Sphere Volume Ratios in Tetrahedral and Triangular Patterns, and Some Implications

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Although not obvious, there exists a volumetric ratio among big and small spheres in two basic tetrahedrally arrayed patterns that equals a basic spheres ratio in a somewhat similar triangular pattern. We display the cases. We show how the average of two volumetric ratios, using the most basic tetrahedrally and triangularly structured concentric spheres, equals the proton-to-electron mass ratio rather precisely. We outline how some of the above relates to some chemistry and physics, and discuss implications.

1. Introduction

The author's previous papers considered only **2**-dimensional arrayed patterns when addressing basic sphere patterns and their volumetric ratios (and when comparing them with particle mass ratios) [1]. A main feature of this new paper is this: There also exists a **3**-dimensionally arrayed pattern, the most elegant and basic in its class, which when averaged together with its '**2**-dimensional counterpart', gives a volumetric sphere ratio nearly equaling the proton-to-electron mass ratio. (See Fig. 1)

A second 3-dimensionally arrayed sphere pattern, almost as elegant and basic as the first, is also displayed in this paper. And both those **3**-dimensionally arrayed patterns exhibit equal volumetric sphere ratios; and each equals a spheres ratio occurring in a basic and related **2**-dimensional counterpart [2]. (See Fig. 2, another important comparison.)

Among many things discussed is how chemists have long used the helpful concept of spherically modeled atoms packed around smaller ones. And good fits vs. poor fits! And there may be some implications for physics, perhaps slight - but interesting, when we now broaden our treatment of particles and aether to include tetrahedrally arrayed patterns.

2. Discussion

A careful look at all the Figures in this paper might help the reader skip many of the paragraphs below, but those paragraphs are provided anyway to perhaps enhance clarity.

All spheres patterns in Fig. 1 are shown 'closely packed'. The upper pattern shows one very large sphere circumscribing a triangular array of three equal medium-sized spheres, which in turn, surrounds one centered 'small' sphere. And every 'small' sphere shown in this paper is each considered that same volume.

The mass of each sphere shown in this article is considered to be proportional to its volume, and that proportionality is crucial when making relative comparisons. (Incidentally, Bohr used that same convenient concept in his 'liquid drop model' of the nucleus, i.e., the density of all material in his nucleus is regarded as the same, regardless of nucleus content – regardless of protons, neutrons, or electrons in it. And the material is also considered incompressible.)

Near the middle of Fig. 1 is shown the close-packed **3**-dimensionally arrayed 'counterpart' of the **2**-dimensionally arrayed pattern above it. That **3**-dimensionally structured pattern consists of one large sphere circumscribing four medium-sized spheres – and note that that set of 4 spheres is tetrahedrally arrayed. And those four spheres also surround a single centered small sphere.

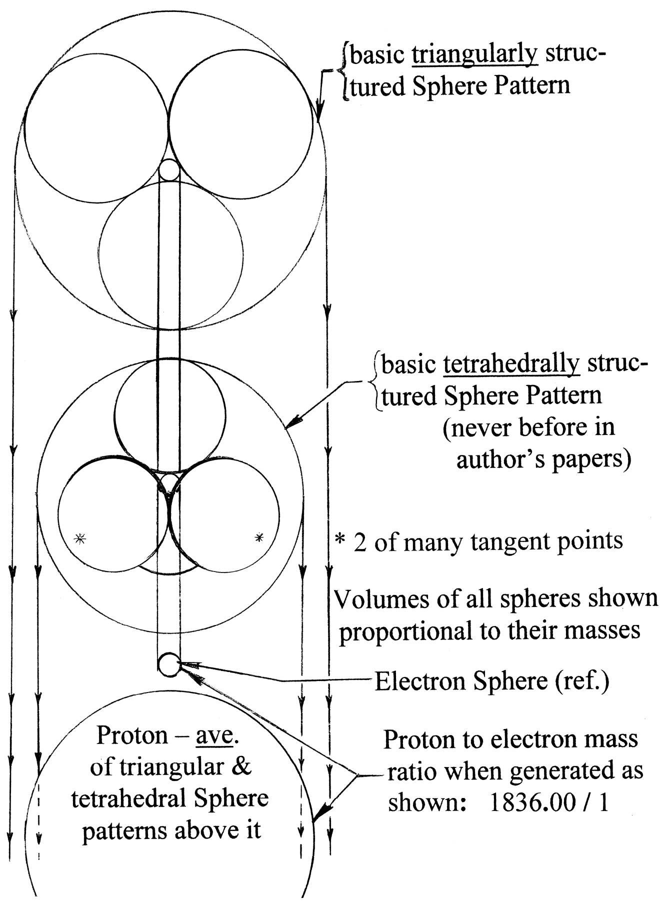

Fig. 1. Proton – the average of 2 big patterns above it

Those two very large spheres, shown near the top and middle of Fig. 1 (circumscribing the triangularly and tetrahedrally arrays, respectively); represent the most beautiful and basic spherical patterns in '**2**' and '**3**' dimensions, respectively, in this author's opinion. The volumes of those very large (circumscribing) spheres are averaged together to obtain the volume for constructing the very large sphere shown near the bottom of Fig. 1.

