Redshift in Evolving and Rotating Primordial Black Hole Universe

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Abstract: In this paper an attempt is made to understand the basic unified concepts of gravity, electromagnetism, nuclear charge radius, cosmic geometry; cosmic mass density, cosmic thermal energy density and cosmic red shift. The four key assumptions are : 1) Planck's constant increases with cosmic time. 2) Being a primordial evolving black hole and angular velocity being H_t, universe is always rotating with light speed. 3) Atomic gravitational constant is squared Avogadro number times the classical gravitational constant and 4) Avogadro number is discrete and hence the atomic gravitational constant is discrete. This may be the root cause of discrete nature of revolving electron's potential energy. Finally it can be suggested that current cosmological changes may be reflected in any existing atom.

Keywords: Planck's constant**;** Hubble length; Hubble mass; Hubble volume; Hubble density; Cosmic red shift; CMBR temperature; Avogadro number; Atomic gravitational constant;

1. INTRODUCTION

For a cosmologist, there are only few parameters needed to describe the universe. All models are based on Einstein's theory of general relativity. The world models are characterized by two parameters: the current rate and the deceleration of the expansion. The first parameter is called the Hubble constant after Edwin Hubble [1]. The other parameter describes the change of the expansion and depends on the energy density and the curvature of the universe. The contributions to the density are expressed as fractions of the critical density. The expansion itself is typically measured by the redshift and is the ratio of the scale factor at two different times of the expansion. In 1947, Hubble suggested that [2]:

"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."

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 [3-11] and so on.

"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 [12] 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, "within the Hubble volume, each and every point in free space is influenced by the Hubble mass". In this paper an attempt is made to understand the basic unified concepts of the four fundamental cosmological interactions. With this approach unification of gravity and electromagnetism, nuclear charge radius, cosmic red shift and cosmic expansion etc. can be studied in a unified manner.

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]. 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 1920s), 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 [14,15].

1.1 The cosmic 'critical density' and its dimensional analysis

Physicists and astronomers have long believed that the universe has mirror symmetry, like a basketball. But 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. This recent news [16] can be seen at following two web sites.

http://phys.org/news/2011-07-universe-born-symmetry-cosmos.html and

http://news.discovery.com/space/do-we-live-in-a-spinning-universe-110708.html.

With a simple derivation it is possible to show that, Hubble's constant (H_t) represents cosmological angular velocity [17-19]. Assume that, a planet of mass (M) and size (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,

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

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

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, $M = \frac{4\pi}{3}R^3\rho_e$,

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

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

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.

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

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

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 depends 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. Galaxies spin, stars spin, and planets spin. So, why not the whole universe? The consequences of a spinning universe would be profound.

2.0 POSSIBLE ASSUMPTIONS IN UNIFIED COSMIC PHYSICS

The possible assumptions in unified cosmic physics can be expressed in the following way [20-22],[23-36]:

1. Planck's constant increases with cosmic time.
2. Being a primordial evolving black hole [17-19] and angular velocity being H_t, universe is always rotating with light speed.
3. Atomic gravitational constant is squared Avogadro number [23,24] 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.
4. Avogadro number is discrete and hence the atomic gravitational constant is discrete. Thus
$$(n.N)^2 G \cong n^2 \left(N^2 G\right) \cong n^2 G_A \tag{10}$$
where $n = 1, 2, 3, ..$ This may be the root cause of discrete nature of revolving electron's potential energy.

