Black hole universe and to verify the cosmic acceleration

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1. Introduction

Based on the big bang concepts- in the expanding universe, rate of decrease in CMBR temperature is a measure of the cosmic rate of expansion. Modern standard cosmology is based on two contradictory statements. They are - present CMBR temperature is isotropic and the present universe is accelerating. In particle physics also, till today laboratory evidence for the existence of dark matter and dark energy is very poor. Recent observations and thoughts supports the existence of the cosmic axis of evil. Independent of the cosmic red shift and CMBR observations, cosmic acceleration can be verified by measuring the 'rate of decrease' in the fine structure ratio. In this connection an attempt is made to study the universe with a closed and growing model of cosmology. If the primordial universe is a natural setting for the creation of black holes and other non-perturbative gravitational entities, it is also possible to assume that throughout its journey, the whole universe is a primordial (growing and rotating) cosmic black hole. Instead of the Planck scale, initial conditions can be represented with the Coulomb scale. Obtained value of the present Hubble constant is close to 70.75 Km/sec/Mpc.

2. Modified Hubble's law

Ever since the late 1920's, when Edwin Hubble discovered a simple proportionality between the redshifts in the light coming from nearby galaxies and their distances, we have been told that the Universe is expanding. Hubble found the recession speed v of a nearby galaxy was related to its radial distance r, $v = H_0 r$, where H_0 is the constant of proportionality. This relationship- dubbed the Hubble law- has since been strengthened and extended to very great distances in the cosmos.This was the incomplete interpretation that changed the destiny of the modern cosmology. Based on this interpretation modern cosmologists arrived at the conclusion that - at present, universe is flat and is accelerating. The SI unit of H_0 is sec^{-1} but it is most frequently quoted in 'Km/s/Mpc' and its best value is $70.4^{+1.3}_{-1.4}$ Km/s/Mpc. Later in his life Hubble varied from his initial interpretation and said that the Hubble law was due to a hitherto undiscovered mechanism, but not due to expansion of space - now called cosmological expansion.

For the same observations it can also be possible to state that, in a closed and expanding universe, from and about the cosmic center, rate of increase in galaxy redshift is a measure of cosmic rate of expansion. This statement includes 3 points. 1) Light from the galaxy travels opposite to the direction of cosmic expansion and shows redshift and thus redshift is a measure of galaxy distance from the cosmic center. 2) In the expanding universe, increase in redshift is instantaneous due to instantaneous increase in galaxy distance (which is due to instantaneous increase in cosmic volume) and 3) Rate of increase in redshift indicates the cosmic rate of expansion.

A. Proposed four assumptions

Starting from the Coulomb scale, it is assumed that, at any time (t),

1. The universe can be treated as a primordial rotating and growing black hole.

2. With increasing mass and decreasing angular velocity, the universe is always rotating with speed of light.

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3. 'Rate of decrease' in CMBR temperature is a measure of cosmic 'rate of expansion'.

4. 'Rate of decrease' in fine structure ratio is also a measure of cosmic 'rate of expansion'.

B. 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,

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

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

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

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

$$\text{Density, } \rho_{\mathrm{e}} = \frac{3\omega_{\mathrm{e}}^2}{8\pi \mathrm{G}} \tag{4}$$

In real time, this obtained density may or may not be equal to the actual density. But the ratio, $\frac{8\pi G\rho_{real}}{3\omega^2_{real}}$ 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 (12), it is very clear that, proportionality constant being $\frac{3}{8\pi G}$,

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

Equation (12) is similar to "flat model concept" of cosmic "critical density"

$$\rho_c = \frac{3H_0^2}{8\pi G} \tag{6}$$

Comparing equations (4) and (6) dimensionally and conceptually,

$$\rho_e = \frac{3\omega_e^2}{8\pi G} \text{ with } \rho_{\mathrm{c}} = \frac{3\mathrm{H}_0^2}{8\pi \mathrm{G}} \tag{7}$$

$$H_0^2 \to \omega_{\mathrm{e}}^2 \text{ and } H_0 \to \omega_{\mathrm{e}} \tag{8}$$

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 dimensional analysis can not be ignored.

