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Review Paper

On fixing the magnitudes of gravitational constant and strong coupling constant

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Abstract

In the earlier published papers the authors suggested that, **"**Magnitude of the unified force can be assumed to be equal to the classical or astrophysical force limit $\left(c^4/G\right)$. Strength of any interaction can be defined as the ratio of the operating force magnitude and the magnitude of $\left(c^4/G\right)$. If strength of the Schwarzschild interaction is assumed to be unity, then weak interaction strength seems to be 'squared Avogadro number' times less than the Schwarzschild interaction. The characteristic atomic force can be represented by $\left(c^4/N_A^2 G\right)$". Thinking in this way, atomic gravitational constant can be expressed as $G_A \cong N_A^2 G$. With current atomic physical constants and with the assumed two new grand unified back ground numbers $x \cong 38.72479081$ and $y \cong 47.41543166$, analytically - value of G can be fixed for 10 digits and can be verified. Inverse of the strong coupling constant can be considered as the 'natural logarithm of square root of ratio of gravitational and electromagnetic force ratio of down quark mass where the operating gravitational constant is squared Avogadro number times the gravitational constant'. Finally an attempt is made to fit and understand the mystery of Up and Down quarks, nuclear stability, and nuclear binding energy. For medium and heavy atomic nuclides, at the stable mass number, nuclear binding energy seems to be equal to the sum of rest energy of $2Z$ up quarks and Z down quarks.

Keywords: *Gravitational constant; Schwarzschild's interaction; Astrophysical force limit; Avogadro number; Particle rest masses; Strong interaction; nuclear binding energy; and Electron's (n^2) quantum states.*

1. Introduction

From final unification point of view, it is very much essential to couple the universal gravitational constant with the elementary physical constants. Then only the essence of unification can be understood. So far scientists proposed several interesting models (P. A. M. Dirac 1937), (Witten, Edward 1981), (David Gross 2005), (Abdus Salam 1981), (Salam A. & Sivaram C 1993), (Recami E 1994), (Dine, Michael 2007), (Roberto Onofrio 2013). In this context, readers may go through the authors published papers (U. V. S. Seshavatharam & S. Lakshminarayana 2014, 2013, 2011). By introducing two new back ground unified numbers (x, y), in the published paper the authors expressed their views (U. V. S. Seshavatharam & S. Lakshminarayana 2014) on final unification and proposed three characteristic relations for connecting, fitting and verifying the Newtonian gravitational constant in a unified approach via the Avogadro number N_A. In this paper, the topics covered and reviewed are: Schwarzschild interaction strength, meaning of strength of interaction in atomic physics, significance of Avogadro number, fitting of the gravitational constant, muon an tau rest masses, strong coupling constant, fine structure ratio, reduced Planck's constant, rest masses of Up & Down quarks, Nucleon rest masses, rms radius of proton, nuclear charge radius, nuclear stability, nuclear binding energy and unified atomic mass unit. Important points can be expressed as follows.

1) In any inverse square law of force, system is sustained only by means of the central attractive force and it is the root cause of revolving body's angular momentum. If it is confirmed that, revolving body's angular momentum is discrete, then it is a clear indication of the discrete nature of the central force acting on the revolving body. If one is willing to think in this direction, the historical mystery of Bohr's discrete atomic structure and discrete angular momentum can be understood.
2) Note that, as per the basic concepts of final unification, there exists a fundamental unified force from which all the observed forces emerged. If so, magnitude of the unified force can be assumed to be equal to the astrophysical force limit $\left(c^4/G\right)$. Note that, magnitude of the radial inward force acting on any black hole surface (U. V. S. Seshavatharam & S. Lakshminarayana 2014) is of the order of $\left(c^4/G\right)$.

