Classical and quantum limits in unified GTR

U. V. S. Seshavatharam
Honorary faculty, I-SERVE,
Alakapuri, Hyderabad-35, AP, India.
email: seshavatharam.uvs@gmail.com

ABSTRACT: It is noticed that $\left(c^4 / G\right)$ is the classical limit of force and $\left(c^5 / G\right)$ is the classical limit of power. With these two limits, mathematical complexity involved in GTR can be simplified. Planck mass can be derived very easily. Light speed rotating black hole's formation can be understood. Force $\left(c^4 / G\right)$ keeps the light speed rotating black hole stable. It is noticed that , any elementary particle can escape from the light speed rotating black hole's equator. Origin of cosmic ray can be understood in this view. GTR and quantum mechanics can be coupled in a unified manner. Rotating black hole temperature formula can be derived very easily. Finally a rotating model of 'black hole cosmology' can be developed.

KEYWORDS : Classical limit of force, classical limit of power, Planck scale, Light speed rotating Black holes or Special holes, cosmic ray and Black hole cosmology.

I. CLASSICAL LIMITS OF FORCE AND POWER

Special theory of relativity says that light speed is the maximum speed that a material particle can move with. It is the natural speed with which photon or electromagnetic signal travels in free space. Till today there is no explanation for this characteristic speed limit. Throughout the cosmic evolution whether the speed limit is constant or changing? is also an answerless question. It is an accepted and universal idea that 'gravity' and 'gravitational radiation' also propagates with speed of light.

Dimensionally and physically a characteristic force form can be obtained with speed of light (c) and Newton's gravitational constant (G). It can be expressed as $\left(c^4 / G\right)$. It can be considered as the 'classical limit' of 'force' [1-5]. It represents the maximum 'gravitational force of attraction' and maximum 'electromagnetic force'. It plays an important role in 'unification'

scheme. It is the origin of "Planck scale". It is the origin of 'Quantum gravity'. Similar to this 'classical force', classical limit of 'power' can be given by $\left(c^5/G\right)$. It plays a crucial role in 'gravitational radiation'. It represents the 'maximum limit' of 'mechanical' or 'electromagnetic' power and 'radiation power'. $\left(c^4/G\right)$ can be derived based on 'Newton's law of gravitation' and 'constancy of speed of light'. In Sun-Planet system, from Newton's law of gravitation,

$$F_g = \frac{GM_S m_P}{r^2} \tag{1}$$

Here, M_S = mass of sun, m_P = mass of planet and r = distance between them.

$$\text{Centripetal fore on planet is, } F_c = \frac{m_P v^2}{r} \tag{2}$$

where, v = orbiting velocity of planet. Eliminating 'r' from equation (2), force of attraction between sun-planet can be given as,

$$F = \left(\frac{m_P}{M_S}\right)\left(\frac{v^4}{G}\right) \tag{3}$$

It is very clear that, since (m_P/M_S) is a ratio, (v^4/G) must have the dimensions of 'force'. Following the 'constancy of speed of light', a force of the form, $\left(c^4/G\right)$ can be constructed. This can be considered as the upper limit or magnitude of any force. Nature of the force may be mechanical or electromagnetic or gravitational. Note that in GTR this force appears in an inverse form [6] as

$$\frac{1}{F} = \frac{8\pi G}{c^4} \tag{4}$$

This can be called the "**Inverse of Einstein's force constant**". Considering this magnitude as the upper limit of gravitational force of attraction minimum distance between any 2 massive bodies can be obtained as follows.

