

Applications of Hubble Volume in Atomic Physics, Nuclear Physics, Particle Physics, Quantum Physics and Cosmic Physics

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Abstract In this paper an attempt is made to emphasize the major shortcomings of standard cosmology. It can be suggested that, the current cosmological changes can be understood by studying the atom and the atomic nucleus through ground based experiments. If light is coming from the atoms of the gigantic galaxy, then redshift can be interpreted as an index of the galactic atomic 'light emission mechanism'. In no way it seems to be connected with 'galaxy receding'. With 'cosmological increasing (emitted) photon energy', observed cosmic redshift can be considered as a measure of the age difference between our galaxy and any observed galaxy. If it is possible to show that, (from the observer) older galaxy's distance increases with its 'age', then 'galaxy receding' and 'accelerating universe' concepts can be put for a revision at fundamental level. At any given cosmic time, the product of 'critical density' and 'Hubble volume' gives a characteristic cosmic mass and it can be called as the 'Hubble mass'. Interesting thing is that, Schwarzschild radius of the 'Hubble mass' again matches with the 'Hubble length'. Most of the cosmologists believe that this is merely a coincidence. At any given cosmic time, 'Hubble length' can be considered as the gravitational or electromagnetic interaction range. If one is willing to think in this direction, by increasing the number of applications of Hubble mass and Hubble volume in other areas of fundamental physics like quantum physics, nuclear physics, atomic physics and particle physics - slowly and gradually - in a progressive way, concepts of 'Black hole Cosmology' can be strengthened and can also be confirmed.

Keywords: Hubble length, Hubble volume, Hubble mass, Cosmic redshift, CMBR energy density, Reduced Planck's constant, rms radius of proton.

1. INTRODUCTION

The basic proposal of this paper is that current cosmological changes can be understood by studying the atom and the atomic nucleus through ground based experiments. So far no Institute has accepted this subject for R&D. With this proposal, the openness in the subjects of cosmology and fundamental interactions can be minimized and 100 years of atomic, nuclear and cosmic physics can be refined and unified. If H_0 is the current characteristic angular velocity of the universe [1-4] and R_0 is the current characteristic radius of the universe, then

$$R_0 \cong (c/H_0) \quad (1)$$

Journal of Nuclear
Physics, Material
Sciences, Radiation
and Applications
Vol. 1, No. 1
August 2013
pp. 45-60



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Now the characteristic cosmic Hubble volume is

$$V_0 \cong \frac{4\pi}{3} R_0^3. \quad (2)$$

With reference to the presently believed critical density

$$\rho_c \cong \frac{3H_0^2}{8\pi G} \cong (\rho_0) \quad (3)$$

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and the characteristic current cosmic Hubble volume, the characteristic cosmic Hubble mass can be expressed as

$$M_0 \cong \rho_c \cdot V_0 \cong \frac{c^3}{2GH_0} \quad (4)$$

If we do not yet know whether the universe is spatially closed or open, then the idea of Hubble volume [5-8] or Hubble mass can be used as a tool in cosmology and unification. This idea is very close to the Mach's idea of distance cosmic background. It seems to be a quantitative description to the Mach's principle. In understanding the basic concepts of unification of the four cosmological interactions, the cosmic radius (c/H_0) can be considered as the infinite range of the gravitational or electromagnetic interaction. Within the Hubble volume it is noticed that: 1) Each and every point in free space is influenced by the Hubble mass. 2) Hubble mass plays a vital role in understanding the properties of electromagnetic and nuclear interactions and 3) Hubble mass plays a key role in understanding the geometry of the universe. Now from the above relation, Schwarzschild radius of M_0 can be expressed as

$$\frac{2GM_0}{c^2} \cong \frac{c}{H_0} \cong R_0 \quad (5)$$

From this relation it is possible to guess that, at present, H_0 being the angular velocity, current Hubble volume can be considered as a growing and light speed rotating black hole. If universe constitutes so many galaxies, if each galaxy constitutes a central fast growing and (light speed) spinning black hole and if black hole geometry is more intrinsic than its 'mass' and 'mass density' [4], then considering universe as a 'growing and light speed rotating black hole' may not be far away from reality[2-4,10-16].

