Article

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Understanding the Origins of Quark Charges, Quantum of Magnetic Flux, Planck's Radiation Constant and Celestial Magnetic Moments with 4G Model of Nuclear Charge

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Abstract: In our previous published papers, considering 3 large atomic gravitational constants assumed to be associated with weak, strong and electromagnetic interactions, we have proposed the existence of a nuclear charge of magnitude, e_n=2.95e and developed a nuclear mass formula associated with strong and weak interactions having 4 simple terms and only one energy coefficient. Two important assumptions are, there exists a weak fermion of rest energy 585 GeV and strong coupling constant is the squared ratio of electromagnetic charge and nuclear charge. The aim of this paper is associated with understanding the mystery of quantum of magnetic flux, Planck's quantum radiation constant and Reduced Planck's constant. Proceeding further, quark charges, strong coupling constant, nuclear stability, nuclear binding energy, medium and heavy atomic X-ray levels and celestial magnetic moments can be understood in a unified approach. It may also be noted that, by considering integral nature of elementary particle masses, it seems possible to understand the discreteness of angular momentum. Considering our proposed e_n=2.95e=3e as a characteristic nuclear charge, it seems possible to understand the integral nature of quarks electromagnetic charge. With this idea, neutron, proton and pions decay can be understood very easily. In all the cases, up quark of charge (±2e) seems to play a crucial role with the internal transformation of down quark of charge (±e) and external observable elementary basic elementary particles. It needs further study at fundamental level.

Keywords: 4G model of final unification; 3 atomic gravitational constants; nuclear charge; electromagnetic charge; Integral charge quarks; quantum of magnetic flux; Planck's radiation constant; celestial magnetic moments

1. Introduction

According Einstein [1], unification means - finding correlations between gravity, magnetism and quantum mechanism. As per the EPR paradigm [2], quantum mechanics is having no independent existence. In this context, in a unified approach and to bring down the concepts of string theory to laboratory level, in our recent publications, we have reintroduced [3,4], quantified and established the existence of three large atomic gravitational constants assumed to be associated with weak, strong and electromagnetic interactions [5,6]. Considering the Newtonian gravitational constant and the three atomic gravitational constants, we call our model as – '4G model of final unification'. To understand the strong interaction and fractional quark charges, we have suggested the existence of nuclear elementary charge [7]. To understand the mystery of quantum constants, we have introduced the existence of weak fermion of rest energy 585 GeV [8–10]. Based on these points, we have proposed

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many applications in the light of 'nuclear quantum gravity'. In this paper, we make an attempt to understand the origins of electromagnetic charge, quantum of magnetic flux and Planck's radiation constant. Our three basic assumptions can be read as follows.

1) There exists a characteristic electroweak fermion of rest energy, $M_{wf}c^2 \cong 584.725$ GeV. It can be considered as the zygote of all elementary particles.
2) There exists a strong interaction elementary charge (e_n) in such a way that, its squared ratio with normal elementary charge is close to the reciprocal of the strong coupling constant.
3) Each atomic interaction is associated with a characteristic large gravitational coupling constant.

2. Origin of the Electromagnetic Charge and Quantum of Magnetic Flux

Existence of the proposed three atomic gravitational constants can be validated vide our published papers [4–17]. We appeal the physicists to see the possibility of understanding the existence of the three atomic gravitational constants based on the failure of string theory in understanding atomic and nuclear scale results [18,19]. Let,

Electromagnetic gravitational constant= $G_e \cong 2.374335\times10^{37}$ m^{3}kg^{-1}sec^{-2}

Nuclear gravitational constant = $G_n \cong 3.329561\times10^{28}$m^{3}kg^{-1}sec^{-2}

Weak gravitational constant = $G_w \cong 2.909745\times10^{22}$ m^{3}kg^{-1}sec^{-2}

Newtonian gravitational constant = $G_N \cong 6.679855\times10^{-11}$ m^{3}kg^{-1}sec^{-2} (Our estimation)

It may be noted that, recommended value [17] of $G_N \cong 6.674030(15)\times10^{-11}$ m^{3}kg^{-1}sec^{-2} and its most recent experimental value having considerable uncertainty [20] is $G_N \cong 6.821(71)\times10^{-11}$ m^{3}kg^{-1}sec^{-2}. (https://ethz.ch/en/news-and-events/eth-news/news/2022/07/eth-researchers-remeasure-gravitational-constant.html)

High energy nuclear physics point of view [17], estimated values of the nuclear charge and strong coupling constant are, $e_n \cong 2.9463591e$ and $\alpha_s \cong \left(\frac{e}{e_n}\right)^2 \cong 0.1151937$. This approach helps in understanding the actual physical meaning of currently believed strong coupling constant. We would like to emphasize the fact that, current unified models are simply using the experimental values of electromagnetic charge and Planck's constant without addressing their origin. Our model is shedding light on the mystery to some extent in the following way. We stress the point that, at fundamental level, especially at nuclear scale, electromagnetic charge is having a special bonding with nuclear charge. It can be expressed as,

$$e \cong \left(\frac{\hbar c}{G_n m_p^2}\right)e_n \cong \left(\frac{G_w M_{wf}^2}{G_n m_p^2}\right)e_n \cong \frac{e_n}{2.9464} \approx \frac{e_n}{3} \quad (1)$$

$$\frac{e}{e_n} \cong \left(\frac{\hbar c}{G_n m_p^2}\right) \cong \left(\frac{G_w M_{wf}^2}{G_n m_p^2}\right) \cong \frac{1}{2.9464} \approx \frac{1}{3} \quad (2)$$

We would like to emphasize the point that, there exists a strong interconnection between fractional charge of quarks and the proposed nuclear charge [13–15]. It can be understood as follows. For strongly interacting elementary particles,

a) Up, Charm and Top quark's electromagnetic charge is $+\frac{2}{3}e_n \cong +2e$.
b) Down, Strange and Bottom quark's electromagnetic charge is $-\frac{1}{3}e_n \cong -e$.
c) Quarks having an electromagnetic charge of $\pm 2e$ and $\mp e$ can be called as integral charge quarks.
d) There exists no repulsion between any two particles having same kind of nuclear charge.

For example, proton can be assumed to have one up quark pair and one anti down quark. Neutron can be assumed to have two anti down quarks and one anti up quark. Positive and negative pions can be assumed to have one Up quark and one down quark or one anti up quark and anti down quark. Neutral pions can be assumed to have one Up quark pair or one down quark pair. Thus, decay of neutrons, protons and pions can be understood very easily. For the case of neutron decay, one anti up quark transforms to one down quark and releases one electron. For the case of proton decay, one up quark transforms to one anti down quark and releases one positron. In case of charged pions, up quark plays a vital role in the decay process. For positive pion, up quark transforms positive electron or positive muon and generates a neutral pion. For negative pion, anti up quark transforms to electron or negative muon and generates a neutral pion. With reference to Up quark pair, neutral pion can decay into 2 positive particles and two negative particles. With reference to down quark pair, neutral pion can decay into one positive particle and one negative particle. We are working in this new direction. It needs a careful study. With reference to current notion of fractional quark charges we have prepared Table 1. It may be noted that, in the second column, quark charges expressed in '( )' indicate their own internal decay in the third column. In all the cases, up quark of charge $(\pm 2e)$ seems to play a crucial role in final decay.

Table 1. Internal and external decay modes of neutron, proton and pions .