$$\text{Let, } \frac{Gm_1m_2}{r^2} \le \frac{c^4}{G} \tag{5}$$

Here, m_1 and m_2 are any 2 massive bodies and r is distance between them. Then minimum distance r_{min} between the 2 bodies can be obtained as

$$r_{\min} = \frac{G\sqrt{m_1 m_2}}{c^2} \tag{6}$$

This is a simple very strange expression. By any chance if mass of the 2 bodies is equal then

$$r_{\min} = \frac{Gm}{c^2} \quad \text{where } m_1 = m_2 = m \tag{7}$$

Without going deep into general theory of relativity and combining Newton's law of gravitation and Special theory of relativity, results of GTR can be obtained. This idea can be applied to elementary particles also. Magnitude of force of attraction or repulsion between any 2 elementary particles having charges e_1 and e_2 can be expressed as

$$F = \frac{e_1 e_2}{4\pi\varepsilon_o r^2} \le \frac{c^4}{G} \tag{8}$$

Minimum distance between e_1 and e_2 can be obtained as

$$r_{\min} = \sqrt{\frac{e_1 e_2}{4\pi\varepsilon_o}\left(\frac{G}{c^4}\right)} = \sqrt{\frac{e^2}{4\pi\varepsilon_o}\left(\frac{G}{c^4}\right)} \quad \text{where } e_1 = e_2 = e \tag{9}$$

Charged particle's space-time curvature can be understood from this expression. With this idea GTR can be applied to charged elementary particles easily. Not only that this method simply and directly leads to planck scale and grand unification or TOE. Grand unification assumes that in the past the observed 4 fundamental interactions are same and having the same strength. Magnitude of the force at that time can be taken as (c^4/G). With a suitable proportionality ratio quark confinement can be understood as a charged space-time curvature. Clearly speaking 'gravity' can be implemented very easily in nuclear and quark physics [7,8]. From quantum mechanics

$$\frac{e^2}{4\pi\varepsilon_o \hbar c} = \alpha \quad \text{and} \quad \frac{e^2}{4\pi\varepsilon_o} = \alpha\hbar c \tag{10}$$

From above equation it is noticed that

$$r_{\min} = \sqrt{\alpha\hbar c\left(\frac{G}{c^4}\right)} = \sqrt{\alpha\hbar c\left(\frac{G}{c^4}\right)} = \sqrt{\alpha\left(\frac{\hbar G}{c^3}\right)} \tag{11}$$

This obtained length is smaller than the planck length by $\sqrt{\alpha}$.

II. ORIGIN OF THE PLANCK SCALE

Assume that 2 planck particles having mass M_P moving in opposite direction and coming closer and closer. At some minimum distance their magnitude of gravitational force of attraction approaches

$$\frac{GM_PM_P}{r_{\min}^2}=\frac{c^4}{G} \tag{12}$$

If mass of planck particle is = $M_P=\frac{hc}{\lambda_P}$ and (13)

From wave mechanics, $2\pi.r_{\min}=\lambda_P$ (14)

$$\frac{GM_PM_P}{r_{\min}^2}=\frac{c^4}{G}=\frac{G\hbar^2}{r_{\min}^4c^2} \tag{15}$$

$$\therefore r_{\min}=\sqrt{\frac{G\hbar}{c^3}} \text{ and } 2\pi.r_{\min}=\lambda_P=2\pi\sqrt{\frac{G\hbar}{c^3}} \tag{16}$$

Rest energy of planck particle = $M_Pc^2=\frac{hc}{\lambda_P}=\sqrt{\frac{\hbar c^5}{G}}=\sqrt{\hbar c\left(\frac{c^4}{G}\right)}$ (17)

Mass of planck particle = $M_P=\sqrt{\frac{\hbar c}{G}}$ (18)

Here the fundamental questions to be answered are

1. Is planck particle a photon or a black hole?
2. Is planck particle follows strong gravity?
3. Is planck particle obeys particle nature?
4. What is the mass range of black holes?

If the planck particle is not a real massive particle just like a photon it can be easily implemented in the early cosmology. It can be considered as the mass of the baby universe. Big bang model assumes that in the early phase matter was in the form of radiation. If one consider planck photon as the baby universe its characteristic mass can be considered as the basic or characteristic mass of the baby universe. Thus qualitatively and quantitatively the planck photon couples GTR, quantum mechanics and big bang cosmology.

