Global Journal of Pure and Applied Mathematics.
ISSN 0973-1768 Volume 22, Number 1 (2026), pp. 35-52

https://dx.doi.org/10.37622/GJPAM/22.1.2026.35-52

Analyzing Phantom Energy Ascribable to the Ultimate Fate of the Cosmos in Connection to Big Rip Cosmology in Relativistic Cosmology

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Abstract

Dark energy is a hypothetical form of energy that has been unremittingly applying force on the cosmos in every permissible direction. Astrophysicists and space scientists have been persistently investigating about the ultimate fate of the cosmos with the progress and several revolutionary presumptions articulated on the subject arena of Relativistic Cosmology. Since dark energy is extremely responsible for the exponential expansion incurred in the cosmos, therefore the space researchers have been persuading the concept that in far future the shape of the observable cosmos is tending to be flat, at the similar instance also builds a privilege whether the cosmos in the long run will on the verge of re-collapse and finish off with a colossal pulverization. Phantom energy is a hypothetical form of dark energy, possessing negative kinetic energy and satisfying the equation of state $p = \omega\rho c^2$ with $\omega < -1$ where the dimensionless parameter ω has been acknowledged as the Equation of State (EoS) parameter, p represents pressure, ρ stands for the density of the fluid and c is the velocity of light waves in vacuum. Here in this present study, an investigation has been portrayed regarding the vivid scenarios experienced whenever the subsistence of dark energy in the cosmos is under the governance of phantom dominance era satisfying the condition that the summation of the two physical measures viz., the pressure and energy density lead to a negative quantity. With a specified predetermined time span, the value of the positively aggrandized phantom-energy density grows to be infinite in spite of the subsistence of any cosmic matter in the cosmos. At long

last, the phantom energy escalates the cosmic repulsion or detaching away of the interstellar objects like the constituents of the solar system, the galaxy clusters, the Milky Way, the mere fundamentals of an atom before the cosmos experiences a Big Rip Cosmological spectacle or an eminent annihilation.

Keywords: Big Rip Cosmology, Cosmos, Dark Energy, Phantom Energy, Singularity.

1.0 Introducing the Phantom Energy:

Phantom energy is a deviant appearance of dark energy that accentuates the spreading out of the cosmos in surplus of the theory that has been geared up by a cosmological constant, usually denoted by the Greek letter **Λ**, introduced by Albert Einstein in his field equations of the theory of General Relativity which conforms to a disastrous phenomenon named the Big Rip Cosmology. The space scientists adhere to this phantom dark energy [1], [2], [3], [4] in revealing the evolutionary concepts of incessant progression of dark fluid in the cosmos possessing negative mass, where the cosmological constant fluctuates with time. Phantom energy is an aberrant edition of dark energy that has been hypothesized to impinge on the large- scale structure of the cosmos [5], [6].

The implementation of phantom energy has been registered in the year 2007 in fabricating the cyclic model of the cosmos. This cyclic model pressurizes to stabilize the escalation in streaming out phenomenon of the cosmos which predominantly gets minimized earlier to the commencement of the Big Rip cosmic phenomenon.

2.0 Presenting Dark Energy: The Energy Responsible for Accelerated Expansion of the Cosmos:

In Cosmology, dark energy has been regarded as the hypothetical form of energy which is extremely responsible for the exponential expansion of the cosmos and at the similar instance has been exerting negative pressure on the interstellar constituents and thereby significantly defeating gravity which in turn making the cosmos to be stretching out in every permissible direction at an accelerated rate.