Particle	Integral Quark charges	Internal Decay mode	Decay Result
Neutron	+e, +e, (-2e)	-2e → -e, -e	[+e, +e, (-e)] = Proton and Electron (-e)
Anti neutron	-e, -e, (+2e)	+2e → +e,+e	[-e,-e,(+e)] = Anti proton and Positron (+e)
Proton	(+2e), (-2e), +e +e, +e, -e	+2e → +e,+e -2e → -e, -e	[(+e), -2e, +e] = Neutron and Positron (+e) [+2e, (-e),+e] = (Baryon^{+2e}) and (electron or muon^{-}) Lepton^{+} and Gamma or Pion^{0} Lepton^{-} and meson^{+2e}
Anti proton	(-2e), (+2e), -e -e,-e, +e	-2e → -e, -e +2e → +e,+e	[(-e), +2e, -e] = Anti neutron and Electron (-e) [-2e, (+e),-e] = (baryon^{-2e}) and (positron or muon^{+}) Lepton^{-} and Gamma or Pion^{0} Lepton^{+} and meson^{-2e}
Pion^{+}	(+2e),-e	+2e → +e, +e	Positron or Muon^{+} and [(+e),-e] = Gamma or Pion^{0}
Pion^{-}	(-2e),+e	-2e → -e,-e	Electron or Muon^{-} and [(-e),+e] = Gamma or Pion^{0}
Pion^{0}	(+2e),(-2e); - e,+e	(+e,+e),(-e,-e) -e,+e	Two Gamma Electron, Positron and Gamma Two electrons and Two positrons Electron and positron One Gamma

With reference to strong interaction, this kind of approach helps in understanding baryons and mesons, neuron-proton short ranges pairs, nuclear binding stability and binding energy, magnetic moments of electrically neutral particles, binding of quarks and strength of strong interaction etc. We are working in this new direction for accommodating them in current quark models [13–15].

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Proceeding further, ignoring the factor $\left(\frac{1}{2}\right)$, quantum of magnetic flux [21,22] can be addressed with,

$$\frac{h}{e} \cong \frac{e_n}{e}\sqrt{\frac{\mu_0}{4\pi}\left(G_e m_e^2\right)} \tag{3}$$

From this relation one can understand the significance of the ratio $\left(\frac{e_n}{e}\right)$ and the significance of the proposed electromagnetic gravitational constant G_e. It may also be noted that, $\frac{e_n}{e} \cong \frac{4\pi^2 m_e}{\alpha m_p}$. Thus, from the experimental value of $\left(\frac{h}{e}\right)$, electromagnetic gravitational constant can be estimated.

Interesting point to be noted is that, discreteness of the observed magnetic flux can be understood with increasing number of electrons. Clearly speaking,

$$n\left(\frac{h}{e}\right) \cong \frac{e_n}{e}\sqrt{\frac{\mu_0}{4\pi}\left[G_e\left(n.m_e\right)^2\right]} \tag{4}$$

where n =1,2,3,.. = Number of electrons.

3. Origin of the Planck's Radiation Constant

The mysterious and the famous Planck's radiation constant seems to have its root connected with the proposed nuclear charge. It can be expressed as,

$$h \cong \sqrt{\left(\frac{e_n^2}{4\pi\varepsilon_0 c}\right)\left(\frac{G_e m_e^2}{c}\right)} \cong \frac{e_n}{e}\sqrt{\left(\frac{e^2}{4\pi\varepsilon_0 c}\right)\left(\frac{G_e m_e^2}{c}\right)} \tag{5}$$

This relation seems to be very simple having a deep inner meaning associated with number of electrons or number of oscillators as described in quantum theory of light [23]. Similar to the Planck's constant, one may be interested in understanding the origin of the famous Reduced Planck's constant. It can be addressed as,

$$\frac{\hbar}{m_e} \cong \frac{\sqrt{G_n m_p}\sqrt{G_e m_e}}{c} \tag{6}$$

$$\begin{aligned}\hbar &\cong \frac{m_e\sqrt{G_n m_p}\sqrt{G_e m_e}}{c} \cong \left(\frac{G_e G_w}{G_n}\right)\frac{m_p m_e}{c} \\ &\cong \left[\left(\frac{e}{m_e}\right)\div\left(\frac{e_n}{m_p}\right)\right]\frac{G_n m_p m_e}{c} \cong \left(\frac{e}{e_n}\right)\frac{G_n m_p^2}{c}\end{aligned} \tag{7}$$

Magnetic moment of electron can be expressed as,

$$\begin{aligned}\mu_e &\cong \frac{e\hbar}{2m_e} \cong \sqrt{\left(\frac{eG_n m_p}{2c}\right)\left(\frac{eG_e m_e}{2c}\right)} \cong \frac{e\sqrt{G_n m_p}\sqrt{G_e m_e}}{2c} \\ &\cong \left[\left(\frac{e}{m_e}\right)\div\left(\frac{e_n}{m_p}\right)\right]\left(\frac{eG_n m_p}{2c}\right) \cong \left[\left(\frac{e}{m_e}\right)\div\left(\frac{e_n}{m_p}\right)\right]\mu_p\end{aligned} \tag{8}$$

Qualitatively, $\frac{\mu_e}{\mu_p} \cong \frac{\text{Specific charge of electron having charge } e}{\text{Specific charge of proton having charge } e_n}$

This is a very good and very strong application of the proposed nuclear charge. Quantitatively, ratio of actual magnetic moment of electron to Bohr magneton seems to be,

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$\left[1+\left(\frac{\alpha}{2\pi}\right)\right] \cong \left[1+\left(\frac{e^2}{4\pi\varepsilon_0 hc}\right)\right] \cong \left[1+\left(\frac{e}{e_n}\sqrt{\frac{e^2}{4\pi\varepsilon_0 G_e m_e^2}}\right)\right] \cong 1.00116141$. This can be compared with actual ratio 1.001159653. This coincidence clearly demonstrates the potential applications in estimating the electron anomalous magnetic moment. Quantitatively, $\frac{e_n}{e} \cong \frac{4\pi^2 m_e}{\alpha m_p}$. By substituting this expression in the above and considering electron's anomalous magnetic moment, electromagnetic gravitational constant can be estimated. Here we would like to stress the point that, by considering the ratio $\sqrt{\frac{e^2}{4\pi\varepsilon_0 G_e m_e^2}}$, electron, muon and tau masses can be fitted accurately [14].

4. Origin of Celestial Magnetic Moments

Considering the above concepts and relations, any celestial body's magnetic dipole moment [24,25] can be understood with a relation of the form,

$$\mu_{Cel} \cong \left(\frac{M_{Cel}}{M_{wf}}\right)\left(\mu_{wf} \text{ Or } \mu_p \text{ Or } \mu_e\right) \tag{9}$$

where,

$M_{Cel} \cong$ Mass of any celestial body.

$\mu_{Cel} \cong$ Magnetic moment of celestial body.

$\mu_{wf} \cong$ Magnetic moment of proposed weak fermion $\cong \frac{e\hbar}{2M_{wf}} \cong 8.105\times10^{-30}$ J/tesla.

$\mu_p \cong$ Magnetic moment of proton $\cong \frac{e_n\hbar}{2m_p} \cong 1.4875\times10^{-26}$ J/tesla.

$\mu_e \cong$ Magnetic moment of electron $\cong \frac{e\hbar}{2m_e} \cong 9.274\times10^{-24}$ J/tesla.

