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Subject: White Paper on FESAC Charge
Date: July 20, 2012 10:01:44 AM CDT
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Robert Rosner:

We've been trying to fuse whole nucleons for decades. Fusion based on whole nucleon synthesis has not succeeded. String theorist plan spending their life trying to understand how whole nucleons combine. U.S. physicists are loosing support for their failing programs.

A much needed healthy new attitude is emerging in our U.S. nuclear community. Our Office of Fusion Energy Sciences is soliciting and considering new fusion concepts. Our American Nuclear Society has meetings devoted to “Alternate Fusion Concepts”. New ideas are being solicited and embraced.

Quark Synthesis String Theory has now shown it's the string-like quarks that do the synthesizing: not whole nucleons. Quark Synthesis String Theory provides the new correct scientific basis for fusion. It will revitalize our Magnetic Fusion Energy programs.

The FESAC's first priority should be to consider Quark Synthesis String Theory. It provides the new correct nuclear science. I apologize for its simplicity. Its concepts and math can be refereed by your local high school physics teacher. It cannot be refereed using erroneous concepts from whole nucleon synthesis.

Success in nuclear fusion starts by assuming its the string-like quarks that do the synthesizing: not whole nucleons. An introduction is attached. For further discussion, please contact <wbwebb@rconnect.com>.

William B. Webb

Quark Synthesis String Theory From Dark Matter to Light Emitting Atoms

William B. Webb

Forefather physicists formulated fusion based on nucleosynthesis. They directed that whole nucleons synthesize. Quark Synthesis String Theory now shows that <u>it's the string-like quarks that do the synthesizing: not whole nucleons</u>. In a dark region, string-like quarks can synthesize with other string-like quarks to make more massive rope-like quarks. Those string-like quarks remaining string-like can structure into neutron threesomes. Synthesized more massive rope-like quarks can structure into more massive neutronium**A** threesomes. Quarks not structuring as threesomes remain dark. All threesomes are bound only by balanced electrostatic and gravitational forces. After their formation, neutrons and neutronium**A**s quickly begin emitting electrons. This paper develops equations that correctly describe nuclear structures and the electron emissions therefrom. Electron emission beta decay is precisely calculated for the 30 least massive neutronium**A** nuclei and their subsequent transmutation thru 203 intermediate nuclei on their way to becoming well known nuclei centering the 30 least massive light emitting atoms. This is a perfect 233 for 233 match between calculations of Quark Synthesis String Theory and factual nuclear data. This perfect match provides affirmation that nuclei have no need for the unknown strong or weak nuclear forces and mediating particles. Nuclear physics succeeds by selecting a string theory that has the quarks doing the synthesizing.

I. Introduction

Figure 1 illustrates Quark Synthesis String Theory's neutron and neutronium**19** nuclei. The neutron, as prescribed by ***Nobel Laureate Murray Gell-Mann***[1] consists of three single strand, fractionally charged, vibrating, string-like quarks. Neutronium**19** has the same threesome dimensional structure as the neutron but has 19 strands in each of its three rope-like quarks. **It** has 19 times more total mass-energy. All quarks, both string-like and rope-like, rotate like a lariat so they take a circular shape. Rotation speeds are relativistic. All nuclei in the universe have two "outer quarks" and one "center quark". The neutron's single strand string-like quarks are denoted in their figure by their mass number **A =1.** The neutronium**19**'s multiple strand rope-like quarks are denoted by their mass number **A =19.** With the charges shown, both the neutron and neutronium**19** are electrically neutral and both are an electrostatically balanced structure.