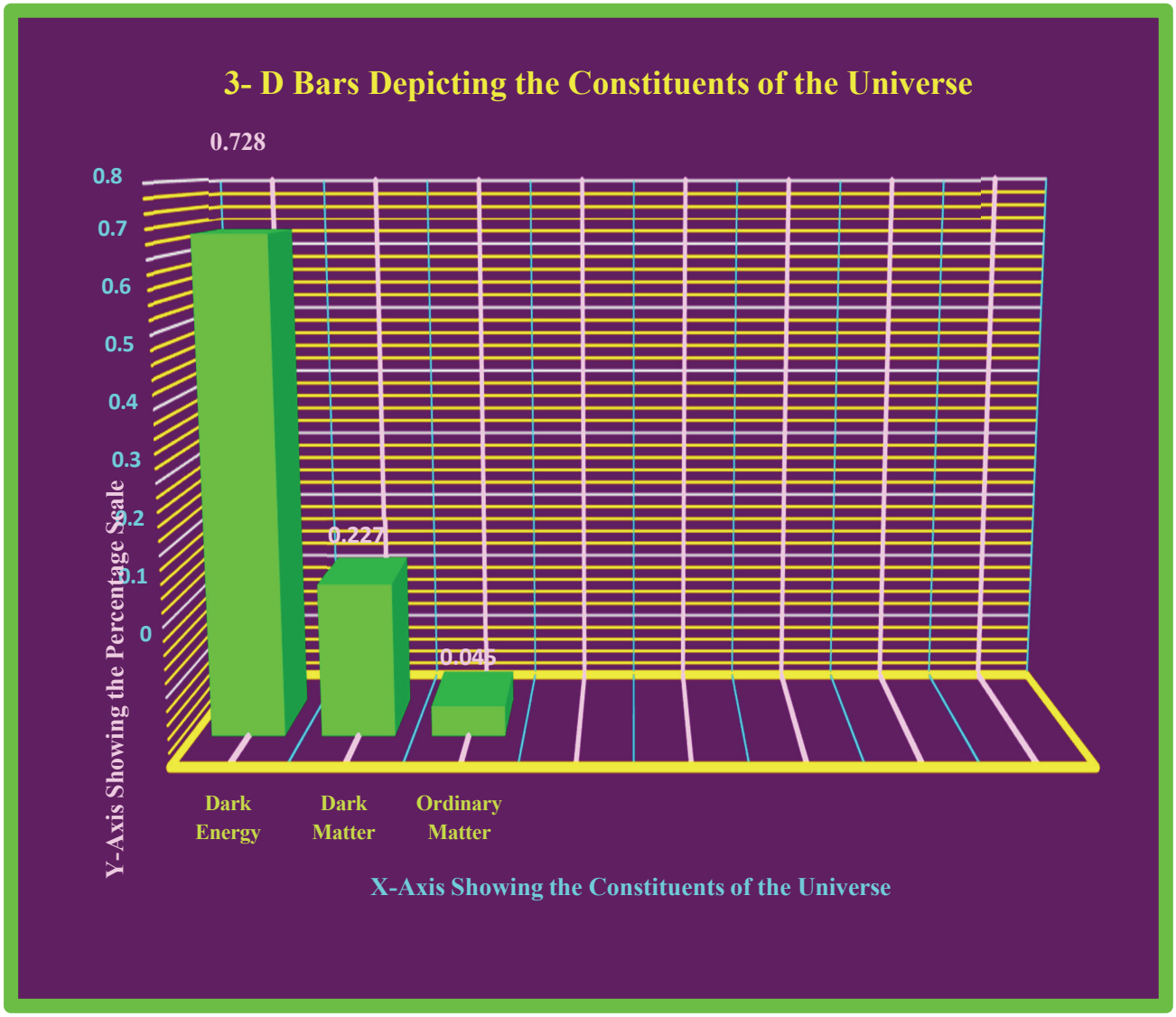

Fig. 1

Illustration Credit: NASA's Goddard Space Flight Center.

The very nomenclature dark energy was initially coined in a research paper titled: Dark Matter and Energy in the Universe by eminent Astrophysicist from the university of Chicago, USA named Michael Turner in the year 1998. This name, dark energy has been pronounced with an intension to indicate a similar mysterious substance in the universe, named dark matter which was intentionally illustrated to describe a likewise enigmatic matter prevailing at a massive scale in the cosmos [1], [3], [4], [5], [6].

There are two proposed forms of dark energy:

(i) *The Cosmological Constant:*
Introduction of this cosmological constant by Albert Einstein presumed of a static universe

(ii) *Scalar Fields:*
These have been considered as dynamical quantities having energy densities that fluctuates with respect to time and space such as quintessence.

Out of these two proposed forms of dark energy viz., introduction of the Cosmological Constant as enunciated by Einstein for the presumption of a static universe and secondly the scalar fields as stated above which have been considered as dynamical quantities having energy densities that fluctuates with respect to time and space such as quintessence, sketching the portrayal of an exponentially escalating cosmos in all possible dimensions. This has its very effective interpretation as equivalent to the mass of empty space or the very conceptual feature, the vacuum energy. Einstein necessitated the introduction of this cosmological constant since the empty space executes the function of gravitating negative masses which are abundant throughout the interstellar province of space [3], [4], [5], [6].

The first observational evidence for dark energy's existence established from rigorous investigations of supernovae which have the colossal explosions incurred in the cosmic domain. The red shift is the sturdiest phenomena also supported from Edwin Hubble’s extensive explorations indicating the farthest away celestial entity to be accelerating to the uttermost remote province of space i.e., proceeding towards the extreme distant red band or strata of the spectrum which essentially indicates an accelerated streaming out of the observable cosmos [1], [3], [4], [5], [6].

The General Theory of Relativity [7], [8] as put forwarded by Albert Einstein maps the geometry of space-time to the allocation of matter substances within the geometry of space. These equations enunciated by Einstein in the very year 1915 were expressed in the form of a tensor equation that portrays the bond between the local space-time curvature and the local energy-momentum and stress tensor within that space-time expressed by the stress– energy tensor equation. The accompanying generalizations can be encompassed as a process of approximating the space time portraying essentially small deviations from flat space-time,
tending to the linear Field Equations which have the utilizations in pervading the phenomena like gravitational waves. A gravitational wave is an incredibly fast ripple in space. Gravitational waves [2] propagate at the speed of light waves which is analogous to 1,86,000 miles per second. These waves squeeze and stretch out whatsoever appear in their tracks as they pass nearby [2]. The strongest gravitational waves are produced by cataclysmic events such as colliding black holes and colliding neutron stars [2].

Quantum gravitational effects are credited to expose the secrets of dark matter and energy along with the ultimate fate of the cosmos or the phenomenon known as Big Rip Singularity. Quantum gravitational effects are the upshots of gravity when treated according to the principles of Quantum Mechanics, particularly relevant in extreme physical regimes like near the Planck scale or inside black holes where quantum effects become significant [9], [10].

