Exploration

New Concepts & Semi-Empirical Fittings in Understanding SUSY & the Four Cosmological Interactions

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Abstract

Even though SUSY is having excellent theoretical support and in-depth mathematical back ground, no single SUSY boson could be detected in the Large Hadron Collider so far based on SUSY concepts. This puzzling issue casts doubt on the continued existence of SUSY. It forces some of the particle physicists to relinquish or review the basic concepts of SUSY. In our earlier published papers we proposed and established 'integral charge quark super symmetry' and 'integral charge Higgs super symmetry'. In this paper, the authors make an attempt to fit the SUSY fermion-boson mass ratio, SUSY Higgs rest masses, charged lepton rest masses, electron and proton rest masses and nuclear binding energy coefficients in a cosmological approach. The concepts proposed herein and the results obtained thereof seem to indicate that the Higgs boson of rest energy 125 GeV may be a compound particle.

Key words: cosmology, modified SUSY, integral charge quarks, charged Higgs boson, charged lepton rest masses, nucleon rest mass, nuclear binding energy coefficients.

1. Introduction

In this paper, the authors make an attempt to review, revise and refine the basic concepts related to the four fundamental interactions and super symmetry [1] in a cosmological approach [2-10]. The earlier proposed basic concepts were: 1) Fermion-boson mass ratio is close to 2.26 but not unity and all the observed mesons are SUSY bosons only. 2) There exist integral charge quark family particles and Higgs family particles. 3) Atomic gravitational constant is squared Avogadro number times the 'classical' gravitational constant and 4) During cosmic evolution – magnitudes of nuclear charge radius, reduced Planck's constant and inverse of the fine structure ratio increase with cosmic time and there will be no change in the magnitude of Planck's constant.

2. Integral charge quark system

Till today there is no reason for the question: why there exist 6 individual quarks? Till today no experiment reported a free fractional charge quark. The herein Authors' opinion is nuclear charge (either positive or negative) constitutes 6 different flavors and each flavor holds certain mass. Charged flavor can be called as a quark. It is neither a fermion nor a boson. A fermion is a container

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for different charges, a charge is a container for different flavors and each flavor is a container for certain matter. If charged matter rests in a fermionic container it is a fermion and if charged matter rests in a bosonic container it is a boson. The fundamental questions to be answered in future are: what is a charge? Why and how opposite charges attracts each other? Why and how there exists a fermion? And why and how there exists a boson? Here interesting thing is that if 6 flavors exist with 6 different masses then a single charge can have one or two or more flavors simultaneously. Since charge is a common property, mass of the multiple flavor charge seems to be the geometric mean of the mass of each flavor. If charge with flavor is called as a quark then charge with multi flavors can be called as a hybrid quark. Hybrid quark generates a multi flavor baryon. It is a property of strong interaction space time - charge. Important consequence of this idea is that- there is no need to consider the existence of fractional charge quarks and for generating any baryon of charge $\pm e$, there is no need to couple any 3 fractional charge quarks.

In integral charge quark system, the basic idea is that, for each and every quark fermion, there exists a corresponding super symmetric quark boson. Quark fermion Q_f and quark boson Q_b mass ratio is close to 2.254. Any quark fermion after losing some mass to its SUSY boson remains as an ‘effective quark fermion’ Q_{ef}. Quark fermions transform into ground state quark baryons Q_{By} via the charged Higgs fermion. Up and down baryons seem to play a key role in the nucleons mass generation. Effective quark fermions transform into ground state effective quark baryons Q_E via the charged Higgs fermion and play a major role in the generation of observable unstable baryons. From now onwards we can have two sets of the 6 quark fermions. First set: Ordinary quark fermions and Effective quark fermions. Second set: Actual quark baryons and Effective quark baryons. In most of the cases effective quark baryons only seem to play a major role in understanding the observed baryon mass spectrum. Quark bosons transform into ground state quark mesons Q_M via the charged Higgs boson and play a key role in the observed mesons mass generation. All these possess unit charge.