2. The classical limits of force and power

To unify cosmology, quantum mechanics and the four observed fundamental cosmological interactions certainly a 'unified force' is required. In this connection $\left(c^4/G\right)$ can be considered as the classical force or astrophysical force limit. Similarly $\left(c^5/G\right)$ can be considered as the classical power limit. If it is true that c and G are fundamental physical constants in physics, then $\left(c^4/G\right)$ and $\left(c^5/G\right)$ can also be considered as fundamental compound physical constants. These classical limits are more powerful than the Uncertainty limit. Without considering the current notion of black hole physics, Schwarzschild radius of black hole (Roger Penrose 1996), (Subrahmanyan Chandrasekhar 1983) can be understood with the characteristic astrophysical limiting force of magnitude $\left(c^4/G\right)$. Note that by considering $\left(c^4/G\right)$, the famous Planck mass can be obtained very easily.

2.1. Simple applications of $\left(c^4/G\right)$

a) Magnitude of force of attraction or repulsion between any two charged particles never exceeds $\left(c^4/G\right)$.
b) Magnitude of gravitational force of attraction between any two massive bodies never exceeds $\left(c^4/G\right)$.
c) Magnitude of mechanical force on a revolving/rotating body never exceeds $\left(c^4/G\right)$.
d) Magnitude of electromagnetic force on a revolving body never exceeds $\left(c^4/G\right)$.

2.2. Simple applications of $\left(c^5/G\right)$

a) Mechanical power never exceeds $\left(c^5/G\right)$
b) Electromagnetic power never exceeds $\left(c^5/G\right)$
c) Thermal radiation power never exceeds $\left(c^5/G\right)$
d) Gravitational radiation power never exceeds $\left(c^5/G\right)$

3. Understanding the role of $\left(c^4/G\right)$ in black hole formation and Planck mass generation

3.1. Schwarzschild radius of a black hole

The four basic physical properties of a rotating black hole are its mass, size, angular velocity and temperature. Without going deep into the mathematics of black hole physics in this section an attempt is made to understand the Schwarzschild radius of a black hole. In all directions, if a force of magnitude $\left(c^4/G\right)$ acts on the mass-energy content of the assumed celestial body it approaches a minimum radius of $\left(GM/c^2\right)$ in the following way. Origin of the force $\left(c^4/G\right)$ may be due to self-weight or internal attraction or external compression or something else.

$$R_{\min} \cong \frac{Mc^2}{\left(c^4/G\right)} \cong \frac{GM}{c^2} \tag{1}$$

If no force (of zero magnitude) acts on the mass content M of the assumed massive body, its radius becomes infinity. With reference to the average magnitude of $\left(0, \frac{c^4}{G}\right) \cong \frac{c^4}{2G}$, the presently believed Schwarzschild radius can be obtained as

$$(R)_{ave} \cong \frac{Mc^2}{\left(c^4/2G\right)} \cong \frac{2GM}{c^2} \tag{2}$$

This proposal is very simple and seems to be different from the existing concepts and may be a unified form of the Newton's law of gravity, Special theory of relativity and General theory of relativity.

3.2 To derive the Planck mass

So far no theoretical model proposed a derivation for the Planck mass. To derive the Planck mass the following two conditions can be given a chance.
Assuming that gravitational force of attraction between two Planck particles of mass $\left(M_P\right)$ separated by a minimum distance ($r_{\min}$) be,

$$\left[\frac{GM_P M_P}{r_{\min}^2}\right] \equiv \left(\frac{c^4}{G}\right) \tag{3}$$

With reference to wave mechanics, let

$$2\pi . r_{\min} \cong \lambda_P = \left[\frac{h}{c.M_P}\right] \tag{4}$$

Here, λ_P represents the wavelength associated with the Planck mass. With these two assumed conditions Planck mass can be obtained as follows.

$$M_P = \sqrt{\frac{hc}{2\pi G}} \cong \sqrt{\frac{\hbar c}{G}} \tag{5}$$

3.3. Understanding the strength of any interaction

From the above relations it is reasonable to say that,
1) If it is true that c and G are fundamental physical constants, then $\left(c^4/G\right)$ can be considered as a fundamental compound constant related to a characteristic limiting force.
2) Black holes are the ultimate state of matter's geometric structure.
3) Magnitude of the operating force at the black hole surface is the order of $\left(c^4/G\right)$.
4) Gravitational interaction taking place at black holes can be called as 'Schwarzschild interaction'.
5) Strength of 'Schwarzschild interaction' can be assumed to be unity.
6) Strength of any other interaction can be defined as the ratio of operating force magnitude and the classical or astrophysical force magnitude $\left(c^4/G\right)$.

