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Photon Decay Hypothesis in Cosmological Models: Revisiting Primordial Nucleosynthesis Constraints for Alternative Universe Origin Theories

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Abstract: ***This paper critiques existing models of the universe, highlighting their limitations and proposing a new model based on the concept of photon decay. The proposed model challenges the Big Bang theory, suggesting that the universe is boundless but finite and is not expanding. Instead, it proposes a continuous decay of photons into smaller particles, which has significant implications for understanding cosmic phenomena, including redshifts and cosmic microwave background radiation. This theoretical framework offers an alternative perspective on cosmology, emphasizing the need for further exploration and validation.***

Keywords: Photon Decay, Universe Model, Big Bang, Cosmology, Redshift

1. Introduction

It is a very difficult task to unveil the mystery regarding the formation and beginning, evolution and fate of our universe. There are a number of proposals about the model of the universe, but till now none has been established to be correct because no concrete evidence can be obtained easily in favour of any of the proposed models, rather each model has some serious drawbacks.

What is our universe? Everything present around us, which we can see or even cannot see, which we can feel or cannot feel, which we perceive or even do not perceive, makes our universe. All visible and invisible objects present up to an infinite distance around 360^0 solid angle from our earth are to be included into our universe. Everyone can see innumerable stars and galaxies every night in every direction of space. How big our universe is? Theoretically its volume is infinite, i.e. it should be of spherical shape with infinite radius. Up to this much we can think about our universe. But in actual case some unexpected consequences arise during determination of its size, volume, time of birth, fate etc.

The purpose of this article is to propose a new theoretical model of the universe based on photon decay, offering an alternative explanation to the Big Bang theory and expanding our understanding of cosmic phenomena.

2. Methods of size determination

2.1 Now, let us try to find out the probable size or volume of our universe and for this we have to detect the possible farthest object present in every direction of space around us. The main criterion for such measurement is that some information must come to us from that farthest object. Who will be the information carrier for this purpose? The one and only one such carrier is the light itself, i.e. the only signal which can come to us carrying some information about that object is the electromagnetic radiation or the photons. No information carrier other than light is not known to us at present, which can bring some information from such remote objects. Again, a distant object should be sufficiently luminous for its detection ---- the more is the distance of an object from us the more should be its luminosity. Now, let us find out the detection limit of an object on the basis of its luminosity with distance in the following way.

At first, let us calculate the detection limit of a light source with respect to its luminosity and distance. The necessary condition for an object to be detectable (or visible) to an observer is that sufficient light from that object must come to the observer, i.e. for a good detection sufficient intensity of light at the point of observer is essential. An electric bulb of 100 W power emits total energy, in ideal case, at the rate of 100 Joule per second (J/s) in all directions of space around it and for simplicity let it emits only yellow light having wavelength of 6000A ($\lambda = 6 \times 10^{-5}$cm.). Then total number of yellow photons (X) emitted per second will be 3×10^{20}. The intensity (I) of light decreases with distance and it is inversely proportional to the square of the distance (r). In Table-I, the intensity (I) in terms of number of yellow photons passing through one square centimeter ($1cm^2$) area per second at a given distance is shown. The relation used is

$$I = \frac{X}{4\pi r^2} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (2a)$$

Where, I = Intensity, X = Total number of yellow photons emitted by the light source per second, r = Distance where the intensity is calculated.

Table I: Variation of intensity of light with distance.

Distance (in cm)	10^2	10^4	10^5 (1 km)	10^6 (10 km)	10^7 (100 km)	10^8 (1000 km)
I (No of photons)	2.4×10^{15}	2.4×10^{11}	2.4×10^{9}	2.4×10^{7}	2.4×10^{5}	2.4×10^{3}

Is it possible to detect a 100 W bulb from a distance of 100 km? It seems almost impossible. Even if it be made possible with the help of a very powerful detecting device, then the critical intensity (I) will be around 10^5 to 10^6 yellow photons

passing through 1 cm^2 area per second at that point. But it can be firmly said that a 100 W bulb can never be detected at a distance of 1000 km by any means.

Now, applying the same principle, let us calculate the detection limit of stars, galaxies and other celestial objects around us. Luminosities of different celestial objects are known to have the following values ----

Our sun (Sun-1) = 4×10^{26}W
Milky Way Galaxy (GX-1) = 4×10^{37} W

For comparison other sun like stars having brightness 10^3 times (Sun-2),10^5 times (Sun-3) that of our sun (Sun-1) and other galaxies having brightness 10^3 times (GX-2), 10^5 times (GX-3) that of our galaxy (GX-1) are also considered. Assuming the same rate of brightness, the super black-hole U-1 which is wrongly taken as our universe[1] should have a luminosity of 4×10^{47} W. In all cases, approximate values are taken. In Table - II intensities of various celestial objects are shown as a function of distance.

Table II: Variation of Intensities of different celestial objects as a function of distance

Objects	Power (in W)	X (No. of yellow photons)	I (Intensity at a distance of)			
			1 AU	1 BLY	15 BLY	100 BLY
Sun-1	4×10^{26}	1.2×10^{45}	4.24×10^{17}	9.55×10^{-11}	4.24×10^{-13}	9.55×10^{-15}
Sun-2	4×10^{29}	1.2×10^{48}	4.24×10^{20}	9.55×10^{-8}	4.24×10^{-10}	9.55×10^{-12}
Sun-3	4×10^{31}	1.2×10^{50}	4.24×10^{22}	9.55×10^{-6}	4.24×10^{-8}	9.55×10^{-10}
GX-1	4×10^{37}	1.2×10^{56}	4.24×10^{28}	9.55×10^{0}	4.24×10^{-2}	9.55×10^{-4}
GX-2	4×10^{40}	1.2×10^{59}	4.24×10^{31}	9.55×10^{3}	4.24×10^{1}	9.55×10^{-1}
GX-3	4×10^{42}	1.2×10^{61}	4.24×10^{33}	9.55×10^{5}	4.24×10^{3}	9.55×10^{1}
U-1	4×10^{47}	1.2×10^{66}	4.24×10^{38}	9.55×10^{10}	4.24×10^{8}	9.55×10^{6}

Here, 1 AU (Astronomical Unit) = Average distance between Earth and Sun = 1.5×10^{13} cm.