Considering the average density, average temperature, average radius, conductivity and other properties of any celestial body, its possible lower, mean and upper limits of magnetic moments can be approximated as,

$$\left(\mu_{Cel}\right)_{lower} \cong \left(\frac{M_{Cel}}{M_{wf}}\right)\left(\mu_{wf}\right) \tag{10}$$

$$\left(\mu_{Cel}\right)_{mean} \cong \left(\frac{M_{Cel}}{M_{wf}}\right)\left(\mu_p\right) \tag{11}$$

$$\left(\mu_{Cel}\right)_{upper} \cong \left(\frac{M_{Cel}}{M_{wf}}\right)\left(\mu_e\right) \tag{12}$$

Here important observation is that, $\left(\frac{M_{Cel}}{M_{wf}}\right)$ i.e, ratio of mass of celestial object to the mass of proposed weak fermion seems to play a key role. To some extent, it supports our fist assumption in a macroscopic approach. It may be noted that, considering the mean value associated with proton magnetic moment, Earth's estimated magnetic moment is 8.1×10^{22} J/Tesla. It is very close to the actual value. With reference to magnetic moments of proton and electron, $\frac{\mu_p}{\mu_e} \approx \frac{m_p}{M_{wf}}$. Thus, by modifying relation (11), Earth's magnetic moment can be fitted with a relation,

$$\mu_{Earth} \cong \left(\frac{M_{Earth}}{m_p}\right)\left(\frac{m_p}{M_{wf}}\right)\mu_p \cong \left(\frac{M_{Earth}}{m_p}\right)\left(\frac{\mu_p^2}{\mu_e}\right) \cong 7.7\times10^{22} \text{ J/Tesla.} \quad (13)$$

With further study, there is a scope for understanding the celestial magnetism in terms of elementary particles magnetic moments as well as arrangement of atoms and internal structure of celestial bodies.

5. Discussion on Interaction Strength and Large gravitational Coupling Constants at Atomic Level

The fundamental question to be answered is – What is final unification in physics? One line answer is – To understand the observed four interactions in a unified approach. In this context, in our paper published in 2015 [7]- by considering 'gravity' as the basic controlling mechanism and considering $\left(c^4/G_N\right)$ as the ultimate force of all interactions, we have suggested a simple mechanism for understanding the interaction strengths associated with the three atomic interactions based on the operating force ratio. Ultimate interaction strength can be defined as 1. In case of black holes [26], operating force [27] is $\left(c^4/4G_N\right)$ and interaction strength is $\left[\left(c^4/4G_N\right)/\left(c^4/G_N\right)\right] \cong 0.25.$ It can be called as "Schwarzschild interaction strength" [17]. Thinking in this way, for the three atomic interactions, interaction strength can be defined as follows. At atomic scale,

For weak interaction, $\left[\left(c^4/G_w\right)/\left(c^4/G_N\right)\right] \cong G_N/G_w \cong 2.294\times10^{-33}$.

For nuclear or strong interaction, $\left[\left(c^4/G_n\right)/\left(c^4/G_N\right)\right] \cong G_N/G_n \cong 2.0\times10^{-39}$.

For electromagnetic interaction, $\left[\left(c^4/G_e\right)/\left(c^4/G_N\right)\right] \cong G_N/G_e \cong 2.811\times10^{-48}$.

Based on these values, at atomic scale, it seems logical to say that, based on $\left(c^4/G_N\right)$ –

a) Interaction range is inversely proportional to interaction strength.

b) Effective magnitude of the operating gravitational constant is, $G_x \cong \dfrac{G_N}{\text{Interaction strength}}$

Considering the above concepts and relations, we have developed a very novel model having wide range of applications starting from elementary particles to celestial objects. For example, mass of a black hole having a mass density equal to nuclear mass density can be expressed as, $M_{BH} \cong \left(\dfrac{G_n}{G_N}\right)^{3/2} m_n \cong 9.37$ Solar masses. It needs a review at fundamental level.

6. Discussion on Discreteness Associated with Quantum Nature at Atomic Level

Here it seems important to discuss on the relation, $\hbar c \cong G_w M_{wf}^2$ assumed to be associated with quantum mechanics. We would like to suggest the point that, $\hbar c$ is a compound quantum constant and is having no independent existence. It is an outcome of electroweak gravity [11]. Clearly speaking,

1) Proposed weak fermion and proposed weak gravitational constant play a key role in quantifying $\hbar c$.
2) 'Numbering nature' of elementary particles seems to be the root cause of origin of discreteness in microscopic physics.
3) Discreetness of $\hbar$ can be understood with,

$$n^2.\hbar \cong \frac{G_w\left(n.M_{wf}\right)^2}{c} \quad (14)$$

where n =1,2,3,.. = Number of M_{wf} .

4) Based on relation (7) and considering $\left(\sqrt{G_n m_p}, \sqrt{G_e m_e}\right)$ as characteristic inherent constants, Bohr's discrete angular momentum of electron [28] can be understood with,

$$n.\hbar \cong \frac{\sqrt{G_n m_p}\sqrt{G_e m_e}}{c} \times \left(n.m_e\right) \qquad (15)$$

where n =1,2,3,.. = Number of electrons or number of hydrogen atoms.

7. Various Applications of the Proposed Nuclear Elementary Charge

It may be noted that,

1) Fine structure ratio can be expressed as,

$$\alpha \cong \left(\frac{e^2}{4\pi\varepsilon_0 \hbar c}\right) \cong \sqrt{\left(\frac{e^2}{4\pi\varepsilon_0 G_e m_e^2}\right)\left(\frac{e^2}{4\pi\varepsilon_0 G_n m_p m_e}\right)} \cong \frac{ee_n}{4\pi\varepsilon_0 G_n m_p^2} \qquad (16)$$

2) Potential energy of electron in Bohr radius can be expressed as,

$$P.E_{Bohr} \cong -\alpha^2 m_e c^2 \cong -\left(\frac{e^2}{4\pi\varepsilon_0 G_n m_p^2}\right)\left(\frac{e_n^2}{4\pi\varepsilon_0 G_n m_p^2}\right) m_e c^2 \cong -\left(\frac{e^2}{4\pi\varepsilon_0 G_e m_e^2}\right)\left(\frac{e^2}{4\pi\varepsilon_0 \left(G_n m_p / c^2\right)}\right) \qquad (17)$$

3) Starting form Z=40, L-alpha X-ray transition energies (Transition: L_3M_5 ($L\alpha_1$)) can be understood with a very simple relation,

$$h\nu_{L\alpha} \cong \left[\frac{(Z-7.2)^2}{7.2}\right] 13.6 \text{ eV} \quad \text{where } \frac{e_n}{e}\left(\frac{e_n}{e}-\frac{1}{2}\right) \cong 7.2. \qquad (18)$$

See the following Table 2. For data comparison readers are encouraged to visit Wikipedia and other related web sites. Important points to be noted here are:

a) Moseley's [29,30] nuclear charge screening factor for L-alpha X-rays is strikingly matching with $\frac{e_n}{e}\left(\frac{e_n}{e}-\frac{1}{2}\right) \cong 7.2.$ This can be considered as one best application of the proposed nuclear elementary charge in atomic physics.

b) Strange coincidence is that, $\frac{e_n}{e}\left(\frac{e_n}{e}-\frac{1}{2}\right) \cong \left(\frac{1}{2^2}-\frac{1}{3^2}\right)^{-1} \cong 7.2.$ It needs further study. Solving this relation, obtained $\frac{e_n}{e} \cong 2.944902596.$ Considering this value, all other proposed gravitational constants can be estimated. Estimated Newtonian gravitational constant is, $G_N \cong 6.669957 \times 10^{-11}$ m³kg⁻¹sec⁻² and error is 0.0651%. Our estimated unified value is $G_N \cong 6.679851 \times 10^{-11}$ $\text{m}^3\text{kg}^{-1}\text{sec}^{-2}$. Average value of these two is $G_N \cong 6.674904 \times 10^{-11}$ $\text{m}^3\text{kg}^{-1}\text{sec}^{-2}$. This value is matching with the recommended value [18]. It may be a coincidence and needs a review.

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Table 2. Estimated and experimental energy levels of L_3M_5 ($L\alpha_1$) for Z = (40 to 94).

