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Geometric Ratios that nearly match the Mass Ratios of major Particles

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Abstract

In many simple geometric patterns, when big spheres are close packed around small spheres, volumetric ratios arise, big sphere to small sphere. And in nature, there are found major particles such as the average Kaon and Pion with much greater mass than the electron mass, and thus mass ratios are noted, large mass to small. Amazingly, in many key cases, the most important particle mass ratios nearly equal the simplest geometric ratios. We present some of the most important cases below, and we explore some possible causes. It is unlikely that the close matches are just coincidence.

Key words: Particle Mass Ratios, Geometric Ratios, Platonic Patterns, Sphere Volumes

Introduction

At least three Nobel laureates have bemoaned that science cannot explain why particles have the masses that they have. The below and related works attempt to largely rectify that. In 1995, the author presented, in a prominent journal, some examples of sphere volume ratios in abstract basic geometric patterns that nearly matched prominent particle mass ratios [1]. Since then, there have been empirical advances and new discoveries in science. And the mass of the Higgs particle has been approximately determined, based on analysis of empirical data [2]. A few years after that, this author discovered a major platonic geometric ratio that nearly equals the Higgs to proton mass ratio. And he now presents that below, along with some of his other work before that. The basic simplicity of the geometric ratios resulting in the close matches is quite impressive!

Examples of Geometric Ratios and Particle Mass Ratios

In some the many 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. For more examples, click or put in browser 'URL address bar': https://www.gsjournal.net/Science-Journals/research%20PapersQuantum%20Theory%20/%20Particle%20Physics/Download/8803 to optionally read author's other article, or go to his hopefully active website articles [3].

Now **SCROLL DOWN** below, and begin:

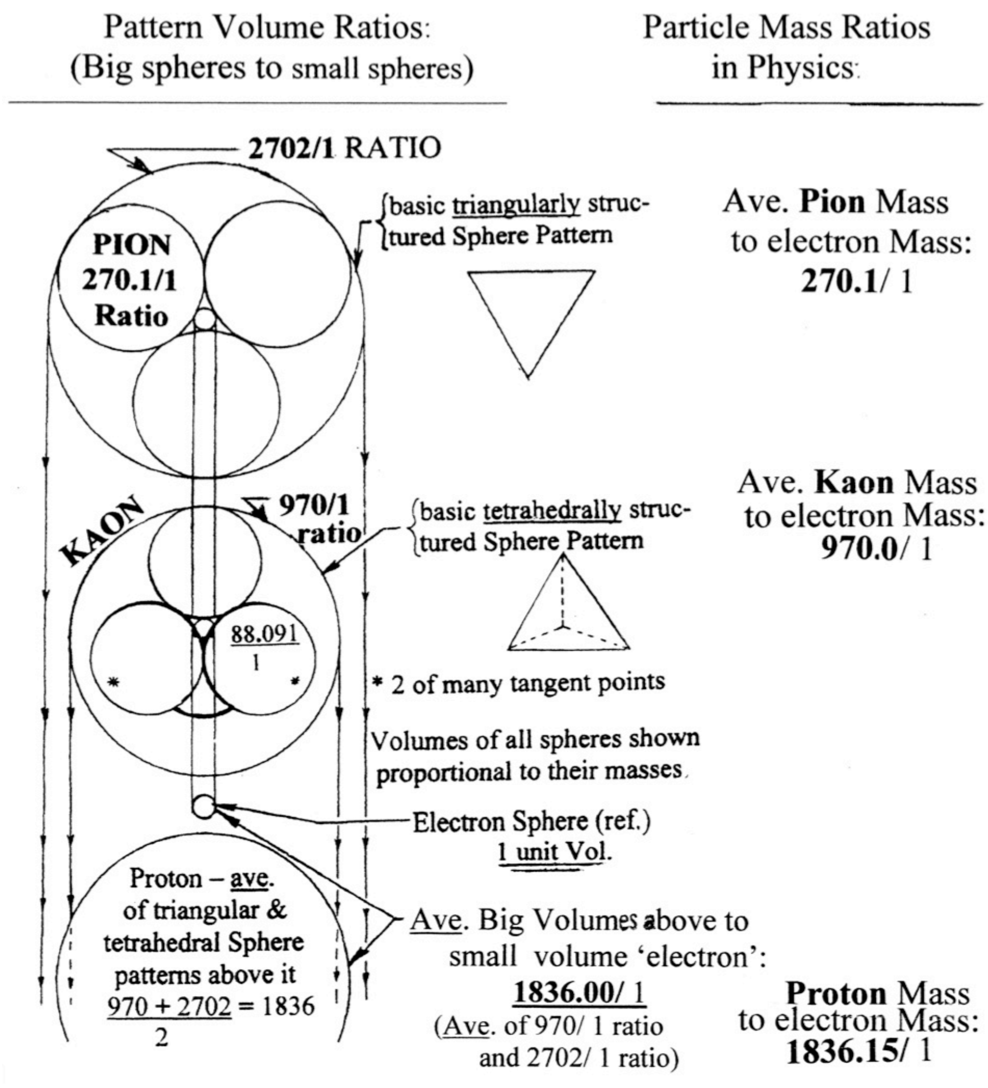


Figure 1

In the top sketch, we show 1 big sphere around 3 medium-sized around 1 small sphere. For the middle sketch, 1 big sphere around 4 spheres around 1 small sphere. Sphere volume ratios thus result, based on patterns that the mathematician, Courant, considered the most basic structure in 2 dimensions (the equilateral **triangle**) – **and** in 3 dimensions (the equilateral **tetrahedron**) [4]. We explore whether the resulting sphere volume ratios nearly match the 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 also average the sphere volumes ratios that they generate together: **(970 + 2702)/2** = **1836.00/1**, and then look for a particle mass ratio nearly matching **that**. That happens to be very near the **proton** to electron mass ratio, **1836.15/1**. And the volume ratio in middle sketch: 1 big sphere around 4 medium-sized, around 1 small sphere, gives the ave. **Kaon** particle to electron mass ratio, **970.0**/1. And in the upper sketch, 3 medium-size spheres around one small, gives a volume ratio (each medium-sized to small) equaling the ave. **Pion** to electron mass ratio, **270.1**/1.