X = Total number of yellow photons emitted per second. 1 LY = 9.467×10^{17} cm $\simeq10^{18}$ cm.
1 BLY (Billion light year) = 10^9 LY = 10^{27} cm.

Probable masses of certain celestial objects are as follows –

Earth = 6×10^{27}g, Sun (Sun-1) = 2×10^{33}g, Milky Way Galaxy (MWG) =10^{46}g, Universe (U-1)= 10^{56}g, U-2 = 10^{72}g, U-3 =100^{100}g and so on. U-2, U-3, U-4... etc. are imaginary universes if the actual universe may be of much larger size than our estimated universe U-1.

It is clear from Table-II that our sunlike objects and even other brighter objects like Sun-2, Sun-3, GX-1 and GX-2 will remain undetectable at a distance of 1 BLY and hence they will remain invisible and unknown to us. Only GX-3 like objects will be detectable just at 1 BLY distance. All objects like Sun-1 to GX-3 will remain invisible at 15 BLY distance, but only U-1 like objects can be detected even at a distance of 100 BLY provided they can throw light into outer space because it has been shown in my previous paper that U-1, U-2, U-3... etc. are nothing but super black-holes. Even if, there are a quite good number of objects like Sun-1 to GX-3 at or beyond a distance of 15 BLY evenly distributed in the very same way as we see around us within a few million light year distance, yet they cannot be detected at all and they will remain unknown to us for ever. A sunlike star should be 10^{20} times luminous than our own sun and a galaxy should be 10^9 times luminous than our own galaxy (GX-1) to be detectable by us from a distance of 15 BLY. Is it possible for a sunlike star to be such tremendously luminous (power = 4×10^{46} W) ? If it be so, then what will be the nature of that object and how much will be its temperature? Perhaps there will be no such sufficiently luminous object that can be detected at a distance of 15 BLY or more. So, there must be a boundary of our detectable universe. Then, who will tell and what will prove that how big our universe is? Therefore, on the basis of luminosity and detection limit we are compelled to assume that our universe is a sphere of radius of merely 15 BLY, although the actual universe may be of much larger size than this. Even if, we can increase the detection limit of measuring device to any higher degree again there must be a boundary of the universe beyond which no object can be identified. So, it becomes clear that it is almost impossible to find out the actual size and volume of the universe by this method.

2.2 During cataloguing of stars and galaxies Edwin Hubble surprisingly noticed that all stars and galaxies were receding away from each other and the more is the distance among them the more is the rate of recession irrespective of their direction of position in the sky. This is known as Hubble's law[2]. Actually, this was indicated by the red-shift of light emitted from them. As we go more and more into the past, the stars and galaxies as well as all objects in the universe were closer and closer. As a consequence of Hubble's law it has to be assumed that our universe has a beginning and it is the 'Big-Bang'. Some 14 billion year (14 BY) ago our present universe has evolved through a tremendous explosion known as 'Big-Bang' and started to expand ---- this expansion is still going on.

Hubble's law can be stated as "The rate of mutual recession (V) of two objects (stars or galaxies) is directly proportional to the distance (L) between them" and mathematically this can be shown as ----
$V \propto L$

or, $V = H L$ .....(2b)

where, H = Hubble's constant.
The value of 'H' was primarily estimated to lie in the range of 60 to 75 km/s per MPc and now the accepted value is nearly 70 km/s per MPc. Here,

1 parsec (1 Pc) = 3 LY = 3×10^{18}cm
1 MPc (1 Mega Parsec) = 10^6 Pc = 3×10^{24} cm

According to the Special Theory of Relativity (STR) by Einstein, the maximum limiting speed in the universe is that of light (c) and nothing can move faster than light. As a consequence of Hubble's law it is evident that the velocity (V) of mutual recession between two objects will be that of light when they are situated sufficiently apart from each other depending on the value of Hubble's constant "H". Now, let us

calculate such distances (L_c) for different values of "H" by rearranging the Hubble's equation (2b) as follows –

L = V/H

or, L_c = c/H ..... (2c)

when V = c, L = L_c.

In Table-III different values of L_c for different values of 'H' are shown.

Table III: Different values of L_c corresponding to different values of H

H (in Km/s per MPc)	50	55	60	65	70	75	80	90
Lc (in BLY)	18	16.36	15	13.85	12.86	12	11.25	10

One example of above calculation is shown below:-

H = 50 Km/s per MPc = $\frac{50\times10^5\ cm/s}{3\times10^{24}\ cm}$ =$1.67\times10^{-18}s^{-1}$

$L_c = \frac{c}{H} = \frac{3\times10^{10}}{1.67\times10^{-18}}$ cm = 18×10^{27} cm = 18 BLY

Similarly, all other values can be obtained.

