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Article

Confirming the Possible Occurrence of Cold Nuclear Fusion with Improved Strong and Electroweak Nuclear Binding Energy Formula

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Abstract: In our recent publications pertaining to 4G model of final unification and based on strong and electroweak interactions, we have developed a completely new formula for estimating nuclear binding energy. With reference to currently believed Semi Empirical Mass Formula (SEMF), we call our formula as 'Strong and Electroweak Mass Formula' (SEWMF). Our formula constitutes 4 simple terms and only one energy coefficient of magnitude 10.1 MeV. First term is a volume term, second term seems to be a representation of free nucleons associated with electroweak interaction, third term is a radial term and fourth one is an asymmetry term about the mean stable mass number. Considering this kind of approach, nuclear structure can be understood in terms of strong and weak interactions and cold nuclear fusion like complicated concepts can be understood in a theoretical approach positively. In this paper, by considering the accountability of $\beta \cong 1 - [(N - Z)/A]^2$, we are making an attempt to improve the applicability and effectiveness of SEWMF. Number 0.00125 being a workable electroweak coefficient for $Z=6$ to 132 and $A=2Z$ to $3.5Z$, number of free nucleons assumed to be associated with electroweak interaction can be expressed as

$$A_{free} \cong \frac{1}{2} + \left[\beta \times 0.00125 \left(\frac{A^2 - ZN}{A} + \frac{Z}{A} \left(\frac{Z^2}{N} \right)^2 \right) \right] \cong \frac{1}{2} + \left[\beta \times 0.000625 \left(\frac{A^2 + N^2 + Z^2}{A} + \frac{2Z}{A} \left(\frac{Z^2}{N} \right)^2 \right) \right].$$

Improved asymmetry term can be expressed as, $A_{asym} \cong \beta [(A_s - A)/A_s]^2$ where A_s represents the light house like stable mass number. With reference to old version, our improved binding energy formula can be expressed as, $BE \cong (A - \beta A_{free} - A^{1/3} - \beta A_{asym}) 10.1 \text{ MeV}$. We are working on its possible modification for mass numbers less than the stable mass numbers. Following this approach, it is possible to show that nuclear binding energy scheme is associated with strong and weak interactions and is practically independent of Coulombic repulsions. Proceeding further, currently believed cold nuclear fusion assumed be associated with hydrated metals can be understood and can be confirmed with strong and weak interactions independent of coulombic repulsions. We are very confident to say that our approach will certainly motivate modern science community in this new direction.

Keywords: 4G model of final unification; Semi Empirical Mass Formula (SEMF); improved Strong and Electroweak Mass Formula (SEWMF); improved electroweak term; improved asymmetry term; free nucleons; light house like stable mass number; super heavy atomic nuclides; cold nuclear fusion

1. Introduction

With reference to our 4G model of final unification, in our recent publications [1-12], we have developed a new formula for estimating nuclear binding energy [13-24] in terms of strong and electroweak interactions [25]. Our formula constitutes 4 simple terms and only one energy coefficient of magnitude 10.1 MeV. First term is a volume term, second term seems to be a representation of free

nucleons associated with electroweak interaction, third term is a radial term and fourth one is an asymmetry term about the mean stable mass number. Considering this kind of approach, nuclear structure can be understood in terms of strong and weak interactions and cold nuclear fusion like complicated concepts [26-33] can be understood in a theoretical approach positively.

In this paper, we make an attempt to develop another workable formula for the electroweak term based on $\beta \cong 1 - [(N - Z)/A]^2$. Proceeding further, asymmetry term seems to be effective with an expression of the form $A_{\text{asym}} \cong \beta [(A_s - A)/A_s]^2$ where A_s represents light house like stable mass number. Following the success of our formulae, we are working on developing new formulae for estimating free nucleons by implementing the basic concepts of Liquid drop model [13-17].

2. Three assumptions of 4G model of final Unification

Following our 4G model of final unification [1-12]

- 1) There exists a characteristic electroweak fermion of rest energy, $M_{wf}c^2 \cong 584.725 \text{ GeV}$. It can be considered as the zygote of all elementary particles.

- 2) There exists a nuclear elementary charge in such a way that, $\left(\frac{e}{e_n}\right)^2 \cong \alpha_s \cong 0.1152$ = Strong coupling constant and $e_n \cong 2.9463e$.

- 3) Each atomic interaction is associated with a characteristic large gravitational coupling constant. Their fitted magnitudes are,

$$G_e \cong \text{Electromagnetic gravitational constant} \cong 2.374335 \times 10^{37} \text{ m}^3 \text{kg}^{-1} \text{sec}^{-2}$$

$$G_n \cong \text{Nuclear gravitational constant} \cong 3.329561 \times 10^{28} \text{ m}^3 \text{kg}^{-1} \text{sec}^{-2}$$

$$G_w \cong \text{Electroweak gravitational constant} \cong 2.909745 \times 10^{22} \text{ m}^3 \text{kg}^{-1} \text{sec}^{-2}$$

It may be noted that,

- 1) Weak interaction point of view, following our assumptions, Fermi's weak coupling constant can be fitted with the following relations.

$$\left. \begin{aligned} G_F &\cong \left(\frac{m_e}{m_p}\right)^2 \hbar c R_0^2 \cong G_w M_{wf}^2 R_w^2 \cong 1.44021 \times 10^{-62} \text{ J.m}^3 \\ \text{where, } \left\{ \begin{aligned} R_0 &\cong \frac{2G_n m_p}{c^2} \cong 1.24 \times 10^{-15} \text{ m} \\ R_w &\cong \frac{2G_w M_{wf}}{c^2} \cong 6.75 \times 10^{-19} \text{ m} \end{aligned} \right. \end{aligned} \right\} \quad (1)$$

- 2) In a unified approach, most important point to be noted is that [10],

$$\hbar c \cong G_w M_{wf}^2 \quad (2)$$

Clearly speaking, based on the electroweak interaction, the well believed quantum constant $\hbar c$ seems to have a deep inner meaning. Following this kind of relation, there is a possibility to understand the integral nature of quantum mechanics with a relation of the form,

$$n^2 \hbar \cong \frac{G_w (n M_{wf})^2}{c} \text{ where } n = 1, 2, 3, \dots \text{ It needs further study with reference to EPR argument [34-37] and [1,38].}$$

3. Understanding the Mechanism of Cold Nuclear Fusion Associated with Iron-56 and Hydrogen

In our recent publications [26,27], we have clearly explained the origin of the mystery of hidden energy liberation mechanism of cold nuclear fusion associated with hydrated metals. Proceeding further, we have shown the possibility of considering Iron-56 as a cold nuclear fuel. In this paper, we try to show that, cold nuclear fusion is associated with strong and weak interactions and is practically independent of coulombic repulsions. In this section, we briefly outline the mechanism of cold nuclear fusion assumed to be associated with Iron-56 and Hydrogen.

- 1) By virtue of electroweak interaction, on absorbing Hydrogen atom in the form of a neutron, (super fine powder of semi liquid) Iron-56 becomes Iron-57 and liberates thermal energy.
- 2) During the neutron absorption process, Iron-56 gains an energy of 8.8 MeV (theoretical maximum binding energy per nucleon).
- 3) Within a short time interval, Iron-56 of binding energy 492.26 MeV transforms to Iron-57 of binding energy 499.91 MeV.
- 4) Thus, with no net increase in internal kinetic energy of Iron-57 nucleons, a maximum possible thermal energy of $[8.8 - (499.91 - 492.26)] \text{ MeV} = 8.8 - 7.65 = 1.15 \text{ MeV}$ can be expected.
- 5) As Iron-56 and Iron-57 are naturally available and stable against nuclear radiations, there exists no chance for emission of hazardous radiation in Iron-56 to Iron-57 transformation.
- 6) To confirm our ideology, we appeal the nuclear scientists to see the possibility of bombarding liquid or semi liquid form of super fine Iron-56 powder with direct neutrons coming from neutron generators.

Thinking in this way, it seems possible to consider Magnesium-24 as a cold nuclear fuel. If so, as melting point of Magnesium is less than the melting point of Iron, working temperature of cold nuclear fusion process can be reduced further. It may help in minimizing energy losses and needs further study.

4. Understanding the Electroweak Term and Number of Free Nucleons

Our basic idea is that, all the nucleons are not participating in the nuclear binding energy scheme and non-participating nucleons can be called as 'Free nucleons'. These free nucleons revolve round the nuclear core. Each free nucleon reduces the nuclear binding energy by 10.1 MeV. Protons and neutrons jointly play a crucial role in fixing the number of free nucleons. Electroweak interaction is having a key role in understanding free nucleons and nuclear stability against beta decay. In this context, we noticed that,

$$\frac{m_p}{M_{wf}} \cong \left(\frac{\sqrt{(m_\pi c^2)^0 (m_\pi c^2)^{\pm}}}{\sqrt{(m_\pi c^2)^0 (m_\pi c^2)^{\pm}}} \right) \cong \left(\frac{\sqrt{134.98 \times 139.57 \text{ MeV}}}{\sqrt{80379.0 \times 91187.6 \text{ MeV}}} \right) \cong 0.0016032 \quad (3)$$

Here ratio of rest mass of proton to the assumed electroweak fermion is equal to the ratio of mean mass of pions to the mean mass of electroweak bosons. Based on this unique and concrete observation, we are very confident to say that, strong and weak interactions play a vital role exploring the secrets of nuclear structure. In our previous research articles [1-12], we have proposed the following first three formulae for the electroweak term.

Formula-1

$$A_{free} \cong \left[2 - \left(\frac{N}{Z} \right) \right] + \left[0.0016 \left(\frac{Z^2 + A^2}{2} \right) \right] \cong \left[2 - \left(\frac{N}{Z} \right) \right] + \left[0.0008 (Z^2 + A^2) \right] \quad (4)$$

Problem with this relation is that, as Z is increasing, at lower mass numbers of any Z, estimated binding energy seems to be on higher side compared to actual binding energies.

Formula-2

$$\begin{aligned}
 A_{free} &\cong \left[2 - \left(\frac{N}{Z} \right) \right] + 0.0016 \left[\left(Z^2 + N^2 + \left(\frac{Z^2}{N} \right)^2 \right) - \left(\frac{A-2Z}{2} \right)^2 \right] \\
 &\cong \left[2 - \left(\frac{N}{Z} \right) \right] + 0.0016 \left[\frac{3}{4} N^2 + \left(\frac{3}{4} + \frac{Z^2}{N^2} \right) Z^2 + \frac{NZ}{2} \right]
 \end{aligned} \quad (5)$$

Problem with this relation is that [2], number of terms are increasing and becoming complicated.

Formula-3

$$A_{free} \cong \left[2 - \left(\frac{N}{Z} \right) \right] + 0.0016 \left[\left(Z^2 + N^2 + \left(\frac{Z^2}{N} \right)^2 \right) - ZN \left(\frac{N-Z}{A} \right)^2 \right] \quad (6)$$

Even though it is complicated, advantage of this relation is that, $ZN \left(\frac{N-Z}{A} \right)^2 \cong ZN \left(\frac{N-Z}{N+Z} \right)^2$ seems to have an interesting role with respect to isospin concept. With further study, it can be modified as $Z^2 \left(\frac{N-Z}{N+Z} \right)^2$ and $N^2 \left(\frac{N-Z}{N+Z} \right)^2$. This relation can be given a good priority in developing other possible formulae. Its early preprint version associated with $Z^2 \left(\frac{N-Z}{N+Z} \right)^2$ can be available at <https://ssrn.com/abstract=4617769>. We are working on publishing this relation (6) with a ground work on estimating the electroweak term based on the liquid drop model dependent volume and surface area concepts applicable to nucleons as well as protons and neutrons independently.

Formula-4

In this paper, we propose another simple relation having only 3 terms in the following way.

$$A_{free} \cong \frac{1}{2} + 0.00125 \left[A^2 - ZN + \frac{Z}{A} \left(\frac{Z^2}{N} \right)^2 \right] \quad (7)$$

In this relation, the proposed coefficient $\Upsilon \cong 0.00125$ is based on trial-error with an approximation. It can be understood with the mass ratio of nucleon mass difference to the electron mass. See section (7). Interesting point is that, for $Z=6$ to 132 , the coefficient 0.00125 seems to be a constant. It needs further study. To extend its applicability and validity of relation (7), we consider $\beta \cong 1 - \left(\frac{N-Z}{A} \right)^2$ as an extrapolating factor for $A=2Z$ to $3.5Z$.

$$A_{free} \cong \frac{1}{2} + 0.00125 \beta \left[A^2 - ZN + \frac{Z}{A} \left(\frac{Z^2}{N} \right)^2 \right] \quad (8)$$

5. Understanding nuclear stability against beta decay

Based on the proposed electroweak coefficient 0.0016 , approximate stable mass number of any proton number against beta decay can be estimated with a simple relation of the form,

$$\left. \begin{aligned} A_s &\cong 2Z + 0.0016(2Z)^2 \cong 2Z + 0.0064Z^2 \\ &\rightarrow \frac{A_s - 2Z}{4Z^2} \cong 0.0016 \end{aligned} \right\} \quad (9)$$

One can find a similar relation in the literature [16]. This relation can be well tested for $Z=21$ to 92 . For example,

$$\frac{45-(2 \times 21)}{4(21)^2} \cong 0.00170; \quad \frac{63-(2 \times 29)}{4(29)^2} \cong 0.00149; \quad \frac{89-(2 \times 39)}{4(39)^2} \cong 0.00181;$$

$$\frac{109-(2 \times 47)}{4(47)^2} \cong 0.0017; \quad \frac{169-(2 \times 69)}{4(69)^2} \cong 0.00163; \quad \frac{238-(2 \times 92)}{4(92)^2} \cong 0.001595;$$

This is one best practical and quantitative application of our proposed electroweak fermion and bosons. Following this relation and based on various semi empirical mass formulae [13-19], by knowing any stable mass number, its corresponding proton number can be estimated with,

$$Z \cong \frac{A_s}{1 + \sqrt{1 + 0.0064 A_s}} \cong \frac{A_s}{2 + 0.0153 A_s^{2/3}} \quad (10)$$

$$\text{where } \frac{a_c}{2a_{asy}} \cong \frac{0.71 \text{ MeV}}{2 \times 23.21 \text{ MeV}} \cong \frac{0.6615 \text{ MeV}}{2 \times 21.6091 \text{ MeV}} \cong 0.0153$$

For super heavy atomic nuclides [39], estimated A_s seems to be on higher side compared to modern estimates. Hence, we have developed another simple formula.

6. An Alternative Formula for Stable Mass Numbers

Independent of electroweak interaction, the ratio of proposed nuclear charge to electromagnetic charge seems to play a crucial role in understanding and estimating the approximate stable mass number of any atomic nuclide having a proton number Z . Our estimated mass number close to stability can be called as 'light house (like) mass number' where one can find the beginning of relatively long living isotopes of Z compared to its lower mass numbers. Keeping light and heavy atomic nuclides in view, we suggest a common and simple relation of the form [6],

$$A_s \cong \text{RoundOff} \left\{ \left(Z + \left(\frac{e_n}{e} \right) \right)^{1.2} - \sqrt{\frac{e_n}{e}} \right\} \cong \text{RoundOff} \left\{ (Z + 2.9463)^{1.2} - 1.7165 \right\} \quad (11)$$

$$\text{where } \left(\frac{e_n}{e} \right)^{\frac{1}{6}} \cong \left(\frac{1}{\alpha_s} \right)^{\frac{1}{12}} \cong 1.19733 \cong 1.2$$

Here one can see the direct role of the proposed nuclear elementary charge and strong coupling constant in understanding nuclear stability.

It may be noted that, right selection of stable mass number greatly helps in minimizing the error in estimating nuclear binding energy. Especially, for light atomic nuclides, whose stable mass number is very close to $2Z$, estimated binding energy seems to be on lower side compared to actual binding energy. Hence, it seems better to select stable mass number of Z based on their relative time of living. Considering even-odd corrections, above relation can be refined for a better understanding in the following way. It can be reviewed in a better way with further study.

- 1) If Z is even and obtained A_s is odd, then, $A_s \cong A_s + 1$.
- 2) If Z is even and obtained A_s is even, then, $A_s \cong A_s$.
- 3) If Z is odd and obtained A_s is odd, then, $A_s \cong A_s$.
- 4) If Z is odd and obtained A_s is even, then, $A_s \cong A_s + 1$.

$$A_s \cong \text{RoundOff} \left\{ (Z + 2.9463)^{1.2} - 1.7165 \right\} + \{EO \text{ correction} \cong [0, 1]\} \quad (12)$$

Following this relation, for odd elements including super heavy atoms, their best possible three mass numbers can be expressed as,

$$A_s \equiv \left[\text{RoundOff} \left\{ (Z + 2.9463)^{1.2} - 1.7165 \right\} + [0,1] \right] + 2n \quad (13)$$

where $n = 0,1,2$

Based on the concept of 'binding energy per nucleon= BE/A ', we noticed that,

- 1) For light and medium atomic numbers, when the increasing excess neutron number approaches the estimated number of free nucleons – mass number approaches the estimated light house like estimated stable mass number and (BE/A) reaches a maximum value.
- 2) For heavy and super heavy atomic numbers, when the increasing excess neutron number approaches the estimated number of free nucleons – mass number crosses the estimated light house like stable mass number and (BE/A) starts to decrease from the maximum BE/A .
- 3) Thus, in case of isotopes of light and medium proton numbers, estimated light house like stable mass number seems to be an index of beginning range of maximum BE/A and in case of isotopes of heavy and super heavy proton numbers, estimated light house like stable mass number seems to be an index of ending range of maximum BE/A .
- 4) Thus, above points seems to be in-line with currently believed nuclear binding energy scheme.

Hence, for heavy and super heavy atoms, range of possible mass numbers can be understood with a relation of the form,

$$A_s \equiv \left[\text{RoundOff} \left\{ (Z + 2.9463)^{1.2} - 1.7165 \right\} + [0,1] \right] - 2n \quad (14)$$

where $n = 0,1,2$

Thus, a range of heavy and super mass numbers can be understood with

$$A_s \equiv \left[\text{RoundOff} \left\{ (Z + 2.9463)^{1.2} - 1.7165 \right\} + [0,1] \right] \mp 2n \quad (15)$$

where $n = 0,1,2$

Based on the semi empirical mass formulae [13-21], for these estimated range of mass numbers, we noticed that,

$$Z \equiv \frac{A_s}{2 + 0.0153 A_s^{2/3}} \quad (16)$$

It may be noted that,

- a) By adding 0, 2 and 4 to the even-odd corrected mass number, odd proton's 2 expected stable mass numbers above the estimated light house like stable mass number can be estimated.
- b) By subtracting 0, 2 and 4 from the even-odd corrected mass number, odd proton's 2 expected stable mass numbers below the estimated light house like stable mass number can be estimated.
- c) Following the same procedure, super heavy even proton numbers' best possible range of mass numbers can be estimated.
- d) With further study and replacing the power factor of $(Z + 2.9463)$ with its best experimental value associated with strong coupling constant or customized values like 1.195, 1.196, 1.197... etc, possible heavy and super heavy lower mass numbers can be estimated.
- e) In Table 1, we have presented the estimated light house like mass numbers of $Z = 6$ to 118. Following the above points, super heavy atomic nuclides' possible mass number range can be understood. Here we would like to highlight the point that compared to other mass numbers, these mass numbers can have relatively long living time. It needs further study, experimental design, set up and observations. For example,

- 1) Mass numbers of Z=100: 254 to 262
- 2) Mass numbers of Z=101: 257 to 265
- 3) Mass numbers of Z=102: 260 to 268
- 4) Mass numbers of Z=103: 265 to 273
- 5) Mass numbers of Z=104: 268 to 276
- 6) Mass numbers of Z=105: 271 to 279
- 7) Mass numbers of Z=106: 274 to 282
- 8) Mass numbers of Z=107: 277 to 285
- 9) Mass numbers of Z=108: 280 to 288
- 10) Mass numbers of Z=109: 283 to 291
- 11) Mass numbers of Z=110: 286 to 294
- 12) Mass numbers of Z=111: 289 to 297
- 13) Mass numbers of Z=112: 292 to 300
- 14) Mass numbers of Z=113: 295 to 303
- 15) Mass numbers of Z=114: 298 to 306

For the case of currently believed heavy magic proton number, Z=114, its estimated mass number range is 298 to 306. Here it is quite interesting to note that, lower mass number is 298 and its corresponding neutron number is 298-114=184 and is nicely matching with the currently believed heavy magic neutron number at 184. Thus, Z=114 and A=298 can be given a strong priority for its experimental identification as a doubly magic super heavy atomic nuclide [40].