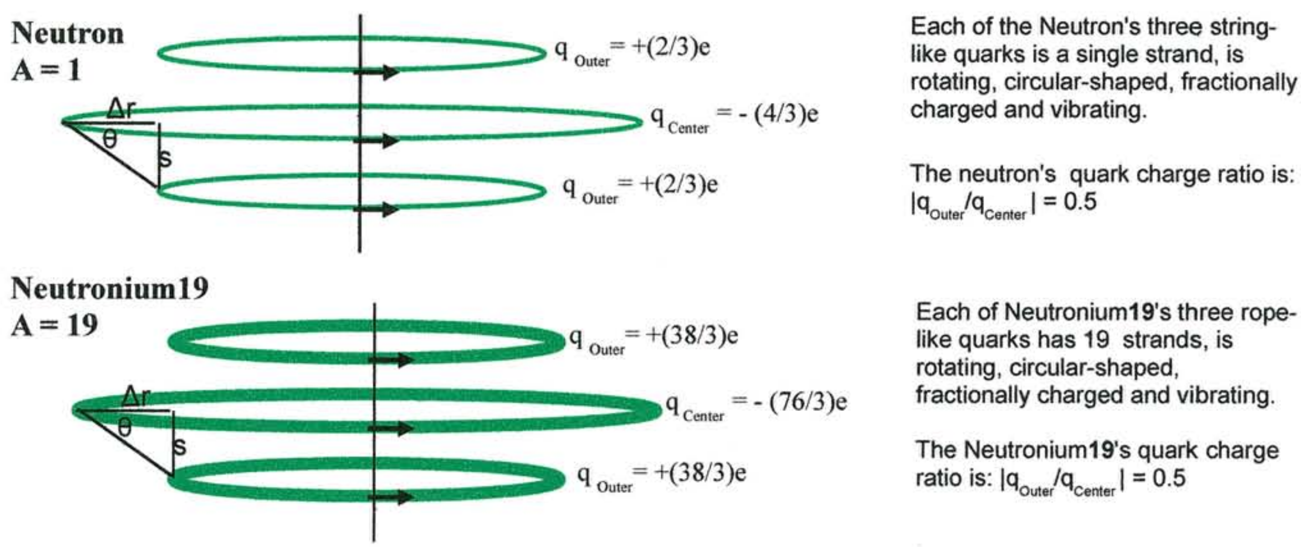

Figure 1 The Neutron and Neutronium**19** Nuclei.

The charge on a general neutronium**A** rope-like quark with mass number **A**, is just **A** times larger than the corresponding charge on the neutron's string-like quark. Charge on the two outer rope-like quarks of a neutronium**A** nucleus will then be:

$$q_{Outer} = +\mathbf{A}(2/3)e \tag{1}$$

The Neutronium**19** in the figure above thus has charge $q_{Outer} = +(38/3)e$ on each of its two outer quarks.

The negatively charged center quark of all nuclei is the supplier of electrons for electron emission beta decay. The charge on the center quark of a neutronium**A** before starting electron emission is $q_{Center} = -\mathbf{A}(4/3)e$. In the Neutronium**19** figure above the center quark thus has initial charge $q_{Center} = -(76/3)e$. After having emitted **Z** electrons, each with charge $-(3/3)e$, the center quark will have the lesser negative charge:

$$q_{Center} = -[(\mathbf{A})(4/3)e - \mathbf{Z}(3/3)e] \quad (2)$$

In equation (2) **Z** is the atomic number.

The neutron and all other neutronium**A**s have the smallest possible initial charge ratio with absolute value $|q_{Outer} / q_{Center}| = 0.5$. In the following paragraphs we'll develop the comprehensive law that all nuclei with a quark charge ratio $|q_{Outer} / q_{Center}| < 0.77$ are electron emitters.

II. Discussion of Electron Emission

A. The neutron's electron emission beta decay is typical of all neutronium**A** and other electron emitting nuclei. Figure 2 shows the neutron in decaying green. Quark vibrations loosen a circular-shaped string-like electron from the rotating negatively charged center quark. Once loosened the electron's emission is electrostatically forced. The radially expanding circular-shaped electron is shown in black. The resulting stable proton is shown in red. The proton recoils radially in place without need for a recoil antineutrino particle. The proton has gained stability with its larger charge ratio $|q_{Outer} / q_{Center}| = 2.00$.