Since a light signal from one object can never reach the other when the velocity of their mutual recession exceeds that of light; therefore, two such objects will remain completely unknown to each other for ever. Thus, our observable or communicable universe will be merely a sphere of radius 18 BLY at the maximum (when H = 50 Km/s per MPc) and 10 BLY at the minimum (when H = 90 Km/s per MPc) as shown in Table-III. As the universe is expanding, stars and galaxies are gradually and continuously disappearing for ever from the boundary of our observable universe each and every moment. Even if the actual universe be much larger in size, we shall be completely ignorant of that. We cannot firmly say what is the actual size of our universe. If we go more and more into the past, more and more disappeared and unseen objects would come within our vision keeping the size of the universe same, because we cannot find out the actual boundary of the universe. Even if we go back 14 BY into the past, the universe would appear the same as we see now, because there is no concrete evidence against this. So, from Hubble's law it becomes evident that the size of our observable universe remains the same whether we go back into the remote past (of 14 BY or 30 BY or 100 BY or even more) or we go forward into the far future. This directly contradicts the time of Big-Bang and also the idea of Big-Bang. Moreover, the observable universe is continuously losing massive objects as the expansion is constantly going on and hence it can be concluded that the universe is heading towards a zero density, i.e. a time will come when there will be no material particle within it. Is it true or is it possible at all ? Now, it is better to conclude that it is impossible for us to determine the actual size of our universe.

3. Existing Models of the Universe

3.1 The Standard Model of Cosmology (SMC)[3] was widely accepted by many scientists in the world. According to SMC our universe was created in the Big-Bang from pure energy and is now composed of about 5% ordinary matter, 27% dark matter and 68% dark energy. The solution of Friedmann's equation showed that the space itself is expanding and the galaxies are at rest within the expanding space. Thus the red-shift for each galaxy is a consequence of the wavelength of the light being stretched by expansion of space and is not a Doppler red shift. Again, according to Steady State Theory (by H. Bondi, T. Gold[4] and also by F. Hoyle[5]), the universe is always expanding maintaining a constant average density of matter and matters are continuously created to form new stars and galaxies at the same rate that old ones become unobservable as a consequence of their increasing distance and velocity of recession. A steady universe has no beginning or end in time. But the discovery of CMB (Cosmic Microwave Background) has changed the idea towards Big-Bang model and from then the Steady State Theory became less important.

3.2 According to Friedmann's Model, the space itself is expanding and galaxies are at rest within the expanding space. Red shift is nothing but stretching of wavelength of light due to expansion of space itself, i.e., it is not a Doppler Effect at all. This means that the space is one whose expansion is possible and conversely one must have to assume that contraction of space is also possible. As the wavelength of light increases its energy decreases, then where the energy will go or who will take up it? Then it must be assumed that the energy is taken up by the space for its expansion; it means that energy is needed for its expansion and hence work has to be done to do this. Therefore, in the reverse process energy must be released during contraction of space ---- then who will take up the released energy or where the energy will go? These two changes can be shown as ----

i) Space + Energy $\xrightarrow[\text{Expansion}]{}$ Expanded Space

ii) Space $\xrightarrow[\text{Contraction}]{}$ Compressed Space + Energy

Now, the vital question is which one of the two changes will be spontaneous and why?

During contraction, energy content of the space will decrease and hence from thermodynamic principle, we can say that this should be the spontaneous process. If it be true, then space is one which has an inherent tendency to undergo contraction automatically and hence there is no opposing force to prevent it. Whether this is true or not is not clearly known to us.

Again, according to Steady State Theory, as universe expands matter is continuously created to form new stars and galaxies at the same rate that old ones become unobservable as a consequence of their increasing distance and velocity of recession. What does this mean? Space is one which can create matter. Then what is the composition of space? Does it contain essential ingredients from which matter can be created? If it be so, then in what form they exist in the empty space? The answer is not known. Again, if it be not so, i.e. space does not contain such ingredients then it must be assumed that something can be produced from nothing ---- Is it scientifically true? Conversely, during contraction of space it must have to be assumed that matter should vanish into the space. How is this possible? What will be the mechanism behind this? So, it is better to assume that either expansion or contraction of space is not possible at all.

Now, it is seen that existing models about the universe cannot be accepted because they have some serious drawbacks. Even the widely accepted Big-Bang Model and expanding universe cannot be accepted as it also has few serious defects as shown in my previous paper[6].

Now let us have a discussion on some important relevant parameters regarding our universe such as temperature, singularity, Cosmic Microwave Background (CMB), etc.

4. Temperature of a system

It has so far been established that the temperature of a system containing some material particles such as atoms, molecules etc. is nothing but a measure of various types of agitations or motions of the constituent particles of it.

It has been thought that at the time of its birth, i.e. at the time of Big-Bang, our universe did not contain any material particle; it had only energy in the form of EM-radiation or at the same time in the form of photons. For a system containing only photons and no material particle, should there be a relation between temperature and energy of the photons? Obviously, there must be such relation and then it would be quite feasible to assume that the temperature would be directly proportional to the energy of the photons. Again, energy of a photon means its kinetic energy (K.E.) only, i.e. K.E $=\frac{1}{2}mc^2$ where, 'm' is the mass of the moving photon[7] and 'c' is the velocity of light. Thus the relation becomes –

T $\alpha \frac{1}{2}mc^2$

Or, T= $\frac{1}{2}k^1mc^2$

Or, m = $\frac{2T}{k^1c^2}$ ……..(4a)

where, T = Temperature, k^1 = Proportionality constant whose value is not known to us, c= Velocity of light.

A table (Table-IV) can be prepared from the above relation (4a) and now k^1 is taken to have a value of unity (later its value will be predicted). Now, equation (4a) becomes –

m = $\frac{2T}{c^2}$ …….(4b)

Here, the value of $2/c^2$ in C.G.S. unit becomes 2.22 x 10^{-21} sec^2/cm^2.