7. Improved Electroweak Term and the Modified Strong and Electroweak Mass Formula

For Z=6 to 132, improved binding energy relation can be expressed as,

$$\begin{aligned}
 BE &\equiv (A - A_{free} - A_{radial} - A_{asym})(B_0 \cong 10.1 \text{ MeV}) \\
 &\equiv \left\{ A - \left[\frac{1}{2} + 0.00125\beta \left[A^2 - ZN + \frac{Z}{A} \left(\frac{Z^2}{N} \right)^2 \right] \right] \right\} - A^{1/3} - \frac{\beta(A_s - A)^2}{A_s} \Bigg\} 10.1 \text{ MeV} \quad (17)
 \end{aligned}$$

where $\beta \cong 1 - \left(\frac{N - Z}{A} \right)^2$

where, $\boxed{A \times 10.1 \text{ MeV}}$ represents the volume term
 $\boxed{A_{free} \times 10.1 \text{ MeV}}$ represents the modified electroweak term
 $\boxed{A_{radial} \times 10.1 \text{ MeV}}$ represents the radial term
 $\boxed{A_{asym} \times 10.1 \text{ MeV}}$ represents the modified asymmetry term

$$B_0 \cong - \left(\frac{1}{\sqrt{\alpha_s}} \right) \frac{e^2}{8\pi\epsilon_0 (\hbar/m_p c)} \cong - \frac{e_n^2}{8\pi\epsilon_0 (G_n m_p / c^2)} \cong -10.1 \text{ MeV}$$

where $\begin{cases} \alpha_s = \text{Strong coupling constant} \cong 0.115 \text{ to } 0.12 \\ \hbar/m_p c = \text{Reduced Compton wavelength of proton} \\ G_n m_p / c^2 \cong 0.62 \times 10^{-15} \text{ m} \end{cases}$

With reference to old version, our improved binding energy formula can be expressed as,

$$BE \equiv (A - \beta A_{free} - A_{radial} - \beta A_{asym}) 10.1 \text{ MeV}.$$

For evaluating the effectiveness of relation (17), we consider the following advanced relation (18) as a reference [19].

$$BE \cong \left\{ \left[1 + \left(\frac{4k_v}{A^2} \right) |T_z| (|T_z| + 1) \right] a_v * A \right\} + \left\{ \left[1 + \left(\frac{4k_s}{A^2} \right) |T_z| (|T_z| + 1) \right] a_s * A^{\frac{2}{3}} \right\} + \left\{ a_c * \left(\frac{Z^2}{A^{1/3}} \right) \right\} + \left\{ f_p * \frac{Z^2}{A} \right\} + E_p \tag{18}$$

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

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

Close to the stable mass numbers, our formula can be expressed as,

$$BE \cong (A - A_{free} - A_{radial})(B_0 \cong 10.1 \text{ MeV})$$
$$\cong \left\{ A - \left[\frac{1}{2} + 0.00125\beta \left[A^2 - ZN + \frac{Z}{A} \left(\frac{Z^2}{N} \right)^2 \right] \right] \right\} - A^{1/3} \Bigg\} 10.1 \text{ MeV} \tag{19}$$

where $\beta \cong 1 - \left(\frac{N - Z}{A} \right)^2$ and $A_{asym} \cong \frac{\beta(A_s - A)^2}{A_s} \rightarrow 0$

In a comparative approach, close to the estimated light house like stable mass numbers and considering relations (8), (12), (17) and (18), we present Table. 1 for clarity and understanding. See Table. 2 for the estimated binding energy of isotopes of Z=6, 20, 34, 48, 62, 76, 90, 104,118,132.

Table 1. Estimated binding energy of light house like stable mass numbers of Z=6 to 132.

Proton number	Mass number	Neutron number	Excess neutron number	Est.stable mass number As	Υ value	Beta value	Est.no of free nucleons	Estimated BE (MeV)	Reference BE (MeV)	Difference of BE (MeV)
6	12	6	0	12	0.00125	1.000000	0.66	91.44	85.36	-6.08
7	15	8	1	15	0.00125	0.995556	0.73	119.20	109.43	-9.77
8	16	8	0	16	0.00125	1.000000	0.78	128.27	122.04	-6.23
9	19	10	1	19	0.00125	0.997230	0.88	156.10	147.28	-8.82
10	20	10	0	20	0.00125	1.000000	0.94	165.12	159.06	-6.06
11	23	12	1	23	0.00125	0.998110	1.06	192.91	185.06	-7.85
12	24	12	0	24	0.00125	1.000000	1.13	201.85	196.09	-5.76
13	27	14	1	27	0.00125	0.998628	1.27	229.57	222.61	-6.96
14	28	14	0	28	0.00125	1.000000	1.36	238.42	232.96	-5.46
15	31	16	1	31	0.00125	0.998959	1.52	266.02	259.82	-6.20

16	32	16	0	32	0.00125	1.000000	1.62	274.77	269.53	-5.25
17	35	18	1	35	0.00125	0.999184	1.80	302.24	296.63	-5.62
18	38	20	2	38	0.00125	0.997230	2.01	329.58	326.81	-2.77
19	39	20	1	39	0.00125	0.999343	2.12	338.20	332.97	-5.23
20	42	22	2	42	0.00125	0.997732	2.35	365.38	363.18	-2.20
21	43	22	1	43	0.00125	0.999459	2.48	373.89	368.84	-5.05
22	46	24	2	46	0.00125	0.998110	2.72	400.90	399.02	-1.88
23	49	26	3	49	0.00125	0.996252	2.99	427.77	425.32	-2.45
24	50	26	2	50	0.00125	0.998400	3.14	436.13	434.32	-1.81
25	53	28	3	53	0.00125	0.996796	3.42	462.81	460.66	-2.15
26	56	30	4	56	0.00125	0.994898	3.72	489.36	489.78	0.43
27	57	30	3	57	0.00125	0.997230	3.89	497.55	495.42	-2.13
28	60	32	4	60	0.00125	0.995556	4.21	523.90	524.47	0.57
29	63	34	5	63	0.00125	0.993701	4.56	550.11	550.01	-0.10
30	66	36	6	66	0.00125	0.991736	4.91	576.16	578.25	2.09
31	67	36	5	67	0.00125	0.994431	5.10	584.14	584.07	-0.07
32	70	38	6	70	0.00125	0.992653	5.48	610.00	612.22	2.23
33	73	40	7	73	0.00125	0.990805	5.88	635.70	637.06	1.36
34	74	40	6	74	0.00125	0.993426	6.09	643.51	645.57	2.06
35	77	42	7	77	0.00125	0.991736	6.51	669.01	670.36	1.35
36	80	44	8	80	0.00125	0.990000	6.94	694.36	697.71	3.35
37	83	46	9	83	0.00125	0.988242	7.40	719.55	721.90	2.34
38	84	46	8	84	0.00125	0.990930	7.63	727.13	730.26	3.13
39	87	48	9	87	0.00125	0.989298	8.10	752.12	754.39	2.27
40	90	50	10	90	0.00125	0.987654	8.59	776.95	781.01	4.06
41	93	52	11	93	0.00125	0.986010	9.10	801.63	804.59	2.96
42	94	52	10	94	0.00125	0.988683	9.36	808.98	812.73	3.75
43	97	54	11	97	0.00125	0.987140	9.89	833.44	836.23	2.79
44	100	56	12	100	0.00125	0.985600	10.43	857.75	862.17	4.42
45	103	58	13	103	0.00125	0.984070	10.99	881.91	885.18	3.27
46	106	60	14	106	0.00125	0.982556	11.57	905.91	910.61	4.69
47	107	60	13	107	0.00125	0.985239	11.86	912.96	915.95	2.99
48	110	62	14	110	0.00125	0.983802	12.46	936.75	941.25	4.50
49	113	64	15	113	0.00125	0.982379	13.08	960.38	963.70	3.33
50	116	66	16	116	0.00125	0.980975	13.71	983.85	988.52	4.67
51	119	68	17	119	0.00125	0.979592	14.36	1007.17	1010.55	3.38
52	122	70	18	122	0.00125	0.978232	15.03	1030.34	1034.92	4.58
53	123	70	17	123	0.00125	0.980898	15.35	1037.02	1040.19	3.17
54	126	72	18	126	0.00125	0.979592	16.04	1059.96	1064.42	4.46
55	129	74	19	129	0.00125	0.978307	16.74	1082.75	1085.94	3.19
56	132	76	20	132	0.00125	0.977043	17.46	1105.38	1109.75	4.36
57	135	78	21	135	0.00125	0.975802	18.20	1127.86	1130.89	3.03

58	138	80	22	138	0.00125	0.974585	18.95	1150.18	1154.29	4.11
59	141	82	23	141	0.00125	0.973392	19.72	1172.35	1175.07	2.72
60	142	82	22	142	0.00125	0.975997	20.09	1178.59	1182.61	4.02
61	145	84	23	145	0.00125	0.974839	20.88	1200.53	1203.26	2.73
62	148	86	24	148	0.00125	0.973703	21.69	1222.32	1226.14	3.82
63	151	88	25	151	0.00125	0.972589	22.51	1243.95	1246.44	2.50
64	154	90	26	154	0.00125	0.971496	23.35	1265.42	1268.95	3.53
65	157	92	27	157	0.00125	0.970425	24.21	1286.74	1288.93	2.18
66	160	94	28	160	0.00125	0.969375	25.08	1307.90	1311.08	3.18
67	163	96	29	163	0.00125	0.968347	25.96	1328.91	1330.73	1.82
68	166	98	30	166	0.00125	0.967339	26.86	1349.76	1352.55	2.79
69	167	98	29	167	0.00125	0.969845	27.29	1355.41	1357.41	2.00
70	170	100	30	170	0.00125	0.968858	28.22	1376.03	1379.07	3.04
71	173	102	31	173	0.00125	0.967891	29.16	1396.50	1398.27	1.77
72	176	104	32	176	0.00125	0.966942	30.12	1416.81	1419.60	2.79
73	179	106	33	179	0.00125	0.966012	31.09	1436.96	1438.50	1.54
74	182	108	34	182	0.00125	0.965101	32.08	1456.96	1459.50	2.55
75	185	110	35	185	0.00125	0.964207	33.08	1476.80	1478.11	1.31
76	188	112	36	188	0.00125	0.963332	34.10	1496.48	1498.81	2.32
77	191	114	37	191	0.00125	0.962474	35.14	1516.01	1517.12	1.11
78	194	116	38	194	0.00125	0.961632	36.19	1535.38	1537.52	2.14
79	197	118	39	197	0.00125	0.960808	37.26	1554.59	1555.55	0.96
80	200	120	40	200	0.00125	0.960000	38.35	1573.65	1575.65	2.00
81	203	122	41	203	0.00125	0.959208	39.45	1592.55	1593.42	0.87
82	206	124	42	206	0.00125	0.958432	40.56	1611.29	1613.22	1.94
83	209	126	43	209	0.00125	0.957670	41.69	1629.87	1630.72	0.85
84	212	128	44	212	0.00125	0.956924	42.84	1648.30	1650.25	1.94
85	215	130	45	215	0.00125	0.956193	44.00	1666.57	1667.48	0.91
86	218	132	46	218	0.00125	0.955475	45.18	1684.69	1686.73	2.04
87	219	132	45	219	0.00125	0.957778	45.73	1689.10	1691.03	1.93
88	222	134	46	222	0.00125	0.957065	46.94	1706.98	1710.11	3.12
89	225	136	47	225	0.00125	0.956365	48.15	1724.71	1726.93	2.22
90	228	138	48	228	0.00125	0.955679	49.39	1742.28	1745.74	3.45
91	231	140	49	231	0.00125	0.955005	50.64	1759.70	1762.30	2.61
92	234	142	50	234	0.00125	0.954343	51.90	1776.95	1780.84	3.89
93	237	144	51	237	0.00125	0.953693	53.18	1794.05	1797.16	3.10
94	240	146	52	240	0.00125	0.953056	54.48	1810.99	1815.43	4.44
95	243	148	53	243	0.00125	0.952429	55.79	1827.78	1831.50	3.72
96	246	150	54	246	0.00125	0.951814	57.12	1844.40	1849.51	5.11
97	249	152	55	249	0.00125	0.951210	58.46	1860.87	1865.34	4.47
98	252	154	56	252	0.00125	0.950617	59.82	1877.18	1883.10	5.91
99	255	156	57	255	0.00125	0.950035	61.20	1893.34	1898.68	5.34

100	258	158	58	258	0.00125	0.949462	62.59	1909.34	1916.19	6.85
101	261	160	59	261	0.00125	0.948900	64.00	1925.17	1931.54	6.36
102	264	162	60	264	0.00125	0.948347	65.42	1940.86	1948.79	7.94
103	269	166	63	269	0.00125	0.945150	67.64	1968.56	1975.25	6.69
104	272	168	64	272	0.00125	0.944637	69.10	1983.85	1992.19	8.35
105	275	170	65	275	0.00125	0.944132	70.58	1998.97	2007.01	8.04
106	278	172	66	278	0.00125	0.943636	72.07	2013.94	2023.72	9.78
107	281	174	67	281	0.00125	0.943149	73.58	2028.75	2038.31	9.57
108	284	176	68	284	0.00125	0.942670	75.11	2043.40	2054.78	11.38
109	287	178	69	287	0.00125	0.942199	76.65	2057.89	2069.15	11.26
110	290	180	70	290	0.00125	0.941736	78.21	2072.23	2085.39	13.16
111	293	182	71	293	0.00125	0.941281	79.78	2086.41	2099.53	13.13
112	296	184	72	296	0.00125	0.940833	81.37	2100.43	2115.54	15.11
113	299	186	73	299	0.00125	0.940392	82.98	2114.29	2129.47	15.17
114	302	188	74	302	0.00125	0.939959	84.60	2128.00	2145.24	17.24
115	305	190	75	305	0.00125	0.939532	86.23	2141.55	2158.95	17.40
116	308	192	76	308	0.00125	0.939113	87.89	2154.94	2174.49	19.55
117	311	194	77	311	0.00125	0.938700	89.55	2168.17	2187.99	19.82
118	314	196	78	314	0.00125	0.938294	91.24	2181.24	2203.30	22.06
119	317	198	79	317	0.00125	0.937894	92.94	2194.16	2216.59	22.43
120	320	200	80	320	0.00125	0.937500	94.65	2206.92	2231.68	24.76
121	323	202	81	323	0.00125	0.937112	96.38	2219.52	2244.75	25.23
122	326	204	82	326	0.00125	0.936731	98.13	2231.97	2259.62	27.65
123	331	208	85	331	0.00125	0.934055	100.84	2254.71	2282.43	27.72
124	334	210	86	334	0.00125	0.933701	102.63	2266.75	2297.04	30.29
125	337	212	87	337	0.00125	0.933353	104.43	2278.64	2309.65	31.01
126	340	214	88	340	0.00125	0.933010	106.25	2290.37	2324.04	33.68
127	343	216	89	343	0.00125	0.932673	108.09	2301.94	2336.45	34.51
128	346	218	90	346	0.00125	0.932340	109.94	2313.35	2350.63	37.28
129	349	220	91	349	0.00125	0.932012	111.80	2324.60	2362.83	38.23
130	352	222	92	352	0.00125	0.931689	113.68	2335.70	2376.79	41.09
131	355	224	93	355	0.00125	0.931371	115.58	2346.64	2388.79	42.15
132	358	226	94	358	0.00125	0.931057	117.49	2357.42	2402.54	45.12

Table 2. Estimated binding energy of isotopes of Z= 6, 20, 34, 48, 62, 76, 90, 104,118,132

Proton number	Mass number	Neutron number	Excess neutron number	Est.stable mass number As	Υ value	Beta value	Est.no of free nucleons	Estimated BE (MeV)	Reference BE (MeV)	Difference of BE (MeV)
6	8	2	-4	12	0.00125	0.750000	0.78	42.66	37.61	-5.05
6	9	3	-3	12	0.00125	0.888889	0.68	56.32	49.07	-7.25
6	10	4	-2	12	0.00125	0.960000	0.65	69.45	65.11	-4.34

6	11	5	-1	12	0.00125	0.991736	0.65	81.26	73.32	-7.94
6	12	6	0	12	0.00125	1.000000	0.66	91.44	85.36	-6.08
6	13	7	1	12	0.00125	0.994083	0.67	99.92	90.71	-9.20
6	14	8	2	12	0.00125	0.979592	0.69	106.77	99.66	-7.12
6	15	9	3	12	0.00125	0.960000	0.71	112.12	102.72	-9.40
6	16	10	4	12	0.00125	0.937500	0.74	116.10	109.24	-6.86
6	17	11	5	12	0.00125	0.913495	0.76	118.84	110.47	-8.37
6	18	12	6	12	0.00125	0.888889	0.78	120.49	115.09	-5.40
6	19	13	7	12	0.00125	0.864266	0.81	121.14	114.85	-6.29
6	20	14	8	12	0.00125	0.840000	0.83	120.91	117.94	-2.98
6	21	15	9	12	0.00125	0.816327	0.86	119.90	116.51	-3.39
Proton number	Mass number	Neutron number	Excess neutron number	Est.stable mass number As	Υ value	Beta value	Est.no of free nucleons	Estimated BE (MeV)	Reference BE (MeV)	Difference of BE (MeV)
20	36	16	-4	42	0.00125	0.987654	2.13	300.15	288.52	-11.63
20	37	17	-3	42	0.00125	0.993426	2.15	312.36	301.28	-11.09
20	38	18	-2	42	0.00125	0.997230	2.18	324.04	316.76	-7.28
20	39	19	-1	42	0.00125	0.999343	2.21	335.17	327.78	-7.39
20	40	20	0	42	0.00125	1.000000	2.25	345.77	341.51	-4.26
20	41	21	1	42	0.00125	0.999405	2.30	355.84	351.01	-4.83
20	42	22	2	42	0.00125	0.997732	2.35	365.38	363.18	-2.20
20	43	23	3	42	0.00125	0.995133	2.40	374.41	371.31	-3.10
20	44	24	4	42	0.00125	0.991736	2.46	382.93	382.08	-0.85
20	45	25	5	42	0.00125	0.987654	2.52	390.95	388.98	-1.97
20	46	26	6	42	0.00125	0.982987	2.59	398.50	398.51	0.01
20	47	27	7	42	0.00125	0.977818	2.65	405.57	404.31	-1.26
20	48	28	8	42	0.00125	0.972222	2.72	412.18	412.70	0.52
20	49	29	9	42	0.00125	0.966264	2.79	418.34	417.50	-0.84
20	50	30	10	42	0.00125	0.960000	2.87	424.08	424.88	0.80
20	51	31	11	42	0.00125	0.953479	2.94	429.39	428.77	-0.62
20	52	32	12	42	0.00125	0.946746	3.01	434.30	435.21	0.92
20	53	33	13	42	0.00125	0.939836	3.09	438.81	438.29	-0.52
20	54	34	14	42	0.00125	0.932785	3.17	442.94	443.88	0.94
20	55	35	15	42	0.00125	0.925620	3.25	446.70	446.20	-0.50
20	56	36	16	42	0.00125	0.918367	3.32	450.10	451.02	0.92
20	57	37	17	42	0.00125	0.911050	3.40	453.16	452.65	-0.51
20	58	38	18	42	0.00125	0.903686	3.48	455.88	456.76	0.88
20	59	39	19	42	0.00125	0.896294	3.57	458.27	457.75	-0.52
20	60	40	20	42	0.00125	0.888889	3.65	460.36	461.20	0.85
20	61	41	21	42	0.00125	0.881483	3.73	462.14	461.61	-0.52
20	62	42	22	42	0.00125	0.874089	3.81	463.62	464.46	0.84

