-Incarceration stage, assumed by us.

D. Pre-Incarceration stage

We have already conceived the presence of a pre-Incarceration stage, preceded by Sleeping stage. We

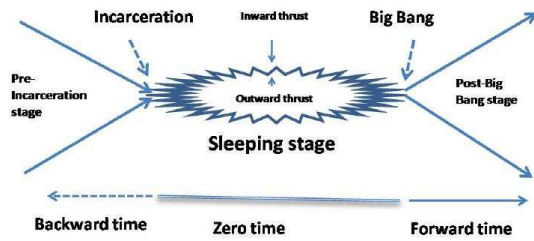


FIG. 5: An imaginative picture of pre-Incarceration and post-Big Bang stages connected by Sleeping stage vs time.

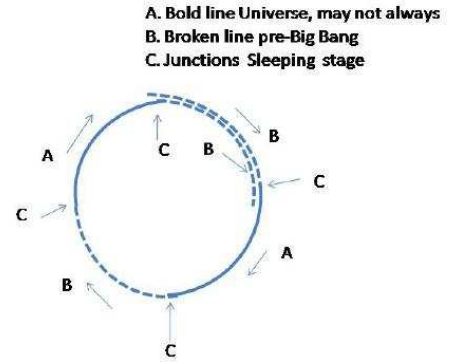


FIG. 6: The conceptual process from pre-incarceration period to post-Big Bang, (may not be universe always), followed by end of post-Big Bang period, again followed by pre-incarceration period in an end-less cyclic manner is presented here.

would like to imagine a picture of that stage. Despite the enormous power wielded by Creator, it may not be out of place to assume that Creator is not likely to be iconoclast and may not hit upon a new plan every now and then. Principle of Occam’s Razor may be noted here. So we presume that pre-Incarceration stage should almost be the mirror image of the post-Big Bang stage. Accordingly we would like to picturise the pre-Incarceration stage.

We have no idea about Creator, which/who may be God to the believers and a supernatural power to others. Energy of immeasurably large amount was controlled by Creator. The amount of energy may be somehow equivalent to the mass of the observable and the unobservable universes combined. In order to handle such big amount of energy Creator might have hit upon a plan. It is contemplated that the plan was executed in stages. In stage one a few balls of energy were made. In the next stage a few fictitious packets of some such balls were made. In the cases of both the balls and the packets therefrom were densely packed by application of inward thrust. In the next stage again a few fictitious packets of the earlier packets were made in the same way. After number of stages the total energy, equivalent to the mass of the observable and the unobservable universes was wrapped by the final blanket of inward thrust to form the final or the primal packet. At each stage some unsheathed energy corpuscles might have evaded the notice of Creator and remain unwrapped. The primal packet, may be the other packets also, contained some unsheathed energy corpuscles. But nothing was outside the primal packet. It is like creating a walled-in zoo with fiercest animals under multiple covers and mild animals in free space. With the completion of the zoo sleeping stage begins. Bringing order from disorder was executed and sleeping stage begins. All these three stages are shown with the help of fig.5.

E. Entropy study

In this study we have mentioned states of order and disorder. This cautions me not to forget entropy. It was a very important area of research in nineteenth century and is still continuing. Boltzmann[24] did statistical study of entropy. We know that in case of irreversible processes entropy always increases. This is an well accepted theory, developed, extended and applied by Clausias[27] and Clapyron[28]. When an irreversible process goes on it moves from the state of order to disorder. For example growth of man from fetus in mother’s womb to a full grown man cannot be reversed. We may agree that in fetus state there is very little complexity. Almost all is in order. But in a full grown man there are many anatomical complexities. So with the growth the state of man goes from order to disorder. Entropy increases.

Let us examine the entropy theory from the standpoint of Universe. First of all we have to see the question of irreversibility. In pre-incarceration stage Creator disciplined energy of various intensities, distributed in space and then herded those in a well built zoo (the primal packet) for unknown time. The whole action may be an example of irreversible process going from disorder to order. We may consider that in this stage entropy decreases.

On the contrary, the post-Big Bang process is also an irreversible process going from order to disorder. Entropy should be increasing. In this context we would like to refer to the Eddington’s [25-26] legendary work on entropy, named as "Arrow of time". According to him with progress of time entropy would be increasing for ever in irreversible processes. Poincar’s [29] recurrence theorem gets into more detail. It states that "In physics, certain

systems will, after a sufficiently long but

nite time, return to a state very close to, if not exactly the same as, the initial state." In case of creation of universe we would like to assume that this theorem holds good. In case of post-Big Bang period the universe would expand and during the expansion it would go from

order to disorder with increase of entropy. After long but

nite time it would reach the limiting stage of disorder when entropy ceases to change. It then returns to the initial stage, may not be exactly same. Poincar recurrence theorem is explained by a sketch, (vide fig.6).

