Geometric hypothesis on the shape of matter

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Abstract

Assuming the Riemann Hypothesis serves as a mathematical explanation for physics, I have deduced the following two points:

1. If the Riemann Hypothesis originates from number theory and the mathematics describing matter is based on number theory, then matter must begin as a singularity.
2. The number π^2/6, derived from the Basel problem which initiated the Riemann Hypothesis, must be a numerical description of matter.

Building on these two points, my hypothesis evolves to propose that all matter is composed of two-dimensional photons, existing throughout the universe as a medium. This material folds in a three-dimensional "Paper folding" manner to form protons and electrons.

1. The Beginning of Hypotheses and the Shape of Matter

"Know the truth not by blind faith but through your own intuition and experience."

While exploring physical theories, I sought to understand protons, neutrons, and electrons, but ended up more confused about what is what.

I wondered why it's so difficult to comprehend. Upon reflection, I realized that both major theories of matter don't mention the shape of matter. The Standard Model treats particles as mere zero-dimensional points, and String Theory interprets particles as appearing different based on the vibration patterns or frequencies of strings, which also doesn't precisely describe the shape of matter. Could the difficulty in understanding be because we can't imagine the shape of matter?

As a biologist, I understand that the shape of a substance determines its function. The reason a rod-shaped bacterium is rod-shaped is because it has grown in length towards a certain direction. Without directionality, microbes typically take on a spherical shape. The reason hemoglobin can carry oxygen is due to the shape of the protein, and many structural biologists strive to determine the shapes of proteins because shape dictates function.

Up until classical physics, the same logic seems to apply, but as we move into quantum mechanics, the shape of matter seems to become something we are not supposed to imagine, as it's hardly ever mentioned. Many texts represent particles as spherical, and the nucleus as clusters of these spheres, like grapes bunched together. But is that representation accurate? If protons and neutrons are randomly attached, shouldn't the properties of matter change depending on the shape they form?

So, are we not supposed to imagine the shape of matter?

From a quantum mechanical perspective, we are told not to think of the shape of matter in concrete forms. In quantum mechanics, subatomic particles do not have a fixed 'shape' or 'form' in the traditional sense. Their behavior and properties are explained through wave functions and probabilistic interpretations.

1. Wave-Particle Duality: One of the core principles of quantum mechanics, wave-particle duality, means that subatomic particles act like waves in certain situations and like particles in others. This makes it difficult to understand particles as having a fixed shape in the traditional sense of physics.
2. Uncertainty Principle: According to Heisenberg's Uncertainty Principle, the position and momentum (velocity) of subatomic particles cannot be accurately known at the same time. This means that defining a particle's 'exact position' is fundamentally impossible.
3. Quantum Superposition: Subatomic particles can exist in a 'superposition' of multiple possible states and are not determined to be in a specific state until observed. This characteristic of superposition contradicts the concept of a particle having one concrete shape at any given moment.
4. Probabilistic Interpretation: In quantum mechanics, the position, velocity, and other properties of particles can only be predicted probabilistically. This indicates that determining a particle's 'shape' requires a probabilistic approach rather than a deterministic one in the classical sense.

For these reasons, thinking of subatomic particles as having concrete shapes like classical objects does not align with the principles of quantum mechanics. Instead, subatomic particles should be understood through their wave functions and possible states, presenting a significant limitation to imagining the shape of matter.

Could these constraints be why understanding particle physics is difficult?

While exploring various quantum mechanics textbooks and resources amidst these constraints that make understanding difficult, I came across discussions on the connection between the Riemann hypothesis and physics.

The Riemann hypothesis is one of the most important unsolved problems in mathematics, particularly in the fields of number theory and complex analysis. Proposed by the German mathematician Georg Friedrich Bernhard Riemann in 1859, the hypothesis concerns the fundamental properties of the distribution of prime numbers. To understand the Riemann hypothesis, one must first grasp the concept of the Riemann zeta function, which is defined as follows for complex numbers s:

$$\zeta(s) = \sum_{n=1}^{\infty} \frac{1}{n^s}$$

The Riemann hypothesis concerns the zeros of the Riemann zeta function in the 'non-trivial' region of complex numbers, where the function takes on the value of 0. The Riemann zeta function has a 'trivial' zero at s=1. Riemann conjectured that the non-trivial zeros of this function lie on the 'critical line' $\Re(s)= 1/2$, meaning that the real part of all non-trivial zeros is 1/2.

