Particle Mass Ratios that nearly equal basic Geometric Ratios

Carl Littmann
25 Washington Lane #313, Wyncote PA 19095 USA clittmann@verizon.net
February 2019

Abstract

In physics, there exits the massive Proton and much less massive Electron. And thus, a Particle Mass Ratio, when comparing them, about 1836.15 to 1. And there exists many other important particles, too, although unstable, such as the major Pion and major Kaon particles classes. And they have mass ratios, too, relative to the electron, of about 270.1 to 1, and 970.0 to 1, respectively. Interestingly, all those Particle Mass Ratios nearly equal basic Solid Geometry Ratios, some of which we likely saw in High School Geometry class, when viewing sphere patterns. (Or the average of two major solid geometry ratios.) This article lists prominent Particle Mass Ratios and shows the basic Ratio in Solid Geometry that each one nearly equals. Some simple comments are made. (Less specialized readers may skip my more technical comments.)

Introduction and Examples of nearly Matching Ratios

At least three Nobel laureates have bemoaned that science cannot explain why particles have the masses that they have. The below and related works should largely rectify that!

To do so, we present, below, examples of simple sphere patterns with basic geometric volume ratios that nearly equal major particle mass ratios. In some the sketches below, we use some exaggeration, portions cut-away, section views, etc., so that otherwise blocked features, etc., are more clearly seen. Discussion about each sketch also appears below each sketch.

Some of the below sketches and comments basically appeared in another article by author in a prominent journal in 1995. [**1**] And the main features of some sketches below are basically the same as were found on tablets in old Japanese Buddhist temples or Shinto shrines. More on that later.

Optionally, for more examples than space allows here, see author's other vixra article by clicking or putting in browser 'URL address bar':
http://viXra.org/abs/2106.0052
Or optionally, click below to his hopefully active website articles:
http://www.causeeffect.org/articles/book.html, or
http://www.causeeffect.org/video/RatioTalk11-11-16.mp4 (for this link, allow 30 sec. to load)
Optionally, these articles and more can also be viewed, hopefully, at his website by clicking:
http://www.causeeffect.org/

Please **SCROLL DOWN** below, to view the major Sketches, etc.:

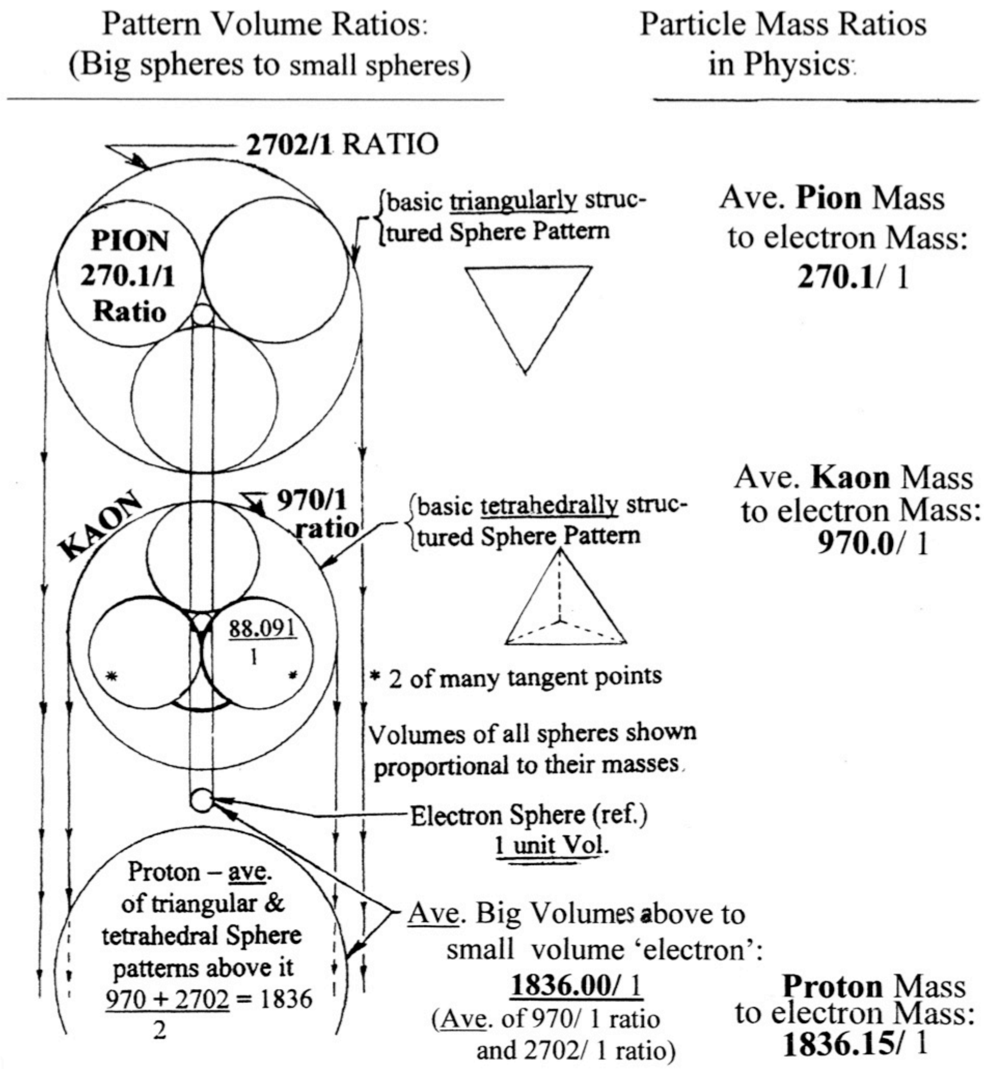


Figure 1 (The Proton, Kaon, and Pion)
In the upper sketch, we show 1 big sphere around 3 equal medium-sized spheres and those around 1 small sphere. For the middle sketch, 1 big sphere around 4 equal spheres and those around 1 small sphere. Sphere volume ratios thus result, based on those patterns which the mathematician, Courant, considered the most basic structure in 2 dimensions (the equilateral **triangle**) – **and** in 3 dimensions (the equilateral **tetrahedron**), respectively. [**2**] We next discuss which geometric sphere volume ratios nearly match which mass ratios of the most prominent **particles** found in nature!