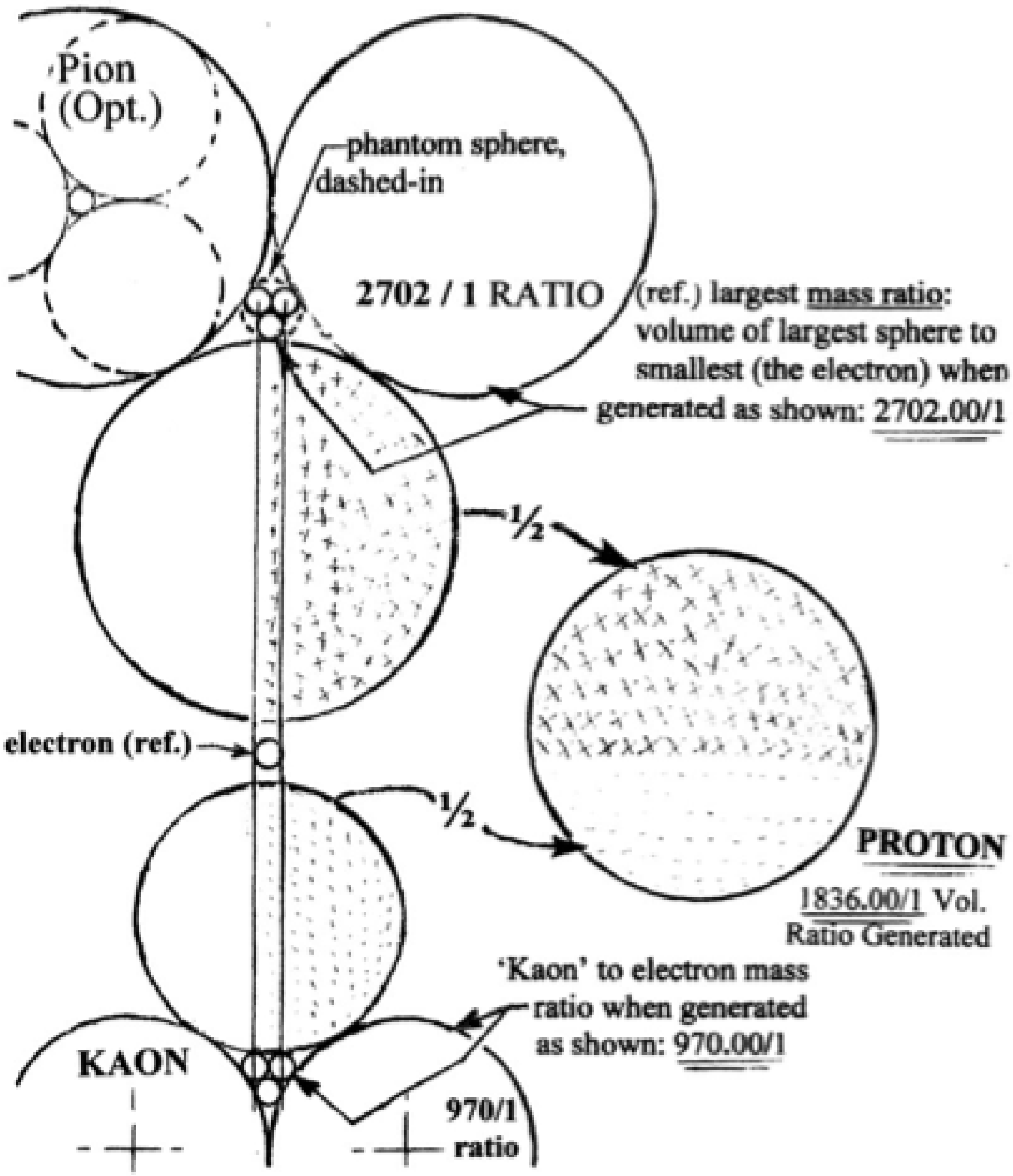


Figure 2

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, the greater the chance of finding in nature -- particles with a rather similar mass ratio. And the more closely such particle mass ratios will match those sphere volume ratios.) See first footnote for a very similar drawing by author in a prominent journal, 1995. Except Fig. 2, above, leaves out a few details for simplicity.