7) If one is willing to represent the magnitude of the operating force as a fraction of $\left(c^4/G\right)$ i.e X times of $\left(c^4/G\right)$, where $X = 1$, then

$$\frac{X \text{ times of } \left(c^4/G\right)}{\left(c^4/G\right)} \cong X \rightarrow \text{Effective } G \Rightarrow \frac{G}{X} \tag{6}$$

If X is very small, $\frac{1}{X}$ becomes very large. In this way, X can be called as the strength of interaction. Clearly speaking, strength of any interaction is $\frac{1}{X}$ times less than the 'Schwarzschild interaction' and effective G becomes $\frac{G}{X}$.

4. Basic concepts and relations final unification

The following concepts and relations can be given a chance in final unification program.

1) With reference to the elementary charge and with mass similar to the Planck mass, a new mass unit can be constructed in the following way.

$$\left.\begin{aligned} \left(M_S\right)^{\pm} &\cong \sqrt{\frac{e^2}{4\pi\varepsilon_0 G}} \cong 1.859272\times 10^{-9} \text{ kg} \\ M_S c^2 &\cong \sqrt{\frac{e^2c^4}{4\pi\varepsilon_0 G}} \cong 1.042975\times 10^{18} \text{ GeV} \end{aligned}\right\} \tag{7}$$

It can be called as the Stoney mass (G. J. Stoney, 1881). It is well known that e, c, G play a vital role in fundamental physics. With these 3 constants, space-time curvature concepts at a charged particle surface can be studied. It was first introduced by the physicist George Johnstone Stoney. He is most famous for introducing the term 'electron' as the 'fundamental unit quantity of electricity'. In unification program, with this mass unit and with a suitable proportionality ratio- characteristic mass of any elementary charge can be generated.

2) Avogadro number is an absolute number and it is having no units like 'per mole'.

3) Atomic interaction strength is N_A^2 times less than the Schwarzschild interaction and hence atomic gravitational constant can be expressed as:

$$G_A \cong N_A^2 G \tag{8}$$

4) Similar to the classical force limit $\left(c^4/G\right)$, in atomic system there exists a characteristic force of magnitude:

$$F_X \cong \left(1/N_A^2\right)\left(c^4/G\right) \cong \left(c^4/N_A^2 G\right) \tag{9}$$

5) Independent of system of units and without considering the Avogadro number, unified atomic mass unit (P.J. Mohr et al 2010), (B. Andreas et al 2011), (B P Leonard 2007),(K.A. Olive et al 2014) can be fitted as follows.

$$m_u c^2 \cong \left(\sqrt{m_n m_p} c^2 - B_a\right) + m_e c^2 \tag{10}$$

Where m_u is the unified atomic mass unit and B_a is the average binding energy per nucleon. If $B_a \cong (7.90 \text{ to } 8.0)$ MeV, obtained magnitude of $m_u \cong 931.4295 \text{ to } 931.5295 \text{ MeV/c}^2$. Thus it can be suggested that, accuracy of m_u depends only on the accurate 'average binding energy per nucleon'.

4.1. Semi empirical applications of (x, y):

There exist two new numbers (x, y). they can be called as the 'primordial unified back ground numbers'. They can also be called as the 'back ground analytical numbers' using by which micro-macro physical constants can be interlinked qualitatively and quantitatively.