And since we can't decide if the triangle or tetrahedron is the more basic, we average together, the sphere volumes ratios that those two patterns helped us generate: **(970 + 2702)/2** = **1836.00/**1. And then we note that that average geometric ratio, **1836.00/**1**,** nearly equals the '**proton** to electron' mass ratio, **1836.15/**1.

And the volume ratio in the middle sketch, where 1 big sphere surrounds 4 equal medium-sized spheres, around 1 small sphere, gives a geometric ratio, **970.0/**1, (outer sphere to centered sphere). And that geometric ratio virtually equals the ave. '**Kaon** particle to electron' mass ratio, **970.0/**1.

And in the upper sketch, where 3 equal medium-size spheres surrounds one small sphere -- that gives (for each 'medium-sized to small sphere') a geometric ratio, **270.1/1**, virtually equaling the ave. '**Pion** to electron' mass ratio, **270.1/**1.

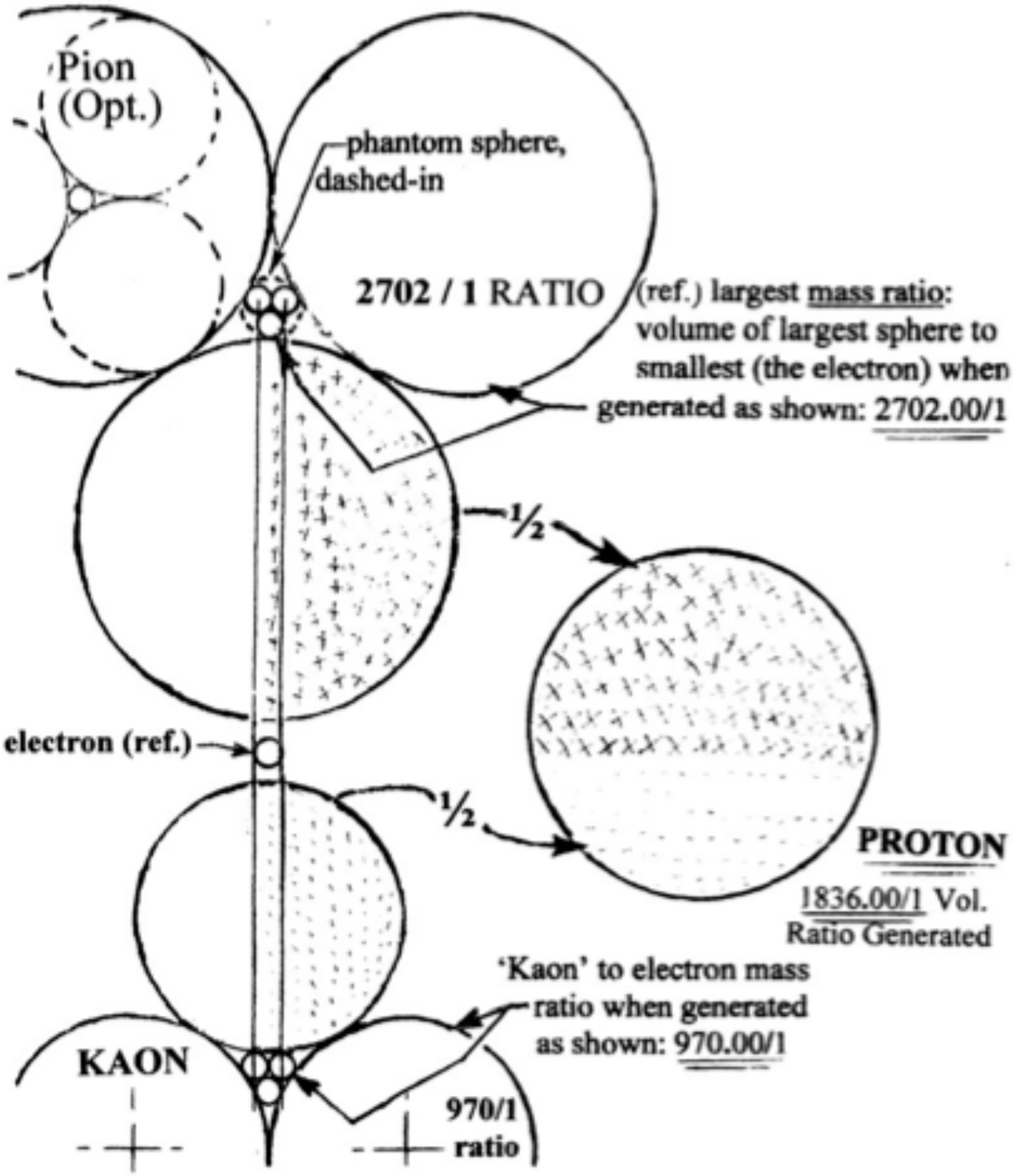


Figure 2 (Alternative methods for the Proton, Kaon, and Pion)
Some other patterns, as shown above, give the same sphere volume ratios as in the previous drawing, 'Figure 1'. (It seems like the greater the number of different geometric patterns that lead to the same sphere volume ratio, or nearly so, the greater the chance of also finding in nature -- particles with mass ratio nearly equaling those geometric ratios. And the longer the life, or half-half, of those particles.)

See first footnote for reference to an article, by author, in a prominent journal, in 1995, which also showed a drawing and comments like those above, except above is slightly simplified.