Thus at any given cosmic time t,

5. Hubble length (c/H_t) can be considered as the gravitational or electromagnetic interaction range.
6. Planck's constant inccrases with increasing cosmic time and $\frac{d(h)}{dt}$ is a measure of cosmic rate of expansion. 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 [37,38].
7. Past light quanta emitted from aged galaxy will have less Planck's constant and show a red shift with reference to the receiving galaxy. During journey light quanta will not lose energy and there will be no change in light wavelength.
8. The basic definition of redshift (z) seems to be $z \cong \frac{\lambda_G - \lambda_0}{\lambda_G}$ but not $z \cong \frac{\lambda_G - \lambda_0}{\lambda_0}$. Here 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, red shift (z) will be directly proportional to the age difference of our galaxy and the old galaxy (Δt). Thus $z \propto \Delta t$ and $z \cong H_t \Delta t$. Here H_t is the proportionality constant. In this way H_t can be incorporated directly. Our galaxy and observed galaxy age difference is, $\Delta t \cong \frac{z}{H_t}$. If $c\Delta t$ is a measure of galaxy distance, then $c\Delta t \cong z \cdot \frac{c}{H_t}$. 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.
9. Like a primordial black hole, universe is evolving and rotating. Being a black hole and angular velocity being H_t, universe is always rotating with light speed.
10. The Schwarzschild radius [17-19] of universe is
$$\frac{2GM_t}{c^2} \cong \frac{c}{H_t} \tag{11}$$
11. where M_t is the cosmic mass at that time. Thus the cosmic mass can be expressed as
$$M_t \cong \frac{c^3}{2GH_t}. \tag{12}$$
12. It can be called as the Hubble mass. Thus the cosmic volume density takes the following well known 'critical density' form,
$$(\rho_v)_t \cong \frac{c^3}{2GH_t} \div \frac{4\pi}{3}\left(\frac{c}{H_t}\right)^3 \cong \frac{3H_t^2}{8\pi G}. \tag{13}$$
It can be caled as the cosmic Hubble density.

3.0 APPLICATIONS OF THE PROPOSED ASSUMPTIONS

3.1 Cosmic matter density

Approximate ratio of cosmic volume density $(\rho_v)_t$ and matter density $(\rho_m)_t$ can be expressed as

$$\left(\frac{\rho_v}{\rho_m}\right)_t \cong 1+\ln\sqrt{\frac{4\pi\varepsilon_0 GM_t^2}{e^2}} \tag{14}$$

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 [39]

$$(\rho_m)_0 \cong 1.5\times10^{-32}\eta h_0 \ \text{gram/cm}^3 \tag{15}$$

where for any galaxy, $\langle M/L\rangle_{Galaxy} = \eta\langle M/L\rangle_{\text{Sun}}$ and the number: $h_0 \cong \dfrac{H_0}{100\ \text{Km/sec/Mpc}} \cong \dfrac{70.75}{100} \cong 0.7075$. 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 (6.0 to 6.67) $\times$ 10^{-32} gram/cm^3.

3.2. 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 [40].

Method-1: Pair particles creation and annihilation in 'free space'- is an interesting idea. In the expanding universe, by considering the proposed charged M_C and its pair annihilation as characteristic cosmic phenomena, origin of the isotropic CMB radiation can be addressed. With reference to the Wein's displacement law and if $(M_e)^{\pm} \cong \sqrt{\dfrac{e^2}{4\pi\varepsilon_0 G}}$ represents a characteristic fundamental unified charged mass unit, wave length of the most strongly emitted CMB radiation can be expressed as

$$(\lambda_m)_t \cong \left(\frac{\rho_v}{\rho_m}\right)_t \frac{G\sqrt{M_t M_e}}{c^2} \cong \left[1+\ln\left(\frac{M_t}{M_e}\right)\right]\frac{G\sqrt{M_t M_e}}{c^2} \tag{16}$$

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: This method is based on the pair annihilation of $(M_e)^{\pm}$. Thermal energy can be expressed as

$$k_B T_t \cong \sqrt{\frac{M_e}{M_t}}\cdot\left[(M_e)^{+}+(M_e)^{-}\right]c^2 \cong \sqrt{\frac{M_e}{M_t}}\cdot 2M_e c^2 \tag{17}$$

Based on Wein's displacement law,

$$(\lambda_m)_t \cong \frac{b}{T_t} \cong \sqrt{\frac{M_t}{M_e}}\cdot\frac{bk_B}{2M_e c^2} \tag{18}$$

