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On the Evolving Black Holes and Black Hole Cosmology-Scale Independent Quantum Gravity Approach

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Abstract So far many models have been proposed for understanding the real picture of 'quantum gravity'. But none is successful in interpreting the observed cosmological phenomena. By going through this revised paper as a review article, many concepts on evolving black holes, black hole radiation, black hole cosmology, scale independent cosmological quantum gravity, CMBR isotropy and anisotropy, ordered galactic structures, galactic rotation curves, observed galactic redshifts, present and future cosmic rate of expansion etc. can be understood. The three heuristic concepts are: 1) Evolving universe is a scale independent quantum gravitational object. 2) CMBR temperature is a quantum gravitational effect of the (evolving and light speed rotating) primordial black hole universe and 3) Observed cosmic redshift is the result of a characteristic light emission mechanism of the cosmologically evolving hydrogen atom and is inversely proportional to the cosmic temperature.

Keywords: *standard cosmology, stoney mass, black hole cosmology, cosmic growth index, cosmic red shift, galaxy rotation curves, cosmic age CMB isotropy and anisotropy, final unification*

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1. Introduction

Photons and black holes can be considered as the best candidates of quantum gravitational objects. It is true that, without the universe there is no independent existence to any photon or any black hole. Now the fundamental question to be answered is: Is the universe a quantum gravitational object or something else? Physicists expressed several opinions with many possible solutions. Most of the black hole physicists and cosmologists believe in the existence of primordial black holes [1]. When the early universe was able to create a number of primordial black holes, it may not be a big problem for the whole universe to behave like a big primordial black hole. With reference to the current concepts of modern cosmology [2-9], probability of 'this' to happen may be zero, but its possibility cannot be ruled out. Thinking positively and by correlating the basics of Quantum mechanics, Newton's law of gravitation and Special and General theories of relativity- in this review paper [10-15] authors see the possibility of developing a scale independent quantum gravitational black hole cosmology. In reality one may see or may not see a black hole, but by considering the whole 'observable universe' as a huge primordial (quantum gravitational) evolving black hole, many interesting things will come into review. Future science, engineering and technology may resolve all the related issues.

1.1. Scale Independent Quantum Gravitational Black hole Cosmology

Most of modern physicists believe that, 1) Quantum gravitational effects [16-20] are extremely weak and cannot be tested in any ground based laboratory operating under low energy scales. 2) As the laboratory experimental energy scale increases and approaches the Planck scale, quantum gravitational effects become stronger and their results can be observed and measured. Some of the other modern physicists believe that, during the cosmic evolution, Planck scale quantum gravitational interactions might have an observable effect on the current observable cosmological phenomena. In this context, the latter proposal seems to have more impact on the observable universal laboratory. Clearly speaking, with respect to the Planck scale early universal laboratory, current universe can be considered as a low energy scale laboratory. If so, cosmological quantum gravity can be considered as the scale independent model. If one is willing to consider the current observable universe as a low energy scale operating laboratory, currently believed cosmic microwave back ground temperature can be considered as the low energy quantum gravitational effect. At any time in the past, i.e as the operating energy scale was assumed to be increasing; past high cosmic back ground temperature can be considered as the high energy quantum gravitational effect. Thinking in this way, starting from the Planck scale and with reference to the decreasing magnitude of cosmic back ground temperature, quantum gravity can be considered as a scale independent model and the universe can be considered as the best quantum gravitational object.

2. The Classical Limits of Force and Power

Without considering the current notion of black hole physics [21,22], Schwarzschild radius of black hole can be estimated with the characteristic limiting force of magnitude. The outstanding problem in particle physics today is the inclusion of gravity in a single, unified quantum theory of all the fundamental interactions [23]. Particle physicists have long suggested that the four observed fundamental forces of nature (the gravitational, electromagnetic, weak nuclear and strong nuclear forces) are separate, low energy manifestations of what was once a single force at times close to the Big Bang. It is postulated that as the universe expanded and cooled, this single force gradually broke down into the four separate interactions as observed today. However, unification theories that seek to unify the force of gravity with all the other forces (Theories of Everything) remain elusive, as the gravitational interaction lacks a quantum formulation.

To unify cosmology, quantum mechanics and the four observed fundamental cosmological interactions – certainly a 'unified force' is required [23]. In this connection $\left(c^4/G\right)$ can be considered as the classical force limit. Similarly $\left(c^5/G\right)$ can be considered as the classical power limit. If it is true that c and G are fundamental physical constants in physics, then $\left(c^4/G\right)$ and $\left(c^5/G\right)$ can also be considered as fundamental compound physical constants. These classical limits are more powerful than the Uncertainty limit. Note that by considering the classical force limit $\left(c^4/G\right)$, the famous Planck mass can be obtained in the following unified approach.

2.1. To Derive the Planck Mass

So far no theoretical model proposed a derivation for the Planck mass. Two derive the Planck mass the following two conditions can be given a chance. Assuming that gravitational force of attraction between two Planck particles of mass $\left(M_P\right)$ separated by a minimum distance ($r_{\min}$) be,

$$\left[\frac{GM_P M_P}{r_{\min}^2}\right] \equiv \left(\frac{c^4}{G}\right) \tag{1}$$

With reference to wave mechanics, let

$$2\pi.r_{\min} \cong \lambda_P = \left[\frac{h}{c.M_P}\right] \tag{2}$$

Here, λ_P represents the wavelength associated with the Planck mass. With these two assumed conditions Planck mass can be obtained as follows.

$$M_P = \sqrt{\frac{hc}{2\pi G}} \cong \sqrt{\frac{\hbar c}{G}} \tag{3}$$

Clearly speaking, Planck scale is inherently interconnected with the astrophysical force limit $\left(c^4/G\right)$.

2.2. Simple Applications of $\left(c^4/G\right)$

A. Magnitude of force of attraction or repulsion between any two charged particles never exceeds $\left(c^4/G\right)$.

B. Magnitude of gravitational force of attraction between any two massive bodies never exceeds $\left(c^4/G\right)$.

C. Magnitude of mechanical force on a revolving/rotating body never exceeds $\left(c^4/G\right)$.

D. Magnitude of electromagnetic force on a revolving body never exceeds $\left(c^4/G\right)$.

2.3. Simple Applications of $\left(c^5/G\right)$

A. Mechanical power never exceeds $\left(c^5/G\right)$

B. Electromagnetic power never exceeds $\left(c^5/G\right)$

C. Thermal radiation power never exceeds $\left(c^5/G\right)$

D. Gravitational radiation power never exceeds $\left(c^5/G\right)$

2.4. Schwarzschild Radius of a Black Hole

The four basic physical properties of a rotating black hole are its mass, size, angular velocity and temperature. Without going deep into the mathematics of black hole physics in the following subsections an attempt is made to understand and fit the black hole radius and temperature.

In all directions if a force of magnitude $\left(c^4/G\right)$ acts on the mass-energy content of the assumed celestial body it approaches a minimum radius of $\left(GM/c^2\right)$ in the following way. Origin of the force $\left(c^4/G\right)$ may be due to self weight or internal attraction or external compression.

$$R_{\min} \cong \frac{Mc^2}{\left(c^4/G\right)} \cong \frac{GM}{c^2} \tag{4}$$

If no force (of zero magnitude) acts on the mass content M of the assumed massive body, its radius becomes infinity. With reference to the average magnitude of $\left(0, \frac{c^4}{G}\right) \cong \frac{c^4}{2G}$, the presently believed Schwarzschild radius can be obtained as

$$(R)_{ave} \cong \frac{Mc^2}{\left(c^4/2G\right)} \cong \frac{2GM}{c^2} \quad (5)$$

This proposal is very simple and seems to be different from the existing concepts of General theory of relativity.

