Dirac Large Numbers-- $F_e/F_g = L_n = 2.27\times10^{39}$ Can Be Verified With The New Formulas of BH-theory Proposed By Author

Zhang Dongsheng

17 Pontiac Road, West Hartford, CT 06117-2129, U.S.A.
Email: zhangds12@hotmail.com; zds@outlook,com

[Preface]. By a comparison of hydrogen atom as a model, a proper ratio F_e/F_g between the electromagnetic force F_e and the gravitational force F_g could be accurately established as a famous Dirac large numbers $L_n = F_e/F_g=2.27\times10^{39}$, this is because in a hydrogen atom, the electrical force F_e and the gravitational force F_g can act on the same electron and the same proton with the same acting distance R. The electromagnetic force F_e and the gravitational force F_g are two fundamental forces in the Universe. Since $F_e/F_g = L_n = 2.27\times10^{39}$ is a constant for a hydrogen atom, it should not be an isolated case, and it should be universal. In the book < **Blackhole(BH)-Cosmology** > [1] written by author, on the basis of Hawking's the black hole (BH) theory, author deduced many new formulas and improved the black hole theory. This article will take advantage of several new formulas to test and verify the correctness and accurateness of Dirac large numbers-- $F_e/F_g = L_n = 2.27\times10^{39}$, it can also verify the correctness of the new BH-theory and new formulas. **The question is what kind of a BH can be used as a suitable model of $F_e/F_g= L_n$.**
[Zhang Dongsheng. **Dirac Large Numbers-- $F_e/F_g = L_n = 2.27\times10^{39}$ Can Be Verified With The New.** *Nat Sci* 2014;12(5):148-150]. (ISSN: 1545-0740). http://www.sciencepub.net/nature. 21

Key Words: The electromagnetic force F_e and the gravitational force F_g; Dirac large numbers $F_e/F_g = L_n = 2.27\times10^{39}$; to test and verify the correctness of Dirac large numbers with some new formulas of BHs; ideal BH--M_{bo} formed by pure protons; the physical meaning of Dirac large numbers;

§ 1; $F_e/F_g = L_n= 2.27\times10^{39}$ = Dirac large numbers could be calculated out with the model of a hydrogen atom.

First, let us look back how to get the Dirac large number—L_n. Taking a hydrogen atom as a model, in which an electron on its surface can possess a e^- (= e^+ = 4.80325×10^{-10} esu.), and mass $e_m= 9.1096\times10^{-28}$g, a proton in the center can possess a e^+ and a proton mass $p_m =1.6727\times10^{-24}$g, the atomic radius is R, G = the gravitational constant = 6.6726×10^{-8} $cm^3/s^2{*}g$, Electronic power = 4.80325×10^{-10} esu. Then, the electromagnetic force F_e and the gravitational force F_g are as below,

$$\mathbf{F_g} = Gp_me_m/R^2=6.6726\times10^{-8}\times1.6727\times10^{-24}\times9.1096\times10^{-28}/R^2=\mathbf{101.67\times10^{-60}/R^2}\ [3] \quad (1a)$$

$$\mathbf{F_e}=(4.80325\times10^{-10})^2/R^2=\mathbf{23.10\times10^{-20}/R^2}\ [3] \quad (1b)$$

$$\underline{\mathbf{F_e/F_g = L_n}} = 23.10\times10^{-20}/101.67\times10^{-60} = \underline{\mathbf{2.27\times10^{39}}}\ [3] \quad (1c)$$

Formula (1c) shows that, in hydrogen atom, the distance R is the same for F_e and F_g, Then, the no dimension constant $L_n = e^2/Gp_me_m = 2.27\times10^{39}=F_e/F_g$.