20	63	43	23	42	0.00125	0.866717	3.90	464.83	464.33	-0.49
20	64	44	24	42	0.00125	0.859375	3.98	465.75	466.62	0.86
20	65	45	25	42	0.00125	0.852071	4.07	466.42	465.99	-0.43
20	66	46	26	42	0.00125	0.844812	4.15	466.82	467.76	0.93
20	67	47	27	42	0.00125	0.837603	4.24	466.98	466.67	-0.31
20	68	48	28	42	0.00125	0.830450	4.32	466.90	467.95	1.05
20	69	49	29	42	0.00125	0.823356	4.41	466.58	466.43	-0.15
20	70	50	30	42	0.00125	0.816327	4.50	466.04	467.26	1.22
Proton number	Mass number	Neutron number	Excess neutron number	Est.stable mass number As	Υ value	Beta value	Est.no of free nucleons	Estimated BE (MeV)	Reference BE (MeV)	Difference of BE (MeV)
34	64	30	-4	74	0.00125	0.996094	5.31	538.75	522.81	-15.95
34	65	31	-3	74	0.00125	0.997870	5.36	550.70	535.99	-14.71
34	66	32	-2	74	0.00125	0.999082	5.42	562.31	551.57	-10.74
34	67	33	-1	74	0.00125	0.999777	5.49	573.58	563.63	-9.95
34	68	34	0	74	0.00125	1.000000	5.56	584.53	578.07	-6.46
34	69	35	1	74	0.00125	0.999790	5.63	595.15	589.09	-6.06
34	70	36	2	74	0.00125	0.999184	5.72	605.45	602.48	-2.97
34	71	37	3	74	0.00125	0.998215	5.80	615.44	612.53	-2.90
34	72	38	4	74	0.00125	0.996914	5.89	625.10	624.94	-0.17
34	73	39	5	74	0.00125	0.995309	5.99	634.46	634.09	-0.37
34	74	40	6	74	0.00125	0.993426	6.09	643.51	645.57	2.06
34	75	41	7	74	0.00125	0.991289	6.19	652.26	653.88	1.62
34	76	42	8	74	0.00125	0.988920	6.29	660.71	664.51	3.80
34	77	43	9	74	0.00125	0.986338	6.40	668.87	672.03	3.16
34	78	44	10	74	0.00125	0.983563	6.51	676.74	681.86	5.11
34	79	45	11	74	0.00125	0.980612	6.62	684.33	688.64	4.32
34	80	46	12	74	0.00125	0.977500	6.74	691.63	697.71	6.08
34	81	47	13	74	0.00125	0.974242	6.85	698.67	703.81	5.14
34	82	48	14	74	0.00125	0.970851	6.97	705.43	712.17	6.74
34	83	49	15	74	0.00125	0.967339	7.09	711.93	717.62	5.69
34	84	50	16	74	0.00125	0.963719	7.21	718.17	725.31	7.15
34	85	51	17	74	0.00125	0.960000	7.34	724.15	730.15	6.00
34	86	52	18	74	0.00125	0.956193	7.46	729.88	737.21	7.34
34	87	53	19	74	0.00125	0.952305	7.59	735.36	741.48	6.12
34	88	54	20	74	0.00125	0.948347	7.71	740.60	747.95	7.35
34	89	55	21	74	0.00125	0.944325	7.84	745.60	751.67	6.06
34	90	56	22	74	0.00125	0.940247	7.97	750.37	757.59	7.21
34	91	57	23	74	0.00125	0.936119	8.10	754.92	760.79	5.87
34	92	58	24	74	0.00125	0.931947	8.23	759.23	766.18	6.95
34	93	59	25	74	0.00125	0.927737	8.37	763.33	768.90	5.57

34	94	60	26	74	0.00125	0.923495	8.50	767.21	773.78	6.58
34	95	61	27	74	0.00125	0.919224	8.63	770.88	776.04	5.16
34	96	62	28	74	0.00125	0.914931	8.77	774.34	780.46	6.12
34	97	63	29	74	0.00125	0.910617	8.91	777.59	782.28	4.68
34	98	64	30	74	0.00125	0.906289	9.04	780.65	786.24	5.59
34	99	65	31	74	0.00125	0.901949	9.18	783.51	787.65	4.14
34	100	66	32	74	0.00125	0.897600	9.32	786.18	791.19	5.01
34	101	67	33	74	0.00125	0.893246	9.46	788.66	792.20	3.54
34	102	68	34	74	0.00125	0.888889	9.60	790.95	795.33	4.38
34	103	69	35	74	0.00125	0.884532	9.74	793.07	795.97	2.91
34	104	70	36	74	0.00125	0.880178	9.88	795.00	798.72	3.72
34	105	71	37	74	0.00125	0.875828	10.02	796.76	799.00	2.24
34	106	72	38	74	0.00125	0.871485	10.16	798.35	801.38	3.02
34	107	73	39	74	0.00125	0.867150	10.31	799.77	801.32	1.55
34	108	74	40	74	0.00125	0.862826	10.45	801.03	803.34	2.31
34	109	75	41	74	0.00125	0.858514	10.59	802.12	802.97	0.84
34	110	76	42	74	0.00125	0.854215	10.74	803.06	804.65	1.59
34	111	77	43	74	0.00125	0.849931	10.88	803.84	803.97	0.12
34	112	78	44	74	0.00125	0.845663	11.03	804.47	805.33	0.86
34	113	79	45	74	0.00125	0.841413	11.17	804.95	804.35	-0.60
34	114	80	46	74	0.00125	0.837181	11.32	805.29	805.41	0.13
34	115	81	47	74	0.00125	0.832968	11.47	805.48	804.15	-1.33
34	116	82	48	74	0.00125	0.828775	11.61	805.52	804.91	-0.61
34	117	83	49	74	0.00125	0.824604	11.76	805.43	803.38	-2.05
34	118	84	50	74	0.00125	0.820454	11.91	805.21	803.87	-1.34
34	119	85	51	74	0.00125	0.816327	12.05	804.85	802.08	-2.77
Proton number	Mass number	Neutron number	Excess neutron number	Est.stable mass number As	Υ value	Beta value	Est.no of free nucleons	Estimated BE (MeV)	Reference BE (MeV)	Difference of BE (MeV)
48	92	44	-4	110	0.00125	0.998110	10.21	750.79	731.24	-19.55
48	93	45	-3	110	0.00125	0.998959	10.29	763.08	744.81	-18.27
48	94	46	-2	110	0.00125	0.999547	10.38	775.13	760.59	-14.54
48	95	47	-1	110	0.00125	0.999889	10.48	786.93	773.32	-13.61
48	96	48	0	110	0.00125	1.000000	10.58	798.50	788.24	-10.26
48	97	49	1	110	0.00125	0.999894	10.69	809.83	800.18	-9.65
48	98	50	2	110	0.00125	0.999584	10.80	820.93	814.30	-6.63
48	99	51	3	110	0.00125	0.999082	10.92	831.80	825.49	-6.31
48	100	52	4	110	0.00125	0.998400	11.04	842.44	838.84	-3.60
48	101	53	5	110	0.00125	0.997549	11.17	852.85	849.31	-3.54
48	102	54	6	110	0.00125	0.996540	11.30	863.04	861.93	-1.11
48	103	55	7	110	0.00125	0.995381	11.43	873.01	871.73	-1.28

48	104	56	8	110	0.00125	0.994083	11.57	882.75	883.65	0.90
48	105	57	9	110	0.00125	0.992653	11.71	892.28	892.80	0.52
48	106	58	10	110	0.00125	0.991100	11.86	901.60	904.07	2.48
48	107	59	11	110	0.00125	0.989431	12.00	910.70	912.61	1.91
48	108	60	12	110	0.00125	0.987654	12.15	919.59	923.25	3.66
48	109	61	13	110	0.00125	0.985776	12.31	928.27	931.20	2.93
48	110	62	14	110	0.00125	0.983802	12.46	936.75	941.25	4.50
48	111	63	15	110	0.00125	0.981738	12.62	945.02	948.64	3.62
48	112	64	16	110	0.00125	0.979592	12.78	953.09	958.11	5.02
48	113	65	17	110	0.00125	0.977367	12.94	960.97	964.97	4.00
48	114	66	18	110	0.00125	0.975069	13.10	968.64	973.90	5.25
48	115	67	19	110	0.00125	0.972703	13.27	976.13	980.25	4.12
48	116	68	20	110	0.00125	0.970273	13.44	983.42	988.65	5.24
48	117	69	21	110	0.00125	0.967784	13.61	990.52	994.52	4.00
48	118	70	22	110	0.00125	0.965240	13.78	997.43	1002.42	4.99
48	119	71	23	110	0.00125	0.962644	13.95	1004.16	1007.82	3.66
48	120	72	24	110	0.00125	0.960000	14.12	1010.71	1015.25	4.54
48	121	73	25	110	0.00125	0.957312	14.30	1017.08	1020.20	3.12
48	122	74	26	110	0.00125	0.954582	14.48	1023.27	1027.18	3.91
48	123	75	27	110	0.00125	0.951814	14.66	1029.29	1031.70	2.42
48	124	76	28	110	0.00125	0.949011	14.83	1035.13	1038.24	3.11
48	125	77	29	110	0.00125	0.946176	15.02	1040.80	1042.35	1.55
48	126	78	30	110	0.00125	0.943311	15.20	1046.30	1048.47	2.17
48	127	79	31	110	0.00125	0.940418	15.38	1051.64	1052.19	0.55
48	128	80	32	110	0.00125	0.937500	15.56	1056.81	1057.90	1.09
48	129	81	33	110	0.00125	0.934559	15.75	1061.82	1061.24	-0.57
48	130	82	34	110	0.00125	0.931598	15.94	1066.67	1066.57	-0.10
48	131	83	35	110	0.00125	0.928617	16.12	1071.36	1069.55	-1.81
48	132	84	36	110	0.00125	0.925620	16.31	1075.89	1074.50	-1.39
48	133	85	37	110	0.00125	0.922607	16.50	1080.28	1077.14	-3.14
48	134	86	38	110	0.00125	0.919581	16.69	1084.51	1081.73	-2.78
48	135	87	39	110	0.00125	0.916543	16.88	1088.59	1084.03	-4.56
48	136	88	40	110	0.00125	0.913495	17.07	1092.52	1088.28	-4.25
48	137	89	41	110	0.00125	0.910437	17.27	1096.31	1090.25	-6.06
48	138	90	42	110	0.00125	0.907372	17.46	1099.96	1094.17	-5.79
48	139	91	43	110	0.00125	0.904301	17.65	1103.46	1095.84	-7.62
48	140	92	44	110	0.00125	0.901224	17.85	1106.82	1099.43	-7.39
48	141	93	45	110	0.00125	0.898144	18.04	1110.05	1100.80	-9.25
48	142	94	46	110	0.00125	0.895061	18.24	1113.14	1104.09	-9.05
48	143	95	47	110	0.00125	0.891975	18.44	1116.09	1105.17	-10.93
48	144	96	48	110	0.00125	0.888889	18.63	1118.92	1108.16	-10.76
48	145	97	49	110	0.00125	0.885803	18.83	1121.61	1108.96	-12.65

48	146	98	50	110	0.00125	0.882717	19.03	1124.17	1111.66	-12.51
48	147	99	51	110	0.00125	0.879633	19.23	1126.61	1112.19	-14.42
48	148	100	52	110	0.00125	0.876552	19.43	1128.92	1114.62	-14.30
48	149	101	53	110	0.00125	0.873474	19.63	1131.11	1114.89	-16.21
48	150	102	54	110	0.00125	0.870400	19.83	1133.18	1117.05	-16.12
48	151	103	55	110	0.00125	0.867330	20.03	1135.12	1117.08	-18.04
48	152	104	56	110	0.00125	0.864266	20.23	1136.95	1118.98	-17.97
48	153	105	57	110	0.00125	0.861207	20.44	1138.66	1118.76	-19.90
48	154	106	58	110	0.00125	0.858155	20.64	1140.25	1120.41	-19.84
48	155	107	59	110	0.00125	0.855109	20.84	1141.73	1119.96	-21.77
48	156	108	60	110	0.00125	0.852071	21.05	1143.10	1121.37	-21.73
48	157	109	61	110	0.00125	0.849041	21.25	1144.36	1120.69	-23.67
48	158	110	62	110	0.00125	0.846018	21.46	1145.51	1121.87	-23.64
48	159	111	63	110	0.00125	0.843005	21.66	1146.55	1120.97	-25.57
48	160	112	64	110	0.00125	0.840000	21.87	1147.48	1121.92	-25.56
48	161	113	65	110	0.00125	0.837005	22.07	1148.31	1120.81	-27.49
48	162	114	66	110	0.00125	0.834019	22.28	1149.03	1121.54	-27.49
48	163	115	67	110	0.00125	0.831044	22.49	1149.65	1120.23	-29.42
48	164	116	68	110	0.00125	0.828079	22.70	1150.17	1120.75	-29.43
48	165	117	69	110	0.00125	0.825124	22.90	1150.60	1119.24	-31.36
48	166	118	70	110	0.00125	0.822180	23.11	1150.92	1119.55	-31.37
48	167	119	71	110	0.00125	0.819248	23.32	1151.14	1117.84	-33.30
48	168	120	72	110	0.00125	0.816327	23.53	1151.27	1117.95	-33.32
Proton number	Mass number	Neutron number	Excess neutron number	Est.stable mass number As	Υ value	Beta value	Est.no of free nucleons	Estimated BE (MeV)	Reference BE (MeV)	Difference of BE (MeV)
62	120	58	-4	148	0.00125	0.998889	16.82	938.82	913.34	-25.49
62	121	59	-3	148	0.00125	0.999385	16.94	951.36	927.26	-24.10
62	122	60	-2	148	0.00125	0.999731	17.06	963.70	943.24	-20.46
62	123	61	-1	148	0.00125	0.999934	17.18	975.86	956.49	-19.37
62	124	62	0	148	0.00125	1.000000	17.32	987.82	971.79	-16.03
62	125	63	1	148	0.00125	0.999936	17.46	999.60	984.39	-15.21
62	126	64	2	148	0.00125	0.999748	17.60	1011.19	999.03	-12.16
62	127	65	3	148	0.00125	0.999442	17.75	1022.60	1011.01	-11.58
62	128	66	4	148	0.00125	0.999023	17.90	1033.82	1025.03	-8.79
62	129	67	5	148	0.00125	0.998498	18.06	1044.86	1036.42	-8.45
62	130	68	6	148	0.00125	0.997870	18.22	1055.73	1049.82	-5.90
62	131	69	7	148	0.00125	0.997145	18.39	1066.41	1060.64	-5.77
62	132	70	8	148	0.00125	0.996327	18.56	1076.92	1073.47	-3.45
62	133	71	9	148	0.00125	0.995421	18.73	1087.26	1083.74	-3.52
62	134	72	10	148	0.00125	0.994431	18.91	1097.42	1096.01	-1.41

62	135	73	11	148	0.00125	0.993361	19.09	1107.41	1105.76	-1.65
62	136	74	12	148	0.00125	0.992215	19.28	1117.23	1117.49	0.26
62	137	75	13	148	0.00125	0.990996	19.46	1126.88	1126.73	-0.15
62	138	76	14	148	0.00125	0.989708	19.65	1136.36	1137.94	1.58
62	139	77	15	148	0.00125	0.988355	19.85	1145.68	1146.69	1.01
62	140	78	16	148	0.00125	0.986939	20.04	1154.83	1157.41	2.58
62	141	79	17	148	0.00125	0.985464	20.24	1163.82	1165.69	1.87
62	142	80	18	148	0.00125	0.983932	20.44	1172.65	1175.93	3.28
62	143	81	19	148	0.00125	0.982346	20.64	1181.32	1183.76	2.44
62	144	82	20	148	0.00125	0.980710	20.85	1189.83	1193.54	3.71
62	145	83	21	148	0.00125	0.979025	21.05	1198.18	1200.93	2.75
62	146	84	22	148	0.00125	0.977294	21.26	1206.38	1210.26	3.88
62	147	85	23	148	0.00125	0.975519	21.48	1214.43	1217.24	2.81
62	148	86	24	148	0.00125	0.973703	21.69	1222.32	1226.14	3.82
62	149	87	25	148	0.00125	0.971848	21.90	1230.06	1232.71	2.65
62	150	88	26	148	0.00125	0.969956	22.12	1237.65	1241.19	3.54
62	151	89	27	148	0.00125	0.968028	22.34	1245.09	1247.37	2.28
62	152	90	28	148	0.00125	0.966066	22.56	1252.39	1255.45	3.07
62	153	91	29	148	0.00125	0.964074	22.78	1259.53	1261.25	1.72
62	154	92	30	148	0.00125	0.962051	23.01	1266.54	1268.95	2.41
62	155	93	31	148	0.00125	0.960000	23.23	1273.40	1274.38	0.98
62	156	94	32	148	0.00125	0.957922	23.46	1280.13	1281.71	1.58
62	157	95	33	148	0.00125	0.955820	23.69	1286.71	1286.79	0.08
62	158	96	34	148	0.00125	0.953693	23.91	1293.15	1293.75	0.60
62	159	97	35	148	0.00125	0.951545	24.15	1299.46	1298.49	-0.97
62	160	98	36	148	0.00125	0.949375	24.38	1305.63	1305.10	-0.53
62	161	99	37	148	0.00125	0.947186	24.61	1311.67	1309.51	-2.16
62	162	100	38	148	0.00125	0.944978	24.84	1317.57	1315.78	-1.79
62	163	101	39	148	0.00125	0.942753	25.08	1323.35	1319.87	-3.47
62	164	102	40	148	0.00125	0.940512	25.32	1328.99	1325.82	-3.17
62	165	103	41	148	0.00125	0.938255	25.55	1334.50	1329.60	-4.91
62	166	104	42	148	0.00125	0.935985	25.79	1339.89	1335.22	-4.66
62	167	105	43	148	0.00125	0.933701	26.03	1345.15	1338.70	-6.44
62	168	106	44	148	0.00125	0.931406	26.27	1350.28	1344.02	-6.26
62	169	107	45	148	0.00125	0.929099	26.52	1355.29	1347.21	-8.08
62	170	108	46	148	0.00125	0.926782	26.76	1360.18	1352.23	-7.95
62	171	109	47	148	0.00125	0.924455	27.00	1364.95	1355.14	-9.81
62	172	110	48	148	0.00125	0.922120	27.25	1369.60	1359.87	-9.73
62	173	111	49	148	0.00125	0.919777	27.49	1374.13	1362.50	-11.62
62	174	112	50	148	0.00125	0.917426	27.74	1378.54	1366.95	-11.58
62	175	113	51	148	0.00125	0.915069	27.99	1382.83	1369.32	-13.51
62	176	114	52	148	0.00125	0.912707	28.23	1387.01	1373.50	-13.51