3. Light speed rotating Black Holes : The special holes

Origin of 'rotating black hole' formation can be understood with the classical power limit $\left(c^5/G\right)$ and $\left(\mathrm{Mc}^2\right)$ within 3 steps. For any rotating celestial body assume that,

$$\text{torque}, \tau \leq Mc^2 \tag{9}$$

$$\text{power}, P = \tau\omega \leq \frac{c^5}{G} \tag{10}$$

$$\text{thus, } \omega \leq \frac{\mathrm{c}^3}{\mathrm{GM}} \text{ and } \omega_{\max} = \frac{\mathrm{c}^3}{\mathrm{GM}} \tag{11}$$

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

$$R_{min} = \frac{c}{\omega_{max}} = \frac{GM}{c^2} \tag{12}$$

This expression is similar to the 'Schwarzschild radius' of a black hole. The only change is that coefficient 2 is missing. This is really a very interesting case. This obtained expression indicates that, to get 'light speed rotation', celestial body

should have a 'minimum size' of $\frac{GM}{c^2}$. Clearly speaking this proposal is entirely different from the existing concepts of General theory of relativity. It is not speaking about the gravitational collapse of stars or space-time curvature or singularity. Now this is the time to re-examine the foundations of modern black hole physics. It can be suggested that, the subject of 'black hole physics' has to be studied in a new direction. If the concept of 'Schwarzschild radius' is believed to be true, for any rotating celestial body or 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 $\left(c^5/G\right)$. Note that, based on the Virial theorem, potential energy is twice of kinetic energy and thus,$\tau \leq 2Mc^2$.

4. 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 $\sqrt{\frac{e^2}{4\pi\varepsilon_0 G}}$. It can be called as the 'Coulomb mass'. Its corresponding rest energy is $\sqrt{\frac{e^2c^4}{4\pi\varepsilon_0 G}}$. It can be called as the 'Coulomb energy'. Planck energy can be replaced with the 'Coulomb energy'.

$$M_C \cong \sqrt{\frac{e^2}{4\pi\varepsilon_0 G}} \cong 1.859211 \times 10^{-9} \text{ Kg} \quad (13)$$

$$M_C c^2 \cong \sqrt{\frac{e^2c^4}{4\pi\varepsilon_0 G}} \cong 1.042941 \times 10^{18} \text{ GeV} \quad (14)$$

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

$$R_C \cong \frac{2GM_C}{c^2} \cong 2.716354 \times 10^{-36} \text{ m} \quad (15)$$

Considering 'light speed rotation', characteristic 'Coulomb scale angular velocity' is

$$\omega_C \cong \frac{c}{R_C} \cong \frac{c^3}{2GM_C} \cong 1.085672{\times}10^{44} \text{ rad/sec} \quad (16)$$

5. The reduced Planck's constant - a strange coincidence

Large dimensionless constants and compound physical constants reflects an intrinsic property of nature. Whether to consider them or discard them depends on the physical interpretations, experiments and observations. The mystery can be resolved only with further research, analysis and discussions. If m_e and m_p are the rest masses of electron and proton respectively, it is noticed that,

$$\frac{\hbar c}{Gm_p\sqrt{M_0 m_e}} \cong 0.99753 \quad (17)$$

where $M_0 \cong \frac{c^3}{2GH_0}$. Surprisingly this ratio is close to unity! How to interpret this ratio? Giving a primary significance to the existence of m_e, m_p, G & c, and considering the Machian concept of the distance cosmic back ground in the form of 'distance cosmic mass', $\hbar$ can be considered as the compound physical constant and can be expressed as

$$\hbar \cong \sqrt{\frac{M_0}{m_e}} \cdot \frac{Gm_p m_e}{c} \cong 1.0572 \times 10^{-34} \text{ J.sec} \quad (18)$$

From the atomic structure point of view also this idea can be strengthened. If electron is revolving round the nucleus, naturally m_p and m_e both are the characteristic physical inputs. By considering the origin of the Bohr radius of Hydrogen atom this proposal can be given a chance. If so: in the expanding universe 'quanta' increases with increasing mass of the universe. Any how this is a very sensitive problem. Considering the 'integral nature' of number of protons, integral nature of $n \cdot \hbar$ can be understood. Considering any two successive integers n and $(n+1)$, their geometric state is $\sqrt{n\,(n+1)} \cdot \hbar$. If this logic is true, it can be suggested that $\hbar$ is connected with

the large scale structure of the expanding universe. The laboratory fine structure ratio is

$$\alpha \cong \sqrt{\frac{m_e}{M_0}} \cdot \frac{e^2}{4\pi\varepsilon_0 G m_p m_e} \tag{19}$$