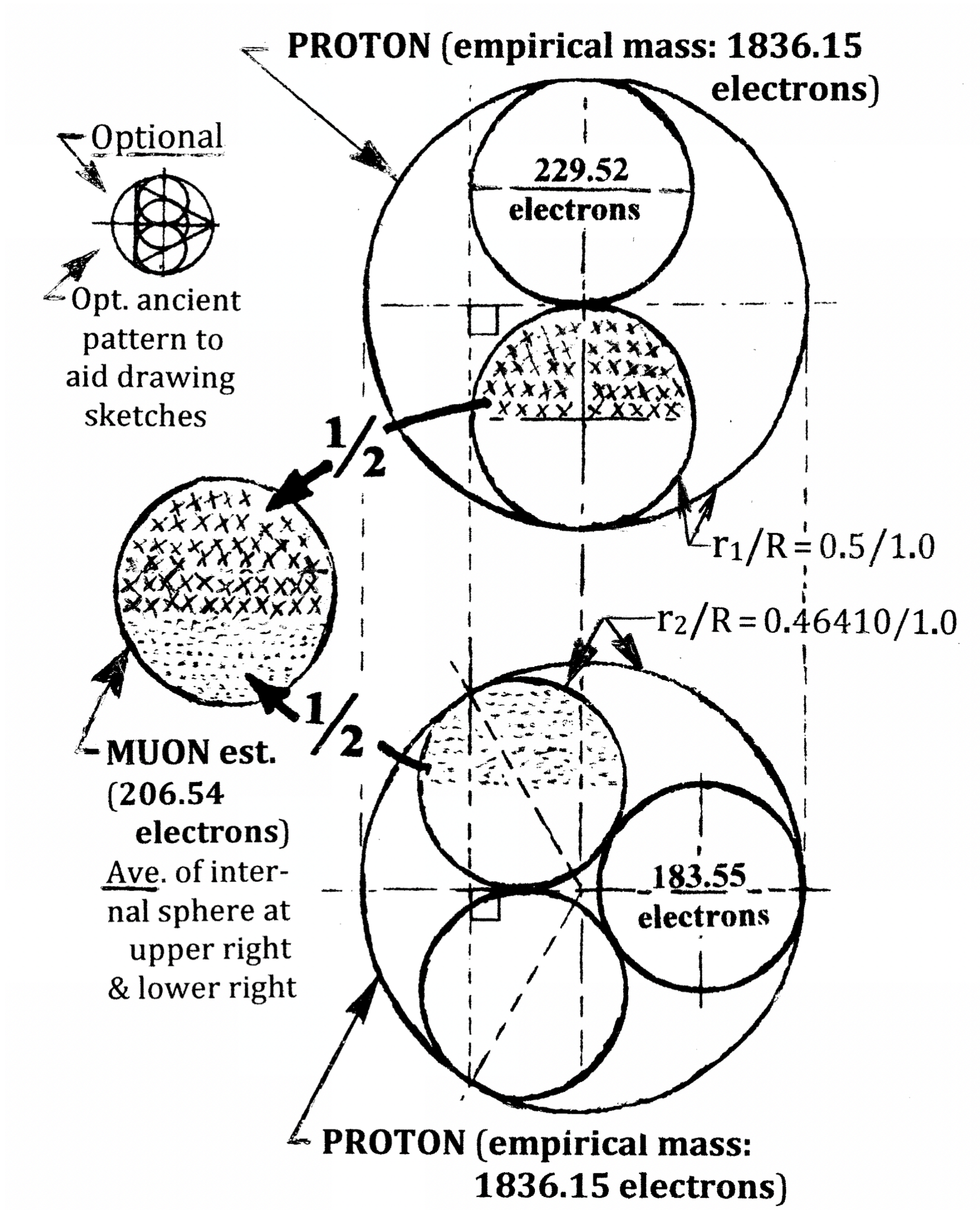
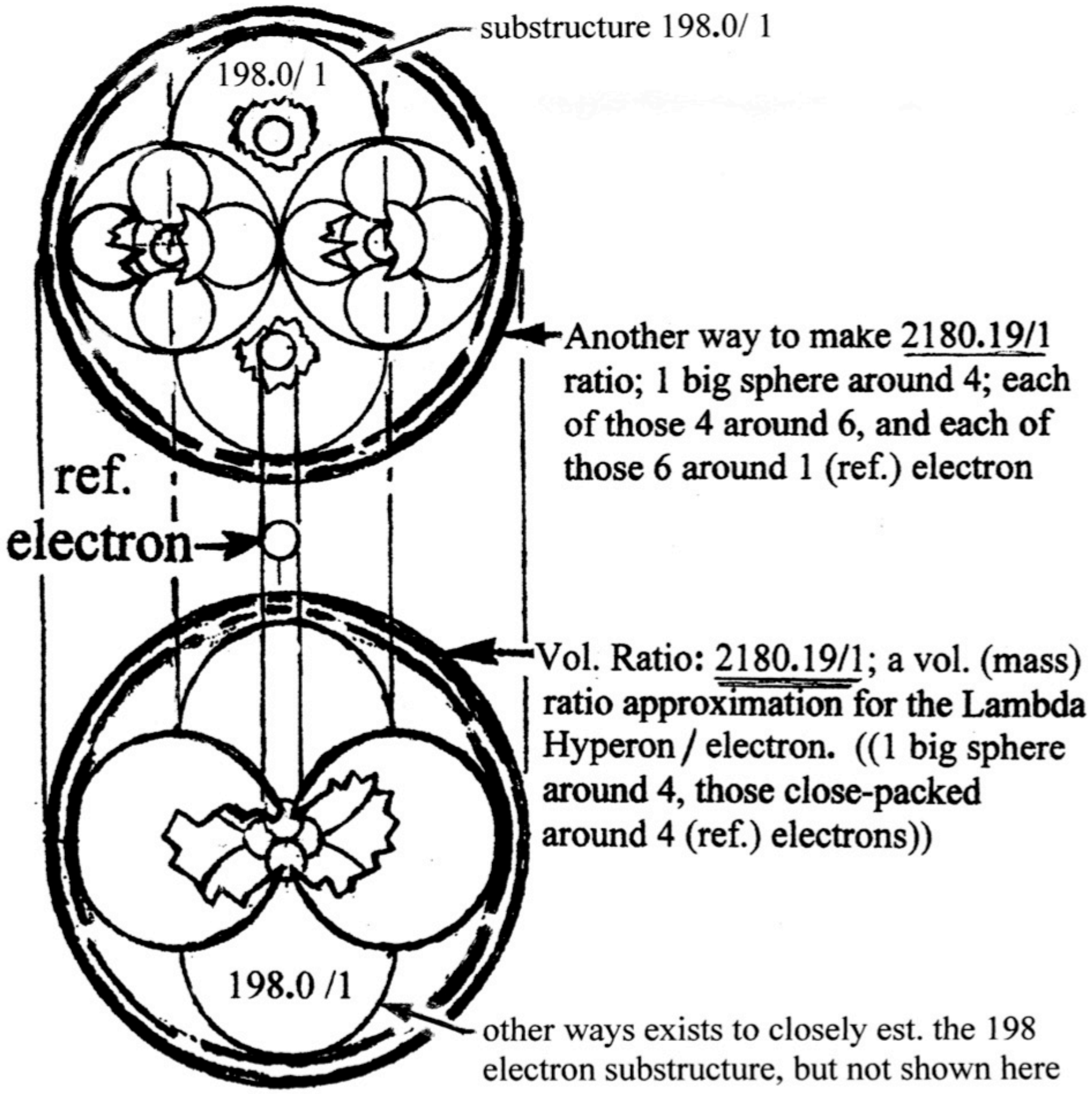


