4G model of final unification - A very brief report

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Abstract: With our long experience in the field of unification of gravity and quantum mechanics, we understood that, when mass of any elementary is extremely small/negligible compared to macroscopic bodies, highly curved microscopic space-time can be addressed with large gravitational constants and magnitude of elementary gravitational constant seems to increase with decreasing mass and increasing interaction range. In our earlier publications, we proposed that, 1) There exist three atomic gravitational constants associated with electroweak, strong and electromagnetic interactions; 2) There exists a strong interaction elementary charge in such a way that, it's squared ratio with normal elementary charge is close to inverse of the strong coupling constant; and 3) Considering a fermion-boson mass ratio of 2.27, quarks can be split into quark fermions and quark bosons. Further, we noticed that, electroweak field seems to be operated by a primordial massive fermion of rest energy 584.725 GeV and hadron masses seem to be generated by a new hadronic fermion of rest energy 103.4 GeV. In this context, starting from lepton rest masses to stellar masses, we have developed many interesting and workable relations. With further study, a workable model of final unification can be developed.

Key words: Four gravitational constants; Strong nuclear charge; Electroweak fermion; Hadron mass generator; Super symmetry;

Nomenclature	
1) Newtonian gravitational constant $= G_N$	12) Mass of proton $= m_p$
2) Electromagnetic gravitational constant $= G_e$	13) Mass of electron $= m_e$
3) Nuclear gravitational constant $= G_s$	14) Root mean square radius of proton $= R_p$
4) Weak gravitational constant $= G_w$	15) Nuclear fine structure ratio $\alpha_n \cong \left(e_s^2/4\pi\varepsilon_0\hbar c\right)$
5) Fermi's weak coupling constant $= G_F$	16) Fermion-boson mass ratio $= \Psi$
6) New electroweak fermion $= M_{wf}$	17) Hadron mass generator $= M_{hf}$
7) Reduced Planck's constant $= \hbar$	18) Proton-electron charge ratio $= \Upsilon_c \cong \left(e_s/e\right)$
8) Speed of light $= c$	19) Electron-proton specific charge ratio= $\Upsilon_{sc} \cong \left[\left(e/m_e\right) \div \left(e_s/m_p\right)\right]$
9) Strong coupling constant $= \alpha_s$	20) Range of interaction $= r_x$
10) Elementary charge $= e$	
11) Strong elementary charge $= e_s$	

1. Introduction

Even though celestial objects that show gravity are confirmed to be made up of so many atoms, so far scientists could not find any relation in between gravity and the atomic interactions at quantum gravity level [1,2]. Black hole temperature point of view [3], strong interaction point of view [4-7] and electroweak interaction point of view [8], scientists found very interesting similarities in between gravity and quantum phenomena. Quantum cosmology point of view [9] and nuclear quantum gravity point of view [10-20], we have developed many workable ideas, concepts and relations. Super symmetry point of view[21-24], we proposed a method for understanding baryon and meson masses. On a whole, workability is still lagging. It clearly indicates that, there is something wrong in our notion of understanding or there is something missing in developing the unified physical concepts and needs a critical review at fundamental level. In this context, we hope that, electroweak scale [25,26,27] can certainly yield useful stuff.

2. Basic assumptions

1) Each atomic interaction is associated with a characteristic gravitational coupling constant.
2) There exists a characteristic electroweak fermion of rest energy [18], $M_{wf}c^2 \cong 584.725$ GeV. It can be considered as the zygote of all elementary particles.
3) Fermi's weak coupling constant (G_F) can be considered as the basic unified coupling constant.
4) There exists a strong interaction elementary charge (e_s) in such a way that, it's squared ratio with normal elementary charge is close to inverse of the strong coupling constant [28].
5) There exists a hadronic fermion of rest energy $M_{hf}c^2 \cong 103.4$ GeV. It can be called as hadron mass generator.
6) Fermion - boson mass ratio is, $\Psi \cong 2.27$.

