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A Comparative Study of Sanatan Cosmology and Modern Cosmology Perspectives on the Formation of the Universe

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ABSTRACT

This research mainly focuses on Sanatan cosmology and modern cosmology, both of which deal with the formation of the universe. It starts with the concept of quantum mechanics and vacuum energy, which arise in the null space, and further explores the Big Bang theory, supported by evidence such as Friedmann's equation, cosmic microwave background radiation (CMB), Hubble's Law, and other evidence that describes the formation of the universe from a singularity i.e. a point of infinite energy density which evolved from other cosmological events into the present universe, which is still expanding due to the presence of dark energy and matter that dominate gravitation. This work connects the metaphorical concept of ancient cosmology mentioned in the Bhagavad Gita, where God is considered the supreme source of energy that cannot be destroyed but can change from one form to another. Both concepts suggest that the universe started from energy, and that energy transformed into other forms to create the universe.

1. Introduction

The evolvement of modern cosmology [[1], [2] has solved many mysteries regarding the universe. However, these facts were already mentioned in the ancient Bhagavad Gita and other Sanatan books metaphorically, which precisely match modern cosmological models and theories like the Big Bang [[3], multiverse [4], and parallel universe [5]. However, due to the lack of strong experimental evidence, except for the concept written metaphorically, these facts have not evolved yet and are disappearing from the field of science. This research is going to figure out the mentioned ideas related to the origin of the universe their similarities with modern cosmological theories. By doing so, it seeks to demonstrate that the widely accepted cosmological theories were already mentioned in the Bhagavad Gita thousands of years ago in Sanatan religion. This research mainly focuses on the question that to what extent do the scriptures mentioned in the Bhagavad Gita align with modern cosmological theories like the Big Bang and quantum physics? This research offers a novel blend of science, philosophy and ancient wisdom with the proper verses of the Bhagwat Geeta making it unique from traditional study in cosmology or religious interpretations.

2. Literature review

For centuries people have raised their question regarding the formation of the universe and have their own philosophical ideas for the formation of universe [[6] and now today the cosmological science [7] is able to give the answer to the raised question regarding the universe like its formation, structure and expansion. Today modern cosmology relay on the observation and the complex mathematical relation to explain the formation, structure and expansion of the universe. The theories like Big Bang, quantum physics, the hypothesis like multiverse [8] and parallel universe have reshaped and make our vision board to look in the cosmological entities. But the Sanatan's view of cosmology was even board than today's modern cosmologies since all the concept of formation of the universe given in the Bhagwat Geeta and other Sanatan text precisely align with the theories like big bang, quantum physics and theory of relativity.

Some modern theories, relation and concept for the formation of universe

The Big Bang and the Friedmann's equation: [9]

The big bang theory was first proposed by Georges Lemaitre (1929). It was later confirmed by the observational evidence of research such like red shift [10] , Hubble's law (expansion of universe) [11] and mainly from the Cosmic Microwave Background Radiation (CMB) and Friedmann - Lemaitre (Fl) equation which gives the brief overview of the origin expansion, and concept of big bang and proves it. Friedmann-Lemaitre first equation for the homogeneous and the iso-tropic universe:

$$\left(\frac{\dot{a}}{a}\right)^2 = \frac{8\pi G}{3}\rho - \frac{k}{a^2} + \frac{\Lambda}{3}$$ [12]

Explanation of Terms:

•a: The scale factor of the universe, which measures the relative expansion of the universe over time.
•$\dot{a}$: The rate of change of the scale factor, representing the expansion speed of the universe.
•G: The gravitational constant, a fundamental constant in physics.

•ρ (rho): The energy density of the universe, including matter, radiation, and dark energy.
•k: The curvature parameter, indicating whether the universe is open (k = -1), flat (k = 0), or closed (k = +1).
•Λ (Lambda): The cosmological constant, associated with dark energy, which drives the accelerated expansion of the universe.

Where,
ρm= ρm= matter energy
ρr= radiation energ
$\rho\Lambda$= dark energy

$$\rho = \rho m + \rho r + \rho\Lambda$$

This equation of the Friedmann strongly suggests that the universe began to start from the energy weather in the form of dark energy, vacuum energy (before big bang) or radiation energy everything is started from the energy. It suggests that the energy is the fundamental thing for the creation of this universe.