Application-1: Rest masses of electron and proton

Electron rest mass can be expressed in the following way.

$$m_e \cong x^{\frac{1}{2}} y \sqrt{\frac{e^2}{4\pi\varepsilon_0 G_A}} \tag{11}$$

With (x, y), proton rest mass can be expressed in the following way.

$$m_p \cong x^{\frac{3}{2}} y^2 \sqrt{\frac{e^2}{4\pi\varepsilon_0 G_A}} \tag{12}$$

Thus,

$$\frac{m_p}{m_e} \cong xy \tag{13}$$

Application-2: Rest masses of muon and tau

$$\text{Let, } \beta \cong x^{\frac{1}{2}} y \tag{14}$$

Where β can be called as the electron mass index. It can be estimated as:

$$\beta \cong x^{\frac{1}{2}} y \cong \sqrt{\frac{4\pi\varepsilon_0 N_A^2 G m_e^2}{e^2}} \cong 295.0509223 \tag{15}$$

With this number β, electron, muon and tau rest masses can be fitted with the semi empirical relation.

$$\left.\begin{aligned} \left(m_{lepton}\right)_n c^2 &\cong \left[\beta^3 + \left(n^2\beta\right)^n \sqrt{N_A}\right]^{\frac{1}{3}} \sqrt{\frac{e^2 F_X}{4\pi\varepsilon_0}} \\ &\cong \left[\beta^3 + \left(n^2\beta\right)^n \sqrt{N_A}\right]^{\frac{1}{3}} 0.001731 \text{ MeV} \end{aligned}\right\} \tag{16}$$

Where $n = 0, 1, 2.$ Obtained rest energies are 0.511 MeV, 105.95 MeV and 1777.4 MeV respectively (K.A. Olive et al 2014). New heavy charged lepton at $n = 3$ may be predicted close to 42262 MeV.

Application-3: The reduced Planck's constant and the rms radius of proton

From above relations,

$$\left.\begin{array}{l} x \cong \left(\frac{1}{\beta}\frac{m_p}{m_e}\right)^2 \cong 38.72787108 \\ y \cong \left(\frac{1}{x}\frac{m_p}{m_e}\right) \cong 47.41166036 \end{array}\right\} \quad (16)$$

If so, Reduced Planck's constant can be expressed in the following way.

$$\left(e^x\right)^{-\frac{1}{6}}\left(\frac{G_A m_e^2}{c}\right) \cong \hbar \cong 1.053946635\times10^{-34} \text{ J.sec} \quad (17)$$

Characteristic nuclear radii like rms radius of proton (P.J. Mohr et al 2010), (Geiger H & Marsden. E 1909), (Michael O. Distler et al 2011), (Roberto Onofrio 2013) nuclear charge radius etc can be expressed in the following way.

$$\left.\begin{array}{l} \left(e^x\right)^{-\frac{1}{2}}\left(\frac{G_A m_p}{c^2}\right) \cong 1.753816617\times10^{-15} \text{ m} \\ \frac{1}{2}\left(e^x\right)^{-\frac{1}{2}}\left(\frac{G_A m_p}{c^2}\right) \cong 0.8769083083\times10^{-15} \text{ m} \\ \sqrt{\frac{1}{2}}\left(e^x\right)^{-\frac{1}{2}}\left(\frac{G_A m_p}{c^2}\right) \cong 1.240135623\times10^{-15} \text{ m} \end{array}\right\} \quad (18)$$

If so, it is possible to show that,

$$\hbar \cong \left(\frac{2R_p c^2}{G_A m_p}\right)^{\frac{1}{3}}\left(\frac{G_A m_e^2}{c}\right) \quad (19)$$

Application-4: To fit and verify the gravitational constant

In astronomy, the only one available characteristic empirical physical constant is the gravitational constant. Its value has been measured in the lab only within a range of 1 cm to a few meters. Until one measures the value of the gravitational constant with microscopic physical constants, the debate of final unification cannot be stopped up. In this context, G. Rosi et al say (G. Rosi et al 2014): "There is no definitive relationship between G and the other fundamental constants, and there is no theoretical prediction for its value, against which to test experimental results. Improving the precision with which we know G has not only a pure metrological interest, but is also important because of the key role that G has in theories of gravitation, cosmology, particle physics and astrophysics and in geophysical models". In general, 'Unification' means:

a) Understanding the origin of the rest mass of atomic elementary particles.
b) Finding and understanding the critical compositeness of the elementary physical constants.
c) Minimizing the number of elementary physical constants.
d) Merging different branches of physics with possible and suitable physical concepts.