If any two oppositely charged quark bosons couples together then a neutral quark boson can be generated. It may be called as a neutral ground state meson. If any light quark boson couples with any ground state ‘effective quark baryon’ then a neutral baryon or baryon with $\pm$2e can be generated This idea is very similar to the `photon absorption by electron'. When a weakly interacting electron is able to absorb a boson, in strong interaction it is certainly possible. More over if any effective quark baryon couples with two or three light quark bosons then the its mass increases and charge also changes. Here also if the system follows the principle `unlike charges attracts each other' in most of the cases effective quark baryon charge changes from $\pm$e to neutral and neutral to $\pm$e. Doublets and triplets can be understood in this way.

Key points to be noted in Integral charge system:

A) Instead of unity, fermion and its SUSY boson mass ratio can be considered as ~ 2.26. This idea can be applied to leptons, quarks, nucleons and electroweak bosons [1,2].
B) Both quark fermions and quark bosons can be assumed to have integral charge. At low energies as well as at high energies, all the observed mesons are SUSY bosons only.
C) Oppositely charged quark mesons joins together to form a ground state neutral meson. There is no need to consider the concept of ‘coupling of 2 quark fermions to form a meson’.

D) Strange quark boson pair generates the neutral PI meson. Charged PI meson seems to be geometric mean of Proton's SUSY boson and electron's SUSY boson.
E) Both Higgs fermions and Higgs boson can be assumed to have integral charge.
F) Electroweak W boson is nothing but the Top quark boson.
G) There exist charged Higgs fermion of rest energy ~ 103.1 GeV and its charged Higgs boson of rest energy ~ 45.6 GeV [1,2].
H) Charged Higgs boson pair generates the observed electroweak neutral Z boson [1,2].
I) Charged Higgs boson and the W boson jointly generate a neutral boson [20] of rest energy ~126 GeV [2].
J) W boson pair generates a neutral boson of rest energy ~161 GeV [2].
K) Down quark and up quark mass ratio can be expressed as $\frac{D_f}{U_f} \cong \beta \cong \frac{1}{\sin\theta} \cong \frac{1}{0.464}$ and Down quark and electron mass ratio can be expressed as $\frac{D_f}{m_e} \cong e^{\beta}$.
L) Down, charm and top quark family geometric ratio is close to $\left[\beta\left(\frac{\beta+1}{\beta-1}\right)\right]^2$ and similarly Up, strange and bottom quark family geometric ratio is close to $\left[2\beta\left(\frac{\beta+1}{\beta-1}\right)\right]^2$.
M) Quark baryon mass can be expressed as $Q_{By} \approx \frac{1}{2\beta}\left(M_{Hf}^2 Q_f\right)^{1/3} \approx 0.232\left(M_{Hf}^2 Q_f\right)^{1/3}$ where Q_{By}, M_{Hf}, Q_f represent quark baryon, charged Higgs fermion and Quark fermion respectively.
N) Effective quark baryon mass can be expressed as $Q_E \approx \frac{1}{2\beta}\left(M_{Hf}^2 Q_{ef}\right)^{1/3} \approx 0.232\left(M_{Hf}^2 Q_{ef}\right)^{1/3}$ where Q_E, M_{Hf}, Q_{ef} represent effective quark baryon, charged Higgs fermion and effective quark fermion respectively.
O) Quark meson mass can be expressed as $Q_M \approx \frac{1}{2\beta}\left(M_{Hb}^2 Q_b\right)^{1/3} \approx 0.232\left(M_{Hb}^2 Q_b\right)^{1/3}$ where Q_M, M_{Hb}, Q_b represent quark meson, charged Higgs boson and Quark boson respectively.

3. Gravity & Cosmology in microscopic physics

The key concepts to be noted are:

1) There exist three cosmological variables in the presently believed atomic and nuclear physical constants and with reference to the increasing cosmic time, 'rate of change' in their magnitudes, the absolute cosmic rate of expansion can be understood.

2) Final unification demands the existence of one 'unified force'. Note that, in any bound system, 'operating force' only plays a major role in maintaining the 'existence of the bound system' and 'angular momentum' is one of the results. If one is able to make the operating force as discrete, then automatically one can observe a discrete structure like discrete radii, discrete angular momentum and discrete energy levels.

3) During cosmic evolution if nuclear mass and nuclear charge radius both are assumed to play a fundamental role in the formation of atom and cause electron to revolve round the nucleus, then reduced Planck's constant can be assumed as cosmological compound atomic physical variable and can be considered as an outcome result of the atomic system and may not an input to the atomic system.