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 wave length obtained from methods-1 and 2, wave length of the most strongly emitted CMB radiation can be expressed as

$$\left(\lambda_t^2\right)_t \cong \left[1+\ln\left(\frac{M_t}{M_e}\right)\right]\cdot\left(\frac{M_t}{2M_e}\right)\cdot\left(\frac{bk_B G}{c^4}\right) \tag{19}$$

$$(\lambda_m)_t \cong \sqrt{\left[1+\ln\left(\frac{M_t}{M_e}\right)\right]\cdot\left(\frac{M_t}{2M_e}\right)\cdot\left(\frac{bk_B G}{c^4}\right)} \tag{20}$$

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,

$$(\lambda_m)_t \propto \sqrt{1+\ln\left(\frac{M_t}{M_e}\right)} \propto \sqrt{\left(\frac{\rho_v}{\rho_m}\right)_t} \tag{21}$$

$$(\lambda_m)_t \propto \sqrt{\frac{M_t}{2M_e}} \tag{22}$$

and $\sqrt{\dfrac{bk_B G}{c^4}} \cong 1.818\times10^{-35}$ m seems to be a constant and can be considered as the characteristic thermal wave length. The most important point is that, as the black hole universe is expanding, its expansion rate can be checked with $\dfrac{d}{dt}(\lambda_m)_t$. Present observations indicates that, CMB radiation is smooth and uniform. Thus it can be suggested that, at present there is no detectable cosmic expansion or cosmic acceleration.

3.3. Characteristic Nuclear Charge Radius

At any given cosmic time, in a semi empirical way, the characteristic nuclear charge radius [40,41] can be expressed as

$$R_{ct} \cong \left(\frac{Gm_p^2}{G_A m_e^2}\right)\frac{c}{H_t} \tag{23}$$

Here m_p is the proton rest mass. At present If H_0 is close to 70 km/sec/Mpc,

$$R_{c0} \cong \left(\frac{Gm_p^2}{G_A m_e^2}\right)\frac{c}{H_0} \cong 1.23 \text{ fm} \quad (24)$$

Thus it can be suggested that, $R_{ct} \propto \frac{c}{H_t}$.This is a very strange and peculiar result and is beyond the current physics concepts and interpretations. Interpretation seems to be a big puzzle.

3.4. Scattering Distance Between Electron And The Nucleus

If 1.21 to 1.23 fm is the characteristic scattering distance between electron and the nucleus [41,42], semi empirically it is noticed that,

$$\left(\frac{\hbar c}{\sqrt{GG_A}m_e^2}\right)^2 \frac{2Gm_e}{c^2} \cong 1.21565 \text{ fm} \quad (25)$$

Here it is very interesting to consider the role of the Schwarzschild radius of the 'electron mass'. This is a very strange and peculiar result and is beyond the current physics concepts and interpretations.

3.5. Characteristic Reduced Planck's Constant

From above semi empirical relations it is noticed that,

$$\hbar \cong \sqrt{\frac{M_0}{m_e}} \cdot \frac{Gm_p m_e}{c} \quad (26)$$

This is also a very strange and peculiar result and is beyond the current physics concepts and interpretations. Based on this coincidence, magnitude of the present Hubble's constant [43,44] can be expressed as

$$H_0 \cong \frac{Gm_p^2 m_e c}{2\hbar^2} \cong 70.75 \text{ Km/sec/Mpc} \quad (27)$$

At any given cosmic time, the characteristic reduced Planck's constant can be expressed as

$$\hbar_t \cong \sqrt{\frac{M_t}{m_e}} \cdot \frac{Gm_p m_e}{c} \quad (28)$$

where M_t is the cosmic mass at time t. As cosmic time passes, magnitude of $\hbar_t$ increases.