Considering the proposed concepts and relations accurate values of Gravitational constant (L.L. Williams 2009), (George T Gillies 1997), (J Stuhler et al 2003), (Terry Quinn 2013), (J. B. Fixler et al 2007), (Brandenburg, J.E 1992), (Jun Luo and Zhong-Kun Hu 2000), (St. Schlamminger et al 2002) and Avogadro number can be estimated from elementary atomic physical constants. For the time being (i.e until a perfect model is developed), if one is willing to consider the revolving electron's angular momentum as a compound physical constant and depends on the proton-electron rest masses, characteristic nuclear charge radius and the proposed discrete force $\left(c^4/N_A^2 G\right)$, it paves a path for coupling and interconnecting the micro-macro elementary physical constants in a consistent manner. Thus it is possible to couple Avogadro number and Gravitational constant in the following way.

$$x \cong \ln\left(\frac{G_A m_e^2}{\hbar c}\right)^6 \quad (20)$$

$$y \cong \left(\frac{m_e}{m_p}\right)\frac{4\pi\varepsilon_0 G_A m_e^2}{e^2} \quad (21)$$

$$xy - \left(\frac{m_p}{m_e}\right) \cong 0 \quad (22)$$

$$\left.\begin{array}{l} \text{By considering} \\ N_A \cong 6.022141293\times10^{23} \\ m_e \cong 9.109382914\times10^{-31} \text{ kg} \\ m_p \cong 1.672621777\times10^{-27} \text{ kg} \\ \text{h} \cong 1.054571726\times10^{-34} \text{ J.sec} \\ c \cong 2.99792458\times10^{8} \text{ m/sec} \\ \text{e} \cong 1.602176565\times10^{-19} \text{ C} \\ \varepsilon_0 \cong 8.854187817\times10^{-12} \text{ J.m} \\ \text{and by assuming,} \\ G \cong 6.674378868\times10^{-11} \text{ m}^3\text{kg}^{-1}\text{sec}^{-2} \\ \text{obtained values of } x \text{ and } y \text{ are,} \\ x \cong 38.72479081 \text{ and } y \cong 47.41543166 \end{array}\right\} \quad (23)$$

Thus relations (20, 21 and 22) can be considered as the 3 characteristic semi empirical unified relations. This assumed value of G may not be absolute but can be given some consideration in unification program for further analysis This entire procedure depends on the two proposed new numbers (x, y) and needs further research. So far there is no verifying procedure for the measured or estimated magnitude of G. with this kind of procedure, like other physical constants, value of G can be fixed for 10 digits.

Application-5: Strong coupling constant, Up and Down quarks and nuclear binding energy

Inverse of the strong coupling constant can be fitted as follows (A.V. Manohar and C.T. Sachrajdahttp 2014):

$$\begin{array}{l} \frac{1}{\alpha_s} \cong y - x \cong 8.69064085 \\ \rightarrow \alpha_s \cong 0.115066313 \end{array} \quad (24)$$

Now Down quark mass can be expressed as follows (Halzen, F.; Martin, A. D 1984).

$$\begin{array}{l} m_d c^2 \cong \exp\left(\frac{1}{\alpha_s}\right)\sqrt{\frac{e^2 F_X}{4\pi\varepsilon_0}} \cong \exp\left(\frac{1}{\alpha_s}\right)0.001731 \text{ MeV} \\ \cong 10.3 \text{ MeV} \end{array} \quad (25)$$

$$\left(\frac{1}{\alpha_s}\right) \cong \ln\sqrt{\frac{4\pi\varepsilon_0 G_A m_d^2}{e^2}} \quad (26)$$

