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Understanding Theory of Origin of Universe using Cosmological Wave theory

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Abstract: ***In this paper we have presented the wave theory of big bang. On the basis of new cosmological wave theory, it will be helpful understanding various issues unanswered in the existing theories of origin of universe like creation of matter, antimatter, dark matter, energy conservation, limitation of speed of light in universe and nature of medium before big bang. The concept given will help in concluding final shape of universe. We have also drawn some concepts and correlations on expansion of universe, nature of force of gravity and magnetic permeability etc. in this paper, which may be helpful in resolving the well-known big bang issues.***

Keywords: Origin of Universe, Wave theory, Gravity, dark matter, antimatter, Cosmological constant,

I. INTRODUCTION

The explanation of modern cosmological evolution is based on the successful so-called hot Big Bang theory, which occurs nearly 13.7 billion years ago [1]. This theory rests on following four pillars [2].

1) Theoretical framework based on general relativity put forward by Albert Einstein, Alexander Friedmann, Schwarzschild etc. in 1920
2) Observation of expansion of Universe described by Edwin P. Hubble.
3) Relative abundance of light element in the universe as explained by George Gamow.
4) Uniform, isotropic cosmic microwave background [CMB], the afterglow of big bang discovered by A.A. Penzias and R. W. Wilson.

General Relativity demonstrates a relationship between mass-energy and the space time structure of our universe that is bonded by spacetime curvature and called as 'Gravitational force G'. Mass can create distortion in space. As a result of that, space-time curvature will be bent towards the massive object and causing the motion of objects in the space [2].

However, above observations support hot big bang, but some issues remain to address like how big bang occurs at what place and how such enormous energy is releases and how the mass is generated after big bang. Similarly other issues like mass and energy equivalence of universe at the time of origin, all type of matter particle and dark matter in universe (ΛCDM model). What happened to antimatter generated at the time of big bang? Origin of einstein cosmological constant 'Λ', the origin of matter over anti-matter in the Universe, source of super inflation of universe in the first moment of big bang, limit of speed of light etc. [3]

In this paper, we make some basic calculations to show how universe started and how mass is generated. Why universe expanded so fast in initial 10-30 seconds of big bang. What happened to antimatter. What is origin of cosmological constant 'Λ' and source of Dark energy causing expansion of universe [4]. There are many theories exists for creation of universe, expansion of universe, theory of mass and gravity which has been subsequently modified based on the latest observations of universe [5]. This paper proposes the theory of wave for origin of universe as a proposed solution of origin of universe and its related issues in context to current observations.

II. WAVE THEORY AND BIG BANG

When a calm medium like water called as "quantum foam" is perturbed by quantum vacuum fluctuation, a wave is generated similar to shown below in figure 1. Quantum fluctuations of the geometry of spacetime can be violent that it can generate wave like fluctuations which can break smooth space time matric and can create big bang.

It can be visualized as flat space for 'supercooled energy state' and 'curved spacetime' as perturbed quantum foam. It can be a superimposition of all possible topologies / modes which only looks smooth and placid on large enough length scales [6]. It has been observed that zero-point energy of vacuum fluctuation was quite enormous and is capable of making seed for such big bang [4,7,8). The initial flat spacetime structure has generated curvature due to quantum vacuum fluctuations of the order of Plank length 'l' ($1.616X10^{-35}$m) to accommodate such fluctuations and is equal to matric fluctuation length L(t,x).

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Now if we calculate Schwarzschild radius (r_s) which is equal to $2G*m_p/ c^2$ for Plank mass (m_p), it comes to be 3.23×10^{-35} m. This is double of plank length 'l'. So, the Plank length will have double mass of r_s. If we consider this is as a mass defect, it will have equivalent amount of energy. This comes out to be $6.3X10^{21}$ MeV for a mass defect of $1.1X10^{-8}$ kg. So initial spacetime curvature of plank length 'l' will have enormous energy due to small curvature of space time. Similar calculations by Nassim Haramein [7] for plank length 'l' is also giving same energy of $6.24X10^{21}$ MeV (see appendix 1). This might have released during big bang due to quantum fluctuation in the quantum foam or perfect energy fluid as explained using wave theory.



Fig 1. Calm medium like water or "quantum foam" after perturbation

III. MASS AND ENERGY EQUIVALENCE OF UNIVERSE AS PER WAVE THEORY

Now consider that quantum foam as a perfect fluid and quantum fluctuation generated wavefront in 4D vector spacetime as shown below in fig 2 and fig 3. In this figure, one axis is time and other one is wave length lambda (λ).

We can calculate mass and energy equivalent of this wavefront using energy of wave formula as follows.

Total energy of wave is given by formula

$$E= K.E.+P.E.$$

The total mechanical energy of the wave is the sum of its kinetic energy (K.E.) and potential energy (P.E.). The kinetic energy of wave is

$$K = 1/4(\mu A^2\omega^2\lambda)$$

where Aω is the amplitude of the wave (in meters), ω is the angular frequency of the wave oscillator (in hertz), λ is the wavelength (in meters).

