Particle Mass Ratios nearly equaling Geometric Ratios -- Additional examples

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June 2021

Abstract
There are many important Particle Mass ratios in Physics, such as the 'Proton to electron' mass ratio, about 1836.15 to 1. And there are many major Volumetric ratios in 'Solid Geometry', some of which we may have seen in high school. And, remarkably, some of the major particle Mass ratios nearly equal some of those major geometric Volumetric ratios! This article gives many additional examples of these matches, which couldn't be included in my earlier article, but that earlier article should be read first, preferably, at:
Ref. http://viXra.org/abs/1901.0299
(But even both articles don't give all the important examples -- to prevent unwieldy length.)

Introduction
As implied by the above Abstract, the goal of this article is to find out why the different Particles in physics have the different masses they do! And that was the goal of many Nobel Laureates. But that goal eluded them. But this article largely **succeeds**. In many cases, we have importantly discovered that a major particle mass ratio, existing in Nature, nearly equals a basic volume ratio in a symmetrical sphere pattern. In many cases, we have also found that the Average of two different major volumetric ratios nearly equals a major particle mass ratio. Or simply averaging the masses of two different particles together -- nearly equals the mass of a third particle! Quite remarkable, and unlikely to be just 'chance'.

So, 'Nature' sometimes accomplished the same thing, or almost the same, in two different ways. For example, two different atoms in 'Chemistry' can strongly 'bond' together, either with a 'covalent' bond **or** an 'ionic' bond. And in this article, we find two different ways that Nature often uses to create a mass for a major 'particle' to have, relative to the electron. I.e., by creating a particle with mass ratio that will nearly equal a major geometric ratio **or** with such mass as will nearly equal the Average of two such geometric ratios.

And, importantly, the more different patterns that are found which give nearly the same geometric ratio -- the greater the chance of there being a particle in Nature with a mass ratio (relative to the electron) almost matching that geometric ratio. And the more prominent and longer half-life, such particle will generally have. (Note, the more modern term, 'Baryon', may be used in place of my older term, 'Hyperon', in my article.)

Related helpful information can also be found by 'clicking' or otherwise using my (website) links below:
http://www.causeeffect.org/articles/book.html
http://www.causeeffect.org/video/RatioTalk11-11-16.mp4   (for this link, allow 30 sec. to load)

Now, readers should **SCROLL DOWN BELOW**, and view the many drawings, examples, and comments -- thus completing the goals of this Article:
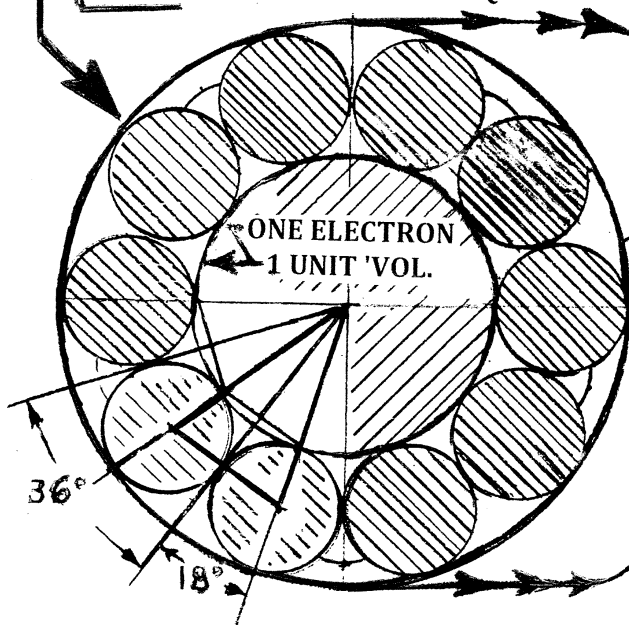
Example 1: The main mass ratio estimate, obtained from the dwgs, below, is 1836.36/1, and that est.is a pinch high. But perhaps it interacts with the main ratio estimate in the earlier paper, using other sketches, 1836.00/1 -- so the combined result is even closer to the actual Proton to electron mass ratio, 1836.15/1.

AN ICOSIDODECAHEDRON-DIRECTED ARRAY OF 30 SMALL SPHERES (SOME HID-
DEN) SURROUNDING AN 'INNER SPHERE' ('DASHED-IN')
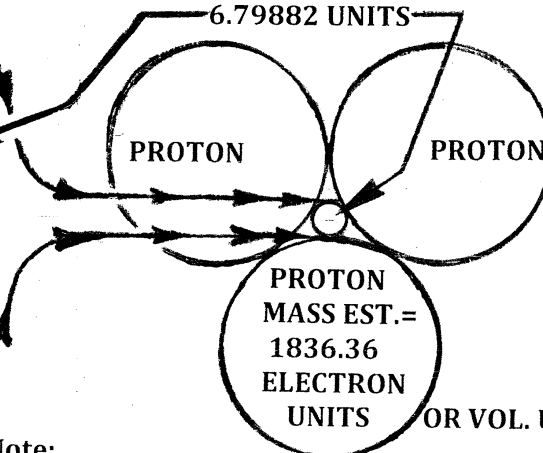AND THOSE 30 SURROUNDED BY LARGER OUTER SPHERE