Figure 3 (The Muon constructed from the proton)
In the above, we attempt to nearly equate a major particle mass ratio, the 'Muon particle to electron particle' mass ratio, to a special 'average of two geometric ratios'. For the geometric ratios, we imagine each of two large spheres, the 1st being the proton shown above the middle of drawing, and the 2nd being another proton just below the 1st proton. Since a proton mass equals about 1836.15 electrons, we can imagine that each of those large spheres, (1st and 2nd), each have a volume of 1836.15 electrons.

Next, we further imagine that inside the 1st proton, that 1 of the 2 equal spheres there equals 229.52 electrons; and for the 2nd proton, that 1 of the 3 equal spheres there equals 183.55 electrons. So the geometric average of the two is: (229.52 + 183.55)/2 = 206.54 electron volumes (or electron masses). So our good **estimate** is: **206.54** electron masses, vs. the **empirical** reality of **206.77** electron masses for the Muon's mass. (And there also exists other patterns with average ratios also yielding good approximation to the 'Muon to electron' mass ratio, although not as good as the above, and not enough space to show here.) But the method of 'averaging two basic geometric sphere volume ratios together' to nearly equal a major empirical particle mass ratio – is successful very often, and cases very impressive. Too often to likely be just 'luck'.



. .

Figure 4 (The Lambda 'hyperon' or 'baryon', Λ^o)

The above illustrates two different patterns giving the same volume ratio, (outer biggest sphere to each of the four small spheres nearer its center). That rather basic sphere volume ratio turns out to be **2180.19/1**, and motivates our expectation and hope of finding a major particle mass ratio nearly equaling that geometric ratio. And we do find one! The **most prominent** Lambda Hyperon, symbol (Λ^o), has an empirical mass ratio, relative to the electron mass, of **2183.34/1**, and was one of the earlier particles discovered. Note, it is fine to use the more modern term, 'Baryon' instead of 'Hyperon', in my articles.

The lower sketch shows one big outer sphere close packed around 4 equal medium-sized spheres, and those close-packed around 4 small touching spheres. The upper sketch shows the one outer sphere close packed around 4 equal medium-sized spheres, and each of those 4 around 6 equal, platonically positioned spheres, and each of those group of 6 around a small sphere. All small spheres, shown above, are equal.

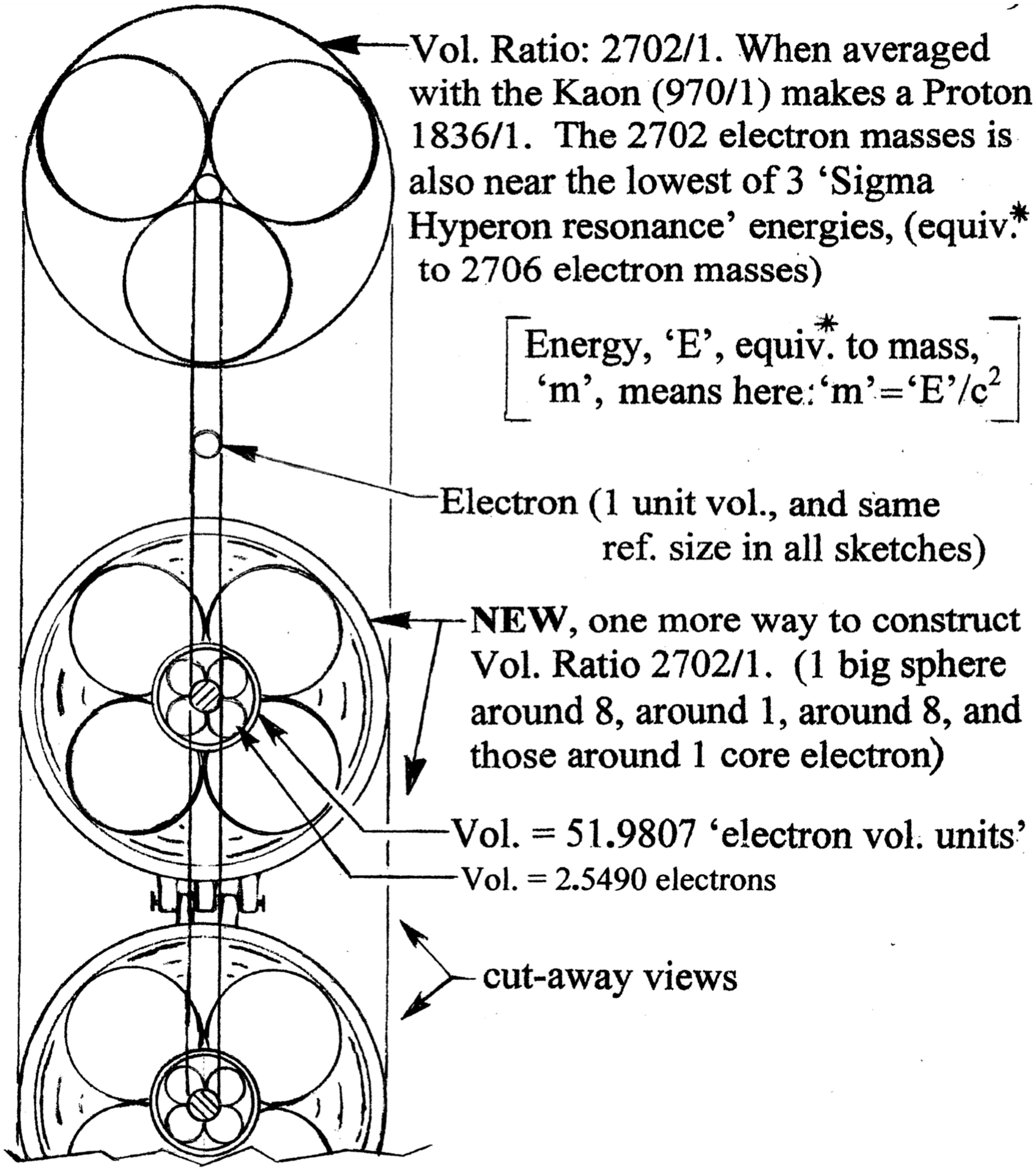


Figure 5 (Several ways to construct the (Σ*+) 'mass equivalent energy')

