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THE THEORY OF EVERYTHING: A SEARCH INTO THE CORE OF OUR EXISTENCE

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Abstract:*The cosmos we dwell is a mystery beyond much human comprehension till date. The more it is revealed, the more it becomes mysterious. Still, man, an insignificant creature compared to the immense grandeur of the universe, unraveled to its great secrets, extending from sub-atomic particles (quantum world) to galaxies and quasars within a short span of time. The impressive achievements of science have rendered knowledge of many previously inaccessible domains of nature. The latest milestone being the first photograph of black hole released by NASA on 10th April 2019.*

Key Words:Space, NASA, Cosmos, Science, GUT, TOE

"Where were you when I laid the foundations of the earth?" (Job 38:4)
"I feel much more comfortable with the concept of God who is clever enough to devise the laws of physics that make the existence of our marvelous universe inevitable." (James Trefil)

1. Introduction

The cosmos we dwell is a mystery beyond much human comprehension till date. The more it is revealed, the more it becomes mysterious. Still, man, an insignificant creature compared to the immense grandeur of the universe, unraveled to its great secrets, extending from sub-atomic particles (quantum world) to galaxies and quasars within a short span of time. The impressive achievements of science have rendered knowledge of many previously inaccessible domains of nature. The latest milestone being the first photograph of black hole released by NASA on 10th April 2019.

For some people, science seems to be the only reliable path to knowledge. Much of humanity has turned their gaze to science-based technology as a source of fulfillment and hope. Often it has offered the power, control and prospects of overcoming our helplessness and dependency. Our generation is a witness to a new perspective of nature whereby many of its domains exhibit characteristics radically different from those assumed in past centuries. In view of possessing a minute knowledge of the nature, can we rely upon few theories and equations as the ultimate? Man, in his horizon of experiential knowledge, revolves around many unanswered problems of cosmology. Why is there this kind of a universe? How the universe came into being? Why there is a universe at all?

2. Finding a solution

Ever since scientific cosmology has pondered on the question of existence of the universe, many theories have emerged trying to answer this quest. These theories have ended up in a hope of formulating a basic theory that explains everything.

2.1. Anthropic principle

In the traditional argument from design, it was claimed that, both biological forms and the physical conditions favorable for life must be the products of an intelligent designer because it is inconceivably improbable that they would have occurred by chance.1 An interesting feature of the new cosmological theories opines that even a small variation in the physical constants would have rendered an uninhabitable universe. "If the rate of expansion one second after the Big Bang had been smaller even by one part in a hundred thousand million million it would have collapsed before it reached its present size."2

Reflecting on the fine-tuned manner of the universe, cosmologists Dicke and Carter formulated the Anthropic Principle- "What we can expect to observe must be restricted by the conditions necessary for our presence as observers."3 This principle was illustrated by Hawking as a possible answer for the question why only 4 dimensions (three dimensions of space and one time) are flat while other dimensions (string theory

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suggests 10 to 26 dimensions) are curled up in quantum space. Neither do 2D conditions support life nor does a condition with 5D or more.

Some physicists see the evidence of design in the early universe. Freeman Dyson says, "The more I examine the universe and the details of its architecture, the more evidence I find that universe in some sense must have known we were coming."4 There follows a religious implications too in considering the perfect design. This argument could be taken as a base for the existence of a Grand Designer, "perhaps God with an interest in conscious life."5

2.2. Chance

Let us suppose, there were billions of worlds with differing constants existing simultaneously. It would not be surprising then, that one of them, by chance happened to have constants that support our forms of life. It can be that Big Bang produced multiple domains with different constants or even differing laws that exists simultaneously. An even better hypothetical model succeeds this. Hugh Everett's proposal of alternative quantum potentialities in an atom, resulting in several branches split from one universe, ends in a mind-boggling multiplicity of worlds. There are various theories that propose such a model. But in many cases, it seems to be inherently unverifiable since no communication could be established between the various worlds. These theories try to explain the combination of constants favorable to life as a chance occurrence among a set of worlds.

2.3. Towards unification: Grand Unification Theory (GUT)

Sidelining the proposals put forward from design and chance, a third possibility of necessity is considered. Perhaps a grounding principle proves that the constants can haveonly the values that they have. In simpler words, the cosmic conditions that present an ideal world for us are in fact directed by the most fundamental structures at its origin.

Often we look our past experiences, memories and even generations to quench our thirst for knowledge and insights. How about walking backward over 13.7 billion years to the point of Cosmo-genesis? The first nuclei of the light atoms (hydrogen and helium) were formed out of protons and neutrons in the first 3 seconds at a temperature of the scale 109 degrees. Further moving backward we find all the fundamental forces (gravitational, electromagnetic, weak and strong nuclear forces) were united, before a time of 10-43seconds after Big Bang.