From standard cosmology point of view, it may be erroneous but the evidence for dark energy is only indirect and many things about the nature of dark energy remain matters of speculation. Not only that, in understanding the basic concepts of unification or TOE, role of dark energy is insignificant. Please note the 'standard model' of cosmology is much less certain than the standard model of particle physics, much less supported by experimental evidence and much less coherent. A number of ad hoc 'fixes' are

introduced to incorporate such phenomena as the large scale flatness of space-time, the rotation curves of galaxies, and the apparent acceleration in the expansion of the universe. The whole theory would be unsustainable if a non-expansionary explanation of the cosmological redshift should emerge. In the following section an attempt is made to highlight the major shortcomings of standard cosmology. It can be suggested that, that there exists a number of applications in support of this idea. Only thing is that it has to be confirmed with further research, analysis and applications.

2. IMPORTANT SHORTCOMINGS OF STANDARD COSMOLOGY

1. It may be noted that, increased redshifts and increased distances forced Edwin Hubble to propose the Hubble's law. In fact there is no chance or scope or place for 'galaxy receding'. Its only our belief in its 'given' (Doppler shift based) interpretation. Even then, merely by estimating galaxy distance and without measuring galaxy receding speed, one cannot verify its acceleration. Clearly speaking: two mistakes are happening here. A) Assumed galaxy receding speed is not being measured and not being confirmed. B) Without measuring and confirming the galaxy receding speed, how can one say and confirm that it (galaxy) is accelerating. If it is possible to show that, (from the observer) older galaxy's distance increases with its 'age', then the concepts 'galaxy receding' and 'accelerating universe' can be put for a revision at fundamental level.
2. With reference to our laboratory or our galaxy, the possible definitions of redshift seem to be:

$$z \cong \frac{E_0 - E_G}{E_0} \cong \frac{\lambda_G - \lambda_0}{\lambda_G} \leq 1 \cong z_x \quad (6)$$

$$z \cong \frac{E_0 - E_G}{E_G} \cong \frac{\lambda_G - \lambda_0}{\lambda_0} \cong z_y \quad (7)$$

$$z_x \cong \frac{z_y}{1 + z_y} \quad (8)$$

Here $E_0 \cong \frac{hc}{\lambda_0}$ is the energy of photon at our galaxy/laboratory 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. Very interesting thing is that, when redshift is very small (up to $z \cong 0.01$), both relations (6) and (7) almost all will give the same result. Important point to be noticed is that, by Hubble's time the maximum redshift noticed was 0.003 and was less than 0.01. Another interesting point to be noted is that, by Hubble's time, estimated value of H_0 was close to 530 (km/sec)/Mpc

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and its present value is close to 70 (km/sec)/Mpc. With these errors, certainly it is possible to replace relation (7) by relation (6). Now the fundamental question to be answered is: which relation is correct: either relation (6) or relation (7)?

3. During cosmic expansion, assuming past and present galaxies (which actually found to have gigantic structures) as 'points' and guessing photons coming from that galactic point particles seem to be ad-hoc. If light is coming from the atoms of the gigantic galaxy, then redshift can be interpreted as an index of the galactic atomic 'light emission mechanism'. In no way it seems to be connected with 'galaxy receding'.
4. If cosmic expansion is continuous and accelerating and redshift is a measure of cosmic expansion, then '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. More over the current definition of red shift seems to be ad-hoc and not absolute hence one may not be able to understand or confirm the actual cosmic rate of expansion.
5. According to the modern cosmological approach, bound systems like 'atoms' which found to be the major constituents of galactic matter - will not expand with cosmic expansion/acceleration. As per the present observational data this may be true. It might be the result of ending stage of expansion also. In this regard, without considering and without analysing the past data, one can not come to a conclusion. If it is not possible to collect the past data, theoretically it may be possible to proceed further in this new direction.
6. Even though it was having strong footing, Mach's principle was not implemented successfully. 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.
7. Even though the whole physics strictly follow the 'constancy of speed of light', cosmic acceleration seems to violate it. This is really doubtful.
8. There is no scientific evidence for the Friedmann's second assumption. As suggested by S.W. Hawking [17], we believe it only on the grounds of modesty.
9. 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.

