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Is red shift – an index of galactic 'atomic light emission' mechanism?

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Abstract: By highlighting the major shortcomings of modern cosmology, in this paper, an attempt is made to verify the cosmic acceleration in a quantum mechanical approach. With reference to the valuable opinion of Edwin Hubble, redshift can be related to a new atomic phenomenon. If light is coming from the atomic matter of the galaxy, then the observed redshift can be interpreted as an index of the galactic atomic 'light emission mechanism'. Clearly speaking, redshift may not be connected with 'galaxy receding'. The authors propose the following: During cosmic evolution, an 'aged' hydrogen atom emits an energetic photon. As the age of the hydrogen atom increases, it emits photons with increased quanta of energy and thus past light quanta emitted from an old galaxy will have less energy and show a red shift with reference to our galaxy. During its journey light quanta will not lose energy and there will be no change in the light's wavelength. If so current cosmological changes may be reflected in any existing atom. The possible assumptions are : 1) At any given cosmic time, Hubble length can be considered as the gravitational or electromagnetic interaction range. 2) Being a primordial evolving black hole and Hubble's constant being the angular velocity, universe is always rotating with light speed. 3) In atomic and nuclear physics, atomic gravitational constant (G_A) is squared Avogadro number times the Newton's gravitational constant and is discrete as $\left[(n.N)^2 G\right]$, where n =1,2,3.. 4) Key conceptual link that connects the gravitational force and non-gravitational forces is - the classical force limit, $F_C \cong \left(c^4/G\right)$. Ratio of classical force limit and the imaginary electroweak force magnitude is $(F_C/F_I) \cong N^2$. 5) Avogadro number is discrete and thus the imaginary electroweak force is discrete and can be expressed as $\left(F_I/n^2\right)$ and it seems to be more fundamental than the electromagnetic and strong nuclear forces. 6) Discrete imaginary electroweak force may be the responsible force for revolving electron's discrete total energy in hydrogen atom. 7) Characteristic nuclear radius and Reduced Planck's constant increases with cosmic time. 8) It can be suggested that, fermion and its corresponding boson mass ratio is not unity but a value close to $\Psi \approx 2.2623$. This idea can be applied to quarks, leptons, proton and the charged Higgs fermion. One can see "super symmetry" in low energies as well as high energies.

Keywords: Reduced Planck's constant**;** Hubble length; Hubble mass; Hubble volume; Hubble density; Cosmic red shift; CMBR temperature; Classical force limit; Avogadro number; Imaginary electroweak force magnitude; Atomic gravitational constant;

1. INTRODUCTION

This paper is an updated version and a review of the authors' recently published work 'Unified Concepts in Cosmic, Atomic and Nuclear Physics' [1]. In physics history, for any new idea or observation or new model - at the very beginning – their existence was very doubtful. The best examples were : 1) Existence of atom 2) Existence of quantum of energy 3) Existence of integral nature of angular momentum 4) Existence of wave mechanics 5) Six quarks having fractional charge 6) Confusion in confirming the existence of muon/pion 7) Existence of Black holes 8) Black hole radiation 9) Einstein's cosmological Lambda term 10) Cosmic red shift 11) Discovery of CMBR and 12) Accelerating universe and so on [2-16].

It is accepted that a complete theory of the evolution of the universe will not be possible until the development of a successful quantum theory of gravity. In this respect, cosmology resembles another branch of physics, the study of the elementary particles. By considering the observed 'cosmic redshift' as a result of galactic 'atomic light emission' mechanism the two central branches of physics i.e. 'cosmology' and 'quantum mechanics' can be studied in a unified manner. The outstanding problem in particle physics today is the inclusion of gravity in a single, unified quantum theory of all the fundamental interactions. Particle physicists have long suggested that the four fundamental forces of nature (viz. 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 observed today (by the process of spontaneous symmetry breaking). A detailed quantum theory that describes the electromagnetic and weak nuclear forces in terms of a single force (the electroweak interaction) was developed in the 1970's and dramatically verified by high-energy experiments in particle accelerators a decade later. More ambitious quantum theories that incorporate the strong nuclear force (Grand Unified Theories) have been developed, and some experimental support for these models has emerged. 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. In this connection $\left(\frac{c^4}{G}\right)$ can be considered as a fundamental unified force. Please note that, in any bound system, 'operating force' only plays major role in maintaining the 'existence of the bound system' and 'angular momentum' is one of the result. By any reason and with any 'large proportionality ratio', if one is able to bring down its magnitude to the observed force magnitudes as in atomic system and make it discrete, then automatically one can see a discrete structure or arrangement in the atomic system. Then the observed discrete radii, discrete angular momentum and discrete energy levels can be easily understood. Now the fundamental question to be answered is - How to select a 'discrete' and 'large' proportionality ratio? Answer is very simple. Implement the existing large numbers and see the consequences.

Many physicists think about the possible variation of the 'fine structure ratio' and experiments are in progress. In a theoretical approach, a varying α has been proposed as a characteristic and unified way of solving problems in cosmology and astrophysics. More recently, theoretical interest in varying constants (not just α) has been motivated by string theory and other such proposals for going beyond the Standard Model of particle physics. In October 2011 Webb et. al. [17] reported a variation in α dependent on both 'redshift' and 'spatial direction'. Here it should be noted that, the concept - 'variation of alpha' directly and indirectly is giving a clue to think about the possible 'variation' of the reduced Planck's constant or Planck's constant. This is a very sensitive point and needs strong experimental evidence and vigorous theoretical analysis. But till today from ground based laboratory experiments no variation was noticed in the magnitude of the fine structure ratio. In this paper authors made an attempt to study this complicated issue in a theoretical way.

In understanding the basic concepts of unification or TOE, role of dark energy and dark matter is insignificant. Even though there were a number of papers/books published on cosmology, the attempt for a comprehensive study on this subject, coupled with comparative studies with the modern cosmology on one hand and with the modern atomic physics on the other, was not made by anybody so far. The present study can be considered as a 'beginning project' in this field. Cosmological observations through ground telescope or satellite telescope is a normal practice. In this paper under consideration, it can be suggested that: current cosmological changes can be understood by studying the atom and atomic nucleus through ground based experiments. It is an interesting part of the study of cosmology and fundamental interactions. So far no Institute has taken this subject for R&D. This idea is quite unique, natural and the openness in the subjects of cosmology and fundamental interactions can be eliminated. The future science generation can adopt this proposed concept as a characteristic reference for the future scientific observations, analysis and experiments. It is an interesting idea and 100 years of atomic, nuclear and cosmic physics can be refined and unified. We continue this section with the major shortcomings of modern cosmology.

1.1 Major shortcomings of modern cosmology

A) If light is coming from the atomic matter of the galaxy, then redshift can be interpreted as an index of the galactic atomic matter 'light emission mechanism'. In no way it seems to be connected with 'galaxy receding'.

B) If cosmic expansion is continuous and accelerating and redshift is a measure of cosmic expansion, 'rate of increase in redshift' can be considered as a measure of cosmic 'rate of expansion'. Then there is no possibility to observe a 'constant' red shift. Merely by estimating galaxy distance (instead of estimating galaxy receding speed) one cannot verify the cosmic acceleration.

C) 'Drop in cosmic temperature' can be considered as a measure of cosmic expansion and 'rate of decrease in cosmic temperature' can be considered as a measure of 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.

D) If 'Dark energy' is the major outcome of the 'accelerating universe', it is very important to note that - in understanding the basic concepts of unification or other fundamental areas of physics, role of dark energy is very insignificant. So far no ground based experiment confirmed the existence of dark energy. There is no single clue or definition or evidence to any of the natural physical properties of (the assumed) dark energy.

E) Dimensionally it is possible to show that, the dimensions of Hubble's constant and angular velocity are same. If so considering Hubble's constant merely as an expansion parameter may not be correct.

1.2 Isotropy may be best possible in a closed expanding universe

If universe is really accelerating, based on the Hubble's law [2], for the observer - the receding or accelerating galaxy must show a continuous increase in its red shift! Some says: instantaneously red shift cannot increase due to the limited photon speed. If cosmic acceleration began 5 billion years ago, then during its accelerated receding journey, the galaxy must show a continuous increase in red shift - whether the change is due to past accelerated receding or present accelerated receding. There is no such evidence. In this connection - the appropriate idea can be stated as follows: 1) 'Redshift' is a measure of expansion and 2) 'Rate of increase in red shift' is a measure of cosmic 'rate of expansion'. This idea can be supported by another simple concept: 1) 'Drop in cosmic temperature' is a measure of cosmic expansion and 2) 'Rate of decrease in cosmic temperature' is a measure of cosmic 'rate of expansion'. It can be suggested that,

A) In a closed expanding universe, in tandem with expansion rate, instantaneously thermal waves undergo continuous stretching in all directions with respect to the center of the closed universe and the closed boundary.

B) When the expansion rate is very slow. i.e, practically zero expansion rate, stretching in thermal waves is almost zero and one can observe uniform thermal wavelength in all directions.

C) In a flat universe, where there is no boundary and no center, it may not be possible.

