The 3 atomic forces and the strong coupling constant

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Abstract: Key conceptual link that connects the gravitational force and non-gravitational forces is - the classical force limit, $F_C \cong \left(\frac{c^4}{G}\right)$. Nuclear weak force magnitude is $F_W \cong \frac{F_C}{N^2}$ where N is the Avogadro number. Relation between the nuclear strong force and weak force magnitudes can be expressed as $\sqrt{\frac{F_S}{F_W}} \cong 2\pi \ln\left(N^2\right)$. It is noticed that there exists simple relations in between the nuclear strong force, weak force and the force on the revolving electron in the Bohr radius of the Hydrogen atom. An attempt is made to couple the strong coupling constant with these 3 forces.

Keywords: Avogadro number; nuclear strong force; nuclear weak force; weak coupling angle; up and down quark mass ratio; up quark and electron mass ratio; proton and electron mass ratio; neutron and proton mass difference; strong coupling constant;

1 Introduction

In the earlier published papers authors [1,2] proposed many interesting ideas in 'strong gravity' and 'super symmetry'. The subject of unification is very interesting and very complicated. By implementing the Avogadro number as a scaling factor in unification program, one can probe the constructional secrets of elementary particles. The Planck's quantum theory of light, thermodynamics of stars, black holes and cosmology totally depends upon the famous Boltzmann constant which in turn depends on the Avogadro number [3]. From this it can be suggested that, Avogadro number is more fundamental and characteristic than the Boltzmann constant and indirectly plays a crucial role in the formulation of the quantum theory of radiation. In this connection authors proposed the following four assumptions.

2 Key assumptions in unification

Assumption-1

Nucleon behaves as if it constitutes molar electron mass. Molar electron mass $(N.m_e)$ plays a crucial role in nuclear and particle physics.

Assumption-2

The key conceptual link that connects the gravitational and non-gravitational forces is - the classical force limit

$$F_C \cong \left(\frac{c^4}{G}\right) \cong 1.21026 \times 10^{44} \text{ newton} \tag{1}$$

It can be considered as the upper limit of the string tension. In its inverse form it appears in Einstein's theory of gravitation as $\frac{8\pi G}{c^4}$. It has multiple applications in Black hole physics and Planck scale physics [4]. It has to be measured either from the experiments or from the cosmic and astronomical observations.

Assumption-3

Ratio of 'classical force limit $= F_C$' and 'weak force magnitude $= F_W$, ' is N^2 where N is a large number close to the Avogadro number.

$$\frac{F_C}{F_W} \cong N^2 \cong \frac{\text{Upper limit of classical force}}{\text{nuclear weak force magnitude}} \tag{2}$$

Thus the proposed weak force magnitude is $F_W \cong \frac{c^4}{N^2 G} \cong 3.33715 \times 10^{-4}$ newton and can be considered as the characteristic nuclear weak string tension. It can be measured in the particle accelerators.

Assumption-4

The strong force magnitude can be defined as follows.

$$\sqrt{\frac{F_S}{F_W}} \cong 2\pi \ln\left(N^2\right) \cong 4\pi \ln(N) \tag{3}$$

Thus $F_S \cong 157.9944$ newton.

2.1 The lepton-quark mass generator

In the earlier published papers [1,2] it was defined that X_E

$$X_E \cong \sqrt{\frac{4\pi\epsilon_0 G\left(N.m_e\right)^2}{e^2}} \cong 295.0606338 \tag{4}$$

where N is the Avogadro number, G is the gravitational constant and m_e is the rest mass of electron. It can be called as the lepton-quark-nucleon gravitational mass generator. It plays a very interesting role in nuclear and particle physics. Using this number lepton and quark rest masses can be fitted [1]. Weak coupling angle was defined as

$$\frac{m_u c^2}{m_d c^2} \cong \sin\theta_W \cong \frac{1}{X_E \alpha} \cong 0.464433353 \tag{5}$$

where m_u is the rest mass of up quark, m_d is the rest mass of down quark and $\sin\theta_W$ is the weak coupling angle. In the modified Susy the fermion and boson mass ratio Ψ can be fitted in the following way.

$$\Psi^2 \ln\left(1+\sin^2\theta_W\right) \cong 1 \tag{6}$$

Thus $\Psi \cong 2.262706$. If m_f is the mass of fermion and m_b is the mass of its corresponding boson then

$$m_b \cong \frac{m_f}{\Psi} \tag{7}$$

With this idea super symmetry can be observed in the strong interactions [1] and can also be observed in the electroweak interactions [2].