ICOSIDODECAHEDRON, WITH 30 VERTICES:
1 OF 13 ARCHIMEDEAN 'GLOBAL' SOLIDS,
1 OF 2 QUASI-
REGULAR
POLY-
HEDREN

1 OF 30
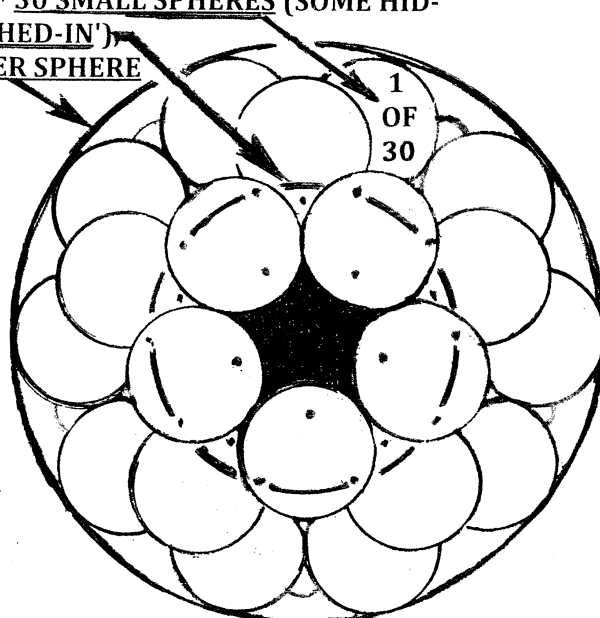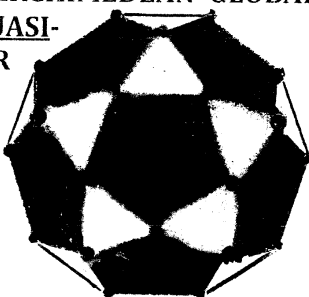
SECTIONAL VIEW OF UPPER RIGHT
SPHERE SLICED THRU ITS 'EQUATOR'

SPHERES: VOL. (MASS) =
6.79882 UNITS

ONE ELECTRON
1 UNIT 'VOL.

PROTON   PROTON

36°

18°

PROTON
MASS EST.=
1836.36
ELECTRON
UNITS   OR VOL. UNITS

Note:
Author thinks above's influence on Proton's
mass result is less than his other 'constructs'.

Another Way to Est. Proton's Mass, close to 1836.15 electrons

The sketches above give an estimate for Proton's mass of 1836.36 electrons, near proton's actual mass, 1836.15. In the super-expanded 'Sectioned View', lower left, 1 core electron sphere (Vol. = 1 Unit) is shown surrounded by 10 small 'sliced' spheres (among 30 small spheres in an 'icosidodecahedron' pattern). These 30 are surrounded by an Outer sphere (*Vol. = 6.79882 units*). At lower right, with that same *6.79882 unit Vol. sphere*, we generate 3 big spheres around it, in a simple triangular pattern. And each resulting sphere volume =1836.36 unit electrons, our Proton Mass Est.

(Interestingly, the main sphere pattern above was also found in an old Japanese shrine.[1])

<u>Example 2</u>, See discourse near bottom of below Dwg.
  Note a small electron sphere =1 unit of mass (or vol.) at centers of upper two sketches.