Atomic number	Name of the Element	Estimated energy level (eV)	Experimental energy level (eV)	%Error
40	Zr	2033.0	2042.489	0.46
41	Nb	2158.8	2165.89	0.33
42	Mo	2288.5	2293.187	0.20
43	Tc	2421.9	2423.99	0.09
44	Ru	2559.1	2558.579	-0.02
45	Rh	2700.1	2696.775	-0.12
46	Pd	2844.8	2838.638	-0.22
47	Ag	2993.3	2984.340	-0.30
48	Cd	3145.6	3133.755	-0.38
49	In	3301.7	3286.982	-0.45
50	Sn	3461.6	3444.011	-0.51
51	Sb	3625.2	3604.756	-0.57
52	Te	3792.7	3769.38	-0.62
53	I	3963.9	3937.70	-0.67
54	Xe	4138.9	4110.088	-0.70
55	Cs	4317.6	4286.49	-0.73
56	Ba	4500.2	4466.30	-0.76
57	La	4686.5	4651.02	-0.76
58	Ce	4876.6	4840.06	-0.75
59	Pr	5070.5	5033.79	-0.73
60	Nd	5268.1	5230.239	-0.72
61	Pm	5469.6	5432.6	-0.68
62	Sm	5674.8	5635.970	-0.69
63	Eu	5883.8	5846.46	-0.64
64	Gd	6096.6	6057.37	-0.65
65	Tb	6313.1	6272.82	-0.64
66	Dy	6533.5	6495.27	-0.59
67	Ho	6757.6	6719.675	-0.56
68	Er	6985.5	6947.913	-0.54
69	Tm	7217.1	7180.113	-0.52
70	Yb	7452.6	7415.70	-0.50
71	Lu	7691.8	7655.55	-0.47
72	Hf	7934.8	7899.08	-0.45
73	Ta	8181.6	8146.17	-0.43
74	W	8432.2	8398.242	-0.40
75	Re	8686.6	8652.55	-0.39

76	Os	8944.7	8911.83	-0.37
77	Ir	9206.6	9175.18	-0.34
78	Pt	9472.3	9442.39	-0.32
79	Au	9741.8	9713.44	-0.29
80	Hg	10015.0	9988.91	-0.26
81	Tl	10292.0	10268.62	-0.23
82	Pb	10572.8	10551.60	-0.20
83	Bi	10857.4	10838.94	-0.17
84	Po	11145.8	11130.87	-0.13
85	At	11437.9	11426.94	-0.10
86	Rn	11733.9	11727.09	-0.06
87	Fr	12033.6	12031.40	-0.02
88	Ra	12337.0	12339.86	0.02
89	Ac	12644.3	12652.16	0.06
90	Th	12955.3	12967.937	0.10
91	Pa	13270.2	13290.8	0.15
92	U	13588.8	13614.87	0.19
93	Np	13911.1	13944.26	0.24
94	Pu	14237.3	14278.74	0.29

4) As expected, by considering the proposed nuclear charge, there is a scope for understanding nuclear binding energy. For $Z \geq 3$ and $N \geq Z$, nuclear binding energy, can be understood with a simple relation of the form [31,32],

$$BE \cong \left\{ A - \left[1 + \left(0.0016 \left(\frac{Z^2 + A^2}{2} \right) \right) \right] - A^{1/3} - \frac{(A_s - A)^2}{A_s} \right\} (B_0 \cong 10.1 \text{ MeV}) \tag{19}$$

$$\text{where} \begin{cases} \text{Z=Proton number} \\ \text{A=Mass number} \\ A_s \cong (2Z) + 0.0016(2Z)^2 \cong 2Z + 0.0064Z^2 \\ = \text{Estmated mass number close to stable mass number} \\ B_0 \cong \sqrt{\left(\frac{e^2}{8\pi\varepsilon_0 (\hbar/m_p c)} \right) \left(\frac{e_n^2}{8\pi\varepsilon_0 (\hbar/m_p c)} \right)} \cong \frac{e_n e}{8\pi\varepsilon_0 (\hbar/m_p c)} \cong 10.1 \text{ MeV} \\ \text{where } \hbar/m_p c = \text{Reduced Comption wavelength of proton.} \end{cases}$$

Here, first term A being a representation of nuclear volume,

1) $\left[1 + \left(0.0016 \left(\frac{Z^2 + A^2}{2} \right) \right) \right]$ seems to be linked with electroweak interaction.

2) $A^{1/3}$ seems to be linked with nuclear radius.

3) $\frac{(A_s - A)^2}{A_s}$ seems to be associated with asymmetry about mean stable mass number.

4) $\left[1 + \left(0.0016 \left(\frac{Z^2 + A^2}{2} \right) \right) \right]$ can be considered as a representation of number of free nucleons and minimum number of free nucleons can be defined as 1.

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Either unification point of view or understanding point of view or application point of view, important point to be noted is that, the coefficient 0.0016 seems to be a ratio of the mean mass of pions to the mean mass of electroweak bosons [18]. It can be expreessed as,

$$\left(\frac{\sqrt{\left(m_{\pi}c^{2}\right)^{0}\left(m_{\pi}c^{2}\right)^{\pm}}}{\sqrt{\left(m_{z}c^{2}\right)^{0}\left(m_{w}c^{2}\right)^{\pm}}}\right)\cong\left(\frac{\sqrt{134.98\times139.57}\ \text{MeV}}{\sqrt{80379.0\times91187.6}\ \text{MeV}}\right)\cong 0.0016032 \tag{20}$$

5) Root mean square radius of proton can be addressed with a relation of the form [33,34],

$$R_p \cong \sqrt{\left(\frac{4\pi\varepsilon_0\hbar^2}{e_n^2 m_p}\right)\left(\frac{\hbar}{m_p c}\right)} \cong 0.835\ \text{fm} \tag{21}$$

This is another very important application of the proposed nuclear charge. It seems to play a vital role in nuclear experiments associated with finding the root mean square radius of proton.

6) Magnetic moment of proton can be understood with,

$$\mu_p \cong \frac{e_n\hbar}{2m_p} \cong 1.49\times10^{-26}\ \text{J/Tesla} \tag{22}$$

This is a striking application of the proposed nuclear charge and we are sure to say that, with this application science community will certainly recognize the physical existence of e_n. Considering the electromagnetic charge nature of proton and neutron, their magnetic moments can be fitted with the following relations.

Let, to a very good approximation,

$$e_n \cong 3e \tag{23}$$

By considering proton as a combined state of $2e^{+}+e^{-}\cong e^{+}$, its magnetic moment can be expressed as,

$$\mu_p \cong \frac{e_n\hbar}{2m_p} \cong \frac{(3e)\hbar}{2m_p} \tag{24}$$

By considering neutron as a combined state of $e^{+}+e^{-}\cong 0$, its magnetic moment can be expressed as,

$$\mu_n \cong \frac{(2e)\hbar}{2m_n} \cong \frac{(e_n-e)\hbar}{2m_n} \tag{25}$$

Considering the ratio of magnetic moments of neutron and proton,

$$\frac{\mu_n}{\mu_p} \cong \left(\frac{(2e)\hbar}{2m_n}\right) \div \left(\frac{(3e)\hbar}{2m_p}\right) \cong \frac{2m_p}{3m_n} \tag{26}$$

Quantitatively, by considering a ratio of the form, $\left(\frac{2.9464}{3}\right)^3 \cong \left(\frac{e_n}{3e}\right)^3 \cong 0.9473$, experimental values can be fitted approximately as,

$$\mu_n \cong \left(\frac{e_n}{3e}\right)^3 \frac{(2e)\hbar}{2m_p} \cong 9.556\times10^{-27}\ \text{J.Tesla}^{-1} \tag{27}$$

$$\mu_p \cong \left(\frac{e_n}{3e}\right)^3 \frac{(3e)\hbar}{2m_p} \cong 1.435\times10^{-26}\ \text{J.Tesla}^{-1} \tag{28}$$

7) Considering the proposed nuclear charge, nuclear stability line for Z=3 to 118 can be expressed as

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$$A_s \cong \text{RoundOff}\left\{\left(Z+\left(\frac{e_n}{e}\right)\right)^{1.2}\right\}-1 \cong \text{RoundOff}\left\{(Z+2.9464)^{1.2}\right\}-1$$
$$\text{where, } \left(\frac{e_n}{e}\right)^{1/6} \cong 1.1973 \cong 1.2 \tag{29}$$

This is a direct application in understanding nuclear stability line. With even-odd corrections, it can be refined for a better fit. In a comparative study, for these estimated stable mass numbers, corresponding proton numbers can be fitted with Green's beta stability relation [35].

$$Z \cong \frac{A_s}{2} - \frac{0.2A_s^2}{A_s+200} \tag{30}$$

See the following Table 3 prepared with relations (29) and (30). With even-odd corrections it can be developed further.