Scientists of the 20th century held the view that in the initial moments of the universe, the temperature was immensely high that all the forces were in singularity and in super-symmetry. Soon this symmetry broke apart and formed the four fundamental forces of the nature. Based on this argument, scientists claim if such a condition is recreated, this unification could be brought. Abdus Salam from Pakistan, Stephen Weinberg from Harvard and Sheldon Glashow in an experiment conducted in 1967 successfully unified weak nuclear force and electromagnetic force. The theory, born from this, known as Electro-Weak theory, gained them Nobel Prize in 1979. European Council for Nuclear Research (CERN), Geneva in a series of experiments confirmed this theory. With this the idea of uniting the four forces was more emphasized in the scientific circles. A hypothetical theory that embraces every minute detail of the cosmos, that arranges every phenomenon, events and actions, that unites everything into a single law, was thus aimed and hoped for. Stephen Hawking was the main person behind this search. And the prime motive of this search was to prove, "A creator is no longer necessary!"

3. Grand Unification Theory (GUT)

We already spoke of successful attempts of unifying weak nuclear and electromagnetic forces. The remaining strong nuclear forces have not yet successfully unified with the electro-weak force, in any experiment. Instead they seem to be described by a separate theory called Quantum Chromo-Dynamics (QCD). The electro-weak theory and the QCD together constitute the so called Standard model of particle physics.

A grand unified theory (GUT) is a model in particle physics in which at high energies the three forces are merged into a single force. Although this unified force has not directly observed, the many GUT models theorize its existence. The acronym GUT was first coined in 1978 by CERN researchers John Ellis, Andrzej Buras, Mary K. Gaillard and Dmitri Nanopoulos. If such a unification is possible, then it raises the possibility that there was a unified epoch in the infancy of universe when these forces were not distinct. Although, GUT models predict that at much higher energy, the three forces can be unified into a single electronuclear interaction, it still rules out the space for gravity.

4. Theory of Everything (TOE)

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I took a great interest in this topic ever since I saw in 2016 the movie The Theory of Everything that narrated the biography of Stephen Hawking. In unifying gravity with electro nuclear interactions would provide a theory of everything rather than GUT. GUTs are often seen as an intermediate step towards the final goal of TOE. In the words of Hawking, "the real reason we are seeking a complete theory is that, we want to understand the universe, and fell we are not just the victims of dark mysterious forces. If we can understand the universe, then we control it, in a sense."6 Such a theory successfully explains the time of infancy of our cosmos. And in a way gives an answer how and why the universe came to be.

5. Drawbacks and the end of a saga

Long years of hard work didn't bear the expected fruit for the physicists. The standard model itself is unsatisfactory. Firstly, "the particles are grouped in an apparently arbitrary way, and the standard model depends on 24 numbers whose values cannot be deduced from first principles, but have to be chosen to fit the observations."7 Secondly, it does not include gravity. Gravity has to be described by Einstein's General Theory of Relativity and since his theory is not a quantum theory it would be inconsistent with other laws.

While electro-weak forces require energy of 100 GeV, the grand unified energy claims energy of a thousand million million GeV. Such a gap may not be bridged in near future by laboratories. However the universe in its infancy might have exhibited an arena where such energies must have existed.

Goedel theorem says that any finite system of axioms is not sufficient to prove every result in mathematics. According to positivist philosophy of science, a physical theory is a mathematical model. So, mathematical results that are unproven results in physical problems that cannot be predicted. In this light, Stephen Hawking, the brilliant scientist, who hoped for a theory of everything and expressed its sure possibility in 1988 through his statement, "I think there is a good chance that the study of early universe and the requirements of mathematical consistency will lead us to a complete unified theory within the lifetime of some of us who are around today"8, delivered a speech in 2004 at Cambridge. He said, "Maybe it is not possible to formulate the theory of the universe in a finite number of statements."9 The great physicist who danced into the geometry that created universe in his wheelchair, died on 14th March 2018.

Even when such an all-embracing principle is formulated, the question, 'why such a universe?' remains unanswered. "Even if there is one possible unified theory, it is just a set of rules and equations…The usual approach of science of constructing a mathematical model cannot answer the questions of why there should be a universe for the model to describe."10

6. Conclusion

The great scientists, who dreamed of a Theory of everything, have thus abandoned all hopes of having it. In spite of great inventions in the realm of science and technology, an all-embracing theory remains a mystery. Macrocosm and the microcosm are still subjects of great wonders for human intellect. Science still has a long distance to walk. Quoting Stephen Hawking, "our search for understanding will never come to an end, and that we will always have the challenge of new discovery. Without it, we would stagnate."11 Will a successful TOE eliminate the concept of God from us? Will its failure of being established, prove the existence of God? Will such a future make our life more meaningful? There is still immensely long time to assume a grossly anthropocentric goal of creation. Before reaching that stage, let us focus on the challenges of our own present, to build a just and sustainable society of values. Our hope is based on the conviction that God is at work in this world and that we must participate in that work. A Jewish morning prayer which expresses gratitude for the world and the gift of life goes on like this,

"Praised are You, O lord our God, King of the universe.
You fix the cycles of light and darkness;
You ordain the order of all creation…"

7. End Notes

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4Dyson, Freeman. *Disturbing the Universe.* New York: Harper & Row, 1979, 250
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