3.6. Electron's Characteristic Potential Energy

In Hydrogen atom, it is noticed that,

$$\left(\frac{e^2}{4\pi\varepsilon_0 G_A m_e^2}\right)\sqrt{\frac{\sqrt{m_p m_e^3}}{2}}.c^2 \cong \alpha^2 m_e c^2 \quad (29)$$

This is an observation. Here, LHS = 27.356 eV and RHS = 27.21138 eV. Here error is 0.5315%. With reference to the error bars [45] in the magnitudes of (N,G), this relation can be given a chance. Thus in hydrogen atom, Bohr radius can be expressed as

$$a_0 \cong \left(\frac{4m_e}{m_p}\right)^{\frac{1}{4}} \cdot \frac{G_A m_e}{c^2} \cong \left(\frac{m_e}{4m_p}\right)^{\frac{1}{4}} \cdot \frac{2G_A m_e}{c^2}. \quad (30)$$

Then $\hbar$ can be expressed as

$$\hbar \cong \left(\frac{4m_e}{m_p}\right)^{\frac{1}{8}} \sqrt{\frac{G_A m_e^2}{c^2} \cdot \frac{e^2}{4\pi\varepsilon_0 c}} \quad (31)$$

Here, LHS = $1.054571628\times10^{-34}$ J.sec and RHS = $1.055410917\times10^{-34}$ J.sec and error is 0.0796%. Hence this relation can be given a chance. Now

$$n.\hbar \cong \left(\frac{4m_e}{m_p}\right)^{\frac{1}{8}} \sqrt{\frac{\left(n^2.G_A\right)m_e^2}{c^2} \cdot \frac{e^2}{4\pi\varepsilon_0 c}} \quad (32)$$

where $n = 1,2,3,..$ In this way, the mystery of 'discrete angular momenta' of revolving electron can be understood. Now equation (29) can be written as

$$E_p \cong -\left[\left(\frac{e^2}{4\pi\varepsilon_0 G_A m_e^2}\right)\sqrt{\frac{\sqrt{m_p m_e^3}}{2}}.c^2\right]^2 \div \alpha^2 m_e c^2 \quad (33)$$

On simplification, it takes the following simple form.

$$E_{pt} \cong -\left(\frac{\hbar c}{G_A m_e^2}\right)^2 \cdot \frac{\sqrt{m_p m_e}\cdot c^2}{2} \quad (34)$$

From unification point of view, at any given cosmic time, in hydrogen atom, electron's characteristic potential energy [36,37] can be expressed as

$$E_{pt} \cong -\left(\frac{\hbar_t c}{G_A m_e^2}\right)^2 \cdot \frac{\sqrt{m_p m_e}\cdot c^2}{2} \quad (35)$$

Thus it can be suggested that, $E_{pt} \propto \hbar_t^2$. From equation (26), above relation can be written as

$$E_{pt} \cong -\left(\frac{Gm_p^2}{G_A m_e^2} \cdot \frac{c}{H_t} \cdot \frac{c^2}{2\left(n^2.G_A\right)m_e}\right)\frac{\sqrt{m_p m_e}\cdot c^2}{2} \quad (36)$$

$$E_{pt} \cong -\left(\frac{R_{ct}c^2}{2\left(n^2.G_A\right)m_e}\right)\frac{\sqrt{m_p m_e}\cdot c^2}{2} \quad (37)$$

Here G_A is the proposed atomic gravitational constant and R_{ct} is the characteristic nuclear charge radius and $\left(2G_A m_e / c^2\right)$ is the characteristic black hole radius of electron where G_A is the operating atomic gravitational constant. Thus at present,

$$E_{p0} \cong -\left(\frac{R_{c0}c^2}{2\left(n^2.G_A\right)m_e}\right)\frac{\sqrt{m_p m_e}\cdot c^2}{2} \cong -27.12 \text{ eV} \quad (38)$$

This is a note worthy observation. Thus it can be suggested that, $E_{pt} \propto \frac{c}{H_t}$. Note that in Bohr's theory of Hydrogen atom, the role of nuclear charge radius and role of proton rest mass is not clear.