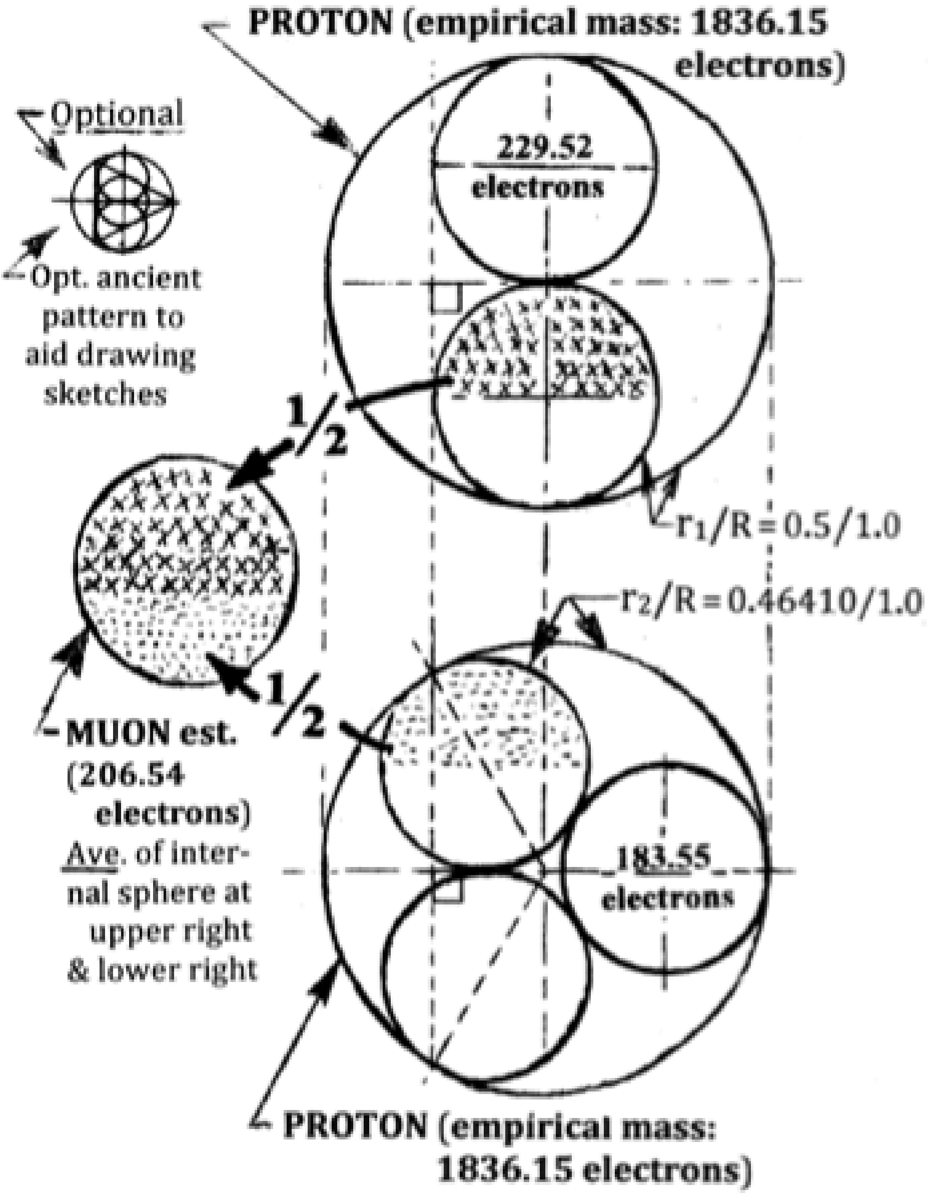


Figure 3

In the above, we attempt to nearly match a major particle mass ratio, the Muon particle to electron mass ratio. We average spheres volumes inside each of 2 protons: 1 of 2 spheres inside top proton with 1 of 3 inside the lower proton. Each proton = 1836.15 electrons.

Our resulting **estimate** gives: **206.54** electron masses, vs. **empirical** reality of **206.77** electron masses for the Muon. [(We also find, in many other cases too, that when averaging 2 different sphere volumes together (as generated from two different basic patterns) – that that often nearly matches other real particle mass ratios. But we can only address a few such cases in this limited length article.)] Averaging some other pairs of spheres in some other basic patterns also comes close to the 206.54/1 ratio result above.

