Avagadro number and the mystery of TOE and Quantum Theory

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Abstract. 'N' being the Avagadro number, it is suggested that there exists a charged lepton mass unit $m_L = 3.087292 \times 10^{-33}\ Kg$ in such a way that its electromagnetic and classical gravitational force ratio is N^2. Assuming that N neutrons transform into $\frac{1}{2}N$ neutrons, $\frac{1}{2}N$ protons and $\frac{1}{2}N$ electrons a simple relation is proposed in between the lepton mass generator X_E [1,2] strong gravitational constant G_S [2], classical gravitational constant G_C and the Avagadro number N. X_E being the proportionality ratio electron rest mass is proportional to its charge e and inversely proportional to N and $\sqrt{G_C}$. Muon and tau rest masses are fitted. With a new (uncertain) quantum number at n=3, a new heavy charged lepton at 42260 MeV is predicted. Considering $N, 2N, 3N...$ moles X_E takes discrete values and it can be shown that $\hbar$ is a true unified compound physical constant. A simple relation is proposed for estimating [2] the mass of strong interaction mass unit $M_{Sf}c^2 \cong 105.33255\ MeV$. From super symmetry [1] considering the proposed value of fermion-boson mass ratio $= \Psi = 2.2623411$ values of nuclear stability factor S_f and strong interaction mass generator X_S are revised in a unified manner. Proportionality constant being X_S if nuclear mass is proportional to integral multiples M_{Sf} it can be shown that revolving electron's angular momentum is discrete. Combining the joint effects of M_{Sf} and (M_{Sf}/Ψ) mystery of $\sqrt{n^2+n}$ can be understood. Proton and neutron rest masses are fitted to 3 decimal places. It it is suggested that $X_E \sin(\theta_W) \cong \frac{1}{\alpha}$. Finally in sub quark physics [1] the proposed strongly interacting fermionic mass unit 11450 MeV is fitted with $\ln\left(N^2\right)$.

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1. Introduction

In this paper previously [1, 2] defined lepton mass generator X_E is redefined in a unified approach and is shown that it is more fundamental than the fine structure ratio α. Muon and Tau masses are fitted. With a new (uncertain) quantum number at n=3, a new heavy charged lepton is predicted at 42260 MeV. Without considering the classical gravitational constant G_C establishing a relation in between charged particle's mass and charge is impossible. Till now Avagadro number [3] is a mystery. The basic counting unit in chemistry, the mole, has a special name Avogadro's number in honor of the Italian scientist Amadeo Avogadro (1776-1856). The commonly accepted definition of Avogadro number is the number of atoms in exactly 12 g of the isotope $^{12}_{6}C$ and the quantity itself is $6.02214179(30) \times 10^{23}$. *Considering N as a fundamental input in grand unified scheme authors made an attempt to correlate the electron rest mass and its charge. It is also noticed that $\hbar$ is slipping from the net and there lies the the secret of true grand unification.*

As the culmination of his life work, Einstein wished to see a unification of gravity and electromagnetism [4] 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 [5, 6] 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- "A brief history of time" [7] 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.

1.1. Charge-mass unification

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 behavior with surroundings when it is created. Fourth step is to understand its behavior 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 some how one must implement the gravitational constant in sub atomic physics. Till now quantitatively or qualitatively either the large number hypothesis or the string theory or the planck scale is not implemented in particle physics.*

Unifying gravity with the other three interactions would form a theory of everything (TOE), rather than a GUT. As of 2009, there is still no hard evidence that nature is described by a Grand Unified Theory. Moreover, since the Higgs particle has not yet been observed, the smaller electroweak unification is still pending. The discovery of neutrino oscillations indicates that the Standard Model is incomplete. The gauge coupling strengths of QCD, the weak interaction and hypercharge seem to meet at a common length scale called the GUT scale and approximately equal to 10^{16} *GeV, which is slightly suggestive. This interesting numerical observation is called the gauge coupling unification, and it works particularly well if one assumes the existence of super partners of the Standard Model particles.*

1.2. Super symmetry

In particle physics, a super partner (also sparticle) is a hypothetical elementary particle. Authors proposed and clearly showed that in strong interaction there exists super symmetry [1] with a fermion-boson mass ratio, $\Psi \cong 2.26$ *(but not unity). The word super partner is a portmanteau of the words super symmetry and partner. Super symmetry is one of the synergistic bleeding-edge theories in current high-energy physics which predicts the existence of these "shadow" particles. According to the theory, each fermion should have a partner boson, the fermion's super partner and each boson should have a partner fermion. When the more familiar leptons, photons, and quarks were produced in the Big Bang, each one was accompanied by a matching sparticle: sleptons, photinos and squarks. This state of affairs occurred at a time when the universe was undergoing a rapid phase change, and theorists believe this state of affairs lasted only some* 10^{-35} *seconds before the particles we see now "condensed" out and froze into space-time. Sparticles have not existed naturally since that time. In this case also authors showed that [1] these sparticles or super symmetric bosons can be seen at any time in the laboratory.*

Boson corresponding to nucleon mass is 415 MeV and considering the basic idea of string theory that elementary particle masses are excited states of basic levels, it is clearly shown that 493, 547 and 890 MeV etc strange mesons are the excited states of 415 MeV boson. In the same paper [1] it is suggested that charged W boson is the super symmetric boson of Top quark! Finally authors wish to say that there is something wrong with the basic concepts of SM. After all from true grand unification point of view *there is no independent existence for SM.*