The potential energy of wave is

$$K = 1/4(\mu A^2\omega^2\lambda)$$

Thus, the total energy of wavefront is,

$$= 1/4(\mu A^2\omega^2\lambda) + 1/4(\mu A^2\omega^2\lambda)$$
$$= 1/2(\mu A^2\omega^2\lambda) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

This can be considered as a half wave with "Aω "as amplitude, which has time dimension, equal to 13.8 billion light year and wavelength 'λ' equal to width of universe size of 94 billion Light Years. Here λ is 6.8 times of Aω, which gives a flatter bell shape or called as de-sitter space [4]

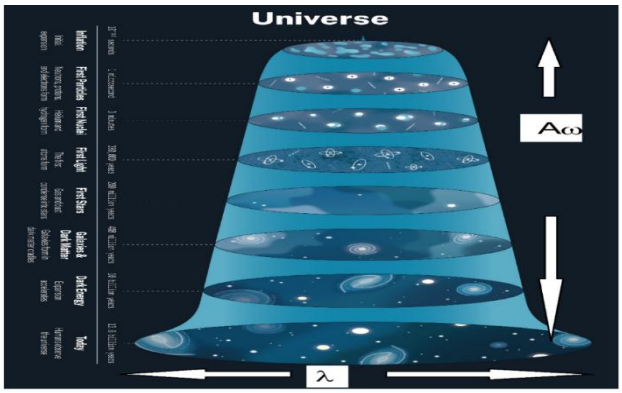


Fig 2: wavefront shape universe

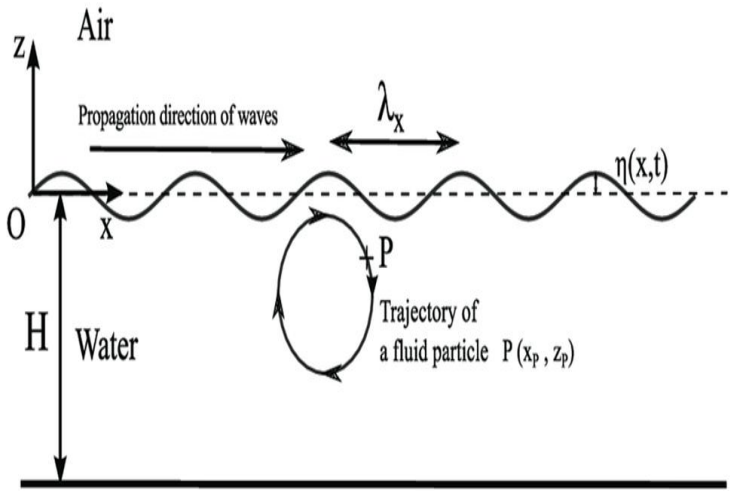


Fig 3. Graphical representation of wave in the medium

The energy of the wave will be given by equation (1) as follows

Light travels in one year = 9.46X 10^{15} meter

Aω, amplitude of crest of this wave in meter is = (9.46X10^{15}) *(13.8X10^{9})
= 1.3X 10^{26}

And λ wavelength in meter = (9.46X10^{15}) *(94X10^{9})
= 8.9X10^{26}

Putting the value of Aω and λ in the equation 1, the energy E of this crest of wave will be

E=1/2((1.3X10^{26})^2* (8.9x10^{26}))
= 7.5X 10^{78} Joule

So this much energy is accumulated in the crest of wave. This energy is equivalent to temperature of the order of nearly 10^{19} K by Stefen Boltzmann law (T proportional to $\sqrt[4]{}$ E).

At the time of big bang, there is no mass (m) and zero specific heat (c_p). So, temperature increased exponentially fast due to zero heat capacity of system. Due to this, the volume of the universe must have expanded by a factor of 10^{102} times in less than 10^{-32} seconds [9] following Charles's gas law. This may be the reason of hyperinflation at the first friction of time after big bang. The reason of hyperinflation more than velocity of light will be discussed in subsequent paras.

Now using famous Einstein formula E= mc2, where c is speed of light, The mass of universe will be

Mass m = E/c^2

= 7.5X 10^{78}/ (2.99X 10^{8})^2

= 8.4X10^{62}gm or 8.4X10^{59} Kg

This is in confirmation to the mass of universe reported in literature [10,11,12]. This also confirms the origin of universe by quantum fluctuations in the calm medium and wave nature of generation of universe by big bang.

IV. SOURCE OF GENERATION OF ALL SIZES OF MATTER PARTICLE AND DARK MATTER

At that time (after 10-32 seconds) to contain the temperature of system, Higgs field is generated and operated on the energy field expanded so far. This has created mass and heat capacity of system which cools down the temperature of universe due to adiabatic expansion and resulted in shaping down of universe of present form.