Table IV: Different values of 'm' corresponding to different values of 'T'

T (in K)	1	10	100	10^6	10^{10}	10^{20}	10^{30}	10^{35}
m (in g)	2.22×10^{-21}	2.22×10^{-20}	2.22×10^{-19}	2.22×10^{-15}	2.22×10^{-11}	2.22×10^{-1}	2.22×10^{9}	2.22×10^{14}

It has been estimated that at the time of its birth the new-born universe had a temperature in the range of 10^{30} to 10^{35}K. From Table-IV it is clear that mass of the photons was in the range of 10^9 to 10^{14}g at temperature range of 10^{30} to 10^{35} K respectively. But such extremely large values of photon masses are almost impossible and hence the value of constant k^1 must be very large.

On the other hand, when there are material particles within a system, it will behave as a black body. Our new born universe, after some period of time, contained some material particles such as newly formed atoms of H, He,....etc. and would behave as an ideal blackbody and the emitted radiation from it would obey Wien's displacement law which is

λ_{max}T = Constant (= 0.2892 cm.K)…….(4c)

Where λ_{max} is the particular wavelength at which the maximum amount of energy is emitted by a system at temperature TK. In Table-V the values of λ_{max} with energy and mass equivalent corresponding to different temperatures are shown.

Table V: Values of λ_{max} with energy and mass equivalents at different temperatures.

T (in K)	λ_{max} (in cm)	Energy equivalent E (in M_{ev})	Mass equivalent (in g)
10^{-6}	2.89×10^{5}	1.196×10^{-17}	2.13×10^{-44}
10^{-3}	2.89×10^{2}	1.196×10^{-14}	2.13×10^{-41}
1	2.89×10^{-1}	1.196×10^{-11}	2.13×10^{-38}
100	2.89×10^{-3}	1.196×10^{-9}	2.13×10^{-36}
10^3	2.89×10^{-4}	1.196×10^{-8}	2.13×10^{-35}
10^6	2.89×10^{-7}	1.196×10^{-5}	2.13×10^{-32}
10^9	2.89×10^{-10}	1.196×10^{-2}	2.13×10^{-29}
4.26×10^{10}	1.23×10^{-11}	0.51	9.08×10^{-28} (=m_e)
7.82×10^{13}	$3{,}7\times10^{-13}$	935	1.66×10^{-24} (=m_p)
10^{20}	2.89×10^{-21}	1.196×10^{9}	2.13×10^{-18}
10^{30}	2.89×10^{-31}	1.196×10^{19}	2.13×10^{-8}
4.68×10^{36}	6.2×10^{-38}	5.6×10^{26}	1.00
4.68×10^{39}	6.2×10^{-41}	5.6×10^{29}	1000 (=1 Kg)

N.B.: m_e = mass of electron, m_p = mass of proton

It is seen from the above table that a system at a temperature of 4.26×10^{10} K. will emit maximum amount of γ-ray having mass equivalent to that of an electron and at 7.82×10^{13} K it will emit photons of mass equivalent to that of protons and neutrons. At still higher temperatures the mass equivalent of emitted photons by a system will be 2.13×10^{-8}g, 1 g and 1000 g (1 kg) at temperatures 10^{30} K, 4.68×10^{36} K and 4.68×10^{39} K respectively. Is it possible for a system to emit photons having mass equivalent in gram (g) or kilogram (kg) range ? If it be not so, then it is not possible for the new born universe to have a temperature in the range of 10^{30} to 10^{40} K.

Now, let us try to have a probable value of the constant 'k^1'. The values of Table-V is acceptable and comparing these values with those of Table-IV we get the value of k^1 as

At 1 K, $k^1 = \frac{2.22\times10^{-21}}{2.13\times10^{-38}} = 1.04\times10^{17}$

and at 10^{30} K, $k^1 = \frac{2.22\times10^{9}}{2.13\times10^{-8}} = 1.04\times10^{17}$

Therefore, the probable value of k^1 becomes nearly 10^{17}.

Again when a given region of space does not contain any matter and even any energy, then the region should be called perfect vacuum. It does not matter at all whether the real existence of such a perfect vacuum space is possible or not, but we can think of it easily. Then the question is - "Should a perfect vacuum have any temperature?" If it be yes, then what is responsible for its temperature rather what is the actual cause for its temperature? It is known that any system (solid, liquid, gas or plasma) containing any type of material particle can show a definite temperature (> 0 K) only when its particles possess any type of motion such as translational, rotational, vibrational etc. and if there is no such motion the system will not show any positive temperature, i.e. its temperature will be zero Kelvin. Thus, it can be firmly said that no EM-radiation (or photons) can come out from a perfect vacuum, i.e. a vacuum can never be a source of photons. So, a perfect vacuum will show a temperature of zero Kelvin provided that the idea, "The lowest possible temperature in the universe is absolute zero" remains true.

If the existence of perfect vacuum becomes impossible, then any region of space must contain either energy (photon) or matter or both and consequently that region of space should have some definite temperature (> 0 K) provided it has not attained the state of BEC (Bose-Einstein Condensate). Again, if a system contains only energy (photons) and no matter at all and it has attained the BEC state, then its temperature will be zero Kelvin and consequently all the energy photons will remain at complete rest having no motion at all, because it has been shown earlier that a system containing only moving photons can show a definite positive temperature. Therefore, in a nutshell, it can be said that the temperature of a system is the outcome of various motions of the constituent particles present in it.