The above illustrates one more of many existing ways to construct the Volume Ratio (or mass ratio) equal to **2702/1**. **That** 2702/1 volume ratio is also very close to the mass equivalent value of the lowest of the very prominent 'Sigma Hyperon Resonance' (Σ*+) energies -- as compared to 1 'rest mass' electron: a **2706/1** ratio.

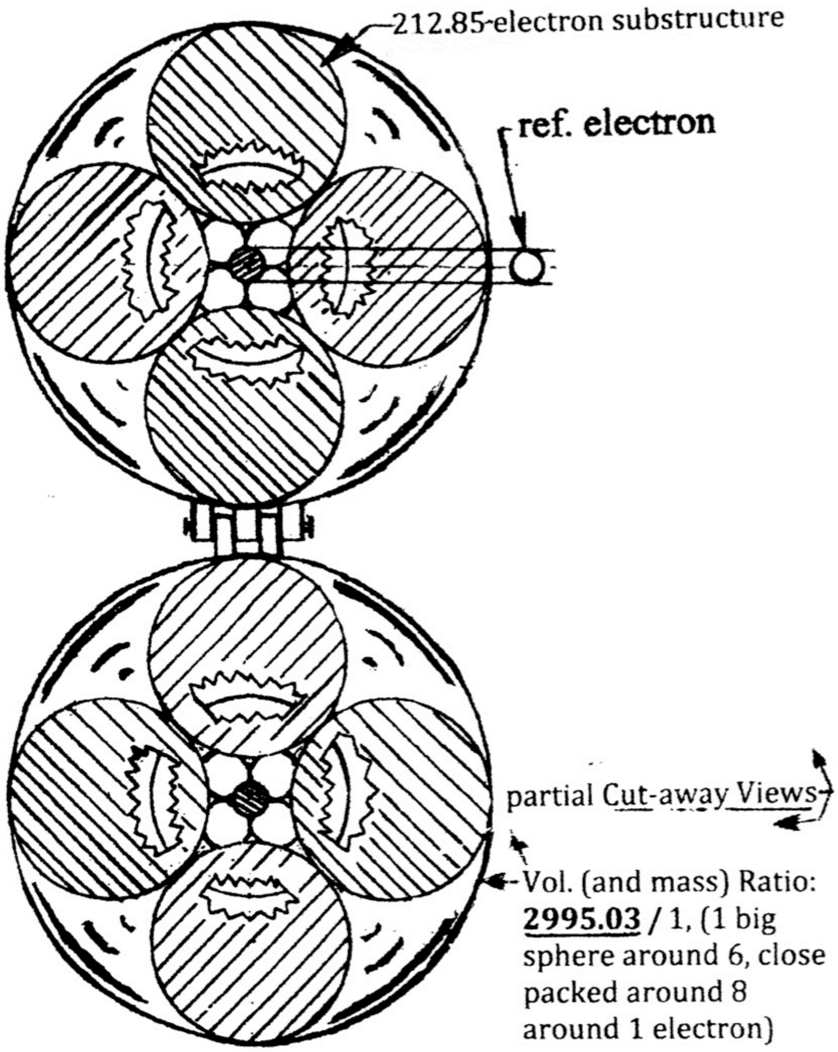
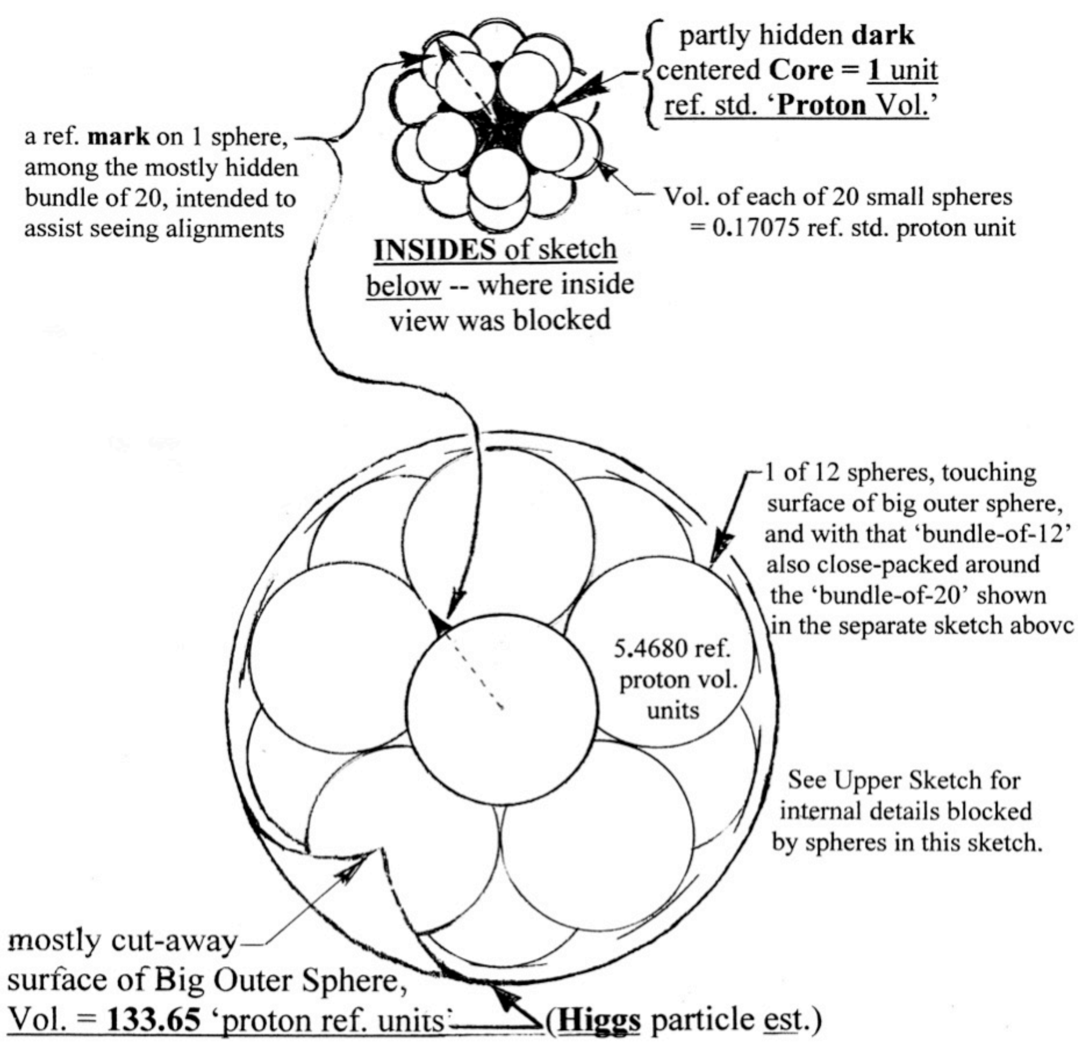


