Strong nuclear gravity - a brief report

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September 14, 2011

Abstract: Key conceptual link that connects the gravitational force and non-gravitational forces is - the classical force limit $\left(\frac{c^4}{G}\right)$. For mole number of particles, if strength of gravity is $(N.G)$, any one particle's weak force magnitude is $F_W \cong \frac{1}{N} \cdot \left(\frac{c^4}{N.G}\right) \cong \frac{c^4}{N^2 G}$. Ratio of 'classical force limit' and 'weak force magnitude' is N^2. This can be considered as the beginning of 'strong nuclear gravity'. Assumed relation for strong force and weak force magnitudes is $\sqrt{\frac{F_S}{F_W}} \cong 2\pi \ln\left(N^2\right)$. If m_p is the rest mass of proton it is noticed that $\ln \sqrt{\frac{e^2}{4\pi\varepsilon_0 G m_P^2}} \cong \sqrt{\frac{m_p}{m_e} - \ln\left(N^2\right)}$. From SUSY point of view, 'integral charge quark fermion' and 'integral charge quark boson' mass ratio is $\Psi = 2.262218404$ but not unity. With these advanced concepts starting from nuclear stability to charged leptons, quarks, electroweak bosons and charged Higgs boson's origin can be understood. Finally an "alternative" to the 'standard model' can be developed.

Keywords: Avogadro number, classical gravitational constant, grand unification, strong nuclear gravity, charged lepton masses, nuclear stability, nucleon rest masses, super symmetry, quark physics and electroweak physics.

1 Introduction

Unification means : finding the similarities, finding the limiting physical constants, finding the key numbers, coupling the key physical constants, coupling the key physical concepts, coupling the key physical properties, minimizing the number of dimensions, minimizing the number of inputs and implementing the key physical constant or key number in different branches of physics. This is a very lengthy process. In all these cases observations, interpretations, experiments and imagination play a key role. The main difficulty is with interpretations and observations. As the interpretation changes physical concept changes, physical equation changes and finally the destiny changes. Universe is a very big laboratory and its life span is very large. Modern physics is having only and hardly 200 years of strong scientific back ground. Strong motivation, good reasoning, nature friendly concepts, simplicity and applicability are the most favorable and widely accepted qualities of any new model [1-3].

Note that in the atomic or nuclear physics, till today no one measured the gravitational force of attraction between the proton and electron and experimentally no one measured the value of the gravitational constant. Physicists say, if strength of strong interaction is unity, with reference to the strong interaction, strength of gravitation is 10^{-39}. The fundamental question to be answered is: is mass an inherent property of any elementary particle? 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 (observed) interactions, for 10 dimensions there may exist 10 (observable) interactions. To unify 10 interactions 20 dimensions are required. From this idea it can be suggested that- with 'n' new dimensions 'unification' problem can not be resolved.

As the culmination of his life work, Einstein wished to see a unification of gravity and electromagnetism as aspects of one single force. In modern language he wished to unite electric charge with the gravitational charge (mass) into one single entity. Further, having shown that mass the 'gravitational charge' was connected with space-time curvature, he hoped that the electric charge would likewise be so connected with some other geometrical property of space-time structure. For Einstein the existence, the mass, the charge of the electron and the proton the only elementary particles recognized back in 1920s were arbitrary features. One of the main goals of a unified theory should explain the existence and calculate the properties of matter.

Stephen Hawking - in his famous book [4]- says: It would be very difficult to construct a complete unified theory of everything in the universe all at one go. So instead we have made progress by finding partial theories that describe a limited range of happenings and by neglecting other effects or approximating them by certain numbers. (Chemistry, for example, allows us to calculate the interactions of atoms, without knowing the internal structure of an atomic nucleus.) Ultimately, however, one would hope to find a complete, consistent, unified theory that would include all these partial theories as approximations, and that did not need to be adjusted to fit the facts by picking the values of certain arbitrary numbers in the theory. The quest for such a theory is known as "the unification of physics". Einstein spent most of his later years unsuccessfully searching for a unified theory, but the time was not ripe: there were partial theories for gravity and the electromagnetic force, but very little was known about the nuclear forces. Moreover, Einstein refused to believe in the reality of quantum mechanics, despite the important role he had played in its development.

The first step in unification is to understand the origin of the rest mass of a charged elementary particle. Second step is to understand the combined effects of its electromagnetic (or charged) and gravitational interactions. Third step is to understand its behaviour with surroundings when it is created. Fourth step is to understand its behaviour with cosmic space-time or other particles. Right from its birth to death, in all these steps the underlying fact is that whether it is a strongly interacting particle or weakly interacting particle, it is having some rest mass. To understand the first 2 steps somehow one must implement the gravitational constant in sub atomic physics.

2 Gravitational constant and Avogadro number in unification

The accuracy of the measured value of G has increased only modestly since the original Cavendish experiment. G is quite difficult to measure, as gravity is much weaker than other fundamental forces, and an experimental apparatus cannot be separated from the gravitational influence of other bodies. Furthermore, gravity has no established relation to other fundamental forces, so it does not appear possible to calculate it indirectly from other constants that can be measured more accurately, as is done in some other areas of physics. 2007 recommended value [5] of G = $6.6742867 \times 10^{-11} \mathrm{m^3 Kg^{-1} sec^{-2}}$. Based on the newly developed interferometry techniques [6], measured value of G $= 6.693 \times 10^{-11} \mathrm{m^3 Kg^{-1} sec^{-2}}$. Fitting the gravitational constant with the atomic and nuclear physical constants is a challenging task.