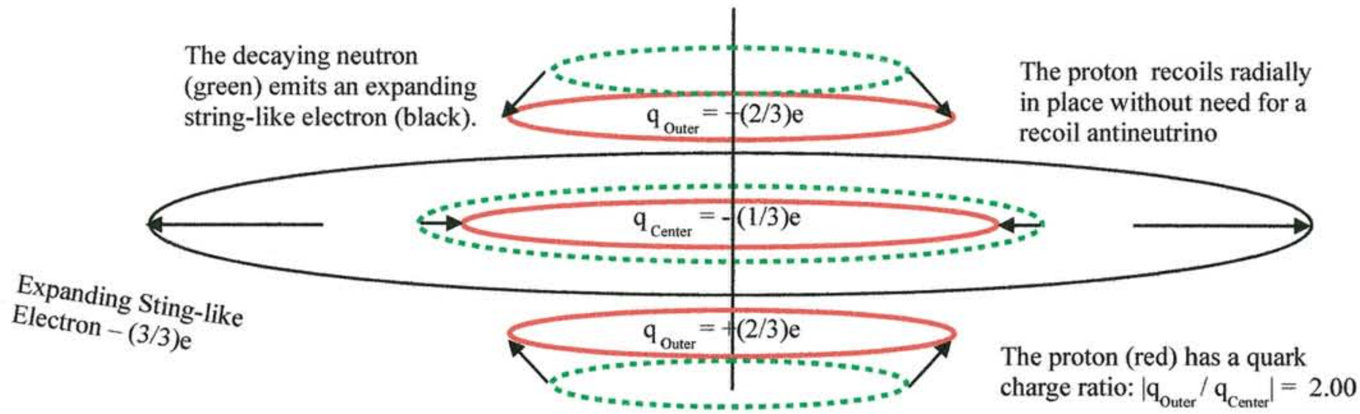

Figure 2 The Neutron's Electron Emission is Typical of Electron Emission from all Nuclei

B. Forces Binding Quarks The quarks of this string theory are closely spaced resulting in huge inter quark electrostatic binding forces. The reference textbook[2] uses electric fields (on page 673) to analyze forces binding a threesome consisting of a negative charged circular-shaped central loop and two positive charged outer points. The axial-directed attractive force between the negative central loop and either positive outer point is given by:

$$F_{Attract} = (1/4\pi\varepsilon_o)(q_{Outer}\, q_{Center} \sin\theta \cos^2\theta) /(\Delta r)^2 \quad (3)$$

The axial-directed repulsive force between the two outer positive point charges is given by:

$$F_{Repel} = (1/4\pi\varepsilon_o)\,(q_{Outer})^2/(2s)^2 = (1/4\pi\varepsilon_o)\,(q_{Outer})^2\,(\cos^2\theta / \sin^2\theta) /(2\Delta r)^2 \quad (4)$$

These textbook equations (3) and (4) involve points charges and a single loop so these force equations are theoretically exact. These same equations are found to suffice with good accuracy to describe attractive and repulsive forces binding Quark Synthesis Sting Theory circular-shaped threesomes.

A quark threesome is at balance when its axial-directed attractive and repulsive forces are equal. Equating equations (3) and (4) provides the requirement for balance. That requirement is called the **charge ratio equation** and is given by:

$$| q_{Outer} / q_{Center} | = 4 \sin^3 \theta \tag{5}$$

Equation (5) imposes limits on the charge ratio. Figure 1 shows that the angle θ can have values more than $0°$ but less than $90°$ so the term $\sin^3 \theta$ will be larger than zero but less than one. The charges on quarks can therefore have any value, large or small, as long as the absolute value of their charge ratio is more than zero but less than four:

$$0 < | q_{Outer} / q_{Center} | < 4 \tag{6}$$

In practice, the smallest possible charge ratio is the value $|q_{Outer} / q_{Center}| = 0.5$ for neutrons and other neutronium**A**s. These are the most fundamental of all nuclei. The stable proton has a larger charge ratio $|q_{Outer} / q_{Center}| = 2.0$. One of the largest charge ratios is $|q_{Outer} / q_{Center}| = 3.5$ for the very stable oxygen**16** nucleus. The obvious implication is that balanced threesomes use electron emission to increase their charge ratio and thereby improve their stability.