3. About the three atomic gravitational constants

What we understood is :

1) When mass of any elementary is extremely small/negligible compared to macroscopic bodies, highly curved microscopic space time can be understood with large gravitational constant.
2) Compared to particles having a structure, for point particles, magnitude of gravitational constant can be much higher.
3) Magnitude of the elementary gravitational constant seems to increase with decreasing mass and increasing interaction range of the elementary particle under consideration.

Based on these points, for each atomic interaction, one different gravitational constant can be assigned in the following way.

a) For electroweak interaction,

$$G_w M_{wf}^2 \equiv \hbar c \quad (1)$$

where,
Weak gravitational constant= G_w
Characteristic weak massive fermion = M_w

b) For strong interaction,

$$G_s m_p^2 \cong \left(\frac{e_s}{e}\right)\hbar c \quad (2)$$

where,
Nuclear or strong gravitational constant= G_e
Mass of proton = m_p
Strong elementary charge = e_s
Ordinary elementary charge = e

$$G_s m_p^2 \cong \Upsilon_c \times \hbar c \quad (3)$$

where,
Proton- electron charge ratio = $\Upsilon_c \cong \left(\frac{e_s}{e}\right)$

c) For electromagnetic interaction,

$$G_e m_e^2 \cong \left[\left(\frac{e}{m_e}\right) \div \left(\frac{e_s}{m_p}\right)\right]\hbar c \cong \left[\left(\frac{e m_p}{e_s m_e}\right)\right]\hbar c \quad (4)$$

where,
Electromagnetic gravitational constant= G_e
Mass of electron = m_e

$$G_e m_e^2 \cong \Upsilon_{sc} \times \hbar c \quad (5)$$

where,
Electron-Proton specific charge ratio=
$\Upsilon_{sc} \cong \left[\left(\frac{e}{m_e}\right) \div \left(\frac{e_s}{m_p}\right)\right]$

Based on these relations, it is possible to arrive at,

$$\frac{G_e m_e^2}{\hbar c} \cong \frac{\hbar c}{G_s m_p m_e} \cong \left(\frac{M_{wf}}{m_p}\right) \cong \sqrt{\frac{\hbar c}{G_w m_p^2}} \quad (6)$$

Out of the three (G_e, G_s, G_w), if anyone is known, other two can be estimated.

With reference to their approximate magnitudes, we noticed that,

$$\left(\frac{m_p}{m_e}\right) \cong 2\pi \sqrt{\frac{4\pi\varepsilon_0 G_e m_e^2}{e^2}} \quad (7)$$

$$\sqrt{\frac{e_s^2}{4\pi\varepsilon_0 G_s m_p m_e}} \cong 2\pi \quad (8)$$

4. Characteristic unified relations

Our assumption (2) seems to help us in two ways.

1) Our earlier proposed complicated relations can be simplified.
2) One can understand the direct role of the Newtonian gravitational constant in elementary particle physics.

Based on the above assumptions, the following new and workable relations can be developed.

$$\hbar c \cong G_w M_{wf}^2 \cong \sqrt{G_F \left(\frac{c^4}{4G_w}\right)} \quad \Rightarrow \hbar \cong \frac{G_w M_{wf}^2}{c} \cong \sqrt{\frac{G_F c^2}{4G_w}} \qquad (9)$$

where $\left(\frac{c^4}{4G_w}\right) \cong 6.9401 \times 10^{10}$ N is the characteristic force associated with electroweak interaction.

$$m_e \cong \left(\frac{G_w}{G_s}\right) M_{wf} \qquad (10)$$

$$m_p \cong \left(\frac{G_s}{G_w}\right)\left(\frac{G_s}{G_e}\right) M_w \cong \left(\frac{G_s^2}{G_w G_e}\right) M_{wf} \qquad (11)$$

$$\frac{M_{wf}}{m_e} \cong \frac{G_w^{5/2} G_e^{5/3}}{G_s^4 G_N^{1/6}} \qquad (12)$$

$$\frac{M_{wf}}{m_p} \cong \frac{G_s^{1/2} G_e^{1/6} G_N^{1/12}}{G_w^{3/4}} \qquad (13)$$

$$\frac{m_p}{m_e} \cong \frac{G_w^{13/4} G_e^{3/2}}{G_s^{9/2} G_N^{1/4}} \cong \frac{G_s^3}{G_w^2 G_e} \qquad (14)$$