§ 2; Hawking formula of entropy ratio before and after the collapse of a stellar BH

According to the Hawking's famous formula of entropy ratio of a stellar black holes, in the collapse process of a qualified star, it could increase in its entropy and decrease in its information amount. Suppose S_b—the entropy before its collapse; S_a—the entropy after its collapse; M_0—sun mass = 2×10^{33}g, then,

$$\mathbf{S_a/S_b \approx 10^{18}M_b/M_0}\ [1][2] \quad \mathbf{(2a)}$$

Jacob Bekinstein pointed out, **under the ideal condition,** while in the collapse process of a qualified star from its beginning to its end, if $S_a = S_b$, from (2a), a mini black hole of $\underline{\mathbf{M_{bs} \approx 2\times10^{15}g}}$ could be got, it was so-called original mini black hole in the Universe. The density $\underline{\boldsymbol{\rho_{bs}}}$ of $\underline{\mathbf{M_{bs}}}$ $\underline{\mathbf{-\rho_{bs} \approx 1.8\times10^{52}g/cm^3.}}$

From Bekinstein's interpretation to the equal entropy process of stellar collapse can draw a very significant conclusions.

Bekinstein for Hawking formula (2a) only made a simple mathematical explanation, and let it be established in harmony. But author believes, (2a) should be used to explain the importantly physical meaning in the stellar collapse.

First, formula (2a) shows that, entropy could not keep a constant in the stellar **collapse process to form BHs of >** $M_{bs} \approx 2\times10^{15}$g. **Second, <u>the physical significance of entropy conservation shows that, only after quarks decomposed from protons could have no heat movement and no friction, they would enter in the ideal condition. Thus, quarks either in a contractive or in an expansive process between densities $1.8\times10^{52}g/cm^3$ and $10^{93}g/cm^3$ as the density of the Planck particles, they should be in the ideal process of no heat movement 、 no friction and no energy exchanges. It is said, in case of protons not decomposed into quarks, i.e., in BHs of density--$\rho_{bs}<1.8\times10^{52}g/cm^3$. it will be non-ideal</u>**

state.

In modern physics,[5] quark model and its structures inside have not be completely recognized yet, only some properties of quarks relevant to verify **Dirac Large Numbers-- $F_e/F_g = L_n$** can be simply described below: 1*; According to the theories of modern particle physics and quantum chromodynamics (QCD), quarks are all imprisoned in protons, no quark could exist singly and freely. 2*, A proton is formed by 3 quarks of 'uud' with 3 different colors—green, blue and red, every quark has its special color. Only 3 quarks bundled together with above 3 different colors can form a stable proton. Color may be the source of nuclear strong forces and be the expression of Pauli exclusion principle. 3*, There are 2 'u' quarks and a 'd' quark in a decomposed proton, every 'u' quark has $2e^+/3$ electrical charge, and a 'd' quark has $e^-/3$ electrical charge. Therefore, a proton can hold a completely positive charge e^+. All protons composed from 3 quarks can closely paste together in the whole space of $M_{bo} = 0.71\times10^{14}$g. 4*, Every electron as a free one can be gathered in the vicinity of the inner horizon radius R_b of M_{bs} due to their exclusive forces each others. 5*, It can be seen, every proton and electron can be acted simultaneously the electromagnetic forces F_e and the gravitational forces F_g, and has **a same distance R. Thus, it will be simple and easy for us to find out F_e/F_g.**

The important conclusion: It can be seen from above statements and analyses, any BH of $M_{bo} < M_{bs}(2\times10^{15}$g) and its density--$\rho_{bs} > 1.8\times10^{52}$ g/cm^3 **are formed from pure protons incomposed from quarks, and must be in the ideal state.** That is to say, in a mini BH M_{bo}, except all protons close to each other, there are no impurities or other high radiations between protons. Thus, in the ideal process, when the temperature increases or decreases, their entropy will inverse decrease or increase with no additional entropy produced.

§ 3; How to find some ideal mini BH--M_{bo} composed from pure protons as a suitable model