C. String Theory's Quark Charge Ratio 0.77 The axial-directed attractive force of equation (3) has value zero at both $0°$ and $90°$ and a maximum at some intermediate angle. Location of that intermediate angle is found by equating the differential $\delta F_{Attract} / \delta\theta$ to zero. The maximum attractive force occurs at the spatial angle: $\theta_{Max\ Att} = \tan^{-1}(1/\sqrt{2}) = 35.26°$. (This angle is confirmed by the reference text[2] in problem 20, page 683). The charge ratio corresponding to the spatial angle of maximum attraction $35.26°$ can be calculated from the charge ratio equation (5) and has value:

$$| q_{Outer} / q_{Center} |_{Max\ Attract} = 0.77 \tag{7}$$

The charge ratio 0.77 is found to be the single determinant that segregates, with perfect accuracy, the 233 smallest mass electron emitting nuclei. Recall the general quark charge equations (1) and (2). The ratio of these charges is:

$$| q_{Outer} / q_{Center} | = 2\mathbf{A} / (4\mathbf{A} - 3\mathbf{Z}) \tag{8}$$

Equation (8) is graphed in figure 3 as a function of different mass numbers **A** and different atomic numbers **Z** for the 30 least massive neutronium**A** nuclei and the 203 intermediate nuclei resulting therefrom because of electron emission. All the 233 nuclei in the graph have a calculable quark charge ratio equal to or more than 0.50 but less than 0.77 and all are only electron emitters. All these 233 nuclei then transmute to nuclei using additional modes of decay with a quark charge ratio larger than 0.77.

III. Additional Modes of Decay

Most nuclei with a charge ratio larger than 0.77 undergo additional calculable charge rearrangements that further increase their charge ratio to values well above 0.77 (but, of course, still less then 4.0). Figure 4 illustrates most of the wide variety of additional modes of decay. All modes have a common reason for their act: every step of every decay mode, without exception, continues to increase the quark charge ratio and thereby further improve stability.

{Modes of decay cause the collection of nuclei to have a deceptive stair step appearance when presented on a nucleosynthesis style *chart of the nuclides*. Since whole nucleons do not synthesize, charts based on counting numbers of whole nucleons making up a nucleus are misleading. Those charts cannot be used to referee correct nuclear science. Figure 4 is the beginning of a more correct chart of nuclides.}

We'll now discuss the additional decay modes for the ten least massive nuclei having mass numbers A = 1 thru 10.

<u>Neutronium1</u>, the neutron, has the single step electron emission shown on the vertical line A = 1. The emission, designated $\mathbf{e}^-$, has no effect on the magnitude of the outer quark charges but decreases the absolute value of the center quark's charge. Electron emission increases the atomic number by one. Equation (8) is used to calculate the increase of the quark charge ratio as follows.

$|q_{Outer}/q_{Center}|_{Initial} = 2/4 = \mathbf{0.5}$ then $\mathbf{e}^-$ giving $|q_{Outer}/q_{Center}|_{Final} = 2/1 = \mathbf{2.0}$ (H^1)