The strong or atomic gravitational constant is supposed physical constant of strong gravitation, involved in the calculation of the gravitational attraction at the level of elementary particles and atoms. The idea of strong gravity originally referred specifically to mathematical approach of Abdus Salam of unification of gravity and quantum chromo-dynamics, but is now often used for any particle level gravity approach. In literature one can refer the works of Abdus Salam, C. Sivaram, Sabbata, A.H. Chamseddine, J. Strathdee, Usha Raut, K. P. Sinha, J.J.Perng, E. Recami, R. L. Oldershaw, K.Tennakone, S.I Fisenko and S.G.Fedosion [7-11].

The key conceptual link that connects the gravitational and non-gravitational forces is - the classical force limit $\left(\frac{c^4}{G}\right)$. This classical force limit [12] plays a vital role in Black hole and Planck scale physics. For mole number of particles, if strength of gravity is $(N.G)$, any one particle's weak force magnitude is $F_W \cong \frac{1}{N} \cdot \left(\frac{c^4}{N.G}\right) \cong \frac{c^4}{N^2 G}$. Ratio of 'classical force limit' and 'weak force magnitude' is N^2. This can be considered as the beginning of 'strong nuclear gravity'. If $\left(\frac{c^4}{G}\right)$ is the 'limit of classical force', in a grand unified scheme $\frac{c^4}{N^2G}$ can be defined as the 'characteristic weak force magnitude' and $\sqrt{\frac{e^2}{4\pi\varepsilon_0}\cdot\frac{c^4}{N^2G}}$ can be defined as the 'characteristic weak energy constant'. This can be considered as the beginning of 'strong (nuclear) gravity'[13-22].

In his large number hypothesis [23,24] Dirac compared the ratio of characteristic size of the universe and classical radius of electron with the electromagnetic and gravitational force ratio of electron and proton. If the cosmic closure density is, $\rho_0 \cong \frac{3H_0^2}{8\pi G}$, number of nucleons in a Euclidean sphere of radius $\left(\frac{c}{H_0}\right)$ is equal to $\frac{4\pi}{3m_n}\left(\frac{c}{H_0}\right)^3\cdot\frac{3H_0^2}{8\pi G} \cong \frac{c^3}{2Gm_nH_0} \cong \frac{c}{H_0} \div \frac{2Gm_n}{c^2}$. It can be suggested that coincidence of large number ratios reflects an intrinsic property of nature.

It can be supposed that elementary particles construction is much more fundamental than the black hole's construction. If one wishes to unify electroweak, strong and gravitational interactions it is a must to implement the classical gravitational constant G in the sub atomic physics. By any reason if one implements the planck scale in elementary particle physics and nuclear physics automatically G comes into subatomic physics. Then a large 'arbitrary number' has to be considered as a proportionality constant. With this large arbitrary number it is be possible to understand the mystery of the strong interaction and strength of gravitation. The basic and important problem is : How to select the 'arbitrary number' ? For this purpose 'mole' concept can be considered as a fundamental tool. The combination of Avogadro number and the classical gravitational constant generates the 'effective' 'strong gravitational constant'. Semi empirically it is noticed that

$$\ln\sqrt{\frac{e^2}{4\pi\varepsilon_0 G m_P^2}} \cong \sqrt{\frac{m_p}{m_e} - \ln\left(N^2\right)} \quad (1)$$

where m_p is the proton rest mass and m_e is the electron rest mass. From this expression

$$G \cong \left(e^{\sqrt{\frac{m_p}{m_e} - \ln(N^2)}}\right)^{-2}\cdot\frac{e^2}{4\pi\varepsilon_0 m_P^2} \cong 6.666270179\times10^{-11}\ \mathrm{m^3Kg^{-1}sec^{-2}} \quad (2)$$

Here the important question is: What is the role of squared Avogadro number in grand unified physics? In the foregoing sections it is discussed in depth with many interesting results.

3 To fit the gravitational constant with atomic constants

It is well established that, in β decay, neutron emits an electron and transforms to proton. Thus the nuclear charge changes and the nucleus gets stability. From the semi empirical mass formula, it is established that,

$$Z \cong \frac{A}{2 + (E_c/2E_a)\, A^{2/3}}. \tag{3}$$

where Z = number of protons of the stable nucleus and A =number of nucleons in the stable nucleus. E_a and E_c are the asymmetry and coulombic energy constants. Semi empirically it is noticed that,

$$A_S \cong 2Z + \frac{Z^2}{S_f} \cong 2Z + \frac{Z^2}{157.069} \tag{4}$$

Here S_f is a new number and can be called as the nuclear stability factor and A_S is stable mass number. With reference to the ratio of neutron and electron rest masses, S_f can be expressed

$$S_f \cong \sqrt{\alpha} \cdot \frac{m_n}{m_e} \cong 157.0687113 \tag{5}$$

Here α is the fine structure ratio. If Z= 21, A_S = 44.8, Z= 29, A_S = 63.35, Z=47, A_S = 108.06, Z=79, A_S = 197.73 and Z=92, A_S = 237.88. By considering A as the fundamental input its corresponding stable Z = Z_S takes the following form.