It is well-known that the temperature of a system or a material body can be raised by supplying heat. Heat is a form of energy and it is also a type of EM-radiation or stream of photons lying in Infra-Red (IR) region in the EM-Spectra. On absorbing heat i.e. by taking up IR-photons, the constituent particles present in the system get energised and the temperature increases, because the more is the energy content of a system the more will be its temperature. Heat can be supplied to a system by keeping it in an environment having higher temperature than it. It is known from Stefan's law that any system having a positive temperature (> 0 K) will spontaneously emit radiations into the surrounding environment in the form EM-wave or photons and this is an inherent property of each and every system in the universe. But a system having a temperature of zero Kelvin (0 K) cannot emit any radiation. Theoretically, it can be said that once the photons are ejected from a system having a definite temperature (> 0 K) can continue its journey up to an infinite distance in all directions of space around it provided they do not face any obstruction in their path and to do this the photons must not lose energy. Thus, a photon ejected just now from a source having a definite energy can be detected after 100 BY (or more) at a distance of 100 BLY (or more) from the source in a particular direction towards which the photon started it journey. Is this possible?

How a system can continue to remain at a fixed temperature ? For this, the system must have to be in thermal equilibrium with its surroundings, when the amount of energy received by the system from its surroundings should be equal to that emitted by itself into its surroundings; but the exchange of energy is never stopped. When the amount of exchange energies become unequal, cooling or heating of the system will be noticed. Any system in the universe can never stop emitting radiation in the form of EM-wave or photons into its environment so long it remains at any temperature greater than zero Kelvin.

Now, we can think of a special situation which is discussed below. Let a system containing particles and also remaining at a definite temperature (> 0 K) is surrounded by perfect vacuum so that no radiation can come into the system from its surrounding environment. What will happen then? The system will continuously emit energy in the form of EM-wave or photons into its environment, as a result its temperature will continuously decrease and finally it must have to attain a temperature of zero Kelvin. Is it possible for such a system to exist? The answer is certainly 'NO'. Because as the system continuously emits radiation into its environment the perfect vacuum character of it will be lost and the environment will attain a definite temperature and hence the system can never attain a temperature of zero Kelvin.

5. Singularity

What is singularity? According to the recent views of our scientists the term can be discussed as shown below –

"A singularity describes the centre of a black hole, a point of infinite density and gravity from which no object can ever escape, not even light. This would lead to a spacetime with an infinite curvature. The current knowledge of physics breaks down at the singularity and cannot describe reality inside of it. Singularities are predicted to exist in black holes in the theory of General Relativity (GR) by Einstein".

What is a black hole? A black hole is one from which nothing (including light) can escape. What will be the composition of a black hole and how can it be determined? Since, no information can be obtained from a black hole by any outside observer, then it is not possible for anyone to have any idea about the composition of a black hole. What one can do about this; he can only have a hypothetical idea based on his present-day knowledge and it may be purely imaginary having no reality. It has been shown in my previous paper that there are different types of black holes. Even our so-called universe (U-1) having a mass of nearly 10^{56} g and volume of nearly $10^{85}\ cm^3$ with a radius of 15 BLY (appx.) is nothing but a super black hole. Our universe contains roughly 10^{10} - 10^{12} galaxies each containing a large number of stars, planets with living systems like us. Similar are the cases of U-2 (mass = 10^{72} g, SR = 1.48 x 10^{17} BLY), U-3 and so on. U-2 can contain 10^{16} U-1 like systems and U-3 can contain 10^{44} U-1 like systems. U-2, U-3 ...etc. can have trillions and trillions... of galaxies like MWG and even larger ones within them. Actually, we do not know the proper mass of our real universe. U-1, U-2, U-3 ...etc. are the systems of black holes within a black hole and we are really enclosed within a super black hole U-1. Since U-1 is a super black hole, it is impossible for an outside observer to collect any information about us. Therefore, it is quite natural for that outside observer

to think that U-1 is in a state of singularity. But it is absolutely wrong, because we are not in a state of singularity. Similarly, we cannot collect any information from our nearby such black holes and we don't know the actual composition of them. Even if we assume that our ignorance regarding the actual composition of a black hole does not matter at all, then can we stupidly assume that there is a singularity within every type of black holes? Then, on the basis of pure assumption can we conclude that there should be a state of singularity within such black holes? Obviously, this should be a matter of farce. Therefore, in a nutshell, it can be firmly said that there is no possibility of existence of singularity within any type of black-holes. If our real universe either in the remote past or in far future contains both matter and energy which constitute atoms molecules, stars, planets, galaxies, etc. along with spontaneous occurrence of innumerable incidents each and every moment as we see now around us, then there is no possibility of attainment of singularity by it. But, if we believe that once there was a singularity within our universe, then we have to find out the reason how it was possible in the past or how it will be possible in the future.

Now, let us consider 'Singularity' from a different angle of viewpoint. The state of singularity should be like this. The word single means 'one only' and 'singularity' means "uncommonness" of a system or the state of being singular. Singularity is something that is strange or unusual and cannot be compared with any other thing. How can we say that a system has attained singularity? A system can be said to have attained singularity only when it contains only one kind of particle and nothing of second kind. Can we say that a piece of pure (100%) gold or iron has attained singularity? The answer is 'No', because each atom of gold (or iron) contains definite numbers of protons, electrons, neutrons and many other subatomic particles. It has been shown that there are different types of black holes and they contain different types of material particles and hence no singularity is possible within them. If the gravitational collapse of a system can continue to such an extent that all material particles are fused together to produce a single particle (obviously of unknown nature) to produce a blackhole having almost zero volume and infinite density, only then it is possible for that system to attain singularity. But again there is a confusion. How can we say or how can it be proved that the system has converted into a single particle, because no information can be obtained from it by us. Is it possible for our real universe to attain such singularity? Obviously at present our universe is not in such a state. How and when this will be possible? Let us try to realize it later.