Suppose m_{ss} be a Hawking quantum radiations of a ideal mini BH—M_{bo}, it can be seen from [Referebce 1], on the horizon radius R_b of any BH, there are some generally suitable formulas as below,

$$M_bT_b = (C^3/4G)\times(h/2\pi\kappa) \quad (3a)$$

$$E = m_{ss}C^2 = \kappa T_b \quad (3b)$$

$$GM_b/R_b = C^2/2 \quad (3c)$$

$$m_{ss}M_b = hC/8\pi G = 1.187\times10^{-10}g^2 \quad (3d)$$

Formula (3d) was newly derived from (3a) and (3b) by author, it improved the Hawking BH- theory. In above formulas, M_b—amonnt of tatol energy-matters of any BH, R_b—the horizon radius of BH, T_b-- temperature on R_b of a BH, m_{ss} -- mass of a Hawking quantum radiation, **h**—Planck constant=6.63×10^{-27}gcm^2/s, **C**– light speed=3×10^{10}cm/s, **G**—gravitational constant = 6.67×10^{-8}cm^3/s^2*g, **κ**—Bolzmann constant = 1.38×10^{-16}g*cm^2/s^2*k, m_p--Planck participle =1.09×10^{-5}g,

If using some ideal mini BH--M_{bo} as a model, it must be formed from pure protons. Then, **its m_{ss} must also be equal to a proton--p_m**, so,

$$m_{ss} = p_m = 1.6727\times10^{-24}\text{g}, \quad (3e)$$

From **(3d)**,

$$m_{ss}M_{bo} = hC/8\pi G = 1.187\times10^{-10}g^2$$

So, $M_{bo} = 1.187\times10^{-10}/m_p = 1.187\times10^{-10}/1.6727\times10^{-24} = 0.71\times10^{14}$g, (3f)

According to **(3c), finding R_{bo} of M_{bo},**

$$R_{bo} = 2GM_{bo}/C^2 = 2\times6.67\times10^{-8}\times0.71\times10^{14}\ g/9\times10^{20} = 1.05\times10^{-14}\text{cm},$$

According to sphere formula, finding density $_{bo}$ of M_{bo},

$$_{bo} = 3M_{bo}/4\pi R_{bo}^3 = 1.5\times10^{55}\text{g/cm}^3$$

$T_{bo} = 1.09\times10^{13}$k;

Numbers n_p of protons in mini M_{bo},

$$n_p = M_{bo}/p_m = 0.71\times10^{14}/1.67\times10^{-24} = 0.424\times10^{38} \quad (3g)$$

Conclusions: It can be known from above calculations, $M_{bs}(2\times10^{15}$g) > M_{bo} (0.71×10^{14}g), and $\rho_{bs}(1.8\times10^{52}$g/cm^3) < $_{bo}$ (1.5×10^{55} g/cm^3). Thus, **M_{bo} has already been in the ideal state of pure protons as a qualified model**。See also [Reference 1], any Hawking radiations of equivalent mass < m_{ss} of M_{bo} can be impossible to exist in M_{bo}, but must naturally flee out to external M_{bo}. Thus, **there are only pure protons ($p_m = m_{ss}$) in M_{bo}.**

Therefore, it will be suitable to do a qualified model for a special mini $M_{bo} = 0.71\times10^{14}$g。

§ 4; Using $M_{bo} = 0.71\times10^{14}$g composed by pure protons as a qualified model to find out the Dirac large number $F_e/F_g = L_n$。

From above paragraphs, since special M_{bo} is formed from pure protons which paste closely each others, every proton has a e^+ and the gravitational force of a proton mass p_m. All e^- are pushed to the inside surface of M_{bo} due to their repulsions, and every free electron has a e^- and the gravitational force of an electronic mass e_m. The distributions of gravitational forces and electromagnetic forces on protons and on electronns are very similar to the hydrogen atom. No matter whether all protons as a concentrative mass or the distributed mass, **the total effects of both forces of all protons to a electron is exactly the same.** That is why M_{bo} can do a better model as the same with

hydrogen atom to find out $\mathbf{F_e/F_g = L_n}$.