3. About the Stoney Scale and Stoney Mass Unit

George Johnstone Stoney was one of the first scientists to understand that electric charge was quantized; from this quantization he deduced the units that are now named after him [24]. He is most famous for introducing the term 'electron' as the 'fundamental unit quantity of electricity'. Since 1881, the 'Stoney units' form a system of units and were the first historical example of natural units of measurement designed so that certain dimensionless physical constants or fundamental physical constants serve as fundamental units or base units. The Stoney mass, the Stoney length and the Stoney energy, collectively called the Stoney scale, are not far from the Planck Mass, Planck length and the Planck energy. Clearly speaking, the Stoney scale and the Planck scale-both are the length and energy scales at which quantum processes and gravity occur together. At both of these scales, many physicists expected a unified theory [25,26,27]. Note that the basic concept of unification is to understand the origin of 'mass' of any particle. Mass is the basic property in 'gravitation' and charge is the basic property in 'atomicity'. So far no model established a cohesive relation in between 'electric charge' and 'mass' of any 'elementary particle'. From physics point of view, the fundamental questions to be answered are: 1) Without charge, is there any independent existence to "mass"? 2) Without mass, is there any independent existence to "charge"? To understand these questions it is possible to guess that, there exists a fundamental mass unit having charge e, in such way that its gravitational force of attraction is equal to its electromagnetic force of attraction.

$$\frac{GM_S^2}{r^2} \cong \frac{e^2}{4\pi\varepsilon_0 r^2} \Rightarrow GM_S^2 \cong \frac{e^2}{4\pi\varepsilon_0} \quad (6)$$

where r is the distance between two Stoney mass units. With this idea, it can be suggested that, there exists a fundamental mass in the following way.

$$(M_S)^{\pm} \cong \sqrt{\frac{e^2}{4\pi\varepsilon_0 G}} \cong \frac{e}{\sqrt{4\pi\varepsilon_0 G}} \cong 1.859272\times10^{-9} \text{ Kg} \quad (7)$$

$$\left.\begin{aligned} M_S c^2 &\cong \sqrt{\frac{e^2c^4}{4\pi\varepsilon_0 G}} \cong \sqrt{\left(\frac{e^2}{4\pi\varepsilon_0}\right)\left(\frac{c^4}{G}\right)} \\ &\cong 1.042975\times10^{18} \text{ GeV}\end{aligned}\right\} \quad (8)$$

It is generally called as the 'Stoney mass'. Considering the integral nature of the elementary charge, Stoney mass can be guessed to be discrete. It can be considered as the seed of galactic matter or galactic central black hole. It can also be considered as the seed of any cosmic structure. If two such oppositely charged particles annihilate, a large amount of energy can be released. If so under certain extreme conditions at the vicinity of massive stars or black holes, a very high energy radiation can be seen to be emitted by the pair annihilation of M_S. With this mass unit, proton-electron mass ratio and proton and electron rest masses can be fitted. With trial-error method and with reference to the elementary charge and electron and proton rest masses, magnitude of the gravitational constant can be fitted in the following way.

$$\left(\frac{m_p}{m_e}\right)\ln\sqrt{\frac{m_p}{m_e}} \cong \frac{\left(M_S m_e^2\right)^{\frac{1}{3}}}{m_p} \quad (9)$$

Here, LHS=6908.3745 and RHS=6899.7363. Accuracy can be improved with the following fitting.

$$\frac{\left(M_S m_e^2\right)^{\frac{1}{3}}}{m_p} \cong \left[\left(\frac{m_p}{m_e}\right)\ln\sqrt{\frac{m_p}{m_e}}\right] + \ln\left[\left(\frac{m_p}{m_e}\right)\ln\sqrt{\frac{m_p}{m_e}}\right] \quad (10)$$

From the above relation, magnitude of the gravitational constant [28,29,30] can be fitted in the following way.

$$\left.\begin{aligned} &\text{If } X \cong \left(\frac{m_p}{m_e}\right)\ln\sqrt{\frac{m_p}{m_e}} \text{ and } M_S \cong \left[X + \ln(X)\right]^3\left(\frac{m_p^3}{m_e^2}\right) \\ &G \cong \frac{e^2}{4\pi\varepsilon_0 M_S^2} \cong 6.672681991\times10^{-11} \text{ m}^3.\text{kg}^{-1}\text{sec}^{-2}\end{aligned}\right\} \quad (11)$$

$$m_p \cong 1.672621777(74)\times10^{-27} \text{ kg},$$

where, $m_e \cong 9.109\,382\,91(40)\times10^{-31}$ kg,

$$e \cong 1.602\,176\,565(35)\times10^{-19} \text{ C}.$$

4. About the Evolving Black Holes

Very recently S.W. Hawking modified his Black hole theory [31] with "Apparent horizons". This brought a serious confusion among the black hole physicists and whole science community. In his words: "There is no escape from a black hole in classical theory. Quantum theory, however, enables energy and information to escape from a black hole". He admits that, a full explanation of the process would require a theory that successfully merges gravity with the other fundamental forces of nature. But that is a goal that has eluded physicists for nearly a century. However 'the correct treatment'- 'remains a mystery'.

Abhas Mitra [32] has shown that true black holes can never form. In his opinion the so-called black holes observed by astronomers are actually radiation pressure supported Eternally Collapsing Objects (ECOs). These balls of fire are so hot that even neutrons and protons melt there and whose outward radiation pressure balances the inward pull of gravity to arrest a catastrophic collapse before any Black Hole or 'singularity' would actually form.

Now the fundamental question to be answered is- Will any black hole exists without its event horizon? In authors' opinion – the answer is "yes". By considering Hawking's view and Abhas Mitra's view, if one is willing to replace the "event horizon" with "geometric horizon", black holes can be considered as real 'very hot celestial quantum objects' with emission of electromagnetic energy under extreme gravitational attraction. Along with the presently believed black holes that are expected to be formed by gravitational collapse of massive star, there may exist primordial very hot evolving black holes and their origin may be interlinked with the Planck scale or the Stoney scale. Extending this proposal, the current universe can be considered as a huge evolving black hole of radius equal to the current Hubble length and temperature equal to the current cosmic microwave back ground temperature 2.725 Kelvin.

4.1. To Understand the Growing Geometric Boundary of a Growing Black Hole

Generally any living or non-living object is being identified by its shape. In our daily life generally it is observed that any animal or fruit or human being (from birth to death) grows with closed boundaries (irregular shapes also can have a closed boundary). An apple grows like an apple. An elephant grows like an elephant. A plant grows like a plant. A human being grows like a human being. As their shape is being maintained continuously throughout their life time they won't change their respective identities. These are the observed biological facts. From these observed facts it can be suggested that "growth"' or "expansion" can be possible with a closed boundary. Thinking that nature loves symmetry, in a heuristic approach in this paper authors assume that any black hole possesses a (growing) structural boundary by which its physical structure always seems to be identified as a (growing) black hole. Such type of boundary can be called as the growing geometric boundary of the growing black hole. Stoney mass can be considered as the primordial very hot baby black hole. It can be considered as the seed of any growing black hole and can be called as the "baby black hole".

4.2. Natural Non-escaping of a Freely Falling Body

A freely falling body attains light speed when it reaches the black hole surface. At the same time it completely loses its shape and size due to black hole's surface gravity and high temperature. The moment it reaches the light speed, (in a highly deformed state) it stats escaping from the black hole geometric horizon. Due to high surface gravity, its light speed escape velocity becomes zero within a short span. By any strange control mechanism if it is able to maintain its shape, size and light speed (against the black hole surface gravity and temperature), then certainly it will escape from the black hole geometric horizon.

4.3. Natural Escaping of Photon

Even though surface gravity is high at the black hole's geometric horizon, being a quantum mechanical object photon will escape from the massive Black hole's geometric horizon. Clearly speaking during its escape from the massive Black hole's geometric horizon, photon may lose energy due to massive Black hole's surface gravity and show gravitational redshift but it will not lose its speed. Thus with increasing redshift photon will continue its journey until its energy becomes zero and redshift reaches infinity. For a photon moving towards the massive Black hole's horizon, its speed remaining constant it experiences gravitational blue shift and again speed remaining constant it leaves the massive Black hole's horizon by losing its earlier acquired (gravitational blue shift) energy by the gravitational redshift. Compared to the photon that originates from the black hole, photon that enters and leaves the black hole will make a long journey.

4.4. Growth and Temperature of the Evolving Primordial Black Holes

The Stoney mass being the seed and by absorbing the vacuum energy primordial black holes will grow. As they grow, their mass and size will increase, temperature and density will decrease. The intrinsic feature is that evolving primordial black holes materialize the vacuum energy into massive form. If one is willing to guess that, evolving black hole's growth rate is proportional to its mass, from the beginning of the Stoney scale, growth rate increases with increasing mass of the black hole. If so, by this time, the galactic central black holes may grow rapidly very soon it may eat the whole galaxy. Alternatively, if one is willing to guess that, evolving black hole's growth rate is inversely proportional to its mass, from the beginning of the Stoney scale, growth rate decreases with increasing mass of the black hole. If so by this time, the galactic central black hole may grow slowly and very soon the whole galaxy may get stability. From future study and observations, it has to be confirmed. By measuring the evolving black hole's decreasing temperature and rate of decrease in the temperature, its actual growth rate can be understood.