4) If light is coming from the atoms of the gigantic galaxy, then cosmic redshift can be interpreted as an index of the galactic atomic 'light emission mechanism'. During cosmic evolution, as cosmic time increases, hydrogen atom emits photons with increased quanta of energy. Thus past light quanta emitted from old galaxy will have less energy and show a red shift with reference to our galaxy. During journey light quanta will not lose energy and there will be no change in light wavelength.

These concepts cast doubt on the independence existence of quantum mechanics. In this regard the key discoveries, definitions and results can be expressed as follows:

A) Atomic gravitational constant G_A is squared Avogadro number $\left(N_A\right)$ times the 'classical' gravitational constant *G*. i.e $G_A \cong N_A^2 G$ where N_A is the Avogadro number [2-11].

B) Independent of any system of units, the characteristic relation that connects the 'gram mole' and the unified atomic mass unit can be expressed $G_A m_u^2 \cong G M_x^2$ and $M_x \cong \sqrt{\frac{G_A}{G}} \cdot m_u \cong N_A \cdot m_u$. Here m_u is the unified atomic mass unit and $m_u c^2 \cong \left(\sqrt{m_p m_n} c^2 - B_{Ave}\right) + m_e c^2 \cong 931.43$ MeV where $B_{Ave} \approx 8$ MeV is the average binding energy per nucleon. $M_x \approx 0.001$ kg and may not be exactly 'one' gram'. Accuracy mainly depends upon the average binding energy per nucleon.

C) Similar to the classical force limit $\left(c^4/G\right)$, if $n = 1, 2, 3, \ldots$ based on the new idea (nN_A), $\frac{c^4}{\left(nN_A\right)^2 G} \cong \frac{c^4}{n^2\left(N_A^2 G\right)} \cong \frac{1}{n^2}\left(\frac{c^4}{G_A}\right) \cong \frac{F_B}{n^2}$ can be considered as a characteristic discrete binding force. It is having many applications in atomic physics, nuclear physics, quantum physics and particle physics. It plays a very interesting role in estimating the charged lepton rest masses.

D) If Z is the number of protons in the nucleus then $Z\left(c^4/G_A\right)$ can be considered as the force acting on any electron.

E) At any time Hubble length $\left(\frac{c}{H_t}\right)$ can be considered as the electromagnetic and gravitational interaction range. In a cosmological approach, if H_0 is the current Hubble's constant [12-

14], current nuclear charge radius can be expressed as follows [10,15-16]. $(R_c)_0 \cong \frac{1}{N_A^2}\left(\frac{m_p}{m_e}\right)^2\left(\frac{c}{H_0}\right) \cong \left(\frac{\hbar_0 c}{G_A m_e^2}\right)^2 \frac{2G_A m_e}{c^2} \cong 1.21565$ fm.

F) Current reduced Planck's constant can be expressed as [10] $(\hbar_0) \cong m_e c^2 \sqrt{\left(\frac{G_A}{c^4}\right)\frac{m_e (R_c)_0}{2}} \cong \sqrt{\frac{M_0}{m_e}}\left(\frac{G m_p m_e}{c}\right)$. Here the ratio (M_0/m_e) represents the virtual number electrons that may exist in the present Hubble volume of mass $M_0 \cong \left(c^3/2GH_0\right)$. Discrete form of $(\hbar_0)$ seems to be $n(\hbar_0) \cong m_e c^2 \sqrt{\left(\frac{n^2 G_A}{c^4}\right)\frac{m_e (R_c)_0}{2}}$.

G) Current potential energy of electron in hydrogen atom can be expressed as [10] $(E_P)_0 \cong -\left(\frac{\hbar_0 c}{G_A m_e^2}\right)^2 \frac{\sqrt{m_p m_e}\cdot c^2}{2n^2}$ where $n = 1, 2, 3...$ In a unified picture it can be expressed as follows.

$$(E_P)_0 \cong -\frac{1}{4}\sqrt{\frac{m_p}{m_e}}\left(\frac{c^4}{n^2 G_A}\right)(R_c)_0 \cong -\frac{1}{4}\sqrt{\frac{m_p}{m_e}}\frac{F_B (R_c)_0}{n^2}.$$

H) If h represents the (cosmological) Planck's constant, current rms radius of proton [10,17-19] can be expressed as $(R_p)_0 \cong \frac{4\pi G m_p m_e}{hH_0} \cong \frac{G m_p m_e}{(h/4\pi)H_0}$ and at any time, $(R_p)_t \cong \frac{4\pi G m_p m_e}{hH_t} \cong \frac{G m_p m_e}{(h/4\pi)H_t}$. It can be suggested that, at any time, $(R_p)_0 H_0 \cong (R_p)_t H_t \cong \frac{G m_p m_e}{(h/4\pi)}$.