Similarly, we also have:
$E = mc^2$ [13] [14]

This also suggests that the mass and energy are interchangeable [15], or both are same when considered to the speed of light. And the same energy associated is responsible for the creation of the entire universe. The main source of entire energy (the universe) is associated with the singularity point (the single point of highly dense energy density and the temperature responsible for the creation of the entire universe) since energy cannot be created, only can be transformed with one form to another form.

2.1 Cosmic Microwave Background Radiation (CMB)
Another important piece of evidence supporting the Big Bang Theory is the Cosmic Microwave Background (CMB) Radiation, first discovered by Arno Penzias and Robert Wilson in 1965.
Using a radiometer, they detected faint microwave radiation, which was found to be a remnant of the early universe, dating back approximately 14 billion years. This discovery provided strong observational support for the Big Bang Theory

$$B_\nu(T) = \frac{2h\nu^3}{c^2} \cdot \frac{1}{e^{\frac{h\nu}{kT}} - 1}$$ [16][17][18]

Where:
•h: Planck's constant.
•v: Frequency of radiation.
•c: Speed of light in a vacuum.
•k: Boltzmann constant.
•T: Temperature of the body in Kelvin.

This is an equation of the plank's blackbody radiation which strongly suggests that the fossil radiation of the cosmic background radiation from hot dense plasma which burst, and the radiation of the blackbody is distributed almost equally across the expanding universe. this suggests that the universe once was in hot, dense and in thermalized stage which was termed as singularity in the big bang. Hence, this cosmic microwave background radiation and the plank's blackbody equation support the big bang and the formation of universe from the hot dense and thermalized point or from energy. From the above given research and the equation regarding the formation of the universe have the clear view that the core factor of the formation of the universe is energy, and this cause the creation of existence of entire universe and components of it. But how was this energy created? This explanation is given by the Heisenberg's uncertainty principle in null space.
Energy before the big bang in null space
According to the Heisenberg's uncertainty principle, the two entities in the space i.e. positions and the momentum of any particle cannot be calculated exactly simultaneously. But in context of energy over time we cannot measure the time and energy simultaneously.

$$\Delta E \cdot \Delta t \geq \frac{h}{2}$$ [19]

Where,
ΔE = Uncertainty in energy
Δt = Uncertainty in time
h= Planck's constant (6.626×10^{-34} Js)

Here the relation says that even in vacuum where no particle is present there may the fluctuation in energy can occur due to inherent uncertainty in the system. Due to this energy fluctuation which is termed as quantum fluctuation energy is created in the null space over a short period of time and after which it become the singularity point having infinite energy density and temperature in that null space [20] and big bang happen. In null space the fluctuation in the quantum field [21] has happened due

to which the energy fluctuation began to take place and later it turns into the present universe and finally will be collapse from where it started which is termed as big crunch.
From these relations and expression, we can say that the ultimate source of formation of the universe is the energy weather in the form of dark energy, dark matter or other form every entity is composed of the energy.[22], [23], [24], [25]

In prospective of the Bhagwat Geeta:
The Bhagwat Geeta is one of the ancient religious books full of metaphorical scientific facts. The central story began from the Mahabharata in which the lord Krishna motivates Arjun to continue the war and to get the victory over the evils. During that he told many mysteries of the universe to the Arjun. If we connect that dot or relate some of the verse of it, we can get the idea about the formation of the entire universe. Some of them are listed below:

मया ततममदं सर्वं जगदव्यक्तमम् ूतिना।। (verse 9.2)

Translation--> I pervade this whole world in My unmanifest form Krishna says that he is found in every entity of the entire universe but in unmanifest form, meaning that he is found in everything but not visible all the time.
In context of the modern physics every entity in the universe is associated with energy or composed with energy but we are only able to see the mass even though mass and energy are interchangeable. From our frame of reference, we can't look for that energy. The ultimate source of energy is only one which can be said as supreme energy which is God i.e. supreme energy.