1.3. Planck mass, neutrino mass and Avagadro number

It is noticed that ratio of planck mass and electron mass is 2.389×10^{22} *and is 25.2 times smaller than the Avagadro number. Qualitatively this idea implements gravitational constant in particle physics. Note that planck mass is the heaviest mass and neutrino mass is the lightest mass in the known elementary particle mass spectrum. As the mass of neutrino is smaller than the electron mass, ratio of planck mass and neutrino mass will be close to the Avagadro number or crosses the Avagadro number. Since neutrino is an electrically neutral particle if one is able to assume a charged particle close to neutrino mass it opens a window to understand the combined effects of electromagnetic (or charged) and gravitational interactions in sub atomic physics. Compared to planck scale (past cosmic high energy scale), Avagadro number is having some physical significance in the (observed or present low energy scale) fundamental physics or chemistry.*

2. Proposed new ideas in papers [1, 2]

In the previous papers [1, 2] authors collectively proposed the following new ideas.
1. Strong nuclear gravitational constant can be given as $G_S = 6.94273 \times 10^{31}\ m^3/kg\, sec^2$.
2. There exists two strongly interacting "confined" fermionic mass units $M_{Sf}c^2 = 105.38$ MeV *and* $M_{Gf}c^2 = 11450$ MeV.
3. In super symmetry, for strong and weak interactions boson mass is equal to fermion mass/2.26234.
4. There exists integral charge quark bosons and boso-gluons.
5. There exists integral charge quark effective fermions and effective fermi-gluons.
6. No two fermions couples together to form a meson. Only bosons couples together to form a meson. Light quark bosons couples with effective quark fermi gluons to form doublets and triplets.
7. Strong interaction mass generator $= X_S = 8.8034856$ *and it can be considered as the inverse of the strong coupling constant.*
8. Lepton mass generator $= X_E = 294.8183$ *is a number. It plays a crucial role in particle and nuclear physics.*
9. In the semi empirical mass formula ratio of "coulombic energy coefficient" and the proposed 105.383 MeV is equal to α. *The coulombic energy constant* $= E_C = 0.769$ MeV.
10. The characteristic nucleon's kinetic energy or sum of potential and kinetic energies is close to the rest energy of electron.

2.1. Nuclear force and charge distribution radii

The magnitude of nuclear force is [2]

$$\frac{e^2}{4\pi\epsilon_0 R_0^2} \cong \frac{c^4}{G_S} \quad \textit{and} \tag{1}$$

$$R_0 \cong \sqrt{\frac{e^2}{4\pi\epsilon_0}\frac{G_S}{c^4}} \cong \frac{e^2}{8\pi\epsilon_0 m_e c^2} \cong \frac{2G_S m_e}{c^2} \cong 1.409\ fermi. \quad (2)$$

Here $R_0 \cong 1.409\ fermi$ *can be considered as the nuclear characteristic force distribution radius. Nuclear charge potential can be given as*

$$Nuclear\ charge\ potential \cong \frac{e^2}{4\pi\epsilon_0 R_C} \cong \ln\sqrt{\frac{M_{Sf}c^2}{2m_e c^2}}\ m_e c^2. \quad (3)$$

Here, $M_{Sf}c^2$ *is the assumed characteristic strong interaction fermionic mass unit=105.383 MeV,* R_C *can be considered as the nuclear characteristic charge distribution radius.*

$$Nuclear\ charge\ radius \cong R_C \cong \left[\ln\sqrt{\frac{M_{Sf}c^2}{2m_e c^2}}\right]^{-1} \frac{e^2}{4\pi\epsilon_0 m_e c^2} \cong 1.21565\ fermi. \quad (4)$$

In the foregoing sections this (ln) idea is eliminated.

2.2. Nuclear charge radius, Avagadro number and the Bohr radius

Quantitatively to a very good accuracy it is noticed that

$$Avagadro\ number \cong \sqrt{\frac{2G_C m_e}{c^2 R_C}\ \frac{\hbar c}{G_C m_e^2}} \cong N. \quad (5)$$

Here, $\frac{2G_C m_e}{c^2}$ *= classical Black hole radius of electron,* $R_C = Nuclear\ charge\ radius \cong 1.21565\ fermi$*. This equation can be considered as a key observation for the implementation of Avgadro number in true unification. Using this equation value of the classical gravitational constant* G_C *can be estimated accurately with the microscopic physical constants.*

$$Classical\ gravitational\ constant \cong G_C \cong \frac{2\hbar^2}{N^2 R_C m_e^3}. \quad (6)$$

On simplification equation (5) can be written as

$$\hbar \cong \left(\frac{N}{2}\right) m_e c \sqrt{\left(\frac{2G_C m_e}{c^2}\right) R_C}. \quad (7)$$

With the proposed lepton mass generator X_E *and the strong gravitational constant* G_S *equation (7) can be simplified as*

$$\hbar \cong (X_E)\, m_e c \sqrt{\left(\frac{2G_S m_e}{c^2}\right) R_C} \cong (X_E)\, m_e c \sqrt{R_0 R_C}. \quad (8)$$