Ratio of Up and down quark masses can be guessed as follows.

$$\left.\begin{array}{l} \left(\dfrac{m_d c^2}{m_u c^2}\right) \cong \ln\left(\dfrac{1}{\alpha_s}\right) \cong 2.1622467 \\ \left(\dfrac{m_u c^2}{m_d c^2}\right) \cong \left[\ln\left(\dfrac{1}{\alpha_s}\right)\right]^{-1} \cong 0.462482 \end{array}\right\} \tag{27}$$

Thus Up quark mass can be fitted as follows.

$$m_u c^2 \cong \left[\ln\left(\frac{1}{\alpha_s}\right)\right]^{-1} \cong 4.764 \text{ MeV} \tag{28}$$

Note that, these proposed Up and Down quark masses are roughly 2.20 times higher than the current estimates and their proposed mass ratio is matching with the current estimates. In a super symmetric approach, neutron and proton mass difference can be expressed as follows.

$$\left(m_n - m_p\right)c^2 \cong \frac{\left(m_e m_u m_d\right)^{1/3} c^2}{\psi} \cong \frac{\left(m_e m_u m_d\right)^{1/3} c^2}{2.26} \tag{29}$$

Where $\psi \cong 2.26$ can be considered as the super symmetric fermion-boson mass ratio (U. V. S. Seshavatharam & S. Lakshminarayana 2010, 2011).

With Up and Down quark masses nuclear binding energy (Chowdhury, P.R. et al 2005), (W.D. Myers & W.J. Swiatecki 1994), (G. Audi & A.H. Wapstra 1993) can be fitted as follows.

Step-1: To fit the stable mass number of Z

$$A_S \cong 2Z + \left(\frac{m_u}{m_d}\right)\left(Z\alpha_s\right)^2 \tag{30}$$

Step-2: To fit the nuclear binding energy at stable mass number of Z

$$\left(B\right)_{A_S} \cong k\left(2Zm_u c^2 + Zm_d c^2\right) \tag{31}$$

Where, $\left\{\begin{array}{l} \text{For } Z >= 30, k \cong 1.0 \text{ and} \\ \text{for } Z < 30,\ k = \left(Z/30\right)^{1/6} \end{array}\right\}$

See table-1 for the estimated nuclear binding energy near to the stable mass number. Considering even-odd corrections on the estimated stable mass number and

With further research, data accuracy can be improved. From the data it is very clear to say that:

1) At the stable mass number, nuclear binding energy seems to be equal to the sum of rest energy of $2Z$ up quarks and Z down quarks.
2) As per the quark theory proton constitutes two Up quarks and one Down quark. Hence it can be guessed that, near to stable mass number, nuclear binding energy seems to depend only on the proton number.

Step-3: To fit the nuclear binding energy above and below the stable mass number of Z

$$\left(B\right)_A \cong \left(\frac{A}{A_S}\right)^p \left\{k\left(2Zm_u c^2 + Zm_d c^2\right)\right\} \tag{32}$$

where $\left\{\begin{array}{l} \text{If } \left(A<A_S\right), p = 4/3, \\ \text{If } \left(A>A_S\right), p = 2/3, \end{array}\right\}$