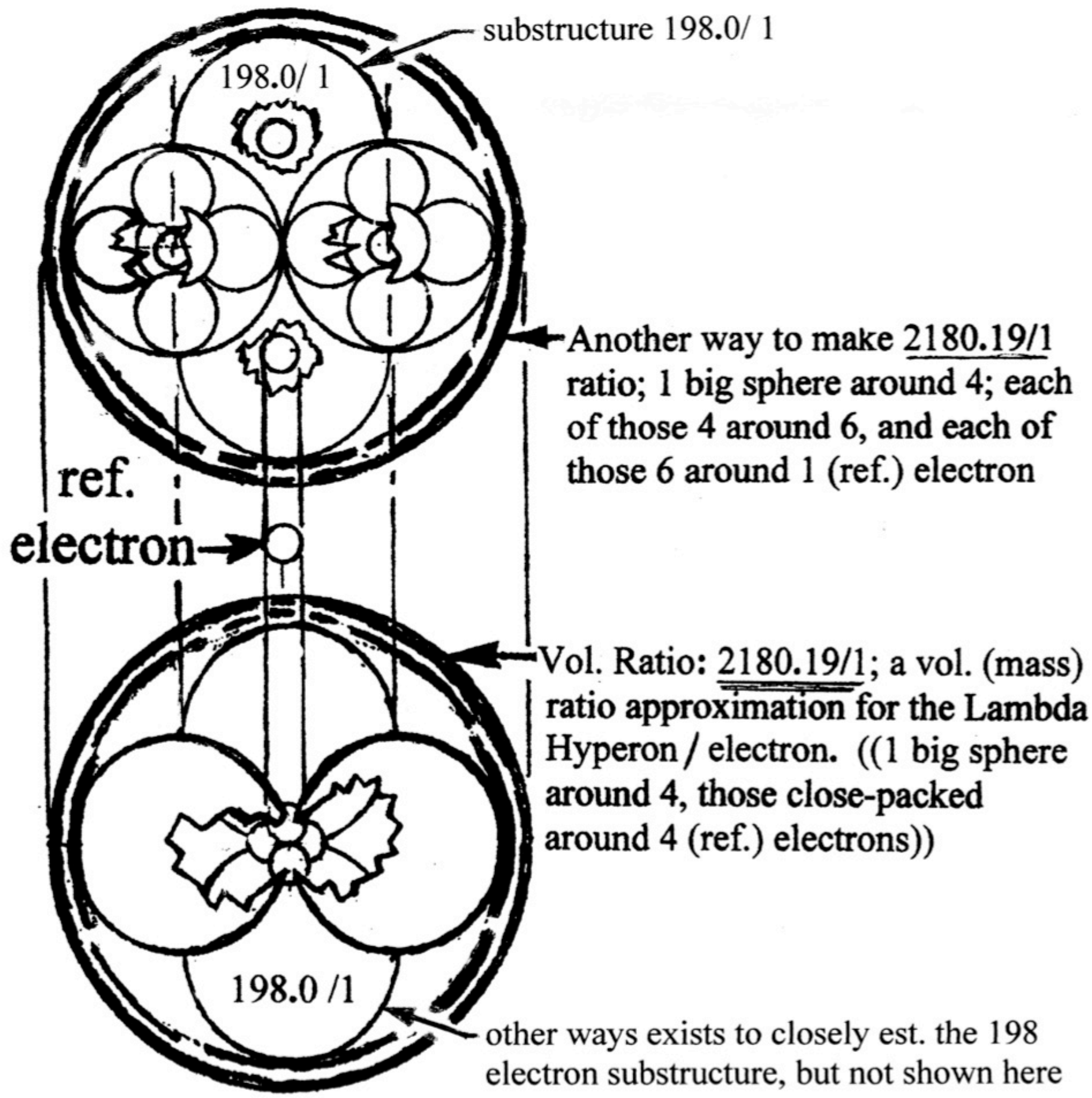


Figure 4

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 near that ratio. And we do find one! The **most prominent** Lambda Hyperon, symbol (Λ^0), 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 around 4 medium-sized spheres, and those close packed around 4 small touching spheres. The upper sketch shows the one outer sphere around 4 medium-sized, and each of those 4 around 6 platonically positioned spheres, and each of those 6 around a small sphere. All small spheres, shown above, are equal.