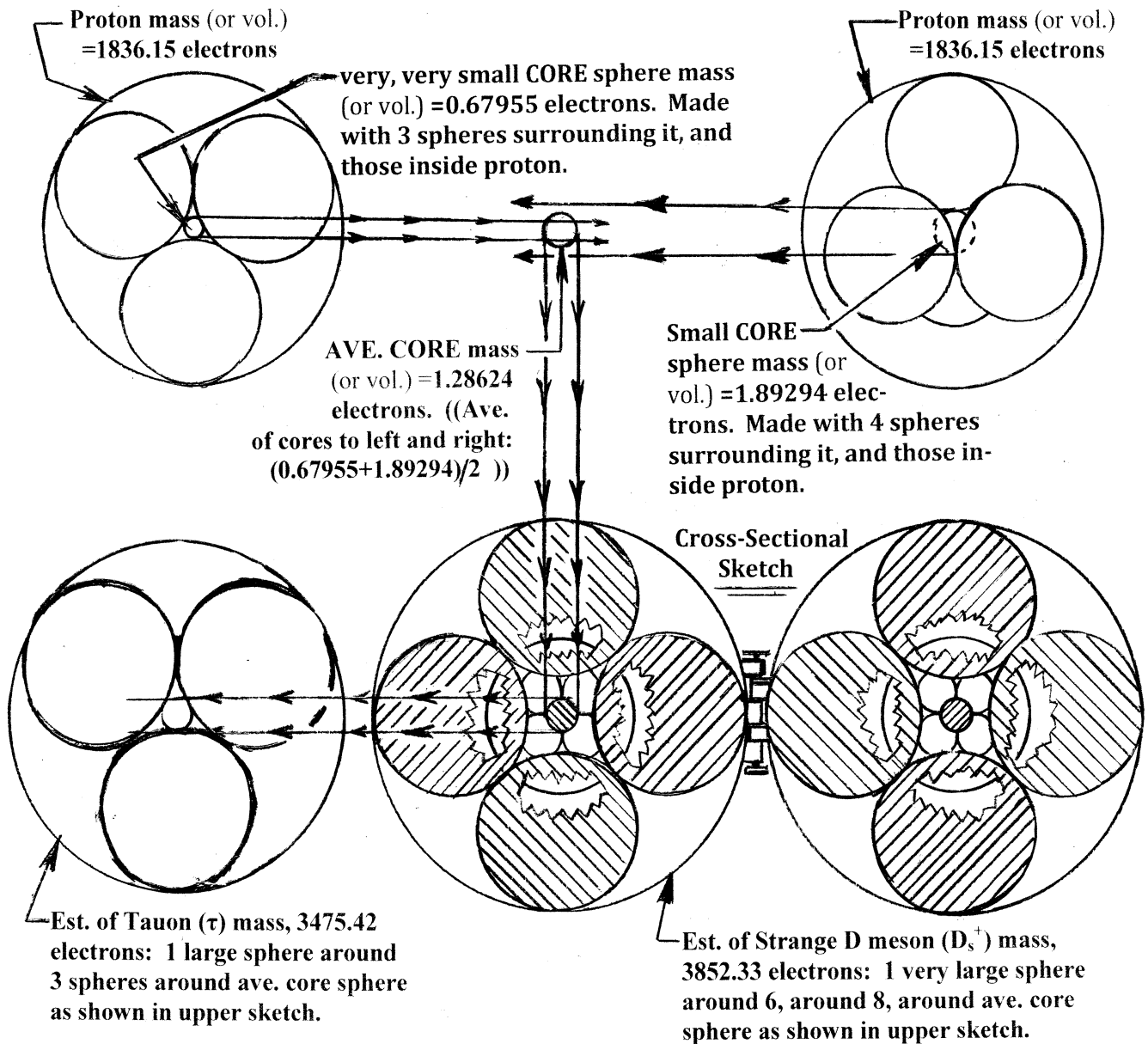**2702/1 RATIO**

PION 270.1/1 Ratio

{basic <u>triangularly</u> struc-
{tured Sphere Pattern

KAON

970/1 ratio

{basic <u>tetrahedrally</u> struc-
{tured Sphere Pattern

$\frac{88.091}{1}$

* 2 of many tangent points

Volumes of all spheres shown
proportional to their masses

Electron Sphere (ref.) 1 unit Vol.

Proton – <u>ave.</u>
of triangular &
tetrahedral Sphere
patterns above it
$\frac{970 + 2702}{2} = 1836$

{ Proton-to-electron mass ratio:
{ Average of ratios: 970/1 & 2702/1;
{ Generated as shown: 1836/1.

**An earlier good Way to Est. mass of Proton, and
also the ave. mass of the Pion & Kaon Particles**

The above Dwg. (also shown in an earlier article) shows one of two ways to construct an
estimate of the Proton's mass, 1836.00 electrons, close to its 1836.15 empirical mass.
Note, Dwg. also shows how to construct a great estimate for the ave. PION particle mass,
270.10 electrons, and the ave. KAON particle mass, 970.00 electrons.
Those particle mass estimates were also needed to construct sphere volumes, which we
averaged together, to estimate the Proton's mass, relative to the electron's.

Example 2A, See discourse near bottom of below Drawing. Note, we start with the 2 proton masses (or their volumes) shown near the top of Dwg., and make estimates for (τ) and (D_s^+).

Proton mass (or vol.) =1836.15 electrons

Proton mass (or vol.) =1836.15 electrons

very, very small CORE sphere mass (or vol.) =0.67955 electrons. Made with 3 spheres surrounding it, and those inside proton.

AVE. CORE mass (or vol.) =1.28624 electrons. ((Ave. of cores to left and right: (0.67955+1.89294)/2))

Small CORE sphere mass (or vol.) =1.89294 electrons. Made with 4 spheres surrounding it, and those inside proton.

Cross-Sectional Sketch

Est. of Tauon (τ) mass, 3475.42 electrons: 1 large sphere around 3 spheres around ave. core sphere as shown in upper sketch.

Est. of Strange D meson (D_s^+) mass, 3852.33 electrons: 1 very large sphere around 6, around 8, around ave. core sphere as shown in upper sketch.