I) At present, inverse of the Fine structure ratio can be expressed as follows.

$\left(\frac{1}{\alpha}\right)_0 \cong \ln\sqrt{\left(1+\ln\left(\frac{M_0}{M_C}\right)\right)^{-1}\left(\frac{M_0}{M_C}\right)}$ where $M_0 \cong \left(c^3/2GH_0\right)$ and $M_C \cong \sqrt{\frac{e^2}{4\pi\varepsilon_0 G}}$.

J) Present cosmic microwave back ground radiation wavelength can be expressed as

$(\lambda_m)_0 \cong \sqrt{\left(1+\ln\left(\frac{M_0}{M_C}\right)\right)\left(\frac{M_0}{M_C}\right)\left(\frac{k_B bG}{2c^4}\right)}$. Corresponding present thermal energy density can be expressed as $aT_0^4 \cong \left(1+\ln\left(\frac{M_0}{M_C}\right)\right)^{-2}\left(\frac{3H_0^2 c^2}{8\pi G}\right)$. Similarly present matter density can be expressed as $(\rho_m)_0 \cong \left(1+\ln\left(\frac{M_0}{M_C}\right)\right)^{-1}\left(\frac{3H_0^2}{8\pi G}\right)$.

4. To fit the modified SUSY fermion-boson mass ratio

In a cosmological approach authors assume that, the modified SUSY fermion-boson mass ratio does not change with cosmic time. It can be fitted in the following way.

$$\text{Let, } x \cong \ln\sqrt{\frac{c}{(R_c)_0 H_0}} \cong \ln\sqrt{\frac{c}{(R_c)_t H_t}} \cong \ln\left[N_A\left(\frac{m_e}{m_p}\right)\right] \tag{1}$$

where $(R_c)_t$ and H_t represent nuclear charge radius and Hubble's constant at time t respectively. It can be suggested that, $(R_c)_0 H_0 \cong (R_c)_t H_t \cong \text{Constant.}$

$$y \cong x\left[1 - \frac{1}{\ln\left(x\sqrt{y}\right)}\right] \tag{2}$$

With trial and error, if x is known, value of y can be fitted. Let $(R_c)_0 \cong 1.22$ fm and $H_0 \cong 71$ km/sec/Mpc. Then $x \cong 47.2359.$ Please see the following table 1 for fitting the value of $y.$ At 7$^{\text{th}}$ trial, assumed value of y is equal to the obtained value of $y = 38.92852184.$ It is noticed that y plays an interesting role in fitting the rest masses of charged leptons and nucleons.

Table 1: To fit the value of $y.$

Trial No	Assumed value of $y.$	Obtained value of $y.$
1	47.2359	39.06746
2	39.06746	38.931124
3	38.931124	38.9285707
4	38.9285707	38.9285228
5	38.9285228	38.9285219
6	38.9285219	38.92852184
7	**38.92852184**	**38.92852184**

The modified SUSY fermion-boson mass ratio [1,2,10] can be fitted with the following semi empirical relation.

$$\frac{m_f}{m_b} \cong \Psi \cong \sqrt{\frac{x}{\sqrt{x+y}}} \cong 2.256 \tag{3}$$

Here m_f represents the rest mass of fermion and m_b represents the rest mass of boson. This idea can be applied to charged leptons, quarks, hadrons and Higgs particles. Characteristic weak coupling angle can be expressed as follows.