Let us assume that mass generated due to Higgs field will have Maxwell-Boltzmann distribution as shown in figure 4. At the centre, there will be formation of (i) subatomic interacting particles like leptons: electron, quarks, muon, tau, tau neutrino like heavy interacting particles. It so happens that only 5-6 % mass so generated have strongly interacting particle with big particle size and rest are feebly interacting (ii) ultra-light FIPs and their connection with cosmology and astrophysics; (iii) light Dark Matter in particle. This has also generated other astro-particle and cosmology and their connection with active neutrino physics causing generation of dark mass [13,14].

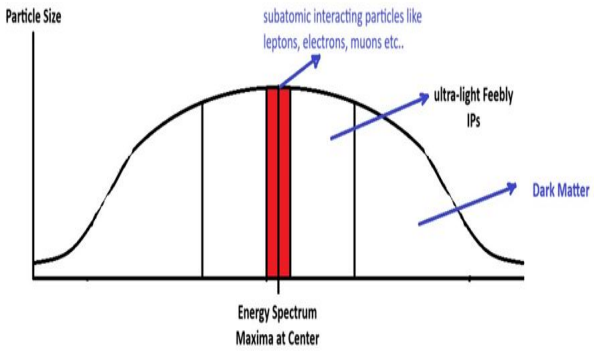


Fig:4 Source of generation of all sizes of matter particle and dark matter

Now we know that initially after big bang, there was cosmic microwave background which has average wavelength of 2.2 mm. This corresponds to a mass of ~ 10^{-39} kg using famous Plank relation E=h.c/λ and famous Einstein mass energy relation. The rest mass of electron is 9.1X 10^{-31}kg and mass of neutrino is around 2X10^{-37} Kg [15]. So, after big bang, lot of microwave radiation and other high energy radiation is converted into mass by Higgs field having mass range 10^{-31}-10^{-40} kg. As they are smaller than leptons and quarks and also have no spin. This will be the source of all type of FIP masses /dark matter or mass strings. The String theory is a candidate for a unified theory of the four fundamental forces of nature [16].

V. ORIGIN OF ANTIMATTER AND MULTIVERSE

As we assume that energy generated due to quantum wave perturbation, it will have crest and trough. The mass generated in crest will be matter and we call the crust as Matterverse and mass generated in trough will be antimatter and we call the trough as Antimatterverse and net energy of both will be zero and conversation of energy is maintained.

As shown in fig 5 and 6. It may be noted that both are generated at the same time so there is no disparity. It is also observed by Breit–Wheeler process [17,18,19] and also in bubble chamber as shown in fig 5 and fig 6.

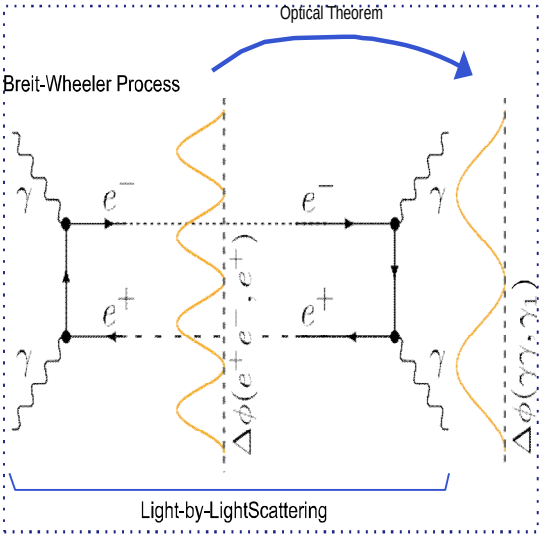


FIG. 5. A Feynman diagram for the exclusive Breit-Wheeler process and the related Light-by-Light scattering process illustrating the unique angular distribution predicted for each process due to the initial photon polarization [19].

In the recent experiment in CERN, Geneva, and STAR collaboration USA, it is observed that collision of two High energy photons can generate electrons and positron shown in above fig 5 by Breit-Wheeler process. But the angle of production is for linearly polarized photons, the distinct differential cross sections lead to a cos 4ΔΦ angular distribution (Fig. 5),

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where $4\Delta\Phi$ is the azimuthal angle of phase difference in the laboratory frame between the momentum of the (e+) +(e-) pair and are ejected at a phase difference of $\pi/2$ apart from each other [13,14]. So, at the start moment of universe (10^{-32} sec), there was no fundamental particle as per standard model and they will be created by generation of polarity in the medium (described later) and ejected $\pi/2$ apart as postulated by Breit-Wheeler process and separated by event horizon (See fig 8) and will not inhale each other and will generate their own universe as shown in next fig.7 and fig 8.