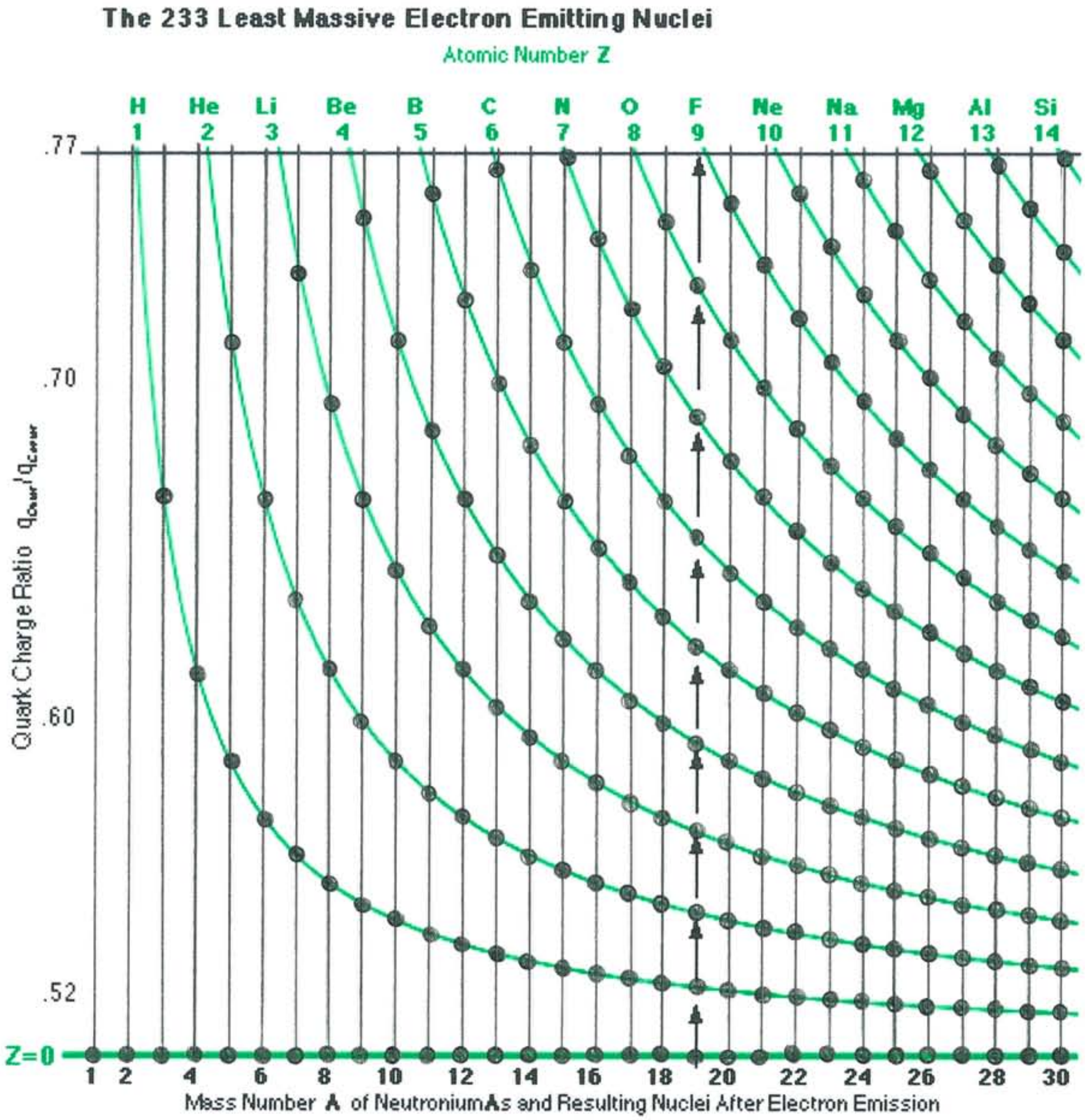

Figure 3. Graphs of the Quark Charge Ratio Equation $| q_{\text{Outer}} / q_{\text{Center}} | = 2\mathbf{A} / (4\mathbf{A} - 3\mathbf{Z})$ for values from 0.5 to 0.77. The horizontal straight graph line $\mathbf{Z} = \mathbf{0}$ at the base of the figure intersects the vertical mass number lines 1 thru 30. These base line intersections are the locus of 30 electron emitting neutronium**A** nuclei having those mass numbers. The graph lines that are concave up each have an integer atomic number **Z** with values 1 thru 14. These curved lines have 203 intersections with the vertical mass number lines. All (30 + 203) 233 intersections are a correct representation of a specific electron emitting nucleus with correct mass numbers, atomic numbers, charge, charge ratio and beta decay instability,. The nine steps of electron emission for neutronium**19** are illustrated. It transmutes to the stable nucleus of the light emitting Fluorine**19** atom.