6. Cosmic Microwave Background (CMB)

Now let us have a discussion on CMB. What is known to us as CMB? It is known that CMB is the "Cosmic Microwave Background" and it is also known as "Relic Radiation". It was discovered by Arno Penzias and Robert Wilson in 1965[7], for which they were awarded with Nobel Prize in Physics in 1978. CMB is regarded as a proof of Big-Bang. The first or the oldest electromagnetic radiation which was produced during recombination epoch by the new born universe just after 380000 years (approx.) of its birth via Big-Bang, is nothing but the today's CMB. At that time atoms were first formed and photons had started to travel freely through space. Since then nearly 13.8 billion year have passed up to now. Those photons that existed during photon decoupling era have been propagating ever since though getting less energetic due to expansion of space causing their wavelength to increase over time. At present, wavelength of CMB is nearly 1.063 nm or 10630000A (282 GHZ, 1.186 x 10^{-3} ev). It is isotropic, i.e. it is not associated with any star or galaxy or any other object. These are the findings about CMB.

Now let us try to have a proper explanation of the above finding about CMB. It has been estimated that during recombination epoch the universe had a temperature of nearly 3000 K and early universe would behave as an ideal black body. So, according to Wien's Law the most abundant radiation emitted at that time would have wavelength (λ_{max}) of 9640A (IR-Zone) and this wavelength has elongated to about 10630000 A at present, i.e. nearly 1100 times elongation has taken place. What is the mechanism of such elongation? It has been already discussed in para 3.2, where it was indicated that the expansion of space is the actual cause of elongation. Is it possible at all for the space to undergo expansion or contraction? If it be possible, then what is the actual cause of expansion rather what compels the space to expand? According to Big-Bang model it must have to be assumed that there was no free space before Big-Bang and space has started to expand as the universe has started to expand via Big-Bang. Before Big-Bang the universe had zero volume and hence there was no space around the primordial egg. After Big-Bang space was created due to expansion of universe and all the space was enclosed within the boundary of the expanding universe whatever be its size or volume, i.e. no extra space was there outside its boundary and still now there must be such boundary wall of the present universe. Hence, it must be assumed that no radiation would go outside the boundary of the universe, i.e. all the radiations emitted at the early stage of the universe would have been confined within it and these are the today's CMB. Then, what were they doing for such a long period of 14 billion year? Were they wandering about for such a long period of time? But where was so large space in the baby universe? At the beginning the universe had a very small size of spherical shape and its size was continuously increasing with time due to its expansion. Then, one must have to assume that either the so-called oldest radiation got rebounded or reflected many times from the boundary wall of the universe for a long period of time of 14 BY and so doing energy of the early radiation has decreased and wavelength has increased to be converted into todays CMB. This becomes only possible when the speed of light of relic radiation was greater than the rate of expansion of the early universe. But if it be not so, i.e. if the rate of expansion of the early universe was much greater than speed of light, then there should be many places where still now the CMB has not yet reached and we are present at a place where CMB has just reached few years ago, and this indicates that we are present in the outer part of the universe and not in the central part. At the same time it can be also assumed that in those places where CMB has not till now reached, the formation of stars, planets, galaxies, living systems like human being are going on smoothly as in our place. Is it true or possible? Again, if the CMB is regarded as the glow of Big-Bang, then how long it will come to our earth? One day it must be stopped in future, i.e. it cannot continue to come to our earth for ever. Then, how will the energy of early radiation be conserved? Is

it correct that during such long journey their energy has automatically decreased and wavelength has increased to attain the present value? Then, it must be assumed that during such long journey in free space every radiation must suffer energy loss. Perhaps, there is no proper explanation of the energy loss of the so-called 'Relic Radiation'. An alternative explanation is given below.

At present, it has been established that inter-stellar and inter-galactic spaces are not perfect vacuum, rather filled with fine material particles such as atoms of H, He, along with those of other higher elements, molecules and also many bigger particles although their density is extremely small. H and He are the main constituent of the universe while atoms of higher elements are produced in stars through nuclear fusion reactions and they are thrown into space during their explosion as supernova or nova. Our sun is a 3rd or 4th generation star and at the time of its birth it contained H and He along with higher elements. Similarly, inter-galactic spaces also contain many such material particles as mentioned above. At present, these inter-stellar and inter-galactic regions have attained a temperature of nearly 3 K. A perfect empty space must have no temperature at all and to have some temperature (> 0 K) presence of material particles is essential. No EM-radiation or photons can come out from a perfect vacuum, i.e. vacuum space can never be a source of photons and for this presence of matter is essential as the source. Thus, these particles remaining at 3 K temperature will behave as an ideal black body and λ_{max} for this temperature, according to Wien's law, will be 0.0964 cm (=9640000A) and if the temperature of the said zone be 2.72 K (instead of 3 K), the λ_{max} value will be nearly 10630000 A which is equal to that of CMB. According to Stefan's law, any material body having any temperature greater than zero Kelvin must radiate energy in the form of EM-wave (wave theory) or in the form of photons (Quantum theory). The distribution of these material particles is almost uniform in every directions of space around our earth when we consider a spherical space of few thousand to few million light year radius around earth. The radiations emitted by these particles will come to our earth from all directions of space having almost the same intensity and this is wrongly taken as Relic Radiation or CMB by us. These are not actually produced before 14 BY, rather they are produced in the near past. Since there are no concrete evidence regarding the origin and time of production of CMB, this proposal can be accepted easily. These radiations will continue to come to our earth for ever and they will be never stopped, whereas the so-called CMB must cease to come to our earth one day. In this case, there is no problem regarding the energy conservation of these radiations. Therefore, it is meaningless to accept CMB as a proof of 'Big-Bang'.

From the above discussions it becomes clear that so far proposed models of the universe cannot be accepted because each of them has many serious drawbacks. Now, let us try to have a new model of the universe.