1.3 Edwin Hubble's opinion on Cosmic redshift

In 1947 Hubble [3] suggested that "*The red shifts are more easily interpreted as evidence of motion in the line of sight away from the earth – as evidence that the nebulae in all directions are rushing away from us and that the farther away they are, the faster they are receding. This interpretation lends itself directly to theories of expanding universe. The interpretation is not universally accepted, but even the most cautious of us admit that red shifts are evidence of either an expanding universe or of some hitherto unknown principle of nature*".

"*Attempts have been made to attain the necessary precision with the 100 inch, and the results appear to be significant. If they are valid, it seems likely that the red-shifts may not be due to an expanding universe, and much of the current speculation on the structure of the universe may require re-examination. The significant data, however, were necessarily obtained at the very limit of a single instrument, and there were no possible means of checking the results by independent evidence. Therefore the results must be accepted for the present as suggestive rather than definitive*".

"*We may predict with confidence that the 200 inch will tell us whether the red shifts must be accepted as evidence of a rapidly expanding universe, or attributed to some new principle in nature. Whatever may be the answer, the result may be welcomed as another major contribution to the exploration of the universe.*"

1.4 Albert Einstein's opinion on unification of electromagnetic and gravitational interactions

Note that, Einstein, more than any other physicist, untroubled by either quantum uncertainty or classical complexity, believed in the possibility of a complete, perhaps final, theory of everything. [13,14]. He also believed that the fundamental laws and principles that would embody such a theory would be simple, powerful and beautiful. Physicists are an ambitious lot, but Einstein was the most ambitious of all. His demands of a fundamental theory were extremely strong. If a theory contained any arbitrary features or undetermined parameters then it was deficient, and the deficiency pointed the way to a deeper and more profound and more predictive theory. There should be no free parameters – no arbitrariness. According to his philosophy, electromagnetism must be unified with general relativity, so that one could not simply imagine that it did not exist. Furthermore, the existence of matter, the mass and the charge of the electron and the proton (the only elementary particles recognized back in the 1920's), were arbitrary features. One of the main goals of a unified theory should be to explain the existence and calculate the properties of matter. In this paper authors made an attempt to understand the basic concepts of unification via particle cosmology [15,16].

1.5 Current status of Mach's principle - Hubble volume

In theoretical physics, particularly in discussions of gravitation theories, Mach's principle [12] is the name given by Einstein to an interesting hypothesis often credited to the physicist and philosopher Ernst Mach. The idea is that the local motion of a rotating reference frame is determined by the large scale distribution of matter. There are a number of rival formulations of the principle. A very general statement of Mach's principle is 'local physical laws are determined by the large-scale structure of the universe'. This concept was a guiding factor in Einstein's development of the general theory of relativity. Einstein realized that the overall distribution of matter would determine the metric tensor, which tells the observer which frame is rotationally stationary.

One of the main motivations behind formulating the general theory of relativity was to provide a mathematical description to the Mach's principle. However, soon after its formulation, it was realized that the theory does not follow Mach's principle. As the theoretical predictions were matching with the observations, Einstein believed that the theory was correct and did not make any farther attempt to reformulate the theory to explain Mach's principle. Later on, several attempts were made by different researchers to formulate the theory of gravity based on Mach's principle. However most of these theories remain unsuccessful to explain different physical phenomena. In the standard cosmology, 'Hubble volume' or 'Hubble sphere' is a spherical region of the Universe surrounding an observer beyond which objects recede from that observer at a rate greater than the speed of light due to the expansion of the Universe. The co-moving radius of a Hubble sphere (known as the Hubble radius or the Hubble length) is, (c / H_0), where 'c' is the speed of light and 'H_0'is the Hubble constant. More generally, the term 'Hubble volume' can be applied to any region of space with a volume of the order of $(4\pi/3)(c / H_0)^3$. 'Hubble volume' can be considered as a key tool in cosmology and unification. Some cosmologists use the term 'Hubble volume' to refer to the volume of the observable universe. With reference to the Mach's principle and the Hubble volume, at any cosmic time, if 'Hubble mass' is the product of cosmic 'critical density' and the 'Hubble volume', then it can be suggested that, 1) Each and every point in the free space is influenced by the Hubble mass, 2) Hubble volume and Hubble mass play a vital role in understanding the properties of electromagnetic and nuclear interactions and 3) Hubble volume and Hubble mass play a key role in understanding the geometry of the universe. Thus, in this paper, an attempt is made to understand the basic unified concepts of 'electromagnetism', 'gravity' and 'strong interaction range' via the Hubble length, Hubble volume and Hubble mass.

The basic idea of unification is – 1) To minimize the number of physical constants and 2) To merge a group of different fundamental constants into one compound physical constant with appropriate interpretation. In this journey, the first step is to see the numerical coincidences or discoveries, second step is to interpret the numerical coincidences and the third step is to synchronize the current interpretations and new interpretations. When the new interpretation disagrees with the current interpretation, generally with the help of emerging science and technology, discrepancies can be resolved with future observations and experiments. Mean while mathematical physics plays a key role in understanding and analyzing the new and old interpretations. When the subject under consideration is very sensitive to human thoughts, observations and interpretations and when the subject under consideration is also related with large numbers, proposed accurate numerical coincidences and new interpretations may be given some consideration.

1.6 Major role of Mach's principle in understanding the universe and the atom

In between the 'flat' universe and the 'closed' universe, there is one compromise. That is 'Hubble volume'. Without considering the Mach's principle, physical meaning cannot be attached to "Hubble volume". Note that till today quantitatively Mach's principle was not implemented successfully in cosmic and nuclear physics. If we do not yet know whether the universe is spatially closed or open, then the idea of 'Hubble volume' can be used as a tool in cosmology and unification. Some cosmologists use the term 'Hubble volume' to refer to the volume of the observable universe. At any cosmic time, if "Hubble mass" is the product of cosmic critical density and the Hubble volume, then it can be suggested that, "within the Hubble volume, each and every point in free space is influenced by the Hubble mass". It seems to be a quantitative description to the Mach's principle. In the universe, if the current critical density is $(\rho_c)_0 \cong (3H_0^2 / 8\pi G)$ and the current characteristic Hubble radius is $R_0 \cong (c / H_0)$, current mass of the cosmic Hubble volume is $M_0 \cong \dfrac{c^3}{2GH_0}$ and its 'Schwarzschild radius' resembles the 'Hubble length'. For the time being let us call this mass as 'Hubble mass'. With this definition, apart from cosmology, Mach's principle can be given a fundamental and unified significance in atomic, nuclear and particle physics! Here, as a point of curiosity, if one is willing to consider this mass as a characteristic current mass of the universe, very easily, Planck scale, cosmology and particle physics can be studied in a unified manner. It depends only on our choice of scientific interest.

1.7 The cosmic 'critical density' and its dimensional analysis

Recent findings from the University of Michigan suggest that the shape of the Big Bang might be more complicated than previously thought, and that the early universe spun on an axis. A left-handed and right-handed imprint on the sky as reportedly revealed by galaxy rotation would imply the universe was rotating from the very beginning and retained an overwhelmingly strong angular momentum [18]. Galaxies spin, stars spin, and planets spin. So, why not the whole universe? The consequences of a spinning universe seems to be profound [19-31], natural and 'cosmic collapse' can be prevented. Thus 'cosmic (light speed) rotation' can be considered as an alternative to the famous 'repulsive gravity' concept.

With a simple derivation it is possible to show that, Hubble's constant (H_t) represents cosmological angular velocity. Assume that, a planet of mass (M) and radius (R) rotates with angular velocity (ω_e) and linear velocity (v_e) in such a way that, free or loosely bound particle of mass (m) lying on its equator gains a kinetic energy equal to potential energy as,

$$\frac{1}{2}mv_e^2 = \frac{GMm}{R} \tag{1}$$

$$R\omega_e = v_e = \sqrt{\frac{2GM}{R}} \text{ and } \omega_e = \frac{v_e}{R} = \sqrt{\frac{2GM}{R^3}} \tag{2}$$

i.e linear velocity of planet's rotation is equal to free particle's escape velocity. Without any external power or energy, test particle gains escape velocity by virtue of planet's rotation. Using this idea, 'Black hole radiation' and 'origin of cosmic rays' can be understood. Note that if Earth completes one rotation in one hour then free particles lying on the equator will get escape velocity. Now writing, $M = \frac{4\pi}{3}R^3\rho_e$,

$$\omega_e = \frac{v_e}{R} = \sqrt{\frac{8\pi G\rho_e}{3}} \text{ Or } \omega_e^2 = \frac{8\pi G\rho_e}{3} \tag{3}$$

$$\text{Density, } \rho_e = \frac{3\omega_e^2}{8\pi G} \tag{4}$$

In real time, this obtained density may or may not be equal to the actual density. But the ratio, $\frac{8\pi G\rho_{real}}{3\omega_{real}^2}$ may have some physical meaning. The most important point to be noted here, is that, as far as dimensions and units are considered, from equation (4), it is very clear that, proportionality constant being $\frac{3}{8\pi G}$,

$$\text{density} \propto (\text{angular velocity})^2 \tag{5}$$

Equation (4) is similar to "flat model concept" of cosmic "critical density"

$$\rho_c = \frac{3H_t^2}{8\pi G} \tag{6}$$

Comparing equations (4) and (6) dimensionally and conceptually, i.e.

$$\rho_e = \frac{3\omega_e^2}{8\pi G} \text{ with } \rho_c = \frac{3H_t^2}{8\pi G} \tag{7}$$

$$H_t^2 \to \omega_e^2 \text{ and } H_t \to \omega_e \tag{8}$$

It is very clear that, dimensions of 'Hubble's constant' must be 'radian/second'. In any physical system under study, for any one 'simple physical parameter' there will not be two different units and there will not be two different physical meanings. This is a simple clue and brings "cosmic rotation" into picture. This is possible in a closed universe only. Cosmic models that depend on this "critical density" may consider 'angular velocity of the universe' in the place of 'Hubble's constant'. In the sense, 'cosmic rotation' can be included in the existing models of cosmology. Then the term 'critical density' simply appears as the 'spherical volume density' of the closed and expanding universe.