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10. The evidence for dark energy is only indirect and many things about the nature of dark energy remain matters of speculation. If 'Dark energy' is the major outcome of the 'accelerating universe', it is very important to note that so far no ground based experiment confirmed the existence of dark energy. How to identify its existence? is also a big answer less question.
11. There is no single clue or definition or evidence to any of the natural physical properties of (the assumed) dark energy. Without knowing its any basic physical property, it is impossible to implement 'Dark energy' in other areas of physics. In understanding the basic concepts of unification or other fundamental areas of physics, role of dark energy is very insignificant.
12. Some cosmologists use the term 'Hubble volume' to refer to the volume of the observable universe. At any given time, the product of 'critical density' and 'Hubble volume' gives a characteristic cosmic mass and it can be called as the 'Hubble mass'. Interesting thing is that, Schwarzschild radius of the Hubble mass again matches with the Hubble length. Most of the cosmologists believe that this is merely a coincidence. If one is able to show the applications of 'Hubble volume' and 'Hubble mass' in different areas of fundamental physics, certainly it can be given more significance and superiority compared to the mysterious 'dark energy'. Not only that, Mach's principle can successfully be implemented in atomic, nuclear and quantum physics.
13. Dimensionally it is perfectly 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. Galaxies spin, stars spin, and planets spin. So, why not the whole universe? The consequences of a spinning universe seem to be profound, natural and 'cosmic collapse' can be prevented. Clearly speaking, 'cosmic rotation' can be considered as an alternative to the famous 'repulsive gravity' concept.
14. From unification point of view, synthesis of elementary physical constants seem to be more fundamental than the 'cosmological nucleosynthesis'.

From these shortcomings, independent of the redshift and CMBR observations it is possible to think about a new model of cosmology- that connects atom and the atomic nucleus.

3. OBSERVATION-1

Note that large dimensionless constants and compound physical constants reflect an intrinsic property of nature [18,19]. If $\rho_c c^2$ is the present cosmic critical energy density and aT_0^4 is the present cosmic thermal energy density, with this M_0 it is noticed that,

$$\ln \sqrt{\frac{aT_0^4}{\rho_c c^2} \cdot \frac{4\pi\epsilon_0 GM_0^2}{e^2}} \cong \frac{1}{\alpha} \quad (9)$$

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and at present if $T_0 \cong 2.725 \text{ } ^\circ\text{K}$, obtained $H_0 \cong 71.415 \text{ Km/sec/Mpc}$ [20-23]. It is also noticed that

$$\ln \left[\frac{\rho_m}{\rho_c} \sqrt{\frac{4\pi\epsilon_0 GM_0^2}{e^2}} \right] \cong \frac{1}{\alpha} \quad (10)$$

where ρ_m is the present cosmic matter density. Obtained $\rho_m \cong 6.70 \times 10^{-29} \text{ Kg/meter}^3$ is matching with the matter density of spiral and elliptical galaxies. Please note that, almost (60 to 70)% of the galaxies are in the form of elliptical and spiral galaxies.

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4. OBSERVATION-2

With this M_0 it is also noticed that,

$$\frac{\hbar c}{Gm_p \sqrt{M_0 m_e}} \cong 1 \quad (11)$$

where m_p and m_e are the rest masses of proton and electron respectively. This is a very peculiar result. With this relation, obtained value of the present Hubble's constant is 70.75 Km/sec/Mpc . From this relation it is clear that, in the presently believed atomic and nuclear "physical constants", there exists one cosmological variable! By observing its cosmological rate of change, the "future" cosmic acceleration can be verified. Note that, Einstein [24], 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. He also believed that the fundamental laws and principles that would embody such a theory would be simple, powerful and beautiful. Physicists are ambitious, 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, 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. If one is willing to think in this new direction, certainly other relations can also be discovered. At any given cosmic time, the cosmological reduced Planck's constant \hbar_t can be expressed as [9]

$$\hbar_t \cong \sqrt{\frac{M_t}{m_e}} \frac{Gm_p m_e}{c} \quad (12)$$

Here $\left(\frac{M_t}{m_e}\right)$ can be considered as the equivalent number of electrons in the Hubble volume at time t . At present,

$$\hbar_0 \cong \sqrt{\frac{M_0}{m_e}} \frac{Gm_p m_e}{c} \quad (13)$$

Here $\left(\frac{M_0}{m_e}\right)$ can be considered as the equivalent number of electrons in the current Hubble volume. With this relation, current Hubble's constant can be expressed as

$$H_0 \cong \frac{Gm_p^2 m_e c}{2\hbar_0^2} \cong 70.75 \text{ km/sec/Mpc} \quad (14)$$

5. OBSERVATION-3

The characteristic nuclear radius be expressed as

$$R_s \cong \frac{G\sqrt{M_0}\sqrt{m_p m_e}}{c^2} \cong 1.38 \times 10^{-15} \text{ m} \quad (15)$$

where $H_0 \cong 71 \text{ km/sec/Mpc}$. In reality, this length is close to the observed strong interaction range or the characteristic nuclear unit radius [25-28]. But please note that, till today no nuclear model could explain this strong interaction range. Now the fundamental question to be answered is - is the characteristic nuclear size increases with cosmic time? Answer seems to be 'yes' and to be confirmed by the future science and technology.