Table 3. Comparison of assumed and estimated stable mass numbers and proton numbers.

Assumed Proton number	Estimated stable mass number Relation (29)	Estimated proton number Relation (30)	Assumed Proton number	Estimated stable mass number Relation (29)	Estimated proton number Relation (30)
3	7	3	61	146	61
4	9	4	62	149	62
5	11	5	63	151	63
6	13	6	64	154	64
7	15	7	65	157	65
8	17	8	66	160	66
9	19	9	67	163	67
10	21	10	68	165	68
11	23	11	69	168	69
12	25	12	70	171	70
13	27	13	71	174	71
14	29	14	72	177	72
15	31	15	73	180	73
16	33	16	74	182	74
17	35	16	75	185	75
18	37	17	76	188	76
19	40	19	77	191	77
20	42	20	78	194	78
21	44	20	79	197	79
22	46	21	80	200	80
23	49	23	81	203	81
24	51	23	82	206	82
25	53	24	83	208	83

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26	56	26	84	211	84
27	58	26	85	214	85
28	60	27	86	217	86
29	63	28	87	220	87
30	65	29	88	223	88
31	68	31	89	226	89
32	70	31	90	229	90
33	73	33	91	232	91
34	75	33	92	235	92
35	78	35	93	238	93
36	80	35	94	241	94
37	83	37	95	244	95
38	85	37	96	247	96
39	88	39	97	250	97
40	90	39	98	253	98
41	93	41	99	256	99
42	95	41	100	259	100
43	98	43	101	262	101
44	100	43	102	265	102
45	103	44	103	268	103
46	106	46	104	271	104
47	108	46	105	274	105
48	111	48	106	277	106
49	113	48	107	280	107
50	116	49	108	284	109
51	119	51	109	287	110
52	121	51	110	290	111
53	124	53	111	293	112
54	127	54	112	296	113
55	130	55	113	299	114
56	132	56	114	302	115
57	135	57	115	305	116
58	138	58	116	308	117
59	140	58	117	311	118
60	143	60	118	315	119

8) Based on the proposed relation (19) and assumption (2), we have unified binding energy coefficient is 10.1 MeV and the strong coupling constant is $\alpha_s \cong (e/e_n)^2 \cong 0.1152$. Considering these two inputs, binding energy coefficients of the modern and advanced form of Myer and Swiatecki's modified mass formula [36] can be fitted as follows. Volume and surface energy coefficients can be fitted as, $a_v \cong 20.2(1-2\alpha_s) \cong 15.546$ MeV and

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$a_s \cong 20.2(1-\alpha_s) \cong 17.873$ MeV where $\frac{e_n e}{4\pi\varepsilon_0 (\hbar/m_p c)} \cong 2 * B_0 \cong 20.2$ MeV. Proton form factor coefficient can be fitted as $f_p \cong 20.2\alpha_s/2 \cong$ 1.1635 MeV. Pairing energy coefficients of proton, neutron and proton-neutron can be expressed as, $d_n \cong d_p \cong 2 * 20.2\alpha_s \cong$ 4.6541 MeV and $d_{np} \cong 3 * 20.2\alpha_s \cong 6.981$ MeV. To comply with the assumed energy coefficients, we consider coulombic energy coefficient as 0.71 MeV. Based on the reference data, isospin coefficients of volume and surface energy terms can be fitted as $(k_v, k_s) \cong 2 \mp \left[\left[(1+\alpha_s)/(1-\alpha_s)\right]^2 \alpha_s\right] \cong 2 \mp 0.183 \cong (1.817, 2.183)$. Starting from Z=6 to 118 and A=2Z to 3.5Z, for 10594 atomic nuclides' extrapolated reference binding energy data, standard deviation is 1.13 MeV. Corresponding reference formula is,

$$BE \cong \left\{ \begin{array}{l} \left\{\left[1+\left(\frac{4k_v}{A^2}\right)|T_z|(|T_z|+1)\right]a_v * A\right\} + \left\{\left[1+\left(\frac{4k_s}{A^2}\right)|T_z|(|T_z|+1)\right]a_s * A^{\frac{2}{3}}\right\} \\ +\left\{a_c * \left(\frac{Z^2}{A^{1/3}}\right)\right\} + \left\{f_p * \frac{Z^2}{A}\right\} + E_p \end{array} \right. \quad (31)$$

where, $T_z \cong \text{3rd component of isospin} = \frac{1}{2}(Z-N)$

$$\left\{ \begin{array}{l} a_v = -15.4963 \text{ MeV}, a_s = 17.7937 \text{ MeV} \\ k_v = -1.8232, k_s = -2.2593 \\ a_c = 0.7093 \text{ MeV}, f_p = -1.2739 \text{ MeV} \\ d_n = 4.6919 \text{ MeV}, d_p = 4.7230 \text{ MeV} \\ d_{np} = -6.4920 \text{ MeV} \end{array} \right\} \text{ and } \left\{ \begin{array}{l} \text{for } (Z, N) \text{ Odd, } E_p \cong \frac{d_n}{N^{1/3}} + \frac{d_p}{Z^{1/3}} + \frac{d_{np}}{A^{2/3}} \\ \text{for } (\text{Odd } Z, \text{ Even } N), E_p \cong \frac{d_p}{Z^{1/3}} \\ \text{for } (\text{Even } Z, \text{ Odd } N), E_p \cong \frac{d_n}{N^{1/3}} \\ \text{for } (\text{Even } Z, \text{ Even } N), E_p \cong 0 \end{array} \right\}$$

See the following Table 4 for a comparative study on estimated and reference binding energies.

Table 4. Comparison of estimated and reference binding energies of isotopes of Z=8, 20, 28, 50, 82 and 112.