III. THE PLANCK MASS AND THE COULOMB MASS

With this classical limit of force $\left(c^4/G\right)$, similar to the planck mass-energy, 'coulomb mass-energy' can be expressed as

$$M_C c^2 = \sqrt{\alpha}\times\sqrt{(\hbar c)\left(\frac{c^4}{G}\right)} = \sqrt{\left(\frac{e^2}{4\pi\varepsilon_o}\right)\left(\frac{c^4}{G}\right)} \tag{19}$$

$$M_C = \sqrt{\alpha}\times\sqrt{\frac{\hbar c}{G}} = \sqrt{\frac{e^2}{4\pi\varepsilon_o G}} \tag{20}$$

Here 'e' is the elementary charge and $\left(c^4/G\right)$ 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 [9].

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.

IV. PLANCK PHOTON AND ITS LIGHT SPEED ROTATION

If planck particle or planck photon follows strong gravity and rotates at light speed [10-12],

a) If planck mass = $M_P = \sqrt{\frac{\hbar c}{G}} \cong 2.176436\times10^{-8}$ Kg (21)

b) Planck size = $R_P = \left(\frac{2GM_P}{c^2}\right) \cong 3.23251\times10^{-35}\ \text{m} \cong 2\sqrt{\frac{G\hbar}{c^3}}$ (22)

c) Planck ang. velocity = $\omega_P \cong \frac{c}{R_P} \cong \frac{c^3}{2GM_P} \cong \frac{1}{2}\sqrt{\frac{c^5}{G\hbar}} \cong 9.2743\times10^{42}\ \frac{\text{rad}}{\text{sec}}$ (23)

d) Planck temperature = $T_P \cong \frac{\hbar c^3}{8\pi k_B GM_P} \cong \frac{\hbar\omega_P}{4\pi k_B} \cong 5.63721\times10^{30}\ ^0\text{kelvin}$ (24)

V. LIGHT SPEED ROTATING BLACK HOLES : THE SPECIAL HOLES

Origin of 'rotating black hole' formation can understood with the classical power limit $\left(c^5/G\right)$ and $\left(\text{Mc}^2\right)$ within 3 steps as, for any rotating star or black hole assume that,

$$\text{torque}, \tau \le Mc^2 \tag{25}$$

$$\text{power}, P = \tau\omega \le \frac{c^5}{G} \tag{26}$$

$$\text{Hence } \omega \le \frac{c^3}{GM} \text{ and } \omega_{\max} = \frac{c^3}{GM} \tag{27}$$

When the black hole rotates at light speed, to have maximum angular velocity, size should be minimum as,

$$R_{\min} = \frac{c}{\omega_{\max}} = \frac{GM}{c^2} \tag{28}$$

Please note that here only the number 2 is missing compared to Schwarzschild radius. If the concept of 'Schwarzschild radius' is believed to be true, for any rotating black hole of rest mass (M) the critical conditions can be stated as follows.

1. Magnitude of 'kinetic energy' never crosses 'rest energy'.
2. Magnitude of 'torque' never crosses 'potential energy' and
3. Magnitude of mechanical power never crosses $\left(c^5/G\right)$

Based on Virial theorem, potential energy is twice of kinetic energy and hence, $\tau \le 2Mc^2$. In this way factor 2 can be obtained easily from equations (25), (26) and (27). Not only that special theory of relativity, classical mechanics and general theory of relativity can be studied in a unified way. **Such light speed rotating black holes may be called the 'special holes'**.

This simple idea which is based on 'limits of classical force and power' indicates that, without going deep into General theory of Relativity and considering 'Special theory of Relativity', there is a scope for understanding 'rotating black hole's formation'. This proposed method couples classical mechanics, special theory of relativity and GTR. Clearly speaking, (Mc^2) is the result of special theory of relativity, $\left(c^5/G\right)$ is the result of unification of Newton's law of gravitation and special theory of relativity and can be considered as the maximum magnitude of mechanical or electromagnetic or gravitational or radiation power.