6. OBSERVATION- 4

6.1 The Coulomb scale: alternative to the Planck scale

By any chance, if \hbar is a cosmic variable, then what about the validity of 'Planck mass' and 'Planck scale'? Answer is very simple. $\sqrt{\frac{\hbar c}{G}}$ can be replaced with $\sqrt{\frac{e^2}{4\pi\epsilon_0 G}}$. It can be called as the 'Coulomb mass'. Its corresponding rest energy is $\sqrt{\frac{e^2 c^4}{4\pi\epsilon_0 G}}$. It can be called as the 'Coulomb energy'. Planck energy can be replaced with the 'Coulomb energy'.

$$M_c \cong \sqrt{\frac{e^2}{4\pi\epsilon_0 G}} \cong 1.859211 \times 10^{-9} \text{ Kg} \quad (16)$$

$$M_c c^2 \cong \sqrt{\frac{e^2 c^4}{4\pi\epsilon_0 G}} \cong 1.042941 \times 10^{18} \text{ GeV} \quad (17)$$

Here 'e' is the elementary charge and (c^4/G) is the classical limit of force. How to interpret this mass unit? Is it a primordial massive charged particle? If 2 such oppositely charged particles annihilates, a large amount of energy can be released. Considering so many such pairs annihilation hot big bang or inflation can be understood. This may be the root cause of cosmic energy reservoir. Such pairs may be the chief constituents of black holes. In certain time interval with a well defined quantum rules they annihilate and release a large amount of energy in the form of γ photons. In the expanding universe, with its pair annihilation, origin of the CMBR can be understood.

It is widely accepted that charged leptons, quarks, and baryons all these comes under matter or mass carriers and photons and mesons comes under force carriers. If so what about this new mass unit? is it a fermion? or is it a boson? or else is it represents a large potential well in the primordial matter or mass generation program? Is it the mother of magnetic monopoles? Is it the mother of all charged particles? By any suitable proportionality ratio or with a suitable scale factor if one is able to bring down its mass to the observed particles mass scale, very easily a grand unified model can be developed.

Clearly speaking e , c and G play a vital role in fundamental physics. With these 3 constants space-time curvature concepts at a charged particle surface can be studied. Characteristic 'Coulomb size' can be expressed as

$$R_c \cong \frac{2GM_c}{c^2} \cong 2.716354 \times 10^{-36} \text{ m} \quad (18)$$

Considering 'light speed rotation', characteristic 'Coulomb scale angular velocity' can be expressed as

$$\omega_c \cong \frac{c}{R_c} \cong \frac{c^3}{2GM_c} \cong 1.085672 \times 10^{44} \text{ rad/sec} \quad (19)$$

By considering $R_c \cong \frac{2GM_c}{c^2}$ and $R_0 \cong \frac{c}{H_0} \cong \frac{2GM_0}{c^2}$ as the characteristic limits of cosmic radii, surprisingly it is noticed that

$$\left(R_0 R_c^2\right)^{\frac{1}{3}} \cong 9.97 \times 10^{-16} \text{ m} \quad (20)$$

This is very close to the observed strong interaction range and may be a coincidence also.

6.2 To understand the CMBR temperature and energy density

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 a characteristic cosmic phenomena, origin of the isotropic CMB radiation can be addressed. At any time t , it can be suggested that

$$k_B T_t \cong \sqrt{\frac{M_c}{M_t}} \cdot 2M_c c^2 \quad (21)$$

where M_t is the cosmic mass at time t and T_t is the cosmic temperature at time t . Please note that, at present

$$T_0 \cong \sqrt{\frac{M_c}{M_0}} \cdot \frac{2M_c c^2}{k_B} \cong 3.52 \text{ } ^0\text{Kelvin} \quad (22)$$

Qualitatively and quantitatively this can be compared with the present [22,23] CMBR temperature 2.725 0 Kelvin. It seems to be a direct consequence of the Mach’s principle. It means - at any time, the cosmic Hubble mass plays a critical role in the pair annihilation energy of M_c . Characteristic initial temperature of the universe can be expressed as

$$T_c \cong \frac{2M_c c^2}{k_B} \cong 2.42 \times 10^{31} \text{ } ^0\text{Kelvin} \quad (23)$$