Inflation qualitatively portraying parallel conception to dark energy resulted in an exponential expansion of the cosmos just an infinitesimal fraction of time later to the Big Bang Cosmology. Such escalation is an essential characteristic of almost entire set of existing models of the Big Bang [11]. It has been predicted that inflation must have transpired at a much- elevated degree of negative energy density in comparison to the today's observed dark energy in the cosmos and inflation is predictably supposed to have totally come to an end when the universe was immediately a fraction of a second old. Another celestial spectacle black hole is a region of space where gravity is so strong that nothing can escape from it. An excessive amount of gravitational force warps the fabric of space-time.

3.0 Revealing the subsistence of Dark Matter in the Cosmos:

In Physical Cosmology and Astronomy, dark matter signifies a hypothetical matter, occupying a significant stratum of the universe's mass and which cannot be straightforwardly observed since this does not discharge any nature of electromagnetic radiation. Its mere existence can be entirely apprehended because of its sturdy gravitational effects existential on some of the visible matter constituents of the universe such as the planetary galaxies or galaxy clusters.

The indisputability regarding the subsistence of dark matter is indispensable in the universe since without its sturdy presence in the cosmos, it would have been quite uncomprehensible to explore the behaviour of the constituents of the cosmos like the stars, planets and galaxies etc. Unlike dark matter that has been supposed to clusters round the interstellar galaxies, dark energy gives the practical conception of homogeneously dispersed throughout cosmic space [6].

The following are the key salient points regarding dark matter:

- *Invisible Property:*
  Dark matter cannot be directly visible in the cosmos as it does not interact with light waves in the manner as ordinary visible matter in the universe interacts [3], [4].
- *Gravitational Influence:*
  The space scientists provoke the presence of dark matter in the universe by apprehending the its gravitational effects transpired on visible matter. For instance, the rotation of galaxies has been presumed to be due to the effect of dark matter abundant in the cosmos.

- *Abundant Propensity of Matter:*
  Recent space investigations and cosmological models evidenced that dark matter occupies a much grander strata of the universe's mass in comparison to ordinary visible matter [3].

3.1 Techniques of Experimenting Dark Matter in the Universe:

- **Gravitational Lensing:**
  By investigating the embedded mechanism of how light emanating from the furthest interstellar objects is being deviated due to the gravity of galaxy clusters which are supposed to encompass bulky extents of dark matter.
- *The Curves Created Due to the Rotation of Galaxy or Cluster of Galaxies:*
  By making rigorous investigations impending on how swiftly the stars constructing the galaxies orbit the galactic centres indicating the presence of some supplementary mass engrained substances as compared to ordinary visible matter in the cosmos [5].
- *Construction of Large-Scale Structures in the Universe:*
  The abundancy of dark matter has been performing an emphasized role in forming the clustering of galaxies, thereby configuring the large-scale structure of the universe.

4.0 Review of the Correlated Literature and Experiential Evidences Performed:

The sturdy observational existence of dark energy has been reportedly registered in the space scientists' statistics from the data engrained from the huge colossal explosion incurred in the cosmos i.e., the supernovae. In this context, Type Ia Supernovae effectively has been providing invariable luminosity in abundance, confirming their utility for précised measurements of vast expanses throughout the terrestrial terrain. Comparing this distance data to the drifting statistics gained from redshift mechanism that the cosmos is stretching exponentially at an accelerated rate and is still stretching [1], [2], [3], [4].

The High-Z Supernova Search Team articulated the revelations regarding the Type Ia Supernovae in the very year 1998. The subsequent year 1999 has been aroused as a milestone in which another innovative verdict was put forwarded by the Supernovae Cosmology Project proclaiming that the stretching apart of the cosmos has been transpiring at an exponential rate.

A good numeral of cosmological observations has been authenticated by numerous space investigators, for instance the measurements performed of the Cosmic Microwave Background, Gravitational Lensing and the large-scale structure of the cosmos along with enhanced measurements of supernovae. Those investigations have been implementing in harmony with the Lambda CDM Model. The Plank Spacecraft rendering data of the cosmic microwave background in the year 2013, fortified with an extra added perfect estimation of 68.3% dark energy, 26.8% dark matter and 4.9% ordinary matter. The Wilkinson Microwave Anisotropy Probe (WMAP) spacecraft after performing seven years of continuous and rigorous investigation has enumerated about a cosmos which is made up of 72.8% dark energy,

22.7% dark matter and a supplementary 4.5% of ordinary matter. Up to date exploration of supernovae are compliant with a cosmos that is comprising of 71.3% dark energy and 27.4% is an accumulation of two components viz., the dark matter and baryonic matter [1], [2], [3], [4], [6]. This cosmic ambiance has been depicted in Fig. 1.

5.0 An Explication Articulated on Describing the Subject Stratum, Modern Scientific Cosmology:

It's been a worldwide breakthrough that the topic, Modern Scientific Cosmology has sprouted its generous roots in the year 1917 with Albert Einstein, concentrating with the world- shattering discovery of the Theory of General Relativity [12].

Another name for General relativity is Einstein's Theory of Gravity, in the very year of 1915 which has been grounded on the geometrical perspective of the theory of gravitation and the subsequent implications, explanations and developments of the mathematically apprised illustration of gravitation in Modern Physics [12]. The theory of General Relativity has been plinth on the showground of Special Relativity and simultaneously generalizes Newton's Laws of Universal Gravitation, substantializing an amalgamated depiction of gravity in terms of a sturdy geometrical property of space and time or four- dimensional spacetime curvature [13], [14]. In cosmology, space-time is a mathematical model that combines the three dimensions of space and one dimension of time into a single four-dimensional continuum i.e., for a 4-D manifold, the space-time coordinates can be expressed as (x, y, z, t).