2.0 POSSIBLE ASSUMPTIONS IN UNIFIED COSMIC PHYSICS

The possible assumptions in unified cosmic physics can be expressed in the following way [30-33],[34-51]:

A) Hubble length (c/H_t) can be considered as the gravitational or electromagnetic interaction range.

B) Being a primordial evolving black hole and angular velocity being H_t, universe is always rotating with light speed [30-34].

C) Atomic gravitational constant [38-51] is squared Avogadro number times the classical gravitational constant. Thus,

$$G_A \cong N^2 G \tag{9}$$

where 'G_A' is the Atomic gravitational constant, 'N' is the Avogadro number and 'G' is the classical gravitational constant.

D) The key conceptual link that connects the gravitational and non-gravitational forces is - the classical force limit

$$F_C \cong \frac{c^4}{G} \cong 1.2106 \times 10^{44} \text{ newton} \tag{10}$$

It can be considered as the unified cosmic force magnitude or the upper limit of the string tension. In its inverse form it appears in Einstein's theory of gravitation [6] as $\frac{8\pi G}{c^4}$. It has multiple applications in Black hole physics and Planck scale physics [30]. It has to be measured either from the experiments or from the cosmic and astronomical observations.

E) Ratio of 'classical force limit (F_C)' and ' imaginary electroweak force magnitude(F_I)' is N^2 where N is a large number close to the Avogadro number.

$$\frac{F_C}{F_I} \cong N^2 \cong \frac{\text{Upper limit of classical force}}{\text{Imaginary electroweak force magnitude}} \tag{11}$$

Thus the proposed imaginary electroweak force magnitude is $F_I \cong 3.33715 \times 10^{-4}$ newton. It seems to be more fundamental than the electroweak and strong nuclear forces. It plays a very interesting role in understanding the scattering distance between electron and the charged nucleus. Along with the characteristic nuclear size, this force plays a vital role in understanding the revolving electron's distance from the nucleus in the hydrogen atom. Considering this F_I 'charged', Higgs fermion and boson masses can be fitted. Muon and tau masses can be fitted accurately. In this connection please refer our earlier published papers [40-44].

With $\ln\left(\frac{F_C}{F_I}\right) \cong \ln\left(N^2\right)$, proton-electron mass ratio can be fitted. Gravitational constant or the Avogadro number can also be fitted.

F) Avogadro number is discrete and thus the imaginary electroweak force is discrete. The discrete imaginary electroweak force can be expressed as

$$\frac{c^4}{(n.N)^2 G} \cong \frac{c^4}{n^2.\left(N^2 G\right)} \cong \frac{c^4}{n^2.G_A} \cong \frac{F_I}{n^2} \tag{12}$$

where $n = 1,2,3,..$ This discrete imaginary electroweak force may be the responsible force for revolving electron's discrete total energy in hydrogen atom.

G) Reduced Planck's constant increases with cosmic time [32]. At present if we represent $\hbar \cong \hbar_0$, in the past the operating reduced Planck's constant was $\hbar_t$ and its magnitude was less than $\hbar_0$.

H) In modified quark SUSY [40,41], if m_f is the mass of fermion and m_b is the mass of boson, then

$$\frac{m_f}{m_b} \cong \Psi \cong 2.2623 \tag{13}$$

and $\left(1-\frac{1}{\Psi}\right)m_f$ represents the effective fermion mass. With this idea super symmetry can be observed in the low and high energy strong interactions and can also be observed in the electroweak interactions. With this idea, Avogadro number can be fitted from particle physics. In our earlier published paper authors suggested that, if $\sin\left(\theta_W\right)$ is the weak coupling angle, fermion of spin 'half' makes 13 jumps (with a jumping angle of $\sin^{-1}\left(\theta_W\right) \cong 27.67$ degree) in one revolution and comes to its starting position. Similarly boson of spin 1 makes 78 jumps (with a jumping angle of 55.35 degree) in 13 revolutions and comes to its starting position. Thus the fermion - boson mass ratio can approximately be fitted with the following expression: $\ln\left(6+\sqrt{13}\right) \cong 2.26234 \cong \Psi$. Here, in this expression, the number '6' represents the ratio of number of jumps made by boson in 13 revolutions and number of jumps made by fermion in 1 revolution. For the time being this number can be approximately fitted with the particle data.

Thus at any given cosmic time t,

1) $\frac{d(\hbar)}{dt}$ is a measure of cosmic rate of expansion. As time is passing, one can expect a very small change in $\frac{d(\hbar)}{dt}$ and it may be beyond the scope of experimental accuracy. But to have a rapid (detectable) change in $\frac{d(\hbar)}{dt}$ present cosmic time should run fast or should accelerate. It is possible to show that, potential energy of electron in hydrogen atom is directly proportional to $\hbar^2$. Bohr's second postulate which suggests that potential energy of electron in hydrogen atom is inversely proportional to $\hbar^2$ seems to be a coincidence [52,53].

2) During cosmic evolution 'aged' Hydrogen atom emits energetic photon. Clearly speaking, as age of the hydrogen atom increases, it emit photons with increased quantum of energy. Thus past light quanta emitted from old galaxy will have less energy and show a red shift with reference to our galaxy. During journey light quanta will not lose energy and there will be no change in light wavelength.

3) The basic or original definition of present/current redshift $\left(z_0\right)$ seems to be:

$$z_0 \cong \frac{E_0 - E_G}{E_0} \cong \frac{\lambda_G - \lambda_0}{\lambda_G} \le 1 \text{ but not } z_0 \cong \frac{\lambda_G - \lambda_0}{\lambda_0}. \tag{14}$$

Here $E_0 \cong \frac{hc}{\lambda_0}$ is the energy of photon at our galaxy and $E_G \cong \frac{hc}{\lambda_G}$ is the energy of photon at the observed galaxy when it was emitted. Similarly λ_G is the wave length of light received from observed galaxy and λ_0 is the wave length of light in laboratory. Note that, based on the increasing value of the Planck's constant, present red shift $\left(z_0\right)$ will be directly proportional to age difference between our galaxy and observed galaxy or time taken by light to reach our galaxy from the old galaxy $\left(\Delta t\right)$. Thus $z_0 \propto \Delta t$ and

$$z_0 \cong H_0 \Delta t. \tag{15}$$

Here H_0 is the proportionality constant. In this way H_0 can be incorporated directly. Time taken by light to reach our galaxy or the age difference of our galaxy and observed galaxy can be expressed as,

$$\Delta t \cong \frac{z_0}{H_0}. \tag{16}$$

$$c\Delta t \cong z_0 \cdot \frac{c}{H_0}. \tag{17}$$

In this way, the basic and original definition of 'galaxy receding' and 'accelerating universe' concepts can be eliminated and a 'decelerating or expanded universe' concept can be continued without any difficulty.

Now the fundamental question to be answered is: If $\left(\hbar_t\right)$ takes the role of $\left(\hbar\right)$, how to define the red shift?. In section 3.7, considering $\left(\frac{E_0 - E_G}{E_0}\right)$, we proposed a simple solution to this problem. With different galaxies and with different (Δt),

$$H_0 \cong \left(\frac{z_0}{\Delta t}\right)_{G_1} \cong \left(\frac{z_0}{\Delta t}\right)_{G_2} \cong \left(\frac{z_0}{\Delta t}\right)_{G_3} \qquad (18)$$

where G_1, G_2 and G_3,.. represent different galaxies. In an alternative way the authors propose the following concept: during cosmic evolution 'aged' Hydrogen atom emits energetic photon. Clearly speaking, as age of the hydrogen atom increases, it emits photon with increased quantum of energy. Thus past light quanta emitted from old galaxy will have less energy and show a red shift with reference to our galaxy. During journey light quanta will not lose energy and there will be no change in light wavelength.