$$Z_S \cong \left[\sqrt{\frac{A}{157.069} + 1} - 1\right] 157.069 \tag{6}$$

Thus Green's stability formula in terms of Z takes the following form.

$$\frac{0.4A^2}{A + 200} \cong A_S - 2Z \cong \frac{Z^2}{S_f}. \tag{7}$$

Surprisingly it is noticed that this number S_f plays a crucial role in fitting the nucleons rest mass. Another interesting observation is that

$$(m_n - m_p)\, c^2 \cong \ln\left(\sqrt{S_f}\right) m_e c^2 \cong 1.29198 \text{ MeV} \tag{8}$$

Here m_n, m_p and m_e are the rest masses of neutron, proton and electron respectively. Semi empirically it is noticed that

$$\frac{E_c}{2E_a} \cdot \frac{e^{S_f}}{N} \cong \frac{e^2}{4\pi\varepsilon_0 G m_e^2} \tag{9}$$

Electron rest mass can be expressed as

$$m_e \cong \sqrt{\frac{2E_a}{E_c} \cdot \frac{N}{e^{S_f}}} \cdot \sqrt{\frac{e^2}{4\pi\varepsilon_0 G}} \tag{10}$$

Here N is the Avogadro number. $\frac{e^2}{4\pi\varepsilon_0 G m_e^2}$ is the electromagnetic and gravitational force ratio of electron. In this proposal the important questions are:

What is the role of Avogadro number in β decay ? and How to interpret the expression $\sqrt{\frac{e^2}{4\pi\varepsilon_0 G}}$? This is a multipurpose expression. Either the value of Avogadro number or the value of gravitational constant can be fitted. From the semi empirical mass formula if E_a= 23.21 MeV and E_c= 0.71 MeV,

$$G \cong \frac{2E_a}{E_c} \cdot \frac{N}{e^{S_f}} \cdot \frac{e^2}{4\pi\varepsilon_0 m_e^2} \cong 6.6866323 \times 10^{-11} \text{ m}^3\text{Kg}^{-1}\text{sec}^{-2} \tag{11}$$

Since all other atomic constants are well measured, accuracy of G only depends upon E_a and E_c of the semi empirical mass formula. Multiplying and dividing RHS of equation (10) by N

$$m_e c^2 \cong \sqrt{\frac{2E_a}{E_c} \cdot \frac{N^3}{e^{S_f}}} \cdot \sqrt{\frac{e^2}{4\pi\varepsilon_0} \cdot \frac{c^4}{N^2 G}} \cong X_E \cdot \sqrt{\frac{e^2}{4\pi\varepsilon_0} \cdot \frac{c^4}{N^2 G}} \tag{12}$$

where $X_E \cong \sqrt{\frac{2E_a}{E_c} \cdot \frac{N^3}{e^{S_f}}}$ can be called as the 'gravitational mass generator' of electron.

$$X_E \cong \sqrt{\frac{2E_a}{E_c} \cdot \frac{N^3}{e^{S_f}}} \cong N\sqrt{\frac{4\pi\varepsilon_0 G m_e^2}{e^2}} \cong 295.0606338 \tag{13}$$

$$\sqrt{\frac{e^2}{4\pi\varepsilon_0 N^2 G}} \cong 3.087291597 \times 10^{-33} \text{ Kg} \tag{14}$$

$$\frac{c^4}{N^2 G} \cong 3.337152088 \times 10^{-4} \text{ newton} \tag{15}$$

$$\sqrt{\frac{e^2 c^4}{4\pi\varepsilon_0 N^2 G}} \cong \sqrt{\frac{e^2}{4\pi\varepsilon_0} \cdot \frac{c^4}{N^2 G}} \cong 1.731843735 \times 10^{-3} \text{ MeV} \tag{16}$$

4 The beginning of Strong nuclear gravity

1. For any one elementary particle of mass m_0, magnitude of gravitational constant is G only. As the number of particles increases to Avogadro number (N), magnitude of gravitational constant approaches $N.G$. Mass of the system approaches to $N.m_0$. This idea leads to "nuclear strong gravity" in the following way.

2. Based on strong gravity, similar to the 'Schwarzschild radius', size of the system can be expressed as $R_N \cong \frac{2(NG)(Nm_0)}{c^2}$. Volume of one particle can be expressed as total volume divided by Avogadro number = $\frac{4\pi}{3N} R_N^3$.

3. Similar to the classical force limit $\frac{c^4}{G}$, force required to bind N particles can be expressed as $\frac{c^4}{(NG)}$. Force required to bind one particle is $\frac{1}{N} \cdot \frac{c^4}{NG} \cong \frac{c^4}{N^2 G}$. Rest energy of electron is very close to $m_e c^2 \cong 8\pi\sqrt{\hbar c \cdot \frac{c^4}{N^2 G}} \cong \frac{8\pi}{\sqrt{\alpha}}\sqrt{\frac{e^2}{4\pi\varepsilon_0} \cdot \frac{c^4}{N^2 G}} \cong 0.50952547$ MeV.