It is predominantly significant that the curvature configure of spacetime is directly connected to the energy and momentum which further apprehends the effectual existence of matter and radiation incurred in the cosmos which has been specified by the revolutionary Einstein's Field Equations that employ a system of second order partial differential equations.

5.1 Illustrating the Space-time Fabric in Relativistic Cosmology:

The year 1916 brought a new dimension to the tactic of space-time curvature which was propositioned by the greatest physicist of modern epoch, Albert Einstein. According to his revolutionary enunciation where he postulated that it is the force of gravity that warps the fabric of space in such a manner that even objects encompassing light waves discharged from stars ought to follow a curved path around massive bodies of gravity like stars and black holes. Einstein had revealed the mechanism why light waves tend to curve or bend towards massive gravity fields, those surrounding the stars when the light waves were supposed to bear no mass [15].

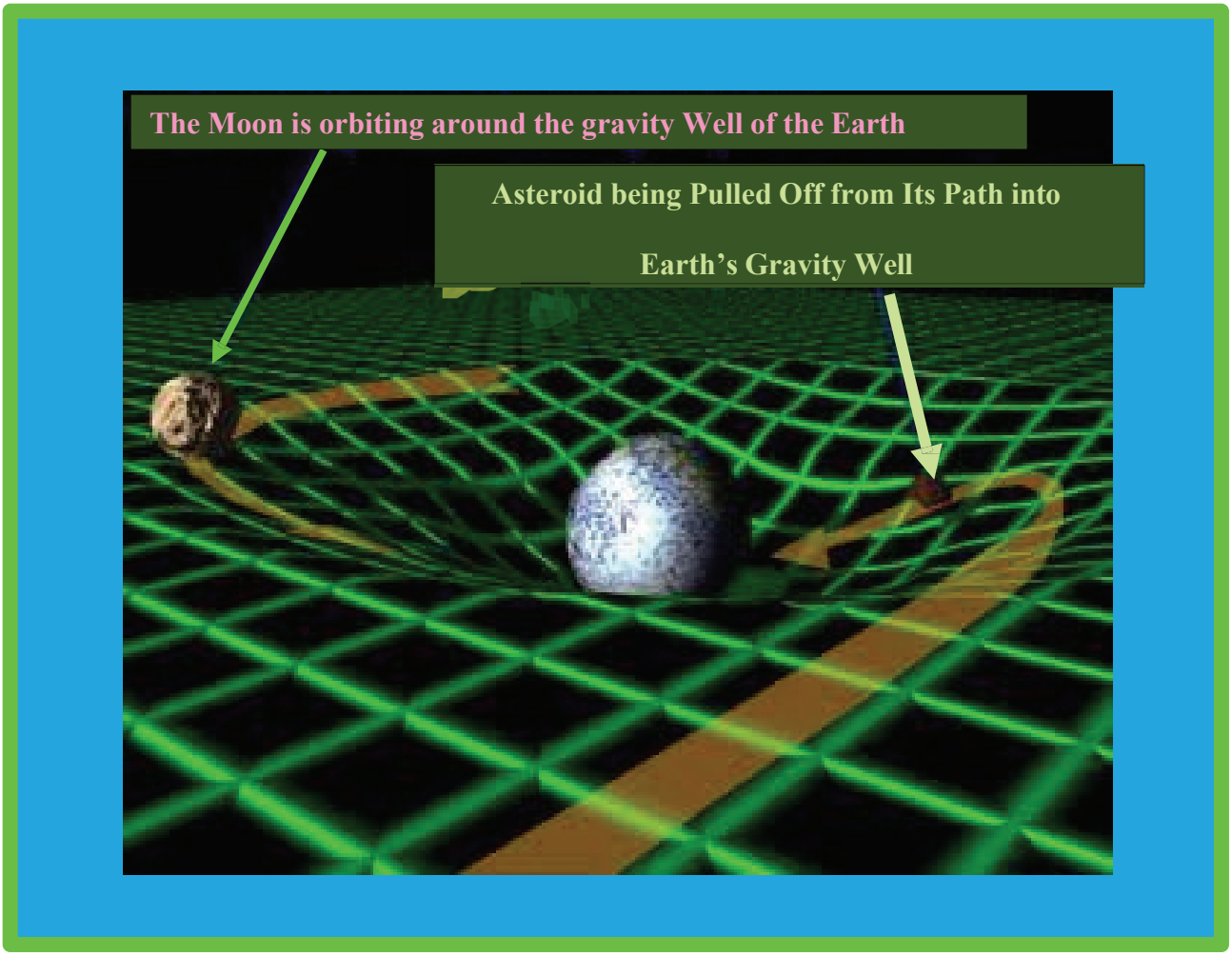

Fig. 2
Celestial Objects Being get Hauled Towards the Gravity Well of Comparatively Massive Objects

5.2 Throwing Light on Albert Einstein's Theory of General Relativity:
The General Theory of Relativity as enunciated by Albert Einstein which he proposed in the year 1915 after his postulates of the theory of Special Relativity which he published ten years prior i.e., in 1905 to the formulation of the General Theory of Relativity. Special relativity is rooted on the logic that space and time are indistinguishably associated, however it did not recognize the subsistence of gravity [16], [17], [18].