VI. DERIVATION FOR BLACK HOLE TEMPERATURE

Dr. Stephen Hawking [7] says- "*The main difficulty in finding a theory that unifies gravity with the other forces is that general relativity is a "classical" theory; that is, it does not incorporate the uncertainty principle of quantum mechanics. On the other hand, the other partial theories depend on quantum mechanics in an essential way. A necessary first step, therefore, is to combine general relativity with the uncertainty principle. As we have seen, this can produce some remarkable consequences, such as black holes not being black, and the universe not having any singularities but being completely self-contained and without a boundary*"**.**

Einstein's general theory of relativity seems to govern the large-scale structure of the universe. It is what is called a classical theory; that is, it does not take account of the uncertainty principle of quantum mechanics, as it should for consistency with other theories. The reason that this does not lead to any discrepancy with observation is that all the gravitational fields that we normally experience are very weak. However, the singularity theorems discussed earlier indicate that the gravitational field should get very strong in at least two situations, black holes and the big bang. In such strong fields the effects of quantum mechanics should be important. Thus, in a sense, classical general relativity, by predicting points of infinite density, predicts its own downfall, just as classical (that is, non quantum) mechanics predicted its downfall by suggesting that atoms should collapse to infinite density. We do not yet have a complete consistent theory that unifies general relativity and quantum mechanics, but we do know a number of the features it should have. The consequences that these would have for black holes and the big bang will be described in later chapters. For the moment, however, we shall turn to the recent attempts to bring together our understanding of the other forces of nature into a single, unified quantum theory.

A black hole of mass (M) having size, $R=\frac{2GM}{c^2}$ rotates with an angular velocity (ω) and rotational speed $(\mathrm{v}=R\omega)$. Assume that, its temperature (T) is inversely proportional to its rotational time period (t). Keeping '**Law of uncertainty**' in view, assume that,

$$\left(k_B T\right)*t=\frac{h}{4\pi}=\frac{\hbar}{2} \tag{29}$$

$$(\mathrm{Or}) \qquad T*t=\frac{h}{4\pi k_B}=\frac{\hbar}{2k_B} \tag{30}$$

Here, t = rotational time period and T = Temperature, k_B = Boltzmann's radiation constant, h = Planck's constant and $\left[\left(\frac{k_B T}{2}\right)+\left(\frac{k_B T}{2}\right)\right]=k_B T$ is the sum of kinetic and potential energies of a particle in any one direction.

$$\text{We know that, } t=\frac{2\pi}{\omega}=\frac{2\pi R}{v}=\frac{4\pi GM}{c^2 v} \tag{31}$$

$$\text{Hence,} \qquad T=\frac{\hbar c^2 v}{8\pi GMk_B} \tag{32}$$

It is very surprising to say that – a small physical constant is influencing a big massive body. If the black hole rotational speed (v) approaches light speed (c), then temperature reaches to maximum. Here author's humble appeal is : force limit $\left(c^4/G\right)$ keeps the black hole 'stable or rigid' even at light speed rotation.

$$\text{i.e} \qquad \mathrm{v}\rightarrow v_{\max}\rightarrow c, \quad \rightarrow T=\frac{\hbar c^3}{8\pi GMk_B}\cong T_{\max} \tag{33}$$

Please note that, this idea or assumption couples GTR and quantum mechanics successfully. Hawking's black hole temperature formula can be obtained easily. And its meaning is simple and there is no need to consider the pair particle creation for understanding 'hawking radiation'. This is the main advantage of this simple derivation. From this idea it is very clear that, origin of Hawking radiation is possible in another way also. But it has to be understood more clearly. Information can be extracted from a black hole, if it rotates with "light speed". If a black hole rotates at 'light speed', photons or elementary particles can escape from

its ‘equator only’ with light speed and in the direction of black hole rotation and this seems to be a signal of “Black hole radiation” around the black hole equator. *With this idea origin of cosmic rays can also be understood*. Please note that, not only at the black hole equator, Hawking radiation can take place at the event horizon of the black hole having a surface area.

This equation (33) is identical to the famous expression derived by Hawking. From the assumptions and from the obtained expressions, it is clear that, “black hole temperature is directly proportional to the rotational speed of the black hole”. Temperature of a stationary black hole is always ‘zero’ and increases with increasing rotational speed and reaches to maximum at ‘light speed rotation’. In this way also GTR and quantum mechanics can be coupled. But this concept is not the output from Hawking’s black hole temperature formula. In any physical system, for any physical expression there exists only one true physical meaning. Either Dr. Hawking’s concept is true or the proposed concept is true. Since the black hole temperature formula is accepted by the whole science community, author humbly requests the modern scientists to kindly look into this major conceptual clash at utmost fundamental level.