Notes: All sphere patterns used are simple and symmetrical, and several 'platonic-related'.
To emphasize main features, some sketches had to be shown distorted or exaggerated.

Drawing: Ways to Estimate Masses of Tauon (τ) and Strange D Meson (D_s^+)
Our Estimate for the Mass of the Tauon (τ) is 3475.42 electrons (vs. empirical value 3477.19), and for the Strange D Meson (D_s^+), our est. is 3852.33 electrons (vs. empirical value 3852.19).
To make estimates, we started with the Proton and built inwardly small cores (instead of the usual starting with one electron and building outwardly). We used 1st proton around 3 spheres around a core to make 1st core; and we used a 2nd proton around 4 spheres around another core to make 2nd core. We averaged cores together to make an 'Ave. core' vol. And used that average core to make our (τ) est., (1 Sphere around 3 around Ave. core sphere). And the average core to make our (D_s^+) est., (1 Sphere around 6 close-packed around 8 around Ave. core sphere).

Example 3, The below Dwg. (near bottom) shows a third way to construct a great estimate of the mass of the ave. **Pion** particle, **270.10** electrons. (Earlier work showed only 2 ways.) Above that, is shown one (of a few) ways to estimate the mass of an **Omega 'Hyperon'**, each resulting in a **3273.75** electron mass **est.**

Dwg. Est. for Mass of Omega Hyperon (symbol Ω⁻) = 3273.75 electron masses vs. empirical value, 3272.90 electrons. Dwg. shows 1 large sphere surrounding & touching 4 close packed spheres, and those 4 around & touching 1 centered Core sphere of mass, 3.375 electrons. Also see below. That 3.375 electron Core also used in some dwgs. of Pions, along with electrons each of 1 unit mass (or vol.), to give the Pion particle more rigidity than achievable in alternate dwgs. of Pion.

Opt'l. Note: 4 medium size spheres touch largest sphere, but Not at its equator, since 2 of the 4 are mostly to the front of largest sphere's equator, and the other 2 mostly behind its equator.

Opt'l. Note: Alternatively, a set of 3 largest (Omega Hyperon) spheres can be drawn easier on a flat paper sheet by drawing each tangent to 2 of a set of 3 smaller (3.375 electron sized) spheres. Each 3.375 electrons' sphere built from a 'ring' of 6 electrons, also making a substructure in the Pion.

Mass = 1 electron
Mass = 3.375 electrons

Two equal, mutually touching spheres, slightly larger than electrons, have replaced core electron and added rigidity to substructures.
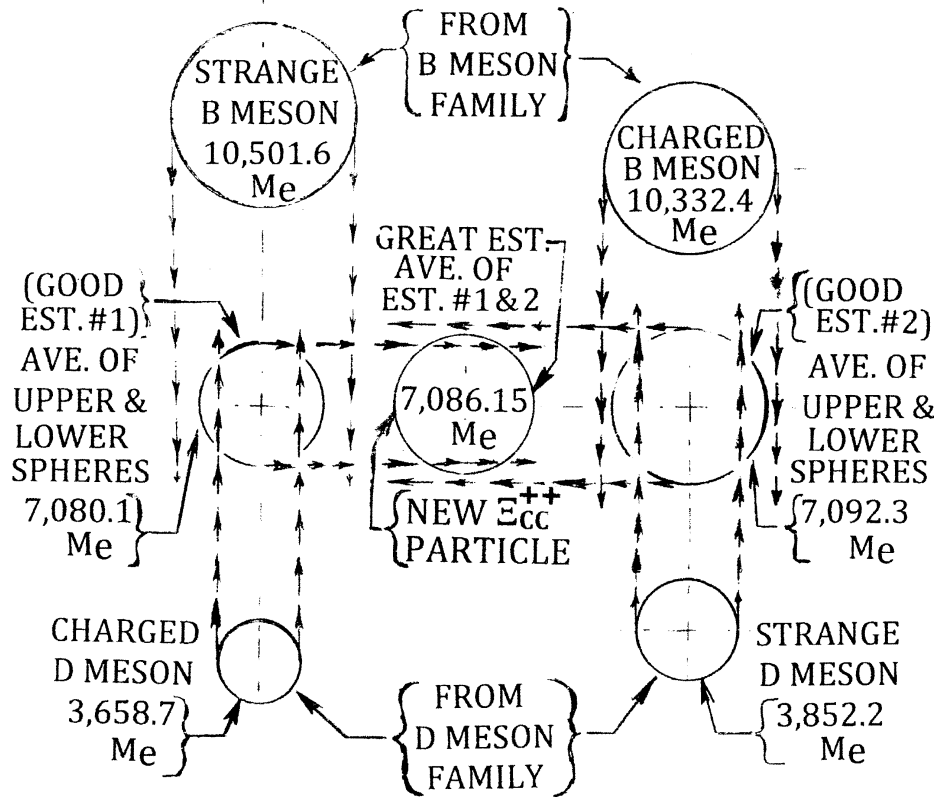
◄PION