4) At any given cosmic time, the Schwarzschild radius of universe is

$$\frac{2GM_t}{c^2} \cong \frac{c}{H_t} \qquad (19)$$

where M_t is the cosmic mass at that time. With this idea, at any given cosmic time, cosmic size can be constrained to a maximum instead of infinity. The cosmic mass can be expressed as

$$M_t \cong \frac{c^3}{2GH_t}. \qquad (20)$$

It can be called as the 'Hubble mass'. Thus the cosmic volume density takes the following well known 'critical density' form,

$$(\rho_v)_t \cong \frac{c^3}{2GH_t} \div \frac{4\pi}{3}\left(\frac{c}{H_t}\right)^3 \cong \frac{3H_t^2}{8\pi G}. \qquad (21)$$

It can be called as the cosmic Hubble density.

3.0 APPLICATIONS OF THE PROPOSED ASSUMPTIONS

Similar to and close to the Planck scale and with reference to the fundamental physical constants $(e \text{ and } G)$, a fundamental mass unit can be constructed as $(M_e)^{\pm} \cong \sqrt{\frac{e^2}{4\pi\varepsilon_0 G}} \cong 1.859211\times10^{-9}$ kg. It can be considered as a characteristic fundamental unified charged mass unit. It is noticed that, the ratio $\left(\frac{M_t}{M_e}\right)$ plays a very interesting role in fitting the cosmic matter density and thermal energy density.

3.1 Cosmic Matter Density

Approximately relation between cosmic volume density $(\rho_v)_t$ and matter density $(\rho_m)_t$ can be expressed as

$$(\rho_m)_t \cong \left[1+\ln\left(\frac{M_t}{M_e}\right)\right]^{-1} \left(\frac{3H_t^2}{8\pi G}\right) \qquad (22)$$

Note that, at present obtained matter density ρ_m can be compared with the elliptical and spiral galaxy matter density. Based on the average mass-to-light ratio for any galaxy [54]

$$(\rho_m)_0 \cong 1.5\times10^{-32}\eta h_0 \text{ gram/cm}^3 \qquad (23)$$

where for any galaxy, $\langle M/L\rangle_{Galaxy} = \eta\langle M/L\rangle_{\text{Sun}}$ and the number: $h_0 \cong \frac{H_0}{100 \text{ Km/sec/Mpc}} \cong \frac{70}{100} \cong 0.70.$ Note that elliptical galaxies probably comprise about 60% of the galaxies in the universe and spiral galaxies are 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 (5.96 to 6.7) $\times$ 10^{-32} gram/cm^3.

3.2. Cosmic Thermal Energy Density

At any given cosmic time, if $`a'$ is the radiation energy constant and $`b'$ is the Wein's displacement constant, ratio of cosmic volume energy density and cosmic thermal energy density can be expressed as

$$\left(\frac{\rho_v c^2}{aT^4}\right)_t \cong \left[1+\ln\left(\frac{M_t}{M_e}\right)\right]^2 \qquad (24)$$

Here, $a \cong \frac{8\pi^5}{15}\frac{k_B^4}{h^3c^3} \cong \left(\frac{8\pi^5}{15\times(4.96511423)^3}\right)\cdot\frac{k_B}{b^3}$

$$\cong 1.3333991714\cdot\frac{k_B}{b^3} \cong \frac{4}{3}\cdot\frac{k_B}{b^3}.$$

Thus, in a classical approach, independent of the Planck's constant, radiation constant can be expressed as above. Even with reference to quantum mechanics also, 'Wien's constant' is a cosmological constant. This is a very sensitive point to be discussed. Wien's law is based on the classical approach [55,56]. With reference to Wien's displacement law, it can be understood that, for any black body, most strongly emitted thermal wave length is inversely proportional to its absolute temperature. With reference to the current magnitude of the Planck's constant, accurate value of the Wien's constant can be estimated and that obtained magnitude can be considered as a constant throughout the cosmic time. If so, at any given cosmic time, thermal energy density can be expressed as

$$aT_t^4 \cong \left[1+\ln\left(\frac{M_t}{M_e}\right)\right]^{-2}\left(\frac{3H_t^2c^2}{8\pi G}\right) \qquad (25)$$

If H_0 is close to 70 km/sec/Mpc, obtained CMBR temperature [57,58] is 2.704 ^{0}K. Thus it can be suggested that, at any given cosmic time, matter energy density can be considered as the geometric mean of thermal-energy density and volume-energy density.

$$\left(\rho_m c^2\right)_t \cong \sqrt{\left(aT_t^4\right)\left(\frac{3H_t^2c^2}{8\pi G}\right)} \cong \sqrt{\left(aT^4\right)_t\left(\rho_v c^2\right)_t} \quad (26)$$

3.3. Wavelength of the CMB radiation

Authors noticed two approximate methods for estimating the CMB radiation. Geometric mean of the 2 methods is fitting with the observational data accurately.

Method-1: With reference to the Wien's displacement law, wave length of the most strongly emitted CMB radiation can be expressed as

$$\left(\lambda_m\right)_t \cong \left(\frac{\rho_v}{\rho_m}\right)_t \frac{G\sqrt{M_tM_e}}{c^2} \cong \left[1+\ln\left(\frac{M_t}{M_e}\right)\right]\frac{G\sqrt{M_tM_e}}{c^2} \quad (27)$$

Note that this expression is free from the 'radiation constants'. If H_0 is close to 70 km/sec/Mpc, obtained (most strongly emitted) wavelength of the CMB radiation is 1.37 mm.

Method-2: Pair particles creation and annihilation in 'free space'- is an interesting idea. In the expanding universe, by considering the proposed charged $\left(M_e\right)^{\pm}$ and its pair annihilation as a characteristic cosmic phenomena, origin of the isotropic CMB radiation can be addressed. Thermal energy can be expressed as

$$k_BT_t \cong \sqrt{\frac{M_e}{M_t}}\cdot\left[\left(M_e\right)^+ + \left(M_e\right)^-\right]c^2 \cong \sqrt{\frac{M_e}{M_t}}\cdot 2M_ec^2 \quad (28)$$

Based on Wien's displacement law,

$$\left(\lambda_m\right)_t \cong \frac{b}{T_t} \cong \sqrt{\frac{M_t}{M_e}}\cdot\frac{bk_B}{2M_ec^2} \quad (29)$$

If H_0 is close to 70 km/sec/Mpc, obtained (most strongly emitted) wavelength of the CMB radiation is 0.822 mm.

Method-3: Considering the geometric mean wave length of wavelengths obtained from methods-1 and 2, wave length of the most strongly emitted CMB radiation can be expressed as

$$\left(\lambda_m^2\right)_t \cong \left[1+\ln\left(\frac{M_t}{M_e}\right)\right]\cdot\left(\frac{M_t}{2M_e}\right)\cdot\left(\frac{bk_BG}{c^4}\right) \quad (30)$$

$$\left(\lambda_m\right)_t \cong \sqrt{\left[1+\ln\left(\frac{M_t}{M_e}\right)\right]\cdot\left(\frac{M_t}{M_e}\right)\cdot\left(\frac{bk_BG}{2c^4}\right)} \quad (31)$$

If H_0 is close to 70 km/sec/Mpc, obtained (most strongly emitted) wavelength of the CMB radiation is 1.064 mm. In this way, in a semi empirical approach, the observed CMB radiation temperature can be understood. Clearly speaking,

$$\left(\lambda_m\right)_t \propto \sqrt{\left(\frac{\rho_v}{\rho_m}\right)_t} \propto \sqrt{1+\ln\left(\frac{M_t}{M_e}\right)} \quad (32)$$

$$\left(\lambda_m\right)_t \propto \sqrt{\frac{M_t}{M_e}} \quad (33)$$

and $\sqrt{\frac{bk_BG}{2c^4}} \cong 1.2856\times10^{-35}$ m seems to be a classical constant and can be considered as a characteristic classical thermal wave length. The most important point is that, as the black hole universe is expanding, its expansion rate can be verified with $\frac{d}{dt}\left(\lambda_m\right)_t$. As time is passing, one can expect a very small change in $\frac{d}{dt}\left(\lambda_m\right)$ and it may be beyond the scope of experimental accuracy. But to have a rapid (detectable) change in $\frac{d}{dt}\left(\lambda_m\right)$, present cosmic time should run fast or should accelerate. Present observations indicate that, CMB radiation is smooth and uniform. This sensitive problem can be resolved only with further research and analysis.