Einstein expended the decade between these two propositions after which he came to the conclusion that sufficiently enormous objects distort the fabric or structure of space-time, an indispensable distortion that manifests as gravity, as per the reports disseminated by National Aeronautics and Space Administration (NASA).

The Einstein's cosmological equations portray the plinth of the General Theory of Relativity. These substantiates an effective formulation of the correspondence between geometry of space-time and the effectual characteristics of matter with the aid of Mathematics. These equations have been formulated by implicating the properties of Riemannian Geometry which takes into account of the geometry of space-time or simply space is explained by means of a quantity known as a metric. This metric predetermines the facts desirable for the essential geometrical correlations connecting distance function in space and angle formed in a curved space or space-time fabric [16], [17], [18].

5.3 Einstein's Field Equations:

It has been predominantly significant that the curvature configure of spacetime is directly connected to the energy and momentum which further apprehends the effectual existence of matter and radiation incurred in the cosmos which has been specified by the revolutionary Einstein's Field Equations that employ a system of second order partial differential equations [7], [8], [13], [19].

The Einstein Field Equations (EFE) can be expressed as:

$$G_{\mu v} + \mathbf{\Lambda} g_{\mu v} = \kappa T_{\mu v} \quad \text{.....(1)}$$

Here in this above equation (1),

$G_{\mu v}$ denotes the Einstein Tensor which is a function of the metric and its derivatives that essentially represents the curvature of spacetime.

$\mathbf{\Lambda}$ is known as Einstein's Cosmological Constant which effectually corresponds to the exponential expansion of the cosmos.

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$g_{\mu v}$ stands for the Metric Tensor. Also referred to as Einstein Tensor, that being a function of the metric and its derivatives which represents the curvature of spacetime.

$T_{\mu v}$ is the Stress-Energy Tensor, essentially depicting the distribution of mass and energy.

κ is the Einstein Gravitational Constant.

The Einstein tensor has been defined as

$$G_{\mu v} = R_{\mu v} - \frac{1}{2} R g_{\mu v} \quad \text{.....(2)}$$

μv

Here in this equation, $R_{\mu v}$ is the Ricci curvature tensor,
R is the scalar curvature.
This is a symmetric second-degree tensor that depends on only the metric tensor and its first and second derivatives.
The Einstein gravitational constant has been rendered the following value:

$$\kappa = \frac{8\pi G}{c^4} \approx 2.07665 \times 10^{-43} N^{-1} \; or \; m \quad \text{.....(3)}$$

where G stands for the Newtonian Constant of Gravitation and c denotes the speed of light in vacuum and $c \cong 3 \times 10^8$ metre/ sec.
The Einstein's Field Equations can also be expressed as

$$R_{\mu v} - \frac{1}{2} R g_{\mu v} + \Lambda g_{\mu v} = \kappa T_{\mu v} \quad \text{.....(4)}$$

In standard units, each term on the left has units of $1/\text{length}^2$ [20].

The expression on the left of Equation (4) represents the curvature of space-time as determined by the metric. Whereas the expression on the right represents the stress-energy- momentum content of space-time. The Einstein's Field Equations can then be interpreted as a set of equations dictating how stress- energy- momentum determines the curvature of space-time.

5.4 Albert Einstein's Theory of Special Relativity:

In Physics, the Special Theory of Relativity or Special Relativity is a scientific theory that grounds the connection between space and time [21], [22], [23]. According to a research paper of Einstein that was published in the very early year of 1905, Einstein essentially throwed light on the Electrodynamics of moving bodies, which had been implemented based on primarily the following two postulates as considered by him viz.,

- The laws of Physics remain invariant in all inertial frames of reference. This very fact is referred to as the Principle of Relativity.

- The speed of light in vacuum is identical for an observer, irrespective of the motion of the source of light or an observer which has been known as the principle of light constancy or the principle of invariance of the speed of light waves.

Special Relativity is a précised explanation of the embedded mechanism that predicts how speed perturbs mass, time and space. The theory has been grounded on the technique which accomplishes the speed of light to bridge the correspondence

between energy and matter flourishing the theory that even very small amounts of mass (m) can be interchangeable with huge amounts of energy (E), as expressed by the classic equation $E = mc^2$ where m is the mass and c is the speed of light in vacuum. Another denotation for this equation is the Mass- Energy Equivalence Relation [15], [17].

6.0 The Cosmic Microwave Background Radiation:

The Cosmic Microwave Background or abbreviately CMB stands for a microwave radiation that eventually fills up the entire observable cosmos. It is identified as the surplus heat generated from the Big Bang Cosmology. The CMB is a sensational indication for the endurance of the Big Bang Cosmology in describing the evolution of the universe. In most of the Big Bang cosmological models it had been predicted that the universe was predominantly filled with an absolutely dense gas cloud, blisteringly hot and additional sub-atomic particles. Since the universe undergoes an escalating expansion, this scorching plasma constituents subsists a gradual chilling to a point where protons and electrons integrated together that structures neutral atoms [11], [24]. The Wilkinson Microwave Anisotropy Probe (WMAP), previously known as the Microwave Anisotropy Probe, was NASA sponsored spacecraft operational between 2001 to the year 2010 which was employed to effectually estimate the temperature differences across the sky in the cosmic CMB terrain of space.