3.7 Bohr Radius Of Hydrogen Atom

From above relations, at present Bohr radius of hydrogen atom can be expressed as

$$a_0 \cong \frac{4G_A m_e}{c^2 R_{c0}} \cdot \frac{e^2}{4\pi\varepsilon_0 \sqrt{m_p m_e} c^2} \tag{39}$$

Note that, 4 characteristic length units are appearing in this expression. This is a very simple relation and from General theory of relativity, the most note worthy observation is the role of $\left(\frac{4G_A m_e}{c^2 R_{c0}}\right)$. Its interpretation seems to be connected with 'bending of electron path' due to nuclear charge radius. Other discrete Bohr radii can be obtained as

$$a_n \cong \frac{4\left(n^2.G_A\right)m_e}{c^2 R_{c0}} \cdot \frac{e^2}{4\pi\varepsilon_0 \sqrt{m_p m_e} c^2} \tag{40}$$

3.8 . About The Fine Structure Ratio

In physics, the fine-structure ratio (α) 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. The most precise value of α obtained experimentally (as of 2012) is based on a measurement of 'Linde g factor' using a 'one-electron' so-called 'quantum cyclotron' apparatus, together with a calculation via the theory of QED. Independent of the Planck's constant, inverse of the fine structure ratio can be expressed as

$$\left(\frac{1}{\alpha}\right)_t \cong \ln\left(\frac{x}{1+\ln x}\right) \tag{41}$$

where $x \cong \frac{M_t}{M_e} \cong \sqrt{\frac{4\pi\varepsilon_0 G M_t^2}{e^2}}$. When $x \cong \frac{4\pi\varepsilon_0 G M_t^2}{e^2}$ $\cong \frac{M_t^2}{M_e^2} \cong 1$, $\frac{1}{\alpha} \to 0$. In this way, in a unified manner, the present fine structure ratio can be fitted. From this relation it is possible to say that, cosmological rate of change in fine structure ratio, $(d\alpha/dt)$ may be considered as an index of the future cosmic acceleration. Many physicists think its possible variation [46] and experiments are in progress.

4.0 TO FIT THE RMS RADIUS OF PROTON

Let R_p be the rms radius of proton. Define two radii R_1 and R_2 as follows.

$$R_1 \cong \left(\frac{\hbar c}{\sqrt{G_A G} m_p^2}\right)^2 \frac{2Gm_p}{c^2} \cong 1.9637\times10^{-25} \text{ m} \tag{42}$$

$$R_2 \cong \left(\frac{\hbar c}{\sqrt{G_A G} m_p^2}\right)^3 \frac{2Gm_p}{c^2} \cong 5.521\times10^{-11} \text{ m} \tag{43}$$

It is noticed that,

$$R_p \cong \left(R_1 R_2^2\right)^{\frac{1}{3}} \cong 8.4278\times10^{-16} \text{ m} \tag{44}$$

$$\text{Thus, } R_p \cong \left(\frac{\hbar c}{\sqrt{G_A G} m_p^2}\right)^{8/3} \frac{2Gm_p}{c^2} \tag{45}$$

This can be compared with the 2010 CODATA recommended rms radius of proton $0.8775(51)$ fm [45]. Recent work on the spectrum of muonic hydrogen (an exotic atom consisting of a proton and a negative muon) indicates a significantly lower value for the proton charge radius, $R_n \cong 0.84184(67)$ fm and the reason for this discrepancy is not clear. This is 10 times more precise than all the previous determinations [47]. Here the most interesting thing is that, R_2 is very close to the Bohr radius of Hydrogen atom. It is very surprising to note that, with R_2 ionic radii of atoms can be fitted very easily as

$$(R)_A \cong A^{1/3} \cdot \left(\frac{R_2}{\sqrt{2}}\right) \cong A^{1/3} \cdot 3.904\times10^{-11} \text{ m} \tag{46}$$

where $(R)_A$ is the ionic radius of mass number A. If $A = 7, (R)_A \cong 0.0747$ nm, if $A = 23, (R)_A \cong 0.111$ nm and if $A = 39, (R)_A \cong 0.132$ nm. Their corresponding recommended radii are 0.076 nm, 0.102 nm and 0.138 nm respectively [48].