Table 1: T$_o$ fit the nuclear binding energy near to stable mass number of Z

Proton number	Estimated stable mass number A_S	Estimated value of k	Binding energy in MeV (near to stable mass number)
2	4	0.6368	25.3
3	6	0.6813	40.5
4	8	0.7148	56.7
5	10	0.7418	73.5
6	12	0.7647	91.0
7	14	0.7846	108.9
8	16	0.8023	127.3
9	18	0.8182	146.0
10	21	0.8327	165.1
11	23	0.8460	184.5
12	25	0.8584	204.2
13	27	0.8699	224.2
14	29	0.8807	244.5
15	31	0.8909	265.0
16	34	0.9005	285.7
17	36	0.9097	306.6
18	38	0.9184	327.8
19	40	0.9267	349.1
20	42	0.9347	370.6
21	45	0.9423	392.4
22	47	0.9496	414.2
23	49	0.9567	436.3
24	52	0.9635	458.5
25	54	0.9701	480.9
26	56	0.9764	503.4
27	58	0.9826	526.0
28	61	0.9886	548.8
29	63	0.9944	571.8
30	66	1.0000	594.8
31	68	1.0000	614.7
32	70	1.0000	634.5
33	73	1.0000	654.3
34	75	1.0000	674.2
35	78	1.0000	694.0
36	80	1.0000	713.8
37	82	1.0000	733.6
38	85	1.0000	753.5
39	87	1.0000	773.3
40	90	1.0000	793.1
41	92	1.0000	812.9
42	95	1.0000	832.8
43	97	1.0000	852.6
44	100	1.0000	872.4
45	102	1.0000	892.3
46	105	1.0000	912.1
47	108	1.0000	931.9
48	110	1.0000	951.7
49	113	1.0000	971.6
50	115	1.0000	991.4
51	118	1.0000	1011.2
52	121	1.0000	1031.1
53	123	1.0000	1050.9
54	126	1.0000	1070.7
55	129	1.0000	1090.5
56	131	1.0000	1110.4
57	134	1.0000	1130.2
58	137	1.0000	1150.0
59	139	1.0000	1169.9
60	142	1.0000	1189.7
61	145	1.0000	1209.5
62	148	1.0000	1229.3
63	150	1.0000	1249.2
64	153	1.0000	1269.0
65	156	1.0000	1288.8

66	159	1.0000	1308.7
67	162	1.0000	1328.5
68	164	1.0000	1348.3
69	167	1.0000	1368.1
70	170	1.0000	1388.0
71	173	1.0000	1407.8
72	176	1.0000	1427.6
73	179	1.0000	1447.4
74	182	1.0000	1467.3
75	184	1.0000	1487.1
76	187	1.0000	1506.9
77	190	1.0000	1526.8
78	193	1.0000	1546.6
79	196	1.0000	1566.4
80	199	1.0000	1586.2
81	202	1.0000	1606.1
82	205	1.0000	1625.9
83	208	1.0000	1645.7
84	211	1.0000	1665.6
85	214	1.0000	1685.4
86	217	1.0000	1705.2
87	220	1.0000	1725.0
88	223	1.0000	1744.9
89	227	1.0000	1764.7
90	230	1.0000	1784.5
91	233	1.0000	1804.4
92	236	1.0000	1824.2
93	239	1.0000	1844.0
94	242	1.0000	1863.8
95	245	1.0000	1883.7
96	248	1.0000	1903.5
97	252	1.0000	1923.3
98	255	1.0000	1943.1
99	258	1.0000	1963.0
100	261	1.0000	1982.8

5. To understand the discrete behavior and the total energy of electron in hydrogen atom

Step-1: To understand the discrete behavior
From Bohr's theory of Hydrogen atom (N.Bohr 1913) maximum number of electrons that can be accommodated in any principal quantum shell are $\left(2n^2\right)$ where n=1,2,3,.. this proposal can be reinterpreted as follows: In Hydrogen atom, in n^{th} principal quantum shell, electron can exist in $\left(n^2\right)$ different quantum states. It can be understood as follows. Guess that currently believed s- shell is the basic unit of all quantum shells and it constitutes a maximum of 2 numbers of electrons. With reference to the current concept of $\left(2n^2\right)$ electrons, there can exit $\left(n^2\right)$ number of s-shells. If one s-shell represents on quantum state, then with reference to $\left(n^2\right)$ number of s-shells, one can expect $\left(n^2\right)$ number of different quantum states with different energy levels.