Additional Stabilizing Decay for Quark Charge Ratios $|q_{Outer} / q_{Center}| > 0.77$

For Mass Numbers A = 1 thru 10

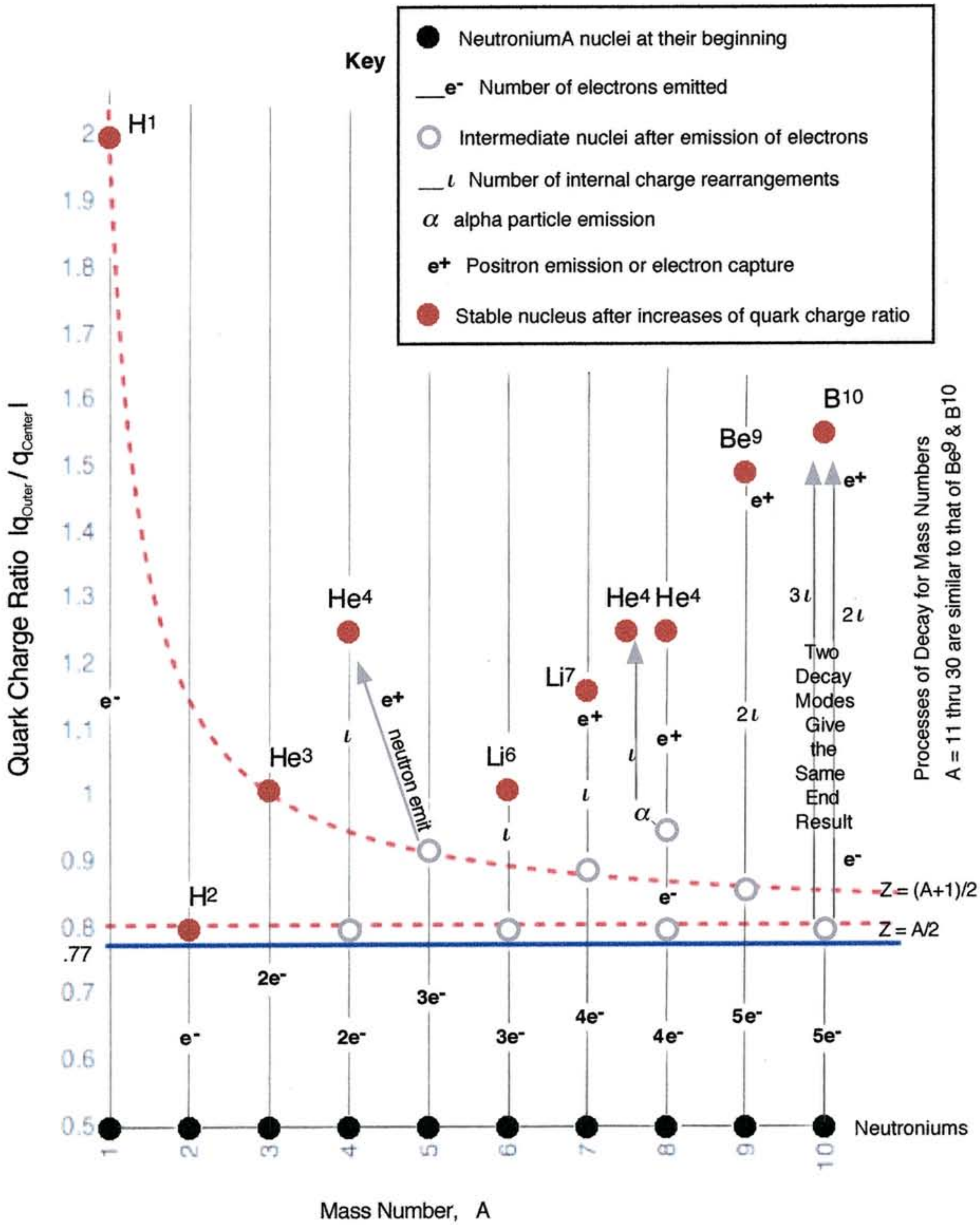

Figure 4

Neutronium2 has the single step of decay shown on the vertical line of mass number A = 2. Like the neutron, its threesome can find stability with its charge ratio above 0.77 by emitting a single electron as follows:

$|q_{Outer}/q_{Center}|_{Initial} = 4/8 = \mathbf{0.5}$ then $\mathbf{e^-}$ giving $|q_{Outer}/q_{Center}|_{Final} = 4/5 = \mathbf{0.8}$ (H^2). Note that H^1 finds stability at a significantly larger charge ratio than does H^2. There are far more protons in nature than deuterons.