62	177	115	53	148	0.00125	0.910339	28.48	1391.08	1375.61	-15.47
62	178	116	54	148	0.00125	0.907966	28.73	1395.03	1379.53	-15.51
62	179	117	55	148	0.00125	0.905590	28.98	1398.87	1381.39	-17.49
62	180	118	56	148	0.00125	0.903210	29.23	1402.60	1385.04	-17.56
62	181	119	57	148	0.00125	0.900827	29.48	1406.23	1386.66	-19.56
62	182	120	58	148	0.00125	0.898442	29.74	1409.74	1390.07	-19.67
62	183	121	59	148	0.00125	0.896055	29.99	1413.15	1391.45	-21.69
62	184	122	60	148	0.00125	0.893667	30.24	1416.45	1394.62	-21.83
62	185	123	61	148	0.00125	0.891278	30.50	1419.65	1395.77	-23.87
62	186	124	62	148	0.00125	0.888889	30.75	1422.74	1398.70	-24.04
62	187	125	63	148	0.00125	0.886499	31.01	1425.73	1399.63	-26.10
62	188	126	64	148	0.00125	0.884110	31.27	1428.62	1402.33	-26.29
62	189	127	65	148	0.00125	0.881722	31.52	1431.41	1403.05	-28.36
62	190	128	66	148	0.00125	0.879335	31.78	1434.10	1405.53	-28.57
62	191	129	67	148	0.00125	0.876950	32.04	1436.69	1406.03	-30.66
62	192	130	68	148	0.00125	0.874566	32.30	1439.18	1408.29	-30.89
62	193	131	69	148	0.00125	0.872184	32.56	1441.58	1408.59	-32.99
62	194	132	70	148	0.00125	0.869806	32.82	1443.88	1410.64	-33.24
62	195	133	71	148	0.00125	0.867429	33.08	1446.09	1410.75	-35.34
62	196	134	72	148	0.00125	0.865056	33.34	1448.20	1412.59	-35.62
62	197	135	73	148	0.00125	0.862686	33.60	1450.23	1412.50	-37.73
62	198	136	74	148	0.00125	0.860320	33.86	1452.16	1414.14	-38.02
62	199	137	75	148	0.00125	0.857958	34.12	1454.00	1413.86	-40.14
62	200	138	76	148	0.00125	0.855600	34.39	1455.75	1415.31	-40.44
62	201	139	77	148	0.00125	0.853246	34.65	1457.41	1414.84	-42.56
62	202	140	78	148	0.00125	0.850897	34.91	1458.98	1416.10	-42.88
62	203	141	79	148	0.00125	0.848553	35.18	1460.47	1415.46	-45.01
62	204	142	80	148	0.00125	0.846213	35.44	1461.87	1416.53	-45.34
62	205	143	81	148	0.00125	0.843879	35.71	1463.19	1415.72	-47.47
62	206	144	82	148	0.00125	0.841550	35.97	1464.42	1416.61	-47.81
62	207	145	83	148	0.00125	0.839226	36.24	1465.57	1415.62	-49.95
62	208	146	84	148	0.00125	0.836908	36.51	1466.63	1416.34	-50.30
62	209	147	85	148	0.00125	0.834596	36.77	1467.62	1415.19	-52.43
62	210	148	86	148	0.00125	0.832290	37.04	1468.52	1415.73	-52.79
62	211	149	87	148	0.00125	0.829990	37.31	1469.35	1414.42	-54.93
62	212	150	88	148	0.00125	0.827697	37.58	1470.09	1414.79	-55.30
62	213	151	89	148	0.00125	0.825409	37.85	1470.76	1413.32	-57.44
62	214	152	90	148	0.00125	0.823129	38.11	1471.34	1413.53	-57.81
62	215	153	91	148	0.00125	0.820855	38.38	1471.86	1411.91	-59.95
62	216	154	92	148	0.00125	0.818587	38.65	1472.29	1411.96	-60.33
62	217	155	93	148	0.00125	0.816327	38.92	1472.65	1410.19	-62.47

Proton number	Mass number	Neutron number	Excess neutron number	Est.stable mass number As	Υ value	Beta value	Est.no of free nucleons	Estimated BE (MeV)	Reference BE (MeV)	Difference of BE (MeV)
76	148	72	-4	188	0.00125	0.999270	25.15	1101.44	1069.66	-31.78
76	149	73	-3	188	0.00125	0.999595	25.30	1114.17	1083.89	-30.28
76	150	74	-2	188	0.00125	0.999822	25.45	1126.74	1100.08	-26.65
76	151	75	-1	188	0.00125	0.999956	25.61	1139.15	1113.76	-25.39
76	152	76	0	188	0.00125	1.000000	25.77	1151.40	1129.37	-22.02
76	153	77	1	188	0.00125	0.999957	25.94	1163.49	1142.50	-20.99
76	154	78	2	188	0.00125	0.999831	26.11	1175.42	1157.56	-17.86
76	155	79	3	188	0.00125	0.999625	26.29	1187.20	1170.16	-17.04
76	156	80	4	188	0.00125	0.999343	26.48	1198.83	1184.68	-14.15
76	157	81	5	188	0.00125	0.998986	26.67	1210.31	1196.77	-13.53
76	158	82	6	188	0.00125	0.998558	26.86	1221.63	1210.78	-10.85
76	159	83	7	188	0.00125	0.998062	27.06	1232.80	1222.38	-10.42
76	160	84	8	188	0.00125	0.997500	27.26	1243.83	1235.88	-7.94
76	161	85	9	188	0.00125	0.996875	27.47	1254.70	1247.00	-7.70
76	162	86	10	188	0.00125	0.996190	27.68	1265.43	1260.02	-5.41
76	163	87	11	188	0.00125	0.995446	27.89	1276.02	1270.68	-5.33
76	164	88	12	188	0.00125	0.994646	28.11	1286.46	1283.23	-3.22
76	165	89	13	188	0.00125	0.993792	28.33	1296.75	1293.45	-3.31
76	166	90	14	188	0.00125	0.992887	28.55	1306.91	1305.54	-1.37
76	167	91	15	188	0.00125	0.991932	28.78	1316.92	1315.33	-1.60
76	168	92	16	188	0.00125	0.990930	29.01	1326.79	1326.98	0.18
76	169	93	17	188	0.00125	0.989881	29.24	1336.53	1336.34	-0.19
76	170	94	18	188	0.00125	0.988789	29.48	1346.13	1347.57	1.44
76	171	95	19	188	0.00125	0.987654	29.71	1355.59	1356.53	0.94
76	172	96	20	188	0.00125	0.986479	29.96	1364.91	1367.34	2.43
76	173	97	21	188	0.00125	0.985265	30.20	1374.10	1375.91	1.81
76	174	98	22	188	0.00125	0.984014	30.45	1383.16	1386.32	3.16
76	175	99	23	188	0.00125	0.982727	30.69	1392.08	1394.50	2.42
76	176	100	24	188	0.00125	0.981405	30.94	1400.87	1404.53	3.65
76	177	101	25	188	0.00125	0.980050	31.20	1409.53	1412.34	2.81
76	178	102	26	188	0.00125	0.978664	31.45	1418.07	1421.99	3.92
76	179	103	27	188	0.00125	0.977248	31.71	1426.47	1429.44	2.97
76	180	104	28	188	0.00125	0.975802	31.97	1434.75	1438.72	3.97
76	181	105	29	188	0.00125	0.974329	32.23	1442.89	1445.83	2.93
76	182	106	30	188	0.00125	0.972829	32.49	1450.92	1454.75	3.83
76	183	107	31	188	0.00125	0.971304	32.76	1458.82	1461.52	2.70
76	184	108	32	188	0.00125	0.969754	33.02	1466.59	1470.09	3.50
76	185	109	33	188	0.00125	0.968181	33.29	1474.25	1476.53	2.28

76	186	110	34	188	0.00125	0.966586	33.56	1481.78	1484.77	2.99
76	187	111	35	188	0.00125	0.964969	33.83	1489.19	1490.89	1.70
76	188	112	36	188	0.00125	0.963332	34.10	1496.48	1498.81	2.32
76	189	113	37	188	0.00125	0.961675	34.38	1503.65	1504.61	0.96
76	190	114	38	188	0.00125	0.960000	34.66	1510.71	1512.21	1.50
76	191	115	39	188	0.00125	0.958307	34.93	1517.65	1517.72	0.07
76	192	116	40	188	0.00125	0.956597	35.21	1524.47	1525.01	0.53
76	193	117	41	188	0.00125	0.954871	35.49	1531.18	1530.22	-0.96
76	194	118	42	188	0.00125	0.953130	35.77	1537.77	1537.21	-0.57
76	195	119	43	188	0.00125	0.951374	36.06	1544.25	1542.13	-2.12
76	196	120	44	188	0.00125	0.949604	36.34	1550.62	1548.83	-1.80
76	197	121	45	188	0.00125	0.947821	36.63	1556.88	1553.48	-3.40
76	198	122	46	188	0.00125	0.946026	36.91	1563.03	1559.89	-3.14
76	199	123	47	188	0.00125	0.944219	37.20	1569.07	1564.27	-4.80
76	200	124	48	188	0.00125	0.942400	37.49	1575.00	1570.40	-4.60
76	201	125	49	188	0.00125	0.940571	37.78	1580.82	1574.51	-6.30
76	202	126	50	188	0.00125	0.938731	38.07	1586.54	1580.38	-6.16
76	203	127	51	188	0.00125	0.936883	38.36	1592.15	1584.24	-7.91
76	204	128	52	188	0.00125	0.935025	38.66	1597.65	1589.84	-7.82
76	205	129	53	188	0.00125	0.933159	38.95	1603.05	1593.45	-9.61
76	206	130	54	188	0.00125	0.931285	39.25	1608.35	1598.79	-9.56
76	207	131	55	188	0.00125	0.929403	39.54	1613.55	1602.15	-11.39
76	208	132	56	188	0.00125	0.927515	39.84	1618.64	1607.25	-11.40
76	209	133	57	188	0.00125	0.925620	40.14	1623.64	1610.38	-13.26
76	210	134	58	188	0.00125	0.923719	40.44	1628.53	1615.22	-13.31
76	211	135	59	188	0.00125	0.921812	40.74	1633.32	1618.12	-15.20
76	212	136	60	188	0.00125	0.919900	41.04	1638.02	1622.73	-15.29
76	213	137	61	188	0.00125	0.917984	41.34	1642.62	1625.40	-17.22
76	214	138	62	188	0.00125	0.916063	41.64	1647.13	1629.78	-17.34
76	215	139	63	188	0.00125	0.914137	41.95	1651.53	1632.24	-19.30
76	216	140	64	188	0.00125	0.912209	42.25	1655.85	1636.39	-19.46
76	217	141	65	188	0.00125	0.910276	42.56	1660.07	1638.63	-21.44
76	218	142	66	188	0.00125	0.908341	42.86	1664.19	1642.56	-21.64
76	219	143	67	188	0.00125	0.906403	43.17	1668.23	1644.59	-23.64
76	220	144	68	188	0.00125	0.904463	43.48	1672.17	1648.30	-23.87
76	221	145	69	188	0.00125	0.902520	43.78	1676.02	1650.13	-25.90
76	222	146	70	188	0.00125	0.900576	44.09	1679.78	1653.63	-26.15
76	223	147	71	188	0.00125	0.898631	44.40	1683.46	1655.26	-28.20
76	224	148	72	188	0.00125	0.896684	44.71	1687.04	1658.56	-28.48
76	225	149	73	188	0.00125	0.894736	45.02	1690.54	1659.99	-30.55
76	226	150	74	188	0.00125	0.892787	45.33	1693.94	1663.09	-30.86
76	227	151	75	188	0.00125	0.890838	45.65	1697.27	1664.33	-32.94

76	228	152	76	188	0.00125	0.888889	45.96	1700.50	1667.23	-33.27
76	229	153	77	188	0.00125	0.886940	46.27	1703.65	1668.28	-35.37
76	230	154	78	188	0.00125	0.884991	46.59	1706.72	1671.00	-35.73
76	231	155	79	188	0.00125	0.883042	46.90	1709.71	1671.87	-37.84
76	232	156	80	188	0.00125	0.881094	47.22	1712.61	1674.39	-38.22
76	233	157	81	188	0.00125	0.879147	47.53	1715.43	1675.09	-40.34
76	234	158	82	188	0.00125	0.877201	47.85	1718.17	1677.43	-40.74
76	235	159	83	188	0.00125	0.875256	48.17	1720.82	1677.95	-42.88
76	236	160	84	188	0.00125	0.873312	48.48	1723.40	1680.11	-43.29
76	237	161	85	188	0.00125	0.871370	48.80	1725.90	1680.46	-45.44
76	238	162	86	188	0.00125	0.869430	49.12	1728.32	1682.45	-45.87
76	239	163	87	188	0.00125	0.867492	49.44	1730.66	1682.63	-48.03
76	240	164	88	188	0.00125	0.865556	49.76	1732.92	1684.45	-48.47
76	241	165	89	188	0.00125	0.863621	50.08	1735.11	1684.47	-50.64
76	242	166	90	188	0.00125	0.861690	50.40	1737.22	1686.12	-51.10
76	243	167	91	188	0.00125	0.859761	50.72	1739.26	1685.99	-53.27
76	244	168	92	188	0.00125	0.857834	51.04	1741.22	1687.47	-53.75
76	245	169	93	188	0.00125	0.855910	51.37	1743.11	1687.18	-55.93
76	246	170	94	188	0.00125	0.853989	51.69	1744.92	1688.51	-56.41
76	247	171	95	188	0.00125	0.852071	52.01	1746.66	1688.06	-58.60
76	248	172	96	188	0.00125	0.850156	52.34	1748.33	1689.23	-59.10
76	249	173	97	188	0.00125	0.848244	52.66	1749.93	1688.64	-61.29
76	250	174	98	188	0.00125	0.846336	52.98	1751.45	1689.65	-61.80
76	251	175	99	188	0.00125	0.844431	53.31	1752.91	1688.92	-63.99
76	252	176	100	188	0.00125	0.842530	53.64	1754.29	1689.78	-64.51
76	253	177	101	188	0.00125	0.840632	53.96	1755.61	1688.90	-66.71
76	254	178	102	188	0.00125	0.838738	54.29	1756.85	1689.62	-67.24
76	255	179	103	188	0.00125	0.836847	54.61	1758.03	1688.59	-69.44
76	256	180	104	188	0.00125	0.834961	54.94	1759.14	1689.17	-69.98
76	257	181	105	188	0.00125	0.833078	55.27	1760.19	1688.01	-72.18
76	258	182	106	188	0.00125	0.831200	55.60	1761.17	1688.44	-72.72
76	259	183	107	188	0.00125	0.829326	55.93	1762.08	1687.15	-74.93
76	260	184	108	188	0.00125	0.827456	56.25	1762.92	1687.44	-75.48
76	261	185	109	188	0.00125	0.825590	56.58	1763.70	1686.02	-77.68
76	262	186	110	188	0.00125	0.823728	56.91	1764.42	1686.18	-78.24
76	263	187	111	188	0.00125	0.821871	57.24	1765.07	1684.63	-80.45
76	264	188	112	188	0.00125	0.820018	57.57	1765.66	1684.65	-81.01
76	265	189	113	188	0.00125	0.818170	57.90	1766.19	1682.97	-83.22
76	266	190	114	188	0.00125	0.816327	58.23	1766.65	1682.87	-83.79

Proton number	Mass number	Neutron number	Excess neutron number	Est.stable mass number As	Υ value	Beta value	Est.no of free nucleons	Estimated BE (MeV)	Reference BE (MeV)	Difference of BE (MeV)
90	176	86	-4	228	0.00125	0.999483	35.20	1245.78	1200.98	-44.81
90	177	87	-3	228	0.00125	0.999713	35.37	1258.54	1215.51	-43.03
90	178	88	-2	228	0.00125	0.999874	35.56	1271.15	1231.90	-39.25
90	179	89	-1	228	0.00125	0.999969	35.74	1283.61	1245.94	-37.68
90	180	90	0	228	0.00125	1.000000	35.94	1295.94	1261.84	-34.11
90	181	91	1	228	0.00125	0.999969	36.14	1308.13	1275.40	-32.73
90	182	92	2	228	0.00125	0.999879	36.34	1320.18	1290.81	-29.37
90	183	93	3	228	0.00125	0.999731	36.55	1332.10	1303.92	-28.18
90	184	94	4	228	0.00125	0.999527	36.77	1343.88	1318.87	-25.01
90	185	95	5	228	0.00125	0.999270	36.99	1355.52	1331.52	-24.00
90	186	96	6	228	0.00125	0.998959	37.21	1367.04	1346.01	-21.02
90	187	97	7	228	0.00125	0.998599	37.44	1378.42	1358.24	-20.18
90	188	98	8	228	0.00125	0.998189	37.68	1389.67	1372.29	-17.38
90	189	99	9	228	0.00125	0.997732	37.91	1400.79	1384.09	-16.70
90	190	100	10	228	0.00125	0.997230	38.16	1411.78	1397.71	-14.07
90	191	101	11	228	0.00125	0.996683	38.40	1422.64	1409.10	-13.54
90	192	102	12	228	0.00125	0.996094	38.65	1433.38	1422.30	-11.08
90	193	103	13	228	0.00125	0.995463	38.90	1443.99	1433.29	-10.69
90	194	104	14	228	0.00125	0.994792	39.16	1454.47	1446.09	-8.38
90	195	105	15	228	0.00125	0.994083	39.42	1464.83	1456.69	-8.14
90	196	106	16	228	0.00125	0.993336	39.68	1475.07	1469.09	-5.97
90	197	107	17	228	0.00125	0.992553	39.95	1485.18	1479.32	-5.86
90	198	108	18	228	0.00125	0.991736	40.22	1495.17	1491.33	-3.84
90	199	109	19	228	0.00125	0.990884	40.49	1505.04	1501.19	-3.85
90	200	110	20	228	0.00125	0.990000	40.77	1514.79	1512.83	-1.96
90	201	111	21	228	0.00125	0.989084	41.05	1524.42	1522.34	-2.09
90	202	112	22	228	0.00125	0.988138	41.33	1533.94	1533.61	-0.33
90	203	113	23	228	0.00125	0.987163	41.61	1543.33	1542.77	-0.57
90	204	114	24	228	0.00125	0.986159	41.90	1552.61	1553.69	1.08
90	205	115	25	228	0.00125	0.985128	42.19	1561.77	1562.50	0.73
90	206	116	26	228	0.00125	0.984070	42.48	1570.82	1573.07	2.25
90	207	117	27	228	0.00125	0.982987	42.77	1579.75	1581.56	1.80
90	208	118	28	228	0.00125	0.981879	43.07	1588.57	1591.80	3.22
90	209	119	29	228	0.00125	0.980747	43.37	1597.28	1599.96	2.68
90	210	120	30	228	0.00125	0.979592	43.67	1605.87	1609.87	3.99
90	211	121	31	228	0.00125	0.978415	43.97	1614.36	1617.71	3.35
90	212	122	32	228	0.00125	0.977216	44.27	1622.73	1627.30	4.57
90	213	123	33	228	0.00125	0.975997	44.58	1630.99	1634.84	3.85