Figure 6 (The 'mass equivalent energy' of lowest, Ξ^{*0}, resonance)
The above cross-sectional sketch gives a volume ratio (outer sphere to inner core sphere) of **2995.03/1**. That 2995.03 is very close to the empirical mass equivalence of the lower of two very prominent **Xi Hyperon resonance** (Ξ^{*0}) energies, **2997.7** and 3003.9 electron masses compared to **1** rest mass electron. (So that lower resonance, **2997.7** electrons (the empirical result), can be compared with our abstract sketch result, above, **2995.03** electrons, a pretty impressive close match.)

Interesting note: If the sphere layering between the big outer sphere and core sphere were **8** spheres around **6**, instead of the **6** spheres around **8** shown, that would **not** change the outer sphere to core sphere volume ratio. Those positioning possibilities, **6** spheres around **8**, vs. **8** spheres around **6**, may be compared to 'platonic **Duals**'. That is – they are analogous to very symmetrical platonic solids with 6 vertices & 8 faces and with 8 vertices & 6 faces. I.e., Those platonic solids are termed 'Duals' in solid geometry, and described in Wikipedia and elsewhere



Note: Interchanging the '20-spheres' (Dodecahedron) position and the '12-spheres' (Icosahedron) position would **not** change the Vol. of the outer sphere.

Figure 7, (the Higgs particle)

The above sketch gives a volume ratio, (Outer sphere to inner centered dark sphere), of **133.65/1**. It involves one very big outer sphere around 12 platonically positioned large spheres -- close packed around 20 platonically positioned very small spheres (but rather hidden and therefore shown near top of the page). And that bundle of 20 spheres surrounds and touches one somewhat bigger dark sphere, which we'll regard as a Proton because its bigger than each of the 20 spheres. That **133.65/1** volume ratio is very close to the **Higgs** particle mass empirically estimated to equal about **133.54 protons** (compared to the **1** unit proton mass). [**3**]

Of course the above discussed 'close packed fitting' comes out perfect, and the geometrical symmetry - perfect.

(Additional information is provided under the heading, 'Interesting Discussion', at the end of the all sketched illustrations and figures.)

(Opt’l.) Figure 8 below:

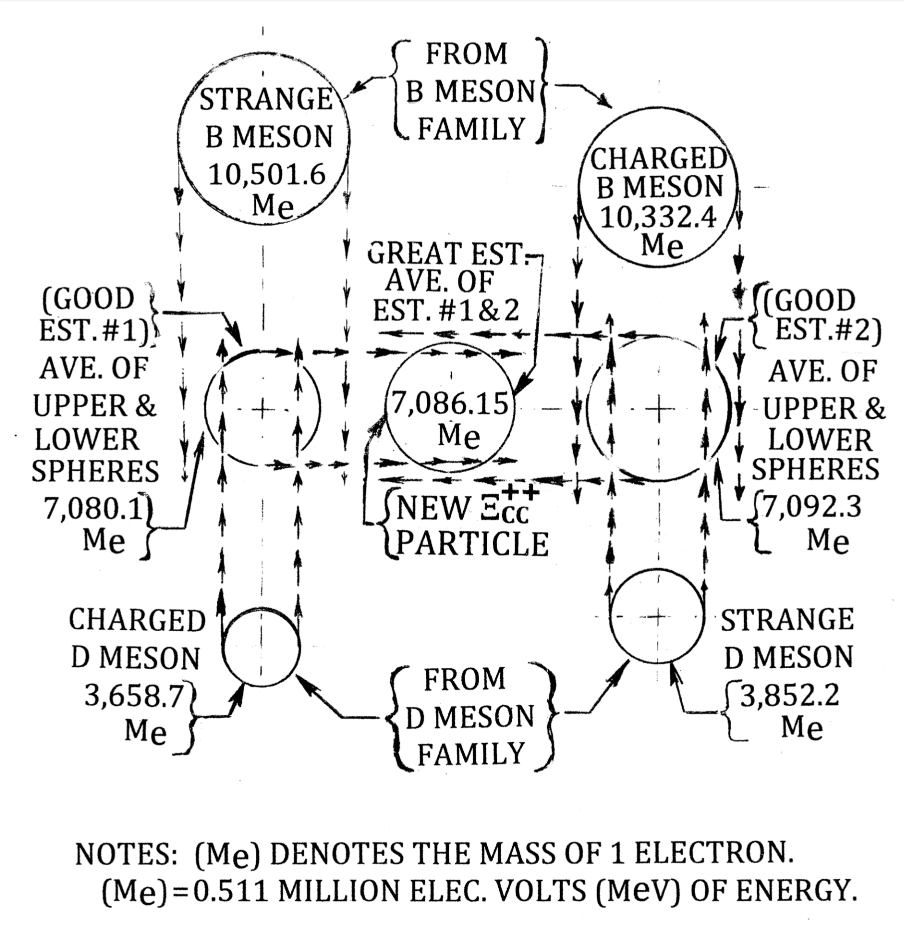


Figure 8 (Optional), the 'Xi Double Charm Baryon’, (Ξcc^{++})
The above Drawing shows how the “Averaging of two already known Particle masses” – tends to predict a good mass candidate that ‘Nature’ is more likely to match, than otherwise– that is, by Nature's creating a new particle with a mass nearly 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’.

