# Is Ratio 3:1 a Comprehensive Principle of the Universe?

Logic of Tetrahedron

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**Abstract**
This paper presents examples of physical evidence supporting the ratio 3:1 as a principle of the Universe. The concepts of Metasymmetry and Broken Metasymmetry (BM) are introduced. The 3:1 Ratio has been found as a numerical measure of BM. Finally, an attempt has been made to explain BM as total effect Bose - Fermi mixture.

There are several different physical facts, which have the same abstract property. We call these facts "broken tetrads". In a broken tetrad, 4 elements are splitting to ratio of 3:1.

Examples of the broken tetrads:
Space is three-dimensional, Time is one-dimensional. Only three elementary particles in nature are stable with a half-integer spin (fermions): (protons, electrons, neutrons). One is stable with an integer spin (boson-photon). Hydrogen is the most abundant of the chemical elements. Helium is the second lightest element and is the second most abundant in the observable Universe. Systems consisting of **n** fermions behave as a fermion or a boson depending on whether **n** is even or odd. This predisposes hydrogen or helium to correspond to fermions or bosons. Hydrogen and helium are estimated to make up approximately 74% and 24% of all baryonic matter in the Universe respectively. This totals 98% and is almost exactly a 3:1 ratio.
Beta minus decay is where one neutron converts into a proton, an electron and an antineutrino. Beta plus decay is where one proton converts into a neutron, a positron, and a neutrino. These both form 3:1 ratios. (Note: these are all fermions).

In the standard theory of electroweak interaction, bosons (W+, W-, Z) have a mass, however a photon doesn't. This forms another 3:1 ration. (Note: these are all bosons.)

Three of the four fundamental interactions (strong, electromagnetic, and weak) are relatively similar in value, but differ greatly from the gravitational force. This again forms the 3:1 ratio.

The contents of the Universe comprise of three elements: natural matter (NM), which is atoms, the building blocks of stars and planets; dark matter (DM), which is responsible for the present-day acceleration of
the universal expansion; and dark energy (DE), that acts as a sort of an anti-gravity force. NM comprises 4% of the Universe, DM comprises 22% of the Universe, and DE comprises 74% of the Universe.

NM = 4%; DM = 22%; DE = 74%;
NM+DM = 26%; DE = 74%;
Matter = 26%; Energy = 74%;

DE / NM + DM = 3:1 (approximately)
Energy:Matter = 3:1 (approximately)

Is ratio 3:1 a fundamental property of the Universe?

**Is there one reasonable foundation for all these testimonies?** This is an attempt to show it.
Consider the concept of discrete-continuous symmetries. There are two different kinds of symmetries: discrete and continuous. The basic difference between them is that discrete symmetry transformations are static symmetries (i.e., reflections, parity, etc.). They do not demand motion or change over time. In contrast, continuous symmetry transformations are dynamic symmetries. They demand motion (i.e., rotations, translations, shifts, etc.) and change over time.

Now consider the question: does there exist a universal symmetry, which includes both symmetries, discrete and continuous? I believe there does exist a unified symmetry, which includes both symmetries, discrete and continuous, and I call it meta-symmetry.

This is an idea inspired by John Wheeler's article "It from bit" [1]. Let us now attempt to represent discrete symmetry and continuous symmetry by minimal means, using at least two symbols: 0 and 1. Then, it follows that the minimal discrete symmetry may be represented as 1 0 or 0 1, and minimal continuous symmetry as 1 1. Note here that we used some approximation, without which our reasoning would be impossible.

Returning to symmetry, between the discrete and the continuous we may use representations 01 11 or 10 11 or 11 01 or 11 10. This allows a general conclusion to follow: the total number of unities to zero makes up the invariant ratio of 3:1. Therefore, the best model of meta-symmetry is a tetrahedron with four faces where each face is a triangle. This means that when a tetrahedron comes to rest on a flat surface, there is one closed side and three open sides; three vertexes lie in one plane, while the fourth is not. As a result of this, any tetrahedron can also be proof of the ratio of 3:1. I call this the ‘logic of the tetrahedron.’

At first glance, this concept of discrete-continuous symmetry and the concept of symmetry-anti-symmetry have nothing in common; however, when we try to compactly describe them, we can see that the two concepts are the same. Any pair of discrete-continuous symmetries looks like a pair of symmetry (11) and anti-symmetry (01 or 10) when represented in the same symbolic form: 01 11; 10 11; 11 01; or 11 10.

What, then, can be said about meta-symmetry? Meta-symmetry is a metastable symmetry; when it falls apart, then the 3:1 effect emerges. The effect most likely emerged simultaneously with the origin of the Universe. Therefore, ratio 3:1 is the numerical measure of broken meta-symmetry. I suggest that 3:1 (examples #1,#2,#3) is enclosed in a total interaction of Bose and Fermi particles or fields, and it is a bootstrapping relationship between mentioned evidences.