Neutronium3 is also an electron emitter. It emits two. Its charge ratio increases to provide stability above 0.77 as follows:

$|q_{Outer}/q_{Center}|_{Initial} = 6/12 = \mathbf{0.5}$ then $\mathbf{e^-}$ giving $6/9 = \mathbf{0.67}$ then $\mathbf{e^-}$ giving $|q_{Outer}/q_{Center}|_{Final} = 6/6 = \mathbf{1.0}$ (He^3)

Most more massive nuclei, after emitting their electrons, will also use "internal charge rearrangement" to increase their quark charge ratio and stability. This rearrangement is designated by the greek letter iota **ι**. It decreases the charges on the quarks without changing the threesome's net positive charge, i.e., its nuclear atomic number. The **ι** process consists of a circular-shaped positron being emitted from each of the two high energy outer quarks. Both positrons are attracted to, and join with, the lower energy negative charged center quark. At the center quark each positron interacts with an electron and that $\mathbf{e^+/e^-}$ pair annihilate. There are thus two pairs annihilated. In equation (8), each **ι** process decreases the numerator by 3 and the absolute value of the denominator by 6.

Neutronium4 is the least massive nucleus capable of employing the **ι** process. Its charge ratio as shown in figure 4 increases as follows:

$|q_{Outer}/q_{Center}|_{Initial} = 8/16 = \mathbf{0.5}$ then $\mathbf{2e^-}$ giving $8/10 = \mathbf{0.80}$ then $\boldsymbol{\iota}$ giving $|q_{Outer}/q_{Center}|_{Final} = 5/4 = \mathbf{1.25}$ (He^4)

Many nuclei, as a final act, allow a positron $\mathbf{e^+}$ to escape (or, equally, they capture an electron). This act increases their quark charge ratio even further and peaks their stability. It also decreases their atomic number. (The decreased atomic number makes these nuclei appear out-of-place when presented on the nucleosynthesis style *chart of the nuclides*.) The positron emission is the same as the **ι** process described above except only one of the two emitted positrons is captured by the lower energy negative charged center quark: the other positron escaping the nucleus. In equation (8), $\mathbf{e^+}$ positron emission decreases the numerator by 3 and the absolute value of the denominator by 3. Only nuclei already having a charge ratio larger than 1.0 can benefit from $\mathbf{e^+}$ emission.

Neutronium5 uses both neutron emission and $\mathbf{e^+}$ emission to decrease its mass number from 5 to 4 while increasing its quark charge ratio and stability. In equation (8), neutron emission decreases the numerator by 2 and the absolute value of the denominator by 4. As shown in figure 4, neutronium5s charge ratio increases as follows:

$|q_{Outer}/q_{Center}|_{Initial} = 10/20 = \mathbf{0.5}$ then $\mathbf{3e^-}$ giving $10/11 = \mathbf{0.91}$ then neutron emission giving $8/7 = \mathbf{1.14}$ then $\mathbf{e^+}$ giving $|q_{Outer}/q_{Center}|_{Final} = 5/4 = \mathbf{1.25}$ (He^4)

Neutronium6 employs three $\mathbf{e^-}$ emissions and a single **ι** to gain its stability as follows:

$|q_{Outer}/q_{Center}|_{Initial} = 12/24 = \mathbf{0.5}$ then $\mathbf{3e^-}$ giving $12/15 = \mathbf{0.80}$ then $\boldsymbol{\iota}$ giving $|q_{Outer}/q_{Center}|_{Final} = 9/9 = \mathbf{1.0}$ (Li^6)