The newly discovered particle, the ‘**Xi Double Charm Baryon**’, (Ξcc^{++}), with the mass of **7,086.1** electrons, is virtually matched, as shown above, by using such 'averaging method' -- i.e., to propose a good, mass value, and thus probable mass value, for a new particle to be found in nature.

Interesting Discussion continues after scrolling below:

Interesting Discussion (Some of the discourse below may be too technical for the non-specialist. They may just skim over or bypass those parts.)

In our 'Figure 7', we addressed the Higgs mass, and we used helpful patterns, based on a Platonic solid that was the goal of the first 8 books of Euclid. And which Plato thought god used to help lay out the universe. [**4**] So Euclid's and Plato's works helped us here to estimate the mass of the so-called 'god' particle, the Higgs mass, (our 'Figure 7'). That Higgs mass was a major goal of the mainstream's *Standard Model of Particle Physics*. (Our article's third footnote provides more details.) The icosahedron & dodecahedron patterns are termed platonic 'Duals'. And corresponding to those platonic layouts, our Figure 7 shows 12 spheres and 20 spheres, in 'close-packed arrays' -- to help us nearly match that 'Higgs to proton' mass ratio.

The upper sphere pattern in Figure 7 (crucial to our Higgs discussion) appears also on an old tablet in an old Japanese Buddhist temple. One of the sphere patterns, used in our Figure 1, also appears on an old tablet in an old Japanese Shinto shrine. Those sketches and information about them appear in a book, Sacred Mathematics -- Japanese Temple Geometry, with a forward written by Freeman Dyson. [**5**] Unfortunately, many other such old tablets (having other sketches and discourses on them) – have long been lost, no longer to be found on old Japanese temples and shrines.

Mass ratios presented in this article are based on particle mass values found in Wikipedia, 11-28-2016 in articles entitled Electron, Pion, Kaon, Proton, Muon, and Hyperon, and may also be found with adequate accuracy using other Internet searches. And that is true for many other particles, too. When we say, for example, "the mass ratio of the average prominent Pion particle, relative to the 1 electron mass" – we mean the following: We add up the mass of each of the three very prominent Pions in that class (those that were 'discovered early-on'): the positively charged Pion (139.570 MeV/c^2), the negatively charged Pion (also 139.570 MeV/c^2), and the uncharged Pion (134.977 MeV/c^2). We divide that by 3, (the number of particles in the group), and then we divide that MeV/c^2 value by the mass of 1 electron (0.510999 MeV/c^2). That gives us, as expected, a 'mass' ratio that is 'dimensionless', since that seemingly awkward unit of mass, (MeV/c^2), cancels out -- because our mass comparison is to the electron mass which we also expressed in units of (MeV/c^2).

It is interesting that before quark theory was well-developed, older physics books often expressed the mass of major mesons and other particle masses – in equivalent numbers of electron masses. [**6**] This tended to somewhat sensitize this article's author to the possibility that the mass of the electron, itself, might partially contribute to the mass value of other particles of greater mass -- some with perhaps short lives, but plenty long enough to be very important. And that by considering basic geometric patterns, including some positions 'platonically directed', and by considering the concept of 'close packing of spheres' – that both those considerations might help us generate fairly close estimates of the relative masses of prominent particles.

That sort of approach has been likely considered by quite a few scientists, historically. For example, the Nobel laureate, John Wheeler, once wrote, "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?" [**7**] And he also wrote, "What else is there out of which to build a particle except geometry itself?" [**8**] (So, in a sense, my article extends ideas similar to those which Wheeler and others suggested.)

Discourse continues below under the heading, 'Important Considerations'.

Important Considerations

In order for this article's methodology to work, we must assume the following: The greater the volume of one of our outer spheres relative to one of our inner spheres (both appearing in the same close-packed sphere pattern we display) -- the, similarly greater, the mass of one particle is to the mass of different particle, that we find 'in Nature'. Thus, for two different particles, whose relative masses we meaningfully compare in this article -- we must assume that the density of material making up both particles is virtually the same. And 'that same density assumption' also applies to all particle mass values we address, that are in-between those two values, too. That is similar to an assumption in the simple and early developed 'Liquid Drop Model of the Nucleus', that was rather successfully developed by Niels Bohr. In that model, the nucleus of the atom is regarded as like a water drop. The density of material making up each of the various particles in the nucleus is regarded as practically incompressible and the same density for the various particles comprising the nucleus.

(Or to speculate and try to extend that approach further, consider this possibility: If the particle's mass is determined by the amount of energy in an ethereal-like sphere pattern adjacent it, then the amount of energy in that ethereal sphere is proportion the volume of that ethereal sphere. And ethereal density rather uniform.)

There seems to be **no compact**, **free** particles existing in the range of "less than 200 electrons worth of mass but greater than 1 electron mass". I believe the reason why relates to Heisenberg's uncertainly principle and the 'reduced Planck constant', and is roughly as follows: Even if such small **compact**, free particle mass tried to exist and harmonically vibrate or spin roughly at the speed of light, 'c'; its corresponding angular momentum generated -- would still not equal as much as a 'reduced Planck constant' worth of angular momentum. Thus, I think that not only would such a particle be difficult to measure accurately – the particle would even find it difficult to exist at all. (The 'free' electron, however, is like a puffball or thin doughnut, and thus is **not** a compact particle. Thus when it spins at roughly 'c', it finds it easier to create sufficiently great angular momentum to aid its stability.)