Proton Number	Neutron Number	Mass Number	Estimated BE (MeV)	Reference BE (MeV)	Diff_BE (MeV)
8	8	16	121.87	122.04	0.17
8	9	17	128.28	128.45	0.18
8	10	18	137.93	138.19	0.26
8	11	19	142.15	142.49	0.34
8	12	20	149.56	150.04	0.48
8	13	21	152.01	152.61	0.60
8	14	22	157.60	158.38	0.78
8	15	23	158.59	159.52	0.93
8	16	24	162.67	163.80	1.13
8	17	25	162.45	163.75	1.30
8	18	26	165.27	166.78	1.51
8	19	27	164.03	165.72	1.70

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8	20	28	165.79	167.70	1.91
Proton Number	**Neutron Number**	**Mass Number**	**Estimated BE (MeV)**	**Reference BE (MeV)**	**Diff_BE (MeV)**
20	20	40	341.38	341.51	0.13
20	21	41	350.93	351.01	0.08
20	22	42	363.11	363.18	0.07
20	23	43	371.26	371.31	0.05
20	24	44	382.01	382.08	0.07
20	25	45	388.91	388.98	0.07
20	26	46	398.40	398.51	0.11
20	27	47	404.17	404.31	0.14
20	28	48	412.51	412.70	0.20
20	29	49	417.26	417.50	0.24
20	30	50	424.56	424.88	0.31
20	31	51	428.40	428.77	0.37
20	32	52	434.76	435.21	0.45
20	33	53	437.76	438.29	0.52
20	34	54	443.26	443.88	0.62
20	35	55	445.50	446.20	0.70
20	36	56	450.22	451.02	0.81
20	37	57	451.76	452.65	0.89
20	38	58	455.75	456.76	1.01
20	39	59	456.65	457.75	1.10
20	40	60	459.98	461.20	1.22
20	41	61	460.29	461.61	1.32
20	42	62	463.01	464.46	1.45
20	43	63	462.78	464.33	1.55
20	44	64	464.94	466.62	1.68
20	45	65	464.20	465.99	1.79
20	46	66	465.83	467.76	1.93
20	47	67	464.63	466.67	2.04
20	48	68	465.77	467.95	2.18
20	49	69	464.13	466.43	2.29
20	50	70	464.83	467.26	2.43
Proton Number	**Neutron Number**	**Mass Number**	**Estimated BE (MeV)**	**Reference BE (MeV)**	**Diff_BE (MeV)**
28	28	56	479.75	479.82	0.07
28	29	57	490.30	490.31	0.01
28	30	58	503.28	503.26	-0.02
28	31	59	512.69	512.64	-0.05

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28	32	60	524.53	524.47	-0.06
28	33	61	532.92	532.83	-0.08
28	34	62	543.70	543.63	-0.07
28	35	63	551.13	551.05	-0.08
28	36	64	560.95	560.89	-0.06
28	37	65	567.49	567.45	-0.05
28	38	66	576.41	576.40	-0.01
28	39	67	582.14	582.15	0.01
28	40	68	590.23	590.28	0.06
28	41	69	595.20	595.29	0.09
28	42	70	602.51	602.65	0.14
28	43	71	606.78	606.97	0.18
28	44	72	613.37	613.62	0.25
28	45	73	616.99	617.28	0.30
28	46	74	622.90	623.27	0.37
28	47	75	625.90	626.33	0.42
28	48	76	631.19	631.69	0.50
28	49	77	633.62	634.19	0.57
28	50	78	638.32	638.97	0.65
28	51	79	640.21	640.93	0.72
28	52	80	644.35	645.16	0.81
28	53	81	645.75	646.63	0.88
28	54	82	649.37	650.35	0.98
28	55	83	650.29	651.35	1.05
28	56	84	653.43	654.58	1.15
28	57	85	653.90	655.14	1.23
28	58	86	656.57	657.91	1.34
28	59	87	656.63	658.05	1.42
28	60	88	658.87	660.40	1.53
28	61	89	658.53	660.15	1.62
28	62	90	660.36	662.08	1.72
28	63	91	659.65	661.46	1.82
28	64	92	661.09	663.01	1.93
28	65	93	660.02	662.04	2.02
28	66	94	661.09	663.23	2.13
28	67	95	659.69	661.92	2.23
28	68	96	660.41	662.76	2.34
28	69	97	658.69	661.14	2.44
28	70	98	659.09	661.64	2.56

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Proton Number	Neutron Number	Mass Number	Estimated BE (MeV)	Reference BE (MeV)	Diff_BE (MeV)
50	50	100	816.20	816.08	-0.12
50	51	101	828.32	828.13	-0.19
50	52	102	842.56	842.33	-0.23
50	53	103	853.94	853.65	-0.29
50	54	104	867.43	867.10	-0.33
50	55	105	878.10	877.73	-0.38
50	56	106	890.88	890.47	-0.40
50	57	107	900.88	900.44	-0.44
50	58	108	912.97	912.51	-0.46
50	59	109	922.34	921.85	-0.49
50	60	110	933.78	933.28	-0.50
50	61	111	942.54	942.01	-0.53
50	62	112	953.36	952.83	-0.53
50	63	113	961.54	960.99	-0.55
50	64	114	971.77	971.23	-0.54
50	65	115	979.40	978.84	-0.55
50	66	116	989.06	988.52	-0.54
50	67	117	996.16	995.61	-0.55
50	68	118	1005.29	1004.75	-0.53
50	69	119	1011.88	1011.34	-0.53
50	70	120	1020.48	1019.97	-0.51
50	71	121	1026.59	1026.08	-0.51
50	72	122	1034.70	1034.22	-0.48
50	73	123	1040.34	1039.87	-0.47
50	74	124	1047.98	1047.54	-0.44
50	75	125	1053.18	1052.76	-0.42
50	76	126	1060.36	1059.97	-0.39
50	77	127	1065.13	1064.76	-0.37
50	78	128	1071.88	1071.55	-0.33
50	79	129	1076.24	1075.94	-0.31
50	80	130	1082.57	1082.31	-0.27
50	81	131	1086.54	1086.30	-0.24
50	82	132	1092.46	1092.27	-0.19
50	83	133	1096.06	1095.89	-0.16
50	84	134	1101.59	1101.48	-0.11
50	85	135	1104.82	1104.74	-0.08
50	86	136	1109.99	1109.96	-0.03
50	87	137	1112.86	1112.88	0.01

50	88	138	1117.67	1117.74	0.07
50	89	139	1120.21	1120.32	0.11
50	90	140	1124.67	1124.84	0.17
50	91	141	1126.89	1127.10	0.21
50	92	142	1131.02	1131.29	0.27
50	93	143	1132.93	1133.24	0.31
50	94	144	1136.74	1137.11	0.38
50	95	145	1138.34	1138.77	0.42
50	96	146	1141.84	1142.33	0.49
50	97	147	1143.16	1143.69	0.54
50	98	148	1146.35	1146.96	0.61
50	99	149	1147.39	1148.05	0.66
50	100	150	1150.30	1151.03	0.73
50	101	151	1151.07	1151.85	0.78
50	102	152	1153.70	1154.55	0.85
50	103	153	1154.21	1155.11	0.91
50	104	154	1156.57	1157.54	0.98
50	105	155	1156.82	1157.86	1.03
50	106	156	1158.92	1160.03	1.11
50	107	157	1158.93	1160.10	1.17
50	108	158	1160.78	1162.02	1.24
50	109	159	1160.56	1161.86	1.30
50	110	160	1162.16	1163.54	1.38
50	111	161	1161.71	1163.15	1.44
50	112	162	1163.08	1164.60	1.52
50	113	163	1162.40	1163.98	1.58
50	114	164	1163.54	1165.20	1.66
50	115	165	1162.65	1164.38	1.73
50	116	166	1163.57	1165.38	1.81
50	117	167	1162.48	1164.35	1.87
50	118	168	1163.18	1165.13	1.95
50	119	169	1161.89	1163.90	2.02
50	120	170	1162.38	1164.48	2.10
50	121	171	1160.89	1163.06	2.17
50	122	172	1161.18	1163.44	2.25
50	123	173	1159.51	1161.82	2.32
50	124	174	1159.60	1162.01	2.40
50	125	175	1157.74	1160.21	2.47
Proton Number	**Neutron Number**	**Mass Number**	**Estimated BE (MeV)**	**Reference BE (MeV)**	**Diff_BE (MeV)**