Suppose that the small sphere (also shown near the very large sphere at the bottom of Fig. 1) is equal to 1 electron mass, for volume comparisons. Then the relative volume of that large bottom sphere comes out to '1836.00 electron masses': (reminder – the actual empirical 'proton-to-electron' mass ratio is 1836.15 – for comparing accuracy). The significance of the pattern (near the middle of Fig. 1) was not realized in time for the author's prior papers. But he believes that its 'special beauty' – especially when shown with its special 'planar partner' above it, now justifies its presentation!

Note: In some patterns shown; part of a sphere is blocked from full view by other spheres. Sometimes, therefore, its blocked part is 'dashed-in', hoping to aid the reader. Other times, some spheres must be regarded as if largely transparent - to show clearly the important spheres behind them. (Or even 'dashed-in' and regarded as semi-transparent.) Those aids may help some, but these drawings may still fall short of ideal clarity. And lastly, there is a labeled imaginary, dashed-in 'phantom sphere', shown in Fig. 2 & 3, and drawn just to highlight certain interesting symmetries. And that may simplify the work for those wishing to 'go through the geometry-related math'.

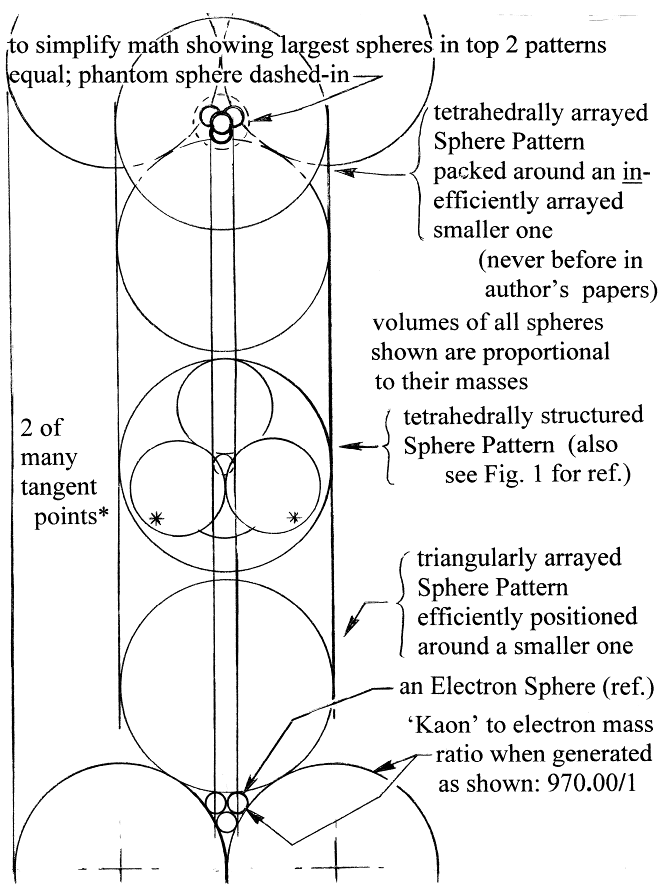

Fig. 2. Three patterns, all exhibiting one main ratio (the Kaon)

Now we shift our attention to near the top of Fig. 2. In this pattern, 4 large spheres are shown tetrahedrally arrayed. The one closest to reader is to be regarded as especially transparent. That big group of 4 is touching a group of 4 small spheres, also tetrahedrally arrayed. Each large one is touching only one small one, and only once. I.e., the tetrahedral arrays are in-line exactly with each other - a very **in**efficient packing, compared to, say, if one array's alignment was offset -- 'swiveled 30 Deg. from the other's alignment and 'turned upside down'.

Important: Note (near the top of Fig. 2) that the size of each of the four large spheres thus generated is equal to the large (circumscribing) sphere shown in the middle of Fig. 2; and equal to each of the 3 large spheres generated near the bottom of Fig. 2.