With M_0 and M_c it can be assumed that, cosmic thermal energy density, matter energy density and the critical energy density are in geometric series and the geometric ratio is $1 + \ln\left(\frac{M_0}{M_c}\right)$. Thus,

$$\left(\frac{\rho_c c^2}{\rho_m c^2}\right)_0 \cong 1 + \ln\left(\frac{M_0}{M_c}\right) \quad (24)$$

and

$$\left(\frac{\rho_c c^2}{aT^4}\right)_0 \cong \left[1 + \ln\left(\frac{M_0}{M_c}\right)\right]^2. \quad (25)$$

It is another peculiar observation and the corresponding present CMBR temperature [22,23] is $T_0 \cong 2.718 \text{ } ^0K$. Independent of the cosmic redshift and CMBR observations, with these coincidences it is possible to understand and decide the cosmic geometry. The mystery can be resolved only with further research, analysis, discussions and encouragement. In this new direction authors noticed the following interesting observations.

7. OBSERVATION- 5

If R_p represents the 'rms' radius of proton [28], to great surprise it is noticed that,

$$\frac{4G\sqrt{M_0 m_e}}{R_p c^2} \cong 1 \quad (26)$$

It is a very sensitive relation and needs a clear explanation. Extending this interesting observation it is noticed that,

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$$\hbar \cong \left(\frac{4GM_0}{R_p c^2} \right) \frac{Gm_p m_e}{c} \cong \left(\frac{2c}{R_p H_0} \right) \frac{Gm_p m_e}{c} \cong \hbar_0 \quad (27)$$

Here m_p represents the rest mass of proton. Another interesting observation is the ratio $\left(\frac{4GM_0}{R_p c^2} \right)$. This resembles the Einsteins famous space - time curvature relation in case of bending of light ray . The famous 'uncertainty relation' can be expressed as

$$\left(\frac{\hbar}{2} \right) \cong \left(\frac{2GM_0}{R_p c^2} \right) \frac{Gm_p m_e}{c} \cong \left(\frac{c}{R_p H_0} \right) \frac{Gm_p m_e}{c} \cong \left(\frac{\hbar}{2} \right)_0 \quad (28)$$

If one is willing to think in this direction, other similar relations can also be surfaced out. From standard cosmology point of view one can not interpret these strange relations. A serious cosmologist will say: it is a play with fundamental physical constants. A serious physicist will say: It is an only an accidental coincidence. But 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. If one is able to make the operating force as discrete, then automatically one can observe a discrete structure like discrete radii, discrete angular momentum and discrete energy levels. Alternatively if atomic nucleus constitutes any fixed number of protons and any fixed number of neutrons, it is possible to guess that, nuclear mass is discrete. If nuclear matter is discrete, it is also possible to have a discrete atomic structure. With this idea, discrete angular momentum of electron that is revolving about the proton can be expressed as

$$n. (\hbar)_0 \cong \left(\frac{4GM_0}{R_p c^2} \right) \frac{G(n.m_p)m_e}{c} \quad (29)$$

where $n = 1, 2, 3, ..$ Thus it can be suggested that, 'quantum of angular momentum' increases with cosmic time [9] and 'discrete nature' of angular momentum may be due the discrete nuclear matter. Thus, with reference to atomic and nuclear physical constants, the present value of Hubble's constant can be expressed as

$$H_0 \cong \frac{2Gm_p m_e}{R_p \hbar_0} \quad (30)$$

Accuracy depends upon the magnitude of the ‘rms’ radius of the proton. If $R_p \cong 0.87680(690)$ fm, the obtained value of $H_0 \cong 67.873$ km/sec/Mpc. This can be compared with the recent value (67.80 ± 0.77) km/sec/Mpc recommended by Ade, P. A. R.; et. al. [22] on 21st March 2013. If $R_p \cong 0.84184$ (67) fm, the obtained value of $H_0 \cong 70.69$ km/sec/Mpc. Note that, the average value of $H_0 \cong 67.873$ km/sec/Mpc and $H_0 \cong 70.69$ km/sec/Mpc is $H_0 \cong 69.28$ km/sec/Mpc which is very close to the value (69.32 ± 0.80) km/sec/Mpc recommended by C. L. Bennett et al [23] on 20th December 2012.