And The expression representing the probability that the distance between two roots of the Riemann zeta function is u is

$$R_{\zeta,2}(u) = 1 - \left(\frac{\sin(\pi u)}{\pi u}\right)^2$$

The expression representing the probability that the energy difference between two particles is r is:

$$R_2(r) = 1 - \left(\frac{\sin(\pi r)}{\pi r}\right)^2$$

As the equivalence between the two equations became known, mathematicians and physicists have been exploring this problem. I've become aware of the resemblance and proof between the Riemann hypothesis and physics, but I'll leave that to others.

For now, I've assumed that the mathematics of the Riemann hypothesis explains physics, and I've contemplated the following two aspects.

1. The Riemann Hypothesis is a problem derived from number theory.
2. The number $\pi^2/6$, which originated from the Basel problem

The Riemann hypothesis is derived from number theory, so assuming that physics is based on number theory, I thought about the following.

While we naturally count numbers and perform arithmetic operations, let's assume this is represented by some physical substance.

Let's call this substance "A," which would be the original substance, so we can set all physical quantities of A (volume/mass, etc.) to 1.

If A has a physical quantity of 1, is it possible for another substance, let's call it "B," to have a physical quantity of 2 compared to all of A's physical quantities? Instead, wouldn't it be more appropriate for B to have a quantity of 2, but only in terms of AA? If a substance has more than two components, it would be very rare for it to have physical quantities that are integer multiples.

Therefore, if number theory represents physics, then...

"Matter begins as one."

The hypothesis is not particularly unusual, considering that string theory also claims that all matter is composed of one fundamental string, although its starting point may differ.

The second, Basel problem, is the question whose answer is π^2/6.

$$\sum_{n=1}^{\infty} \frac{1}{n^2} = \frac{\pi^2}{6}$$

Then, could π^2/6, the result derived from the Basel problem, also represent some physical quantity?

Continuing this line of thought, I scribbled various doodles in my notebook and ended up drawing π^2 as a square, which I divided into six equal strips.

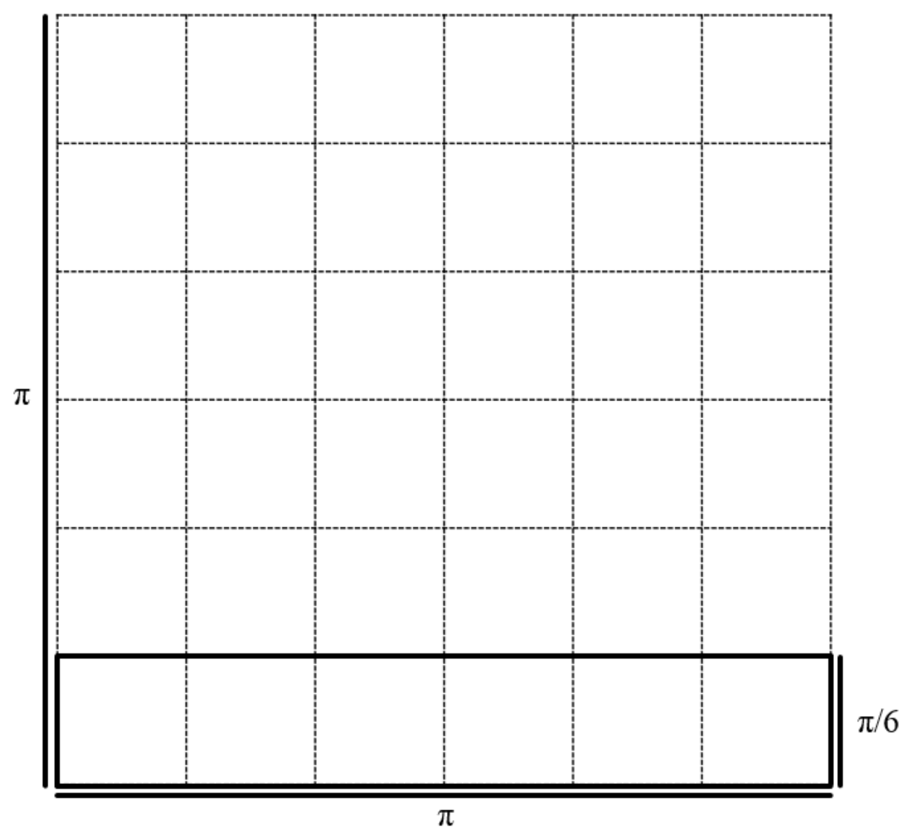

Figure 7. A strip shape covering 1/6 of a square with one side of length π

Could this strip represent an area or shape, as the Basel problem deals with sums of numbers?