3.4 . The Cosmological Fine Structure Ratio

In physics, the fine-structure ratio $`\alpha'$ is a fundamental physical constant, namely the coupling constant characterizing the strength of the electromagnetic interaction. Being a dimensionless quantity, it has constant numerical value in all systems of units. If $\left(\rho_v c^2\right)_0$ is the present cosmic volume energy density and aT_0^4 is the present cosmic thermal energy density, it is noticed that,

$$\ln\sqrt{\left(\frac{aT^4}{\rho_v c^2}\right)_0\cdot\frac{4\pi\varepsilon_0 GM_0^2}{e^2}} \cong \left(\frac{1}{\alpha}\right) \quad (34)$$

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 can be considered as a key tool in particle cosmology. Note that large dimensionless constants and compound physical constants reflect an intrinsic property of nature. At present above relation takes the following form.

$$\ln\sqrt{\frac{2\pi}{3}\cdot\frac{4\pi\varepsilon_0 aT_0^4c^4}{e^2H_0^4}} \cong \frac{1}{\alpha} \quad (35)$$

At present if observed CMBR temperature is $T_0 \cong 2.725\ ^0$K, obtained $H_0 \cong 71.415$ Km/sec/Mpc. After simplification, it can be interpreted as follows. Total thermal energy in the present Hubble volume can be expressed as,

$$\left(E_T\right)_0 \cong aT_0^4\cdot\frac{4\pi}{3}\left(\frac{c}{H_0}\right)^3 \quad (36)$$

If $\left(\frac{c}{H_0}\right)$ is the present electromagnetic interaction range, the present electromagnetic potential can be expressed as

$$(E_e)_0 \cong \frac{e^2}{4\pi\varepsilon_0 (c/H_0)} \quad (37)$$

Now inverse of the present fine structure ratio can be expressed as

$$\left(\frac{1}{\alpha}\right)_0 \cong \ln\sqrt{\frac{(E_T)_0}{2(E_e)_0}} \quad (38)$$

Here, in RHS, denominator '2' may be a representation of total thermal energy in half of the cosmic sphere or thermal energy of any one pole of the cosmic sphere. Thus at any cosmic time,

$$\left(\frac{1}{\alpha}\right)_t \cong \ln\sqrt{\frac{(E_T)_t}{2(E_e)_t}} \quad (39)$$

$$\text{When, } M_t \to M_e \text{ and } \left(aT_t^4\right) \to \frac{3H_t^2c^2}{8\pi G}, \left(\frac{1}{\alpha}\right)_t \to 0.$$

In this way, in a unified manner, the present fine structure ratio can be fitted. In this regard, one can refer the new varying speed of light theories[59].

From this relation it is possible to say that, cosmological rate of change in fine structure ratio, $\frac{d}{dt}\left(\frac{1}{\alpha}\right)$ may be considered as an index of the future cosmic acceleration. As time is passing, one can expect a very small change in $\frac{d}{dt}\left(\frac{1}{\alpha}\right)$ and it may be beyond the scope of experimental accuracy. But to have a rapid (detectable) change in $\frac{d}{dt}\left(\frac{1}{\alpha}\right)$, present cosmic time should run fast or should accelerate.

Many physicists think about α's possible variation and experiments are in progress. Specifically, a varying α has been proposed as a way of solving problems in cosmology and astrophysics. More recently, theoretical interest in varying constants (not just α) has been motivated by string theory and other such proposals for going beyond the Standard Model of particle physics. In October 2011 Webb *et al.* reported a variation in α dependent on both redshift and spatial direction [17]. Till today from ground based laboratory experiments no variation was noticed in the magnitude of the fine structure ratio.

3.5. Current or present characteristic nuclear size

The problem of defining a radius for the atomic nucleus is similar to the problem of atomic radius, in that neither atoms nor their nuclei have definite boundaries. However, the nucleus can be modeled as a sphere of positive charge for the interpretation of electron scattering experiments: because there is no definite boundary to the nucleus, the electrons 'see' a range of cross-sections, for which a mean can be taken. The qualification of "rms" (for "root mean square") arises because it is the nuclear cross-section, proportional to the square of the radius, which is determining for electron scattering. The first estimate of a nuclear charge radius was made by Hans Geiger and Ernest Marsden in 1909, under the direction of Ernest Rutherford at the Physical Laboratories of the University of Manchester, UK [60]. Modern direct measurements are based on the scattering of electrons by nuclei [61-63].

With reference to the current mass $M_0 \cong \left(c^3/2GH_0\right)$ of the expanding black hole universe, we discovered a very strange relation and it can be expressed in the following way.

$$(R_N)_0 \cong \frac{G\sqrt{M_0\sqrt{m_p m_e}}}{c^2} \cong \frac{\sqrt{M_0\sqrt{m_p m_e}}\cdot c^2}{F_C} \cong 1.37 \text{ fm} \quad (40)$$

This length can be considered as the current characteristic nuclear size in the current expanding universe. This is a remarkable coincidence and seems to open a new window in 'cosmology' and 'nuclear physics'. Note that, 1.4 fm is nothing but the observed and well understood strong interaction range [64]. The most important point is that, as the black hole universe is expanding, from nuclear physics point of view, its expansion rate can be verified with $\frac{d}{dt}(R_N)_t$. As time is passing, one can expect a very small change in $\frac{d}{dt}(R_N)$ and it may be beyond the scope of experimental accuracy. But to have a rapid (detectable) change in $\frac{d}{dt}(R_N)$ present cosmic time should run fast or should accelerate. In this regard the proposed basic idea is that, the characteristic nuclear size that is measured in electron scattering experiments increases with increasing cosmic size. We propose the following (another) discovered relation and it has to be derived with a suitable model.

$$(R_x)_0 \cong \left(\frac{F_I}{F_C}\right)\left(\frac{m_p}{m_e}\right)^2\left(\frac{c}{H_0}\right) \cong \left(\frac{\hbar_0 c}{G_A m_e^2}\right)^2 \frac{2G_A m_e}{c^2} \quad (41)$$

$$\cong 1.21 \text{ to } 1.22 \text{ fm}$$

Another interesting observation is $\frac{(R_x)_0}{2} \simeq 0.61 \text{ fm} \cong (R_y)_0$ can be considered as the characteristic imaginary electroweak force range and $\frac{(R_x)_0}{\sqrt{2}} \cong 0.86$ fm can be compared with the rms radius of proton [61-63]. At utmost fundamental level, it may not be possible to give a proof or derivation for any new discovered relation. In due course, it can be applied in different ways and its validity can be verified. From one point of view, it is very peculiar and from another point of view it is very complicated to interpret. Why because till today no model (including the famous string theory) could explain the origin of the strong interaction range! Whether to 'consider this relation' or 'discard this relation', depends only on our choice of scientific interest. Authors noticed interesting applications of this characteristic nuclear size in atomic physics and electroweak interaction.

3.6. The Cosmological Reduced Planck's Constant

From above relations it can be guessed that, there exists a strong interconnection in between universe and the Hydrogen atom. It should be noted that, in Bohr's theory of hydrogen atom, neither the nuclear mass nor the nuclear size has been considered for understanding the energy spectra of the excited hydrogen atom. Not only that, till today no one knows the origin of the well understood Planck's constant. In this connection the following expression can be considered as a discovery.

$$n.\hbar_0 \cong m_e c^2 \sqrt{\frac{m_e \left(R_y\right)_0^2}{\left(\frac{F_I}{n^2}\right)\left(R_y\right)_0}} \tag{42}$$

Here $m_e \left(R_y\right)_0^2$ can be considered as the imaginary moment of inertia of electron about its axis of rotation, where the radial distance is $\left(R_y\right)_0 \simeq 0.61$ fm. $\left(\frac{F_I}{n^2}\right)\left(R_y\right)_0$ can be considered as the characteristic work done related with the discrete imaginary electroweak force and $n = 1, 2, 3, ..$

Above expressions' simple form is:

$$n \cdot \hbar_0 \cong \sqrt{\left(n^2 . G_A\right) m_e^3 \left(R_y\right)_0} \tag{43}$$

From relation (41), this relation takes the form.

$$n.\hbar_0 \cong \frac{n.Gm_p\sqrt{M_0 m_e}}{c} \cong \sqrt{\frac{M_0}{m_e}} \cdot \frac{n.Gm_p m_e}{c} \tag{44}$$

Here $\left(M_0/m_e\right)$ can be considered as the number of electrons in the present universe of mass, $M_0 \cong \left(c^3/2GH_0\right)$. Some may say that this is simply a play with the fundamental physical constants. Most modern physicists and cosmologists may not be interested in accepting this because its consequences seem to contradict the existing concepts of quantum mechanics. Here, the authors request the valuable views of Einstein on unification of 'gravity', 'electromagnetism' and 'quantum mechanics' [64] be reconsidered. If an electron revolves around a proton of size close to its 'rms' radius and (electron & proton) are the massive elementary atomic particles of the observable expanding universe, then the above relation may be given some consideration in the unification program. If so, present Hubble's constant can be expressed as

$$H_0 \cong \frac{Gm_p^2 m_e c}{2\hbar_0^2} \cong 70.743 \text{ km/sec/Mpc} \tag{45}$$

Thus it is possible to guess that,

$$H_0\hbar_0^2 \cong H_t\hbar_t^2 \cong \frac{Gm_p^2 m_e c}{2} \cong \text{constant} \tag{46}$$

Now here we are presenting the following interesting relation.

$$\left(\frac{\hbar_0 c}{G_A m_e^2}\right)^2 \cong \frac{F_I \left(R_y\right)_0}{m_e c^2} \tag{47}$$

Substituting the proposed expression for '$\hbar_0$' from relation (42), in this relation RHS can be obtained.