The large sphere (near middle of Fig. 2) is that elegant one (also in Fig. 1) with the four tetrahedrally arrayed spheres inside of it, which in turn surround one small sphere. And, near the bottom of Fig. 2; the centers of all spheres shown are in the same plane, i.e., a 'planar' layout. And the set of 3 equal large spheres is triangularly arrayed, and they are efficiently packed around the smaller set of 3 equal small spheres.

Lastly, 'Fig. 3' is shown to demonstrate certain symmetry shortcuts, and to remind readers of some important and still relevant patterns shown in my previous papers. That basic pattern, near bottom of Fig. 3, is also now used near the top of Fig. 1. Note, even that largest sphere, shown in Fig. 3, can be generated by two different methods, both employing planar patterns, as illustrated. (In prior papers, only the largest planar patterns in Fig. 2 & 3 were used together to make our proton.)

The author believes that the 'pattern ratios' (per his various papers) plays a causal role in creating the most basic 'particle mass ratios'. And he still believes that the more primitive **2**-dimensionally arrayed patterns may still play a stronger role than the equivalent '**3**-dimensional' patterns do -- in helping to produce a given particle mass ratio in nature. But he believes, like probably many others, that the 'tetrahedral patterns' are at least as beautiful as the triangular! And may contribute at least a little extra to particle stability. (And even may provide the readers with a better 'memory tool' in visualizing the relative high ratios of some basic particle mass ratios in physics – compared to just trying to 'memorize the numbers'.)

As shown in previous articles, the medium-sized internal spheres, shown near the top of Fig. 1, have analogies to 'Pion' masses. And the very large spheres shown near the bottom of Fig. 2 have analogies to 'Kaon' masses. And, similarly, the very large spheres shown near the top and middle of Fig. 2 now also share that analogy - now that we realize each equals the large spheres shown near the bottom of Fig. 2. (See [2])

3. Some Implications and Related Remarks

The relative 'Radius Ratio' of different atomic spheres is important in chemistry textbooks; and used in modeling, applications, and treating several topics, including 'dimorphism' and 'ligancy' in crystals [3]. For example, the question is asked: "how many 'anions' can surround a centrally located 'cation', neatly?" Pauling considers, in his textbook, the special characteristic of silicon tetrafluoride, where the radius ratio fits well by using a tetrahedral pattern – compared to other patterns. See ideal pattern near the middle of Fig. 1 (its 4 internal medium-sized spheres surrounding the small centered one). Pauling also considers radius ratio for germanium dioxide, which is midway between fitting two patterns, and thus it is dimorphous. It has 2 different crystal structures. (Might Fig. 1 resonate between two?)

Thus Pauling shows how resulting strain or 'comfort' (based on actual spherical sizes of atoms, their relative radii, and pattern options attempted) greatly aids in predicting the resulting crystal structure. And also its relative chemical and physical realities -- not otherwise predictable!

So, at least down to the small sizes of atoms**;** the spheres' 'radius ratios' (and thus 'volumetric ratios' and patterns) are of long standing importance, and a practical consideration! So when we attempt that sort of thing, here, (comparing 'spherical volume ratios in patterns' to 'particle mass ratios') that should seem a rather natural extension of science to consider, and not just a baseless, arbitrary theoretical sojourn.

4. Optional – Some Symmetry Shortcuts

A few of the spheres, although appearing in varied patterns, may be easily shown to be equal – if we note certain symmetries. And then write and solve equations involving equal proportions. (That might helpfully bypass using other math 'tools' in some cases.)