4. If nuclear charge radius or characteristic size of nucleus is$R_0 \approx 1.20$ fm, its volume $V_0 \cong \frac{4\pi}{3}R_0^3$ and total volume of N nucleons is $V_N \cong N \cdot \frac{4\pi}{3}R_0^3$. Thus size of N nucleons is $R_N \cong N^{\frac{1}{3}}R_0 \cong \frac{2(NG)(Nm_0)}{c^2}$. Then rest energy of nucleon comes out to be $\mathrm{m_0c^2} \approx 105\ MeV$. This is not matching with the rest energy of nucleon but matching with the geometric mean of nucleon rest energy and its pairing energy constant, 12 MeV. If α_s is the strong coupling constant, it is noticed that $\frac{1}{\alpha_s}\mathrm{m_0c^2} \approx 939\ MeV$ and $\alpha_s \cdot \mathrm{m_0c^2} \approx 12$ MeV. More over it is noticed that $\mathrm{m_0c^2} \approx 105\ MeV$ is close to "half of the QCD energy scale" $\approx 217\ MeV$. It is also noticed that $\ln\sqrt{\frac{c^4}{N^2G} \div \frac{e^2}{4\pi\varepsilon_o R_N^2}} \cong \frac{1}{\sqrt{\alpha}}$.

5. Considering m_0 as a characteristic strong interaction energy constant it is noticed that $\sqrt{e^{\frac{m_0}{m_e}}} \times \frac{Gm_e^2}{c} \cong e^{\frac{m_0}{2m_e}} \times \frac{Gm_e^2}{c} \cong \hbar$. Here m_e is the rest mass of electron. If so it can be represented as $\frac{m_0}{m_e} \cong \ln\left(\frac{\hbar c}{Gm_e^2}\right)^2 \cong 206.1113643$ and $\mathrm{m_0c^2} \cong 105.3226825\ MeV$.

6. Considering strong interaction, inverse of the 'strong coupling constant' can be expressed as $\frac{1}{\alpha_s} \approx \ln\sqrt{\frac{2(G)(Nm_0)}{c^2} \div \frac{\hbar}{(Nm_0)c}} \cong 8.9020493 \cong \frac{1}{0.112334} \cong X_S$. Interpretation seems to be $\frac{2(G)(Nm_0)}{c^2}$ is the black hole radius of (Nm_0) in free space and $\frac{\hbar}{(Nm_0)c}$ is the Compton length of (Nm_0). Natural logarithm of square root of ratio of these two lengths represents the inverse of the 'strong coupling constant'.

7. Another fit is $R_0 \cong \left(\frac{m_e}{m_0}\right)^3 \cdot \frac{NG\sqrt{(Nm_p)(Nm_e)}}{c^2} \cong \left(\frac{m_e}{m_0}\right)^3 \cdot \left(\frac{N^2G}{c^4}\right) \cdot \sqrt{m_p m_e}\ c^2 \cong$ 1.2 fm where m_p is the rest mass of proton.

8. It also noticed that $R_0 \cong \frac{1}{N^2} \cdot \left(\frac{\hbar c}{Gm_e^2}\right)^2 \cdot \frac{2Gm_e}{c^2} \cong \frac{e^{\frac{m_0}{m_e}}}{N^2} \cdot \frac{2Gm_e}{c^2}$. It can be expressed as $\hbar \cong m_e\sqrt{\frac{(NG)(Nm_e)R_0}{2}}$ or $\frac{\hbar}{m_e} \cong \sqrt{\frac{(NG)(Nm_e)R_0}{2}}$. Whether it is real or imaginary, this is a very strange and interesting relation.

9. Thus it is noticed that, $R_0 \cong \sqrt{\frac{\sqrt{m_p m_e}}{m_0}} \cdot \frac{\sqrt{2}\hbar}{m_0 c} \cong 1.2081$ fm. Interesting observation is $\sqrt{\frac{\sqrt{m_p m_e}}{m_0}} \cdot \frac{\hbar}{m_0 c} \cong 0.8543$ fm. This can be compared with the 'rms' radius of proton. It can be suggested that, in nuclear electron scattering experiments minimum distance between proton and electron is close to $\sqrt{2}$ times the proton size.

10. Considering the rest mass of electron, its gravitational mass generator can be expressed as $X_E \cong m_e c^2 \div \sqrt{\frac{e^2}{4\pi\varepsilon_0}\left(\frac{c^4}{N^2G}\right)} \cong 295.0606338$. Using this number, tau and muon masses can be fitted accurately.

11. $\sqrt{\frac{e^2c^4}{4\pi\epsilon_0 N^2G}} \cong 0.0017318\ MeV$ can be considered as the basic electromagnetic mass unit. It can be compared with the characteristic mass unit of

'dark matter'.