3.7. Electron's Characteristic Potential Energy and the cosmic red shift

With reference to the proposed 'F_I' and $\left(R_y\right)_0$ present Bohr radius can be expressed as

$$\left(a_0\right)_0 \cong \left(\frac{m_e c^2}{F_I \left(R_y\right)_0}\right) \cdot \frac{e^2}{4\pi\varepsilon_0 \cdot \frac{1}{2}\sqrt{m_p m_e} \cdot c^2} \tag{48}$$

This is one interesting observation or discovery and is a remarkable coincidence. Clearly speaking, as the universe is expanding or evolving, within the atom, characteristic nuclear size is increasing and distance between electron and the nucleus is decreasing. Now the discrete Bohr radii can be expressed as

$$n^2 \left(a_0\right)_0 \cong \left(\left(\frac{n^2}{F_I}\right)\frac{m_e c^2}{\left(R_y\right)_0}\right) \cdot \frac{e^2}{4\pi\varepsilon_0 \cdot \frac{1}{2}\sqrt{m_p m_e} \cdot c^2} \tag{49}$$

Now it can be seen that,

$$-\frac{e^2}{4\pi\varepsilon_0 \left(a_0\right)_0} \cong -\left(\frac{F_I \left(R_y\right)_0}{m_e c^2}\right) \cdot \frac{\sqrt{m_p m_e} \cdot c^2}{2} \tag{50}$$

Thus in hydrogen atom, discrete potential energy of electron can be expressed as

$$\left(E_{pot}\right)_0 \cong -\left(\left(\frac{F_I}{n^2}\right)\frac{\left(R_y\right)_0}{m_e c^2}\right) \cdot \frac{\sqrt{m_p m_e} \cdot c^2}{2} \tag{51}$$

The major advantage of this relation is that, it constitutes the proton mass and the characteristic nuclear size. If one is willing to accept this relation as a fundamental relation in atomic physics, from relation (47)- in terms of $\hbar_0$, electron's potential energy can be expressed as

$$\left(E_{pot}\right)_0 \cong -\left(\frac{\hbar_0 c}{G_A m_e^2}\right)^2 \cdot \frac{\sqrt{m_p m_e} \cdot c^2}{2n^2} \tag{52}$$

Now with reference to Bohr's first postulate,

$$mvr \cong n.\hbar \tag{53}$$

at present, with in the Bohr radius

$$m(v_0)_0 (a_0)_0 \cong \hbar_0 \tag{54}$$

Thus present speed of electron in the Bohr radius can be expressed as

$$(v_0)_0 \cong \frac{\hbar_0}{m_e (a_0)_0}$$

$$\cong \frac{1}{2}\sqrt{\frac{4\pi\varepsilon_0 (R_y)_0 m_p c^2}{e^2}} \sqrt{\frac{4\pi\varepsilon_0 (R_y)_0^2 F_I}{e^2}} \cdot c \tag{55}$$

If total energy is half of the potential energy, at present, in hydrogen atom, electron's characteristic discrete total energy can be expressed as

$$(E_{total})_0 \cong -\left(\left(\frac{F_I}{n^2}\right)\frac{(R_y)_0}{m_e c^2}\right) \cdot \frac{\sqrt{m_p m_e} \cdot c^2}{4} \tag{56}$$

where n =1,2,3,.. In terms of $\hbar_0$

$$(E_{total})_0 \cong -\left(\frac{\hbar_0 c}{G_A m_e^2}\right)^2 \cdot \frac{\sqrt{m_p m_e} \cdot c^2}{4n^2} \tag{57}$$

Please note that, from Bohr's theory of hydrogen atom, emitted photon energy is inversely proportional to $(\hbar_0^2)$ From quantum theory of light, photon energy is directly proportional to $(\hbar_0)$. This is a very sensitive point to be discussed in depth. At any given cosmic time,

$$(E_{total})_t \cong -\left(\left(\frac{F_I}{n^2}\right)\frac{(R_y)_t}{m_e c^2}\right) \cdot \frac{\sqrt{m_p m_e} \cdot c^2}{4} \quad \text{Or} \tag{58}$$

$$(E_{total})_t \cong -\left(\frac{\hbar_t c}{G_A m_e^2}\right)^2 \cdot \frac{\sqrt{m_p m_e} \cdot c^2}{4n^2} \tag{59}$$

Thus it can be suggested that, $E_{total} \propto (R_y)_t \propto \left(\frac{c}{H_t}\right)$.

Authors are working on this conceptual variance. Solution mainly depends upon the 'origin' of $(\hbar)$ and it takes some time to resolve the issue. Now with reference to Bohr's second postulate, in the past, at any galaxy, emitted photon energy can be expressed as

$$(E_{Pho})_t \cong \left(\frac{\hbar_t c}{G_A m_e^2}\right)^2 \cdot \frac{\sqrt{m_p m_e} \cdot c^2}{4}\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right) \cong \frac{2\pi\hbar_t c}{\lambda_G} \tag{60}$$

where $n_2 > n_1$. Now for any quantum jump, in the past it can be shown that,

$$\hbar_t \cong 4\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)^{-1}\left(\frac{G_A^2 m_e^4}{c^3 \sqrt{m_p m_e}}\right)\left(\frac{2\pi}{\lambda_G}\right) \tag{61}$$

Corresponding to this obtained $\hbar_t$, from the relation $H_0 \hbar_0^2 \cong H_t \hbar_t^2$ its corresponding H_t can be estimated. From H_t and from relations (25) or (31) corresponding CMBR temperature can be estimated. Thus for any galaxy, where $\hbar_t$ was playing a key role, corresponding present cosmic red shift can be expressed as

$$z_0 \cong \frac{(E_{Pho})_0 - (E_{Pho})_G}{(E_{Pho})_0} \cong 1 - \left(\frac{\hbar_t}{\hbar_0}\right)^2 \tag{62}$$

Now, approximately from relation (16), time taken by light to travel from observed galaxy to our galaxy or the age difference of our galaxy and the observed galaxy can be expressed as

$$\Delta t \cong \frac{z_0}{H_0} \cong \left[1 - \left(\frac{\hbar_t}{\hbar_0}\right)^2\right]\frac{1}{H_0} \tag{63}$$

Obtained Δt has to be verified with other developed absolute methods of galaxy age estimation.

3.8 To Fit the Rest Masses of Muon and Tau

Muon and tau rest masses can be fitted in the following way [61,65].

$$\left(m_l c^2\right)_x \cong \left[\gamma^3 + \left(n^2\gamma\right)^n \sqrt{N}\right]^{\frac{1}{3}} \cdot \sqrt{\frac{e^2 F_I}{4\pi\varepsilon_0}} \tag{64}$$

where $\gamma \cong m_e c^2 \div \sqrt{\frac{e^2 F_I}{4\pi\varepsilon_0}} \cong 295.0606339$ and n = 0,1 and 2.

At n = 0, $\left(m_l c^2\right)_0 \cong m_e c^2$ and is defined. Please see table-1.

Table 1: To Fit the Muon and Tau Rest Masses

n	Obtained Lepton Rest Energy (MeV)	Experimental Lepton Rest Energy (MeV)
0	Defined	0.510998910(13)
1	105.951	105.6583668(38)
2	1777.384	1776.99(29)
3	(42262)	To be discovered

Above relation can also be approximately expressed as

$$\left(m_l c^2\right)_x \cong \frac{2}{3}\left[a_c^3 + \left(n^2\gamma\right)^x a_a^3\right]^{\frac{1}{3}} \tag{65}$$

where $a_c \cong 0.7647$ MeV and $a_a \cong 23.87$ MeV are the proposed coulombic and asymmetry energy constants of the semi empirical mass formula respectively. Please see the following section.

3.9 Charged Higgs fermion and the Z boson

Let M_{hf} be the ferminoic form of the charged Higgs fermion [40-44].

$$\frac{M_{hf}}{m_e} \cong \frac{m_e c^2}{F_I\left(R_x\right)_0} \tag{66}$$

$$M_{hf}c^2 \cong \left(\frac{m_e c^2}{F_I\left(R_x\right)_0}\right) m_e c^2 \cong 103125.64 \text{ MeV} \tag{67}$$

Thus with this new mass unit it is noticed that, at present

$$\frac{\hbar_0}{\sqrt{M_{hf} m_e}.c} \cong \frac{\left(R_x\right)_0}{\sqrt{2}} \cong 0.86 \text{ fm} \tag{68}$$

This length is very close to the presently established proton rms radius [61-64]. Based on the proposed SUSY fermion boson mass ratio, its corresponding charged Higgs boson is

$$M_{hb}c^2 \cong \frac{M_{hf}c^2}{\Psi} \cong 45584.42 \text{ MeV} \tag{69}$$

This proposed charged particle can be considered as the first kind of Higgs boson. Researchers say there's more to learn about the Higgs, including whether it is the only one. It is possible that when the Large Hadron Collider reopens up again in 2015 with more power, scientists may be able to detect heavier variations of the Higgs boson. A secondary spike in Higgs data presented in December 2012 led to speculation that physicists had perhaps found a second Higgs boson of a different mass. The neutral (Z) boson rest energy can be expressed as

$$\left(M_Z c^2\right)^0 \cong \left(M_{hb}c^2\right)^+ + \left(M_{hb}c^2\right)^- \cong 2M_{hb}c^2 \tag{70}$$

$$\cong 91168.85 \text{ MeV}$$

This can be compared with the PDG recommended value [66]. Based on 'integral charge quark SUSY' [40-44] authors suggested that W boson may be considered as the SUSY boson of the top quark. Close to the predicted rest energy of Higgs boson, recently a new boson of rest energy 124 to 160 GeV was reported [66]. It can be suggested that, proposed charged Higgs boson and the charged W boson join together to form a neutral boson of rest energy 126 GeV.