Interestingly, $\frac{2G_S m_e}{c^2} \cong strong\ nuclear\ black\ hole\ radius\ of\ electron \cong 1.409\ fermi \cong R_0$*, can be considered as the nuclear mass distribution radius.* $R_C \cong 1.21565\ fermi$ *is the nuclear charge distribution radius and geometric mean of* R_C *and* R_0 *is* $\sqrt{R_0 R_C} \cong$

$1.309\ fermi$. *By considering "1 mole nucleons", "2 mole nucleons", "3 mole nucleons" etc* X_E *takes "discrete" values like* X_E, $2X_E$, $3X_E$. *Using this idea the origin of* $n\hbar$ *may be understood.*

Considering the nucleus-electron system, interestingly to a very good accuracy it is noticed that

$$Bohr\ radius \cong a_0 \cong \frac{X_E^2 R_C}{2}. \tag{9}$$

Considering equations (2), (5), (17) and (27) all these observations can be obtained in a unified approach. Considering equation (48) the individual roles of M_{Sf}, G_C *and* N *in the nuclear physics can be understood. Considering equations (7) and (48) it can be suggested that,* $(N/2)$ *represents a measure of unified gauge coupling strength.*

3. Mole neutrons & relation between electron rest mass and its charge

Assuming that N *neutrons transform into* $\frac{1}{2}N$ *neutrons,* $\frac{1}{2}N$ *protons and* $\frac{1}{2}N$ *electrons authors tried to establish a relation in between the electron rest mass and its charge. This idea may be a hypothesis or might have happened in the history of cosmic evolution. For the time being authors request the world science community to consider this idea positively.*

Assume that out of N *neutrons one neutron transforms into one proton and one electron. Focussing our attention to the rest energy of electron it is assumed that*

$$m_e \propto e, \tag{10}$$

$$m_e \propto \frac{1}{N}, \tag{11}$$

$$m_e \propto \sqrt{\frac{1}{G_C}}, \tag{12}$$

On simplification it can be written as

$$m_e \propto \frac{1}{N}\sqrt{\frac{e^2}{4\pi\epsilon_0 G_C}}, \tag{13}$$

$$m_e c^2 \propto \frac{1}{N}\sqrt{\frac{e^2 c^4}{4\pi\epsilon_0 G_C}}, \tag{14}$$

$$m_e c^2 \cong X_E\left(\frac{1}{N}\sqrt{\frac{e^2 c^4}{4\pi\epsilon_0 G_C}}\right). \tag{15}$$

$$m_e c^2 \cong X_E\, E_L \cong X_E\, 1.732\times 10^{-3}\ \text{MeV}. \tag{16}$$

Here X_E *is a number and can be called as 'lepton mass generator' and* $E_L = 1.732\times 10^{-3}\ MeV$ *can be called as the 'characteristic lepton potential'.*

Authors in the previous papers [1, 2] showed many applications of X_E *in particle physics and nuclear physics. The weak coupling angle can be considered as* $(\alpha X_E)^{-1} =$

$\sin(\theta_W)$. *It plays a crucial role in estimating the charged lepton rest masses. Ratio of Up and Down quark masses is* αX_E. *It plays a very interesting role in fitting energy coefficients of the semi empirical mass formula. It can be used for fitting the nuclear size with "compton wavelength of nucleon". It is noticed that ratio of "nuclear volume" and "A nucleons compton volume" is* X_E. *It can be called as the nuclear "volume ratio" factor. In this paper in a unified approach* X_E *is redefined as*

$$X_E \cong \frac{N}{2}\sqrt{\frac{G_C}{G_S}} \tag{17}$$

Here, $N/2=$ *half mole neutrons or half mole protons or half mole electrons.* G_S = *strong nuclear gravitational constant and* G_C = *classical gravitational constant.*

Till now Avagadro number is a mystery. The strange observation is, by considering "1 mole nucleons", "2 mole nucleons", "3 mole nucleons" etc X_E *takes "discrete" values like* X_E, $2X_E$, $3X_E$... *Using this idea the origin of* $n\hbar$ *may be understood.*

In equation (17) by seeing the strong gravitational constant G_S *every one will be surprised. But it is a fact. In the paper [2] authors proposed many applications of* G_S *in nuclear physics. If neutron is a strongly interacting particle and its origin is related to* G_S *it is reasonable and a must to implement* G_S *in weak decay of neutron. Considering equation (17) electron rest mass can be given as*

$$m_e c^2 \cong \frac{1}{2}\sqrt{\frac{e^2 c^4}{4\pi\epsilon_0 G_S}} \ \textit{and} \tag{18}$$

$$\frac{e^2 c^4}{4\pi\epsilon_0 G_S m_e^2} \cong 4. \tag{19}$$

In this way value of strong nuclear gravitational constant can be estimated from electron rest mass as $G_S \cong 6.950631729 \times 10^{31}\ \frac{m^3}{kg\ sec^2}$. *From equation (15)* X_E *can be obtained as*

$$X_E \cong N\sqrt{\frac{4\pi\epsilon_0 G_C m_e^2}{e^2}} \cong 295.0606339. \tag{20}$$