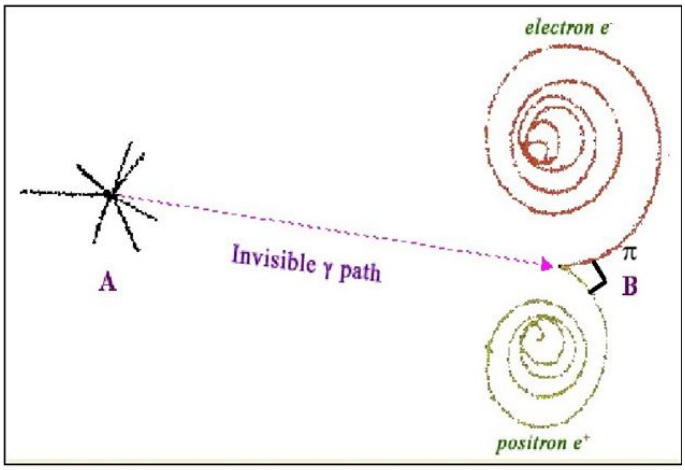


Fig -6 Trajectory of a gamma ray in a bubble chamber Photons deposit their energy in matter by transferring it to charged particles. The bubble chamber picture above displays the birth, life, and death of an individual gamma photon. The gamma was produced at point A, during a collision with a particle originating from an accelerator. After a certain distance travelled without any interaction, the gamma interacts at point B. It transfers its energy by creating an electron/positron pair [20] and they ejected π apart from each other.

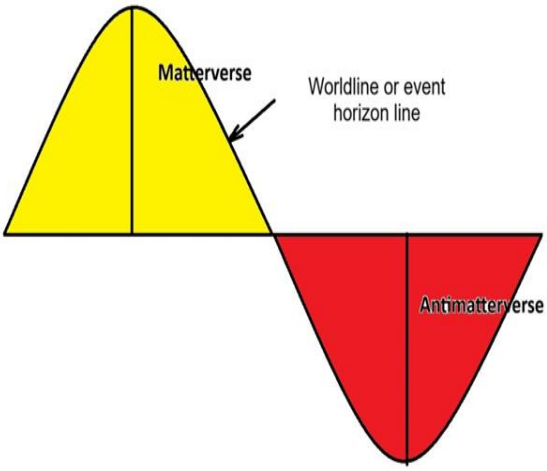


Fig.7. Proposed wave formation of matterverse and antimatteverse with worldline.

In fig. 7, we have shown that matterverse and Antimetterverse are separated by worldline or event horizon line as derived in [21]. So, matter and antimatter will not interact with each other. This was further explained by using Schwarzschild spacetime matric in the Kruskal-Szekeres coordinates. The event horizon breaks at Schwarzschild radius in Schwarzschild coordinates system but behaves well in Kruskal-Szekeres coordinates. This is well defined by eigen Chris in YouTube video [21] (also see fig 8 from lecture notes by Eigen Chris 108d]

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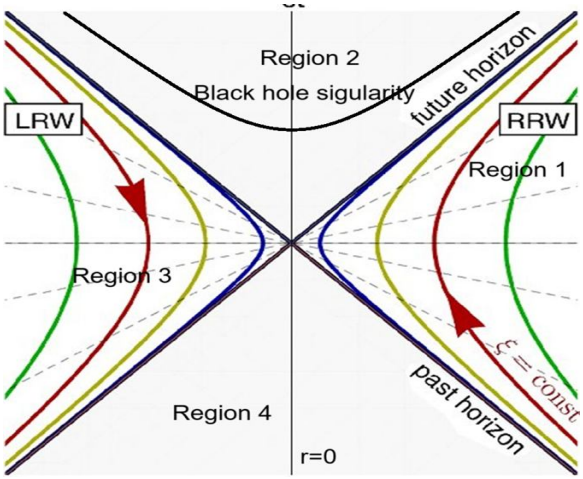


Fig 8. Schwarzschild spacetime in the Kruskal-Szekeres coordinates

Under Kruskal-Szekeres coordinate system as shown in Fig 8, RRW is region of matterverse whereas the region 2 is the antimatterverse. The region 3 and 4 are mathematical hypothetical concept and in reality, it cannot be visualized. Black hole as well as singularity exists in region 2(22]. This concept is important in explaining concept of cosmological constant 'Λ' , 'dark energy' and 'dark matter' of universe [32].

VI. THE CONCEPT OF COSMOLOGICAL CONSTANT AND MOND THEORY

The famous Einstein field equation (EFE), which is an extension of Poisson equation for non-Newtonian field and is given as below

$$R_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu} - \Lambda g_{\mu\nu} = \frac{8\pi G}{c^4}T_{\mu\nu}$$

Where Rμν is Riemann curvature, R is Ricci scaler and gμν space time matrix tensor. This equation is valid for weak gravitational field and flat space time field. ($8\pi G/c^4$) is called space time stiffness. So, this equation is not valid for r<rs (Region 3 or 4) and thus can be used for approximation. The einstein uses Λ, cosmological constant to satisfy both sides of equation [21] and to explain the expanding universe. It is observed by Edwin Hubble in 1929 that universe is expanding, and the Hubble expansion H is given by following formula [23]

$$H = \sqrt{(\Delta.c/3)}$$

It is believed that the expansion of universe is attributed to dark energy. It is also observed that the way the velocity of constituents of a galaxy varies with the radius gives the distribution of mass in galaxy[32]. As per Newtonian dynamics, a solid disc which rotates such that the velocity of particle increases linearly with radius. Also, as per Kepler law, if mass is concentrated at the center, the velocity of object decreases with square root of radial distance from centre of mass. (See the velocity distribution in Rotation curve of a typical galaxy in Fig 9) [24,25]. *In order to explain both for rotating galaxies, I am proposing that there is one more gravitational pull is acting on our universe due to attractive gravitational force generated by antimatterverse* in the region 2 as shown in fig 8 and fig 10 [32].