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82	82	164	1189.55	1189.17	-0.38
82	83	165	1202.94	1202.49	-0.45
82	84	166	1218.22	1217.71	-0.51
82	85	167	1231.11	1230.54	-0.57
82	86	168	1245.88	1245.25	-0.62
82	87	169	1258.29	1257.60	-0.69
82	88	170	1272.55	1271.83	-0.73
82	89	171	1284.49	1283.71	-0.79
82	90	172	1298.28	1297.46	-0.83
82	91	173	1309.77	1308.89	-0.88
82	92	174	1323.09	1322.18	-0.91
82	93	175	1334.13	1333.17	-0.96
82	94	176	1347.01	1346.02	-0.99
82	95	177	1357.62	1356.58	-1.03
82	96	178	1370.06	1369.00	-1.06
82	97	179	1380.25	1379.15	-1.10
82	98	180	1392.26	1391.14	-1.12
82	99	181	1402.06	1400.90	-1.16
82	100	182	1413.66	1412.48	-1.17
82	101	183	1423.06	1421.85	-1.21
82	102	184	1434.26	1433.04	-1.22
82	103	185	1443.28	1442.03	-1.25
82	104	186	1454.09	1452.83	-1.26
82	105	187	1462.74	1461.46	-1.28
82	106	188	1473.18	1471.89	-1.29
82	107	189	1481.47	1480.16	-1.31
82	108	190	1491.54	1490.22	-1.32
82	109	191	1499.48	1498.14	-1.33
82	110	192	1509.19	1507.86	-1.34
82	111	193	1516.79	1515.44	-1.35
82	112	194	1526.16	1524.81	-1.35
82	113	195	1533.43	1532.07	-1.36
82	114	196	1542.46	1541.10	-1.35
82	115	197	1549.40	1548.04	-1.36
82	116	198	1558.10	1556.75	-1.36
82	117	199	1564.74	1563.38	-1.36
82	118	200	1573.12	1571.77	-1.35
82	119	201	1579.45	1578.09	-1.36
82	120	202	1587.52	1586.18	-1.34
82	121	203	1593.55	1592.21	-1.34

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82	122	204	1601.32	1599.99	-1.33
82	123	205	1607.06	1605.73	-1.33
82	124	206	1614.53	1613.22	-1.31
82	125	207	1620.00	1618.69	-1.31
82	126	208	1627.18	1625.89	-1.29
82	127	209	1632.37	1631.09	-1.28
82	128	210	1639.27	1638.01	-1.26
82	129	211	1644.19	1642.94	-1.25
82	130	212	1650.82	1649.59	-1.23
82	131	213	1655.48	1654.26	-1.22
82	132	214	1661.84	1660.65	-1.19
82	133	215	1666.25	1665.07	-1.18
82	134	216	1672.35	1671.20	-1.15
82	135	217	1676.51	1675.37	-1.14
82	136	218	1682.36	1681.25	-1.11
82	137	219	1686.28	1685.18	-1.10
82	138	220	1691.88	1690.81	-1.06
82	139	221	1695.56	1694.51	-1.05
82	140	222	1700.92	1699.90	-1.01
82	141	223	1704.37	1703.37	-1.00
82	142	224	1709.49	1708.53	-0.96
82	143	225	1712.71	1711.77	-0.94
82	144	226	1717.61	1716.70	-0.91
82	145	227	1720.61	1719.73	-0.88
82	146	228	1725.28	1724.43	-0.85
82	147	229	1728.07	1727.25	-0.82
82	148	230	1732.52	1731.73	-0.78
82	149	231	1735.10	1734.34	-0.76
82	150	232	1739.33	1738.61	-0.72
82	151	233	1741.70	1741.01	-0.69
82	152	234	1745.73	1745.07	-0.65
82	153	235	1747.90	1747.28	-0.62
82	154	236	1751.72	1751.14	-0.58
82	155	237	1753.70	1753.15	-0.55
82	156	238	1757.32	1756.80	-0.51
82	157	239	1759.10	1758.62	-0.48
82	158	240	1762.52	1762.09	-0.44
82	159	241	1764.13	1763.72	-0.40
82	160	242	1767.35	1766.99	-0.36
82	161	243	1768.77	1768.45	-0.33

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82	162	244	1771.81	1771.53	-0.28
82	163	245	1773.05	1772.81	-0.25
82	164	246	1775.91	1775.71	-0.20
82	165	247	1776.97	1776.81	-0.16
82	166	248	1779.65	1779.53	-0.12
82	167	249	1780.54	1780.46	-0.08
82	168	250	1783.04	1783.01	-0.03
82	169	251	1783.77	1783.77	0.01
82	170	252	1786.09	1786.15	0.06
82	171	253	1786.66	1786.75	0.09
82	172	254	1788.81	1788.96	0.15
82	173	255	1789.22	1789.40	0.18
82	174	256	1791.21	1791.44	0.24
82	175	257	1791.45	1791.73	0.28
82	176	258	1793.28	1793.61	0.33
82	177	259	1793.37	1793.74	0.37
82	178	260	1795.05	1795.47	0.42
82	179	261	1794.99	1795.45	0.46
82	180	262	1796.50	1797.02	0.52
82	181	263	1796.29	1796.85	0.56
82	182	264	1797.66	1798.27	0.61
82	183	265	1797.30	1797.96	0.66
82	184	266	1798.52	1799.23	0.71
82	185	267	1798.02	1798.78	0.75
82	186	268	1799.09	1799.90	0.81
82	187	269	1798.46	1799.31	0.85
82	188	270	1799.38	1800.29	0.91
82	189	271	1798.61	1799.56	0.96
82	190	272	1799.39	1800.41	1.01
82	191	273	1798.49	1799.55	1.06
82	192	274	1799.13	1800.25	1.12
82	193	275	1798.10	1799.26	1.16
82	194	276	1798.61	1799.83	1.22
82	195	277	1797.44	1798.71	1.27
82	196	278	1797.82	1799.14	1.33
82	197	279	1796.53	1797.90	1.37
82	198	280	1796.78	1798.21	1.43
82	199	281	1795.36	1796.84	1.48
82	200	282	1795.48	1797.02	1.54
82	201	283	1793.94	1795.53	1.59

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82	202	284	1793.94	1795.58	1.65
82	203	285	1792.28	1793.98	1.70
82	204	286	1792.15	1793.91	1.76
82	205	287	1790.38	1792.19	1.81
Proton Number	**Neutron Number**	**Mass Number**	**Estimated BE (MeV)**	**Reference BE (MeV)**	**Diff_BE (MeV)**
112	112	224	1421.72	1421.16	-0.56
112	113	225	1435.94	1435.30	-0.64
112	114	226	1451.89	1451.19	-0.70
112	115	227	1465.72	1464.95	-0.77
112	116	228	1481.27	1480.44	-0.83
112	117	229	1494.71	1493.82	-0.89
112	118	230	1509.88	1508.93	-0.94
112	119	231	1522.96	1521.95	-1.01
112	120	232	1537.74	1536.69	-1.06
112	121	233	1550.46	1549.34	-1.12
112	122	234	1564.88	1563.71	-1.16
112	123	235	1577.24	1576.02	-1.22
112	124	236	1591.30	1590.04	-1.26
112	125	237	1603.32	1602.00	-1.32
112	126	238	1617.02	1615.67	-1.36
112	127	239	1628.70	1627.29	-1.41
112	128	240	1642.06	1640.62	-1.44
112	129	241	1653.41	1651.92	-1.49
112	130	242	1666.44	1664.91	-1.53
112	131	243	1677.46	1675.89	-1.57
112	132	244	1690.16	1688.56	-1.60
112	133	245	1700.87	1699.23	-1.64
112	134	246	1713.25	1711.58	-1.67
112	135	247	1723.65	1721.94	-1.71
112	136	248	1735.71	1733.97	-1.74
112	137	249	1745.81	1744.03	-1.77
112	138	250	1757.56	1755.76	-1.80
112	139	251	1767.36	1765.53	-1.83
112	140	252	1778.81	1776.96	-1.85
112	141	253	1788.33	1786.44	-1.88
112	142	254	1799.48	1797.58	-1.90
112	143	255	1808.71	1806.78	-1.93
112	144	256	1819.58	1817.63	-1.95
112	145	257	1828.53	1826.56	-1.98