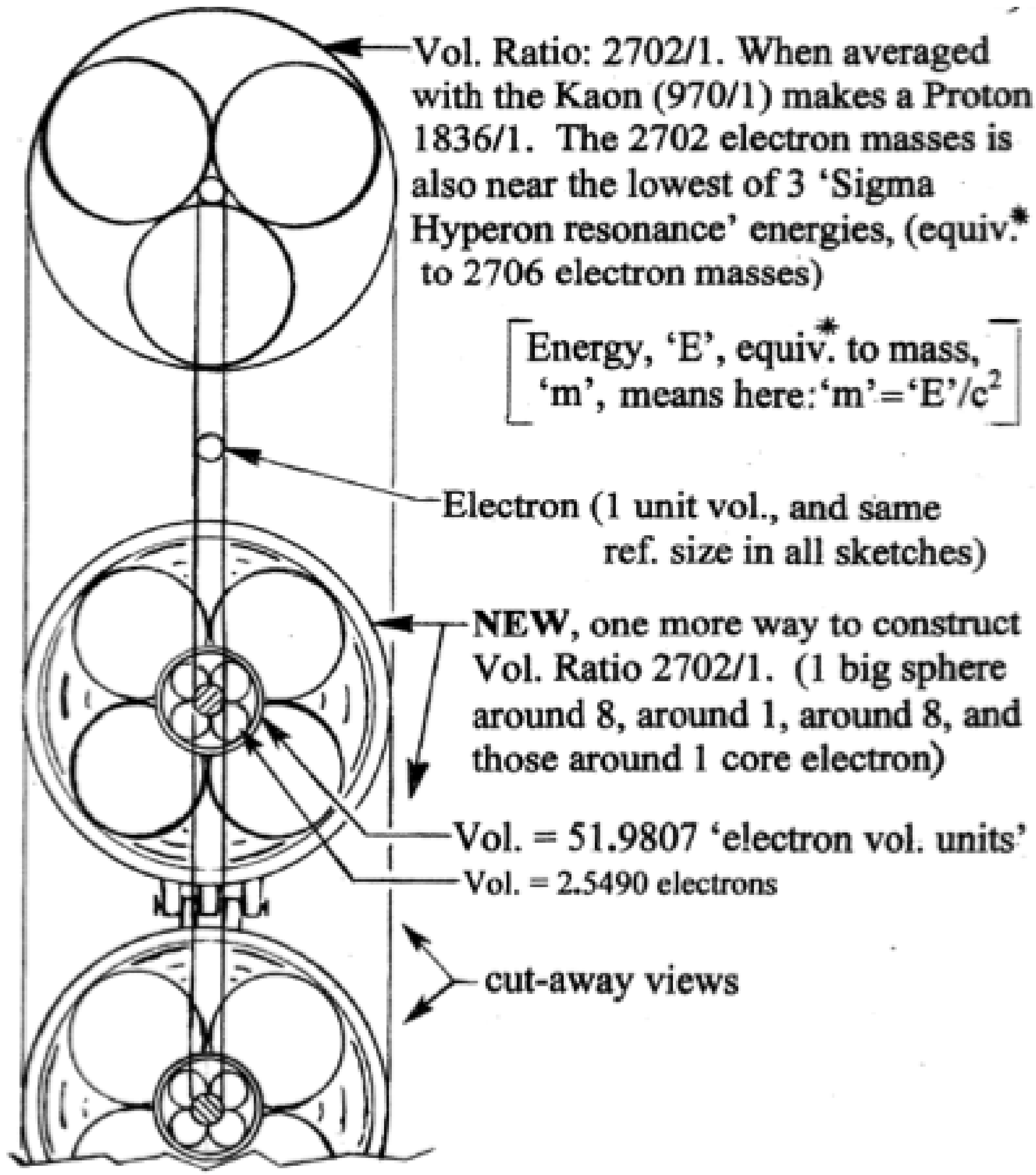


Figure 5

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.