5. Specific unified relations connected with strong coupling constant

Our basic idea is that, there exists a strong interaction elementary charge in such a way that, it's squared ratio with normal elementary charge is close to inverse of the strong coupling constant. Using this charge, proton magnetic moment $\left(e_s \hbar / 2m_p\right)$, nuclear fine structure ratio $\alpha_n \cong \left(e_s^2 / 4\pi\varepsilon_0 \hbar c\right)$, root mean square radius of proton $R_p \cong \left(e_s / e\right)\left(\sqrt{2}\hbar / m_p c\right)$, unified nuclear binding energy coefficient $B_0 \cong \frac{1}{2}\sqrt{\alpha \times \alpha_n}\left(m_p c^2\right)$ and Fermi gas model of nuclear potential $E_F \cong \sqrt{\alpha \times \alpha_n}\left(m_p c^2 + m_n c^2\right)$ can be fitted. Another interesting application is that, based on strong charge conservation, electromagnetic charge conservation and super symmetry, fractional charge quarks can be understood with generation of quark fermions and quark bosons.

$$\frac{m_p}{m_e} \cong \left(\frac{G_s m_p^2}{\hbar c}\right)\left(\frac{G_e m_e^2}{\hbar c}\right) \qquad (15)$$

$$\frac{m_p}{m_e} \cong \left(\frac{e_s^2}{4\pi\varepsilon_0 G_s m_p^2}\right) \Big/ \left(\frac{e^2}{4\pi\varepsilon_0 G_e m_e^2}\right) \qquad (16)$$

$$\frac{e_s}{e} \cong \sqrt{\frac{1}{\alpha_s}} \cong \left(\frac{G_s m_p^2}{\hbar c}\right) \cong \sqrt{\frac{G_s m_p^3}{G_e m_e^3}} \cong \left(\frac{G_s^5}{G_e^2 G_w^3}\right) \qquad (17)$$

$$\left(\frac{e_s}{e}\right)^2 \cong \frac{1}{\alpha_s} \cong \left(\frac{G_s m_p^2}{\hbar c}\right)^2 \cong \frac{G_s m_p^3}{G_e m_e^3} \qquad (18)$$

6. General discussion

1) Newtonian gravitational constant can be addressed with a relation of the form,

$$G_N \cong \frac{G_w^{21} G_e^{10}}{G_s^{30}} \cong 6.679855 \times 10^{-11} \text{ m}^3\text{kg}^{-1}\text{sec}^{-2} \qquad (19)$$

where,
$G_e \cong 2.374335 \times 10^{37}$ m^{3}kg^{-1}sec^{-2}
$G_s \cong 3.329561 \times 10^{28}$ m^{3}kg^{-1}sec^{-2}
$G_w \cong 2.909745 \times 10^{22}$ m^{3}kg^{-1}sec^{-2}

2) Strong coupling constant can be addressed with a relation of the form,

$$\frac{1}{\alpha_s} \cong \left(\frac{G_s^{10}}{G_e^4 G_w^6}\right) \cong (0.11519346)^{-1} \qquad (20)$$

3) Fermi's weak coupling constant can be expressed as,

$$G_F \cong \frac{1}{2} M_{wf} c^2 \left(\frac{2G_w M_{wf}}{c^2} \right)^3 \cong \frac{4\hbar^3}{M_{wf}^2 c} \quad (21)$$
$$\cong 1.4402105 \times 10^{-62} \text{ J.m}^3$$