Temperature of any black hole is very small and may not be found experimentally. But this idea can successfully be applied to the Universe! By any reason if it is assumed that, Universe is a black hole, then it seems to be surprising that, temperature of a stationary cosmic black hole is “zero”. Its temperature increases with increase in its rotational speed and reaches to maximum if the rotational speed of the cosmic black hole approaches ‘light speed”. This is the essence of cosmic black hole rotation. CMBR temperature demands the existence of “cosmic rotation”. This is the most important point to be noted here.

Hawking radiation is maintained at event horizon as a (particle and anti particle) pair particle creation. One particle falls into the black hole and the other leaves the black hole. Since the black hole is situated in a free space and lot of free space is available around the black hole’s event horizon, this might be possible. But applying this idea to the universe, this type of thinking may not be possible. There will be no space for the particle to go outside the cosmic boundary or the cosmic event horizon and there is no scope for the creation of antiparticle also. If so the concept of ‘cosmic black hole radiation’ and normally believed ‘black hole radiation’ has to be studied in a different point of view. If there is no particle creation at the ‘cosmic event horizon’ then there will be no evaporation of the cosmic black hole and hence there is no chance for decay of the cosmic black hole. Due to its internal mechanism it will grow like a black hole.

VII. GTR, PLANCK PHOTON AND THE CMBR TEMPERATURE

Let us assume that present universe is a '**point particle**' having mass M_0. Assume that gravitational force of attraction between the **point universe** mass and the **planck photon** (the baby universe mass) is equal to $\left(c^4/8\pi G\right)$. Author humbly say- this simple assumption unifies GTR, quantum mechanics, planck scale, big bang cosmology and Hubble's observations.

$$\frac{GM_0M_P}{r_0^{\,2}} \cong \frac{c^4}{8\pi G} \tag{34}$$

From big bang model at any time expanding universe possess some temperature and its present CMBR temperature [13] is T_0 = 2.725 ^{o}Kelvin. Surprisingly it is noticed that, above assumption is satisfied at the following 2 conditions.

$$r_0 = \left(\frac{\lambda_m T}{2\pi T_0}\right) = \frac{2.898\times10^{-3}}{2\pi k_B T_0} = \frac{hc}{2\pi\times 4.965 k_B T_0} \text{ meter} \qquad \text{and} \tag{35}$$

$$M_0 = \frac{c^3}{2GH_0} \tag{36}$$

where H_0 is the present cosmic expansion rate index [14-17]. Above expression can be expressed as

$$T_0 = \frac{1}{\sqrt{8\pi * 4.965^2}}\frac{\hbar c^3}{G\sqrt{M_0M_P}} \cong \frac{\hbar c^3}{8\pi G k_B\sqrt{M_0M_P}} \tag{37}$$

Note that, $\sqrt{8\pi * 4.965^2} \cong 24.891 \cong 8\pi = 25.13274123$. Hence

$$T_0 \cong \frac{\hbar}{4\pi k_B}\sqrt{\frac{c^3}{2GM_P}\times\frac{c^3}{2GM_0}} \tag{38}$$

There is no working boundary in the flat model cosmology. It is an usual and widespread practice to say that $\left(c/H_0\right)$ is the characteristic length of the universe and is called as the Hubble radius. Not only that Hubble volume $\frac{4\pi}{3}\left(\frac{c}{H_0}\right)^3$ represents the characteristic and

observable volume of the universe . It is defined and accepted that H_0 value changes with time. Cosmic temperature also changes with time. By any chance if one is able to consider $\frac{c^3}{2GM_0} \cong \omega_0$ as the present angular velocity and $\frac{c^3}{2GM_P} \cong \omega_P$ as the planck photon angular velocity then above relation can be expressed as