$$\left(M_{Hb}c^2\right)^{\pm} + \left(m_W c^2\right)^{\mp} \cong 126.0 \text{ GeV}. \tag{71}$$

This is an accurate and interesting fit and can be given a chance in understanding the electroweak physics. The Higgs charged fermion and charged boson play a vital role in estimating the 'quark baryon' and 'quark meson' masses [40-44]. W boson pair generates a neutral boson of rest energy 161 GeV.

$$\left(m_W c^2\right)^{\pm} + \left(m_W c^2\right)^{\mp} \cong 161.0 \text{ GeV}. \tag{72}$$

4.0 Nuclear Binding Energy Constants

The semi-empirical mass formula (SEMF) is used to approximate the mass and various other properties of an atomic nucleus [67,68]. As the name suggests, it is based partly on theory and partly on empirical measurements. The theory is based on the liquid drop model proposed by George Gamow and was first formulated in 1935 by the German physicist Carl Friedrich von Weizsäcker. Based on the 'least squares fit', volume energy coefficient is $a_v = 15.78$ MeV, surface energy coefficient is $a_s = 18.34$ MeV, coulombic energy coefficient is $a_c = 0.71$ MeV, asymmetric energy coefficient is $a_a =$ 23.21 MeV and pairing energy coefficient is $a_p = 12$ MeV. The semi empirical mass formula is

$$BE \cong Aa_v - A^{\frac{2}{3}}a_s - \frac{Z(Z-1)}{A^{\frac{1}{3}}}a_c - \frac{(A-2Z)^2}{A}a_a \pm \frac{1}{\sqrt{A}}a_p \tag{73}$$

In a unified approach it is noticed that, the energy coefficients are having strong inter-relation with the above number $k \cong \sqrt{\frac{m_e c^2}{F_I\left(R_y\right)_0}} \cong \left(\frac{G_A m_e^2}{\hbar_0 c}\right) \cong 635.3132$. The interesting semi empirical observations can be expressed in the following way.

- Neutron and proton mass difference can be expressed as

$$\left(m_n - m_p\right)c^2 \cong \ln\left(\frac{a_s}{2a_c}\right)\cdot m_e c^2 \tag{74}$$

$$a_v + a_s \cong a_a + a_p \cong \frac{3}{2}a_a \cong \frac{m_p c^2}{1+\sqrt{k}} \cong 35.8045 \text{ MeV} \tag{75}$$

- Asymmetric energy constant be

$$a_a \cong \frac{2}{3}.\left(\frac{m_p c^2}{1+\sqrt{k}}\right) \cong 23.870 \text{ MeV} \tag{76}$$

- Pairing energy constant be

$$a_p \cong \frac{a_a}{2} \cong \frac{1}{3}.\left(\frac{m_p c^2}{1+\sqrt{k}}\right) \cong 11.935 \text{ MeV} \tag{77}$$

- Maximum nuclear binding energy per nucleon be

$$B_m \cong \frac{1}{4}.\left(\frac{m_p c^2}{1+\sqrt{k}}\right) \cong 8.9511 \text{ MeV} \tag{78}$$

- Coulombic energy constant be

$$a_c \cong \sqrt{\alpha_0}.B_m \cong 0.7647 \text{ MeV} \tag{79}$$

- Surface energy constant be

$$a_s \cong 2B_m\left(1+\sqrt{\frac{a_c}{a_a}}\right) \cong 19.504 \text{ MeV} \tag{80}$$

- Volume energy constant be

$$a_v \cong 2B_m\left(1-\sqrt{\frac{a_c}{a_a}}\right) \cong 16.30 \text{ MeV} \tag{81}$$

Table 2: SEMF Binding Energy with the Proposed Energy Coefficients

Z	A	$(BE)_{cal}$ in MeV	$(BE)_{meas}$ in MeV
26	56	492.17	492.254
28	62	546.66	545.259
34	84	727.75	727.341
50	118	1007.76	1004.950
60	142	1184.50	1185.145
79	197	1556.66	1559.40
82	208	1627.11	1636.44
92	238	1805.60	1801.693

In table-2 within the range of $(Z=26; A=56)$ to $(Z=92; A=238)$ nuclear binding energy is calculated and compared with the measured binding energy [69]. Column-3 represents the calculated binding energy and column-4 represents the measured binding energy.

Proton-nucleon stability relation can be expressed as

$$\frac{A_s}{2Z} \cong 1 + 2Z\left(\frac{a_c}{a_s}\right)^2 \tag{82}$$

where A_s is the stable mass number of Z. This is a direct relation. Assuming the proton number Z, in general, for all atoms, lower stability can be fitted directly with the following relation [66]. Stable super heavy elements can also be predicted with this relation.

$$A_s \cong 2Z\left[1 + 2Z\left(\frac{a_c}{a_s}\right)^2\right] \cong 2Z + Z^2 * 0.00615 \tag{83}$$

if $Z = 21$, $A_s \cong 44.71$; if $Z = 29$, $A_s \cong 63.17$;

if $Z = 47$, $A_s \cong 107.58$; if $Z = 53$, $A_s \cong 123.27$

if $Z = 60$, $A_s \cong 142.13$; if $Z = 79$, $A_s \cong 196.37$;

if $Z = 83$, $A_s \cong 208.36$; if $Z = 92$, $A_s \cong 236.04$;

In between $Z = 30$ to $Z = 60$ obtained A_s is lower compared to the actual A_s. It is noticed that, upper stability in light and medium atoms up to $Z \approx 56$ can be fitted with the following relation.

$$A_s \cong 2Z\left[1 + 2Z\left(\left(\frac{a_c}{a_s}\right)^2 + \left(\frac{a_c}{4B_m}\right)^2\right)\right] \tag{84}$$

$$\cong 2Z + Z^2 * 0.0080$$

From this relation for $Z = 56$, obtained upper $A_s \cong 137.1$.

Note that, for $Z = 56$, actual stable $A_s \cong 137 \cong \frac{1}{\alpha_0}$

where α_0 is the fine structure ratio. This seems to be a nice and interesting coincidence. In between 0.00615 and 0.0080, for light and medium atoms up to $Z \approx 56$ or $A_s \approx 137$, mean stability can be fitted with the following relation.

$$A_s \cong 2Z + Z^2 * 0.00706 \tag{85}$$

Surprisingly it is noticed that, in this relation, $0.0071 \approx \alpha$. Thus, up to $Z \cong 56$ or $A_s \approx 137$, mean stability can be expressed as

$$A_s \approx 2Z + \left(Z^2 \alpha_0\right) \tag{86}$$

4.1 To fit the rest mass of proton or the gravitational constant or the Avogadro number

Semi empirically it is also noticed that

$$\ln \sqrt{\frac{e^2}{4\pi\varepsilon_0 G m_p^2}} \cong \sqrt{\frac{m_p}{m_e} - \ln\left(N^2\right)} \tag{87}$$

where m_p is the proton rest mass and m_e is the electron rest mass. Here, LHS $\cong 41.55229152$ and RHS $\cong 41.55289244$ This is another interesting discovery. Considering this as a characteristic relation, and by considering the electron rest mass as a fundamental input, proton rest mass and proton-electron mass ratio can be estimated simultaneously in the following way.

$$e^{\sqrt{\frac{m_p}{m_e} - \ln\left(N^2\right)}} \cdot m_p \cong \sqrt{\frac{e^2}{4\pi\varepsilon_0 G}} \tag{88}$$

Interesting thing is that, this relation is free from $\left(\hbar_0\right)$. Gravitational constant can be expressed as

$$G \cong \left(e^{\sqrt{\frac{m_p}{m_e} - \ln\left(N^2\right)}} \right)^{-2} \cdot \frac{e^2}{4\pi\varepsilon_0 m_p^2} \tag{89}$$

$\cong 6.666270179 \times 10^{-11}$ m^{3}Kg^{-1}sec^{-2}. Old recommended value [60] of G = $6.6742867 \times 10^{-11}$ m^{3}Kg^{-1}sec^{-2} and its revised value is $6.67384(80) \times 10^{-11}$ m^{3}Kg^{-1}sec^{-2}. Fitting the gravitational constant with the atomic and nuclear physical constants is a challenging task. The accuracy of the measured value of $`G'$ has increased only modestly since the original Cavendish experiment. Note that, with reference to the existing unified physics concepts, it is quite difficult to measure $`G'$, as gravity is much weaker than other fundamental forces, and an experimental apparatus cannot be separated from the gravitational influence of other bodies. Furthermore, gravity has no established relation to other fundamental forces, so it does not appear possible to calculate it indirectly from other constants that can be measured more accurately, as is done in some other areas of physics. Now Avogadro number can be expressed as

$$N \cong \sqrt{exp\left[\frac{m_p}{m_e} - \left(\ln\sqrt{\frac{e^2}{4\pi\varepsilon_0 G m_p^2}}\right)^2\right]} \tag{90}$$

$\cong 6.174407621 \times 10^{23}$.