If one is able to assume or guess that,

$$E_L = m_L c^2, \tag{21}$$

$$m_L \cong \frac{1}{N}\sqrt{\frac{e^2}{4\pi\epsilon_0 G_C}} \cong 3.087292 \times 10^{-33}\ Kg. \tag{22}$$

$$\frac{e^2}{4\pi\epsilon_0 G_C m_L^2} \cong N^2. \tag{23}$$

$$\frac{e^2}{4\pi\epsilon_0 G_S m_L^2} \cong (2X_E)^2. \tag{24}$$

From this idea it can be suggested that there exists a charged lepton mass unit $m_L = 3.087292 \times 10^{-33}$ *Kg in such way a that its electromagnetic and classical gravitational force ratio is* N^2*. It plays a crucial role in fitting the rest masses of muon and tau.* $2X_E$ *plays a crucial role in understanding the radius of proton [8].*

4. Fitting of muon and tau rest masses

In the earlier paper [2] authors proposed the following relation for fitting the muon and tau masses [9 -12].

$$m_l c^2 \cong \frac{2}{3}\left[E_C^3 + \left(n^2 X_E\right)^n E_A^3\right]^{\frac{1}{3}}. \tag{25}$$

Here E_C*= coulombic energy coefficient of the semi empirical mass formula =0.769 MeV,* E_A*= asymmetry energy coefficient of the semi empirical mass formula=23.86 MeV and* X_E *= proposed lepton mass generator = 294.8183 and n = 0, 1, 2. In this paper authors simplified equation (25) as*

$$m_l c^2 \cong \left[X_E^3 + \left(n^2 X_E\right)^n \sqrt{N}\right]^{\frac{1}{3}} E_L, \tag{26}$$

where n=0,1 and 2 and $E_L \cong 1.732 \times 10^{-3}$ MeV.

Equation (26) is free from all the binding energy coefficients of the semi-empirical mass formula. Authors hope that the field experts can easily interpret this expression. See the following Table 1.

If electron mass is fitting at n=0, muon mass is fitting at n=1 and tau mass is fitting at n=2 it is quite reasonable and natural to predict a new heavy charged lepton at n=3. Electron was discovered in 1897. Muon was discovered in 1937. Tau was detected in a series of experiments between 1974 and 1977. Positron predicted in 1928 and discovered in 1936. The antiproton and antineutron were only postulated in 1931 and 1935 respectively and discovered in 1956. The charged pion was postulated in 1935 and discovered in 1947 and the neutral pion was postulated in 1938 and discovered in 1950. The 6 quarks were proposed and understood in between 1964 and 1977. By selecting the proper quantum mechanical rules if one is able to confirm the existence of the number n=3, existence of the new lepton can be understood.

At the same time one must critically examine the proposed relation for its nice and accurate fitting of the 3 observed charged leptons. Unfortunately inputs of this expression are new for the standard model. Hence one can not easily incorporate this expression in standard model. Till now in SM there is no formula for fitting the lepton masses accurately. It seems there is something missing from the SM. Not only that the basic inputs of SM are leptons and quarks. Now in this proposed expression authors tried to fit and understand the origin of the fundamental building blocks of electromagnetic interaction! Same authors tried to fit and understand the origin of quarks in the paper [1] with the electron rest mass as a reference mass unit. More interesting thing is that in the paper [1] authors proposed the existence of 'integral charge' quark fermions and

n	Obtained Lepton mass, MeV	Exp. Lepton Mass, MeV
0	0.51096	0.510998922
1	105.95	105.658369
2	1777.3	1776.84 ±0.17
3	42259.20	To be discoverd

Table 1. Fitting of charged lepton rest masses.

'integral charge' quark bosons. Even though this idea is against to the SM, observed strong interaction particles charge-mass spectrum can be understood very easily. Super symmetry plays a key role in this.

5. Strong interaction mass unit $M_{Sf}c^2$ and $\hbar$

See the reference [1].In super symmetry in strong and weak interactions for every fermion there exists a corresponding boson of mass = $\frac{fermion\ mass}{\Psi}$. *Authors clearly showed this in paper [1]. The most interesting idea is that fermion makes 13 jumps in one revolution and comes to the initial position and boson makes 13 revolutions with 6 jumps in each incomplete revolution. Here angle of jump for fermion can be assumed as* $\sin^{-1}\left(\frac{1}{\alpha X_E}\right) \cong 27.67394^0$ *and angle of jump for boson is* 55.34788^0. *Boson in one cycle makes 78 jumps and this is very close to* $X_S^2 \cong 77.6$. *Here* $\Psi = proposed\ strong\ interaction\ fermion-boson\ mass\ ratio = 2.2623412 \cong \ln\left(6+\sqrt{13}\right)$ *and* $\sqrt{\Psi} = 1.504108104$. *The most interesting observation [1] is*

$$\sqrt{M_{Sf}\left(\frac{M_{Sf}}{\Psi}\right)}\frac{1}{m_e} \cong \frac{1}{\alpha} \cong \frac{1}{\sqrt{\Psi}}\frac{M_{Sf}}{m_e}. \tag{27}$$

Here $\frac{M_{Sf}}{\Psi}$ *is the super symmetric boson of the strongly interacting [9] fermion* M_{Sf}. *This equation represents a mass ratio and gives the idea of the origin of* (α). $\left(M_{Sf}, \frac{M_{Sf}}{\Psi}\right)$ *both jointly plays a crucial role in the unification of electromagnetic, strong and gravitational interactions. Knowing the value of* Ψ *value of* $M_{Sf}c^2$ *can be given as*

$$M_{Sf}c^2 \cong \frac{\sqrt{\Psi}}{\alpha}\,m_ec^2 \cong 1.877598136 \times 10^{-28}\ Kg \cong 105.3255407\ MeV. \tag{28}$$