$$\frac{1}{\sin\theta} \cong \sqrt{\frac{\sqrt{x+y}}{2}} \cong 2.15435365 \cong \beta \tag{4}$$

and $\sin\theta \cong 0.464176343.$

5. To fit the charged Higgs fermion and charged Higgs boson rest energy

Mass ratio of Higgs charged fermion and electron can be fitted in the following way:

$$\left(\frac{M_{Hf}c^2}{m_e c^2}\right) \cong \frac{m_e c^2}{F_B\left(R_c\right)_0} \tag{5}$$

$$M_{Hf}c^2 \cong \left(\frac{m_e c^2}{F_B\left(R_c\right)_0}\right) m_e c^2 \cong 103.1186 \text{ GeV} \tag{6}$$

where $\left(R_c\right)_0 \cong 1.21565$ fm. As the nuclear charge radius increases with cosmic time, rest mass of charged Higgs fermion decreases with cosmic time. It can be suggested that, during cosmic evolution charged Higgs fermion mass decreases with increase in cosmic time. Now charged Higgs boson rest energy can be expressed as follows.

$$M_{Hb}c^2 \cong \left(\frac{M_{Hf}c^2}{\Psi}\right) \cong \left(\frac{m_e c^2}{F_B\left(R_c\right)_0}\right)\left(\frac{m_e c^2}{\Psi}\right) \cong 45.7086 \text{ GeV} \tag{7}$$

It can be suggested that, during cosmic evolution charged Higgs boson mass decreases with increase in cosmic time.

6. To fit the rest masses of electron, proton and neutron

With the above obtained numerical values of x and y, to a very good accuracy it is noticed that,

$$\frac{e^2}{4\pi\varepsilon_0 G m_p m_e} \cong \frac{1}{x}\left(\frac{c}{\left(R_c\right)_0 H_0}\right) \cong \frac{1}{x}\left(\frac{c}{\left(R_c\right)_t H_t}\right) \tag{8}$$

$$\frac{e^2}{4\pi\varepsilon_0 G m_e^2} \cong y\left(\frac{c}{\left(R_c\right)_0 H_0}\right) \cong y\left(\frac{c}{\left(R_c\right)_t H_t}\right) \tag{9}$$

$$\frac{m_p}{m_e} \cong xy \cong 1838.8238 \tag{10}$$

$$m_e c^2 \cong x\sqrt{y}\sqrt{\frac{e^2 F_B}{4\pi\varepsilon_0}} \cong 0.5104 \text{ MeV} \tag{11}$$

Now to a very good approximation muon and tau rest masses can be fitted as follows [20].

$$\left(m_{lepton}c^2\right)_n \cong \left[\gamma^3 + \left(n^2\gamma\right)^n \sqrt{N_A}\right]^{\frac{1}{3}} \sqrt{\frac{e^2 F_B}{4\pi\varepsilon_0}} \tag{12}$$

where $F_B \cong \frac{c^4}{G_A}$, $\gamma \cong x\sqrt{y} \cong 294.7074$, $n = 1, 2.$ Please see the following table 2.

Table 2: To fit the muon and tau rest masses

No	Obtained rest energy of lepton in MeV	Experimental rest energy of lepton in MeV
1	105.908	105.6583668(38)
2	1775.97	1776.99(29)
3	**42211.82**	**Not detected**

Proton rest energy can be expressed as follows.

$$m_p c^2 \cong x^2 y^{\frac{3}{2}} \sqrt{\frac{e^2 F_B}{4\pi\varepsilon_0}} \cong 938.545 \text{ MeV} \tag{13}$$

$$\left(m_e \text{ and } m_p\right)c^2 \cong (x)^n (y)^{(2n-1)/2} \sqrt{\frac{e^2 F_B}{4\pi\varepsilon_0}} \cong (x)^n (y)^{(2n-1)/2} \sqrt{\frac{e^2 F_B}{4\pi\varepsilon_0}} \tag{14}$$

where $n=1$ and 2. At $n=3$, it is possible to predict a heavy charged fermion with rest energy 1726 GeV and based on the modified super symmetry its corresponding charged boson with rest energy 765 GeV can also be predicted. Neutron, proton and electron rest masses can be interrelated in the following way.

$$\frac{m_n c^2 - m_p c^2}{m_e c^2} \cong \ln\left(2\sqrt{y}\right) \cong 2.524 \tag{15}$$

$$m_n c^2 \cong m_p c^2 + \ln\left(2\sqrt{y}\right) m_e c^2 \cong 939.833 \text{ MeV} \tag{16}$$