$$4\pi k_B T_0 \cong \hbar\sqrt{\omega_P \omega_0} \tag{39}$$

This is definitely possible only if universe follows strong gravity and light speed rotation [18-31]. During the cosmic evolution, at any time above equation can be re-expressed as

$$4\pi k_B T_t \cong \hbar\sqrt{\omega_P \omega_t} \tag{40}$$

The surprising and interesting idea is for the baby universe or for the planck photon $\omega_t = \omega_P$. Hence

$$4\pi k_B T_t \cong \hbar\omega_P \tag{41}$$

This procedure may be ad-hoc. But beauty of this procedure is that it couples

1. Newton's law of gravitation, 2) Einstein's cosmic force constant,
2. Wein's displacement law and 4) Special theory of relativity

VIII. THE BEGINNING OF 'BLACK HOLE COSMOLOGY'

Concept of 'cosmic rotation' is not new. The subject of cosmic strong gravity is also not new. The only ad-hoc and speculative idea (from accelerating model point of view but not from the black hole physics point of view) of this model is – 'cosmic light speed rotation'. Till today there is no explanation for 'constancy of speed of light'. Recent observations indicates galactic central black holes are spinning close to the speed of light! Really this is a surprise. Not only that present observations confirms that the galactic central black holes co-evolved with the galactic bulge plasma dynamics and the galactic arms [32]. With these fascinating observations one cannot say that, the idea of 'cosmic light speed rotation' is a speculative concept in fundamental physics. It will be a very interesting and challenging task for a mathematician or physicist to describe the light speed cosmic 'space rotation'.

Compared to the other models of cosmology like hot big bang, inflation, accelerating universe, this model is free from speculative concepts like exponential expansion, hot big bang and dark energy. From fundamental physics point of view really and certainly these are speculative concepts. In real life or at least in a laboratory one cannot experience these concepts. Whereas the 'concept of light speed' is an observable and measurable one.

In grand unification program physicists and mathematicians often use the concept of 'n' dimensions. This idea is highly speculative compared to the proposed 'cosmic light speed rotation'. To unify 2 interactions if 5 dimensions are required, for unifying 4 interactions 10 dimensions are required. For 3+1 dimensions if there exists 4 (hitherto observed) interactions, for 10 dimensions there may exist 10 (observable) interactions. To unify 10 interactions 20 dimensions are required. It seems this is a mathematical problem rather than a serious fundamental physical problem. Even though it is very interesting, from fundamental physics point of view this 'n – dimensions' concept is highly speculative. Applying this idea to cosmology some people say- there exists other universes in n-dimensions. But what to do with these unknown and hiding dimensions and universes. In 3+1 if there exists space, ether, gravitational radiation, dark matter and dark energy etc in n- new dimensions there may exist a number of new and strange things. The surprising and compromising statement is that: n- new dimensions curl up in ordinary 3+1 dimensions. **In this sensitive and mysterious issue author's humble appeal is: first let us find the primitive, natural and universal physical limits that may exist in the universal physics lab. With their implementation existing physical concepts and physical equations can be simplified and physical models can be refined**.

(c), $(\hbar/2)$, force (c^4/G) and power (c^5/G) are really the utmost fundamental tools of black hole physics and 'black hole cosmology'. In this paper author presented simple idea for viewing the universe in a 'black hole' picture. In reality, its validity has to be studied, understood and confirmed by the science community at utmost fundamental level. At present also regarding the cosmic acceleration, some conflicts are there [33]. The concept of 'dark energy' is still facing and rising a number of fundamental problems. If one is able to understand the need and importance of 'universe being a black hole for ever', 'CMBR temperature being the Hawking temperature' and 'angular velocity of cosmic black hole being the present Hubble's constant', a true unified model of 'Black hole cosmology' can be developed.