If nuclear mass distribution radius is R_0 *and it assumed that characteristic total energy of the nucleon in the nucleus is close to the rest energy of electron* m_ec^2,

$$\frac{e^2}{8\pi\epsilon_0 R_0} \cong m_ec^2. \tag{29}$$

It is known that

$$\alpha = \frac{e^2}{4\pi\epsilon_0\hbar c}. \tag{30}$$

Considering equations (19), (27), (30) and multiplying lhs and rhs of equation (27) with 4 and rearranging

$$\frac{4}{\sqrt{\Psi}}\frac{G_S M_{Sf} m_e}{c} \cong \hbar. \tag{31}$$

Replacing G_S with G_C

$$\left(\frac{N}{X_E}\right)^2 \frac{G_C m_e}{c}\sqrt{M_S\left(\frac{M_{Sf}}{\Psi}\right)} \cong \hbar. \tag{32}$$

Note that there is no free parameter in this equation. More clearly writing

$$\frac{4G_S m_e}{c}\sqrt{M_{Sf}\left(\frac{M_{Sf}}{\Psi}\right)} \cong \hbar. \tag{33}$$

$$\frac{4G_S m_e}{c}\left(\frac{M_{Sf}}{\sqrt{\Psi}}\right) \cong \hbar \quad and \quad \frac{8\pi G_S M_{Sf} m_e}{\sqrt{\Psi}} \cong hc. \tag{34}$$

In this way value of the famous Planck's constant $\cong h$ and $\hbar$ can be obtained in a unified way. This equation may be given a chance in understanding the origin of quantum mechanics and quantum theory of radiation. M_{Sf} can be considered as a characteristic mass unit related to the nucleus that exhibits strong interaction.

$$\frac{2G_S m_e}{c}\left(\frac{M_{Sf}}{\sqrt{\Psi}}\right) \cong \frac{\hbar}{2} \cong \frac{h}{4\pi}. \tag{35}$$

It can be written as

$$\frac{2G_S}{c^2}\left(\frac{M_{Sf}}{\sqrt{\Psi}}\right)(m_e c) \cong \frac{\hbar}{2} \cong \frac{h}{4\pi}. \tag{36}$$

$(m_e c)$ represents the rest momentum of electron and $\frac{2G_S}{c^2}\left(\frac{M_{Sf}}{\sqrt{\Psi}}\right)$ represents the strong nuclear black hole radius of $\left(\frac{M_{Sf}}{\sqrt{\Psi}}\right)$.

If nuclear mass is proportional to number of nucleons and mass of nucleon is proportional to M_{Sf} it can be understood that central nuclear mass increases in integral multiples of M_{Sf}. Only thing is that compared to the increasing mass of a galactic center, multiple units of M_{Sf} is playing the key role in the nuclear mass. Applying this idea to equation (33) the old and strange concepts of integral nature of electron's angular momentum can be understood. If the nucleus contains n =1, 2, 3,...number of M_{Sf} then electron's angular momentum increases in discrete manner. This idea is very natural. Applying the above idea in equation (33), there is some twist. It can be understood as follows. By considering only the integral multiples of M_{Sf} as integral fermionic mass units from equation (34), $\hbar$ or h takes the discrete values as

$$\frac{4G_S m_e}{c}\left(\frac{nM_{Sf}}{\sqrt{\Psi}}\right) \cong n\hbar \quad and \quad \frac{8\pi G_S m_e}{c}\left(\frac{nM_{Sf}}{\sqrt{\Psi}}\right) \cong nh. \tag{37}$$

By considering only the integral multiples of M_{Sf} as fermionic mass units from equation (33), $\hbar$ takes the discrete values as

$$\frac{4G_S m_e}{c}\sqrt{(nM_{Sf})\left(\frac{M_{Sf}}{\Psi}\right)} \cong \sqrt{n}\,\hbar. \tag{38}$$

By considering the vector sum of $\sqrt{n}$ *and* n *one can get the vector atom model of quatum nature of* $\hbar$ *as* $\sqrt{n^2+n}\,\hbar = \sqrt{n\,(n+1)}\,\hbar$. *This may be the secret of quantum nature of electron's angular momentum.*

By considering the root mean square values of $\sqrt{n}$ *and* n *one can get the discrete values of* $\hbar$ *as* $\sqrt{\frac{n(n+1)}{2}}\,\hbar$. *This may be the secret of quantum nature of excited levels of elementary particles. Some how if* $\hbar$ *goes under a "square root" like the planck energy,* $M_P c^2 = \sqrt{\frac{\hbar c^5}{G_C}}$ *as a ground state energy level in a heuristic way its massive excited levels can be given as*

$$\left(M_P c^2\right)_I = [n\,(n+1)]^{\frac{1}{4}}\sqrt{\frac{\hbar c^5}{G_C}}. \tag{39}$$