Note that, so far Hawking's black hole temperature formula [22] is not verified and not confirmed by any of the advanced astrophysical observations or Large Hadron Collider experiments. It is being believed based on the advanced quantum mechanical theoretical and mathematical formulations. To prove it, it is a must to measure the mass, size and temperature of any black hole. In this paper authors proposed a new formula for the evolving black hole's temperature. It is similar to the Hawking's black hole temperature but differs greatly in the magnitude of the temperature. In authors' opinion, evolving primordial black holes are very hot and their heat source is its initial temperature only. At any time their temperature can be approximated with the following conjecture. It has to be confirmed or verified with further analysis, observations and possible measurements. If one is willing to consider the whole universe as a huge primordial black hole, it can be visualized.

$$\begin{aligned} aT^4 &\cong \left[1+\ln\left(\frac{M}{M_S}\right)\right]^{-2} \left\{ Mc^2 \cdot \left[\frac{4\pi}{3}\left(\frac{2GM}{c^2}\right)^3\right]^{-1} \right\} \\ &\cong \left[1+\ln\left(\frac{M}{M_S}\right)\right]^{-2} \left[\frac{3}{32\pi} \cdot \frac{c^8}{G^3M^2}\right] \end{aligned} \quad (12)$$

Recent observations confirmed the light speed rotation of black holes [33,34]. If so, above relation can be simplified as follows.

Let R and ω be the radius and angular velocity of the evolving black hole when it rotates with light speed. If so,

$$\omega \cong \frac{c}{R} \cong c\left(\frac{2GM}{c^2}\right)^{-1} \cong \frac{c^3}{2GM} \tag{13}$$

$$\left.\begin{aligned} aT^4 &\cong \left[1+\ln\left(\frac{M}{M_S}\right)\right]^{-2}\left\{Mc^2\cdot\left[\frac{4\pi}{3}\left(\frac{2GM}{c^2}\right)^3\right]^{-1}\right\} \\ &\cong \left[1+\ln\left(\frac{M}{M_S}\right)\right]^{-2}\left\{\frac{3\omega^2c^2}{8\pi G}\right\} \end{aligned}\right\} \tag{14}$$

$$\frac{3\omega^2c^2}{8\pi GaT^4} \cong \left[1+\ln\left(\frac{M}{M_S}\right)\right]^2 \tag{15}$$

From Planck's quantum theory of light [35,36] if $x \cong 4.965114231744276...$ and $y \cong 2.82143937212...$ and splitting the radiation constant into the elementary physical constants it is possible to show that,

$$\left.\begin{aligned} T &\cong \left(\frac{1}{xy}\right)^{\frac{1}{2}}\left\{\left(\frac{M}{M_S}\right)\Big/\left[1+\ln\left(\frac{M}{M_S}\right)\right]\right\}^{\frac{1}{2}}\left\{\frac{hc^3}{4\pi Gk_BM}\right\} \\ &\cong \left(\frac{1}{xy}\right)^{\frac{1}{2}}\left[1+\ln\left(\frac{M}{M_S}\right)\right]^{-\frac{1}{2}}\left\{\frac{hc^3}{4\pi Gk_B\sqrt{MM_S}}\right\} \\ &\cong \left(\frac{1}{xy}\right)^{\frac{1}{2}}\left[1+\ln\left(\frac{M}{M_S}\right)\right]^{-\frac{1}{2}}\left\{\frac{h\sqrt{\omega_S\omega}}{4\pi k_B}\right\} \end{aligned}\right\} \tag{16}$$

where $\omega_S \cong \dfrac{c^3}{2GM_S}$. The relation that plays a key role in this procedure can be expressed as follows.

$$(\lambda_f, \lambda_m) \cong \left(\frac{x}{y}\right)^{\pm\frac{1}{2}}\cdot\sqrt{1+\ln\left(\frac{M}{M_S}\right)}\cdot\frac{4\pi G\sqrt{MM_S}}{c^2} \tag{17}$$

where λ_f and λ_m are the peak wavelength in frequency domain and peak wavelength in wavelength domain respectively. If different massive black holes are different states of an evolving black hole that always rotates with light speed, then

$$\omega_t \cong \frac{c}{R_t} \cong c\left(\frac{2GM_t}{c^2}\right)^{-1} \cong \frac{c^3}{2GM_t} \tag{18}$$

$$\left.\begin{aligned} aT_t^4 &\cong \left[1+\ln\left(\frac{M_t}{M_S}\right)\right]^{-2}\left\{M_tc^2\cdot\left[\frac{4\pi}{3}\left(\frac{2GM_t}{c^2}\right)^3\right]^{-1}\right\} \\ &\cong \left[1+\ln\left(\frac{M_t}{M_S}\right)\right]^{-2}\left\{\frac{3\omega_t^2c^2}{8\pi G}\right\} \end{aligned}\right\} \tag{19}$$

$$\frac{3\omega_t^2c^2}{8\pi GaT_t^4} \cong \left[1+\ln\left(\frac{M_t}{M_S}\right)\right]^2 \tag{20}$$

$$\left.\begin{aligned} T_t &\cong \left(\frac{1}{xy}\right)^{\frac{1}{2}}\left\{\left(\frac{M_t}{M_S}\right)\Big/\left[1+\ln\left(\frac{M_t}{M_S}\right)\right]\right\}^{\frac{1}{2}}\left\{\frac{hc^3}{8\pi Gk_BM_t}\right\} \\ &\cong \left\{xy\left[1+\ln\left(\frac{M_t}{M_S}\right)\right]\right\}^{-\frac{1}{2}}\left\{\frac{hc^3}{4\pi Gk_B\sqrt{M_tM_S}}\right\} \end{aligned}\right\} \tag{21}$$

The relation that plays a key role in this procedure can be expressed as follows.

$$(\lambda_f, \lambda_m) \cong \left(\frac{x}{y}\right)^{\pm\frac{1}{2}}\sqrt{1+\ln\left(\frac{M_t}{M_S}\right)}\cdot\frac{4\pi G\sqrt{M_tM_S}}{c^2} \tag{22}$$

where λ_f and λ_m are the peak wavelength in frequency domain and peak wavelength in wavelength domain respectively at time t.

5. About the Black hole Cosmology

5.1. History of Modern Cosmology

History of cosmology is very interesting. At first in 1916 Einstein proposed an intellectual but unsuccessful static model of cosmology with the famous 'lambda term' and science community forced him to abandon the term [37]. Later in 1920s Friedmann proposed an expanding model of cosmology [38]. As a reviewer Einstein rejected it and was recognized only after Hubble's work on the galactic redshift [2]. Without reaching any other part of the universe, Friedmann boldly proposed that universe looks the same from any part of the universe! In this regard in 1988 S.W. Hawking suggested that, there is no scientific evidence to Friedmann's second assumption and it is being believed only on modesty [23]. Very unfortunate thing is that, so far science and technology could not provide a single clue in support of this assumption. If so, one can certainly doubt the output physics and consequences of Friedmann cosmology. In 1948 Fred Hoyle proposed 'steady state cosmology' and was found to be insightful [39]. In 1948 Gamow proposed hot big bang model of expanding cosmology and was not recognized by the science community [40]. In 1964 unexpectedly hot big bang model got a great evidence [41]. In 2000, cosmologists again unexpectedly proposed accelerating model of cosmology with distant super novae dimming [4] against a normally expected 'decelerating model of hot big bang'. Most surprising thing is that so far no telescope or particle accelerator provided evidence to the indirectly confirmed 'dark energy' of the accelerating model of the universe. Another interesting thing is that, the abandoned lambda term has been re-considered by the science community to understand the existence of dark energy. In this long journey the very interesting thing is that, the subject of cosmology was largely influenced by Hubble's interpretations on galactic red shift and Inflation concepts. Since 1980s 'cosmic inflation' is so widely accepted that it is often taken as an established fact. The idea is that the geometry and uniformity of the cosmos were established during an intense early growth burst. But very shocking news is that, some of the creators of the inflation theory, like Paul J. Steinhardt, are having second thoughts [8]. As the original theory has been developed, cracks have appeared in its logical foundations. Various proposals are being circulated for ways to fix or replace it. Quantum cosmology is a field attempting to study the effect of quantum mechanics on the formation of the universe, or its early evolution, especially just after the Big Bang. Despite many attempts, the field remains a rather speculative branch of quantum gravity. Even though the observed galactic rotational curves can be explained by the Modified Newtonian Dynamics [42-47] with the cosmological acceleration term (cH_0) , standard cosmology **i**s not clear about the implementation of (cH_0) .

5.2. To Implement Quantum Gravity in Cosmology

Here the authors would like to stress the fact that, without measuring and confirming the 'actual' galaxy receding, it may not be reasonable to confirm the Hubble's redshift interpretation, the current cosmic acceleration and the existence of dark energy. Even though standard cosmology indirectly confirmed the existence of dark energy and dark matter, so far no ground based laboratory confirmed their individual existence. If theoretical predictions are not in line with the observations, then either observations have to be interpreted in a different manner or theory has to be modified as per the observations. In this context, quantum gravity can be considered as a key tool. Although a quantum theory of gravity or quantum cosmology is needed in order to merge general relativity with the principles of quantum mechanics, difficulties arise when one attempts to apply the usual prescriptions of quantum field theory to the force of gravity. Out of all currently available theories, there is still no complete and consistent quantum theory of gravity, and the candidate mode is still need to overcome major formal and conceptual problems. Even though there are a number of other approaches to quantum gravity, as of now, there is no way to put quantum gravity predictions to experimental tests. Even though it is a must, so far, nobody is clear about 'quantum gravity'. Clearly speaking, whether to see quantum effects in a gravity field or to see a continuum in quantum mechanics or to see the combined effects of gravity and quantum mechanics – is not yet clear. Anyhow combining quantum mechanics and general theory of relativity is a must and needs conceptual fine tuning. It can be achieved in the following way also.