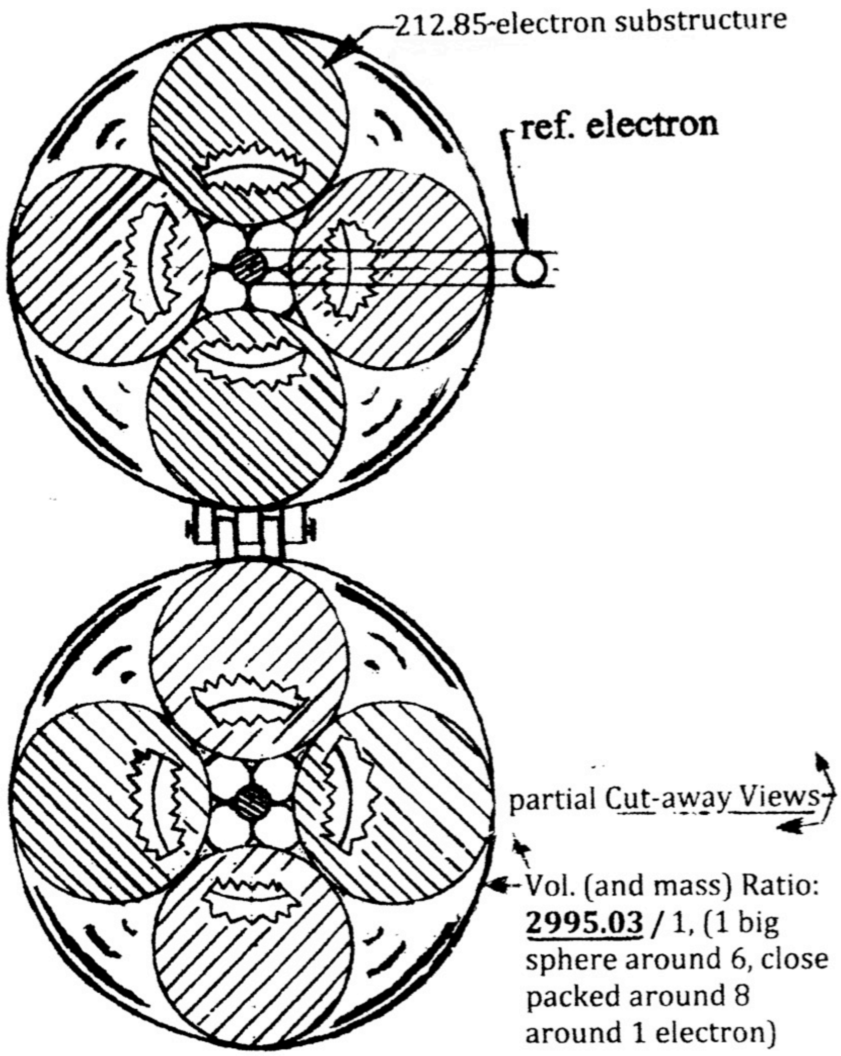
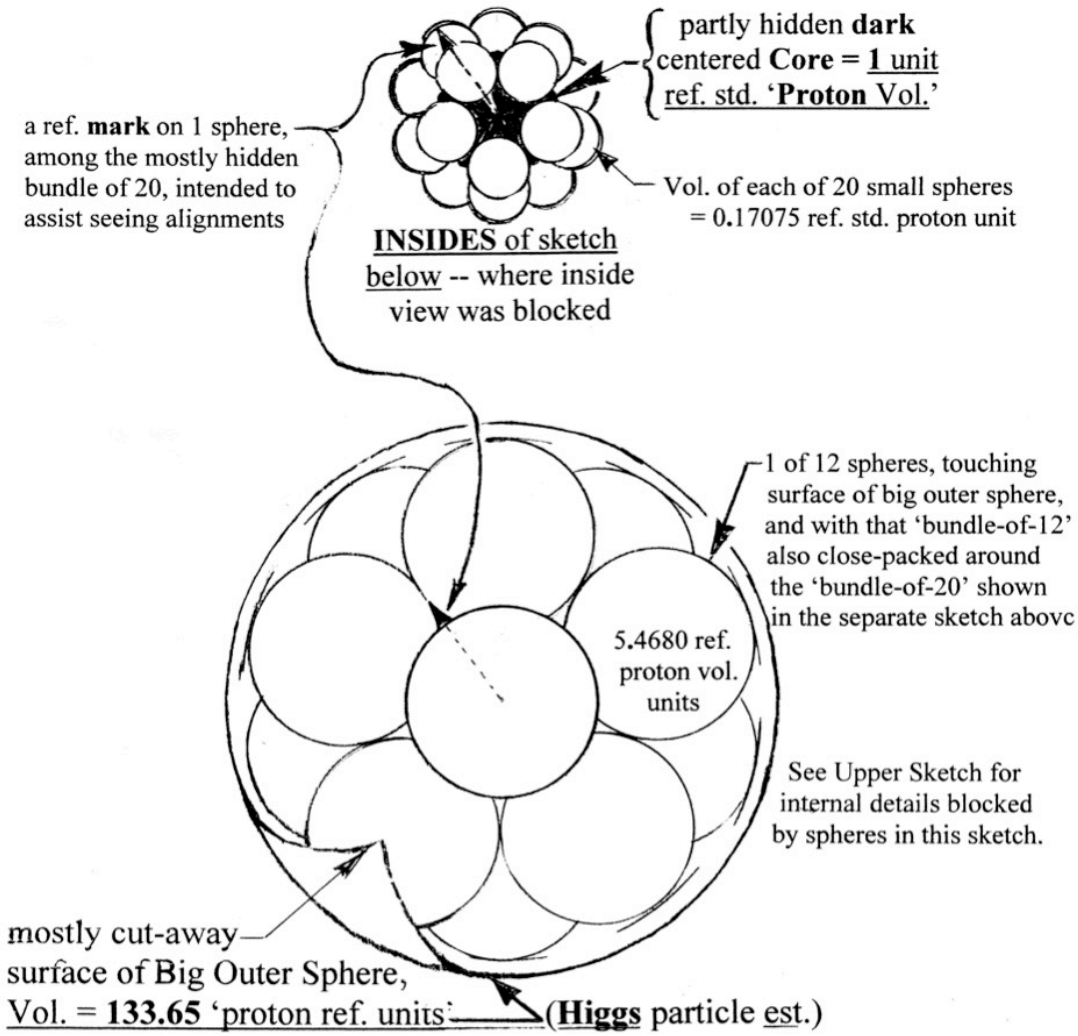


Figure 6

The 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 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.