4.2 To fit the gram mole and the unified atomic mass unit

Unified atomic mass-energy unit $m_u c^2$ can be expressed as [59]

$$m_u c^2 \cong \left(\frac{m_p c^2 + m_n c^2}{2} - B_A\right) + m_e c^2 \tag{91}$$

where B_A is the mean binding energy per nucleon. Accuracy depends on $B_A \approx 8.0$ MeV. The characteristic relation that connects gram mole and the unified atomic mass unit can be expressed in the following way.

$$G_A m_u^2 \cong G M_x^2 . \tag{92}$$

where $M_x \cong 0.001$ kg $\cong 1$ gram and is the 'gram mole'. Thus 'gram mole' [59] can be expressed as

$$M_x \cong \sqrt{\frac{G_A}{G}}.\, m_u \cong \sqrt{\frac{F_C}{F_I}}.\, m_u \cong N.m_u \tag{93}$$

4.3 The charged pion, its ground state boson and the neutral Z boson

With these ideas it is noticed that, the charged pion is a super symmetric boson of proton and muon. It can be expressed as

$$m_\pi^\pm c^2 \cong \frac{1}{\Psi}\sqrt{m_p m_\mu} c^2 \cong 139.18 \text{ MeV} \tag{94}$$

This can be compared with the experimental rest energy of charged pion = 139.57 MeV [66]. With this coincidence it is very natural to apply this idea to electron and proton system. When muon is the excited form of electron and if pion is the SUSY boson of muon, then it is natural to think that there exists a SUSY boson of electron-proton system. It can be called as 'EPION'. Its rest energy can be obtained as

$$m_\varepsilon^\pm c^2 \cong \frac{1}{\Psi}\sqrt{m_p m_e} c^2 \cong 9.679 \text{ MeV} \tag{95}$$

Considering the neutron rest mass and with this new epion, the neutral electroweak boson rest mass can be fitted as

$$m_Z \cong \frac{m_n^2}{m_\varepsilon} \cong 91206.0 \text{ MeV} \tag{96}$$

Really this is a very surprising coincidence [38]. In a simple form,

$$m_n \cong \sqrt{m_Z m_\varepsilon} \tag{97}$$

LHS of this relation represents a fermion where as RHS represents a boson. From SUSY point of view, this coincidence cannot be ignored. Life time of Z boson is close to

$$\sqrt{\frac{m_\varepsilon}{m_Z}} \cdot \frac{\hbar}{2m_\varepsilon c^2} \cong \frac{\hbar}{2\sqrt{m_\varepsilon m_Z}\, c^2} \cong 3.5\times 10^{-25} \text{ sec} \quad (98)$$

From these coincidences it can be suggested that: 1) Pion is the excited state of Epion. 2) 'Epion' can be considered as the basic nuclear force carrier. If so Epion must have some role in basic nuclear structure and nuclear binding energy [51]. In the following sections an attempt is made to implement and understand the applications of Epion.

4.3 To fit the neutron mean life time

Semi empirically it is noticed that,

$$\tau_n \cong N \cdot \frac{m_n}{\Psi m_\varepsilon} \cdot \frac{\hbar_0}{2m_\varepsilon c^2} \cong 878.623 \text{ sec} \quad (99)$$

Here τ_n is the experimental neutron mean life time, 880.1 ± 1.1 sec [65] and $N \cong \sqrt{\frac{F_C}{F_I}}$ is the Avogadro number. Thus, this relation indicates the combined role of N, Ψ and m_ε. This is one very simple relation using which Avogadro number can be estimated directly from nuclear and particle physics. Clearly speaking, there is no need to consider the 'classical gravitational constant'. Thus Avogadro number can be expressed as

$$N \cong \sqrt{\frac{F_C}{F_I}} \cong \left(\frac{\Psi m_\varepsilon c^2}{m_n c^2}\right) \cdot \frac{2m_\varepsilon c^2}{\hbar_0} \cdot \tau_n \quad (100)$$

where $m_\varepsilon c^2 \cong \left(\frac{m_n^2}{m_Z}\right) c^2$ and $\Psi \cong \frac{\sqrt{m_p m_e} \cdot c^2}{m_\varepsilon c^2}$.

5 DISCUSSION & CONCLUSIONS

5.1 About the proposed black hole universe

From cosmic evolution point of view, at any given cosmic time, product of 'Hubble volume' and 'critical density' represents the characteristic 'Hubble mass' and its 'Schwarzschild radius' resembles the 'Hubble length'. From this it is possible to consider the evolving universe as a black hole. Then automatically comic rotation comes into picture and Hubble's constant 'H_t'can be considered as the cosmic angular velocity. From time to time $\frac{d(H)}{dt}$ can be considered as a measure of cosmic rate of expansion. At present, to have a rapid detectable change in $\frac{d(H)}{dt}$, present cosmic time should run fast or should accelerate.

Restricting the speed of rotation to 'light speed' at any given time, cosmic radius can be constrained to Hubble length and galactic ordered arrangement and stability can be understood. Thus the existing concept of 'repulsive gravity' can be eliminated. As thermal wave stretching is taking place instantaneously in all directions in tandem with the cosmic rate of expansion, in a closed expanding universe, 'rate of drop in cosmic temperature' seems to be directly proportional to the rate of expansion. If expansion rate is fast, there will be no chance to see 'thermal isotropy'. If expansion rate is very slow, one can see only 'thermal isotropy' i.e 'rate of drop in cosmic temperature' seems to be practically zero.

5.2 About the proposed imaginary discrete electroweak force

In understanding the basic concepts of unification or TOE, role of dark energy and dark matter is insignificant. From fundamental interactions point of view - a 'unified force' is required and from quantum gravity point of view- a characteristic 'discrete physical parameter' is required. By considering a 'suitable discrete force magnitude' above two problems can be studied in a unified manner. The proposed $F_I \cong \left(\frac{c^4}{N^2 G}\right)$ seems to be more fundamental than the electromagnetic and strong nuclear forces. From the above discovered relations and other proposed relations one can see the various applications of the proposed discrete F_I in atomic, nuclear and particle physics. With further research and analysis its significance, existence and the mystery of unification can be understood.

5.3 To verify the cosmic acceleration from atomic and nuclear inputs

From cosmic evolution point of view- by considering Mach's principle, Hubble length and Hubble mass and considering 'cosmic redshift' as a cosmological 'atomic phenomenon', all observed 'interaction ranges' and 'interaction phenomenon' can be studied in a unified manner. With reference to the current concepts of cosmic acceleration and with current laboratory experiments one may not be able to decide whether universe is accelerating or decelerating. Many experiments are under progress to detect and confirm the existence of dark matter and dark energy. Along with these experiments if one is willing to think in this new direction, from atomic and nuclear inputs, it may be possible to verify the future cosmic acceleration. With the proposed concepts and with the advancing science and technology, from the ground based laboratory experiments, from time to time the two concepts $\frac{d(R_x)}{dt}$ and $\frac{d(\hbar)}{dt}$ can be put for experimental tests. Well established experiments are available by which characteristic nuclear size and Planck's constant can be estimated. Thinking positively, $\frac{d(R_x)}{dt}$ or $\frac{d(\hbar)}{dt}$ can be considered as a measure of cosmic rate of expansion. As time is passing, one can expect a very small change in $\frac{d(R_x)}{dt}$ or $\frac{d(\hbar)}{dt}$ and it may be beyond the scope of experimental accuracy. But to have a rapid (detectable) change in $\frac{d(R_x)}{dt}$ or $\frac{d(\hbar)}{dt}$, present cosmic time should run fast or should accelerate.

Alternatively in a theoretical way, the proposed applications or semi empirical relations can be given a chance and the subject of elementary particle physics and cosmology can be studied in a unified manner. It is true that the proposed relations are speculative and peculiar also. By using the proposed relations and applying them in fundamental physics, in due course their role or existence can be verified. With these relations, Hubble constant can be estimated from atomic and nuclear physical constants. If one is able to derive them with a suitable mathematical model, independent of the cosmic redshift and CMBR observations, the future cosmic acceleration can be verified from atomic and nuclear physical constants.

Based on the proposed relations and applications, Hubble volume or Hubble mass, can be considered as a key tool in unification as well as cosmology. Considering the proposed relations and concepts it is possible to say that there exists a strong relation between cosmic Hubble mass, Avogadro number and unification. Now the new set of proposed relations are open to the science community. Whether to consider them or discard them depends on the physical interpretations, logics, experiments and observations. The mystery can be resolved only with further research, analysis, discussions and encouragement.

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