1. To consider the cosmic microwave back ground temperature as a quantum gravitational effect.

2. To consider the CMBR temperature as the characteristic temperature of the evolving primordial cosmic black hole.

3. To consider the primordial cosmic black hole as an evolving and light speed rotating black hole with angular velocity identical with the cosmological Hubble constant.

4. As suggested by the hot big bang model, to consider the current black hole universe as decelerating. Modern cosmologists believe that rate of the change of the Hubble constant describes how fast/slow the Hubble constant changes over time and this rate does not tell if the Universe is currently expanding. This logic seems to be misleading. In authors' opinion, if magnitude of past Hubble's constant was higher than the current magnitude then magnitude of past (c/H_t) will be smaller than the current Hubble length (c/H_0). If so rate of decrease of the Hubble constant can be considered as a true index of rate of increase in Hubble length and thus with reference to Hubble length, rate of decrease of the Hubble constant can be considered as a true index of cosmic rate of expansion. Proceeding further - in future, certainly with reference to current Hubble's constant, $d(c/H_0)/dt$ gives the true cosmic rate of expansion. Same logic can be applied to cosmic back ground temperature also. Clearly speaking $d(T_0)/dt$ gives the true cosmic rate of expansion. To understand the ground reality, sensitivity and accuracy of current methods of estimating the magnitudes of $(H_0$ and $T_0)$ must be improved.

5. By considering 'black hole geometry' as the 'eternal cosmic geometry' and by assuming 'constant light speed rotation' throughout the cosmic evolution, at any time the currently believed cosmic 'critical density' can be shown to be the cosmic black hole's eternal 'mass density'. If mass of the black hole universe is M_t , (c/H_t) is the radius of the black hole universe that rotates at light speed with angular velocity H_t , at any time in the past,

$$\frac{2GM_t}{c^2} \cong \frac{c}{H_t} \text{ and } M_t \cong \frac{c^3}{2GH_t}. \tag{23}$$

At any time in the past, if one is willing to consider the Hubble length (c/H_t) as the radius of growing cosmic black hole, then angular velocity being H_t , magnitude of the Schwarzschild radius of the light speed rotating cosmic black hole and the magnitude of Hubble length can be the same.

$$\left.\begin{array}{l}(\rho_v)_t \cong (M_t)\left[\dfrac{4\pi}{3}\left(\dfrac{c}{H_t}\right)^3\right]^{-1} \\ \cong \left(\dfrac{c^3}{2GH_t}\right)\left[\dfrac{3}{4\pi}\left(\dfrac{H_t}{c}\right)^3\right] \cong \dfrac{3H_t^2}{8\pi G}\end{array}\right\} \tag{24}$$

At present,

$$\begin{array}{l}(\rho_v)_0 \cong (M_0)\left[\dfrac{4\pi}{3}\left(\dfrac{c}{H_0}\right)^3\right]^{-1} \\ \cong \left(\dfrac{c^3}{2GH_0}\right)\left[\dfrac{3}{4\pi}\left(\dfrac{H_0}{c}\right)^3\right] \cong \dfrac{3H_0^2}{8\pi G}\end{array} \tag{25}$$

Clearly speaking, when the currently believed 'critical density' itself represents the mass density of a light speed rotating black hole universe and as there is no observational or experimental evidence to Friedmann's second assumption, the density classification scheme of Friedmann cosmology must be reviewed at fundamental level.

If 'growth' or 'expansion' is a characteristic feature of the evolving black hole universe, then as time passes, for the growing cosmic black hole (c/H_t) increases to (c/H_0). As a consequence, density of the growing cosmic hole decreases from $\frac{3H_t^2}{8\pi G}$ to $\frac{3H_0^2}{8\pi G}$. To interrelate (c/H_t) and (c/H_0), or to interrelate H_t and H_0, and to understand the outline picture, authors assume that, forever rotating at light speed, high temperature and high angular velocity small sized primordial cosmic black hole of mass close to the Planck scale gradually transforms into a low temperature and low angular velocity large sized massive primordial cosmic black hole. At any given cosmic time, for the primordial growing black hole universe, its 'Schwarzschild radius' can be considered as its characteristic possible minimum radius and 'constant light speed rotation' will give the maximum possible stability from collapsing.

6. Three MAJOR ConjectureS and three Vital Applications in Cosmology

Possible conjectures in unified cosmic physics can be expressed in the following way.

Major Conjecture -1: During cosmic evolution, at any time in the past, in hydrogen atom emitted photon energy was always inversely proportional to the cosmic temperature. Thus past light emitted from older galaxy's hydrogen atom will show redshift with reference to the current laboratory data. There will be no change in the energy of the emitted photon during its journey from the distant galaxy to the observer.

$$\frac{E_0}{E_t} \cong \frac{\lambda_t}{\lambda_0} \cong \frac{T_t}{T_0} \cong (z_0 + 1) \tag{26}$$

Here, E_t is the energy of emitted photon from the galactic hydrogen atom and E_0 is the corresponding energy in the laboratory. λ_t is the wave length of emitted and received photon from the galactic hydrogen atom and λ_0 is the corresponding wave length in the laboratory. T_t is the cosmic temperature at the time when the photon was emitted, T_0 is the current cosmic temperature and z_0 is the current redshift.

If one is willing to consider this proposal, in hydrogen atom emitted photon energy can be understood as follows. As the cosmic time increases, cosmic angular velocity and hence cosmic temperature both decrease. As a result, during cosmic evolution, in hydrogen atom, binding energy increases in between proton and electron. As cosmic temperature decreases, it requires more excitation energy to break the bond between electron and the proton. In this way, during cosmic evolution, whenever it is excited, hydrogen atom emits photons with increased quantum of energy. Thus past light quanta emitted from old galaxy's excited hydrogen atom will have less energy and show a red shift with reference to the current laboratory magnitude. During journey light quanta will not lose energy and there will be no change in light wavelength. Galactic photon energy in hydrogen atom when it was emitted can be estimated as follows.

$$\left.\begin{aligned} E_t &\cong \frac{hc}{\lambda_t} \cong \left(\frac{T_0}{T_t}\right)\left(\frac{hc}{\lambda_0}\right) \cong \left(\frac{T_0}{T_t}\right) E_0 \\ z_0 &\cong \frac{\lambda_t - \lambda_0}{\lambda_0} \cong \frac{E_0 - E_t}{E_t} \cong \frac{T_t - T_0}{T_0} \end{aligned}\right\} \tag{27}$$

z_0 can be called as the current red shift. At any time in the past - in support of the proposed cosmological red shift interpretation, above relations can be re-expressed as follows.

$$(E_{\text{pot}})_t \cong -\left(\frac{T_0}{T_t}\right)\left(\frac{e^4 m_e}{16\pi^2 \varepsilon_0^2 \hbar^2}\right) \cong -\left(\frac{T_0}{T_t}\right)\frac{e^4 m_e}{16\pi^2 \varepsilon_0^2 \hbar^2} \tag{28}$$

$$(E_{\text{tot}})_t \cong -\left(\frac{T_0}{T_t}\right)\left(\frac{e^4 m_e}{32\pi^2 \varepsilon_0^2 \hbar^2}\right) \tag{29}$$

This can be considered as the base for the 'cosmological temperature dependent light emission mechanism'. At any time in the past, at any galaxy, emitted photon energy can be expressed as follows.

$$(E_{photon})_t \cong \left(\frac{T_0}{T_t}\right)\left(\frac{e^4 m_e}{32\pi^2 \varepsilon_0^2 \hbar^2}\right)\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right] \cong \frac{hc}{\lambda_t} \tag{30}$$

where λ_t is the wavelength of photon received from the galactic photon. From laboratory point of view, above concept can be understood in the following way. After some time in future,

$$z_f \cong \frac{E_f - E_0}{E_0} \cong \frac{E_f}{E_0} - 1 \tag{31}$$

Here, E_f is the energy of photon emitted from laboratory hydrogen atom after some time in future. E_0 is the energy of current photon emitted from laboratory hydrogen atom. z_f is the redshift of laboratory hydrogen atom after some time in future. From now onwards, as time passes, in future - $\left[d(z_f)/dt\right]$ can be considered as an index of the absolute rate of cosmic expansion. As cosmic time passes, within the scope of experimental accuracy of laboratory hydrogen atom's redshift, if magnitude of $\left[d(z_f)/dt\right]$ is gradually increasing, it is an indication of cosmic acceleration. If magnitude of $\left[d(z_f)/dt\right]$ is practically constant, it is an indication of uniform rate of cosmic expansion. If magnitude of $\left[d(z_f)/dt\right]$ is gradually decreasing, it is an indication of cosmic deceleration. If magnitude of $\left[d(z_f)/dt\right]$ is zero, it is an indication of cosmic halt. In support of this idea, rate of decrease in 'current Hubble's constant' and rate of decrease in 'current CMBR temperature' can be considered as a true measure of current cosmic 'rate of expansion'.