Now if we use simple formula of gravitational force, we can write

$$\Lambda = GM/r^2 \quad \text{---------- 2.}$$

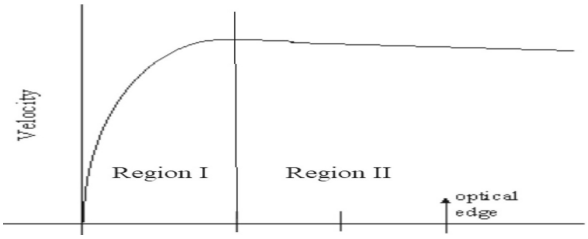


Fig. 9, Rotation curve of a typical galaxy

Where G is gravitational constant, r is proper distance of object on geodesic from event horizon (r=0) in Kruskal-Szekeres coordinates, M is mass equivalent of black hole/ antimatterverse (Fig 7). Matter and antimatter, both experiences same gravitational pull [30]. But both are rotating in opposite direction and cannot leave geodesic without extra energy. *Hence there is no dark energy in the system.*

This gives the idea, that objects near to event horizon line will have more expansion and which contradicts the present belief of dark energy in our universe. Rather both universe is pulling each other and connected through wormhole. It also explains the rotation curve of galaxies as given in fig 9. Due to net cosmological constant, there is pull on galaxies from event horizon and causing the outer periphery of galaxies to rotate at constant speed and slower than the center. The same observations are drawn by C. Meis [26] for G, but it will always be attractive as per my proposal.

This also gives the idea that our universe is uniform from all side as it has event horizon at the edge and so observer can never see or go from one region to other and event horizon is fixed and only celestial bodies are moving towards event horizon so there is no expansion of universe against contrary to belief of expanding of universe. The event horizon is temporal and the space is fixed in spatial horizon and expanding in temporal horizon due to its wave nature [27]. But due to this it is causing illusion of spatial expansion. And due to presence of event horizon, the sky looks black. (See fig 10). If we calculate and add the effect of 'Λ' on celestial bodies using above formula (formula .2), there is no need to give MOND (Modified Newtonian dynamics) or modified MOND theory for gravity.

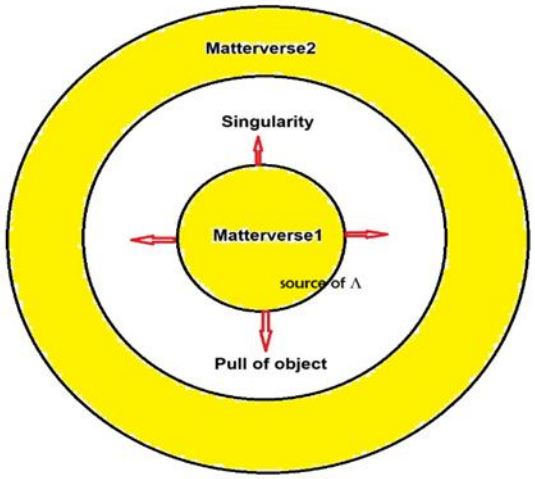


Fig 10. Concept of source of cosmological constant Λ and multiverse

Because it is a de-setter space and follow Kruskal-Szekeres coordinates. The light from one region 1 will not go to region 2 due to presence of event horizon (Fig. 8). So, observer in region 1 will not see the region. However, I feel that in the absence μ, magnetic permeability, there is no barrier of observation from region 3(Fig 11). So, I suggest that of the concept of μ, magnetic permeability and ε, electrical permittivity needs further revision using ΛCDM (Lambda-Cold Dark Matter) cosmological model.

VII. MATHEMATICAL EXPLANATION OF THE WAVE THEORY AND INVARIANCE OF SPEED OF LIGHT C

The vector potential amplitude quantization constant ζ may be given by (positive or negative) following

$$\zeta = \frac{\hbar}{4\pi ec} = \frac{1}{(4\pi)^2}\frac{e\mu_0}{\alpha}$$

This relation as given by Meis C. [26] is correlation between ζ and μ_0 the vacuum magnetic permeability and velocity of light c and e is the electron or positron charge, $\hbar$ is Planck's reduced constant c the speed of light in vacuum, α is the fine structure constant. One can also draw conclusion from above that interacting particle will have inherent magnetic properties.