12. Product (αX_E) can be considered as the ratio of down and up quark masses and can also be considered as the 'inverse' of the weak coupling angle. Inverse of the 'strong coupling constant' can also be expressed as $\frac{1}{\alpha_s} \cong \ln\left(X_E^2\sqrt{\alpha}\right) \cong 8.91424 \cong X_S$. It is also noticed that in Hydrogen atom $\frac{a_0}{R_0} \cong \frac{X_E^2}{2}$ where a_0 is the Bohr radius of electron.

13. Total energy of electron in Hydrogen atom is $\left(\frac{\alpha^2}{2}\right) m_e c^2 \cong G_F \left(\frac{\hbar}{m_0 c}\right)^{-3}$ where G_F is the fermi's weak coupling constant. Thus the famous Fermi's weak coupling constant can be expressed as $G_F \cong \left(\frac{\alpha^2}{2}\right) m_e c^2 \left(\frac{\hbar}{m_0 c}\right)^3 \cong \left(\frac{m_e}{m_0}\right)\left(\frac{e^2}{4\pi\varepsilon_o m_0 c^2}\right)^2 \left(\frac{\hbar c}{2}\right) \approx \frac{1}{3}\left(\frac{e^2}{4\pi\varepsilon_o m_0 c^2}\right)^3 m_0 c^2$.

14. For any black hole if its density approaches the nuclear mass density its mass approaches to $\mathrm{M_F} \cong \left(\frac{\hbar c}{(NG)m_e^2}\right)^3 \cdot \sqrt{\frac{m_e^3}{m_n}} \cong 1.81 \times 10^{31}$ Kg and can be called as the **Fermi black hole mass limit**. Ratio of **Fermi black hole mass limit** and **Chandrasekhar's mass limit** is 2π.

15. Strong interaction range can be expressed as $b \cong \frac{M_F}{M_P} \cdot \frac{2Gm_n}{c^2} \cong 2.06$ fm where m_n is the average rest mass of nucleon and M_P is planck mass.

5 Proposed new concepts and semi empirical results in Strong nuclear gravity

1. N being the Avogadro number, mole number of particles effective atomic gravitational constant G_A is equal to N times the classical gravitational constant G.

2. In mole particles, nuclear weak force magnitude for one one particle is $F_W \cong \frac{c^4}{NG_A} \cong 3.337152088 \times 10^{-4}$ newton. Nuclear strong force and weak force magnitudes can be correlated as $\sqrt{\frac{F_S}{F_W}} \cong 2\pi \ln\left(N^2\right)$. Thus $F_S \cong 157.9944058$ newton.

3. Fine structure ratio is $\frac{1}{\alpha} \cong \frac{1}{2}\sqrt{X_E^2 - \left[\ln\left(N^2\right)\right]^2} \cong 136.9930484$. It can be expressed as $\frac{1}{\alpha} \cong \frac{1}{2}\sqrt{X_E^2 - \left(\frac{F_S}{4\pi^2 F_W}\right)} \cong 137.036$.

4. Characteristic nuclear size is $R_0 \cong \sqrt{\frac{e^2}{4\pi\varepsilon_0 F_S}} \cong 1.208398568$ fm.

5. Nuclear weak energy constant is $E_W \cong \sqrt{\frac{e^2 F_W}{4\pi\varepsilon_0}} \cong 1.731844 \times 10^{-3}$ MeV.

6. Muon and tau rest energy $= \left(mc^2\right)_n \cong \left[X_E^3 + \left(n^2 X_E\right)^n \sqrt{N}\right]^{\frac{1}{3}} E_W$ where n = 1 and 2. At n = 1, $\left(mc^2\right) \cong 105.95$ MeV, n = 2, $\left(mc^2\right) \cong 1777.4$ MeV. At n = 3 predicted heavy charged lepton rest energy is 42260 MeV.

7. The proton-nucleon nuclear stability factor is $S_f \cong X_E - \frac{1}{\alpha} - 1 \cong 157.0246441$. Proton and nucleon stability relation can be expressed as, stable mass number $= A_S \cong 2Z + \frac{Z^2}{S_f}$ where Z is the proton number.

8. At n = 1 and n = 2, with reference to electron rest mass , neutron and proton rest energy $= \left(mc^2\right)_n \cong \frac{S_f}{\sqrt{\alpha}} m_e c^2 - x\left(2^x + \frac{E_c}{2E_a}\right) m_e c^2$ where $x = (-1)^n$, E_c and E_a are the coulombic and asymmetry energy constants of semi empirical mass formula.

9. Nuclear strong energy constant is $E_S \cong \sqrt{\frac{e^2 F_S}{4\pi\varepsilon_0}} \cong 1.191630355$ MeV and nuclear coulombic energy constant is $E_c \cong \frac{3}{5} E_S \cong 0.715$ MeV.

10. Proton rest mass is $m_p c^2 \cong \left(\frac{F_S}{F_W} + X_E^2 - \frac{1}{\alpha^2}\right) E_W \cong 938.1791391$ MeV. Neutron, proton mass difference is $m_n c^2 - m_p c^2 \cong \sqrt{\frac{F_S}{F_W} + X_E^2} \cdot E_W \cong$ 1.29657348 MeV.