Major Conjecture-2: At any time, H_t being the angular velocity, universe can be considered as a growing and light speed rotating primordial black hole. Thus at any given cosmic time,

$$R_t \cong \frac{2GM_t}{c^2} \cong \frac{c}{H_t} \; and \; M_t \cong \frac{c^3}{2GH_t} \tag{32}$$

If $H_0 \cong 70$ km/sec/Mpc, $M_0 \cong 8.8984 \times 10^{52}$ kg and $R_0 \cong 1.32153 \times 10^{26}$ m.

when $M_t \to M_S$,

$$\left.\begin{array}{l} R_S \cong \frac{2GM_S}{c^2} \cong 2.7613\times10^{-36} \text{ m and} \\ H_S \cong \frac{c}{R_S} \cong \frac{c^3}{2GM_S} \cong 1.0857\times10^{44} \text{ rad/sec} \end{array}\right\} \quad (33)$$

can be considered as the characteristic initial physical measurements of the universe. Here the subscript S refers to the initial conditions of the universe and can be called as the Stoney scale. Similarly

$$R_0 \cong \frac{2GM_0}{c^2} \cong \frac{c}{H_0}, M_0 \cong \frac{c^3}{2GH_0} \text{ and } H_0 \cong \frac{c^3}{2GM_0} \quad (34)$$

can be considered as the characteristic current physical measurements of the universe.

Major Conjecture-3: At any given time, ratio of volume energy density and thermal energy density can be called as the cosmic growth index and can be expressed as follows.

$$\frac{3H_t^2c^2}{8\pi GaT_t^4} \cong \left[1+\ln\left(\frac{M_t}{M_S}\right)\right]^2 \cong \left[1+\ln\left(\frac{H_S}{H_t}\right)\right]^2 \cong \text{Cosmic Growth index} \quad (35)$$

$$\left.\begin{array}{l} \text{At the Stoney scale,} \\ \frac{3H_S^2c^2}{8\pi GaT_S^4} \cong \left[1+\ln\left(\frac{M_S}{M_S}\right)\right]^2 \cong \left[1+\ln\left(\frac{H_S}{H_S}\right)\right]^2 \cong 1 \\ \text{At present,} \\ \frac{3H_0^2c^2}{8\pi GaT_0^4} \cong \left[1+\ln\left(\frac{M_0}{M_S}\right)\right]^2 \cong \left[1+\ln\left(\frac{H_S}{H_0}\right)\right]^2 \cong 20450 \end{array}\right\} (36)$$

At present, if H_0 is close to 71 km/sec/Mpc, obtained current CMBR temperature is 2.723 K .

Application-1: Anisotropy of cosmic back ground temperature or fluctuations in cosmic temperature are inversely proportional to the growth index and can be expressed as follows.

$$\begin{array}{l} \frac{\delta T}{T_t} \cong \frac{T_t}{\text{cosmic growth index}} \cong \left(\frac{3H_t^2c^2}{8\pi GaT_t^4}\right)^{-1} T_t \\ \cong \left[1+\ln\left(\frac{M_t}{M_S}\right)\right]^{-2} T_t \cong \left[1+\ln\left(\frac{H_S}{H_t}\right)\right]^{-2} T_t \end{array} \quad (37)$$

At present, $\delta T \cong 133\ \mu\text{K}$. This can be compared with the observed temperature fluctuations of $\delta T \cong 570\ \mu\text{K}$.

Application-2: At any time matter-energy density can be considered as the geometric mean density of volume energy density and the thermal energy density.

$$\left.\begin{array}{l} (\rho_m)_t \cong \frac{1}{c^2}\sqrt{\left(\frac{3H_t^2c^2}{8\pi G}\right)\left(aT_t^4\right)} \\ \Rightarrow (\rho_m)_t \cong \left[1+\ln\left(\frac{H_S}{H_t}\right)\right]^{-1}\left(\frac{3H_t^2}{8\pi G}\right) \text{ Or} \\ (\rho_m)_t \cong \left[1+\ln\left(\frac{H_S}{H_t}\right)\right]\left(aT_t^4\right) \end{array}\right\} \quad (38)$$

Obtained current matter density is $6.0\times10^{-32}\,\text{gram/cm}^3$ and can be compared with the matter density of the elliptical and spiral galaxies whose mass-to-light ratio is 8 to 10.

Application-3: At any given time, cosmic black hole's growth rate can be expressed as $g_t \cong \left(\frac{3H_t^2c^2}{8\pi GaT_t^4}\right)^{-1} c$. With this idea and by considering the average growth rate, cosmic age can be estimated.

$$\begin{array}{l} g_t \cong \text{Cosmic growth rate} \cong \frac{c}{\text{cosmic growth index}} \\ \cong \left(\frac{3H_t^2c^2}{8\pi GaT_t^4}\right)^{-1} c \cong \left[1+\ln\left(\frac{M_t}{M_S}\right)\right]^{-2} \\ c \cong \left[1+\ln\left(\frac{H_S}{H_t}\right)\right]^{-2} c \end{array} \quad (39)$$

At the Stoney scale,

$$g_S \cong \left(\frac{3H_S^2c^2}{8\pi GaT_S^4}\right)^{-1} c \cong \left[1+\ln\left(\frac{H_S}{H_S}\right)\right]^{-2} c \cong c$$

With reference to (H_S, H_0), current Hubble length is growing at a rate of 14.66 km/sec. As a result, at present, within the current Hubble length, galaxy receding speed from the cosmic center increases as $\left(\frac{r_g}{R_0}\right)14.66 \cong \left(\frac{r_g H_0}{c}\right)14.66$ km/sec where $r_g \le \left(R_0 \cong \frac{c}{H_0}\right)$ and r_g is the distance between galaxy and the cosmic center and R_0 is the current Hubble length. Thus $\left(\frac{r_g H_0}{c}\right)14.66$ km/sec can be called as the current receding speed of any galaxy. As the current Hubble length is increasing, again the magnitude of future Hubble constant decreases, and hence the growth rate of future Hubble length falls down to 14.66 km/sec. In this way, theoretically the proposed current cosmic deceleration can be understood.

6.1. To Reinterpret the Hubble's Law

Based on the assumptions it is possible to say that, during cosmic evolution, as the universe is growing and rotating, at any time, any galaxy will have revolution speed as well as receding speed simultaneously and both can be expressed in the following way.

$$\left(V_g\right)_{revolution} \cong \left(\frac{r_g}{R_t}\right)c \cong r_g H_t \; where \; r_g \le \left(R_t \cong \frac{c}{H_t}\right) \quad (40)$$

r_g is the distance between galaxy and the cosmic center and R_t is the cosmic radius at time t.

$$\left(V_g\right)_{receding} \cong \left(\frac{r_g}{R_t}\right) g_t \cong \left(\frac{r_g}{R_t}\right)\left[1+\ln\left(\frac{H_S}{H_t}\right)\right]^{-2} c$$
$$\cong \left[1+\ln\left(\frac{H_S}{H_t}\right)\right]^{-2} r_g H_t \cong \left[1+\ln\left(\frac{H_S}{H_t}\right)\right]^{-2} \left(V_g\right)_{revolution} \quad (41)$$

$$\frac{\left(V_g\right)_{revolution}}{\left(V_g\right)_{receding}} \cong \left[1+\ln\left(\frac{H_S}{H_t}\right)\right]^{2} \quad (42)$$

Please note that both the relations are independent of the observed redshift. This is for further study. For a tiny moment of time, at the Stoney scale, light speed rotation is accompanied by light speed expansion. This may be a case of a speculation but may help in understanding the outline picture of the evolving primordial black hole universe.

6.2. Direct Fitting of the Two Current CMBR Wavelengths

Note that the spectrum from Planck's law of black body radiation takes a different shape in the frequency domain from that of the wavelength domain, the frequency location of the peak emission does not correspond to the peak wavelength using the simple relationship between frequency, wavelength, and the speed of light. In other words, the peak wavelength and the peak frequency do not correspond. The frequency form of Wien's displacement law is derived using similar methods, but starting with Planck's law in terms of frequency instead of wavelength. The effective result is to substitute 3 for 5 in the equation for the peak wavelength. From Planck's quantum theory of light if $x \cong 4.965114231744276...$ and $y \cong 2.82143937212...$ it is possible to say that,

$$\sqrt{\frac{c}{\lambda_m f_m}} \cong \sqrt{\frac{x}{y}} \cong 1.326567 \cong \gamma \quad (43)$$

where λ_m and f_m are the peak wavelength in wavelength domain and peak frequency in frequency domain respectively.