The α is a dimensional less constant and relates other parameters [27] as

$$\alpha = \frac{e^2}{\hbar c} = 1/137$$

The masses of all particles and antiparticles originate from charges and their magnetic moment μ_0 [28]. In the absence of magnetic permeability or moment mass will not be generated (as mention in para 4).

Now here ζ is a function of μ_0, e and α which are constant for vacuum of our universe, but it may not be true for regions 2 or 3 as shown in fig 11.

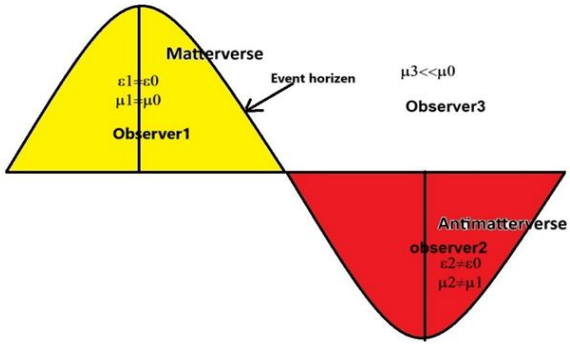


Fig 11. Invariance

If we analysis the above relations, we can draw conclusion that the value of c (speed of light or signal propagation in the vacuum) will be extremely high for low μ_0 and c>>c0 to keep α constant. This may be true for WIMP/ FIP also. *In the absence or exceptionally low value of μ, the particle will not interact with medium, and the WIMP/FIP will not display any signature*. Moreover, they will also show quantum entanglement due to high signal transmission speed c. The absence of μ_0 at the early moment of big bang causes hyperinflation.

Also "impedance of empty space" is the resistance that medium offer to light beam, while travelling in vacuum. There is a very famous relation connecting all four and one of the most important constants that is, permeability of free space (μ_0), permittivity of free space (ε_0), impedance of free space (Z_0) and speed of light in vacuum.

This can be expressed mathematically as

$$Z_0 = E/H = \sqrt{(\mu_0/\varepsilon_0)} = \mu_0 c_0 = 377 \text{ ohm}$$

Where E is electrical field vector and H is magnetic field vector. Here we see that physical parameter like μ_0 , c_0 , ε_0 , h, and α are interdependent and gives some constant values [29]. This will also give same conclusion on speed of light as deduced by equations proposed by [26]. So, in case, if μ has exceptionally low value or limiting to zero, then the speed of signal c_0 travelling will be very high and will be limiting or equal to the hyper-expansion of universe as observed at the beginning of big bang (at 10^{-32} sec) [31].

These values hold good if observer is in matterverse. But the values of ε_0 and μ_0 will not be same if observer is outside matterverse1.(See fig 11). As observer is sitting in observer2 position then values of ε_2 and μ_2 (and probably opposit) will not be equal to values of ε_0 and μ_0. similarly, if observer is sitting in observer3 position, then values of ε_3 and μ_3 will be very much less (~ zero) then values of ε_0 and μ_0, as there is no matter medium and conditions are prior to big bang. (like inside black hole, which do not emit any electromagnetic wave) The velocity of signal propagation will be extremely high (nearly infinite) than the velocity of light for observer3. This is also observed during the first moment of big bang. So, for observer3, there is no time and no space (Singularity), and he can observe all events in all verses. So, in short, the observer1 will have limited vision of say 94 billion Light Years or up to the boundary of event horizon. And light at the edge of matterverse due to existence event horizon will not reflect back so the sky in the night will be dark.

Now for observer3, these events will occur at time t=0. This is the explanation of our observation mentioned in the beginning of this paragraph. It may be noted here is time is origin of start of oscillation in supercooled energy medium. Before start of oscillation, there is no change in any system property, so there is no time and system is called homogeneous or singularity.

The μ, magnetic permeability is the main cause of creation of universe. This generates dipole moment and causes the matter and energy distance apart/ separate apart and works against gravity and is main reason for creation of matter and antimatter. So, for creation of singularity or black hole, μ must be zero and Maxwell equation may be modified for field for region 2 as follows

$$\nabla XB = \mu 0(J + \varepsilon 0 \partial E/\partial t) = 0$$

where B is magnetic field, J is current density and E is electric field. This implies that absence of magnetic field and magnetic forces and separation from mass and energy will not occur. This will allow to form blackhole. The absence of μ is singularity or presence of only cohesive force called gravity. However, the generation of magnetic polarity inside can again explode the black hole.

VIII. CONCLUSION

In this paper, we are trying to present our view on creation of universe and other observations as seen by other researchers. We have argued properties of universe using basic equations like energy of wave, mass energy relations and photon energy relations to derive basic properties of universe like mass of universe, generation of various size/mass elementary matter particles, antimatter particles, WIMP, dark matter etc.

We have also postulated generation of matterverse and antimatterverse based on Brit-wheeler process and our limitations on observations based on Schwarzschild spacetime matric in the Kruskal-Szekeres coordinates and analysis of two universes as postulated by Kruskal-Szekeres.