90	214	124	34	228	0.00125	0.974758	44.89	1639.15	1644.12	4.97
90	215	125	35	228	0.00125	0.973499	45.20	1647.19	1651.36	4.17
90	216	126	36	228	0.00125	0.972222	45.51	1655.13	1660.33	5.20
90	217	127	37	228	0.00125	0.970927	45.83	1662.97	1667.28	4.32
90	218	128	38	228	0.00125	0.969615	46.14	1670.69	1675.96	5.27
90	219	129	39	228	0.00125	0.968287	46.46	1678.31	1682.62	4.31
90	220	130	40	228	0.00125	0.966942	46.78	1685.83	1691.01	5.18
90	221	131	41	228	0.00125	0.965582	47.10	1693.24	1697.40	4.16
90	222	132	42	228	0.00125	0.964207	47.42	1700.55	1705.50	4.95
90	223	133	43	228	0.00125	0.962818	47.75	1707.76	1711.62	3.86
90	224	134	44	228	0.00125	0.961416	48.07	1714.86	1719.44	4.58
90	225	135	45	228	0.00125	0.960000	48.40	1721.87	1725.30	3.43
90	226	136	46	228	0.00125	0.958572	48.73	1728.77	1732.85	4.08
90	227	137	47	228	0.00125	0.957131	49.06	1735.58	1738.45	2.87
90	228	138	48	228	0.00125	0.955679	49.39	1742.28	1745.74	3.45
90	229	139	49	228	0.00125	0.954215	49.72	1748.89	1751.08	2.19
90	230	140	50	228	0.00125	0.952741	50.05	1755.40	1758.11	2.71
90	231	141	51	228	0.00125	0.951257	50.39	1761.81	1763.21	1.40
90	232	142	52	228	0.00125	0.949762	50.73	1768.13	1769.99	1.86
90	233	143	53	228	0.00125	0.948258	51.06	1774.35	1774.85	0.50
90	234	144	54	228	0.00125	0.946746	51.40	1780.48	1781.38	0.90
90	235	145	55	228	0.00125	0.945224	51.74	1786.52	1786.01	-0.51
90	236	146	56	228	0.00125	0.943694	52.08	1792.46	1792.30	-0.16
90	237	147	57	228	0.00125	0.942157	52.43	1798.30	1796.70	-1.61
90	238	148	58	228	0.00125	0.940612	52.77	1804.06	1802.75	-1.31
90	239	149	59	228	0.00125	0.939059	53.12	1809.72	1806.92	-2.80
90	240	150	60	228	0.00125	0.937500	53.46	1815.30	1812.75	-2.55
90	241	151	61	228	0.00125	0.935934	53.81	1820.78	1816.70	-4.08
90	242	152	62	228	0.00125	0.934362	54.16	1826.17	1822.30	-3.87
90	243	153	63	228	0.00125	0.932785	54.50	1831.48	1826.04	-5.44
90	244	154	64	228	0.00125	0.931201	54.85	1836.69	1831.42	-5.28
90	245	155	65	228	0.00125	0.929613	55.21	1841.82	1834.94	-6.88
90	246	156	66	228	0.00125	0.928019	55.56	1846.87	1840.11	-6.75
90	247	157	67	228	0.00125	0.926421	55.91	1851.82	1843.43	-8.39
90	248	158	68	228	0.00125	0.924818	56.26	1856.69	1848.39	-8.31
90	249	159	69	228	0.00125	0.923211	56.62	1861.48	1851.50	-9.97
90	250	160	70	228	0.00125	0.921600	56.97	1866.18	1856.25	-9.92
90	251	161	71	228	0.00125	0.919985	57.33	1870.79	1859.18	-11.62
90	252	162	72	228	0.00125	0.918367	57.69	1875.33	1863.72	-11.60
90	253	163	73	228	0.00125	0.916746	58.05	1879.78	1866.45	-13.33
90	254	164	74	228	0.00125	0.915122	58.40	1884.14	1870.80	-13.34
90	255	165	75	228	0.00125	0.913495	58.76	1888.43	1873.34	-15.09

90	256	166	76	228	0.00125	0.911865	59.13	1892.64	1877.50	-15.14
90	257	167	77	228	0.00125	0.910233	59.49	1896.76	1879.85	-16.91
90	258	168	78	228	0.00125	0.908599	59.85	1900.81	1883.82	-16.99
90	259	169	79	228	0.00125	0.906963	60.21	1904.78	1885.99	-18.78
90	260	170	80	228	0.00125	0.905325	60.58	1908.66	1889.77	-18.89
90	261	171	81	228	0.00125	0.903686	60.94	1912.47	1891.77	-20.70
90	262	172	82	228	0.00125	0.902045	61.30	1916.20	1895.37	-20.84
90	263	173	83	228	0.00125	0.900403	61.67	1919.86	1897.19	-22.67
90	264	174	84	228	0.00125	0.898760	62.04	1923.44	1900.61	-22.83
90	265	175	85	228	0.00125	0.897116	62.40	1926.94	1902.26	-24.68
90	266	176	86	228	0.00125	0.895472	62.77	1930.37	1905.51	-24.86
90	267	177	87	228	0.00125	0.893827	63.14	1933.72	1906.99	-26.73
90	268	178	88	228	0.00125	0.892181	63.51	1937.00	1910.07	-26.93
90	269	179	89	228	0.00125	0.890535	63.88	1940.20	1911.39	-28.81
90	270	180	90	228	0.00125	0.888889	64.25	1943.34	1914.30	-29.04
90	271	181	91	228	0.00125	0.887243	64.62	1946.39	1915.46	-30.94
90	272	182	92	228	0.00125	0.885597	64.99	1949.38	1918.20	-31.18
90	273	183	93	228	0.00125	0.883951	65.37	1952.30	1919.20	-33.09
90	274	184	94	228	0.00125	0.882306	65.74	1955.14	1921.78	-33.36
90	275	185	95	228	0.00125	0.880661	66.11	1957.91	1922.63	-35.28
90	276	186	96	228	0.00125	0.879017	66.49	1960.62	1925.05	-35.56
90	277	187	97	228	0.00125	0.877374	66.86	1963.25	1925.75	-37.50
90	278	188	98	228	0.00125	0.875731	67.24	1965.81	1928.02	-37.80
90	279	189	99	228	0.00125	0.874089	67.61	1968.31	1928.57	-39.74
90	280	190	100	228	0.00125	0.872449	67.99	1970.74	1930.68	-40.06
90	281	191	101	228	0.00125	0.870810	68.37	1973.10	1931.09	-42.01
90	282	192	102	228	0.00125	0.869172	68.74	1975.39	1933.05	-42.34
90	283	193	103	228	0.00125	0.867535	69.12	1977.61	1933.31	-44.30
90	284	194	104	228	0.00125	0.865900	69.50	1979.77	1935.13	-44.65
90	285	195	105	228	0.00125	0.864266	69.88	1981.87	1935.25	-46.62
90	286	196	106	228	0.00125	0.862634	70.26	1983.90	1936.92	-46.97
90	287	197	107	228	0.00125	0.861004	70.64	1985.86	1936.91	-48.95
90	288	198	108	228	0.00125	0.859375	71.02	1987.76	1938.44	-49.32
90	289	199	109	228	0.00125	0.857748	71.40	1989.59	1938.29	-51.31
90	290	200	110	228	0.00125	0.856124	71.78	1991.37	1939.68	-51.69
90	291	201	111	228	0.00125	0.854501	72.16	1993.08	1939.40	-53.68
90	292	202	112	228	0.00125	0.852880	72.55	1994.72	1940.65	-54.07
90	293	203	113	228	0.00125	0.851262	72.93	1996.31	1940.24	-56.07
90	294	204	114	228	0.00125	0.849646	73.31	1997.83	1941.36	-56.47
90	295	205	115	228	0.00125	0.848032	73.70	1999.29	1940.82	-58.47
90	296	206	116	228	0.00125	0.846421	74.08	2000.69	1941.81	-58.88
90	297	207	117	228	0.00125	0.844812	74.47	2002.03	1941.14	-60.88

90	298	208	118	228	0.00125	0.843205	74.85	2003.31	1942.00	-61.31
90	299	209	119	228	0.00125	0.841601	75.24	2004.53	1941.21	-63.31
90	300	210	120	228	0.00125	0.840000	75.62	2005.69	1941.95	-63.74
90	301	211	121	228	0.00125	0.838401	76.01	2006.79	1941.04	-65.75
90	302	212	122	228	0.00125	0.836805	76.40	2007.84	1941.64	-66.19
90	303	213	123	228	0.00125	0.835212	76.78	2008.82	1940.62	-68.20
90	304	214	124	228	0.00125	0.833622	77.17	2009.75	1941.10	-68.65
90	305	215	125	228	0.00125	0.832034	77.56	2010.62	1939.96	-70.66
90	306	216	126	228	0.00125	0.830450	77.95	2011.44	1940.32	-71.12
90	307	217	127	228	0.00125	0.828868	78.34	2012.19	1939.06	-73.13
90	308	218	128	228	0.00125	0.827290	78.73	2012.90	1939.31	-73.59
90	309	219	129	228	0.00125	0.825714	79.12	2013.54	1937.94	-75.61
90	310	220	130	228	0.00125	0.824142	79.51	2014.13	1938.06	-76.07
90	311	221	131	228	0.00125	0.822572	79.90	2014.67	1936.58	-78.09
90	312	222	132	228	0.00125	0.821006	80.29	2015.15	1936.60	-78.56
90	313	223	133	228	0.00125	0.819443	80.68	2015.58	1935.00	-80.58
90	314	224	134	228	0.00125	0.817883	81.07	2015.96	1934.90	-81.05
90	315	225	135	228	0.00125	0.816327	81.46	2016.28	1933.21	-83.07
Proton number	Mass number	Neutron number	Excess neutron number	Est.stable mass number As	Υ value	Beta value	Est.no of free nucleons	Estimated BE (MeV)	Reference BE (MeV)	Difference of BE (MeV)
104	204	100	-4	272	0.00125	0.999616	46.96	1355.04	1308.08	-46.96
104	205	101	-3	272	0.00125	0.999786	47.16	1367.94	1322.88	-45.06
104	206	102	-2	272	0.00125	0.999906	47.38	1380.71	1339.47	-41.25
104	207	103	-1	272	0.00125	0.999977	47.60	1393.36	1353.83	-39.53
104	208	104	0	272	0.00125	1.000000	47.82	1405.88	1369.98	-35.90
104	209	105	1	272	0.00125	0.999977	48.05	1418.28	1383.93	-34.35
104	210	106	2	272	0.00125	0.999909	48.29	1430.55	1399.65	-30.90
104	211	107	3	272	0.00125	0.999798	48.53	1442.71	1413.19	-29.52
104	212	108	4	272	0.00125	0.999644	48.77	1454.74	1428.50	-26.24
104	213	109	5	272	0.00125	0.999449	49.02	1466.65	1441.63	-25.02
104	214	110	6	272	0.00125	0.999214	49.28	1478.45	1456.54	-21.91
104	215	111	7	272	0.00125	0.998940	49.54	1490.12	1469.28	-20.84
104	216	112	8	272	0.00125	0.998628	49.81	1501.68	1483.79	-17.89
104	217	113	9	272	0.00125	0.998280	50.07	1513.12	1496.16	-16.97
104	218	114	10	272	0.00125	0.997896	50.35	1524.45	1510.28	-14.17
104	219	115	11	272	0.00125	0.997477	50.63	1535.66	1522.28	-13.39
104	220	116	12	272	0.00125	0.997025	50.91	1546.76	1536.02	-10.74
104	221	117	13	272	0.00125	0.996540	51.19	1557.75	1547.66	-10.09
104	222	118	14	272	0.00125	0.996023	51.48	1568.62	1561.03	-7.59
104	223	119	15	272	0.00125	0.995475	51.77	1579.38	1572.32	-7.06

104	224	120	16	272	0.00125	0.994898	52.07	1590.03	1585.34	-4.70
104	225	121	17	272	0.00125	0.994291	52.37	1600.58	1596.28	-4.30
104	226	122	18	272	0.00125	0.993657	52.67	1611.01	1608.94	-2.06
104	227	123	19	272	0.00125	0.992994	52.98	1621.33	1619.55	-1.78
104	228	124	20	272	0.00125	0.992305	53.29	1631.55	1631.87	0.33
104	229	125	21	272	0.00125	0.991591	53.60	1641.66	1642.15	0.49
104	230	126	22	272	0.00125	0.990851	53.92	1651.66	1654.14	2.48
104	231	127	23	272	0.00125	0.990086	54.24	1661.55	1664.10	2.54
104	232	128	24	272	0.00125	0.989298	54.56	1671.35	1675.76	4.42
104	233	129	25	272	0.00125	0.988488	54.88	1681.03	1685.40	4.37
104	234	130	26	272	0.00125	0.987654	55.21	1690.62	1696.75	6.13
104	235	131	27	272	0.00125	0.986799	55.54	1700.10	1706.09	5.99
104	236	132	28	272	0.00125	0.985924	55.87	1709.47	1717.12	7.65
104	237	133	29	272	0.00125	0.985027	56.20	1718.75	1726.16	7.41
104	238	134	30	272	0.00125	0.984111	56.54	1727.92	1736.89	8.96
104	239	135	31	272	0.00125	0.983176	56.88	1737.00	1745.63	8.64
104	240	136	32	272	0.00125	0.982222	57.22	1745.97	1756.06	10.09
104	241	137	33	272	0.00125	0.981250	57.56	1754.84	1764.53	9.68
104	242	138	34	272	0.00125	0.980261	57.91	1763.62	1774.66	11.04
104	243	139	35	272	0.00125	0.979255	58.26	1772.30	1782.85	10.55
104	244	140	36	272	0.00125	0.978232	58.61	1780.88	1792.70	11.82
104	245	141	37	272	0.00125	0.977193	58.96	1789.36	1800.61	11.25
104	246	142	38	272	0.00125	0.976139	59.31	1797.75	1810.18	12.43
104	247	143	39	272	0.00125	0.975069	59.67	1806.04	1817.82	11.78
104	248	144	40	272	0.00125	0.973985	60.03	1814.24	1827.12	12.89
104	249	145	41	272	0.00125	0.972888	60.39	1822.34	1834.50	12.17
104	250	146	42	272	0.00125	0.971776	60.75	1830.34	1843.54	13.19
104	251	147	43	272	0.00125	0.970651	61.11	1838.26	1850.66	12.40
104	252	148	44	272	0.00125	0.969514	61.48	1846.08	1859.43	13.36
104	253	149	45	272	0.00125	0.968364	61.84	1853.81	1866.31	12.50
104	254	150	46	272	0.00125	0.967202	62.21	1861.45	1874.82	13.38
104	255	151	47	272	0.00125	0.966028	62.58	1868.99	1881.45	12.46
104	256	152	48	272	0.00125	0.964844	62.96	1876.45	1889.72	13.27
104	257	153	49	272	0.00125	0.963648	63.33	1883.81	1896.11	12.29
104	258	154	50	272	0.00125	0.962442	63.70	1891.09	1904.13	13.04
104	259	155	51	272	0.00125	0.961226	64.08	1898.27	1910.28	12.00
104	260	156	52	272	0.00125	0.960000	64.46	1905.37	1918.06	12.69
104	261	157	53	272	0.00125	0.958765	64.84	1912.38	1923.98	11.60
104	262	158	54	272	0.00125	0.957520	65.22	1919.30	1931.53	12.22
104	263	159	55	272	0.00125	0.956267	65.60	1926.14	1937.22	11.08
104	264	160	56	272	0.00125	0.955005	65.98	1932.89	1944.54	11.65
104	265	161	57	272	0.00125	0.953734	66.37	1939.55	1950.01	10.46

104	266	162	58	272	0.00125	0.952456	66.76	1946.13	1957.10	10.97
104	267	163	59	272	0.00125	0.951171	67.14	1952.63	1962.36	9.73
104	268	164	60	272	0.00125	0.949877	67.53	1959.04	1969.22	10.19
104	269	165	61	272	0.00125	0.948577	67.92	1965.36	1974.27	8.91
104	270	166	62	272	0.00125	0.947270	68.31	1971.61	1980.92	9.31
104	271	167	63	272	0.00125	0.945957	68.71	1977.77	1985.76	7.99
104	272	168	64	272	0.00125	0.944637	69.10	1983.85	1992.19	8.35
104	273	169	65	272	0.00125	0.943311	69.50	1989.84	1996.83	6.99
104	274	170	66	272	0.00125	0.941979	69.89	1995.76	2003.06	7.30
104	275	171	67	272	0.00125	0.940641	70.29	2001.59	2007.49	5.90
104	276	172	68	272	0.00125	0.939298	70.69	2007.35	2013.51	6.17
104	277	173	69	272	0.00125	0.937950	71.09	2013.02	2017.75	4.73
104	278	174	70	272	0.00125	0.936597	71.49	2018.62	2023.57	4.96
104	279	175	71	272	0.00125	0.935240	71.89	2024.13	2027.62	3.48
104	280	176	72	272	0.00125	0.933878	72.29	2029.57	2033.24	3.67
104	281	177	73	272	0.00125	0.932511	72.69	2034.93	2037.10	2.16
104	282	178	74	272	0.00125	0.931140	73.10	2040.22	2042.53	2.31
104	283	179	75	272	0.00125	0.929766	73.50	2045.42	2046.20	0.78
104	284	180	76	272	0.00125	0.928387	73.91	2050.55	2051.44	0.89
104	285	181	77	272	0.00125	0.927005	74.32	2055.61	2054.93	-0.68
104	286	182	78	272	0.00125	0.925620	74.73	2060.59	2059.99	-0.60
104	287	183	79	272	0.00125	0.924231	75.14	2065.49	2063.30	-2.19
104	288	184	80	272	0.00125	0.922840	75.55	2070.32	2068.17	-2.15
104	289	185	81	272	0.00125	0.921445	75.96	2075.08	2071.31	-3.77
104	290	186	82	272	0.00125	0.920048	76.37	2079.76	2076.00	-3.76
104	291	187	83	272	0.00125	0.918648	76.78	2084.37	2078.97	-5.41
104	292	188	84	272	0.00125	0.917245	77.19	2088.91	2083.49	-5.42
104	293	189	85	272	0.00125	0.915841	77.61	2093.37	2086.28	-7.09
104	294	190	86	272	0.00125	0.914434	78.02	2097.77	2090.63	-7.14
104	295	191	87	272	0.00125	0.913025	78.44	2102.09	2093.26	-8.83
104	296	192	88	272	0.00125	0.911614	78.86	2106.34	2097.43	-8.91
104	297	193	89	272	0.00125	0.910202	79.27	2110.52	2099.90	-10.62
104	298	194	90	272	0.00125	0.908788	79.69	2114.63	2103.91	-10.72
104	299	195	91	272	0.00125	0.907372	80.11	2118.67	2106.21	-12.46
104	300	196	92	272	0.00125	0.905956	80.53	2122.64	2110.06	-12.58
104	301	197	93	272	0.00125	0.904537	80.95	2126.55	2112.21	-14.34
104	302	198	94	272	0.00125	0.903118	81.37	2130.38	2115.90	-14.49
104	303	199	95	272	0.00125	0.901698	81.80	2134.15	2117.89	-16.26
104	304	200	96	272	0.00125	0.900277	82.22	2137.85	2121.42	-16.43
104	305	201	97	272	0.00125	0.898855	82.64	2141.48	2123.26	-18.22
104	306	202	98	272	0.00125	0.897433	83.07	2145.05	2126.63	-18.41
104	307	203	99	272	0.00125	0.896010	83.49	2148.55	2128.33	-20.21