Step-2: To understand the potential energy of $\left(n^2\right)$ different states
Let potential energy of electron at any one quantum state be:

$$\left(E_{\text{pot}}\right)_n \cong -\frac{e^2}{4\pi\varepsilon_0 r_n} \tag{33}$$

Where r_n is the distance between electron and proton corresponding to n^{th} quantum state. Potential energy of possible $\left(n^2\right)$ quantum states can be:

$$\left.\begin{aligned}\epsilon_{\text{pot}} &\cong -n^2\left(E_{\text{pot}}\right)_n \cong -n^2\left(\frac{e^2}{4\pi\varepsilon_0 r_n}\right)\\ &\cong -\left(\frac{\hbar c}{G_A m_e^2}\right)^2\frac{\sqrt{m_p m_e}\,c^2}{2}\end{aligned}\right\} \tag{34}$$

Based on the Virial theorem (Celso L. Ladera et al 2010) in a central force field, quantitatively kinetic energy is half the potential energy. Following this idea, total kinetic energy of electron for $\left(n^2\right)$ quantum state can be:

$$\epsilon_{\text{kin}} \cong \frac{1}{2}\left|\epsilon_{\text{tot}}\right| \cong \left(\frac{\hbar c}{G_A m_e^2}\right)^2\frac{\sqrt{m_p m_e}\,c^2}{4} \tag{35}$$

Thus, total energy of electron for $\left(n^2\right)$ quantum states can be:

$$\left.\begin{aligned}&\epsilon_{\text{tot}} \cong \epsilon_{\text{pot}} + \epsilon_{\text{kin}}\\ &\cong -\left(\frac{\hbar c}{G_A m_e^2}\right)^2\frac{\sqrt{m_p m_e}\,c^2}{4}\end{aligned}\right\} \tag{36}$$

If so, potential energy of electron at any one quantum state can be:

$$\left.\begin{aligned}\left(E_{\text{pot}}\right)_n &\cong -\frac{\epsilon_{\text{pot}}}{n^2} \cong -\left(\frac{\hbar c}{G_A m_e^2}\right)^2\frac{\sqrt{m_p m_e}\,c^2}{2\left(n^2\right)}\\ &\cong -\left(\frac{\hbar c}{G_A m_e^2}\right)^2\frac{\sqrt{m_p m_e}\,c^2}{2n^2}\end{aligned}\right\} \tag{37}$$

Kinetic energy of electron at any one quantum state can be:

$$\left.\begin{aligned}&\left(E_{\text{kin}}\right)_n \cong \frac{\epsilon_{\text{kin}}}{n^2}\\ &\cong \left(\frac{\hbar c}{G_A m_e^2}\right)^2\frac{\sqrt{m_p m_e}\,c^2}{4n^2}\end{aligned}\right\} \tag{38}$$

Total energy of electron at any one quantum state can be:

$$\left.\left(E_{\text{tot}}\right)_n \cong \frac{\epsilon_{\text{tot}}}{n^2} \cong -\left(\frac{\hbar c}{G_A m_e^2}\right)^2\frac{\sqrt{m_p m_e}\,c^2}{4n^2}\right\} \tag{39}$$

Step-3: To understand the emitted photon energy
With reference to the jumping nature of electron from one quantum state to another quantum sate, emitted photon energy can be:

$$E_{\text{photon}} \cong \left(\frac{\hbar c}{G_A m_e^2}\right)^2\frac{\sqrt{m_p m_e}\,c^2}{4}\left(\frac{1}{n_1^2}-\frac{1}{n_2^2}\right) \tag{40}$$

Where $n_1 = 1,2,3,..$ and $n_2 > n_1$.

6. Conclusion

So far no model succeeded in coupling and understanding the unified concepts of gravity, electromagnetic and strong interactions. Based on the proposed concepts and accurate relations and with further research and analysis, different models of final unification can be developed with different proportionality ratios and finally a unified model can be standardized. The absolute magnitude of G can be fixed and uncertainty in its current recommended magnitude can be minimized

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