Let λ_f is the wavelength corresponding to $\frac{dE_\nu}{d\nu}$ and E_ν is the total energy at all frequencies up to and including ν, at any given cosmic time. λ_m is the wavelength corresponding to $\frac{dE_\lambda}{d\lambda}$ and E_λ is the total energy at all wavelengths up to and including λ.

Considering the observed CMBR wavelengths, it is possible to express both the wavelengths in the following way.

$$\left[\left(\lambda_m\right)_t \text{ and } \left(\lambda_f\right)_t\right] \propto \sqrt{1+\ln\left(\frac{M_t}{M_S}\right)} \quad (44)$$

$$\left[\left(\lambda_m\right)_t \text{ and } \left(\lambda_f\right)_t\right] \propto \sqrt{\left(\frac{4\pi G M_t}{c^2}\right)\cdot\left(\frac{4\pi G M_S}{c^2}\right)} \quad (45)$$

Guessing in this way it is noticed that,

$$\left(\lambda_f\right)_t \cong \gamma \cdot \sqrt{1+\ln\left(\frac{M_t}{M_S}\right)} \cdot \frac{4\pi G\sqrt{M_t M_S}}{c^2} \quad (46)$$

$$\left(\lambda_m\right)_t \cong \left(\frac{1}{\gamma}\right) \cdot \sqrt{1+\ln\left(\frac{M_t}{M_S}\right)} \cdot \frac{4\pi G\sqrt{M_t M_S}}{c^2} \quad (47)$$

Thus it is possible to express both the wavelength relations in the following way.

$$\left.\begin{aligned}\left(\lambda_f,\lambda_m\right)_t &\cong \gamma^{\pm 1} \cdot \sqrt{1+\ln\left(\frac{M_t}{M_S}\right)} \cdot \frac{4\pi G\sqrt{M_t M_S}}{c^2} \\ &\cong \gamma^{\pm 1} \cdot \sqrt{1+\ln\left(\frac{H_S}{H_t}\right)} \cdot \frac{2\pi c}{\sqrt{H_S H_t}}\end{aligned}\right\} \quad (48)$$

Alternatively geometric mean of $\left(\lambda_f,\lambda_m\right)_t$ can be expressed as follows.

$$\begin{aligned}\sqrt{\left(\lambda_m\right)_t\left(\lambda_f\right)_t} &\cong \sqrt{1+\ln\left(\frac{M_t}{M_S}\right)} \cdot \frac{4\pi G\sqrt{M_t M_S}}{c^2} \\ &\cong \sqrt{1+\ln\left(\frac{H_S}{H_t}\right)} \cdot \frac{2\pi c}{\sqrt{H_S H_t}}\end{aligned} \quad (49)$$

At present, if H_0 is close to 71 km/sec/Mpc,

$$\begin{aligned}\left(\lambda_f,\lambda_m\right)_0 &\cong \gamma^{\pm 1} \cdot \sqrt{1+\ln\left(\frac{M_0}{M_S}\right)} \cdot \frac{4\pi G\sqrt{M_0 M_S}}{c^2} \\ &\cong \gamma^{\pm 1} \cdot \sqrt{1+\ln\left(\frac{H_S}{H_0}\right)} \cdot \frac{2\pi c}{\sqrt{H_S H_0}} \\ &\cong (1.891 \text{ mm},\ 1.0744 \text{ mm})\end{aligned} \quad (50)$$

Now the observed fluctuations in the CMBR temperature i.e. the CMB anisotropy can be fitted in the following way.

$$\frac{\delta T}{T_0} \le \frac{8\pi G a T_0^4}{3H_0^2 c^2} \text{ and } \delta T \le \left(\frac{8\pi G a T_0^4}{3H_0^2 c^2}\right) T_0 \le 133\ \mu\text{K} \quad (51)$$

At any time in the past, the CMB anisotropy can be guessed in the following way.

$$\frac{\delta T}{T_t} \le \left(\frac{8\pi G a T_t^4}{3H_t^2 c^2}\right) \text{ and } \delta T \le \left(\frac{8\pi G a T_t^4}{3H_t^2 c^2}\right) T_t \quad (52)$$

At present, $\delta T \le 133\ \mu\text{K}$. This can be compared with the observed temperature fluctuations of $\delta T \le 570\ \mu\text{K}$. Here the key point to be noted is that, cosmic isotropy is inversely proportional to the cosmic back ground temperature and cosmic anisotropy is directly proportional to the cosmic back ground temperature.

At any time matter-energy density can be considered as the geometric mean density of volume energy density and the thermal energy density and it can be expressed with the following semi empirical relation.

$$\left(\rho_m\right)_t \cong \frac{1}{c^2}\sqrt{\left(\frac{3H_t^2 c^2}{8\pi G}\right)\left(a T_t^4\right)} \quad (53)$$

At present, if H_0 is close to 71 km/sec/Mpc, matter density can be fitted as follows.

$$\left.\begin{aligned}(\rho_m)_0 c^2 &\cong \sqrt{\left(\frac{3H_0^2c^2}{8\pi G}\right)\left(aT_0^4\right)} \text{ and}\\ (\rho_m)_0 &\cong \frac{1}{c^2}\sqrt{\left(\frac{3H_0^2c^2}{8\pi G}\right)\left(aT_0^4\right)} \cong 6.0\times10^{-32}\text{ gram / cm}^3\end{aligned}\right\} \quad (54)$$

Based on the average mass-to-light ratio for any galaxy present matter density can be expressed with the following relation [48].

$$(\rho_m)_0 \cong 1.5\times10^{-32}\eta h_0 \ \text{ gram/cm}^3 \qquad (55)$$

Here

$$\eta \cong \left\langle\frac{M}{L}\right\rangle_{\text{galaxy}} \Big/ \left\langle\frac{M}{L}\right\rangle_{\text{sun}}, \; h_0 \cong H_0/100 \text{ Km/sec/Mpc} \cong 0.71$$

Note that elliptical galaxies probably comprise about 60% of the galaxies in the universe and spiral galaxies thought to make up about 20% of the galaxies in the universe. Almost 80% of the galaxies are in the form of elliptical and spiral galaxies. For spiral galaxies, $\eta h_0^{-1} \cong 9 \pm 1$ and for elliptical galaxies, $\eta h_0^{-1} \cong 10 \pm 2$. For our galaxy inner part, $\eta h_0^{-1} \cong 6 \pm 2$. Thus the average ηh_0^{-1} is very close to 8 to 9 and its corresponding matter density is close to (6.0 to 6.7) × 10^{-32} gram/cm^3 and can be compared with the above proposed magnitude of 6.0× 10^{-32} gram/cm^3.

6.3. To Understand the True Cosmic Rate of Expansion with Inverse of the Fine Structure Ratio

With reference to $(\lambda_m)_t$ and Wien's displacement constant, from above relations $k_B T_t$ can be expressed as follows.

$$T_t \cong \frac{2.898\times10^{-3}}{(\lambda_m)_t} \cong \left(\frac{hc}{xk_B}\right)\left(\frac{1}{(\lambda_m)_t}\right) \qquad (56)$$

$$\left.\begin{aligned}T_t &\cong \left(\frac{\gamma}{x}\right)\sqrt{\left(1+\ln\left(\frac{M_t}{M_S}\right)\right)^{-1}\cdot\left(\frac{hc^3}{4\pi Gk_B\sqrt{M_tM_S}}\right)}\\ &\cong \left(\frac{\gamma}{x}\right)\sqrt{\left(1+\ln\left(\frac{M_t}{M_S}\right)\right)^{-1}\left(\frac{M_t}{M_S}\right)\cdot\left(\frac{hc^3}{4\pi Gk_BM_t}\right)}\end{aligned}\right\} \quad (57)$$

$$k_BT_t \propto \left(\frac{hc^3}{4\pi GM_t}\right) \cong \frac{hH_t}{2\pi} \qquad (58)$$

This relation may not be identical but similar to the famous Hawking's black hole temperature formula [22].

$$k_BT_t \propto \sqrt{\left(1+\ln\left(\frac{M_t}{M_S}\right)\right)^{-1}\left(\frac{M_t}{M_S}\right)} \qquad (59)$$