2.2 Strong force magnitude and its applications in nuclear physics

The characteristic nuclear size is

$$R_0 \cong \sqrt{\frac{e^2}{4\pi\varepsilon_0 F_S}} \cong 1.2084 \text{ fm} \tag{8}$$

Magnetic moment of electron is close to

$$\mu_n \cong \frac{1}{2}\sin\theta_W \cdot ec \cdot \sqrt{\frac{e^2}{4\pi\varepsilon_0 F_W}} \cong 9.274\times 10^{-24} \text{ J/tesla} \tag{9}$$

Similarly magnetic moment of proton is close to

$$\mu_p \cong \frac{1}{2}\sin\theta_W \cdot ec \cdot \sqrt{\frac{e^2}{4\pi\varepsilon_0 F_S}} \cong 1.348\times 10^{-26} \text{ J/tesla} \tag{10}$$

Proton rest mass is close to

$$\left(\frac{F_S}{F_W} + X_E^2 - \frac{1}{\alpha^2}\right)\cdot E_W \cong m_p c^2 \cong 938.18 \text{ MeV} \tag{11}$$

where

$$E_W \cong \sqrt{\frac{e^2 F_W}{4\pi\epsilon_0}} \cong 1.731843735\times 10^{-3} \text{ MeV} \tag{12}$$

Neutron and proton mass difference is close to

$$\sqrt{\frac{F_S}{F_W} + X_E^2}\cdot E_W \cong m_n c^2 - m_p c^2 \cong 1.2966 \text{ MeV} \tag{13}$$

where m_n and m_p are the neutron and proton rest masss respectively [3].

3 Relation between the 3 atomic forces

3.1 Nucleons and the up & down quark masses

It was also defined that

$$\frac{m_u c^2}{m_e c^2} \cong e^{X_E \alpha} \tag{14}$$

In our earlier published papers suggested up quark mass is 4.4 MeV and down quark mass is 9.48 MeV. With these magnitudes it is noticed that,

$$\left(m_n - m_p\right)c^2 \cong \ln\left(\frac{\sqrt{m_u m_d}}{m_e}\right)\cdot m_e c^2 \tag{15}$$

Here lhs =1.2933 MeV and rhs= 1.2963 MeV.

3.2 To fit the strong coupling constant

Semi empirically it is noticed that

$$\frac{m_u c^2}{m_e c^2} \cong \ln\sqrt{\frac{F_S}{\sqrt{F_W.F_E}}} \tag{16}$$

where $F_E \cong 8.2387\times 10^8$ newton is the force of attraction between the electron and the proton in the Bohr radius of the Hydrogen atom. Here in this relation, lhs = 8.6120421 and rhs = 8.61054448. This may not be an accidental coincidence. Inserting the 3 atomic forces in one relation is very interesting and is a requirement of the unification. The important question to be answered is : What will be the physics of this coincidence? In this connection it can be suggested that,

$$\frac{1}{\alpha_s} \cong \ln\sqrt{\frac{F_S}{\sqrt{F_W.F_E}}} \cong 8.61054448 \tag{17}$$

where α_s is the strong coupling constant. Thus $\alpha_s \cong 0.1161367$. This can be compared with the CODATA recommended value [3]. It can be written as

$$\frac{1}{\alpha_s} \cong \ln \sqrt{\frac{e^2}{4\pi\epsilon_0 R_0^2 \sqrt{F_W . F_E}}} \cong 8.61054448 \qquad (18)$$

where $R_0 \cong 1.21$ fm. If F_W and F_E are the characteristic force constants and as the nuclear distance decreases- F_S magnitude increases and the magnitude of α_s decreases.

3.3 Combined role of α and α_s in fitting the nucleon rest masses

It is well established that, neutrons and protons constitutes up and down quarks. It is noticed that

$$\left(\frac{1}{\alpha} + \frac{1}{\alpha_s}\right) \sqrt{m_u m_d}\, c^2 \cong 939.4; \mathrm{MeV} \qquad (19)$$

Another interesting relation is

$$\frac{\sqrt{m_u m_d}\, c^2}{(m_n - m_p)\, c^2} \cong \ln\left(\frac{1}{\alpha} + \frac{1}{\alpha_s}\right) \qquad (20)$$

Conclusion

At one go a unified theory can not be developed. Searching, collecting, sorting and compiling the cosmic code is an essential part of unification. In this attempt the above observations can be given a chance. Further research and analysis may reveal the mystery of the 3 atomic forces.

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