112	146	258	1839.12	1837.13	-1.99
112	147	259	1847.80	1845.78	-2.02
112	148	260	1858.11	1856.08	-2.03
112	149	261	1866.52	1864.47	-2.05
112	150	262	1876.56	1874.50	-2.06
112	151	263	1884.71	1882.63	-2.08
112	152	264	1894.48	1892.40	-2.09
112	153	265	1902.38	1900.28	-2.11
112	154	266	1911.89	1909.78	-2.11
112	155	267	1919.54	1917.41	-2.13
112	156	268	1928.80	1926.67	-2.13
112	157	269	1936.20	1934.05	-2.15
112	158	270	1945.21	1943.06	-2.15
112	159	271	1952.37	1950.21	-2.16
112	160	272	1961.13	1958.97	-2.16
112	161	273	1968.06	1965.88	-2.17
112	162	274	1976.58	1974.41	-2.17
112	163	275	1983.28	1981.09	-2.18
112	164	276	1991.56	1989.38	-2.18
112	165	277	1998.03	1995.85	-2.19
112	166	278	2006.09	2003.91	-2.18
112	167	279	2012.34	2010.15	-2.19
112	168	280	2020.16	2017.98	-2.18
112	169	281	2026.20	2024.01	-2.19
112	170	282	2033.80	2031.62	-2.18
112	171	283	2039.62	2037.43	-2.18
112	172	284	2047.01	2044.83	-2.17
112	173	285	2052.61	2050.44	-2.18
112	174	286	2059.79	2057.62	-2.16
112	175	287	2065.19	2063.02	-2.17
112	176	288	2072.15	2070.00	-2.15
112	177	289	2077.35	2075.20	-2.15
112	178	290	2084.11	2081.97	-2.14
112	179	291	2089.11	2086.98	-2.14
112	180	292	2095.67	2093.55	-2.12
112	181	293	2100.48	2098.36	-2.12
112	182	294	2106.83	2104.73	-2.10
112	183	295	2111.45	2109.36	-2.10
112	184	296	2117.61	2115.54	-2.08
112	185	297	2122.04	2119.97	-2.07

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112	186	298	2128.02	2125.96	-2.05
112	187	299	2132.26	2130.21	-2.05
112	188	300	2138.04	2136.02	-2.03
112	189	301	2142.11	2140.09	-2.02
112	190	302	2147.71	2145.71	-2.00
112	191	303	2151.60	2149.61	-1.99
112	192	304	2157.01	2155.05	-1.97
112	193	305	2160.73	2158.77	-1.96
112	194	306	2165.96	2164.03	-1.93
112	195	307	2169.51	2167.59	-1.92
112	196	308	2174.57	2172.67	-1.90
112	197	309	2177.95	2176.06	-1.88
112	198	310	2182.84	2180.98	-1.86
112	199	311	2186.05	2184.20	-1.85
112	200	312	2190.77	2188.95	-1.82
112	201	313	2193.81	2192.01	-1.81
112	202	314	2198.37	2196.59	-1.78
112	203	315	2201.26	2199.50	-1.76
112	204	316	2205.65	2203.92	-1.73
112	205	317	2208.38	2206.66	-1.72
112	206	318	2212.61	2210.92	-1.69
112	207	319	2215.19	2213.52	-1.67
112	208	320	2219.26	2217.62	-1.64
112	209	321	2221.69	2220.06	-1.62
112	210	322	2225.60	2224.01	-1.59
112	211	323	2227.88	2226.31	-1.57
112	212	324	2231.64	2230.10	-1.54
112	213	325	2233.77	2232.25	-1.52
112	214	326	2237.39	2235.90	-1.49
112	215	327	2239.37	2237.90	-1.47
112	216	328	2242.84	2241.40	-1.44
112	217	329	2244.68	2243.27	-1.42
112	218	330	2248.00	2246.62	-1.38
112	219	331	2249.71	2248.35	-1.36
112	220	332	2252.89	2251.56	-1.32
112	221	333	2254.45	2253.15	-1.30
112	222	334	2257.49	2256.22	-1.27
112	223	335	2258.92	2257.68	-1.24
112	224	336	2261.82	2260.61	-1.21
112	225	337	2263.12	2261.94	-1.18

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112	226	338	2265.88	2264.73	-1.15
112	227	339	2267.05	2265.93	-1.12
112	228	340	2269.68	2268.59	-1.08
112	229	341	2270.72	2269.66	-1.06
112	230	342	2273.21	2272.19	-1.02
112	231	343	2274.13	2273.13	-0.99
112	232	344	2276.49	2275.53	-0.96
112	233	345	2277.28	2276.35	-0.93
112	234	346	2279.52	2278.63	-0.89
112	235	347	2280.18	2279.32	-0.86
112	236	348	2282.29	2281.47	-0.82
112	237	349	2282.84	2282.04	-0.80
112	238	350	2284.83	2284.07	-0.76
112	239	351	2285.25	2284.52	-0.73
112	240	352	2287.12	2286.43	-0.69
112	241	353	2287.42	2286.77	-0.66
112	242	354	2289.17	2288.55	-0.62
112	243	355	2289.36	2288.78	-0.59
112	244	356	2290.99	2290.44	-0.54
112	245	357	2291.07	2290.55	-0.51
112	246	358	2292.58	2292.10	-0.47
112	247	359	2292.54	2292.10	-0.44
112	248	360	2293.94	2293.54	-0.40
112	249	361	2293.79	2293.43	-0.37
112	250	362	2295.08	2294.75	-0.32
112	251	363	2294.82	2294.53	-0.29
112	252	364	2295.99	2295.74	-0.25
112	253	365	2295.63	2295.42	-0.22
112	254	366	2296.69	2296.52	-0.17
112	255	367	2296.23	2296.09	-0.14
112	256	368	2297.18	2297.08	-0.10
112	257	369	2296.61	2296.55	-0.06
112	258	370	2297.46	2297.44	-0.02
112	259	371	2296.78	2296.80	0.02
112	260	372	2297.52	2297.58	0.06
112	261	373	2296.75	2296.85	0.09
112	262	374	2297.39	2297.53	0.14
112	263	375	2296.51	2296.69	0.17
112	264	376	2297.05	2297.27	0.22
112	265	377	2296.08	2296.33	0.26

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112	266	378	2296.51	2296.81	0.30
112	267	379	2295.44	2295.78	0.34
112	268	380	2295.77	2296.16	0.38
112	269	381	2294.61	2295.03	0.42
112	270	382	2294.85	2295.31	0.47
112	271	383	2293.59	2294.09	0.50
112	272	384	2293.73	2294.28	0.55
112	273	385	2292.38	2292.97	0.59
112	274	386	2292.42	2293.05	0.63
112	275	387	2290.98	2291.65	0.67
112	276	388	2290.93	2291.65	0.72
112	277	389	2289.40	2290.15	0.75
112	278	390	2289.25	2290.06	0.80
112	279	391	2287.64	2288.48	0.84
112	280	392	2287.40	2288.29	0.89

8. Conclusion

Einstein and Abdus Salam like great scientists spent lot of time in understanding the secrets of final unification. Even though String theory is having a great role in understating final unification program, it is failing in understanding many atomic and nuclear phenomena. In this context, by following the concepts and relations proposed in our published papers and conference proceedings, we would like to appeal the science community to see the possibility of considering relations (1) to (5) pertaining to quantum of magnetic flux and Planck's radiation constant for a possible research in view of the existence of nuclear elementary charge, nuclear gravitational constant, electromagnetic charge and electromagnetic gravitational constant.

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