4) If G_F and M_w, both, are fundamental, then

$$\hbar \cong \left(\frac{G_F M_{wf}^2 c}{4} \right)^{\frac{1}{3}} \quad (22)$$

5) Based on assumptions (1), (2), relation (21) and with further study, assumption (3) can be ignored.
6) We could notice that, 'Range of four interactions' can be expressed by a model relation of the form,

$$\left.\begin{array}{l} r_x \approx \left(\frac{M_{wf}}{m_p} \right) \sqrt{G_x M_x^2 \left(\frac{c^4}{4G_w} \right)^{-1}} \approx \left(\frac{M_x}{m_p} \right) \sqrt{\frac{4G_x \hbar}{c^3}} \\ \approx 0.42 \text{ fm } \left(\text{for } M_x \cong M_{wf}, G_x \cong G_w \right) \\ \approx 0.72 \text{ fm } \left(\text{for } M_x \cong m_p, G_x \cong G_s \right) \\ \approx 10.5 \text{ fm } \left(\text{for } M_x \cong m_e, G_x \cong G_e \right) \\ \approx 19.1 \text{ pm } \left(\begin{array}{l} \text{for } M_x \cong m_{atom}, G_x \cong G_e \\ \text{Atom 'as a whole' that shows} \\ \text{electromagnetic interaction} \end{array} \right) \end{array} \right\} (23)$$

where M_x, G_x, m_p, M_{wf} represent the characteristic mass of interaction, characteristic gravitational constant, proton mass and the proposed electroweak fermion respectively. Based on this relation, estimated interaction range of Sun is around 3.844×10^{22} m.
7) Our proposed '4G model' of final unification is still under its budding stage and we are working on it.

7. To understand the integral nature of electron's angular momentum

Without considering the rest mass of proton, Bohr's theory of Hydrogen atom [29] attempts to explain the discrete spectral lines. On a whole,

a) If hydrogen atom is characterized by its central mass and central charge,
b) If mass of proton is 1836 times heavier than electron,

then, ignoring proton mass in the calculation of emitted spectral lines seems to be a fundamental snag. Probably it may be the root cause of failure of developing a unified model. With our approach [30], it is possible to show that,

$$\hbar c \cong \left(\frac{G_w G_e}{G_s} \right) m_p m_e \quad (24)$$

As per the Bohr's second postulate,

$$(m_e vr) \cong n\hbar \cong n\left(\frac{1}{c} \right) \left(\frac{G_w G_e}{G_s} \right) m_p m_e \quad (25)$$

where, $n = 1, 2, 3, ..$

It can be inferred as,

$$m_e (vr) \cong \left[\left(\frac{1}{c} \right) \left(\frac{G_w G_e}{G_s} \right) (nm_p) \right] m_e \quad (26)$$

Clearly speaking, integral nature of m_p i.e. $m_p, 2m_p$, $3m_p, .. nm_p$, seems to be responsible for the integral nature of electron's angular momentum. This explanation seems to be very natural and very simple.

8. Interesting outcomes

1) Mystery of H-bar and integral nature of angular momentum [29] can be understood [30].
2) Four interaction ranges can be understood with a common expression [31].
3) Nuclear stability line can be understood with proton number [18,19,32].
4) Nuclear binding energy can be understood with 3 simple terms having single energy coefficient [18,19,32].
5) Nuclear charge radii can be fitted with a simple formula [13,33].
6) Nuclear magic numbers can be understood with quarks [32].
7) Proton and electron rest masses can be fitted.
8) Neutron and proton rest masses can be fitted [21-24].
9) Based on strong charge conservation and Super Symmetry, fractional charge quarks can be understood [34].
10) Quark fermion and quark boson masses can be estimated [21-24].

11) Baryon and meson masses can be fitted with Fluons and Bluons respectively [31].
12) Charged lepton masses and 3.5 keV galactic photons can be fitted [34,35,36,37].
13) Electroweak particle masses can be fitted[34].
14) Elementary particle melting points can be understood [5,34].
15) Neutron life time can be fitted [34,38,39,40].
16) Characteristic atomic radius can be fitted [41].
17) Stellar mass limits can be understood [19, 34,42].
18) Stellar magnetic dipole moments can be understood [43].
19) Newtonian gravitational constant can be estimated with atomic physical constants [44,45].
20) Electroweak [25-27] and Planck scales can be studied in a unified manner [34].
21) Nature of dark matter [44] can be studied with 585 GeV electroweak fermion [18].

9. Conclusion

With further study, research and confirming the existence of the proposed $\left(M_{wf}c^2\right)^{\pm} \cong 584.725$ GeV, actual essence of final unification can be understood. With further study and analysis, microscopic and macroscopic physical constants can be reviewed in a unified manner.

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