Here $n = 0, 1, 2, 3..$ *and* $I = n\,(n+1)$. *Keeping this idea in view it is assumed that "if* $m_0 c^2$ *is the rest energy of a particle then its massive excited levels can be given*

$$mc^2 = [n\,(n+1)]^{\frac{1}{4}}\, m_0 c^2. \tag{40}$$

and each excited state can be seen as a new massive particle". The surprising observation is that in particle physics excited massive states are following two types of discrete levels. Regge trajectory of some baryons and mesons can be understood in this way [1]. They are

$$[n\,(n+1)]^{\frac{1}{4}}\, m_0 c^2 \;\text{ and }\; \left[\frac{n\,(n+1)}{2}\right]^{\frac{1}{4}} m_0 c^2. \tag{41}$$

5.1. The nuclear mass and charge distribution radii

From above equations it can be shown that

$$R_0 \cong (\alpha)\,\frac{2G_S}{c^2}\left(\frac{M_{Sf}}{\sqrt{\Psi}}\right) \cong \frac{2G_S m_e}{c^2} \cong 1.40897\; fermi. \tag{42}$$

From equations (2), (8), (42) it can be shown that

$$R_C \cong \left(\frac{4}{\alpha X_E^2}\right)\frac{2G_S}{c^2}\left(\frac{M_{Sf}}{\sqrt{\Psi}}\right) \cong 1.21565\; fermi. \tag{43}$$

$$\sqrt{R_0 R_C} \cong \left(\frac{2}{X_E}\right)\frac{2G_S}{c^2}\left(\frac{M_{Sf}}{\sqrt{\Psi}}\right). \tag{44}$$

$$\frac{R_0}{R_C} \cong \frac{(\alpha X_E)^2}{4} \tag{45}$$

Significance of (αX_E) *can be given as*

$$\alpha X_E \cong \frac{e^2}{4\pi\epsilon_0 m_e c^2\sqrt{R_0 R_C}}. \tag{46}$$

Here $\frac{e^2}{4\pi\epsilon_0 m_e c^2}$ *is the classical radius of electron. It is also noticed that*

$$X_E \sin(\theta_W) \cong \frac{1}{\alpha}. \tag{47}$$

The final and interesting question is - How to understand the role of electron in nuclear and particle physics? Note that $\sin(\theta_W)$ *plays a crucial role in electroweak physics.*

6. Proton, neutron rest masses & the nuclear stability factor (S_f)

Qualitatively and quantitatively with 99.9 % *accuracy it is noticed that*

$$\frac{m_P c^2 + m_N c^2}{m_e c^2} \cong \frac{N}{2}\sqrt{\left(\frac{2G_C M_{Sf}}{c^2}\right)\left(\frac{M_{Sf}c}{\hbar}\right)}, \tag{48}$$

where $m_P c^2$ = *rest energy of proton,* $m_N c^2$ = *rest energy of neutron,* $m_e c^2$ = *rest energy of electron and* $M_{Sf} =$ *proposed strong interaction fermion mass unit* $\cong$ 105.3255 *MeV. Interesting thing is that,* $\frac{2G_C M_{Sf}}{c^2}$ *can be considered as the classical black hole radius of* M_{Sf} *and* $\frac{\hbar}{M_{Sf}c}$ *is the compton length of* M_{Sf}*. This equation clearly suggests the individual roles of* M_{Sf}, G_C *and* N *in the nuclear physics. On simplification*

$$\frac{m_P c^2 + m_N c^2}{m_e c^2} \cong X_E\sqrt{\left(\frac{2G_S M_{Sf}}{c^2}\right)\left(\frac{M_{Sf}c}{\hbar}\right)}, \tag{49}$$

Here, $\frac{2G_S M_{Sf}}{c^2}$ *can be considered as the strong nuclear black hole radius of* M_{Sf}*. Considering the average mass of nucleon*

$$\frac{m_n c^2}{m_e c^2} \cong \frac{X_E}{2}\sqrt{\left(\frac{2G_S M_{Sf}}{c^2}\right)\left(\frac{M_{Sf}c}{\hbar}\right)} \cong 1836.80336. \tag{50}$$

From equation (19)

$$\frac{e^2}{4\pi\epsilon_0 G_S m_e^2} \cong 4 \text{ and } \sqrt{\frac{e^2}{4\pi\epsilon_0 G_S m_e^2}} \cong 2. \tag{51}$$

Hence, in the above equation (50) denominator 2 can be eliminated as

$$\frac{m_n c^2}{m_e c^2} \cong X_E\sqrt{\left(\frac{4\pi\epsilon_0 m_e c^2}{e^2}\right)\left(\frac{2G_S M_{Sf}}{c^2}\right)}\sqrt{\left(\frac{G_S M_{Sf} m_e}{\hbar c}\right)}, \tag{52}$$

Here, $\frac{e^2}{4\pi\epsilon_0 m_e c^2}$ *is the classical radius of electron. On simplification*

$$\frac{m_n c^2}{m_e c^2} \cong X_E\sqrt{\frac{8\pi\epsilon_0 G_S M_{Sf} m_e}{e^2}}\sqrt{\frac{G_S M_{Sf} m_e}{\hbar c}}, \tag{53}$$

All these equations suggest that the proposed strong nuclear gravitational constant G_S *and the strong interaction mass unit* M_{Sf} *play a key role in understanding the origin of rest mass of nucleon.*