7. To fit the Semi empirical mass formula (SEMF) binding energy coefficients in a cosmological approach

The semi-empirical mass formula (SEMF) is used to approximate the mass and various other properties of an atomic nucleus [3,21,22]. As the name suggests, it is based partly on theory and partly on empirical measurements. Based on the 'least squares fit', volume energy coefficient is $a_v = 15.78$ MeV, surface energy coefficient is $a_s = 18.34$ MeV, coulomb energy coefficient is $a_c = 0.71$ MeV, asymmetric energy coefficient is a_a = 23.21 MeV and pairing energy coefficient is $a_p = 12$ MeV. The semi empirical mass formula is

$$BE \cong Aa_v - A^{\frac{2}{3}} a_s - \frac{Z(Z-1)}{A^{\frac{1}{3}}} a_c - \frac{(A-2Z)^2}{A} a_a \pm \frac{1}{\sqrt{A}} a_p \tag{17}$$

In the semi empirical mass formula energy coefficients can be fitted in the following way. In a unified approach it is noticed that, the energy coefficients are having strong inter-relation with the above cosmological ratio $k_0 \cong \left(\frac{G_A m_e^2}{\hbar_0 c}\right) \cong 635.3132.$ The interesting semi empirical observations can be expressed in the following way. Advantage of this proposal is that, magnitude of all the binding energy coefficients decreases with the increasing magnitude of $\left(\frac{G_A m_e^2}{\hbar_t c}\right)$ and binding energy reaches to zero indicating that there was no binding of nucleons in the past. At present it can be suggested that,

$$(a_v)_0 + (a_s)_0 \cong (a_a)_0 + (a_p)_0 \cong \frac{3}{2}(a_a)_0 \cong \frac{m_p c^2}{1+\sqrt{k_0}} \cong 35.8045 \text{ MeV} \tag{18}$$

Current asymmetric energy coefficient be

$$(a_a)_0 \cong \frac{2}{3}.\left(\frac{m_p c^2}{1+\sqrt{k_0}}\right) \cong 23.870 \text{ MeV} \tag{19}$$

Current pairing energy coefficient be

$$(a_p)_0 \cong \frac{(a_a)_0}{2} \cong \frac{1}{3}.\left(\frac{m_p c^2}{1+\sqrt{k_0}}\right) \cong 11.935 \text{ MeV} \tag{20}$$

Current maximum nuclear binding energy per nucleon be

$$(B_m)_0 \cong \frac{1}{4}.\left(\frac{m_p c^2}{1+\sqrt{k_0}}\right) \cong 8.9511 \text{ MeV} \tag{21}$$

Current coulombic energy coefficient be

$$(a_c)_0 \cong \sqrt{\alpha_0}.(B_m)_0 \cong 0.7647 \text{ MeV} \tag{22}$$

Current surface energy coefficient be

$$(a_s)_0 \cong 2(B_m)_0\left(1+\sqrt{\frac{(a_c)_0}{(a_a)_0}}\right) \cong 19.504 \text{ MeV} \tag{23}$$

Current volume energy coefficient be

$$(a_v)_0 \cong 2(B_m)_0\left(1-\sqrt{\frac{(a_c)_0}{(a_a)_0}}\right) \cong 16.30 \text{ MeV} \tag{24}$$

In table-3 within the range of $(Z=26; A=56)$ to $(Z=92; A=238)$ nuclear binding energy is calculated and compared with the measured binding energy. Column-3 represents the calculated binding energy and column-4 represents the measured binding energy. Proton-nucleon stability relation can be expressed as follows.

$$\left(\frac{A_s}{2Z}\right)_0 \cong 1+2Z\left[\frac{(a_c)_0}{(a_s)_0}\right]^2 \tag{25}$$

where $(A_s)_0$ is the stable mass number of Z. This is a direct relation. Assuming the proton number Z, in general, for all atoms, lower stability can be fitted directly with the following relation. Stable super heavy elements can also be predicted with this relation.