**I suggest that the ratio 3:1 (as given in examples 1, 2, and 3) is enclosed in a total interaction of Bose and Fermi particles or fields, and it forms a bootstrapping relationship between the elements mentioned**.

Surprisingly, the container (space-time), content (fermions-bosons), and content(energy-matter) all obey the same law of 3:1.

Furthermore, examples 4 and 5 are confirmations of ratio 3:1 in fermions and bosons, respectively.

Example 6 may imply that the gravitational force is different (perhaps not fundamental), similar to "induced gravity" proposed by Andrei Sakharov.

Finally, perhaps the puzzle of example 7 is explained by the previous examples combined.

My hypothesis is that the 3:1 effect consists in total of interactions between symmetrical (Bosons) and anti-symmetrical (Fermions) wave functions. Consider the analogy of fields with geometrical concepts which was published in my article "Geometry of microworld" [3]. In this article, the formal analogy between the properties of non-Euclidian geometries was shown on one hand, and the properties of fermions and bosons on the other hand.

Below is the essence of this analogy. Translation from Russian:
"According to contemporary ideas, the spin of elementary particles is a mysterious intrinsic angular momentum of a particle, for which it is impossible to create a somewhat real physical picture. In the absence of a spin visual picture, in the opinion of a number of authors, leaves a regrettable gap in the quantum mechanics interpretation. On the other hand, there are highly developed geometrical disciplines which are difficult to apply to specific physical theories owing to the fact that it is not always possible to point out the objects to which the geometrical notions could corresponded to. We point out one analogy, which, in our view, can testify to the geometrical interpretation of spin as a sign of the curvature of space."

According to the Pauli principle, two identical particles with half-integer spin (fermions) can't (NO - 0) occupy the same quantum state; however, many (infinite) particles with integer spin (bosons) can occupy the same quantum state. This means that two similar fermions can't be found in the same point, but for bosons the opposite is true.

This is a most remarkable fact: the same space can't contain more than one particle of a certain kind, but it can contain an infinite number of another. This gives a clue that spin has some geometrical meaning. Speaking metaphorically, the spin in one case creates a very "tight" space, and in another case, it creates "spacious" space. Why is this so? There is the need to search for the answer to this in geometric concepts.

We proceed to geometry and recall some facts reminding us of the situation with fermions and bosons. It is well known that besides Euclidean geometry, there are other geometrical systems (i.e., hyperbolic, elliptic, etc.). Furthermore, according to Klein's interpretation, based on projective geometry, the Euclidean, hyperbolic, and elliptic geometries are in the unified scheme. The most known indication to identify two geometries are: in elliptic geometry, there exists NO (0) parallels to a given line which cannot cross the given straight line (analogous with fermions); in hyperbolic geometry, MANY (infinite) other extending straight lines pass the given straight line (analogous with bosons); finally, in the Euclidian case, there i 1 straight line. This equates to 0, 1, and infinity

Fermions have an anti-symmetrical wave function, elliptic geometry, and positive Gauss curvature surface (membrane).

Bosons have a symmetrical wave function, hyperbolic geometry and negative Gauss curvature surface (membrane).

There is nothing in common between same quantum state (physics) and parallel (geometry). The analogy is not proof, but the suspicion arises that spin is a sign of an elementary particle pointing to its non-Euclidean nature. Perhaps the zero curvature and three dimensions of space develop by mixing the positive and negative curvatures of surfaces (membranes) created by fermions and bosons? Maybe this is the key to understand "space foam" contrary to "spacetime foam." I admit that these records are sketchy; nevertheless, they deserve attention.

Of course, the additive approach of (3+1 dimensions) space-time has resolved many problems of modern physics and has been very fruitful; however, recognition of splitting the approach 3:1 can give a better understanding of nature.

John A. Wheeler was characterized as a physicist, philosopher, poet, visionary, and guru in "New Scientist", April 15, 2008. I would like to recall a quote by John: "Behind it all is surely an idea so simple, so beautiful, that when we grasp it - in a decade, a century, or a millennium - we will all say to each other, how could it have been otherwise? How could we have been so stupid?" [4]

Other versions of this quote are: "How can we have been so blind for so long?" "Some day a door will surely open and expose the glittering central mechanism of the world in its beauty and simplicity," and "I don't know whether it will be one year or a decade, but I think we can and will understand. That's the central thing I would like to stand for. We can and will understand."

**Perhaps all of what is said above confirms the predictions of this great visionary?**

References:


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3. Misner, C.W., Thorne, K.S., Wheeler, J.A. 1972. Gravitation. Princeton University Press. p.1197