6.1. The strong interaction mass generator X_S

In paper [2] authors proposed a new number called as nuclear stability number $S_f = 2X_S^2 \cong 155.0$ *and* $X_S =$ *Strong interaction mass generator* $\cong \sqrt{\frac{G_S M_{Sf}^2}{\hbar c}}$. *From equation (34) inserting the expression for* $\hbar$

$$X_S \cong \sqrt{\frac{\Psi}{4\alpha}} \cong 8.803723452. \tag{54}$$

$$2X_S^2 \cong \frac{\Psi}{2\alpha} \cong 155.0110932. \tag{55}$$

6.2. Fitting of nucleon rest masses upto 3 decimal places

It is noticed that proportionality constant being $\sqrt{\frac{1}{S_f}}$ *ratio of rest energy of proton and charged lepton potential can be given as*

$$\frac{m_P c^2}{E_L} \propto X_S^2, \tag{56}$$

$$\frac{m_P c^2}{E_L} \propto X_E^2, \tag{57}$$

where $m_P c^2$ = *Rest energy of proton,* E_L = *characteristic charged lepton potential* $\cong 1.732 \times 10^{-3}$ MeV.

$$\frac{m_P c^2}{E_L} \cong \frac{1}{\sqrt{S_f}} \left(X_E X_S\right)^2, \tag{58}$$

Considering proton-electron mass ratio

$$\frac{m_P c^2}{m_e c^2} \cong \frac{1}{\sqrt{S_f}} X_E X_S^2. \tag{59}$$

$$X_S = \sqrt{\frac{S_f}{2}}. \tag{60}$$

$$\frac{m_P c^2}{m_e c^2} \cong \frac{\sqrt{S_f} X_E}{2}. \tag{61}$$

This equation can be written as

$$2 m_P c^2 \cong \sqrt{S_f} X_E \, m_e c^2. \tag{62}$$

If it is assumed that $(m_P c^2 + m_N c^2)$ *is more appropriate than* $2m_P c^2$,

$$m_P c^2 + m_N c^2 \cong \sqrt{S_f} X_E \, m_e c^2. \tag{63}$$

Neutron-proton mass difference can be given as

$$(m_N - m_P)\, c^2 \cong \ln \sqrt{(S_f)}\; m_e c^2. \tag{64}$$

The obtained values are $m_P = 1.672065796 \times 10^{-27}$ *Kg and* $m_N = 1.674362952 \times 10^{-27}$ *Kg. The co-data recommended [10] values are* $m_P = 1.672621637 \times 10^{-27}$ *Kg and* $m_N = 1.674927211 \times 10^{-27}$ *Kg. Accuracy can be improved by modifying equation (62) as*

$$m_P c^2 + m_N c^2 \cong \left(\sqrt{S_f} X_E + 1\right)\; m_e c^2. \tag{65}$$

Now obtained values are $m_P = 1.672521265 \times 10^{-27}$ $Kg \cong 938.2157$ MeV *and* $m_N = 1.674818422 \times 10^{-27}$ $Kg \cong 939.50432$ MeV.

6.3. Nuclear binding energy constant

In paper [2] it is suggested that considering $\sqrt{\frac{\hbar c^5}{G_S}}$ *as the nuclear binding enery constant semi-empirical binding energy coefficients can be fitted in a unified approach. It is noticed that*

$$\sqrt{\frac{\hbar c^5}{G_S}} \cong 2\sqrt{\left(\frac{M_{Sf}c^2}{\sqrt{\Psi}}\right)(m_e c^2)} \cong 11.96374935\; MeV. \tag{66}$$

This can be considered as the pairing energy coefficient of the semi empirical mass formula. Twice of it can be considered as the asymmetry energy coefficient [2]. Note that $(m_e c^2)$ *can be considered as the characteristic kinetic energy of the nucleon.*

6.4. Nucleon-proton stability

Stable isotope A_S *of any* Z *or proton-nucleon stability relation can be given as*

$$A_S \cong 2Z + \frac{Z^2}{S_f} \cong 2Z + \frac{Z^2}{155.01}. \tag{67}$$

This can be compared with the existing nucleon- proton stability relations [13]

$$N_S \cong 0.968051Z + 0.00658803Z^2. \tag{68}$$

$$Z_S \cong \frac{A}{2 + 0.0157A^{\frac{2}{3}}}. \tag{69}$$

Here N_S*=Stable neutron number,* Z_S*=Stable proton number corresponding to mass number A. By considering A as the fundamental input its corresponding stable Z can be obtained as*

$$Z_S \cong \left[\sqrt{\frac{A}{155.01} + 1} - 1\right] 155.01. \tag{70}$$

A_S *can be called as the stable mass number of Z. After rounding off for even (Z) values, if obtained* A_S *is odd consider* $A_S - 1$*, for odd (Z) values if obtained* A_S *is* *even, consider $A_S - 1$. For very light odd elements this correction does not seem to be fitting well. At $Z = 47$ obtained $A_S = 108.25$. Its round off value is 108 which is even. Its nearest odd number is 108-1=107. At $Z = 92$ obtained $A_S = 238.6$. Its round off value is 239 which is odd. Its nearest even number is 239-1=238. At $Z = 29$ obtained $A_S = 63.425$. Its round off value is 63 which is odd. Correction is not required. At $Z = 68$ obtained $A_S = 165.83$. Its round off value is 166 which is even. Correction is not required.*