IX. THE COSMIC CRITICAL DENSITY AND ITS DIMENSIONAL ANALYSIS

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,

$$\frac{1}{2}mv_e^2 = \frac{GMm}{R} \qquad \text{and} \tag{42}$$

$$R\omega_e = v_e = \sqrt{\frac{2GM}{R}} \quad \text{and} \quad \omega_e = \frac{v_e}{R} = \sqrt{\frac{2GM}{R^3}} \tag{43}$$

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,

$$M = \frac{4\pi}{3}R^3\rho_e, \quad \omega_e = \frac{v_e}{R} = \sqrt{\frac{8\pi G\rho_e}{3}} \quad \text{Or} \quad \omega_e^2 = \frac{8\pi G\rho_e}{3} \tag{44}$$

$$\text{Density, } \rho_e = \frac{3\omega_e^2}{8\pi G} \tag{45}$$

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

$$\text{density} \propto (\text{angular velocity})^2 \tag{46}$$

Equation (45) is similar to "flat model concept" of cosmic "critical density"

$$\rho_c = \frac{3H_0^2}{8\pi G} \tag{47}$$

Comparing equations (45) and (47) dimensionally and conceptually,

$$\rho_e = \frac{3\omega_e^{\,2}}{8\pi G} \quad \text{and} \quad \rho_c = \frac{3H_0^{\,2}}{8\pi G} \Rightarrow \; H_0^{\,2} \to \omega_e^{\,2} \;\; and \;\; \mathrm{H}_0 \to \omega_e \tag{48}$$

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. Without any proper reason, if this idea is rejected, surely and assertively the subject of cosmology can be studied in a rotating picture where the ratio of existing Hubble's constant and estimated present cosmic angular velocity will give some valuable information.

X. CONCLUSION

Proposed classical limits can be given a chance in fundamental and unified physics. Author showed the different applications of $\left(c^4/G\right)$ and $\left(c^5/G\right)$ in astrophysics. With these 2 expressions or limits, mathematical complexity in GTR can be resolved. Not only that, $\left(c^4/G\right)$ plays a crucial role in Grand unification and $\left(c^5/G\right)$ plays a crucial role in gravitational radiation. Author humbly requests the world science community to look into this new approach.

ACKNOWLEDGEMENTS

Author is very much thankful to professor S. Lakshminarayana, Dept. of Nuclear physics, Andhra university, India for his kind and valuable guidance. Author is indebted to Prof. K V. Krishna Murthy, chairman and Shri K.V.R.S. Murthy, former scientist IICT (CSIR) Govt. of India and Director (R&D) Institute of Scientific Research on Vedas, Hyderabad, India for their valuable guidance and support.

REFERRENCES

1. U.V.S. Seshavatharam. Physics of Rotating and Expanding Black Hole Universe. Progress in Physics, vol. 2, April, 2010, p. 7-14.
2. W. C. Daywitt. The Planck Vacuum. Progress in Physics, vol. 1, Jan, 2009, p.20-26.
3. N. Haramein et al. The Origin of Spin: A Consideration of torque and coriolis forces in Einstein's field equations and Grand unification theory. 153-168, 2005. The Noetic Press, Printed in the United States of America. http://theresonanceproject.org/.
4. E.A. Rauscher. A Unifying Theory of Fundamental Processes. Lawrence Berkeley National Laboratory Report. (UCRL-20808 June 1971) and Bull. Am. Phys. Soc. 13, 1643 (1968).
5. Ludwik Kostro. Physical Interpretations Of The Coefficients c/G, c2/G, c3/G,c4/G, c5/G That Appear In The Equations Of General Relativity. Paper presented in Mathematics, Physics and Philosophy In the Interpretations of Relativity Theory. Budapest 4-6 September 2009. http://www.phil-inst.hu/~szekely/.
6. J.V. Narlikar. An Introduction to Cosmology. 3rd edition, Cambridge University Press.(2002)
7. Hawking S.W. A Brief History of Time. Bantam Dell Publishing Group. 1988.
8. Role of Avogadro number in grand unification. Hadronic Journal. Vol-33, No 5, 2010 October. p 513.
9. Hawking S.W. Particle Creation by Black Holes. Commun. Math. Phys. 43, 199-220
10. Schwarzschild K. On the gravitational field of a mass point according to Einstein's theory. Sitz. der Koniglich Preuss. Akad. der Wiss, 1916, v. 1, 189-196.
11. Black Holes spinning near the Speed of Light. http://www.space.com/scienceastronomy080115-st-massive-black-hole.html.
12. Dominic Brecher et al. Rotating Black Holes in a Godel Universe. hep-th/0309058 UUITP-15/03.
13. W.-M. Yao et al. Cosmic Microwave back ground. April 2006. Journal of Physics, G33, 1, 2006.
14. Hubble E. P. A relation between distance and radial velocity among extra-galactic nebulae. PNAS, 1929, v. 15, 168-173.
15. Joshua A. Fireman et al. Dark Energy and the Accelerating Universe. http://www.arxiv.org/abs/0803.0982v1.
16. Robert P. Kirsnner. Hubble's diagram and Cosmic expansion. PNAS, Jan-2004 vol.101, no. 1 page no: 8-13.
17. J. Huchara. Estimates of the Hubble Constant, 2009. Harvard-Smithsonian Center for Astrophysics. http://hubble.plot.dat
18. N. Haramein et al. Scale Unification-A Universal scaling law for organized matter. Proceedings of The Unified Theories Conference'08. www.theresonanceproject.org.
19. Tianxi Zhang. A New Cosmological Model: Black Hole Universe. Volume 3, July 2009 Progress In Physics.
20. Mendel Sachs. The Mach Principle and the origin of inertia from general relativity. Proceedings of the International Workshop on Mach's Principle and the Origin of Inertia, Kharagpur, India, 2003.
21. Mustapha Ishak. Remarks on the Formulation of the Cosmological Constant/Dark Energy Problems. Found Phys (2007) 37:1470–1498 .
22. M.L. Fil'chenkov et al. Quantum birth of the rotating universe. Gravitation & Cosmology, Vol. 11 (2005), No. 1–2 (41–42), pp. 116–118 . Proceedings of the International Conference on Cosmoparticle Physics "Cosmion-2004" 2005 Russian Gravitational Society.