6.1 Mechanism Behind the Formation of Cosmic Microwave Background:

- The universe got filled with super-massively hot plasma and photon particles after the Big Bang phenomenon.
- The photons got interconnected with electrons which made this integration mechanism a harder task to traverse far extent in the cosmic expanse.
- As a spontaneous process, the universe got extended and chilled, the electrons combined with protons to form hydrogen atoms.
- The protons were subjected to move in space without any restrictions conferred on them and this light can be visible as the CMB.

7.0 Illustrating the Big Rip Singularity:

In physical cosmology, the Big Rip is a hypothetical cosmological model concerning

the ultimate fate of the universe, in which the matter constituents of the cosmos, encompassing the stars and galaxies to atoms and subatomic particles, and even space-time itself, is progressively torn apart on account of the exponential expansion of the cosmos at an assured finite time in the future, until detachments between particles will infinitely get intensified [25], [26].

In the context of Big Rip cosmological scenario, the value of the Equation of State parameter, denoted by ω must be less than -1 i.e. $\omega < -1$ for the universe to undergo this catastrophic expansion and eventual disintegration. This parameter ω describes the relationship between the pressure and density of the dark energy component of the universe.

The Big Rip is purely a hypothetical state of the universe where the expansion becomes so rapid that it tears apart all structures, including galaxies, stars and even atoms, due to the repulsive force of phantom energy, a special form of dark energy with the condition that $\omega <-1$.

8.0 An Illustration Subjected on Phantom Energy:

Dark energy satisfying the constraint inequality $\omega < -1$ has been termed as phantom energy. It possesses a repulsive force that has been stronger than the force of attraction of gravity that leads to the extreme accelerated expansion and eventually the Big Rip Cosmology [25], [26].

Presumptions Grounded on the Numerical Value of $\boldsymbol{\omega}$*:*

- $\omega = -1$, the universe will undergo an infinite expansion but not big rip.
- If ω is slightly less than -1, the Big Rip will occur in the extremely distant future.
- If ω is significantly less than -1, the Big Rip would occur at an early time epoch [25], [26].

8.1 Phantom Dark Energy Intervening Gravity:

It had been hypothesized by the Astrophysicists that dark energy was extremely conscientious for driving interstellar objects distant extra strappingly in comparison to the force of gravity. This concept has been bestowed upon to a term named Cosmological Constant primarily introduced by Albert Einstein in his field equations of General Relativity which was fixed to supersede gravity and hold the interstellar objects restraining from collapsing after an infinite time an eon. It is the Cosmological Constant which functions in restraining gravity from a sturdy eminent probability of gravitational collapse of the cosmos [25], [26].