Mass=3.375 electrons
Mass=1 electron

Section View, lower half of substructure

Dwg. Est. for Mass of Omega 'Hyperon', (Ω⁻): 3273.75 electrons

Above Dwg. gives, for the Mass of the major 'Omega Hyperon' (aka Omega Baryon): 3273.75 electron masses, vs. an empirical value: 3272.90 electrons. The above sketches use a 3.375 electron mass sphere in est., which is also generated in some Pion dwg. constructions, which also provide greater rigidity. ((Opt'l., had just 1 or a set of 3 electron-sized spheres been used, (instead of spheres sized 3.375 electrons each), then an ave. Kaon particle would have resulted, not the larger mass Omega Baryon.))

Example 4,

The Xi Double Charm Baryon, (Ξcc++), a rather new Particle discovered using the 'super-collider'; and below – a great estimate of its mass, by averaging together two good estimates, each of which is simply an average of a pair of already known particles masses.
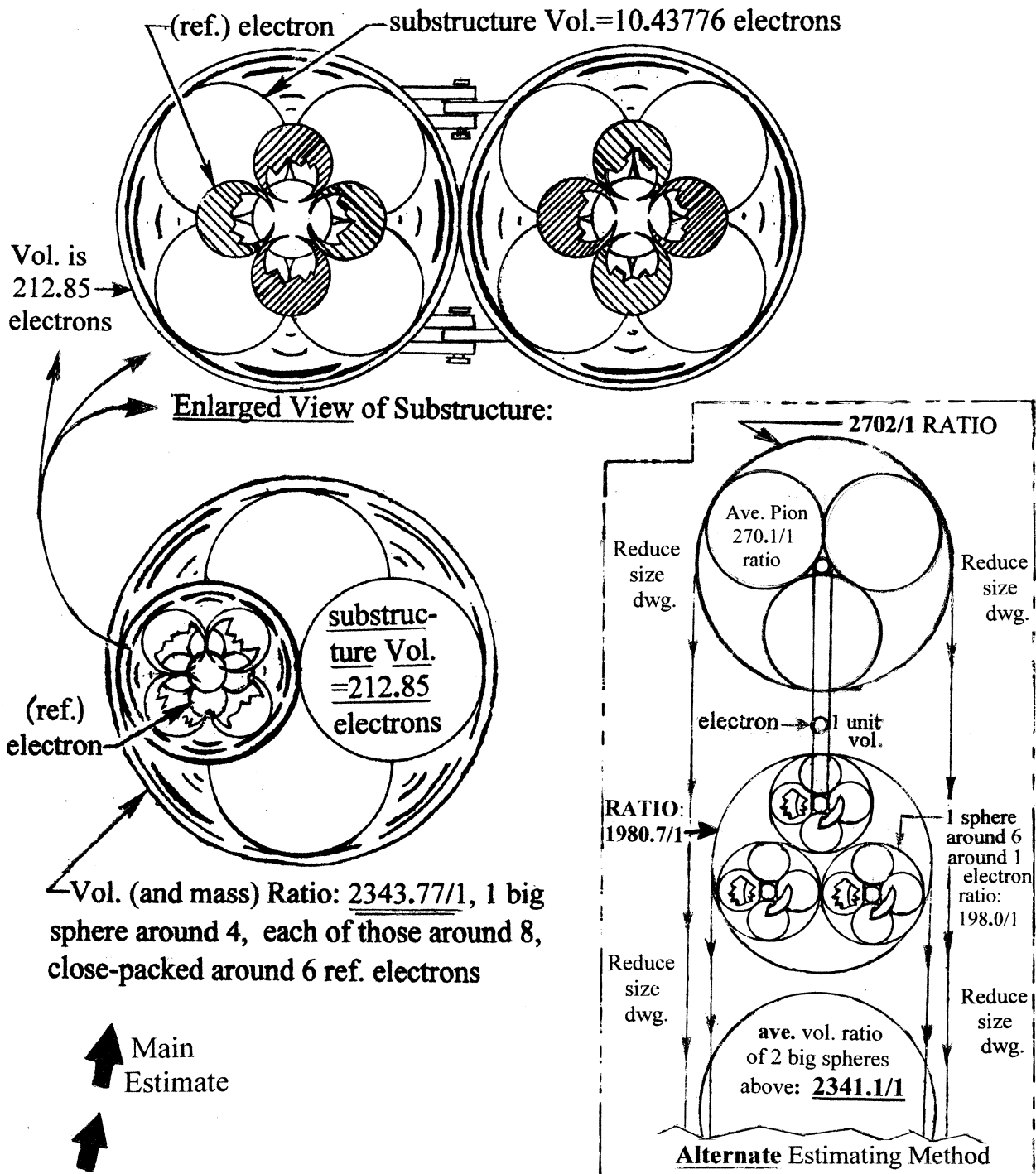


```
                    ┌ FROM  ┐
        STRANGE ←── │B MESON│ ──→
        B MESON     └ FAMILY┘
        10,501.6                  CHARGED
          Me                      B MESON
                                  10,332.4
                     GREAT EST.     Me
(GOOD              AVE. OF
EST.#1)            EST.#1&2                    (GOOD
AVE. OF                                         EST.#2)
UPPER &            7,086.15        ─            AVE. OF
LOWER                 Me                        UPPER &
SPHERES                                         LOWER
7,080.1           ┌NEW Ξcc++                    SPHERES
  Me              └PARTICLE                     7,092.3
                                                  Me
CHARGED                                    STRANGE
D MESON           ┌ FROM  ┐               D MESON
3,658.7           │D MESON│               3,852.2
  Me              └ FAMILY┘                 Me
```