23. Dmitri Rabounski. On the Speed of Rotation of Isotropic Space: Insight into the Redshift Problem. The Abraham Zelmanov Journal, Vol. 2, 2009, 208-223.
24. Dmitri Rabounski. Hubble Redshift due to the global non-holonomity of Space. The Abraham Zelmanov Jounal, Vol. 2, 2009, 11-28.
25. Robert V Gentry. New Cosmic Center Universe Model Matches Eight of Big Bang's Major Predictions Without The F-L Paradigm. CERN preprint, EXT-2003-022, 14 Apr 2003. www.robertvgentry.com/reports/ext-2003-022.pdf.
26. George Chapline et al. Tommy Gold Revisited: Why Does Not The Universe Rotate? http://www.arxiv.org/abs/astro-ph/0509230v2.
27. Mauro Dorato. On becoming cosmic time and rotating universes. Time, Reality and Experience (provisional title), Royal Institute of Philosophy Series, Cambridge University Press, 2001.
28. Frank Grave et al. Visiting the Gödel Universe. posted online 19 October 2008; mailed on 13 October 2008.
29. Istvan Nemeti et al. Visualizing ideas about Godel-type rotating universes. Godel-type Spacetimes: History and New Developments.
30. R. G. Vishwakarma et al. Modeling repulsive gravity with ceation. J. Astrophys. Astr. (2007) 28, 17–27.
31. Yuri N. Obukhov. On physical foundations and observational effects of cosmic Rotation. Published in Colloquium on Cosmic Rotation, Eds M. Scherfner, T. Chrobok and M. Shefaat (Wissenschaft und Technik Verlag: Berlin, 2000) pp. 23-96. http://arxiv.org/abs/astro-ph/0008106v1,7August 2000.
32. Carilli et al. Black Holes Lead Galaxy Growth, New Research Shows. Lecture presented to the American Astronomical Society's meeting in Long Beach, California. 4-8 January 2009. National Radio Astronomy observatory. Socorro, NM. www.nrao.edu/pr/2009/bhbulge.6 Jan 2009.
33. Arman Shafieloo et al. Is cosmic acceleration slowing down? Phys. Rev. D 80, 101301 (Rapid Communication). http://arxiv.org/abs/0903.5141v4. 8 Oct 2009.