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 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).

Additional information is provided under heading, 'Interesting Discussion', below.

Interesting Discussion

So, in a sense, the Platonic structure that was the goal of the first 8 books of Euclid, and which Plato thought god used to help lay out the universe [**5**] – also helped us here to estimate the mass of the so-called 'god' particle, the Higgs mass, a major goal of the mainstream's *Standard Model of Particle Physics*. (Our article's second footnote, previously referenced, gives more details.) The icosahedron & dodecahedron patterns are termed platonic '**Duals**'. And correspondingly, our patterns above used 12 spheres and 20 spheres -- to help us nearly match that Higgs to proton mass ratio.

The upper sphere pattern shown in the previous page (which helped us construct our Higgs mass analogy) also appears on an old tablet in an old Japanese Buddhist temple. One of the sphere patterns used in a substructure shown in our first drawing -- 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 [**6**]. 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 using other Internet searches with adequate accuracy. 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 sum 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 [**7**]. 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.

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

Important Considerations

In order for this article's methodology to work, we must assume that our different sized geometric sphere volumes are directly proportional to the different masses of the various particles. I.e., the greater the volume of one big sphere in the pattern compared to the smallest in the pattern -- the greater a corresponding particle's mass must be, compared to the small electron mass. Thus, we must also assume that a particle of great mass is made up of the same density material as a particle of very low mass, as well as all particles in between, at least under certain conditions. This is similar to Bohr's simple and early developed 'Liquid Drop Model of the Nucleus', that was rather successful. 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 for the various particles comprising the nucleus. (Or to speculate some, if the particle's mass is determined by the amount of energy of an ethereal-like sphere pattern adjacent it, then the amount of energy in that ethereal sphere is proportion the volume of that ethereal sphere.)

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.)

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 two 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 quark theory to predict how such small subtleties as 'charge' could cause an otherwise non-predicted small mass difference to occur. Or the help of a somewhat similar theory.

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) value of the target particle plus incident particle. That is – more so, 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 its 'equivalent mass' – to express it in another way.

Conclusion

There are dozens of examples where sphere volume ratios in geometric patterns (or the average of 2 such geometric ratios) – nearly equal prominent particle mass ratios found in nature. About 8 of the most interesting cases were presented here. They were selected because they exemplified the most basic patterns and, thus, their <u>geometric volume ratios</u> came out especial close to matching prominent <u>particle mass ratios</u>. Or nearly equal to a ratio, given by averaging the masses of particles comprising a prominent group of particles, all of nearly equal mass -- and as compared to a reference 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 prediction. 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 <u>not</u> 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, 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 together will succeed or fail to nearly matched a particle mass ratio. And to understand why. Further research is needed to resolve those issues.

The author has attempted to probe deeply into why the methodology, as advocated in this article, works so impressively in such basic cases. Thus, he recommends that the reader consider the following speculation: What we often regarded as 'empty space' – is really <u>not</u> totally empty. There likely is, instead, a 'electron-positron sea' or some super-rarefied so-called 'aether' matter out there, regardless of what it is called. And that it 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 energy and mass that the particle candidate will evolve with.

To keep this article's length limited, we did not pursue that speculation further, here. We elected, instead, to concentrate on our main theme, i.e., our matching methodology, each geometric ratio with each particle mass ratio, and the effectiveness of that matching.

References

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[2] 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.
[3] As of this paper's date, its author, Carl Littmann, still has a website which includes articles: http://www.causeeffect.org/articles/book.html, and
http://www.causeeffect.org/video/RatioTalk11-11-16.mp4 (for this link, allow 30 sec. to load)
Both of those above 'clickable' linked articles are among some of my website science articles at: http://www.causeeffect.org/
My above GSj article, dated December 2016, was slightly updated in July 2021, mainly by inserting 'clickable' links, and standard particle symbols, like (Λ^0), for the most prominent Lambda Baryon particle.
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