NOTES: (Me) DENOTES THE MASS OF 1 ELECTRON.
(Me)=0.511 MILLION ELEC. VOLTS (MeV) OF ENERGY.

The **Xi Double Charm Baryon** with Dwg's Est. Mass of 7,086.15 electrons

   The newly discovered particle, the '**Xi Double Charm Baryon**', (Ξcc++), with the mass of **7,086.1** electrons, is virtually matched, as shown by the drawing above, by using above 'averaging method' – i.e., to propose a good, and thus probable, mass value for a new particle to have.

   The above Drawing shows how the 'Averaging of two already known Particle masses' – tends to predict a good mass candidate for 'Nature' to match – by Nature's creating a new particle with a mass nearly equal to that 'average'. Especially if averaging each of **2 pairs** of already known particles gives nearly the same mass (for a candidate), not just 1 pair 'making the nomination'.

Example 5, the Sigma Hyperon, Σ⁻, see below, especially the main sketch at left.

(ref.) electron — substructure Vol.=10.43776 electrons

Vol. is 212.85→ electrons

Enlarged View of Substructure:

substruc-ture Vol. =212.85 electrons

(ref.) electron

—Vol. (and mass) Ratio: 2343.77/1, 1 big sphere around 4, each of those around 8, close-packed around 6 ref. electrons

Main Estimate

2702/1 RATIO

Ave. Pion 270.1/1 ratio

Reduce size dwg.

Reduce size dwg.

electron→ 1 unit vol.

RATIO: 1980.7/1→

1 sphere around 6 around 1 electron ratio: 198.0/1

Reduce size dwg.

ave. vol. ratio of 2 big spheres above: **2341.1/1**

Reduce size dwg.

Alternate Estimating Method

The heaviest, longest-life Sigma Hyperon, Σ⁻ (see left sketch, our best estimate)

That main sketch at left, is the best of two estimates shown, for the Sigma Hyperon's mass, **Est.= 2343.77 electrons** vs. an empirical 2343.35 result.

Note the 1 big sphere around and touching a tetrahedral array of 4 spheres. And, as better shown in the close-up view above that main sketch -- inside of each of the 4 spheres, there is a 'cubic' array of 8 smaller spheres close-packed around an octahedral array of 6 electrons.

An alternate, (but less accurate) sketch estimate is shown at right, where two sphere constructions are shown averaged together. We may find that of additional interest - later.

Some other Miscellaneous Mass Ratio Estimates,
And descriptions of the Volume Ratios found in Sphere Patterns, which nearly equal those Mass Ratios. And miscellaneous other comments about our approach:

We have presented above, examples of major Vol. Ratios, in basic sphere patterns, that equal, or nearly so, the Mass Ratios of major particles. And we have provided large drawings to aid our visualizing all that, 'at-a-glance'. Those examples, shown above, along with miscellaneous comments, exemplified how we reach our goal, one at a time. Thus, in total, showing the likely great merit of this article's approach or theme. Therefore, in a sense, all the remainder, below, is **Optional** -- it just enhances the broader goal of providing a more complete reference.

But since many large drawings extend the scrolling required to unwieldy length, in most of what follows -- we will provide just a 'verbal' description of pattern's sphere volumes and mass ratios, and **avoid** the larger space that drawings would require.

Optionally, it might be helpful if we remind reader of 3 general principles, or rules, that we continue to follow. And which were discussed in an earlier article:

a. We regard the relative volume of spheres we view -- as directly proportional to the masses of the particles they represent. Sort of like incompressible water, like the so-called Bohr 'Liquid Drop Model of a compact Nucleus', or like analogous concepts of Pythagoras and Democritus.   I.e., if, relative to an electron vol., the size of the vol. of a sphere is doubled, the mass of that latter sphere is assumed also doubled.

b. We regard aspects of Heisenberg's 'Uncertainty Principle' as generally preventing the existence of a **compact** particle with a mass less than 200 electrons. ((However, a small ball of energy can exist in space with just the Energy of, say, 1 electron ((I.e., its so-called ($E=mc^2$) 'mass-equivalent Energy'.))

c. When we use the term, "Resonance equivalent mass" (or mass equivalence to an $E=mc^2$ amount of 'resonance Energy'), we mean the following: At such special total 'resonance' mass or resonance energy amount -- if two particles, one or both moving, have a 'close encounter' with one-another -- they scatter much more at that special (Resonance) value than if the total energy was typically somewhat lower or higher (than that special value).