7. Estimation of the strongly interacting subquark fermion $M_{Gf}c^2$ and the strongly interacting subquark boson $M_{Gb}c^2$

In the paper [1] it is proposed that there exists a strongly interacting fermionic mass unit $M_{Gf}c^2 \cong 11450\ MeV$ in subquark physics by using which quark gluon masses can be estimated. It is noticed that

$$M_{Gf}c^2 \cong \left[\ln\left(N^2\right) - 1\right]\ M_{Sf}c^2 \cong 11428.85338\ MeV, \tag{71}$$

Its corresponding strongly interacting boson mass $M_{Gb}c^2$ can be given as

$$M_{Gb}c^2 \cong \left[\ln\left(N^2\right) - 1\right]\ \frac{M_{Sf}c^2}{\Psi}, \tag{72}$$

$$M_{Gb}c^2 \cong \left[\ln\left(N^2\right) - 1\right]\ \frac{105.3255407}{2.2623412} \cong 5051.781508\ MeV. \tag{73}$$

Authors shown the applications of these two mass units in particle physics paper [1]. $M_{Gf}c^2$ plays a crucial role in estimating the strongly interacting fermi-gluonic masses of effective quark fermions as

$$Q_{Gfe} \cong \left[\left(M_{Gf}c^2\right)^2 \times Q_{fe}c^2\right]^{\frac{1}{3}}. \tag{74}$$

where Q_{Gfe}=effective quark fermi-gluon mass and Q_{fe}=effective quark fermion mass.

$M_{Gb}c^2$ plays a crucial role in estimating the strongly interacting boso-gluonic masses of quark bosons as

$$Q_{Gb} \cong \left[\left(M_{Gb}c^2\right)^2 \times Q_b c^2\right]^{\frac{1}{3}}. \tag{75}$$

where Q_{Gb}=quark boso-gluon mass and Q_b=quark boson mass.

7.1. Relation between $M_{Gf}c^2$, $M_{Sf}c^2$ and the proton rest energy

If proportionality constant is close to unity, it is noticed that

$$\left(m_P c^2\right)^5 \propto \left(M_{Gf}c^2\right)^2, \tag{76}$$

$$\left(m_P c^2\right)^5 \propto \left(M_{Sf}c^2\right)^2, \tag{77}$$

$$\left(m_P c^2\right)^5 \propto \left[\left(M_{Sf}c^2\right)^2 \left(M_{Gf}c^2\right)\right]^{\frac{1}{3}} \quad and \tag{78}$$

$$m_P c^2 \cong \left(M_{Gf}c^2\right)^{\frac{7}{15}} \left(M_{Sf}c^2\right)^{\frac{8}{15}} \cong 938.46745\ MeV \cong 938.272\ MeV. \tag{79}$$

This equation (79) clearly suggests the individual roles of $M_{Gf}c^2$ *and* $M_{Sf}c^2$ *in understanding the origin of rest mass of the charged proton. Based on this idea strong interaction mass generator* X_S *can be given as*

$$X_S \cong \left(\frac{M_{Gf}}{M_{Sf}}\right)^{\frac{7}{15}} \cong \left(\frac{11428.853}{105.3255}\right)^{\frac{7}{15}} \cong 8.910160281. \tag{80}$$

It is noticed that $\frac{7}{15} \cong 0.4666$ *and* $\frac{8}{15} \cong 0.5333$*. Comparing* $\left(\frac{7}{15}\right)$ *with* $\left(\frac{1}{\alpha X_E}\right) \cong 0.46444$ *and* $\left(\frac{8}{15}\right)$ *with* $\left(1-\frac{1}{\alpha X_E}\right) \cong 0.53556$ *one can see the significance of* (αX_E) *in deciding the origin of nuclear mass.*

$$atomic\ mass\ unit \cong \left(M_{Gf}c^2\right)^{\frac{1}{\alpha X_E}} \left(M_{Sf}c^2\right)^{1-\frac{1}{\alpha X_E}} \cong 928.6955707\ MeV. \tag{81}$$

This is very close to the unified atomic mass unit $931.5\ MeV$*.*

8. Fermi's weak coupling constant F_W

It is noticed that Fermi's weak coupling constant [14], F_W *is a unified compound physical constant. It can be given as*

$$F_W \cong \left(\frac{1}{2}\right)\left(\frac{e^2}{4\pi\epsilon_0 M_{Sf}c^2}\right)^3 \left(\frac{M_{Sf}c^2}{\sqrt{\Psi}}\right) \cong 1.433471924 \times 10^{-62}\ joule.meter^3. \tag{82}$$

This obtained value can be compared with the experimental value of $F_W = 1.435841179 \times 10^{-62}\ joule.meter^3$*. Interesting idea is that, just like the classical radius of electron,* $\left(\frac{e^2}{4\pi\epsilon_0 M_{Sf}c^2}\right)$ *can be considered as the classical radius of the proposed* $M_{Sf}c^2$*. Considering this equation it can be suggested that* $M_{Sf}c^2$ *plays a crucial role in electroweak physics.*

Conclusions

If one is able to develop a relation between electron rest mass and charge certainly it can lead to the true grand unification. To understand the mystery of TOE, quantum theory of radiation and quantum mechanics Avagadro number can be given a chance. Authors request the world science community to kindly look into these new ideas for further analysis.

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