New Model of the Universe

7.1. If we try to determine the actual size or even probable size of our universe, we do not get any conclusive result, rather we get an indication that our universe has a spherical shape with a maximum radius of 15 BLY. Whatever be the method of such determination, may it be on the basis of Hubble's law or on the basis of luminosity and detection limit, in each case we have strong evidence that even if the universe has its existence much before 15 BY or 50 BY or 100 BY or more we have nothing to do with this, because we can never find out any clue by any means in favour of its such existence. But if we reject the idea of Big Bang, then we must have to accept the idea that our universe has its existence much before 15 BY and actually there are many evidences in favour of the non-existence of Big Bang as mentioned earlier.

7.2. Is it possible for a photon to travel an infinite distance without any change of its energy (or frequency) ? The answer is certainly 'No'. Suppose a photon was emitted from a source before 15 BY and it is now detected by us having the same energy as it had at the time of its birth, i.e. it means that the photon has retained the same energy even after travelling a long distance of 15 BLY. But, this is not possible at all. It has been shown in my previous paper[8] that 'Moulikanas' (MKs) are the smallest and fundamental building unit of everything in the universe including photons, electrons, protons, neutrons, atoms, molecules, planets, stars and galaxies etc. and there should be no material particle smaller than it. Moulikanas are the material particles and similarly all photons are also material particles. Each photon contains a large number of MKs; photons are produced through unification of definite number of MKs and at least two MKs are required to be united to make a photon. As mentioned earlier that the idea of expansion or contraction of space is questionable and hence the idea should be discarded, i.e, neither contraction nor expansion of space is possible at all. It is hereby proposed that during motion each photon in the universe decays into smaller photons having lower energies through continuous emission of Moulikanas into the environment. The photon decay process is discussed in the next para and many puzzling problems can be solved by this proposal.

7.3. The new proposition is ----

i) Each photon decays spontaneously into smaller and smaller photons having lower and lower energy through continuous emission of Moulikanas (MKs) into the environment during its journey in free space.

ii) The rate of decay is directly proportional to the number of MKs present within it. The decay process should obey the first order rate equation. Thus, if 'n' be the number of MKs present in a particular photon, then the decay law can be represented as —

$-\frac{dn}{dt} \alpha\ n$
or, $-\frac{dn}{dt}$ = z.n, where 'z' is a decay constant
or, $\int \frac{dn}{n} = -z\int dt$
or, $\ln n = -zt + c'$

where c' is the integration constant. When, t =0, n = n_0 (say), so, $c' = \ln n_0$
Then
$\ln n = -zt + \ln n_0$
or, $\ln\frac{n}{n_0} = -zt$

or, n = $n_0 e^{-zt}$

or, t = $\frac{2.303}{z}\log\frac{n_0}{n}$ ……(7a)

Half-life ($t_{\frac{1}{2}}$) can also be determined in the same way as in case of radioactive decay law.

When, n= $\frac{n_0}{2}$, then t = $t_{\frac{1}{2}}$

Therefore, $t_{\frac{1}{2}} = \frac{0.693}{z}$ ……(7b)

The value of the constant 'z' is yet to be determined. As the number of MKs decreases by decay process within a given photon, its energy as well as frequency also decreases. The rate of decay is very slow and to have a noticeable change in the energy content of a photon it must have to travel a very long distance.

Now, let us try to calculate the probable value of the constant 'z' theoretically. In our previous discussion on CMB it has been shown that an elongation of 1100 times (nearly) of the wavelength of the Relic Radiation has taken place during its journey for a period of 13.8 BY along a distance of 13.8 BLY. If it be assumed that the elongation has occurred only due to this decay process of photons, then the probable value of 'z' can be obtained as shown below —

Since λ is inversely proportional to 'n' (no. of MKs present in a photon), then we have

$\frac{\lambda_2}{\lambda_1} = \frac{n_1}{n_2} = 1100$

Here, t = 13.8 BY and 1 BY = 3.156×10^{16} sec

So, z= $\frac{2.303\times\log 1100}{13.8\times3.156\times10^{16}}\ sec^{-1} = 1.608\times10^{-17}\ sec^{-1}$

On the basis of this value of 'z', $t_{\frac{1}{2}}$ of a photon will be

$t_{\frac{1}{2}} = \frac{0.693}{1.608}\times10^{17}$ sec = 4.31×10^{16} sec = 1.367 BY

This value of 'z' may not be true. Its actual value will be known to us only when its proper measurement will be possible.

7.4. The new model of the universe is hereby proposed in the following way —

a) The universe is boundless but finite. However, its size and mass are beyond our imagination and also beyond our skill of measurement at present as discussed earlier.

b) The process of photon decay will appear to us as Doppler effect showing red-shift only and for this apparent Doppler effect we had to wrongly adopt the idea of Big Bang and expanding universe. So, the idea of Big Bang is totally meaningless and hence it must be rejected; and there is no question of expanding universe. Actually the universe is not expanding at all.

c) When there was no material particle and even no photon, the whole universe was filled up with the Moulikanas (MKs) only, because they are the only smallest and fundamental building unit of everything in the universe. This was the original condition of the universe. There was only one kind of particle (only the MKs) everywhere in the universe and nothing of second kind and they were wandering about at random covering the whole universe. Hence the universe was in a state of singularity. There was no incident, no happening, no change (chemical, physical, nuclear or any other type) and also there was none to observe this condition and hence there was no existence of time. It is meaningless to try to imagine how long had this original state of the universe existed, because there is no means to determine it. Through unification of MKs creation of photons, electrons, protons, neutrons, atoms, molecules, planets, stars, galaxies up to black holes took place step by step. As soon as photons are produced, the changeable universe, as we see now, was born and the time has begun to flow. It might have taken 15 BY or 50 BY or 100 BY or 1000 BY or even more by the universe to come to this present state from its original state of singularity. Again, there is no means to determine the present age of the universe.