Example 6, subj. the Lambda Hyperon, (Λ^0). as shown in a previous article:
A Ratio results, (largest sphere vol. to smallest sphere vol.), when 1 large sphere surrounds & touches each of a group of 4 tetrahedrally arrayed spheres, and that group is 'close-packed' around a tetrahedrally arrayed group of 4 electrons, with each electron equaling 1 unit vol.
The Vol. Ratio resulting, (i.e., our Mass Ratio Estimate): **2180.19/ 1**.
The nearly matching major particle Mass Ratio (found in Nature) is the Lambda Hyperon particle mass, symbol (Λ^0), to electron particle mass: **2183.34 / 1**.
Opt'l. note: Incidentally, each of the spheres; in the first mentioned group of 4 spheres, has a mass of 198.0 electrons. That same mass or ratio, 198.0/1, is found in a substructure shown in the sketch on the right side of Example 5. (The Lambda 'Hyperon' is also known as the major Lambda 'Baryon'.)

Example 7, subj. the so-called lowest 'Sigma Resonance' (Σ^*+),
Ratio of largest sphere vol. to smallest sphere vol. in Example 2, see that previous Dwg. in this article:
The Vol. Ratio (i.e., Mass Ratio) resulting: **2702.0/ 1**,
Thus, the relative mass of that biggest sphere -- is our Est. Mass: **2702.0 electrons.**
The nearly matching entity involves one of the most prominent and early discovered 'Resonance Masses' found in Nature, the so-called lowest 'Sigma Resonance' (Σ^*+), with mass equivalence of **2706.06 electrons**. ((It is in the resonance 'family': "$\Sigma^*(1385)$".))

<u>Example 8</u>, subj. the so-called lowest 'Xi Resonance' ($\Xi*^0$), shown in a previous article:
The Ratio of largest sphere vol. to smallest sphere vol., when 1 very large sphere surrounds & touches an octahedrally arrayed group of 6 internal medium-size spheres and that group is close-packed around a cubically arrayed group of 8 small spheres, and that group surrounds & touches a 1-unit vol. electron.
The Vol. Ratio (i.e., Mass Ratio) resulting: **2995.03/ 1**,
Thus, the relative mass of that biggest sphere -- is our Est. Mass: **2995.03 electrons.**
The nearly matching entity involves one of the most prominent and early-discovered 'Resonance Masses' found in Nature, the so-called lowest 'Xi Resonance' ($\Xi*^0$), with mass equivalence of **2997.65 electrons**, ((It is in the resonance 'family', "Ξ*(1530)".))

<u>Example 9</u>, subj. the major and heaviest 'Xi Hyperon', (Ξ-), a.k.a. 'Xi Baryon'.
The Ratio of the average of two <u>estimated</u> ratios in this article is as follows:
Note Example 6, (Λ^0), Est.= 2180.19/ 1, and note Example 8, ($\Xi*^0$), Est.= 2995.03/ 1.
The averaging of those equals an estimated ratio, 2587.6/1.
So our **Est**. for a good 'candidate' for a particle mass to have is **2587.6** electrons.
And we find in nature, a particle, the 'Xi Hyperon', (Ξ-), with mass =**2586.5** electrons. Thus, our estimate was a very good one.

<u>Example 10</u>, subj. Here we contemplate, simply, a symmetrical sphere pattern, but not, itself, representing a volume ratio nearly equal to any known particle mass ratio or prominent 'resonance'. <u>But</u> its generated volume ratio (2786/1), <u>when averaged</u> with other prominent particle mass ratios, gives an average ratio nearly equal to still another prominent particle mass ratios in nature.
For Example 10, we imagine 1 very large sphere surrounding and touching an octahedrally arrayed group of 6 medium size spheres. And each of those spheres surrounds (internally, within itself) an array of 6 small spheres, and those 6 surround & touch a centered very small sphere -- which we'll regard as a 1-unit vol. (or mass) electron. That creates, (biggest to smallest sphere), a volume ratio of **2786/1**. Or a <u>**2786** electron mass</u> to use in our averaging to help nearly match the mass of other prominent particles.

<u>Discussion of other Estimates nearly matching the mass of other particles, and aided by the above example 10 result:</u>

To keep this article from being unwieldy long, we will address, below, only 'qualitatively' -- how we use abstract geometric patterns to estimate some other particle masses. And we will see how our sphere mass result in Example 10, (2786 electron masses), helps us make our good estimates.