We have also postulated the source of dark energy and Λ, cosmological constant and suggested the modification of Newtonian gravity to explain the expansion of universe and speed of rotating galaxies.

We have also suggested that limit on speed of light and origin of mass is due to generation of polarity by creation of magnetic field at the time of big bang.

Appendix A. Plank length cut off

The Planck units are based on four physical constants:

the speed of light in vacuum, c;
the gravitational constant, G;
the reduced Planck's constant, ħ; and
the Boltzmann constant, k_B.

Planck length is 'l' = $\sqrt{(\hbar G/c^3)} \approx 1.616255\times10^{-35}$ m . The Planck length is very small and nearly 10^{20} times smaller than proton rms radius. At these small distances, the Heisenberg uncertainty principle takes over and conventional physics breaks down.

And the vacuum energy density ρ_{vac} for a continuous mode distribution is given by (7]

$$\rho_{vac} = \frac{3\hbar}{8\pi c^3}\omega^4$$

Where ω is all possible modes of energy of spherical harmonic oscillator and is equal to 2c/ l.. The ρ_{vac} for finite vacuum energy density for plank cut off length is expressed as

$$\rho_{vac} = \frac{6c^7}{\pi\hbar G^2} = 8.9X10^{113}\ J.m^{-3}$$

So, energy of plank length will be

$$\rho_{vac} * l^3 = 6.24X10^{21}\ MeV$$

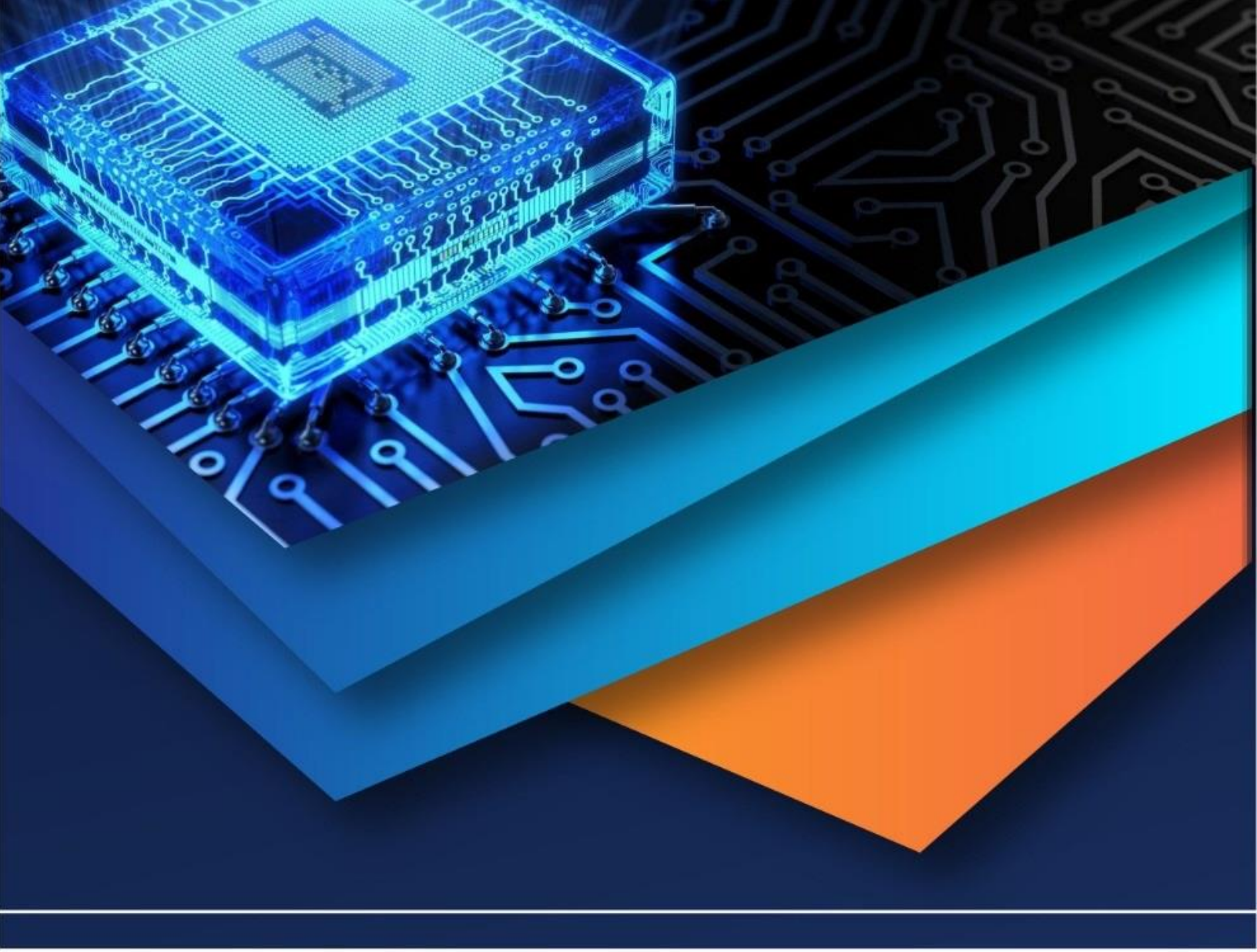
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REFERENCES