d) At present, two processes — 1) unification of MKs into photons including all material particles and 2) decay of photons into MKs are going on side by side. What will be the fate of the universe? This cannot be firmly predicted; however two main possibilities are there

i)The abovementioned two changes 1 & 2 will go on for ever ; however sometimes 1 may dominate over 2 or 2 may dominate over 1 keeping the changeable universe same as we see now, i.e. the present condition of it will continue for ever with fluctuating amount of matter and energy. When the amount of energy and matter is small and that of MKs is large, then the process 1 may dominate over 2 ; conversely the process 2 may dominate over 1 when the reverse condition will be achieved by the universe. This means that once the initial condition of singularity of the universe containing only MKs is broken down, it will continue to exist for ever containing varying amount of MKs, energy (photons) and matter together along with the two processes 1 and 2 occurring side by side.

ii) The second possibility is that the universe may come to its original state of singularity containing only MKs. This may take place in the following way. All the material particles will evaporate into energy particles (i.e. photons) and then all the photons will decay completely into MKs. Since, like everything, the universe should have a strong tendency to go back to its initial position from which it was created, the process of complete evaporation of matter and energy into MKs will be possible and then the universe can attain its original state of singularity. After that the universe will start its second phase of life and this will continue periodically for ever. However, it can never be known to us how many such life phases have already passed.

iii) There is also a third possibility. All the MKs present in the whole universe may unite to form a single particle and there will be only one particle in the universe and this will be also a state of singularity. But this possibility is very small. It is known that during formation of stars through condensation of material particles (under gravity) distributed over a very large space, a huge amount of mass are always left outside the star to conserve angular momentum and also during formation of

black holes through explosion of massive stars (nova or supernova) again a huge mass (30% to 70% of the mass of the star) are thrown into outer space every time. So, it is clear that complete condensation of the whole mass in a given region of space into a star or a black hole is not possible. Similarly, the condensation of all the MKs of the universe into one particle should obey the same principle of star and black hole formation and hence this is not possible at all. Moreover, as the original state of the universe was not in the form of a single particle, the final state of it should not be a single particle i.e. the universe should have no tendency to be converted into a single particle. This is the most probable reason that the universe cannot attain this singularity.

7.5. The proposed model of the universe on the basis of photon decay process is self-explanatory, which can easily explain all the previously mentioned discrepancies. These are summarized below ----

1) In this new model there was no big-bang and the universe is not expanding at all and hence there is no time limit of 13.8 BY or 15 BY towards the past. This means that stars and galaxies might have been formed much earlier than 15 BY and their age may be 100 BY or 1000 BY or even more. Therefore, the limiting distance of the farthest object from us should not be 15 BLY, rather it may be 100 BLY or 1000 BLY or even more. Discovery of an object situated at a distance greater than 15 BLY will experimentally verify the proposed model. However, due to lack of highly sensitive detecting device we are unable to detect now such distant objects as mentioned earlier. But it can be expected that one day in future it will be possible.
2) The process of photon decay will simply appear to us as Doppler effect showing redshift only, which has compelled us to wrongly adopt the idea of bag-bang and expanding universe, rather these are nothing but an illusion.
3) Hubble's law is a simple consequence of photon decay process.
4) Two objects estimated to be situated now at a distance of 15 BLY away from each other, were not at the same point before 15 BY because of non-existence of big-bang.
5) CMB is not actually the proof of big-bang, an alternate explanation regarding its origon was given in item no. 6.
6) Presence of dark energy and dark matter in the universe is clearly indicated in my previous paper[8].

8. Conclusion

If anything has a beginning, it must have an ending; conversely it can also be said that which has an ending it must have a beginning ---- this is the most important and essential principle of the changeable universe. Without this principle the changeable universe does not exist. But if an entity has no ending, then it must have no beginning. Each and every material particle as well as all the energy particles (i.e. photons) will have an ending and all of them have to be ultimately converted into the MKs and hence they all have a beginning. Actually all of them are produced from MKs. But what will be the fate of MKs ? MKs have no ending and hence they have no beginning, because they cannot be split further into anything else, rather the cannot be converted into any other thing. MKs are such particles which have no beginning, no ending and even no intermediate condition. Therefore they need not be created from something, because they are the building material of everything in the universe, i.e. they are the seeds of the universe. Also the original state of the universe containing only Moulikanas (MKs) and having no other particle of second kind need not be created from something. This is the original and unchangeable state of the universe. And this is the actual state of singularity of our universe.

Whatever be the actual size and mass of the universe, we have nothing to do ---- we are completely helpless in this regard. At present our technologies are inadequate to evaluate the universe properly. We have to wait for a super quality technology for this purpose. If we can utilize an information carrier having speed much faster than that of light, then many of the above-mentioned problems may be solved. But no such carrier is available to us now. Finally, it can be said that we are compelled to believe that our universe was there in the remote past, it is now here in its present form and it will continue to exist for ever in any of the above-mentioned forms. Each and everything in the universe were present for infinite time in the past and similarly they will be present for ever in far future ---- however, sometimes it will appear to us as a changeable universe and sometimes it will remain in dormant (unchangeable) state.

In conclusion, this paper proposes a new model of the universe based on photon decay, challenging traditional cosmological theories such as the Big Bang. By addressing the limitations of current models and offering an alternative explanation for cosmic phenomena, this model provides a fresh perspective on our understanding of the universe. Further research and empirical evidence are needed to validate these theoretical propositions and explore their implications for modern cosmology.

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