The methodology, demonstrated and advocated in this article, has great merit, but yet has some limitations which we now discuss: When two different volumetric ratios in two different basic patterns are averaged together, the result doesn't always correspond to the mass ratio of two prominent particles. This article could use the help of special 'selection rules' predicting when our 'methodology of averaging patterns' will work and when it will fail. And explaining why.

Also, sometimes our basic geometric volume ratio lands midway between a group of 2,3, or 4 nearly equal, important particle mass ratios. But one of those particles, say, the neutral one, has a few electrons worth of mass more than our geometric ratio predicts, and the other particle, say, the charged one, has a few less electrons worth of mass than our midpoint. This article could likely use the help of an aspect of quark theory to predict how such small subtleties as 'charge' could cause such very small mass offsets, slightly away from the value predicted. Or the help of a somewhat similar theory.

Suppose we use many sub-structural patterns to create one huge pattern. And thus create one super-large sphere, having a volume that is many thousands of times greater than the smallest sphere in the pattern? Then our chances of finding a prominent mass ratio to match such super-large geometric ratio is much less than for a more modest ratio. It is as if one small sphere or electron can bare only a limited load or big burden mass or volume around it -- before instability of the out-most sphere escalates rapidly, and a hoped-for match tends to fail 'to materialize'. And there are other subtle considerations that affect the effectiveness of the methodology advocated in this article, but not coverable here.

The author realizes that this limited length article raises some questions, problems or issues not thoroughly addressed here. And that some difficult issues may defy simple solutions, including some speculations that the author might propose if this article was longer.

In this article, when we use the term, 'resonance' as applied to a particle -- the following is roughly what we mean: A resonance energy is a special lump of energy in space with slightly greater mean lifetime and other special characteristics – compared to lumps of energy slightly greater or slightly less. Or alternately, we can say, "there is an equivalent resonance mass, 'm', corresponding with that special energy lump, 'E', and that 'E' and 'm' are related by the famous equation, $E = mc^2$. In particular, in scattering experiments, where an incident high-speed particle mass interacts with a target particle mass, there is more scattering for the special total (mc^2) energy value of the 'target particle plus incident particle'. That is – more scattering, than for other total energy values, i.e., those which total either a little more or a little less energy than that special 'resonance' energy. (Or the energy's equivalent mass – to express that in another way.)

Conclusion

There are dozens of examples of sphere volume ratios in geometric patterns (or by averaging such result in two such patterns) – that nearly equal the mass ratios of prominent particles found in nature. About 8 of the most basic, interesting cases were presented here. They were selected because they exemplified the most basic patterns -- and, thus, their geometric volume ratios came out especially close to matching prominent particle mass ratios. (Or nearly equal to a ratio, given by averaging a prominent group of nearly equal particle masses – and comparing that to a small electron mass.)

Those examples are so basic, important and striking that the near matches are very unlikely to be just coincidental! There were enough sphere patterns selected so that geometric analogies with all 5 famous platonic solids was exemplified.

There are some limitations in the success of the methodology advocated in this article – regarding predictions, or preciseness of predictions. Especially when tackling less prominent particle mass ratios and more complicated patterns, and when averaging two different patterns having different geometric ratios. Successful matches are then not always achieved. Some aspects of the use of quarks, or the like, might help further to 'fine tune' the preciseness of many close matches. That is because the slight deviations seem related to whether a particle is charged or uncharged, has spin or lacks spin. And it would be especially helpful to discover special 'selection rules' that predict when the averaging of 2 different geometric ratios will succeed, or fail, in nearly matching a particle mass ratio. And to understand why. Further research might be helpful to help resolve those issues.

The author has attempted to probe deeply into why the methodology, as advocated in this article, works so impressively in the most basic cases. Those cases involve the simplest symmetry, and include the cases associated with the long-known 5 platonic solids. Thus, he recommends that the reader consider the following speculation: What we often regarded as 'empty space' – is really not totally empty. There is probably something like an 'electron-positron sea', or some super-rarefied so-called 'aether' out there, regardless of what it is called. And it likely momentarily forms energized ethereal sphere-like structures with 'close packing of sphere' features. And the energy of those ethereal spheres interacts with dense globs of matter to help determine the amount of energy and mass that the particle candidate will evolve with.

To keep this article's length limited, we have not pursued that causal speculation further, here. Instead, we have concentrated on our article's main theme, i.e., our matching methodology -- each geometric ratio with each particle mass ratio, and the effectiveness of that matching. [**9**]

References

[1] Littmann, C.R., "*Particle Mass Ratios and Similar Volumetric Ratios in Geometry*", J. Chem. Inf. Comput. Sci., **1995**, 35 (3), pp 579–580.

[2] Robbins, H., Courant, R., What is Mathematics?, Oxford University Press, New York, 1941, Topic 3 in Appendix for Chap. IV.

[3] The CMS Collaboration, "*Observation of a new boson at a mass of 125GeV with the CMS experiment at the LHC*", Phys. Lett. B., **2012**, 716 (1), pp 30-61.

[4] Wikipedia, the free online encyclopedia, topic "*Platonic Solid*", and noted 12-3-2016.

[5] Fukagawa Hidetoshi, Tony Rothman, Sacred Mathematics – Japanese Temple Geometry, Princeton University Press, Princeton, NJ., 2008, chap. 4, Prob. 8, p. 96, and chap. 6, Prob. 15, middle of p. 204.

[6] Semat, H., Introduction to Atomic and Modern Physics, Holt, Rinehart and Winston, New York, 1962, 4th Edit., 15-19, p 526, Table 15-1.

[7] Wheeler, J. A., with Ford, K. W., Geons, Black Holes & Quantum Foam: (A Life in Physics), W. W. Norton & Co., Inc., New York, 1998, chap. 5, 'I Try My Wings', p. 119.

[8] Wheeler, J. A., Thorne, K. S., Misner, C. W., Gravitation, W. H. Freeman and Company, 1973, Part 2, Sect. 44, p. 1202.

[9] The above article, originally dated February 2019, was revised in August 2021, mainly by inserting more reliable 'clickable' links, and by adding some standard particle symbols, like (Λ^o), for the most prominent Lambda Baryon particle. Readers comments are welcome – see email address or postal address near top of article, at time article's posting.