4.1 To Fit The Gram Mole

From relations (26) and (45), proton rms radius can be expressed as

$$R_p \cong \left(\frac{\sqrt{M_0 m_e}}{N m_p} \right)^{8/3} \frac{2Gm_p}{c^2} \tag{47}$$

On rearranging,

$$N m_p \cong \left(\frac{2Gm_p}{c^2 R_p} \right)^{3/8} \sqrt{M_0 m_e} \cong M_g \tag{48}$$

where M_g is the mass of 'gram mole' [49] expressed in kg or gram. Please note that, $\left(N m_p\right)$ is very close to the magnitude of gram mole. These relations are speculative and puzzling but at the same time they are peculiar. Interpretation seems to be complicated. Authors are working in this new direction.

4.2 To Fit The Nuclear Binding Energy

Inverse of the strong coupling constant [50,51] can be expressed as

$$\left(\frac{1}{\alpha_s} \right)_t \cong \ln\left(\frac{4\pi\varepsilon_0 G_A m_e^2}{e^2} \right) - \ln\sqrt{1+\left(\frac{1}{\alpha} \right)_t}\,. \tag{49}$$

Thus at present,

$$\left(\frac{1}{\alpha_s} \right)_0 \cong \ln\left(\frac{4\pi\varepsilon_0 G_A m_e^2}{e^2} \right) - \ln\sqrt{1+\left(\frac{1}{\alpha} \right)_0} \tag{50}$$

$$\cong 8.9106 \cong 1/0.1122258$$

At present in the semi empirical mass formula [52-55], coulombic energy constant can be expressed as

$$a_c \cong \alpha \cdot \alpha_s \cdot m_p c^2 \cong 0.7684 \text{ MeV}. \tag{51}$$

Surface energy constant can be expressed as

$$a_s \cong \left(\frac{2G_A m_e}{R_c c^2} \right)^{1/4} \cdot a_c \cong 19.37 \text{ MeV}. \tag{52}$$

Volume energy constant can be expressed as

$$a_v \cong \left(\frac{G_A m_e}{R_c c^2} \right)^{1/4} \cdot a_c \cong 16.29 \text{ MeV}. \tag{53}$$

Asymmetric energy constant can be expressed as

$$a_a \cong \frac{2}{3}\left(a_v + a_s\right) \cong 23.77 \text{ MeV}. \tag{54}$$

Similarly pairing energy constant can be expressed as

$$a_p \cong \frac{1}{3}\left(a_v + a_s\right) \cong 11.88 \text{ MeV}. \tag{55}$$

$$\text{Thus, } \left(a_v + a_s\right) \cong \left(a_p + a_a\right) \cong 3a_p \tag{56}$$

5. DISCUSSION & CONCLUSIONS

After sometime in the late 1920s Einstein became more and more isolated from the mainstream of fundamental physics. To a large extent this was due to his attitude towards quantum mechanics, the field to which he had made so many revolutionary contributions. Einstein, who understood better than most the implications of the emerging interpretations of quantum mechanics, could never accept it as a final theory of physics. He had no doubt that it worked, that it was a successful interim theory of physics, but he was convinced that it would be eventually replaced by a deeper, deterministic theory [13].

Every day quantum mechanics is strongly connected with the constancy of Planck's constant. String theory, quantum cosmology, quantum chromodynamics (QCD) etc. are strongly based on the constancy of Planck's constant. With reference to the present concepts of cosmic acceleration and with laboratory experiments one may not 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 concept $d\left(h_0\right)/dt$ can be put for experimental tests. There is no need to design a new experiment. Well established experiments are already available by which Planck's constant can be estimated. Moreover, conducting an experiment in this direction is also very simple. Only thing is that the same experiment has to be repeated for several times or continuously. This is also very simple. Thus in the near future one can expect the real picture.

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 [56-58]. 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.

In understanding the basic concepts of unification or TOE, role of dark energy and dark matter is insignificant. Even though string theory was introduced for understanding the basics of strong interaction, its success seems to be a dilemma because of its higher dimensions and the non-coupling of the nuclear and Planck scale [13]. 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. In most of the critical cases, 'time' only will decide the issue. The mystery can be resolved only with further research, analysis, discussions and encouragement.

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