In this way in a very simple approach observed CMBR and the proposed Black hole universe concepts can be put into a single frame. Here the very interesting and strange observation is that, at present

$$\left(1+\ln\left(\frac{M_0}{M_S}\right)\right)^{-1}\left(\frac{M_0}{M_S}\right) \cong \exp\left(\frac{1}{\alpha}\right) \qquad (60)$$

where $\left(\frac{1}{\alpha}\right)$ seems to be the inverse of the fine structure ratio. For any mathematician this seems be a fun. For a cosmologist it may be an accidental coincidence. For any physicist it is an exciting coincidence. Even though it depends upon one's own choice of scientific interest, from unification point of view, assuming it to be a cosmological variable it is possible to ex-press $\left(\frac{1}{\alpha}\right)$ in the following way.

$$\left(\frac{1}{\alpha}\right)_0 \cong \ln\left[\left(1+\ln\left(\frac{M_0}{M_S}\right)\right)^{-1}\left(\frac{M_0}{M_S}\right)\right] \cong 137.047 \qquad (61)$$

Here $\left(\frac{1}{\alpha}\right)_0$ may be considered as the current magnitude of 'inverse of the fine structure ratio. Whether this is really the inverse of the fine structure constant or something new to be confirmed from further study. This coincidence seems be interesting and very complicated to understand. In atomic and nuclear physics, the fine structure ratio (α) is a fundamental physical constant namely the coupling constant characterizing the strength [49-59] of the electromagnetic interaction. Being a dimensionless quantity, it has a constant numerical value in all systems of units. Note that, from unification point of view, till today role of dark energy or dark matter is unclear and undecided. Their laboratory or physical existence is also not yet confirmed. In this critical situation this application or coincidence can be considered as a key tool in particle cosmology.

From now onwards, CMBR temperature can be called as **'Comic Black Hole's Thermal Radiation'** temperature and can be expressed as **'CBHTR'** temperature. From ground based laboratory experiments, it is possible to measure the rate of change in $\frac{d}{dt}\left(\frac{1}{\alpha_t}\right)$. Hence the absolute cosmic rate of expansion can be measured. Thus at any time based on $\left[\frac{d}{dt}\left[(\lambda_m)_t \text{ and } (\lambda_f)_t\right], \frac{d}{dt}(T_t) \text{ and } \frac{d}{dt}(H_t)\right]$, the absolute cosmic rate of expansion can be confirmed. At present with reference to $\left[\frac{d}{dt}\left[(\lambda_m)_0 \text{ and } (\lambda_f)_0\right], \frac{d}{dt}(T_0) \text{ and } \frac{d}{dt}(H_0)\right]$ current 'true' cosmic rate of expansion can be understood. Drop in current 'cosmic temperature' can be considered as a measure of the current cosmic expansion and 'rate of decrease in current cosmic temperature' can be considered as a measure of the current cosmic 'rate of expansion'. But if rate of decrease in temperature is very small and is beyond the scope of current experimental verification, then the two possible states are: a) cosmic temperature is decreasing at a very slow rate and universe is expanding at a very slow rate and b) there is no 'observable' thermal expansion and there is no 'observable' cosmic expansion. Similarly 'rate of decrease in current 'Hubble's constant' can be considered as a measure of current cosmic 'rate of expansion'. If rate of decrease in current 'Hubble's constant is very small and is beyond the scope of current experimental verification, then the two possible states are: a) current 'Hubble's constant is decreasing at a very slow rate and current universe is expanding at a very slow rate and b) at present there is no 'observable' cosmic expansion. Fortunately as per the Cobe/Planck satellite data current CMBR temperature is very smooth and isotropic. and there is no data that refers to the rate of change in the current Hubble's constant. Hence it can be suggested that at present there is no significant cosmic expansion. Even though this suggestion is completely against the current notion of cosmic acceleration [7], based on the proposed arguments, relations and observed data authors request the science community to review the standard cosmology. Mostly at the ending stage of expansion, rate of change in H_t will be practically zero and can be considered as practically constant. Thus at its ending stage of expansion, for the whole cosmic black hole as H_t practically remains constant, its corresponding thermal energy density will be 'the same' throughout its volume. This 'sameness' may be the reason for the observed 'isotropic' nature of the current CMB radiation. If observed CMB radiation temperature is 2.725 K and is very low in magnitude and is very close to absolute zero, then thinking about and confirming the 'cosmic acceleration' may not be reasonable.

6.4. The Stoney Scale Temperature and Relation between the Elementary Physical Constants

Based on the above heuristic observation and for the assumed initial conditions of the universe, if $M_t \to M_S, \left(\frac{1}{\alpha}\right)_S \to 0$. Based on the relations (57 to 61), if one is willing to consider the cosmological variable nature of $\left(\frac{1}{\alpha}\right)$, relation (57) can be expressed as follows.

$$T_t \cong \sqrt{\left(e^{\frac{1}{\alpha}}\right)_t \cdot \left(\frac{\gamma b c^2}{4\pi G M_t}\right)} \tag{62}$$

From above relations, at the Stoney scale,

$$T_S \cong \left(\frac{\gamma b c^2}{4\pi G M_S}\right) \cong 2.21585\times 10^{32}\ \text{K} \tag{63}$$

$$T_S \cong \left(\frac{3H_S^2 c^2}{8\pi G a}\right)^{\frac{1}{4}} \cong 2.237\times 10^{32}\ \text{K} \tag{64}$$

Now equating the above two equations, relation between the elementary physical constants can be established in a quantum gravitational approach. With 3.8% error it is noticed that,

$$h \cong \left(\frac{45x^2y^2}{\pi^2}\right)\left(\frac{e^2}{4\pi\varepsilon_0 c}\right) \cong 6.883\times 10^{-34}\ \text{J.sec} \tag{65}$$

With 1.89% error it is noticed that,

$$M_S \cong \left(\frac{\pi}{xy\sqrt{45}}\right)\sqrt{\frac{hc}{G}} \cong 1.824\times 10^{-9}\ \text{kg} \tag{66}$$

Matter-energy density can be considered as the geometric mean density of volume energy density and the thermal energy density and it can be expressed with the following semi empirical relation.

$$\begin{aligned}(\rho_m)_t c^2 &\cong \sqrt{\left(\frac{3H_t^2c^2}{8\pi G}\right)\left(aT_t^4\right)} \\ &\cong \left[1+\ln\left(\frac{H_S}{H_t}\right)\right]^{-1}\left(\frac{3H_t^2c^2}{8\pi G}\right) \\ &\cong \left[1+\ln\left(\frac{M_t}{M_S}\right)\right]^{-1}\left(\frac{3H_0^2c^2}{8\pi G}\right)\end{aligned} \tag{67}$$

Here one important observation to be noted is that, at any time

$$\left.\begin{aligned}\frac{8\pi G(\rho_m)_t}{3H_t^2} &\cong \left[1+\ln\left(\frac{M_t}{M_S}\right)\right]^{-1} \\ &\cong \left[1+\ln\left(\frac{H_S}{H_t}\right)\right]^{-1} \cong (\Omega_m)_t\end{aligned}\right\} \tag{68}$$

Thus at present,

$$\begin{aligned}(\rho_m)_0 &\cong \frac{1}{c^2}\sqrt{\left(\frac{3H_0^2c^2}{8\pi G}\right)\left(aT_0^4\right)} \\ &\cong \left[1+\ln\left(\frac{M_0}{M_S}\right)\right]^{-1}\left(\frac{3H_0^2}{8\pi G}\right) \\ &\cong \left[1+\ln\left(\frac{H_S}{H_0}\right)\right]^{-1}\left(\frac{3H_0^2}{8\pi G}\right) \cong 6.6\times 10^{-32}\ \text{gram/cm}^3\end{aligned} \tag{69}$$

6.5. Age of the Growing Cosmic Black Hole

Age of the growing cosmic black hole can be assumed as the time taken to grow from the assumed Stoney scale to the current scale. At present,

$$\begin{aligned}g_0 &\cong \left(\frac{8\pi G a T_0^4}{3H_0^2c^2}\right)c \cong \left[1+\ln\left(\frac{H_S}{H_0}\right)\right]^{-2} c \\ &\simeq 14.66\ \text{km/sec}\end{aligned} \tag{70}$$

Clearly speaking, at present, Hubble volume is growing at 14.66 km/sec in a decelerating trend. Starting from the Stoney scale, if the assumed growth rate is gradually decreasing, at any time average growth rate can be expressed as follows.

$$\begin{aligned}\frac{g_S+g_t}{2} &\cong \frac{1}{2}\left\{1+\left[1+\ln\left(\frac{M_t}{M_S}\right)\right]^{-2}\right\}c \\ &\cong \frac{1}{2}\left\{1+\left[1+\ln\left(\frac{H_S}{H_t}\right)\right]^{-2}\right\}c\end{aligned} \tag{71}$$

For the current scale, average growth rate can be expressed as follows.