Similarly,

अहमात्मा गुडाके श सर्विभतू ाशयमथितः।

अहमामदश्च मध्यं च भतू ानामन्त एर्व च॥(verse 10.20)

Translation --> I am the Self, dwelling in the hearts of all living beings. I am the beginning and the churning and the end of all beings. It means that the supreme energy is God from which every entity is created in this universe. He says that all the things and living beings as well are started with me, sustain because of me and end with me. if God is the supreme energy than every entity is created due to this supreme energy, sustain due to it and finally end with it but here the end does not mean the end of energy it means the end of existing form of energy and later transformed to another form.

Another key verse,

र्वायुयिमोऽमननर्विरुणः शशाङ् कः प्रजापमतथत्रं प्रमपतामहश्च। नमो नमथतेऽथतु सहस्रकृ त्रवः

पुनश्च भ ोऽमप नमो नमथते॥ (verse 11.39)

Translation --> You are the air, Yama, fire, Varuna, the moon, the creator and the great grandfather.
This is said by the arjun to the Krishana where he said that he is found in everything like in air, water, moon and great grandfather which means the origin of all this also suggest that the god is energy since it is found in object and every life. Every entity is composed from this energy and in Sanatan religion it is said as all the things in existence are the child of the god, not in sense of the biological child it's in spiritual world where God is supreme energy.

Another important verse

अहमात्मा गुडाके श सर्विभतू ाशयमथितः। (verse 10.32)

Translation--> I am the beginning and the end and the middle of creation, O Arjuna
In above verse the god said that he is supreme energy and here in this verse he says that he is the starting of the universe (i.e. point of singularity having infinite energy density), he is the middle of universe (i.e. dark energy and dark matter from which the universe is expanding) and finally he is the end (i.e. the point of big crunch).
This directly says that the concept of formation of the universe started from the energy was already mentioned in the Bhagwat Geeta and the concept of big crunch which is the end of universe is also explained there.

3. Methodology

3.1 Research design:

This research is based on the qualitative and the theoretical analysis that compares the modern scientific theories with ancient Bhagwat Geeta. The research follows a comparative analytical approach based on the textual interpretations, scientific evidence and mathematical model.

3.2 Data collection method

The data used in this research is mainly based on the secondary sources and from the scientific research, journals, and mathematical expression such as the big bang theory, cosmic microwave background radiation, quantum fluctuation and the vacuum energy, Einstein's relativity, Friedmann's equation, Planks radiation law and Einstein's energy equation. The major data are collected from the Bhagwat Geeta for the research. Data analysis This research uses the comparative, interpretive and theoretical analysis of the secondary research and is compared with the Bhagwat Geeta. Drawing the common theme between both the cosmological concepts this research connects the ancient Sanatan cosmology with modern cosmology.

3.3 Limitation of the study:

•Lack of empirical testing:

This research is based on the existing scientific data. No direct experiment or empirical tests were conducted.

•Metaphorical interpretations:

The verses in the Bhagwat Geeta may not have a one-to-one correlation with modern physics. The interpretation is subjective and philosophical in perspective.

•Concept of vacuum energy:

This research does not address the vacuum energy fluctuation in the null space. Instead, it focuses on the superior energy, i.e., singularity.

4. Conclusion

This research draws the parallel between the modern cosmology and the cosmological concepts found in the Bhagwat Geeta. Demonstrating that ancient Sanatan philosophy metaphorically aligns with the modern scientific theories like big bang, Quantum physics and relativity. Both prospective emphasize that the universe started from the singular source of energy which further evolved into the present cosmic structure and further ends within a single energy which is termed as big crunch in the modern physics. This work finds that the modern scientific theories and discovery have the broad view, but Sanatan cosmology have even board view then now. Even at that time they have built the concept of the creation, structure and the end of this universe. The god which is consider as the superior of everything is a supreme source of energy from which every entity and the life are created and ends with that energy. Since the singularity and from many cosmological events the present cosmic structure is created and will ends with the same energy and all happens only due to supreme energy which is God. Ultimately, this comparative study opens the door for the further interdisciplinary research, for the deeper exploration of how ancient Sanatan cosmology align with modern scientific theory and, we can find many other unsolved mysteries of the universe from the deeper research on Sanatan cosmology.

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