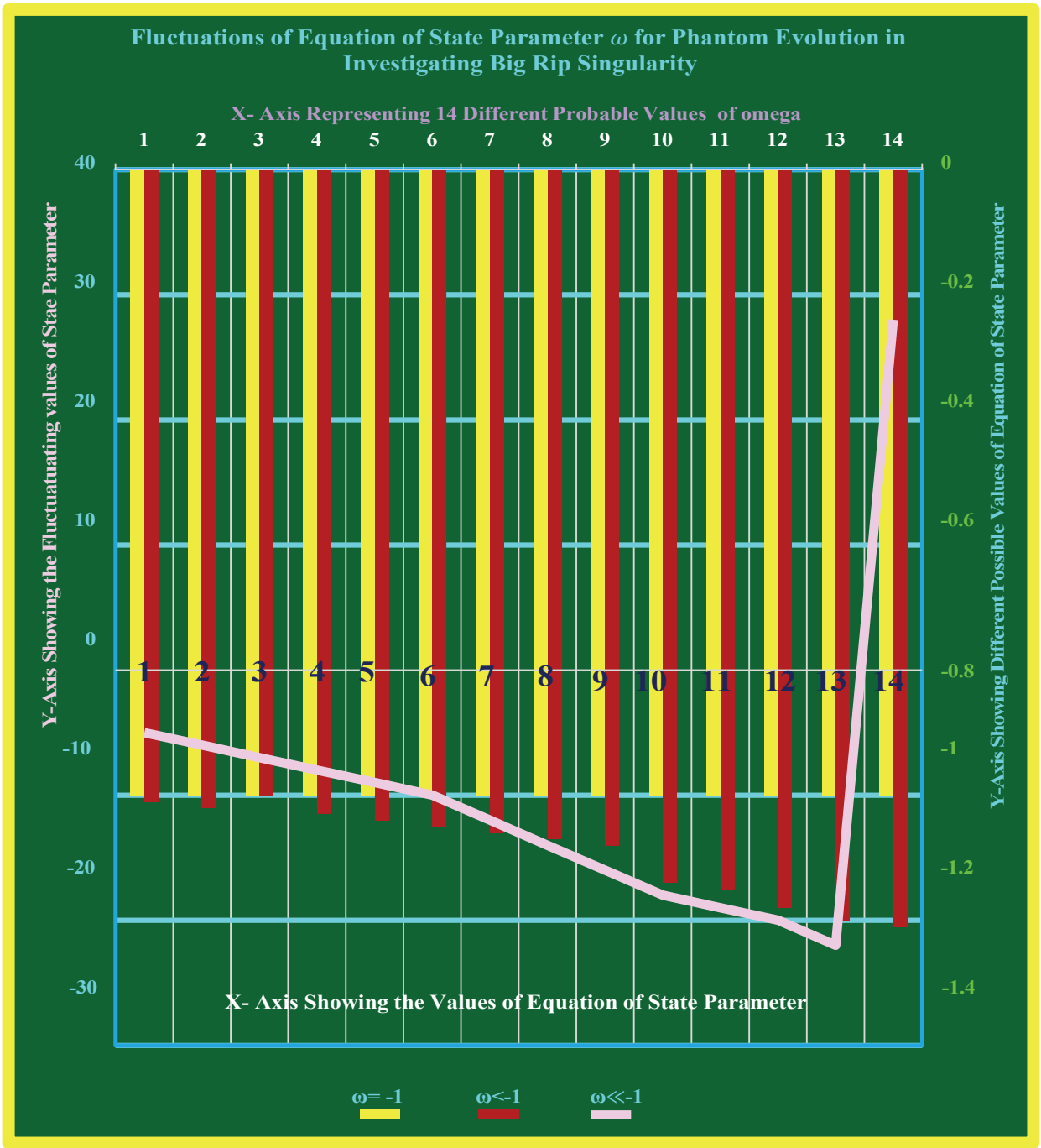

Fig. 3

Clustered Bars and Graph Combination of Different Phantom Evolution Cosmic Scenario

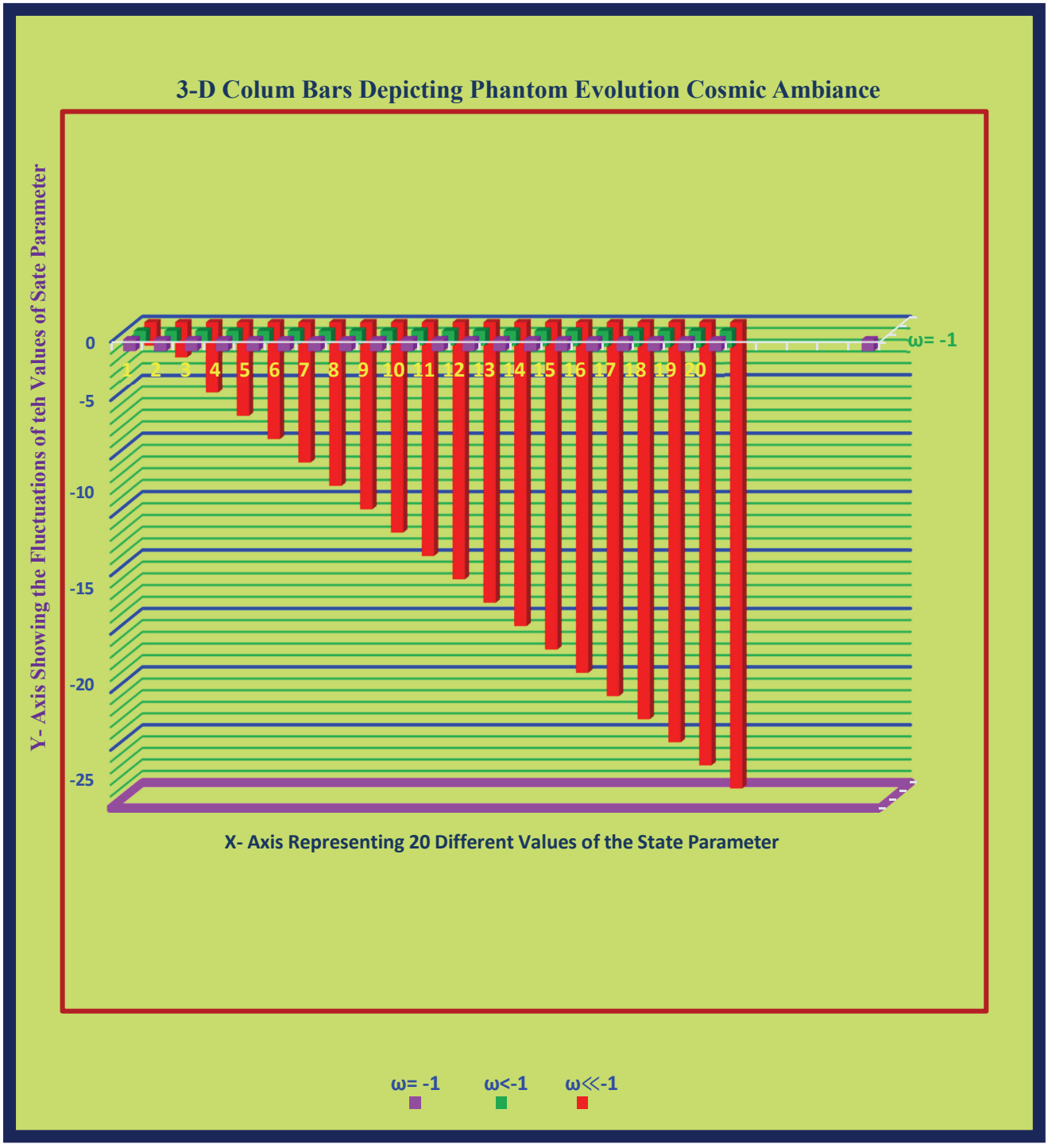

Fig. 4

9.0 Interpretations Based on Physics or Mathematical Inferences Drawn on the Verge of Commencement of the Big Rip Cosmology in the Cosmos:

As illustrated by Astrophysicist Robert R. Caldwell [29], the instance from this

current point of time to the split second of effecting of Big Rip can be represented in a mathematical equation as below:

$$t_{rip} - t_0 \approx 2 \Big/ \text{sqrt}\,[3 \mid (1 + \omega)\, H_0 \mid \text{sqrt}\,(1 - \Omega_m)] \quad \text{.....(5)}$$

where

t_{rip} = The moment of commencing the Big Rip
t_0= The present time-epoch
ω = A dimensionless number
H_0 = Hubble Constant and
Ω_m = Matter density of all substances abundant in the cosmos

where in the R.H.S. of the above Equation (5), the Hubble Constant, H_0 =72 km/s/Mpc, according to the investigations carried out in the year 2001 [26].

So, for the commensuration of the Big Rip cosmological phenomenon, the précised value of the time instance of t_{rip} should become infinitely large. Mathematically, redirecting the following possible scenarios:

The R.H.S. of Equation (6) i.e., $3 \mid (1 + \omega)\, H_0 \mid \text{sqrt}\,(1 - \Omega_m) = 0$

for which the following three possibilities gets accentuated viz.,

for which the following three possibilities gets accentuated viz.,

- $\omega = -1$
- Matter density, Ω_m equal to be unity.
- $\Omega_m = 0.3$ which is a frequently assumed value in cosmological problems.

The antagonist scenario has been hypothesized to occur during the Big Rip phenomenon since the Hubble constant gradually attains an escalating approach and intensifies to infinity (although reaching or more practically approaching infinity is wholly an absurd execution) in a finite interval of time. Recent space investigations carried out across the sphere at present practically advocate for a constant enlargement and high temperature fatality, based on the condition $\omega = -1$ [26], [27], [28], [29]. The likelihood of an impulsive sudden Big Rip Singularity transpires only for phantom dark energy dominated cosmos possessing improbable physical criteria.

It has been a presumption that if the phantom induced dark energy intensifies and tends to infinity, it surpasses all pulling forces that grasps all substances i.e., simply defeating gravity in the cosmos collectively. The exact explanation regarding such circumstance resides in the equation of state of a perfect fluid, represented by

$$\omega \equiv p \Big/ \rho$$

where

ω = Equation of State (EoS) parameter or a dimensionless number

p = Pressure of the cosmic fluid
ρ = Energy density of the abundant fluid in the cosmos

- Thus, for $\omega \in]-1, 0[$, a celestial scenario initiates when the spreading out of the observable cosmos has a propensity to hasten speed whilst the dark energy tend to feeble with time scale and the devastating singularity of Big Rip does not take place.

- Phantom energy with the condition, $\omega < -1$ or $\omega \in]-\infty, -1[$, implies to a cosmological scenario when the phantom induced energy density of dark energy amplifies as the cosmos undergoes spreading out.

10.0 Inferences Drawn for the Ultimate Fate or Destruction Rendering to the Occurrence of Big Rip Singularity in the Cosmos:

There has been persisting some extra enthralling exploratory information regarding the potential innovative future of the observable cosmos. The phantom energy engrained model which are an assimilation of dark energy domination in the cosmos consequential in spreading out which has been is divergent in nature, which in turn strongly proclaim that the efficacious force of dark energy keeps on mounting till that stage where all other enduring physical forces in the cosmos becomes feeble or substantially becomes less effective. On arriving at this critical threshold landmark, dark energy in due course is acknowledged to knock down all gravitationally compelled frontier configurations, counting together with galaxy clusters and even the solar system and conclusively surmount the electrical and nuclear forces to wreck down atoms spontaneously by themselves, finishing the observable cosmos in a mechanism called Big Rip [26].

On developing and working on a contradictory hypothesis formulated by the Astrophysicists which redirects the presumptions that dark energy may disperse or gradually expend in correspondence to time factor or contrarily might emerge as an attractive force. These kind of unpredictable dilemmas give birth to the likelihood of dominance of gravity again and escorts for a cosmos that shrinks or contracts on its own temperament tending in a Big Crunch or Big Rip or there might even escalate the possibility of recurrence be a dark energy cycle that necessitates a cyclic model of the cosmos with the presumption that proclaims an iterative procession for instance the happening of the Big Bang Cosmology then finally stops in a Big Crunch which approximately acquires a time expanse of 1 (one) trillion i.e.,10^{12} years [26], [27], [28], [29], [30], [31]. It is quite justifiably mentioneable that although none of these aforementioned celestially exercised phenomena are endorsed by direct speculations by the usage of Hubble's Space Telescope, High-Z Supernova Search Teams, Wilkinson Microwave Anisotropy Probe or any other investigatory analytical instruments employed for space research techniques by a single generation humankind, since it is not possible for any person to subsist for so prolonged period

throughout the whole life expectancy. So, the formulated hypotheses are yet not been practically endorsed. As science progresses from generation to generation, such type of investigatory observances will certainly be carried out by the successors of our current generation across the globe.

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