$$(A_s)_0 \cong 2Z\left[1+2Z\left[\frac{(a_c)_0}{(a_s)_0}\right]^2\right] \cong 2Z+\left(Z^2 * 0.00615\right) \tag{26}$$

if $Z=21,\ A_s \cong 44.71$; if $Z=29,\ A_s \cong 63.17$; if $Z=47,\ A_s \cong 107.58$; if $Z=53,\ A_s \cong 123.27$
if $Z=60,\ A_s \cong 142.13$; if $Z=79,\ A_s \cong 196.37$; if $Z=83,\ A_s \cong 208.36$; if $Z=92,\ A_s \cong 236.04$;

Table 3: SEMF Binding Energy with the Proposed Energy Coefficients

Z	A	$(BE)_{cal}$ **in MeV**	$(BE)_{meas}$ **in MeV**
6	56	492.17	492.254
28	62	546.66	545.259
34	84	727.75	727.341
50	118	1007.76	1004.950
60	142	1184.50	1185.145
79	197	1556.66	1559.40
82	208	1627.11	1636.44
92	238	1805.60	1801.693

At the beginning of cosmic evolution, binding energy coefficients and hence binding energy reaches to zero, and the expression $2Z\left[\frac{(a_c)_0}{(a_s)_0}\right]^2 \cong 0,$ also reaches to zero, more or the less the proton – nucleon stability takes the following form.

$$\left(\frac{A_s}{2Z}\right)_{\text{beginning}} \cong 1 \tag{27}$$

As nuclear binding energy was zero at the beginning of cosmic evolution, it can be suggested that, from the beginning of formation of nucleons, in any galaxy, maximum scope is being possible only for the survival of light atoms and this may be the reason for the accumulation and abundance of light atoms in large proportion.

8. Discussion and conclusion

1. With the proposed idea, $G_A \cong N_A^2 G$ it is possible to understand the relative strengths of strong interaction and gravitational interactions. In future experiments its hidden back ground mystery and applications can be explored.
2. Authors clearly showed the various applications of the proposed characteristic binding force, $F_B \cong \left(c^4/G_A\right)$ and its discrete nature in hydrogen atom.

3. Authors clearly showed the way of expressing the characteristic nuclear charge radius in a unified cosmological approach. Clearly speaking, ratio of characteristic radius of universe and the characteristic nuclear charge radius is the product of nuclear and gravitational strength ratio and squared electron and proton mass ratio. Advantage of this idea is that Avogadro number can also be considered as a characteristic absolute number and can be obtained in a cosmological way.
4. Based on 'integral charge quark super symmetry' the authors clearly explained the mechanism of obtaining the quark fermion, quark boson and quark meson rest masses. In this paper in a cosmological approach, authors proposed a simple method for estimating the modified SUSY fermion and boson mass ratio. With these ideas it is possible to relinquish the following basic concepts of current quark physics: 1) The fractional charges of quarks. 2) Combination of two quark fermions to form a meson.
5. Considering the proposed ideas it is possible to conclude that currently believed Higgs neutral boson of rest energy 125 GeV is a compound state of the charged Higgs boson and hence it cannot be considered as a god particle.

Even though Quantum mechanics and General theory of relativity both are having individual existence, strong mathematical back ground and good physical beauty, combining them seems to be beyond the scope of current physics standards and demands sound knowledge on unknown and hidden things [23-26] of atom and the universe. Even though SUSY is having excellent theoretical support and in-depth mathematical back ground, based on SUSY concepts so far no single SUSY boson could be detected in the Large Hadron Collider. This puzzling issue casts doubt on the continued existence of SUSY. In a nutshell, it is very clear that something is missing from our knowledge net! Missing knowledge can be obtained only through intellectual thinking, mathematical modeling, probing the atomic nucleus and universe to the possible extent, constructing semi empirical relations among physical constants of various interdisciplinary branches of physics with all possible interpretations and so on. Which way/method is best will be decided by future experiments, observations and interpretations. As it is interconnected with all branches of physics, 'semi empirical approach' seems be the easiest and shortcut way. It sharpens and guides human thinking ability in understanding the reality of unification. For any theoretical concept or mathematical model or semi empirical relation, 'workability' is more important than its inner beauty and 'workability' is the base of any semi empirical approach. Based on these proposals herein the authors argue that this is the time to revise, refine and unify the basic concepts of quark physics, electroweak physics and SUSY at a more fundamental level through a cosmological approach.

Acknowledgements: The first author is indebted to professor K. V. Krishna Murthy, Chairman, Institute of Scientific Research on 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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