11. Electroweak energy scale is $\varepsilon_W \cong \frac{F_S}{F_W} \times m_e c^2 \cong \frac{F_S}{F_W} \times 0.511 \cong 241927.75$ MeV. This is a very simple confirmation for the proposed definitions of F_S and F_W.

12. Weak coupling angle is $\sin\theta_W \cong \frac{1}{\alpha X_E} \cong 0.464433353 \cong \frac{\text{Up quark mass}}{\text{Down quark mass}}$.

13. Relation between electron rest mass and up quark rest mass can be expressed as $\frac{Uc^2}{m_e c^2} \cong \left[\frac{m_e^2 c^4}{\hbar c F_W}\right]^{\frac{1}{3}} \cong 8.596650881 \cong e^{\alpha X_E}$. Relation between up quark and down quark rest masses is $\frac{Dc^2}{Uc^2} \cong \ln\left[\frac{Uc^2}{m_e c^2}\right] \cong 2.151372695 \cong \alpha X_E$. Up, strange and bottom quarks are in first geometric series and Down, charm and top quarks are in second geometric series.

14. USB geometric ratio is $g_U \cong \left[\frac{D}{U} \cdot \frac{D+U}{D-U}\right]^2 \cong \left[\alpha X_E \cdot \frac{\alpha X_E + 1}{\alpha X_E - 1}\right]^2 \cong 34.66$ and DCT geometric ratio is $g_D \cong \left[2 \cdot \frac{D}{U} \cdot \frac{D+U}{D-U}\right]^2 \cong \left[2 \cdot \alpha X_E \cdot \frac{\alpha X_E + 1}{\alpha X_E - 1}\right]^2 \cong$ $138.64 \cong 4r_U$.

15. Surprisingly it is also noticed that $\frac{1}{\alpha_s} \cong \ln\left(r_U r_D\right) \cong 8.4747 \cong \frac{1}{0.1179598}$. Interesting observation is $\left(\frac{1}{\alpha} + \frac{1}{\alpha_s}\right)\sqrt{UD} \cdot c^2 \cong m_p c^2$ and $\frac{\sqrt{UD} \cdot c^2}{(m_n - m_p)c^2} \cong \ln\left(\frac{1}{\alpha} + \frac{1}{\alpha_s}\right)$ where m_p and m_n are the rest masss of proton and neutron.

16. Magnetic moment of electron is $\mu_B \cong \frac{ec}{2}\sqrt{\frac{e^2}{4\pi\varepsilon_0 F_W}}\sin\theta_W$ and magnetic moment of nucleon is $\mu_n \cong \frac{ec}{2}\sqrt{\frac{e^2}{4\pi\varepsilon_0 F_S}}\sin\theta_W \cong \frac{ecR_0}{2}\sin\theta_W$ where R_0 is unit nuclear size or nucleon size.

17. If nucleon's magnetic moment follows the expression, $\mu \cong \frac{ecR_0}{2} sin\theta_W$, it is noticed that for proton and neutron, $R_0 \cong e^{X_E}\left(\frac{Gm_e^2}{\hbar c}\right)^2 \frac{2Gm_n}{c^2} \pm \frac{\hbar}{m_n c} \cong$ 1.27 fm and 0.85 fm where $e^{X_E}\left(\frac{Gm_e^2}{\hbar c}\right)^2 \frac{2Gm_n}{c^2} \cong 1.06$ fm.

18. Total energy of electron in hydrogen atom can be expressed as $\frac{e^2}{8\pi\varepsilon_0 a_0} \cong \frac{1}{2}\alpha^2 m_e c^2 \cong \frac{1}{X_E^2}\times\sqrt{\frac{e^2 F_S}{4\pi\varepsilon_0}} \cong \frac{1}{X_E^2}\times\frac{e^2}{4\pi\varepsilon_0 R_0}$. Here a_0 is the Bohr radius and R_0 is the nuclear characteristic size. Thus it is noticed that $\hbar \cong N\sqrt{\frac{Gm_e^3 R_0}{2}}$ and $\frac{a_0}{R_0} \cong \frac{X_E^2}{2}$.

19. $X_S \cong \ln\left(X_E^2\sqrt{\alpha}\right) \cong 8.91424 \cong \frac{1}{\alpha_s}$ can be considered as 'inverse of the strong coupling constant'.

20. With reference to proton rest energy, semi empirical mass formula coulombic energy constant can be expressed as $E_c \cong \frac{\alpha}{X_S}\cdot m_p c^2 \cong \alpha\cdot\alpha_s\cdot m_p c^2 \cong 0.7681\ MeV$.

21. Pairing energy constant is close to $E_p \cong \frac{m_p c^2 + m_n c^2}{S_f} \cong 11.959$ MeV and asymmetry energy constant can be expressed as $E_a \cong 2E_p \cong 23.918$ MeV.

22. Volume and surface energy constants and asymmetric and pairing energy constants can be related as $E_a - E_v \cong E_s - E_p \cong (X_S+1)E_c \cong$ 7.615 MeV. $E_v + E_s \cong E_a + E_p \cong 3E_p$. Thus $E_v \cong 16.303$ MeV and $E_s \cong 19.574$ MeV.