[1] Lemaître,"The expanding universe",Monthly Notices of the Royal Astronomical Society, Volume 91,p 490 ,March 1931
[2] Rahul Singh, "Mass Distribution in Space-Time and Conception about Space-Time-Mass Continuum**",** Department of Science and Technology National Library, International Journal of Astronomy and Astrophysics ,Vol.8 No.1.,94-103,1,March 2018,
[3] JOÃO E. STEINER ,The Origin of the Universe, estudos avançados,20 (58), 200
[4] Eigen Chris ,Lectures on Relativity by Eigen Chris on YouTube, 101 to 110.
[5] Emilio Elizalde, "All that Matter … in One Big Bang …", &Other Cosmological Singularities"'Galaxies, ,6(1),25; 201
[6] Stanford Encyclopaedia of Philosophy Quantum Gravity, revision Mon Feb 26, 2024
[7] Nassim HarameinCyprien Guermonprez, Olivier Alirol, ," Origin of mass and the Nature of gravity" International space federation laboratory,(ISF) sept 2023
[8] Wheeler J.A. "On the nature of quantum geometrodynamics "Annals of Physics,Vol 2, Issue 6, 604-614, Dec 1957
[9] How The Universe Works 3. "First Second of the Big Bang", Discovery Science, 2014.
[10] Nielsen, Louis, "The Extension, Age and Mass of the Universe" November 20, 1997; http://www.rostra.dk/louis/quant_11.html.
[11] Dimitar Valev," Estimations of total mass and energy of the observable universe ,Physics International, 5(1):15-20 March 201
[12] Wahlin, Lars "The Harmonic Universe",. The Deadbeat Universe. Boulder, Colorado: Colutron Research,27, 1997:

[13] C. Antel et.al. “Feebly interacting particles workshop” Springerlink , The European Physical Journal C, Volume 83, 1122, 2023
[14] Kathryn Zurek, at.el., FIPs 2022, Workshop Report, The European Physical Journal, Volume 83, pp-7,2023
[15] Kartin, M. Aker et el (KATRIN), Direct neutrino-mass measurement based on 259 days of KATRIN data collobrators)
[16] BBC Ideas , String theory - a simple way to understand the universe, youtube channel
[17] Qian Zhao et.al. “Angle-dependent pair production in the polarized two-photon Breit-Wheeler process” , PHYSICAL REVIEW D, 107, 096013, 2023
[18] G. Aad et al., (ATLAS Collaboration), “Observation of WZγ Production in pp Collisions at $\sqrt{s}$=13 TeV with the ATLAS Detector, Physical review letters”, 132, 021802, 2024,
[19] J Adams et.al(STAR Collaboration), “Measurement of e^+e^- momentum and angular distributions from linearly polarized photon collisions”Phys. Rev. Lett. 127,27, 052302 , July 2021radioactivity.eu.com ,”Gamma Rays in Matter/phenomenon”
[20] Eigen Chris ,Lectures on Relativity by Eigen Chris on YouTube, 108(d)
[21] David Tong ,”General Relativity”, Department of Applied Mathematics and Theoretical Physics, Centre for Mathematical Science University of Cambridge UK
[22] Mordehai Milgrom, “Solutions for the modified Newtonian dynamics field equation” Weizmann Institute, The Astrophysical Journal, 15,302:617-625, 1986 March
[23] Rahul Singh, “Mass Distribution in Space-Time and Conception about Space-Time-Mass Continuum”, International Journal of Astronomy and Astrophysics, , 8, 94-103,2018
[24] C Sivaram, Kenath Arun Louise Rebecca, “MOND, MONG, MORG as alternatives to dark matter and dark energy, and consequences for cosmic structures” J. Astrophys. Astr,41,2020
[25] Meis, C, Journal of Modern Physics,13,949-968, 202
[26] Gerd Pommerenke,” Accelerated Expansion a Fallacy “, Adv. Theo. Comp. Phy, vol 7, 30, 2024
[27] Nader Butto, “A New Theory on the Origin and Nature of the Fine Structure Constant” , Journal of High Energy Physics, Gravitation and Cosmology, 6, 579-589, 202
[28] Biman Nath, “The Fine Structure Constant” ,RESONANCE, Volume 20, Issue 5, 283-288 ,May 201
[29] Elizabeth Howell, “What is the Big Bang Theory”, Space.com, July 27, 202
[30] Anna Soter,”Free-falling antihydrogen reveals the effect of gravity on antimatter”,Nature, vol 621, 699-700,2023
[31] M.K.Singh,”Alternative solution of Galaxy Rotation Curves, expansion of universe and Hubble expansion”, Pre print 10.13140/RG.2.2.29445.87520, March 2025



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