It is the strength of electromagnetic interaction and is an intrinsic property of nature. Cosmic acceleration and dark energy constitute one of the most important and challenging of current problems in cosmology and other areas of physics. If so 'rate of increase in $\hbar$' or 'rate of decrease in α' can also be considered as a measure of the cosmic acceleration. With reference to relation (18), magnitude of the Hubble's constant can be fitted as

$$H_0 \cong \frac{G m_p^2 m_e c}{2\hbar^2} \cong 70.75 \text{ Km/sec/Mpc} \tag{20}$$

A. Bohr radius of the Hydrogen atom

In hydrogen atom, potential energy of electron in Bohr radius can be expressed as

$$E_P \cong -\frac{e^2}{4\pi\varepsilon_0 G m_p M_0} \times \frac{e^2 c^2}{4\pi\varepsilon_0 G m_p} \tag{21}$$

Total energy of electron in Bohr radius can be expressed as

$$E_T \cong -\frac{e^2}{4\pi\varepsilon_0 G m_p M_0} \times \frac{e^2 c^2}{8\pi\varepsilon_0 G m_p} \tag{22}$$

Considering the integral nature of number of protons (of any nucleus), above relation is

$$E_T \cong -\frac{e^2}{4\pi\varepsilon_0 G\,(n \cdot m_p)\, M_0} \times \frac{e^2 c^2}{8\pi\varepsilon_0 G\,(n \cdot m_p)} \tag{23}$$

where $n = 1, 2, 3, ..$ Thus in a discrete form,

$$E_T \cong -\frac{1}{n^2} \times \frac{e^2}{4\pi\varepsilon_0 G m_p M_0} \times \frac{e^2 c^2}{8\pi\varepsilon_0 G m_p} \tag{24}$$

Hence 'Bohr radius of hydrogen' atom can be expressed as

$$a_0 \cong \frac{4\pi\varepsilon_0 G m_p M_0}{e^2} \cdot \frac{G m_p}{c^2} \cong \frac{1}{2}\left(\frac{4\pi\varepsilon_0 G m_p^2}{e^2}\right) \cdot \frac{c}{H_0} \tag{25}$$

This is a very simple and natural fit. The real beauty of the Mach's principle can be seen here.

$$a_0 \propto M_0 \propto \frac{c}{H_0} \tag{26}$$

6. Present angular velocity, mass density and time

Present angular velocity is

$$\omega_t \cong \left[1 + \ln\left(\frac{R_t}{R_C}\right)\right] \sqrt{\frac{8\pi G a T_t^4}{3c^2}} \tag{27}$$

Thus $\omega_t \cong \left[1 + \ln\left(\frac{M_t}{M_C}\right)\right] \sqrt{\frac{8\pi G a T_t^4}{3c^2}}$ where $\frac{R_t}{R_C} \cong \frac{M_t}{M_C}$, $M_t \cong \frac{c^3}{2G\omega_t}$ and $M_C \cong \sqrt{\frac{e^2}{4\pi\varepsilon_0 G}}$. Hence,

$$\left[1 + \ln\left(\frac{c^3}{2G\omega_t M_C}\right)\right]^{-1} \omega_t \cong \sqrt{\frac{8\pi G a T_t^4}{3c^2}} \tag{28}$$

Thus by trial-error, we get, $\omega_t \cong H_0 \cong 71$ Km/sec/Mpc. Present mass density is

$$\rho_{mass} \cong \left[1 + 3\ln\left(\frac{R_t}{R_C}\right)\right]\left[\frac{a T_t^4}{c^2}\right] \tag{29}$$

$\cong \left[1 + 3\ln\left(\frac{c^3}{2G\omega_t M_C}\right)\right]\left[\frac{a T_t^4}{c^2}\right] \cong 1.98 \times 10^{-31}$gram/cm^3. Similarly present cosmic time is

$$t \approx \ln\left(\sqrt{\frac{T_C}{T_t}}\right) \sqrt{\frac{3c^2}{8\pi G a T_t^4}} \tag{30}$$

$\approx$ 144.6 Trillion years where $T_C \cong \sqrt{\left[1 + \ln\left(\frac{M_t}{M_C}\right)\right]\frac{M_t}{M_C}} \cdot T_t \cong 2.2374 \times 10^{32}$ ^{0}Kelvin

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