Averaging the 2786 electrons' result with the ave. Kaon particle mass -- comes rather close to the 'Eta Prime meson' mass, (**η′**), although our estimate is a little 'high'.

Averaging that est. for the Eta Prime meson (η′), with our mass est. for the Omega Hyperon (Ω−), ref. example 3, -- comes rather close to the mass of the lightest major Xi Hyperon, (Ξ^0).

Averaging our Est. for the mass of the Eta Prime meson, (η′), with the mass of the ave. Pion gives an estimate for the mass of the Eta meson, (**η**).

There are other, perhaps, better ways to estimate the mass of the particles addressed immediately above. For example, another method involves first generating the Tauon, (**τ**), a.k.a. the Tau particle, <u>see dwg. in example 2A</u>, above. Other possible examples are not addressed here -- to avoid unwieldy article length.

A reminder -- there are many other important particles, but most less prominent, and most are <u>not</u> addressed in this article, nor even in my other more basic ref. online article. Most of these are addressed at my website, and hopefully, by using the link provided previously in this article's Introduction. My website or my other ref. article likely addresses most of the issues that may be on the mind of the reader of this above (present) article, and thus those issues will not be addressed here -- to avoid unwieldy article length.

My major work, (matching abstract geometric ratios with particle mass ratios) -- is likely <u>not</u> 100% complete. And there are at least some rather good geometric sphere patterns which I have not studied, even though having less symmetry than those related to Platonic solids - which I have addressed. For example, I have not well studied geometric sphere patterns related to almost 13 'Archimedean Solids' and others. So, there are still likely some possible sphere patterns which might cast further light on the subject of my articles.

Closing Remarks:
As remarked in this article's Introduction, many rather recent Nobel Laureates, even familiar with 'quark theory', etc., have attempted to discern a 'rationale' as to why the various particles in Nature have the particular mass values they do.

Below, I quote some examples of remarks by some Nobel Laureates, and in some cases my opinion:

In an interview shortly before his death in early 1988, **Feynman** was quoted as saying, "**Why is it that the mass of the muon compared with the electron is exactly 206 or whatever it is, why are the masses of the various particles such as quarks what they are?** All these numbers, and others analogous to that -- which amount to some two dozen -- have **no** explanations in these string theories -- absolutely none! ......
There's not an idea at the present time, in any of the theoretical structures that I have heard of, which will give a clue as to why those masses are what they are."[2]

And **Steven Weinberg**, who was awarded the Nobel Prize for his outstanding contributions to the standard model (of Particle Physics), said in his fairly recent book, *Dreams of a Final Theory*: "**The standard model involves many features that are <u>not</u> dictated by fundamental principles**" (as he would only wish for) "**but instead simply have to be taken from experiment. These apparently arbitrary features include a menu of particles, a number of constants such as <u>ratios of masses</u>**, and even symmetries themselves. **We can easily imagine that any or all of these features of the standard model might have been different.**"[3]

And **John Wheeler** wrote in his book, Geons, Black holes & Quantum Foam (A Life in Science) on page 119, "I was so enchanted with the electron, with its beautiful, exact Dirac theory and its ultimate simplicity, that I couldn't help wondering: **Is everything made out of electrons? Isn't there some way to tie together the electron** and its antiparticle, the positron—perhaps with the help of the photon**—to build all other particles**? "….. "On my own, I kept trying this and that as I worked away at my desk, **but I never came up with a plausible way to build the world from positive and negative electrons.**"
(He also wrote, "What else is there out of which to build a particle except **geometry itself**?")

I have written the above online Journal article, and many others like it, because I think they provide substantial solutions to the problem raised by the Nobel Laureates, quoted above. I regard my above article, and related ones, as largely establishing, in fact, that "**geometry itself**", largely reveals the solution. I.e., Again, see article's drawings, which, 'at a glance', exemplify **that**. And thus Wheeler, although not accomplishing this goal during his time, was, in a sense, correct: There are simple 'geometric methods' which show "**how everything can be constructed rather well from the electron**", and I have illustrated this in major cases in the above and related articles. And in some cases, by using structures that, although not 'electrons' themselves, are structures which were built from the electron. [5]

REFERENCES

[1] Rothman, T., Hidetoshi, F.; <u>Sacred Mathematics-Japanese Temple Geometry</u>, Chap. 6, Prob. 14, pp. 203-204, Princeton University Press, 2008.

[2] Davies, P. C. W., Brown, J., editors; <u>Superstrings: A theory of Everything?</u>; "Richard Feynman", p.195, Cambridge University Press, 1988.

[3] Weinberg, S.; <u>Dreams of a Final Theory</u>, Chap. VIII, p.192, Vintage Books, 1994

[4] Example **2A** and related comments were added to my article in early Sept., 2021

[5] As of this viXra article's date, its author has a website at http://www.causeeffect.org/