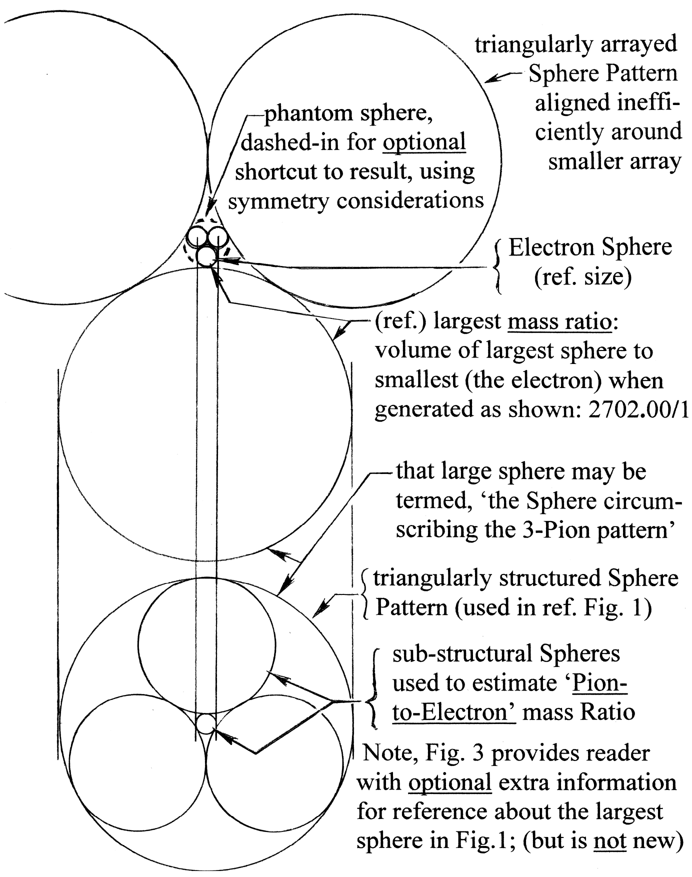

Fig. 3. Two ways to make the largest sphere in Fig. 1.

First we prove all big spheres equal in Fig. 3 (the simplest case): Note, the 'Phantom sphere' size is 'dashed-in' to help see symmetries. Here "dwg' means drawing.

$$\frac{\text{Big Sphere at top of dwg}}{\text{Phantom sphere}} = \frac{\text{'Pion' sphere at bottom of dwg}}{\text{the small centered electron}} \quad (1)$$

$$\frac{\text{Phantom sphere}}{\text{a small electron in pattern}} = \frac{\text{Big Sphere at bottom of dwg}}{\text{'Pion' sphere at bottom of dwg}} \quad (2)$$

Eliminating the Phantom Sphere from both equations and simplifying; we obtain the result: Big Sphere at bottom of Fig. 3 equal to each Big Sphere near top.

Now for Fig. 2; (more difficult to draw than Fig. 3; and our '**shortcut**' applies only to proving big spheres equal for the pattern near the '**middle**' and near the '**top**' of Fig. 2). Note, the 'Phantom sphere' size is again 'dashed-in', but surrounds and touches 4 small 'electron spheres', not 3, although difficult to show. A Big Sphere near top of dwg. / Phantom sphere = an internal 'medium-size' sphere near the center of the dwg., that we'll call a 'Peon' / the centered electron**.** Phantom sphere / a small electron near top of dwg. = Big Sphere near the center of dwg. / a medium-sized 'Peon' sphere. Eliminating the Phantom sphere from both equations and simplifying; we obtain the result**:** Big sphere near middle of Fig. 2 equals each Big sphere near top.

(The author sees no comparable, great symmetry shortcut for comparing the pattern at the bottom of Fig. 2 with the two patterns above it. In fact, he was emailed proof of the equality of all three pattern ratios in Fig. 2 before he realized the equalities, and long before devising partial shortcuts in above paragraphs.)

5. Conclusion

In a previous paper, the author showed that "basic particle mass ratios nearly equal 'basic geometric volume ratios in **2**-dimensionally arrayed patterns'." "And that that likely had causal implications -- even without the need to consider greater geometric complexities." The present article broadens that perspective, by showing that some basic **3**-dimensionally arrayed patterns also exhibit some of those same volume ratios. And particularly, one beautiful tetrahedrally structured example that is analogous to its triangularly structured counterpart. And by averaging analogous volume ratios in those patterns, the same close estimate of the proton-to-electron mass ratio is obtained as was obtained in the author's previous papers.

That may strengthen the proposition that all ethereal space may tend toward a 'quantized structuring' and sub-structuring; and that may follow along basic patterns. And that might further help to stabilize the particles involved in the various basic particle mass ratios of physics, more so than otherwise.

We outlined long-standing analogous and useful approaches in chemistry, based on the 'radius ratios' of different atoms. We also noted some non-obvious symmetries to shortcut math and to show how some patterns fit into others. In fact, some of those symmetries seem to argue for a 'fractal' ethereal space. Author's past and present papers imply that the electron and other major physics particles are related by patterns, contrary to some aspects of the current 'Standard Model of Particle Physics'.

References

[1] C. R. Littmann, "Why some Particle Mass Ratios Nearly Equal Geometric Pattern Ratios", *Proceedings of the NPA* **7**, 282-294 (2010).

[2] Greg Volk's collection of calculations, pictures, and 'Mathematica files' sent to author, Apr., 2008 and Nov., 2009..

[3] L. Pauling, **General Chemistry**, Radius Ratio, Ligancy, and the Properties of Substances, 18-2, pp. 614-621 (Dover Publications, Inc., Mineola, N.Y., 1988)