Owing to $\mathbf{M_{bo} = n_p p_m}$, $\mathbf{m_{ss}} = p_m = \mathbf{e_m} \times p_m / \mathbf{e_m} = \mathbf{1836\ e_m}$。**From (3d),**

$\mathbf{m_{ss}M_{bo}=hC/8\pi G = 1.187\times10^{-10}g^2}$ **can be changed to (4a),**

$$GM_{bo}m_{ss}/R^2=hC/8\pi R^2 \quad \textbf{(4a)}$$

Owing to $M_{bo} = n_p p_m$, every p_m has the same gravitational force F_g and the same electromagnetic force F_e of a e^+. **Then, the distance R between a proton and a electron for F_g and F_e is the same. So, (4a) can be changed to (4b) below,**

$$G\,n_p\,p_m\,e_m/R^2=hC/(1836\times8\pi R^2) \quad \textbf{(4b)}$$

Similarly, $\mathbf{n_p e^+ e^-/R^2=n_p F_e/R^2}$ **(4c)**

From (4b), $G\,p_m\,e_m = hC/(1836\times8\pi n_p) = F_g$

$\underline{F_g} = hC/(1836\times8\pi n_p) = 6.63\times10^{-2}\times3\times10^{10}/(8\pi1836\times0.424\times10^{38}) = \underline{101.7\times10^{-60}}$ **(4d)**

So, $\boxed{\textbf{(4d) } \equiv \textbf{ (1a)}}$ **(4e)**

Since F_e remains.

$\mathbf{F_e = \underline{23.07\times10^{-20}}}$ **(1b)**

$\mathbf{F_e/F_g = \underline{23.07\times10^{-20}}/\underline{101.7\times10^{-60}} = \underline{2.27\times10^{39}}}$。 (1c)

§ 5; Some analyses and conclusions:

（1）; Dirac large number $F_e/F_g = L_n = 2.27\times10^{39}$ is a precise ratio of 2 fundamemtal forces with long distance in the Universe, it has nothing to do with some numbers $10^{38\sim40}$ got from other occasions in nature. Some numerical coincidences have no physical meaning.

（2）; Why could mini $M_{bs} \approx 2\times10^{15}$g not become a qualified model to find $F_e/F_g = L_n$?

Since M_{bs} from formula（2a）is an approximate formula; from **(3d)**, $\mathbf{m_{ss}M_{bs} = hC/8\pi G = 1.187\times10^{-10}g^2}$, so, Hawking radiation $m_{ss} = 1.187\times10^{-10}/2\times10^{15}=6\times10^{-26}$g. Thus, $\mathbf{m_{ss} < p_m(1.67\times10^{-24})}$, it indicates, there may be many participles m_{ss} of high energy in M_{bs}, **i.e. $\mathbf{p_m > m_{ss} > 6\times10^{-26}}$g, they may let many electrons have no fixed locations and walk freely in $\mathbf{M_{bs}}$.** This of course can not make M_{bs} as a suitable model for seeking $F_e/F_g = L_n$.

There is speculation that the number n_s of protons in M_{bs} has some relationship with the Dirac large numbers,

$$\mathbf{n_s = M_{bs}/m_p = 1.2\times10^{39}} \quad \textbf{(5a)}$$

From above analyses, $n_s = 1.2\times10^{39}$ looks like a Dirac large numbers, but its practical significance is a ratio of the total mass of M_{bs} with the mass of a proton. In fact, n_s and $\mathbf{n_p}$ are all coincidences with the Dirac large number $\mathbf{F_e/F_g = L_n}$, they have no physical meaning.

（3）; In this paper, the Dirac large number $\mathbf{F_e/F_g = L_n = 2.27\times10^{39}}$ re-confirmed precisely with the model of a special BH-- $\mathbf{M_{bo}}$ **of pure protons**, it indicates clearly the correctness of many new formulas in BH-theory proposed by author are also verified.

====The End====

References:

1. Zhang Dongsheng: 《 The Originative Blackhole-Cosmogony 》 **http://www.sciencepub.net/newyork/ny0701/**
2. Wang Yong-Jiu. Physics of Black Holes; Hunan Normal University Publishing House. China. 2000.4.
3. Su Yi: 《An Introduction to New Astronomy》. Science & Technology Publishing House Of Central University, Wuhan, China. 2000. 3.
4. Dongsheng Zhang:《Why could not Dirac get the correct conclusions from his hypothesis of large number?》 [New York Science Journal.2009;2(5): (ISSN1554-0200)] http://www.scienceub.net/newyork/0205
5. Xiang Yi-hou: The Instructions to physics for University. Publishing house of Qinghua University. Beijing. China. 1999.1.

5/16/2014