Strange results pertaining to Fermi's weak coupling constant, Strong coupling constant and Newtonian gravitational constant

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Abstract: Assuming that Planck scale plays a crucial role in Strong and Electroweak interactions, we made an attempt to inter-relate the Newtonian gravitational constant, Fermi's weak coupling constant and Strong coupling constant.

Keywords: Planck scale; Weak coupling constant; Strong coupling constant; Newtonian gravitational constant;

1. Introduction

In this letter, by considering the Planck scale and proton-electron mass ratio, we proposed very simple relations among the Newtonian gravitational constant, Fermi's weak coupling constant and Strong coupling constant [1-4].

2. Two results connected with proton-electron mass ratio

$\left(\frac{m_p}{m_e}\right)$ is the proton-electron mass ratio.

G_F is the Fermi's weak coupling constant.

G_N is the Newton's gravitational constant.

α_s is the strong coupling constant.

Let,

$R_{spl} \cong$ Schwarzschild radius of Planck mass

$$\cong \frac{2G_N M_{pl}}{c^2} \cong 2\sqrt{\frac{G_N \hbar}{c^3}} \text{ where } M_{pl} \cong \sqrt{\frac{\hbar c}{G_N}}$$

Result-1: It is noticed that,

$$\left(\frac{m_p}{m_e}\right) \cong \left(\frac{G_F}{\hbar c R_{spl}^2}\right)^{\frac{1}{10}} \cong \left(\frac{G_F c^2}{4G_N \hbar^2}\right)^{\frac{1}{10}} \quad (1)$$

Result-2: It is noticed that,

$$\left(\frac{m_p}{m_e}\right) \cong \left(\frac{1}{\alpha_s}\right)^{\frac{1}{12}} \left(\frac{\hbar c}{G_N m_p^2}\right)^{\frac{1}{12}} \cong \left(\frac{1}{\alpha_s}\right)^{\frac{1}{12}} \left(\frac{M_{pl}}{m_p}\right)^{\frac{1}{6}} \quad (2)$$

3. Other derived results

Based on the above two strange results,

$$\left(\frac{m_p}{m_e}\right) \cong \sqrt{\frac{4\hbar^3}{\alpha_s m_p^2 c G_F}} \quad (3)$$

$$m_e \cong \sqrt{\frac{\alpha_s m_p^4 c G_F}{4\hbar^3}} \quad (4)$$

$$\alpha_s \cong \frac{4\hbar^3 m_e^2}{m_p^4 c G_F} \quad (5)$$

$$G_F \cong \left\{\left(\frac{m_p}{m_e}\right)^{10}\right\}\left(\frac{4G_N \hbar^2}{c^2}\right) \quad (6)$$

$$G_N \cong \left(\frac{m_e}{m_p}\right)^{10}\left(\frac{G_F c^2}{4\hbar^2}\right) \quad (7)$$

$$\frac{G_F}{G_N} \cong \left\{\left(\frac{m_p}{m_e}\right)^{10}\right\}\left(\frac{4\hbar^2}{c^2}\right) \quad (8)$$

4. Discussion

In our previous published contributions and papers [5-7] we proposed that, there exist two large pseudo gravitational constants associated with nuclear and electromagnetic interactions and presented many interesting applications [7] starting from nuclear radii to neutron star radius. By eliminating the two pseudo gravitational constants, in this latter, we proposed the above relations.

With reference to the recommended value of $G_N \cong 6.67408\times10^{-11}$ m^{3}kg^{-1}sec^{-2},

$G_F \cong 1.438965\times10^{-62}$ J.m^3 and $\alpha_s \cong 0.1152934$

With reference to the recommended value of $G_F \cong 1.435850984\times10^{-62}$ J.m^3,

$G_N \cong 6.65963739\times10^{-11}$ m^{3}kg^{-1}sec^{-2} and

$\alpha_s \cong 0.11554343$

From the above relations and estimated magnitudes, we would like to say that,

1) Gravity and Planck scale play a vital role in electroweak interactions.
2) With reference to the above proposed relations, magnitude of α_s seems to be around 0.1153. The same conclusion can also be extracted from Particle data group's (PDG) review on Quantum chromodynamics [5]. See the following table-1.

Table-1 : Magnitude of α_s close to 0.1153

1	$\alpha_s\left(M_Z^2\right)=0.1161^{+0.0041}_{-0.0048}$
2	$\alpha_s\left(M_Z^2\right)=0.1151^{+0.0093}_{-0.0087}.$
3	$\alpha_s\left(M_Z^2\right)=0.1148\pm\ 0.0014(exp.)$ $\pm\ 0.0018(PDF)^{+0.0050}_{-0.0000}$
4	$\alpha_s\left(M_Z^2\right)=0.1134\pm0.0011,$
5	$\alpha_s\left(M_Z^2\right)=0.1142\pm0.0023,$
6	$\alpha_s\left(M_Z^2\right)=0.1151^{+0.0033}_{-0.0032}$
7	$\alpha_s\left(M_Z^2\right)=0.1158\pm0.0035.$
8	$\alpha_s\left(M_Z^2\right)=0.1154\pm0.0020.$
9	$\alpha_s\left(M_Z^2\right)=0.1131^{+0.0028}_{-0.0022}$
10	$\alpha_s\left(M_Z^2\right)\cong0.1156^{+0.0021}_{-0.0022}$
11	$\alpha_s\left(M_Z^2\right)\cong0.1156^{+0.0041}_{-0.0034}$
12	$\alpha_s\left(M_Z^2\right)\cong0.1151^{+0.0093}_{-0.0087}$

All of the above relations can be simplified with the following assumption.

In nuclear structure, there exists a very large gravitational constant [8,9,10], $G_s \cong 3.328\times10^{28}\ \mathrm{m^3kg^{-1}sec^{-2}}$, *in such a way that,*

$$\text{Strong coupling constant, } \alpha_s \approx \left(\frac{\hbar c}{G_s m_p^2}\right)^2 \approx 0.1153 \tag{9}$$

$$\text{Nuclear charge radius, } R_0 \approx \frac{2G_s m_p}{c^2} \approx 1.24\ \text{fm} \tag{10}$$

Magnetic dipole moment of proton,

$$\mu_{proton} \approx \frac{eG_s m_p}{2c} \approx 1.49\times10^{-26}\ \text{J/Tesla} \tag{11}$$

$$\text{Proton-electron mass ratio, } \frac{m_p}{m_e} \approx \left[\left(\frac{G_s}{G_N}\right)\left(\frac{G_s m_e^2}{\hbar c}\right)\right]^{\frac{1}{10}} \tag{12}$$

$$\text{Fermi's Weak coupling constant, } G_F \approx \frac{4G_s^2 m_e^2 \hbar}{c^3} \tag{13}$$

5. Conclusion

We would like to stress that, with reference to String theory models and Quantum gravity models, presented results can be given some consideration in developing a 'workable model' of 'final unification'.

Acknowledgements

Author Seshavatharam U.V.S is indebted to professors K.V. Krishna Murthy, Chairman, Institute of Scientific Research in Vedas (I-SERVE), Hyderabad, India and Shri K.V.R.S. Murthy, former scientist IICT (CSIR), Govt. of India, Director, Research and Development, I-SERVE, for their valuable guidance and great support in developing this subject.

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