104	308	204	100	272	0.00125	0.894586	83.92	2151.98	2131.55	-20.43
104	309	205	101	272	0.00125	0.893162	84.34	2155.35	2133.10	-22.25
104	310	206	102	272	0.00125	0.891738	84.77	2158.65	2136.17	-22.48
104	311	207	103	272	0.00125	0.890313	85.20	2161.89	2137.57	-24.32
104	312	208	104	272	0.00125	0.888889	85.63	2165.07	2140.50	-24.57
104	313	209	105	272	0.00125	0.887464	86.05	2168.18	2141.76	-26.41
104	314	210	106	272	0.00125	0.886040	86.48	2171.22	2144.54	-26.69
104	315	211	107	272	0.00125	0.884616	86.91	2174.21	2145.66	-28.54
104	316	212	108	272	0.00125	0.883192	87.35	2177.13	2148.30	-28.83
104	317	213	109	272	0.00125	0.881768	87.78	2179.99	2149.29	-30.70
104	318	214	110	272	0.00125	0.880345	88.21	2182.79	2151.78	-31.01
104	319	215	111	272	0.00125	0.878922	88.64	2185.53	2152.64	-32.89
104	320	216	112	272	0.00125	0.877500	89.07	2188.20	2154.99	-33.21
104	321	217	113	272	0.00125	0.876078	89.51	2190.82	2155.72	-35.10
104	322	218	114	272	0.00125	0.874658	89.94	2193.37	2157.94	-35.43
104	323	219	115	272	0.00125	0.873238	90.38	2195.86	2158.53	-37.33
104	324	220	116	272	0.00125	0.871818	90.81	2198.30	2160.62	-37.68
104	325	221	117	272	0.00125	0.870400	91.25	2200.67	2161.09	-39.59
104	326	222	118	272	0.00125	0.868983	91.68	2202.99	2163.04	-39.95
104	327	223	119	272	0.00125	0.867566	92.12	2205.25	2163.39	-41.86
104	328	224	120	272	0.00125	0.866151	92.56	2207.45	2165.21	-42.24
104	329	225	121	272	0.00125	0.864737	93.00	2209.59	2165.43	-44.16
104	330	226	122	272	0.00125	0.863324	93.43	2211.68	2167.13	-44.54
104	331	227	123	272	0.00125	0.861913	93.87	2213.70	2167.23	-46.47
104	332	228	124	272	0.00125	0.860502	94.31	2215.67	2168.80	-46.87
104	333	229	125	272	0.00125	0.859093	94.75	2217.59	2168.78	-48.81
104	334	230	126	272	0.00125	0.857686	95.19	2219.45	2170.23	-49.21
104	335	231	127	272	0.00125	0.856280	95.63	2221.25	2170.09	-51.16
104	336	232	128	272	0.00125	0.854875	96.08	2223.00	2171.42	-51.57
104	337	233	129	272	0.00125	0.853472	96.52	2224.69	2171.17	-53.52
104	338	234	130	272	0.00125	0.852071	96.96	2226.33	2172.38	-53.95
104	339	235	131	272	0.00125	0.850671	97.40	2227.91	2172.01	-55.90
104	340	236	132	272	0.00125	0.849273	97.85	2229.44	2173.11	-56.33
104	341	237	133	272	0.00125	0.847877	98.29	2230.91	2172.63	-58.29
104	342	238	134	272	0.00125	0.846483	98.73	2232.34	2173.60	-58.73
104	343	239	135	272	0.00125	0.845090	99.18	2233.70	2173.01	-60.69
104	344	240	136	272	0.00125	0.843699	99.62	2235.02	2173.88	-61.14
104	345	241	137	272	0.00125	0.842310	100.07	2236.28	2173.18	-63.11
104	346	242	138	272	0.00125	0.840924	100.52	2237.50	2173.93	-63.56
104	347	243	139	272	0.00125	0.839539	100.96	2238.66	2173.13	-65.53
104	348	244	140	272	0.00125	0.838156	101.41	2239.76	2173.77	-65.99
104	349	245	141	272	0.00125	0.836775	101.86	2240.82	2172.86	-67.96

104	350	246	142	272	0.00125	0.835396	102.30	2241.83	2173.39	-68.43
104	351	247	143	272	0.00125	0.834019	102.75	2242.78	2172.38	-70.41
104	352	248	144	272	0.00125	0.832645	103.20	2243.69	2172.80	-70.88
104	353	249	145	272	0.00125	0.831272	103.65	2244.54	2171.69	-72.86
104	354	250	146	272	0.00125	0.829902	104.10	2245.35	2172.01	-73.34
104	355	251	147	272	0.00125	0.828534	104.55	2246.10	2170.79	-75.31
104	356	252	148	272	0.00125	0.827168	105.00	2246.81	2171.01	-75.80
104	357	253	149	272	0.00125	0.825805	105.45	2247.47	2169.69	-77.78
104	358	254	150	272	0.00125	0.824444	105.90	2248.08	2169.81	-78.27
104	359	255	151	272	0.00125	0.823085	106.35	2248.64	2168.40	-80.25
104	360	256	152	272	0.00125	0.821728	106.80	2249.15	2168.41	-80.74
104	361	257	153	272	0.00125	0.820374	107.26	2249.62	2166.90	-82.72
104	362	258	154	272	0.00125	0.819023	107.71	2250.04	2166.82	-83.22
104	363	259	155	272	0.00125	0.817673	108.16	2250.41	2165.21	-85.20
104	364	260	156	272	0.00125	0.816327	108.61	2250.74	2165.03	-85.70
Proton number	Mass number	Neutron number	Excess neutron number	Est.stable mass number As	Y value	Beta value	Est.no of free nucleons	Estimated BE (MeV)	Reference BE (MeV)	Difference of BE (MeV)
118	232	114	-4	314	0.00125	0.999703	60.43	1454.56	1391.70	-62.86
118	233	115	-3	314	0.00125	0.999834	60.67	1467.39	1406.75	-60.64
118	234	116	-2	314	0.00125	0.999927	60.91	1480.10	1423.53	-56.57
118	235	117	-1	314	0.00125	0.999982	61.16	1492.69	1438.19	-54.51
118	236	118	0	314	0.00125	1.000000	61.42	1505.17	1454.57	-50.60
118	237	119	1	314	0.00125	0.999982	61.68	1517.54	1468.85	-48.68
118	238	120	2	314	0.00125	0.999929	61.94	1529.79	1484.86	-44.93
118	239	121	3	314	0.00125	0.999842	62.22	1541.93	1498.77	-43.16
118	240	122	4	314	0.00125	0.999722	62.49	1553.96	1514.40	-39.56
118	241	123	5	314	0.00125	0.999570	62.78	1565.88	1527.95	-37.93
118	242	124	6	314	0.00125	0.999385	63.06	1577.69	1543.21	-34.48
118	243	125	7	314	0.00125	0.999170	63.35	1589.39	1556.41	-32.98
118	244	126	8	314	0.00125	0.998925	63.65	1600.99	1571.31	-29.67
118	245	127	9	314	0.00125	0.998651	63.95	1612.47	1584.17	-28.30
118	246	128	10	314	0.00125	0.998348	64.25	1623.86	1598.72	-25.13
118	247	129	11	314	0.00125	0.998017	64.56	1635.13	1611.24	-23.89
118	248	130	12	314	0.00125	0.997659	64.88	1646.30	1625.45	-20.85
118	249	131	13	314	0.00125	0.997274	65.19	1657.37	1637.63	-19.73
118	250	132	14	314	0.00125	0.996864	65.52	1668.33	1651.51	-16.82
118	251	133	15	314	0.00125	0.996429	65.84	1679.19	1663.37	-15.82
118	252	134	16	314	0.00125	0.995969	66.17	1689.95	1676.91	-13.04
118	253	135	17	314	0.00125	0.995485	66.50	1700.61	1688.46	-12.14
118	254	136	18	314	0.00125	0.994978	66.84	1711.17	1701.69	-9.48

118	255	137	19	314	0.00125	0.994448	67.18	1721.62	1712.93	-8.70
118	256	138	20	314	0.00125	0.993896	67.52	1731.98	1725.83	-6.15
118	257	139	21	314	0.00125	0.993323	67.87	1742.24	1736.77	-5.47
118	258	140	22	314	0.00125	0.992729	68.21	1752.40	1749.37	-3.03
118	259	141	23	314	0.00125	0.992114	68.57	1762.47	1760.01	-2.46
118	260	142	24	314	0.00125	0.991479	68.92	1772.43	1772.30	-0.13
118	261	143	25	314	0.00125	0.990825	69.28	1782.30	1782.65	0.35
118	262	144	26	314	0.00125	0.990152	69.64	1792.08	1794.65	2.57
118	263	145	27	314	0.00125	0.989461	70.01	1801.76	1804.72	2.96
118	264	146	28	314	0.00125	0.988751	70.37	1811.34	1816.43	5.08
118	265	147	29	314	0.00125	0.988024	70.74	1820.83	1826.21	5.38
118	266	148	30	314	0.00125	0.987280	71.11	1830.23	1837.64	7.41
118	267	149	31	314	0.00125	0.986520	71.49	1839.54	1847.15	7.62
118	268	150	32	314	0.00125	0.985743	71.87	1848.75	1858.30	9.55
118	269	151	33	314	0.00125	0.984950	72.25	1857.87	1867.55	9.68
118	270	152	34	314	0.00125	0.984143	72.63	1866.90	1878.42	11.52
118	271	153	35	314	0.00125	0.983320	73.01	1875.84	1887.41	11.56
118	272	154	36	314	0.00125	0.982483	73.40	1884.69	1898.01	13.32
118	273	155	37	314	0.00125	0.981631	73.79	1893.45	1906.74	13.29
118	274	156	38	314	0.00125	0.980766	74.18	1902.12	1917.08	14.96
118	275	157	39	314	0.00125	0.979888	74.57	1910.70	1925.56	14.86
118	276	158	40	314	0.00125	0.978996	74.97	1919.19	1935.65	16.45
118	277	159	41	314	0.00125	0.978092	75.37	1927.60	1943.87	16.27
118	278	160	42	314	0.00125	0.977175	75.77	1935.92	1953.71	17.79
118	279	161	43	314	0.00125	0.976246	76.17	1944.15	1961.69	17.54
118	280	162	44	314	0.00125	0.975306	76.57	1952.30	1971.28	18.99
118	281	163	45	314	0.00125	0.974354	76.98	1960.36	1979.03	18.67
118	282	164	46	314	0.00125	0.973392	77.38	1968.33	1988.38	20.04
118	283	165	47	314	0.00125	0.972418	77.79	1976.22	1995.89	19.67
118	284	166	48	314	0.00125	0.971434	78.20	1984.03	2005.00	20.97
118	285	167	49	314	0.00125	0.970440	78.62	1991.75	2012.28	20.53
118	286	168	50	314	0.00125	0.969436	79.03	1999.39	2021.16	21.77
118	287	169	51	314	0.00125	0.968423	79.45	2006.94	2028.22	21.27
118	288	170	52	314	0.00125	0.967400	79.87	2014.42	2036.86	22.45
118	289	171	53	314	0.00125	0.966368	80.29	2021.81	2043.70	21.89
118	290	172	54	314	0.00125	0.965327	80.71	2029.12	2052.12	23.00
118	291	173	55	314	0.00125	0.964278	81.13	2036.35	2058.75	22.40
118	292	174	56	314	0.00125	0.963220	81.55	2043.50	2066.95	23.45
118	293	175	57	314	0.00125	0.962154	81.98	2050.56	2073.36	22.79
118	294	176	58	314	0.00125	0.961081	82.41	2057.55	2081.34	23.79
118	295	177	59	314	0.00125	0.960000	82.84	2064.46	2087.54	23.08
118	296	178	60	314	0.00125	0.958912	83.27	2071.29	2095.31	24.02

118	297	179	61	314	0.00125	0.957816	83.70	2078.04	2101.31	23.27
118	298	180	62	314	0.00125	0.956714	84.13	2084.72	2108.87	24.15
118	299	181	63	314	0.00125	0.955605	84.57	2091.31	2114.67	23.35
118	300	182	64	314	0.00125	0.954489	85.00	2097.83	2122.02	24.19
118	301	183	65	314	0.00125	0.953367	85.44	2104.28	2127.62	23.35
118	302	184	66	314	0.00125	0.952239	85.88	2110.64	2134.78	24.13
118	303	185	67	314	0.00125	0.951105	86.32	2116.93	2140.18	23.25
118	304	186	68	314	0.00125	0.949965	86.76	2123.15	2147.14	23.99
118	305	187	69	314	0.00125	0.948820	87.20	2129.29	2152.35	23.07
118	306	188	70	314	0.00125	0.947670	87.65	2135.36	2159.12	23.76
118	307	189	71	314	0.00125	0.946514	88.09	2141.35	2164.14	22.80
118	308	190	72	314	0.00125	0.945353	88.54	2147.26	2170.71	23.45
118	309	191	73	314	0.00125	0.944188	88.99	2153.11	2175.56	22.45
118	310	192	74	314	0.00125	0.943018	89.43	2158.88	2181.94	23.06
118	311	193	75	314	0.00125	0.941843	89.88	2164.58	2186.61	22.03
118	312	194	76	314	0.00125	0.940664	90.33	2170.21	2192.80	22.60
118	313	195	77	314	0.00125	0.939481	90.79	2175.76	2197.29	21.53
118	314	196	78	314	0.00125	0.938294	91.24	2181.24	2203.30	22.06
118	315	197	79	314	0.00125	0.937103	91.69	2186.66	2207.62	20.96
118	316	198	80	314	0.00125	0.935908	92.15	2192.00	2213.45	21.46
118	317	199	81	314	0.00125	0.934709	92.60	2197.27	2217.59	20.32
118	318	200	82	314	0.00125	0.933507	93.06	2202.47	2223.26	20.78
118	319	201	83	314	0.00125	0.932302	93.52	2207.61	2227.23	19.62
118	320	202	84	314	0.00125	0.931094	93.98	2212.67	2232.72	20.05
118	321	203	85	314	0.00125	0.929882	94.44	2217.66	2236.52	18.86
118	322	204	86	314	0.00125	0.928668	94.90	2222.59	2241.84	19.25
118	323	205	87	314	0.00125	0.927451	95.36	2227.45	2245.49	18.04
118	324	206	88	314	0.00125	0.926231	95.82	2232.24	2250.64	18.40
118	325	207	89	314	0.00125	0.925008	96.29	2236.96	2254.12	17.16
118	326	208	90	314	0.00125	0.923783	96.75	2241.62	2259.11	17.49
118	327	209	91	314	0.00125	0.922556	97.22	2246.21	2262.44	16.22
118	328	210	92	314	0.00125	0.921327	97.68	2250.74	2267.26	16.53
118	329	211	93	314	0.00125	0.920095	98.15	2255.19	2270.43	15.24
118	330	212	94	314	0.00125	0.918861	98.62	2259.59	2275.10	15.51
118	331	213	95	314	0.00125	0.917626	99.09	2263.92	2278.12	14.20
118	332	214	96	314	0.00125	0.916388	99.56	2268.18	2282.63	14.45
118	333	215	97	314	0.00125	0.915149	100.03	2272.38	2285.50	13.12
118	334	216	98	314	0.00125	0.913909	100.50	2276.52	2289.86	13.34
118	335	217	99	314	0.00125	0.912667	100.97	2280.59	2292.58	11.99
118	336	218	100	314	0.00125	0.911423	101.45	2284.60	2296.78	12.19
118	337	219	101	314	0.00125	0.910178	101.92	2288.54	2299.36	10.82
118	338	220	102	314	0.00125	0.908932	102.39	2292.43	2303.42	10.99

118	339	221	103	314	0.00125	0.907684	102.87	2296.25	2305.85	9.60
118	340	222	104	314	0.00125	0.906436	103.35	2300.01	2309.76	9.75
118	341	223	105	314	0.00125	0.905187	103.82	2303.70	2312.05	8.34
118	342	224	106	314	0.00125	0.903936	104.30	2307.34	2315.82	8.48
118	343	225	107	314	0.00125	0.902685	104.78	2310.92	2317.97	7.05
118	344	226	108	314	0.00125	0.901433	105.26	2314.43	2321.59	7.16
118	345	227	109	314	0.00125	0.900181	105.74	2317.89	2323.61	5.72
118	346	228	110	314	0.00125	0.898927	106.22	2321.28	2327.09	5.81
118	347	229	111	314	0.00125	0.897674	106.70	2324.62	2328.98	4.36
118	348	230	112	314	0.00125	0.896420	107.18	2327.89	2332.32	4.43
118	349	231	113	314	0.00125	0.895165	107.66	2331.11	2334.07	2.96
118	350	232	114	314	0.00125	0.893910	108.15	2334.27	2337.28	3.01
118	351	233	115	314	0.00125	0.892655	108.63	2337.37	2338.90	1.53
118	352	234	116	314	0.00125	0.891400	109.12	2340.41	2341.98	1.57
118	353	235	117	314	0.00125	0.890144	109.60	2343.40	2343.47	0.07
118	354	236	118	314	0.00125	0.888889	110.09	2346.33	2346.42	0.09
118	355	237	119	314	0.00125	0.887633	110.57	2349.20	2347.78	-1.41
118	356	238	120	314	0.00125	0.886378	111.06	2352.01	2350.60	-1.41
118	357	239	121	314	0.00125	0.885123	111.55	2354.77	2351.84	-2.93
118	358	240	122	314	0.00125	0.883868	112.04	2357.47	2354.53	-2.94
118	359	241	123	314	0.00125	0.882613	112.53	2360.12	2355.65	-4.47
118	360	242	124	314	0.00125	0.881358	113.02	2362.71	2358.21	-4.50
118	361	243	125	314	0.00125	0.880104	113.51	2365.24	2359.21	-6.03
118	362	244	126	314	0.00125	0.878850	114.00	2367.72	2361.65	-6.07
118	363	245	127	314	0.00125	0.877596	114.49	2370.15	2362.53	-7.62
118	364	246	128	314	0.00125	0.876343	114.98	2372.52	2364.85	-7.68
118	365	247	129	314	0.00125	0.875091	115.47	2374.84	2365.61	-9.23
118	366	248	130	314	0.00125	0.873839	115.97	2377.10	2367.81	-9.30
118	367	249	131	314	0.00125	0.872588	116.46	2379.31	2368.45	-10.86
118	368	250	132	314	0.00125	0.871337	116.95	2381.47	2370.53	-10.94
118	369	251	133	314	0.00125	0.870088	117.45	2383.58	2371.06	-12.51
118	370	252	134	314	0.00125	0.868839	117.94	2385.63	2373.03	-12.60
118	371	253	135	314	0.00125	0.867590	118.44	2387.63	2373.45	-14.18
118	372	254	136	314	0.00125	0.866343	118.94	2389.58	2375.29	-14.28
118	373	255	137	314	0.00125	0.865096	119.43	2391.47	2375.60	-15.87
118	374	256	138	314	0.00125	0.863851	119.93	2393.32	2377.34	-15.98
118	375	257	139	314	0.00125	0.862606	120.43	2395.11	2377.54	-17.58
118	376	258	140	314	0.00125	0.861363	120.93	2396.86	2379.16	-17.70
118	377	259	141	314	0.00125	0.860120	121.42	2398.55	2379.25	-19.30
118	378	260	142	314	0.00125	0.858879	121.92	2400.19	2380.76	-19.43
118	379	261	143	314	0.00125	0.857638	122.42	2401.78	2380.75	-21.03
118	380	262	144	314	0.00125	0.856399	122.92	2403.33	2382.15	-21.17

118	381	263	145	314	0.00125	0.855161	123.42	2404.82	2382.04	-22.78
118	382	264	146	314	0.00125	0.853924	123.93	2406.26	2383.33	-22.93
118	383	265	147	314	0.00125	0.852688	124.43	2407.66	2383.11	-24.54
118	384	266	148	314	0.00125	0.851454	124.93	2409.00	2384.30	-24.70
118	385	267	149	314	0.00125	0.850221	125.43	2410.30	2383.98	-26.32
118	386	268	150	314	0.00125	0.848989	125.94	2411.55	2385.07	-26.48
118	387	269	151	314	0.00125	0.847759	126.44	2412.75	2384.65	-28.10
118	388	270	152	314	0.00125	0.846530	126.94	2413.91	2385.63	-28.27
118	389	271	153	314	0.00125	0.845302	127.45	2415.01	2385.11	-29.90
118	390	272	154	314	0.00125	0.844076	127.95	2416.07	2385.99	-30.08
118	391	273	155	314	0.00125	0.842852	128.46	2417.08	2385.38	-31.71
118	392	274	156	314	0.00125	0.841628	128.96	2418.05	2386.16	-31.89
118	393	275	157	314	0.00125	0.840407	129.47	2418.97	2385.45	-33.52
118	394	276	158	314	0.00125	0.839187	129.98	2419.84	2386.13	-33.71
118	395	277	159	314	0.00125	0.837968	130.48	2420.67	2385.32	-35.35
118	396	278	160	314	0.00125	0.836751	130.99	2421.45	2385.91	-35.54
118	397	279	161	314	0.00125	0.835536	131.50	2422.19	2385.01	-37.18
118	398	280	162	314	0.00125	0.834322	132.01	2422.88	2385.49	-37.38
118	399	281	163	314	0.00125	0.833110	132.52	2423.52	2384.50	-39.02
118	400	282	164	314	0.00125	0.831900	133.03	2424.12	2384.90	-39.23
118	401	283	165	314	0.00125	0.830691	133.54	2424.68	2383.81	-40.87
118	402	284	166	314	0.00125	0.829484	134.04	2425.19	2384.11	-41.08
118	403	285	167	314	0.00125	0.828279	134.56	2425.66	2382.94	-42.72
118	404	286	168	314	0.00125	0.827076	135.07	2426.09	2383.15	-42.94
118	405	287	169	314	0.00125	0.825874	135.58	2426.47	2381.89	-44.58
118	406	288	170	314	0.00125	0.824674	136.09	2426.80	2382.01	-44.80
118	407	289	171	314	0.00125	0.823476	136.60	2427.10	2380.66	-46.44
118	408	290	172	314	0.00125	0.822280	137.11	2427.35	2380.68	-46.67
118	409	291	173	314	0.00125	0.821085	137.63	2427.56	2379.25	-48.31
118	410	292	174	314	0.00125	0.819893	138.14	2427.73	2379.19	-48.54
118	411	293	175	314	0.00125	0.818702	138.65	2427.85	2377.67	-50.18
118	412	294	176	314	0.00125	0.817513	139.17	2427.93	2377.52	-50.41
118	413	295	177	314	0.00125	0.816327	139.68	2427.98	2375.92	-52.06
Proton number	Mass number	Neutron number	Excess neutron number	Est.stable mass number As	Υ value	Beta value	Est.no of free nucleons	Estimated BE (MeV)	Reference BE (MeV)	Difference of BE (MeV)
132	260	128	-4	358	0.00125	0.999763	75.62	1526.87	1452.50	-74.37
132	261	129	-3	358	0.00125	0.999868	75.89	1539.65	1467.79	-71.87
132	262	130	-2	358	0.00125	0.999942	76.16	1552.33	1484.75	-67.58
132	263	131	-1	358	0.00125	0.999986	76.44	1564.89	1499.68	-65.21
132	264	132	0	358	0.00125	1.000000	76.73	1577.35	1516.28	-61.07