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- [1] Wilkinson, Richard H. (2003). *The Complete Gods and Goddesses of Ancient Egypt*. Thames & Hudson. pp. 206207.
- [2] Lindow, John (2001). *Norse Mythology: A Guide to the Gods, Heroes, Rituals, and Beliefs*. Oxford: Oxford University Press.
- [3] Bulfinch, Thomas (2003). *Greek Mythology and Homer. Bulfinch Greek and Roman Mythology*. Greenwood Press.
- [4] Nasadiya Sukta, 129th hymn of the 10th Mandala, Rig Veda. English translation by A. L. Basham. <https://en.wikipedia.org/wiki/NasadiyaSukta>
- [5] Kant, Immanuel; Kitcher, Patricia (intro.); Pluhar, W. (trans.) (1996). *Critique of Pure Reason*. Indianapolis: Hackett. xxviii.
- [6] Hoyle, F. (1948). "A New Model for the Expanding Universe". *Monthly Notices of the Royal Astronomical Society*. 108 (5): 372382.
- [7] Jayant V. Narlikar, The concepts of "beginning" and "creation" in cosmology *Philosophy of Science* 59 (3):361-371 (1992).
- [8] Hawking, S.; Penrose, R. (27 January 1970). "The Singularities of Gravitational Collapse and Cosmology". *Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences*. 314 (1519): 529548.
- [9] Lematre, Georges (1931), "Expansion of the universe, A homogeneous universe of constant mass and increasing radius accounting for the radial velocity of extra-galactic nebulae", *Monthly Notices of the Royal Astronomical Society*, 91: 483490,
- [10] Lematre, G. (1931). "The Beginning of the World from the Point of View of Quantum Theory". *Nature*. 127 (3210): 706.
- [11] Lematre, G. (1931). "The Evolution of the Universe: Discussion". *Nature*. 128 (3234): 699701.
- [12] S. W. Hawking and Thomas Hertog (2018). A smooth exit from eternal inflation? *Journal of High Energy Physics*. April 2018, 2018:147
- [13] Penrose, R. (1989). Fergus, E. J., ed. *Difficulties with Inflationary Cosmology*. Proceedings of the 14th Texas Symposium on Relativistic Astrophysics. New York Academy of Sciences. pp. 249264.
- [14] Hawking, S. W.; Ellis, G. F. R. (1973). *The Large-Scale Structure of Space-Time*. Cambridge University Press. ISBN 978-0-521-20016-5.
- [15] Dicke, R. H.; Peebles, P. J. E. Hawking, S. W.; Israel, W., eds. *The big bang cosmology enigmas and nostrums. General Relativity: an Einstein centenary survey*. Cambridge University Press. pp. 504517.
- [16] Alpher, R. A.; Herman, R. (1948). "Evolution of the Universe". *Nature*. 162 (4124): 774775
- [17] "Astronomers Find Clouds of Primordial Gas from the Early Universe, Just Moments After Big Bang". *Science Daily*. 10 November 2011. Retrieved 13 November 2011.
- [18] Mortonson, Michael J.; Weinberg, David H.; White, Martin (December 2013). "Dark Energy: A Short Review". Particle Data Group 2014 Review of Particle Physics. arXiv:1401.0046
- [19] Davies, P. C. W. (1992). *The Mind of God: The Scientific Basis for a Rational World*. Simon and Schuster.
- [20] Weinberg, S. (1993). *The First Three Minutes: A Modern View of the Origin of the Universe*. Basic Books. ISBN 978-0-465-02437-7.
- [21] Razieh Pourhasan, Niayesh Afshordi, Robert B. Mann. *Out of the White Hole: A Holographic Origin for the Big Bang* arXiv:1309.1487v2
- [22] Kragh, Helge (1999). *Cosmology and Controversy: The Historical Development of Two Theories of the Universe*. Princeton University Press..
- [23] Loeb, Abraham (October 2014). "The Habitable Epoch of the Early Universe". *International Journal of Astrobiology*. 13 (4): 337339.
- [24] Boltzmann, Ludwig. Boltzmann, Ludwig. 1964. *Lectures on Gas Theory*. Berkeley: University of California Press.
- [25] Eddington, A. *The Nature of the Physical World* (Cambridge University Press, Cambridge, 1928).
- [26] Eddington, A. *Nature*, 127, 447 (1931).
- [27] Clausius, Rudolf. (1856). "On the Application of the Mechanical theory of Heat to the Steam-Engine." as found in: Clausius, R. (1865). *The Mechanical Theory of Heat with its Applications to the Steam Engine and to Physical Properties of Bodies*. London: John van Voorst, 1 Paternoster Row. MDCCCLXVII.
- [28] Clapeyron, E (1842) "Mmoire sur le rglement des tiroirs dans la machines vapeur", *Comptes Rendus* 14: 632
- [29] Poincare, Henri. (1890). "Sur le problme des trois corps et les quations de la dynamique". *Acta Math*. 13: 1270. uvres VII 262490 (theorem 1 section 8)