23. It is also noticed that, $\frac{E_a}{E_v} \cong 1+\sin\theta_W$ and $\frac{E_a}{E_s} \cong 1+\sin^2\theta_W$. Thus $E_v \cong 16.332$ MeV and $E_s \cong 19.674$ MeV.

24. Nuclear binding energy can be fitted with 2 terms or 5 factors with $E_c \cong 0.7681$MeV as the single energy constant. First term $= T_1 \cong (f)(A+1)\ln\left[(A+1)X_S\right]E_c$, second term $= T_2 \cong \left[\frac{A^2+\left(f.Z^2\right)}{X_S^2}\right]E_c$ where $f \cong 1+\frac{2Z}{A_S} \cong \frac{4S_f+Z}{2S_f+Z} < 2$ and $A_S \cong 2Z+\frac{Z^2}{S_f} \cong 2Z+\frac{Z^2}{157.025}$. Close to the stable mass number, binding energy $= T_1 - T_2$.

6 Basic concepts and semi empirical results in 'modified' super symmetry

1. There exists a strongly interacting confined fermion of rest energy $M_{Sf}c^2 \cong m_o c^2 \equiv 105.3226825$ MeV. Its boson rest energy can be expressed as

$M_{Sb}c^2 \cong \frac{M_{sf}c^2}{\Psi} \cong 46.6$ MeV where $\Psi \approx 2.26$ is the fermion and boson mass ratio. In particle physics these mass units play a very interesting role.

2. In SUSY it is assumed that $m_e \cong \alpha.\sqrt{M_{Sf}.M_{Sb}} \cong \alpha.\sqrt{M_{Sf}.\left(\frac{M_{Sf}}{\Psi}\right)}$. In this way value of $\Psi \cong 2.262218404$ is fitted. If m_f and m_b are the rest masses of fermion and boson, $m_b \cong \frac{m_f}{\Psi}$. Interesting thing is that $\left(1-\frac{1}{\Psi}\right)m_f$ acts as the effective fermion.

3. For any massive particle, $\frac{\text{mass}}{X_E} \cong \frac{\text{mass}}{295.0606338}$ can be called its electromagnetic mass. Fine structure ratio $= \alpha^2 \cong \frac{e^2 F_W}{4\pi\varepsilon_0}\left(\frac{M_{Sf}c^2}{X_E}\right)^{-1}\left(\frac{M_{Sb}c^2}{X_E}\right)^{-1}$.

4. Fermi's weak coupling constant $= G_F \cong \frac{1}{2\sqrt{\Psi}}\left(\frac{e^2}{4\pi\varepsilon_0 M_{sf}c^2}\right)^3 M_{Sf}c^2 \cong \frac{1}{2}\left(\frac{e^2}{4\pi\varepsilon_0 M_{sf}c^2}\right)^3\sqrt{M_{Sf}M_{Sb}}\cdot c^2 \cong 1.43358632 \times 10^{-62}\ \text{Jm}^3$.

5. Characteristic nuclear fermion is $X_S.M_{Sf}c^2 \cong 938.8716604$ MeV and its corresponding nuclear boson is $M_{Sb}c^2 \cong \frac{X_S M_{Sf}c^2}{\Psi} \cong \frac{938.8716604}{\Psi} \cong 415.0225543$ MeV. This boson is the mother of presently believed strange mesons like 493, 548, 1020 MeV etc.

6. There exists Higgs charged fermion of rest energy $M_{Hf}c^2 \cong 103125.417$ MeV. Its corresponding Higgs charged boson rest energy is $M_{Hb}c^2 \cong \frac{M_{Hf}c^2}{\Psi} \cong 45585.97\ MeV$. With reference to Beta decay, it is noticed that $\frac{m_e c^2}{F_W R_0} \cong \frac{M_{Hf}}{m_e} \cong \frac{1}{2}\left(\frac{m_e^2 c^4}{\hbar c F_W}\right)^2$.

7. Higgs charged boson pair generates the electro weak neutral Z boson. Top quark boson is nothing but the SUSY electroweak W boson. Higgs charged boson and W boson couples together to form a neutral boson of rest energy 126 GeV. W boson pair generates a neutral boson of rest energy 161 GeV.

8. **If a charged quark flavor rests in a fermionic container it is a quark fermion. Similarly if a charged quark flavor rests in a bosonic container it is a quark boson. Strong interaction charge contains multiple flavors and can be called as the hybrid (charge) quark. No three quark fermions couples together to form a baryon and no two quark fermions couples together to form a meson**.

9. There exists nature friendly **integral charge quark fermions** and **integral charge quark bosons**. If Q_f and Q_b are the rest masses of quark fermion and quark boson respectively, $Q_b \cong \frac{Q_f}{\Psi}$. Interesting thing is that $Q_{ef} \cong \left(1-\frac{1}{\Psi}\right)Q_f \cong Q_f - Q_b$ acts as the effective fermion.

10. There exists integral charged massive quark fermi-gluons and integral charged massive quark boso-gluons. Fermi-gluon means massive gluons

Quark	Q_f MeV	Q_F MeV	Q_{ef} MeV	Q_E MeV
Up	4.4	**833.973**	2.455	686.571
Down	9.4755	**1076.966**	5.287	886.615
Strange	152.5427	2719.35	85.11	2238.71
Charm	1313.796	5574.13	733.04	4588.92
Bottom	5287.579	8866.525	2950.24	7299.393
Top	182160.18	28850.43	101637.37	23751.20

Table 1: Proposed quark fermion family rest energies.