$$\frac{g_S+g_0}{2} \cong \frac{1}{2}\left\{1+\left[1+\ln\left(\frac{M_0}{M_S}\right)\right]^{-2}\right\}c \cong \frac{1}{2}\left\{1+\left[1+\ln\left(\frac{H_S}{H_0}\right)\right]^{-2}\right\}c \tag{72}$$

Time taken to reach from the Stoney scale to any assumed scale can be expressed as follows.

$$\left(\frac{g_S+g_t}{2}\right)t \cong \left(R_t-R_S\right) \cong R_t \tag{73}$$

where, $R_t \ggg R_S$ and $R_S \approx 0$. Hence for the current scale,

$$\left(\frac{g_S+g_0}{2}\right)t_0 \cong \left(R_0-R_S\right) \cong R_0 \cong \frac{c}{H_0} \tag{74}$$

$$t_0 \cong \left(\frac{g_S+g_0}{2}\right)^{-1}\frac{c}{H_0} \cong \left\{1+\left[1+\ln\left(\frac{H_S}{H_0}\right)\right]^{-2}\right\}^{-1}\frac{2}{H_0} \tag{75}$$

$\cong$ 27.496 Gyr.

where $\left\{1+\left[1+\ln\left(\frac{H_S}{H_0}\right)\right]^{-2}\right\}^{-1} \cong 0.99995.$

This proposal is for further study. Based on this proposal, after one second from the Stoney scale, cosmic angular velocity is 2 rad/sec, growth rate is 29 km/sec and cosmic temperature is 3×10^9 K.

6.6. Redshift in the Growing Cosmic Black Hole

With reference to the current and past cosmic temperatures, at any time in the past, at any galaxy, for any hydrogen atom,

$$\frac{E_0}{E_t} \cong \frac{\lambda_t}{\lambda_0} \cong \frac{T_t}{T_0} \cong \left\{\frac{\left[1+\ln\left(\frac{H_S}{H_0}\right)\right]H_t}{\left[1+\ln\left(\frac{H_S}{H_t}\right)\right]H_0}\right\}^{\frac{1}{2}} \cong \left\{\frac{\left(\Omega_m\right)_t\ H_t}{\left(\Omega_m\right)_0\ H_0}\right\}^{\frac{1}{2}} \tag{76}$$

Using this relation, cosmic redshift data can be fitted. When the assumed CMBR temperature is 2999 K, estimated red shift is 1099 and is in very good agreement with the standard model of cosmology but differing with the cosmic age estimated by standard cosmology.

By guessing H_t, $\left(z_0+1\right)$ can be estimated. It seems to be a full and absolute definition for the cosmic redshift. Thus at any time in the past,

$$\left.\begin{array}{l}\left(\frac{E_0}{E_t}-1\right) \cong \left(\frac{\lambda_t}{\lambda_0}-1\right) \cong \left(\frac{T_t}{T_0}-1\right) \\ \cong \left\{\frac{\left[1+\ln\left(\frac{H_S}{H_0}\right)\right]H_t}{\left[1+\ln\left(\frac{H_S}{H_t}\right)\right]H_0}\right\}^{\frac{1}{2}} -1 \cong \left\{\frac{\left(\Omega_m\right)_t\ H_t}{\left(\Omega_m\right)_0\ H_0}\right\}^{\frac{1}{2}} \cong z_0\end{array}\right\} \tag{77}$$

7. Galactic Rotational Curves in the Current Black hole Universe

With reference to the Modified Newtonian Dynamics (simply, MOND) results [42-47], empirically rotational speed of a star is being represented as

$$v_s \cong \sqrt[4]{GMa_0} \tag{78}$$

where $a_0 \cong \left(1.2\pm0.3\right)\times10^{-10}\ m.\sec^{-2} \approx cH_0/2\pi$, and M is the mass of galaxy. In the light speed rotating black hole universe,

1. The acceleration constant a_0 is not a constant but a variable and depends on the galactic revolving speed about the center of the light speed rotating black hole universe.
2. Its magnitude can be assumed to be proportional to the current Hubble constant and can be called as the cosmological galactic acceleration.
3. By considering the galactic revolving speed V_g about the center of the cosmic black hole, magnitude of (cH_0) can be assumed to vary in the following way.

$$\left(V_g/c\right)(cH_0) \cong (V_gH_0) \cong a_g \cong r_gH_0^2 \tag{79}$$

where r_g is the distance between the galaxy and the cosmic black hole center. Thus authors replace the empirical acceleration constant a_0 with (a variable) cosmological galactic acceleration, $a_g \cong V_gH_0$. Now rotational speed of a star in any galaxy can be represented as follows.

$$v_s \cong \sqrt[4]{GM\left(V_g\ H_0\right)} \tag{80}$$

Here if it is assumed that, galaxies under observation possesses a cosmological revolving speed in the range 0.1 to 0.25 times the speed of light currently observed all galactic rotational speeds can be fitted well. If current $H_0 \cong 68$ km/sec/Mpc, $0.1\left(cH_0\right) \cong 0.66\times10^{-10} m.\sec^{-2}$ and $0.25\left(cH_0\right) \cong 1.65\times10^{-10} m.\sec^{-2}$. Advantage of this proposal is that, by knowing the galactic mass and rotational speeds of its stars, galactic revolving speed and hence distance between galaxy and the cosmic black hole center can be estimated. This is for further study. It is true that this proposal is 1) Qualitatively suitable for understanding the galactic rotation curves in the light of light speed cosmic rotation. 2) By knowing the galactic rotational speeds quantitatively suitable for estimating the galactic cosmological revolution speed and distance from the cosmic center.

8. Conclusions

8.1. Need of the Mass Unit $M_S \cong \sqrt{e^2/4\pi\varepsilon_0 G}$ in Unification

The basic idea of unification is – 1) To minimize the number of physical constants and to merge a group of different fundamental constants into one compound physical constant with appropriate unified interpretation and 2) To merge and minimize various branches of physics. In this regard instead of Planck mass, $M_S \cong \sqrt{e^2/4\pi\varepsilon_0 G}$ can be considered as the nature's given true unified mass unit [60-64].

8.2. To Consider the Universe as a Growing and Light Speed Rotating Primordial Black Hole

If 'black hole geometry' is more intrinsic compared to the black hole 'mass' and 'density' parameters, if universe constitutes so many galaxies and if each galaxy constitutes a central growing and fast spinning primordial black hole then considering universe as a 'growing and light speed rotating primordial black hole' may not be far away from reality. Clearly speaking, black hole structure or geometry may be a subset of the cosmic geometry. At this juncture considering or rejecting this proposal completely depends on the observed cosmic redshift. Based on the relations proposed in above sections observed cosmic redshift can be considered as a result of cosmological temperature dependent light emission mechanism in hydrogen atom. Authors are working on the assumed Hubble volume and Hubble mass in different directions with different applications that connect micro physics and macro physics. Based on the proposed short comings of the standard cosmology, dimensional analysis on the Hubble's constant, cosmic redshift reinterpretation, numerical data fitting on current CMBR energy density, matter density and CMBR redshift &corresponding temperature– concepts of black hole cosmology [65-76] with rotation [77-90] may be given at least 99% priority.

8.3. About the Current Cosmic Black Hole's Deceleration

In view of the applications proposed in the above sections and with reference to the zero rate of change in inverse of the fine structure ratio (from ground based experiments), zero rate of change in the 'current CMBR temperature' (from Cobe/Planck satellite data) and zero rate of change in the 'current Hubble's constant' (from Cobe/Planck satellite data) it can be suggested that, current cosmic expansion is almost saturated and at present there is no significant cosmic acceleration. Clearly speaking, Stoney scale cosmic black hole's growth rate is equal to the speed of light and current cosmic black hole is growing at 14.66 km/sec in a decelerating trend. It can also be possible to suggest that currently believed 'dark energy' is a pure, 'mathematical concept' and there exists no physical base behind its confirmation. Now the key leftover things are nucleosynthesis and structure formation. Authors are working in this direction. As nuclear binding energy was zero at the beginning of cosmic evolution, by considering the time dependent variable nature of magnitudes of the semi empirical mass formula energy coefficients it is possible to show that, at the beginning of formation of nucleons, nuclear stability is maximum for light atoms only. If so it can be suggested that, from the beginning of formation of nucleons, in any galaxy, maximum scope is being possible only for the survival of light atoms and this may be the reason for the accumulation and abundance of light atoms in large proportion.

8.4. Reviewing the Basics of Inflation with Black Hole Cosmology

A recurrent criticism of inflation is that the invoked inflation field does not correspond to any known physical field and that its potential energy curve seems to be an ad-hoc means to accommodate almost any data obtainable [8]. Anyhow, with reference to the past and current Hubble volumes, and by comparing the concepts, results and outcomes that can be obtained with the proposed model of black hole cosmology, in coming future, the need of inflation can be reviewed.

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