8. CONCLUSION

8.1 To understand the cosmic redshift

If light is coming from the atoms of any observed galaxy, then the redshift can be interpreted as an index of the galactic atomic ‘light emission mechanism’. In 1947 Hubble himself thought for a new mechanism for the observed redshifts [29,30]. With ‘cosmological increasing (emitted) photon energy’ observed cosmic redshift can be considered as a measure of the age difference between our galaxy and any observed galaxy. If it is possible to show that, (from the observer) older galaxy’s distance increases with its ‘age’, then automatically the concepts ‘galaxy receding’ and ‘accelerating universe’ can be put for a revision at fundamental level. Thus, the authors propose the following: during cosmic evolution, as cosmic time increases, hydrogen atom emit energetic photons. As the cosmic age increases, hydrogen atom emit 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 emitted photon’s wavelength. If one is willing to think in this new direction, different mechanisms [31,32] can be invoked for this interpretation. In this way redshift problem can be understood and independent of the cosmic redshift and CMBR observations, a new model of cosmology can be developed with the above proposed observations. By increasing the number of applications of Hubble mass and Hubble volume in other areas of fundamental physics, slowly and gradually and in a progressive way concepts of Black hole Cosmology can be strengthened and can also be confirmed. May be unknowingly the fundamental physical laws are being developed, being executed and being proven inside and under the background of a growing and light speed rotating black hole universe [4,33].

8.2 To consider the Universe as a primordial growing and light speed rotating black hole

Considering the above observations- assuming the observable universe as a ‘black hole’ may not be wrong. At any given time, the product of ‘critical density’ and ‘Hubble volume’ gives a characteristic cosmic mass and it can be called as the ‘Hubble mass’. Interesting thing is that, Schwarzschild radius of the Hubble mass again matches with the Hubble length. Most of the cosmologists believe that this is merely a coincidence.

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If one is able to show the applications of Hubble mass and Hubble volume in different areas of fundamental physics, certainly it can be given more significance and superiority compared to the mysterious 'dark energy'. At any given cosmic time, 'Hubble length' can be considered as the gravitational or electromagnetic interaction range. Hubble volume and Hubble mass play a crucial role in quantum physics, nuclear physics, atomic physics and particle physics. 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. Now the key leftover things are 'nucleosynthesis' and 'structure formation'. The most important point to be noted here is that, synthesis of elementary physical constants seem to be more important and intrinsic than the 'cosmological nucleosynthesis'. Authors are working on this and will be discussed in detail in near future.

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8.3 Hubble's constant and its dimensional analysis

Assume that [2,3], 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,

$$\frac{1}{2}mv_e^2 = \frac{GMm}{R} \quad (31)$$

$$R\omega_e = v_e = \sqrt{\frac{2GM}{R}} \text{ and } \omega_e = \frac{v_e}{R} = \sqrt{\frac{2GM}{R^3}} \quad (32)$$

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

$$\omega_e = \frac{v_e}{R} = \sqrt{\frac{8\pi G\rho_e}{3}} \text{ Or } \omega_e^2 = \frac{8\pi G\rho_e}{3} \quad (33)$$

$$\text{Density, } \rho_e = \frac{3\omega_e^2}{8\pi G} \quad (34)$$

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 (34), it is very clear that, proportionality constant being $\frac{3}{8\pi G}$,

$$\text{density} \propto (\text{angular velocity})^2 \quad (35)$$

Equation (34) is similar to “flat model concept” of cosmic “critical density”

$$\rho_c = \frac{3H_0^2}{8\pi G} \quad (36)$$

Comparing equations (34) and (36) dimensionally and conceptually, $\rho_c = \frac{3\omega_c^2}{8\pi G}$

$$H_0^2 \rightarrow \omega_c^2 \text{ and } H_0 \rightarrow \omega_c \quad (37)$$

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. It is very clear that, dimensions of ‘Hubble’s constant’ must be “radian/second”. Cosmic models that depends on this “critical density” must accept ‘angular velocity of the universe’ in the place of ‘Hubble’s constant’. In the sense, ‘cosmic rotation’ must be included in the existing models of cosmology. Then the term ‘critical density’ simply appears as the ‘spherical geometric density’ of the closed and expanding universe. One should not deny this 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 [34]. An anonymous referee who reviewed the paper for Physics Letters said, “In the paper the author claims that there is a preferred handedness of spiral galaxies indicating a preferred direction in the universe. Such a claim, if proven true, would have a profound impact on cosmology and would very likely result in a Nobel prize”. Galaxies spin, stars spin, and planets spin. So, why not the whole universe? The consequences of a spinning universe seem to be profound [34-48], natural and ‘cosmic collapse’ can be prevented. If so ‘cosmic (light speed) rotation’ can be considered as an alternative to the famous ‘repulsive gravity’ concept.

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