Neutronium7 is one of many nuclei with an odd mass number that employ the $\mathbf{e^+}$ positron emission:

$|q_{Outer}/q_{Center}|_{Initial} = 14/28 = \mathbf{0.5}$ then $\mathbf{4e^-}$ giving $14/16 = \mathbf{0.86}$ then $\boldsymbol{\iota}$ giving $11/10 = \mathbf{1.1}$ then $\mathbf{e^+}$ giving $|q_{Outer}/q_{Center}|_{Final} = 8/7 = \mathbf{1.14}$ (Li^7)

Neutronium8 is unusual: it decays using a combination of steps that produce two identical He^4 nuclei. Each step is again accompanied by an increasing quark charge ratio. First, follow the steps of the parent Neutronium**8** moving directly up the line A = 8 in figure 4.

$|q_{Outer}/q_{Center}|_{Initial} = 16/32 = \mathbf{0.5}$ then $\mathbf{4e^-}$ giving $16/20 = \mathbf{0.80}$ then another $\mathbf{e^-}$ giving $16/17 = \mathbf{0.94}$ then emitting an α with charge ratio 8/10 giving $8/7 = \mathbf{1.14}$ then $\mathbf{e^+}$ giving $|q_{Outer}/q_{Center}|_{Final} = 5/4 = \mathbf{1.25}$ (He^4).

The α emitted from the parent with charge ratio 8/10 then uses **ι** giving $5/4 = \mathbf{1.25}$ (He^4). All these helium producing processes are believed to take place in the roil of a stellar environment.

Neutronium9 is another nucleus with an odd mass number that employs the final $\mathbf{e^+}$ positron emission:

$|q_{Outer}/q_{Center}|_{Initial} = 18/36 = \mathbf{0.5}$ then $\mathbf{5e^-}$ giving $18/21 = \mathbf{0.86}$ then $\mathbf{2\iota}$ giving $12/9 = \mathbf{1.33}$ then $\mathbf{e^+}$ giving $|q_{Outer}/q_{Center}|_{Final} = 9/6 = \mathbf{1.50}$ (Be^9)

Neutronium**10** is the least massive of many nuclei that exhibit two natural modes of decay with both modes of decay producing the identical end point stable nucleus. Follow the two separate modes shown in figure 4 as follows:

$|q_{Outer}/q_{Center}|_{Initial} = 20/40 = \mathbf{0.5}$ then $5e^-$ giving $20/25 = \mathbf{0.80}$ then 3ι giving $|q_{Outer}/q_{Center}|_{Final} = 11/7 = \mathbf{1.57}$ (B^{10})

and

$|q_{Outer}/q_{Center}|_{Initial} = 20/40 = \mathbf{0.5}$ then $5e^-$ giving $20/25 = \mathbf{0.80}$ then another e^- giving $20/22 = \mathbf{0.91}$ then 2ι giving $14/10 = \mathbf{1.40}$ then e^+ giving $|q_{Outer}/q_{Center}|_{Final} = 11/7 = \mathbf{1.57}$ (B^{10}).

Modes of decay for the more massive nuclei with mass number A = 11 thru 30 are calculated in a generally similar manner to that of Be^9 and B^{10}.

IV. Conclusions

Quark Synthesis String Theory allows precise calculation of the electron emission decay for each of the 30 least massive neutronium**A** nuclei. They start as calculable dark matter quark threesomes and transmute thru calculable intermediate nuclei on their way to becoming the nuclei known to be centered in stable light emitting atoms. This is a perfect 233 for 233 match between calculations of Quark Synthesis String Theory and factual nuclear electron emission beta decay data. This perfect match provides affirmation that nuclei have no need for the unknown strong or weak nuclear forces and mediating particles. Nuclear physics succeeds when selecting and using a string theory that has the quarks doing the synthesizing.

References

[1] *Nobel Laureate Murray Gell-Mann* - Wikipedia

[2] HALLIDAY AND RESNICK *Physics Parts I &II*, John Wiley and Sons, New York(1966).