132	265	133	1	358	0.00125	0.999986	77.02	1589.70	1530.87	-58.83
132	266	134	2	358	0.00125	0.999943	77.32	1601.95	1547.13	-54.82
132	267	135	3	358	0.00125	0.999874	77.62	1614.10	1561.38	-52.71
132	268	136	4	358	0.00125	0.999777	77.93	1626.14	1577.30	-48.84
132	269	137	5	358	0.00125	0.999655	78.24	1638.07	1591.22	-46.85
132	270	138	6	358	0.00125	0.999506	78.56	1649.91	1606.80	-43.11
132	271	139	7	358	0.00125	0.999333	78.88	1661.65	1620.40	-41.24
132	272	140	8	358	0.00125	0.999135	79.21	1673.28	1635.65	-37.63
132	273	141	9	358	0.00125	0.998913	79.54	1684.82	1648.94	-35.88
132	274	142	10	358	0.00125	0.998668	79.88	1696.25	1663.87	-32.39
132	275	143	11	358	0.00125	0.998400	80.22	1707.59	1676.84	-30.75
132	276	144	12	358	0.00125	0.998110	80.56	1718.83	1691.46	-27.38
132	277	145	13	358	0.00125	0.997797	80.91	1729.98	1704.13	-25.85
132	278	146	14	358	0.00125	0.997464	81.26	1741.03	1718.43	-22.60
132	279	147	15	358	0.00125	0.997109	81.62	1751.98	1730.80	-21.18
132	280	148	16	358	0.00125	0.996735	81.98	1762.84	1744.80	-18.03
132	281	149	17	358	0.00125	0.996340	82.35	1773.60	1756.88	-16.72
132	282	150	18	358	0.00125	0.995926	82.71	1784.27	1770.59	-13.68
132	283	151	19	358	0.00125	0.995493	83.09	1794.85	1782.38	-12.47
132	284	152	20	358	0.00125	0.995041	83.46	1805.33	1795.79	-9.54
132	285	153	21	358	0.00125	0.994571	83.84	1815.72	1807.30	-8.42
132	286	154	22	358	0.00125	0.994083	84.22	1826.03	1820.43	-5.60
132	287	155	23	358	0.00125	0.993578	84.61	1836.24	1831.66	-4.58
132	288	156	24	358	0.00125	0.993056	85.00	1846.36	1844.50	-1.85
132	289	157	25	358	0.00125	0.992517	85.39	1856.39	1855.47	-0.92
132	290	158	26	358	0.00125	0.991962	85.78	1866.33	1868.04	1.71
132	291	159	27	358	0.00125	0.991391	86.18	1876.18	1878.73	2.55
132	292	160	28	358	0.00125	0.990805	86.58	1885.95	1891.03	5.08
132	293	161	29	358	0.00125	0.990204	86.99	1895.63	1901.47	5.84
132	294	162	30	358	0.00125	0.989588	87.39	1905.22	1913.50	8.28
132	295	163	31	358	0.00125	0.988957	87.80	1914.72	1923.68	8.96
132	296	164	32	358	0.00125	0.988313	88.21	1924.14	1935.45	11.31
132	297	165	33	358	0.00125	0.987654	88.63	1933.47	1945.38	11.91
132	298	166	34	358	0.00125	0.986983	89.05	1942.72	1956.89	14.18
132	299	167	35	358	0.00125	0.986298	89.47	1951.88	1966.57	14.70
132	300	168	36	358	0.00125	0.985600	89.89	1960.96	1977.84	16.88
132	301	169	37	358	0.00125	0.984890	90.32	1969.95	1987.28	17.32
132	302	170	38	358	0.00125	0.984167	90.74	1978.86	1998.29	19.43
132	303	171	39	358	0.00125	0.983433	91.17	1987.69	2007.49	19.80
132	304	172	40	358	0.00125	0.982687	91.60	1996.44	2018.27	21.83
132	305	173	41	358	0.00125	0.981930	92.04	2005.10	2027.23	22.13
132	306	174	42	358	0.00125	0.981161	92.48	2013.68	2037.77	24.08

132	307	175	43	358	0.00125	0.980382	92.92	2022.18	2046.50	24.32
132	308	176	44	358	0.00125	0.979592	93.36	2030.60	2056.80	26.20
132	309	177	45	358	0.00125	0.978792	93.80	2038.94	2065.31	26.37
132	310	178	46	358	0.00125	0.977981	94.24	2047.21	2075.38	28.18
132	311	179	47	358	0.00125	0.977161	94.69	2055.39	2083.67	28.29
132	312	180	48	358	0.00125	0.976331	95.14	2063.49	2093.51	30.03
132	313	181	49	358	0.00125	0.975492	95.59	2071.51	2101.59	30.07
132	314	182	50	358	0.00125	0.974644	96.05	2079.46	2111.21	31.75
132	315	183	51	358	0.00125	0.973787	96.50	2087.33	2119.06	31.74
132	316	184	52	358	0.00125	0.972921	96.96	2095.12	2128.46	33.35
132	317	185	53	358	0.00125	0.972047	97.42	2102.83	2136.11	33.28
132	318	186	54	358	0.00125	0.971164	97.88	2110.47	2145.30	34.83
132	319	187	55	358	0.00125	0.970273	98.34	2118.03	2152.74	34.71
132	320	188	56	358	0.00125	0.969375	98.80	2125.51	2161.71	36.20
132	321	189	57	358	0.00125	0.968469	99.27	2132.92	2168.95	36.03
132	322	190	58	358	0.00125	0.967555	99.74	2140.26	2177.71	37.46
132	323	191	59	358	0.00125	0.966634	100.21	2147.52	2184.75	37.23
132	324	192	60	358	0.00125	0.965706	100.68	2154.70	2193.31	38.61
132	325	193	61	358	0.00125	0.964772	101.15	2161.81	2200.15	38.34
132	326	194	62	358	0.00125	0.963830	101.62	2168.85	2208.51	39.66
132	327	195	63	358	0.00125	0.962882	102.10	2175.82	2215.16	39.34
132	328	196	64	358	0.00125	0.961927	102.58	2182.71	2223.32	40.61
132	329	197	65	358	0.00125	0.960967	103.05	2189.53	2229.78	40.25
132	330	198	66	358	0.00125	0.960000	103.53	2196.28	2237.75	41.47
132	331	199	67	358	0.00125	0.959027	104.02	2202.96	2244.01	41.06
132	332	200	68	358	0.00125	0.958049	104.50	2209.56	2251.79	42.23
132	333	201	69	358	0.00125	0.957065	104.98	2216.10	2257.87	41.78
132	334	202	70	358	0.00125	0.956076	105.47	2222.56	2265.47	42.91
132	335	203	71	358	0.00125	0.955081	105.96	2228.95	2271.37	42.41
132	336	204	72	358	0.00125	0.954082	106.44	2235.28	2278.77	43.50
132	337	205	73	358	0.00125	0.953077	106.93	2241.53	2284.49	42.96
132	338	206	74	358	0.00125	0.952068	107.42	2247.72	2291.72	44.00
132	339	207	75	358	0.00125	0.951053	107.92	2253.83	2297.26	43.43
132	340	208	76	358	0.00125	0.950035	108.41	2259.88	2304.31	44.43
132	341	209	77	358	0.00125	0.949011	108.91	2265.86	2309.68	43.82
132	342	210	78	358	0.00125	0.947984	109.40	2271.77	2316.55	44.78
132	343	211	79	358	0.00125	0.946952	109.90	2277.62	2321.75	44.14
132	344	212	80	358	0.00125	0.945917	110.40	2283.39	2328.45	45.05
132	345	213	81	358	0.00125	0.944877	110.90	2289.11	2333.48	44.38
132	346	214	82	358	0.00125	0.943834	111.40	2294.75	2340.01	45.26
132	347	215	83	358	0.00125	0.942787	111.90	2300.33	2344.88	44.55
132	348	216	84	358	0.00125	0.941736	112.40	2305.84	2351.23	45.39

132	349	217	85	358	0.00125	0.940682	112.91	2311.29	2355.94	44.66
132	350	218	86	358	0.00125	0.939624	113.41	2316.67	2362.13	45.46
132	351	219	87	358	0.00125	0.938564	113.92	2321.99	2366.68	44.69
132	352	220	88	358	0.00125	0.937500	114.43	2327.24	2372.71	45.47
132	353	221	89	358	0.00125	0.936433	114.93	2332.43	2377.10	44.67
132	354	222	90	358	0.00125	0.935363	115.44	2337.55	2382.96	45.41
132	355	223	91	358	0.00125	0.934291	115.95	2342.61	2387.20	44.59
132	356	224	92	358	0.00125	0.933216	116.47	2347.61	2392.91	45.30
132	357	225	93	358	0.00125	0.932138	116.98	2352.55	2396.99	44.45
132	358	226	94	358	0.00125	0.931057	117.49	2357.42	2402.54	45.12
132	359	227	95	358	0.00125	0.929974	118.01	2362.23	2406.48	44.25
132	360	228	96	358	0.00125	0.928889	118.52	2366.98	2411.87	44.90
132	361	229	97	358	0.00125	0.927801	119.04	2371.66	2415.66	44.00
132	362	230	98	358	0.00125	0.926712	119.56	2376.29	2420.91	44.62
132	363	231	99	358	0.00125	0.925620	120.07	2380.85	2424.55	43.69
132	364	232	100	358	0.00125	0.924526	120.59	2385.36	2429.64	44.28
132	365	233	101	358	0.00125	0.923430	121.11	2389.80	2433.14	43.34
132	366	234	102	358	0.00125	0.922333	121.63	2394.18	2438.09	43.90
132	367	235	103	358	0.00125	0.921233	122.16	2398.51	2441.44	42.94
132	368	236	104	358	0.00125	0.920132	122.68	2402.77	2446.25	43.48
132	369	237	105	358	0.00125	0.919030	123.20	2406.97	2449.46	42.49
132	370	238	106	358	0.00125	0.917925	123.73	2411.12	2454.13	43.01
132	371	239	107	358	0.00125	0.916820	124.25	2415.21	2457.20	42.00
132	372	240	108	358	0.00125	0.915713	124.78	2419.23	2461.72	42.49
132	373	241	109	358	0.00125	0.914604	125.31	2423.20	2464.67	41.46
132	374	242	110	358	0.00125	0.913495	125.83	2427.12	2469.05	41.93
132	375	243	111	358	0.00125	0.912384	126.36	2430.97	2471.86	40.89
132	376	244	112	358	0.00125	0.911272	126.89	2434.77	2476.11	41.34
132	377	245	113	358	0.00125	0.910159	127.42	2438.51	2478.78	40.27
132	378	246	114	358	0.00125	0.909045	127.95	2442.19	2482.89	40.70
132	379	247	115	358	0.00125	0.907930	128.48	2445.82	2485.44	39.62
132	380	248	116	358	0.00125	0.906814	129.02	2449.39	2489.42	40.03
132	381	249	117	358	0.00125	0.905698	129.55	2452.91	2491.84	38.93
132	382	250	118	358	0.00125	0.904580	130.08	2456.37	2495.69	39.32
132	383	251	119	358	0.00125	0.903462	130.62	2459.77	2497.98	38.21
132	384	252	120	358	0.00125	0.902344	131.15	2463.12	2501.70	38.58
132	385	253	121	358	0.00125	0.901224	131.69	2466.42	2503.87	37.45
132	386	254	122	358	0.00125	0.900105	132.23	2469.66	2507.46	37.80
132	387	255	123	358	0.00125	0.898984	132.77	2472.84	2509.51	36.67
132	388	256	124	358	0.00125	0.897864	133.30	2475.98	2512.97	37.00
132	389	257	125	358	0.00125	0.896743	133.84	2479.05	2514.90	35.85
132	390	258	126	358	0.00125	0.895621	134.38	2482.08	2518.24	36.16

132	391	259	127	358	0.00125	0.894500	134.92	2485.05	2520.05	35.00
132	392	260	128	358	0.00125	0.893378	135.46	2487.97	2523.27	35.30
132	393	261	129	358	0.00125	0.892256	136.01	2490.84	2524.96	34.12
132	394	262	130	358	0.00125	0.891133	136.55	2493.65	2528.06	34.41
132	395	263	131	358	0.00125	0.890011	137.09	2496.41	2529.63	33.22
132	396	264	132	358	0.00125	0.888889	137.63	2499.12	2532.61	33.49
132	397	265	133	358	0.00125	0.887767	138.18	2501.78	2534.07	32.29
132	398	266	134	358	0.00125	0.886644	138.72	2504.39	2536.93	32.55
132	399	267	135	358	0.00125	0.885522	139.27	2506.94	2538.28	31.34
132	400	268	136	358	0.00125	0.884400	139.81	2509.45	2541.03	31.58
132	401	269	137	358	0.00125	0.883278	140.36	2511.90	2542.26	30.36
132	402	270	138	358	0.00125	0.882156	140.91	2514.31	2544.90	30.59
132	403	271	139	358	0.00125	0.881035	141.46	2516.66	2546.02	29.36
132	404	272	140	358	0.00125	0.879914	142.00	2518.97	2548.54	29.58
132	405	273	141	358	0.00125	0.878793	142.55	2521.22	2549.56	28.34
132	406	274	142	358	0.00125	0.877672	143.10	2523.42	2551.97	28.55
132	407	275	143	358	0.00125	0.876552	143.65	2525.58	2552.88	27.30
132	408	276	144	358	0.00125	0.875433	144.20	2527.69	2555.18	27.49
132	409	277	145	358	0.00125	0.874313	144.76	2529.74	2555.99	26.24
132	410	278	146	358	0.00125	0.873195	145.31	2531.75	2558.18	26.42
132	411	279	147	358	0.00125	0.872076	145.86	2533.72	2558.88	25.16
132	412	280	148	358	0.00125	0.870959	146.41	2535.63	2560.96	25.33
132	413	281	149	358	0.00125	0.869842	146.97	2537.49	2561.56	24.07
132	414	282	150	358	0.00125	0.868725	147.52	2539.31	2563.54	24.23
132	415	283	151	358	0.00125	0.867609	148.08	2541.08	2564.04	22.95
132	416	284	152	358	0.00125	0.866494	148.63	2542.81	2565.91	23.10
132	417	285	153	358	0.00125	0.865380	149.19	2544.48	2566.31	21.82
132	418	286	154	358	0.00125	0.864266	149.74	2546.11	2568.08	21.97
132	419	287	155	358	0.00125	0.863153	150.30	2547.70	2568.38	20.68
132	420	288	156	358	0.00125	0.862041	150.86	2549.24	2570.05	20.81
132	421	289	157	358	0.00125	0.860929	151.41	2550.73	2570.25	19.52
132	422	290	158	358	0.00125	0.859819	151.97	2552.17	2571.82	19.65
132	423	291	159	358	0.00125	0.858709	152.53	2553.57	2571.93	18.35
132	424	292	160	358	0.00125	0.857601	153.09	2554.93	2573.40	18.47
132	425	293	161	358	0.00125	0.856493	153.65	2556.24	2573.41	17.17
132	426	294	162	358	0.00125	0.855386	154.21	2557.51	2574.78	17.27
132	427	295	163	358	0.00125	0.854280	154.77	2558.73	2574.70	15.97
132	428	296	164	358	0.00125	0.853175	155.33	2559.90	2575.97	16.07
132	429	297	165	358	0.00125	0.852071	155.89	2561.03	2575.80	14.76
132	430	298	166	358	0.00125	0.850968	156.45	2562.12	2576.98	14.86
132	431	299	167	358	0.00125	0.849866	157.02	2563.17	2576.71	13.54
132	432	300	168	358	0.00125	0.848765	157.58	2564.17	2577.80	13.63

132	433	301	169	358	0.00125	0.847666	158.14	2565.13	2577.44	12.31
132	434	302	170	358	0.00125	0.846567	158.71	2566.04	2578.43	12.39
132	435	303	171	358	0.00125	0.845470	159.27	2566.91	2577.99	11.07
132	436	304	172	358	0.00125	0.844373	159.84	2567.74	2578.89	11.15
132	437	305	173	358	0.00125	0.843278	160.40	2568.53	2578.35	9.83
132	438	306	174	358	0.00125	0.842184	160.97	2569.27	2579.17	9.90
132	439	307	175	358	0.00125	0.841092	161.53	2569.97	2578.54	8.57
132	440	308	176	358	0.00125	0.840000	162.10	2570.63	2579.27	8.64
132	441	309	177	358	0.00125	0.838910	162.67	2571.25	2578.56	7.31
132	442	310	178	358	0.00125	0.837821	163.23	2571.82	2579.19	7.37
132	443	311	179	358	0.00125	0.836733	163.80	2572.36	2578.40	6.04
132	444	312	180	358	0.00125	0.835646	164.37	2572.85	2578.94	6.09
132	445	313	181	358	0.00125	0.834561	164.94	2573.31	2578.07	4.76
132	446	314	182	358	0.00125	0.833477	165.51	2573.72	2578.53	4.81
132	447	315	183	358	0.00125	0.832395	166.08	2574.09	2577.57	3.48
132	448	316	184	358	0.00125	0.831314	166.65	2574.42	2577.94	3.52
132	449	317	185	358	0.00125	0.830234	167.22	2574.71	2576.90	2.19
132	450	318	186	358	0.00125	0.829156	167.79	2574.96	2577.19	2.23
132	451	319	187	358	0.00125	0.828079	168.36	2575.17	2576.07	0.89
132	452	320	188	358	0.00125	0.827003	168.93	2575.34	2576.28	0.93
132	453	321	189	358	0.00125	0.825929	169.50	2575.48	2575.07	-0.40
132	454	322	190	358	0.00125	0.824856	170.07	2575.57	2575.20	-0.37
132	455	323	191	358	0.00125	0.823785	170.65	2575.62	2573.91	-1.71
132	456	324	192	358	0.00125	0.822715	171.22	2575.64	2573.96	-1.68
132	457	325	193	358	0.00125	0.821646	171.79	2575.61	2572.60	-3.02
132	458	326	194	358	0.00125	0.820579	172.37	2575.55	2572.56	-2.99
132	459	327	195	358	0.00125	0.819514	172.94	2575.45	2571.12	-4.33
132	460	328	196	358	0.00125	0.818450	173.51	2575.31	2571.01	-4.30
132	461	329	197	358	0.00125	0.817387	174.09	2575.13	2569.49	-5.64
132	462	330	198	358	0.00125	0.816327	174.66	2574.92	2569.30	-5.62

8. Brief Discussion on the Electroweak Term and Its Coefficient with Respect to Beta Decay Mechanism

Above proposed electroweak term can be understood in the following way.