Quark	Q_b MeV	Q_B MeV
Up	1.945	368.65
Down	4.189	476.07
Strange	67.43	1202.07
Charm	580.756	2464.01
Bottom	2337.34	3919.39
Top	**80522.81**	12753.16

Table 2: Proposed quark boson and quark meson rest energies.

having fermion behavior and boso-gluon means massive gluons having boson behavior. Quark femi-gluon can be called as the 'quark baryon' and quark boso-gluon can be called as 'quark meson'.

11. Quark fermions convert into quark baryons and effective quark fermions convert into effective quark baryons. Similarly quark bosons convert into quark mesons. Effective quark baryons generates charged and unstable multi flavour baryons.'**Integral charge light quark bosons'** in one or two numbers couples with the ground or excited **effective quark baryons** and generates **doublets and triplets**. This is just like 'absorption of photons by the electron'. Please see tables 1 and 2 for the proposed 'quark fermion family' and 'quark boson family' rest energies.

12. Quark baryon rest energy $= Q_F c^2 \cong \frac{\sin\theta_W}{2}\left[M_{Hf}^2 \times Q_f\right]^{\frac{1}{3}} c^2$ and Quark boso-gluon or quark meson rest energy $= Q_B c^2 \cong \frac{\sin\theta_W}{2}\left[M_{Hb}^2 \times Q_b\right]^{\frac{1}{3}} c^2$. Accuracy point of view $\frac{\sin\theta_W}{2}$ can be replaced with $\frac{1}{2\alpha(X_E+1)}$.

13. Rest energy of nucleon is close to $\left(\frac{2U_F D_F}{U_F+D_F}\right)c^2 \cong 940.02$ MeV and nucleon rest energy difference is close to $(m_n - m_p)\, c^2 \cong \sin^2\theta_W \cdot \left(\frac{2U_f D_f}{U_f+D_f}\right)c^2 \cong$ 1.29623 MeV.

14. Effective quark baryon rest energy $= Q_E c^2 \cong \frac{\sin\theta_W}{2}\left[M_{Hf}^2 \times Q_{ef}\right]^{\frac{1}{3}} c^2$. These effective quark baryons play a vital role in fitting the unstable

baryon masses. Quark meson masses play a vital role in fitting the unstable meson masses.

15. Charged ground state baryon rest energy is close to $(Q_{E1}Q_{E2})^{\frac{1}{2}}\,c^2$ or $\left(Q_{E1}Q_{E2}^2\right)^{\frac{1}{3}}\,c^2$ or $(Q_{E1}Q_{E2}Q_{E3})^{\frac{1}{3}}\,c^2$ where Q_{E1}, Q_{E2}, and Q_{E3} represents any three effective quark baryons.

16. Neutral ground state meson rest energy is close to $(Q_{B1}+Q_{B2})\,c^2$ where Q_{B1} and Q_{B2} represents any two quark mesons.

17. Fine rotational levels of any ground state energy m_xc^2 can be expressed as, if n =1,2,3, $\left(mc^2\right)_I \cong [n\,(n+1)]^{\frac{1}{4}}\,m_xc^2 \cong [I]^{\frac{1}{4}}\,m_xc^2$ and $\left(mc^2\right)_{I/2} \cong \left[\frac{n(n+1)}{2}\right]^{\frac{1}{4}} m_xc^2 \cong \left[\frac{I}{2}\right]^{\frac{1}{4}} m_xc^2$. Super fine rotational levels can be expressed as $\left(mc^2\right)_I \cong [n\,(n+1)]^{\frac{1}{12}}\,m_xc^2 \cong [I]^{\frac{1}{12}}\,m_xc^2$ and $\left(mc^2\right)_{I/2} \cong \left[\frac{n(n+1)}{2}\right]^{\frac{1}{12}} m_xc^2 \cong \left[\frac{I}{2}\right]^{\frac{1}{12}} m_xc^2$.

7 Conclusion

Now a days scientists are vigorously trying to couple the GTR and quantum mechanics. Authors showed many applications in this new direction. Developing a true grand unified theory at 'one go' is not an easy task. In this critical situation, qualitatively proposed semi empirical relations can be given a chance in understanding and developing the grand unified concepts. Here one important and interesting observation is fitting the gravitational constant with the atomic and nuclear physical constants. This can be considered as the beginning of "**strong (nuclear) gravity**". An alternative to the standard model can be developed. Authors request the world science community to kindly look into this new approach.

Acknowledgements

First author is very much thankful to professor S. Lakshminarayana, Dept. of Nuclear physics, Andhra university, India for his kind and valuable guidance. Same author is indebted to professor 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 (I-SERVE), Hyderabad, India for their valuable guidance and great support in developing this subject. Authors are very much thankful to the editors and referees of International Journal of Modern Physics E, Hadronic Journal, Journal of Nuclear Physics, Progress in Physics and Journal of vectorial relativity.

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