Since $A^2 - ZN \equiv Z^2 + N^2 + ZN$, ignoring the factor $\frac{1}{2}$, close to the line of stability, relation (8) can be expressed as.

$$\begin{aligned}
A_{free} &\cong 0.00125\beta \left[Z^2 + N^2 + ZN + \frac{Z}{A} \left(\frac{Z^2}{N} \right)^2 \right] \\
&\cong \left(\frac{0.00125}{2} \right) \beta \left[2(Z^2 + N^2) + 2ZN + \frac{2Z}{A} \left(\frac{Z^2}{N} \right)^2 \right] \\
&\cong \left(\frac{0.00125}{2} \right) \beta \left[Z^2 + N^2 + A^2 + \frac{2Z}{A} \left(\frac{Z^2}{N} \right)^2 \right] \\
&\cong (0.000625) \beta \left[Z^2 + N^2 + A^2 + \frac{2Z}{A} \left(\frac{Z^2}{N} \right)^2 \right]
\end{aligned} \tag{20}$$

We have noticed that, the coefficient 0.000625 seems to be connected with the assumed electroweak coefficient 0.0016 in the following way.

With reference to Beta decay, one can define a mass ratio as,

$$r_\beta \cong \frac{m_n c^2 - m_p c^2}{m_e c^2} \cong \frac{1.2933 \text{ MeV}}{0.511 \text{ MeV}} \cong 2.531 \tag{21}$$

where (m_n, m_p, m_e) represent neutron, proton and electron rest masses respectively.

Based on this ratio, we noticed that,

$$\frac{0.0016}{r_\beta} \cong \frac{0.0016}{2.531} \cong 0.0006322 \tag{22}$$

Thus, with reference to beta stability line, close to stable mass numbers, free nucleon number can be expressed as,

$$A_{free} \cong (0.0006322) \beta \left[Z^2 + N^2 + A^2 + \frac{2Z}{A} \left(\frac{Z^2}{N} \right)^2 \right] \tag{23}$$

Based on this relation (23), relation (8) can be expressed as,

$$A_{free} \cong \frac{1}{2} + 0.000625\beta \left[Z^2 + N^2 + A^2 + \frac{2Z}{A} \left(\frac{Z^2}{N} \right)^2 \right] \tag{24}$$

By considering this kind of approach, it seems logical to consider the coefficient $\frac{0.0016}{r_\beta} \cong \frac{0.0016}{2.531} \cong 0.0006322$ as a characteristic coefficient associated with the beta decay mechanism. With reference to nuclear volume, surface area and radius, minimum number of free nucleons seem to have some interconnection with electroweak interaction and beta decay and its approximate relation can be expressed as,

$$(A_{free})_{\min} \cong \left[0.0006322 (A + A^{2/3} + A^{1/3})^2 \right] \tag{25}$$

Thus, corresponding maximum binding energy assumed to be associated with A can be approximated with,

$$(BE)_A^{max} \cong A - \left[0.0006322 \left(A + A^{2/3} + A^{1/3} \right)^2 \right] - A^{1/3}$$

where
$$\begin{cases} \frac{(A_s - A)^2}{A_s} \cong 0 \text{ since } A_s \cong A \\ Z \cong (A_s + 1.7)^{\frac{1}{1.2}} - 3 \left(\begin{matrix} \text{since } 2.9463 \approx 3 \text{ and } \sqrt{2.9463} \approx 1.7 \\ \text{and ignoring even-odd corrections} \end{matrix} \right) \end{cases}$$

(26)

With a systematic research and applicable corrections, this kind of relation can be applied for the whole range of atomic nuclides for understanding and testing. See the following Table 3. for the estimated binding energy of A=4 to 405. It may be noted that, except for A=4, our estimation is marginally is good for all mass numbers.

Considering relation (26), in terms of Z, N and A, nuclear binding energy can be approximated with,

$$(BE) \cong \left\{ A - \left[\frac{1}{2} + \Upsilon_Z \sqrt{\beta} \left(A + N^{2/3} + Z^{2/3} \right)^2 \right] - A^{1/3} - \beta \frac{(A_s - A)^2}{A_s} \right\} 10.1 \text{ MeV}$$

where $\Upsilon_Z \cong 0.000625(1 + 0.000625Z)$

(27)

We are working in this direction also.

Table 3. Estimated maximum binding energy of A = 4 to 405.

Mass number A	Estimated maximum Binding energy (MeV)	Estimated maximum Binding energy per nucleon (MeV)	Mass number A	Estimated maximum Binding energy (MeV)	Estimated maximum Binding energy per nucleon (MeV))	Mass number A	Estimated maximum Binding energy (MeV)	Estimated maximum Binding energy per nucleon (MeV)
4	23.95	5.99	138	1157.35	8.39	272	2026.03	7.45
5	32.64	6.53	139	1164.84	8.38	273	2031.50	7.44
6	41.46	6.91	140	1172.32	8.37	274	2036.95	7.43
7	50.37	7.20	141	1179.78	8.37	275	2042.39	7.43
8	59.35	7.42	142	1187.22	8.36	276	2047.81	7.42
9	68.38	7.60	143	1194.65	8.35	277	2053.22	7.41
10	77.44	7.74	144	1202.06	8.35	278	2058.61	7.41
11	86.53	7.87	145	1209.46	8.34	279	2063.98	7.40
12	95.64	7.97	146	1216.85	8.33	280	2069.35	7.39
13	104.77	8.06	147	1224.21	8.33	281	2074.69	7.38
14	113.91	8.14	148	1231.57	8.32	282	2080.02	7.38
15	123.05	8.20	149	1238.90	8.31	283	2085.34	7.37
16	132.20	8.26	150	1246.23	8.31	284	2090.64	7.36
17	141.35	8.31	151	1253.53	8.30	285	2095.93	7.35
18	150.51	8.36	152	1260.83	8.29	286	2101.20	7.35
19	159.66	8.40	153	1268.10	8.29	287	2106.46	7.34
20	168.81	8.44	154	1275.37	8.28	288	2111.70	7.33

21	177.95	8.47	155	1282.61	8.27	289	2116.93	7.33
22	187.09	8.50	156	1289.84	8.27	290	2122.14	7.32
23	196.23	8.53	157	1297.06	8.26	291	2127.34	7.31
24	205.35	8.56	158	1304.26	8.25	292	2132.52	7.30
25	214.47	8.58	159	1311.45	8.25	293	2137.69	7.30
26	223.58	8.60	160	1318.62	8.24	294	2142.84	7.29
27	232.69	8.62	161	1325.77	8.23	295	2147.98	7.28
28	241.78	8.64	162	1332.91	8.23	296	2153.10	7.27
29	250.87	8.65	163	1340.04	8.22	297	2158.21	7.27
30	259.94	8.66	164	1347.15	8.21	298	2163.30	7.26
31	269.00	8.68	165	1354.24	8.21	299	2168.38	7.25
32	278.06	8.69	166	1361.32	8.20	300	2173.44	7.24
33	287.10	8.70	167	1368.39	8.19	301	2178.49	7.24
34	296.13	8.71	168	1375.43	8.19	302	2183.52	7.23
35	305.15	8.72	169	1382.47	8.18	303	2188.54	7.22
36	314.16	8.73	170	1389.49	8.17	304	2193.54	7.22
37	323.15	8.73	171	1396.49	8.17	305	2198.53	7.21
38	332.13	8.74	172	1403.48	8.16	306	2203.51	7.20
39	341.10	8.75	173	1410.45	8.15	307	2208.46	7.19
40	350.06	8.75	174	1417.41	8.15	308	2213.41	7.19
41	359.01	8.76	175	1424.35	8.14	309	2218.34	7.18
42	367.94	8.76	176	1431.28	8.13	310	2223.25	7.17
43	376.86	8.76	177	1438.19	8.13	311	2228.15	7.16
44	385.76	8.77	178	1445.09	8.12	312	2233.03	7.16
45	394.65	8.77	179	1451.97	8.11	313	2237.90	7.15
46	403.53	8.77	180	1458.84	8.10	314	2242.76	7.14
47	412.40	8.77	181	1465.69	8.10	315	2247.60	7.14
48	421.25	8.78	182	1472.53	8.09	316	2252.42	7.13
49	430.08	8.78	183	1479.35	8.08	317	2257.23	7.12
50	438.91	8.78	184	1486.16	8.08	318	2262.03	7.11
51	447.72	8.78	185	1492.95	8.07	319	2266.81	7.11
52	456.51	8.78	186	1499.72	8.06	320	2271.57	7.10
53	465.30	8.78	187	1506.49	8.06	321	2276.32	7.09
54	474.06	8.78	188	1513.23	8.05	322	2281.06	7.08
55	482.82	8.78	189	1519.96	8.04	323	2285.78	7.08
56	491.55	8.78	190	1526.68	8.04	324	2290.48	7.07
57	500.28	8.78	191	1533.38	8.03	325	2295.17	7.06
58	508.99	8.78	192	1540.06	8.02	326	2299.85	7.05
59	517.68	8.77	193	1546.73	8.01	327	2304.51	7.05
60	526.37	8.77	194	1553.39	8.01	328	2309.16	7.04
61	535.03	8.77	195	1560.03	8.00	329	2313.79	7.03
62	543.69	8.77	196	1566.65	7.99	330	2318.40	7.03

63	552.32	8.77	197	1573.26	7.99	331	2323.01	7.02
64	560.95	8.76	198	1579.86	7.98	332	2327.59	7.01
65	569.55	8.76	199	1586.44	7.97	333	2332.16	7.00
66	578.15	8.76	200	1593.00	7.97	334	2336.72	7.00
67	586.73	8.76	201	1599.55	7.96	335	2341.26	6.99
68	595.29	8.75	202	1606.08	7.95	336	2345.79	6.98
69	603.84	8.75	203	1612.60	7.94	337	2350.30	6.97
70	612.38	8.75	204	1619.11	7.94	338	2354.80	6.97
71	620.90	8.75	205	1625.60	7.93	339	2359.28	6.96
72	629.40	8.74	206	1632.07	7.92	340	2363.75	6.95
73	637.89	8.74	207	1638.53	7.92	341	2368.21	6.94
74	646.37	8.73	208	1644.97	7.91	342	2372.64	6.94
75	654.83	8.73	209	1651.40	7.90	343	2377.07	6.93
76	663.27	8.73	210	1657.81	7.89	344	2381.48	6.92
77	671.70	8.72	211	1664.21	7.89	345	2385.87	6.92
78	680.12	8.72	212	1670.59	7.88	346	2390.25	6.91
79	688.52	8.72	213	1676.96	7.87	347	2394.61	6.90
80	696.90	8.71	214	1683.31	7.87	348	2398.96	6.89
81	705.27	8.71	215	1689.65	7.86	349	2403.30	6.89
82	713.63	8.70	216	1695.97	7.85	350	2407.61	6.88
83	721.97	8.70	217	1702.28	7.84	351	2411.92	6.87
84	730.30	8.69	218	1708.57	7.84	352	2416.21	6.86
85	738.61	8.69	219	1714.85	7.83	353	2420.48	6.86
86	746.90	8.68	220	1721.11	7.82	354	2424.74	6.85
87	755.18	8.68	221	1727.36	7.82	355	2428.99	6.84
88	763.45	8.68	222	1733.59	7.81	356	2433.22	6.83
89	771.70	8.67	223	1739.81	7.80	357	2437.44	6.83
90	779.93	8.67	224	1746.01	7.79	358	2441.64	6.82
91	788.15	8.66	225	1752.20	7.79	359	2445.82	6.81
92	796.36	8.66	226	1758.37	7.78	360	2450.00	6.81
93	804.55	8.65	227	1764.53	7.77	361	2454.15	6.80
94	812.72	8.65	228	1770.67	7.77	362	2458.29	6.79
95	820.88	8.64	229	1776.80	7.76	363	2462.42	6.78
96	829.02	8.64	230	1782.91	7.75	364	2466.53	6.78
97	837.15	8.63	231	1789.01	7.74	365	2470.63	6.77
98	845.27	8.63	232	1795.09	7.74	366	2474.71	6.76
99	853.37	8.62	233	1801.15	7.73	367	2478.78	6.75
100	861.45	8.61	234	1807.21	7.72	368	2482.83	6.75
101	869.52	8.61	235	1813.24	7.72	369	2486.87	6.74
102	877.57	8.60	236	1819.26	7.71	370	2490.89	6.73
103	885.61	8.60	237	1825.27	7.70	371	2494.90	6.72
104	893.63	8.59	238	1831.26	7.69	372	2498.90	6.72

105	901.64	8.59	239	1837.24	7.69	373	2502.88	6.71
106	909.63	8.58	240	1843.20	7.68	374	2506.84	6.70
107	917.61	8.58	241	1849.14	7.67	375	2510.79	6.70
108	925.57	8.57	242	1855.08	7.67	376	2514.72	6.69
109	933.52	8.56	243	1860.99	7.66	377	2518.64	6.68
110	941.45	8.56	244	1866.89	7.65	378	2522.55	6.67
111	949.36	8.55	245	1872.78	7.64	379	2526.44	6.67
112	957.27	8.55	246	1878.65	7.64	380	2530.31	6.66
113	965.15	8.54	247	1884.51	7.63	381	2534.17	6.65
114	973.02	8.54	248	1890.35	7.62	382	2538.02	6.64
115	980.88	8.53	249	1896.17	7.62	383	2541.85	6.64
116	988.72	8.52	250	1901.98	7.61	384	2545.67	6.63
117	996.54	8.52	251	1907.78	7.60	385	2549.47	6.62
118	1004.35	8.51	252	1913.56	7.59	386	2553.26	6.61
119	1012.15	8.51	253	1919.33	7.59	387	2557.03	6.61
120	1019.93	8.50	254	1925.08	7.58	388	2560.79	6.60
121	1027.69	8.49	255	1930.81	7.57	389	2564.53	6.59
122	1035.44	8.49	256	1936.54	7.56	390	2568.26	6.59
123	1043.17	8.48	257	1942.24	7.56	391	2571.97	6.58
124	1050.89	8.47	258	1947.93	7.55	392	2575.67	6.57
125	1058.60	8.47	259	1953.61	7.54	393	2579.35	6.56
126	1066.28	8.46	260	1959.27	7.54	394	2583.02	6.56
127	1073.96	8.46	261	1964.92	7.53	395	2586.67	6.55
128	1081.61	8.45	262	1970.55	7.52	396	2590.31	6.54
129	1089.26	8.44	263	1976.16	7.51	397	2593.94	6.53
130	1096.88	8.44	264	1981.76	7.51	398	2597.55	6.53
131	1104.49	8.43	265	1987.35	7.50	399	2601.14	6.52
132	1112.09	8.42	266	1992.92	7.49	400	2604.72	6.51
133	1119.67	8.42	267	1998.48	7.48	401	2608.32	6.50
134	1127.24	8.41	268	2004.02	7.48	402	2611.92	6.50
135	1134.79	8.41	269	2009.55	7.47	403	2615.52	6.49
136	1142.33	8.40	270	2015.06	7.46	404	2619.12	6.48
137	1149.85	8.39	271	2020.55	7.46	405	2622.72	6.48

9. Discussion and Results

- Interesting points to be noted are,
- 1) Nuclear binding energy can be understood with one unique energy coefficient and four simple terms.
 - 2) Selecting multiple energy coefficients and arbitrariness in selecting various energy coefficients can be minimized.
 - 3) Without considering the famous coulombic term, nuclear binding energy can be understood with (95 to 100)%.
 - 4) Estimated light house like stable mass number plays a vital role in understanding the binding energy of isotopes.

- 5) Strong interaction plays a vital role in understanding the increasing nature of nuclear binding energy.
- 6) Electroweak interaction plays a vital role in understanding the decreasing nature of nuclear binding energy.
- 7) Nuclear radius associated with nucleon number plays a direct role in reducing the nuclear binding energy. It is very significant in case of light atomic nuclides.
- 8) Considering isotopes, asymmetry about the mean mass number or light house like stable mass number plays a vital role in reducing the (isotopic) nuclear binding energy of mass numbers below and above the mean mass number.
- 9) For increasing Z and A, some of the nucleons are free and not involved in nuclear binding energy scheme.
- 10) For light atomic stable nuclides, free nucleon number is on lower side and most of the nucleons are within the core and tightly bound to each other.
- 11) Increased number of free nucleons will reduce the binding energy in a significant manner.
- 12) There is a scope for the free nucleons to revolve round the nuclear core.
- 13) For semi stable or unstable atomic nuclides, there is a probability for one or two free nucleons to go-in and come-out of the nuclear core.
- 14) Process of in going and out coming of free nucleons around the nuclear core, may result in increasing or decreasing the total binding energy with an order of (5 to 10) MeV.
- 15) Considering isotopes, as (Z and A) are increasing, close to the estimated light house like stable mass number, excess neutron number seems to approach the corresponding free nucleon number and binding energy per nucleon seems to approach the beginning point or seems to leave the ending point of very narrow range of maximum BE/A of the isotopes.
- 16) We are sincerely working on convincing mainstream scientists in this new direction. In this context, we appeal for their self interest and encouragement in considering our three assumptions applicable for low energy nuclear physics. In particular, existence of electroweak fermion of rest energy 585 GeV seems to be a fundamental concept and its identification seems to bring a big change in modern thinking on Higgs boson physics [4,25,41,42].
- 17) As cold nuclear fusion is assumed be associated with stable metals, our proposed relation (19) can be given some consideration in understanding and estimating the nuclear binding energy of stable metals independent of coulombic repulsions.
- 18) Most important point of concern, close to stable mass numbers, as per relations (19) and (20), coulombic part that is trying to reduce the nuclear binding energy is $0.000625\beta Z^2 \left[1 + \frac{2Z^3}{AN^2} \right] 10.1 \text{ MeV}$. With reference to the assumed volume energy of $A \times 10.1 \text{ MeV}$, ratio of coulombic part to volume part can be expressed as $\frac{0.000625\beta Z^2}{A} \left[1 + \frac{2Z^3}{AN^2} \right]$. For the case of Iron having $Z=26, N=30$ and $A=56$, $\frac{0.000625\beta Z^2}{A} \left[1 + \frac{2Z^3}{AN^2} \right] \cong 0.0127 = 1.274\%$. This kind of analysis may help in understanding actual impact of currently believed coulombic repulsion scheme.
- 19) Following the background physics as explained in the above sections, we are confident to say that, Cold nuclear fusion can be considered as an attractive phenomenon between medium size atomic nuclides and hydrogen atom under strong and weak interaction schemes.
- 20) It may be noted that, developed countries like USA, many European countries, Russia and Japan directly and indirectly spending million dollars in exploring the possible occurrence of cold nuclear fusion. If our proposed cold nuclear concept is found to be true on theoretical background, it may not be difficult to design, set up and execute repeatable experiments on hydrated metals in view of the possible occurrence of cold nuclear fusion with liberation of green thermal energy [26-33]. Just it needs to build positive thoughts among mainstream scientists on cold nuclear fusion. We are very confident to say that, our approach will certainly motivate the modern science community in this direction.

10. Conclusion

Considering our improved Strong and Electroweak Mass Formula, proposed electroweak and asymmetry terms seem to be simple and workable and needs a fine tuning based on applicable microscopic corrections. We are working on its possible minor modification for mass numbers less than the stable mass numbers. Our proposal is very much connected with unification of low energy and high energy branches of nuclear physics. With mainstream scientists' involvement, further research can be carried out in a fruitful manner. Proceeding further, cold nuclear fusion concepts can be understood in a theoretical approach positively. It may help in solving the major issues connected with increasing energy demand, increasing scarcity of fossil fuels, increasing environmental pollution and global warming.

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