Even though I think I'm making too many leaps…

If it's this shape, I wondered if there might be some physical significance. Then I thought, what if I divide π^2/6 by the Planck length, which is considered the smallest physically meaningful length?

Planck length : 1.616255(18) × 10^-35 m

Although pi is an irrational number, when considering math.pi (3.141592653589793) with up to 15 decimal places and dividing the Planck length by π^2/6,

0.982456, 0.982456 × 10^-37 m

The result was: It may be a coincidence that this number came out, but the fact that the result was close to 1 gave me the impetus to continue my next thought.

If this strip has pressure or tension, it can tilt and create a shape like the picture below.

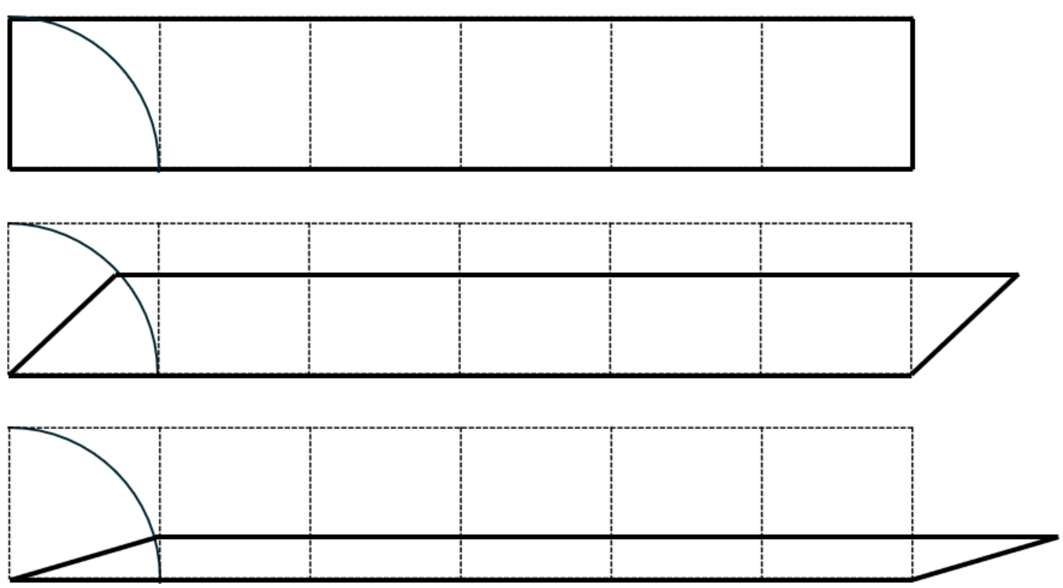

Figure 8. Deformation of the band due to pressure or tension

I considered that even if this ribbon-like shape were the fundamental form of matter, it would need to be in a three-dimensional form to possess mass. I pondered what kinds of three-dimensional shapes could be possible through a **'Paper Folding'** technique.

I realized that for a three-dimensional shape to form, the surface could only be triangular, so I considered shapes that could be formed with one surface being a triangle.

Considering the conditions below, I thought about a three-dimensional shape that folds according to the angle at which the strip can be tilted under tension/pressure.

1. Even if the shape is tilted, maintain the height of pi/6.
2. The number of squares inside must be even. (To maintain the shape of the parallelogram)
3. One strip must be folded to create a three-dimensional shape.
4. Make sure the folded shape continues. This is called 'internal wavelength'.
5. The part that sets the height is named 'amplitude'.

Among 5 shapes

1. A shape in which 12 squares fit within the length of pi to form a tetrahedron.
2. The shape of 8 squares within the length of pi to create a triangular hexahedron.

It was hypothesized that the tetrahedron is the shape of the" Proton", and the triangular hexahedron is the shape of the "Electron".

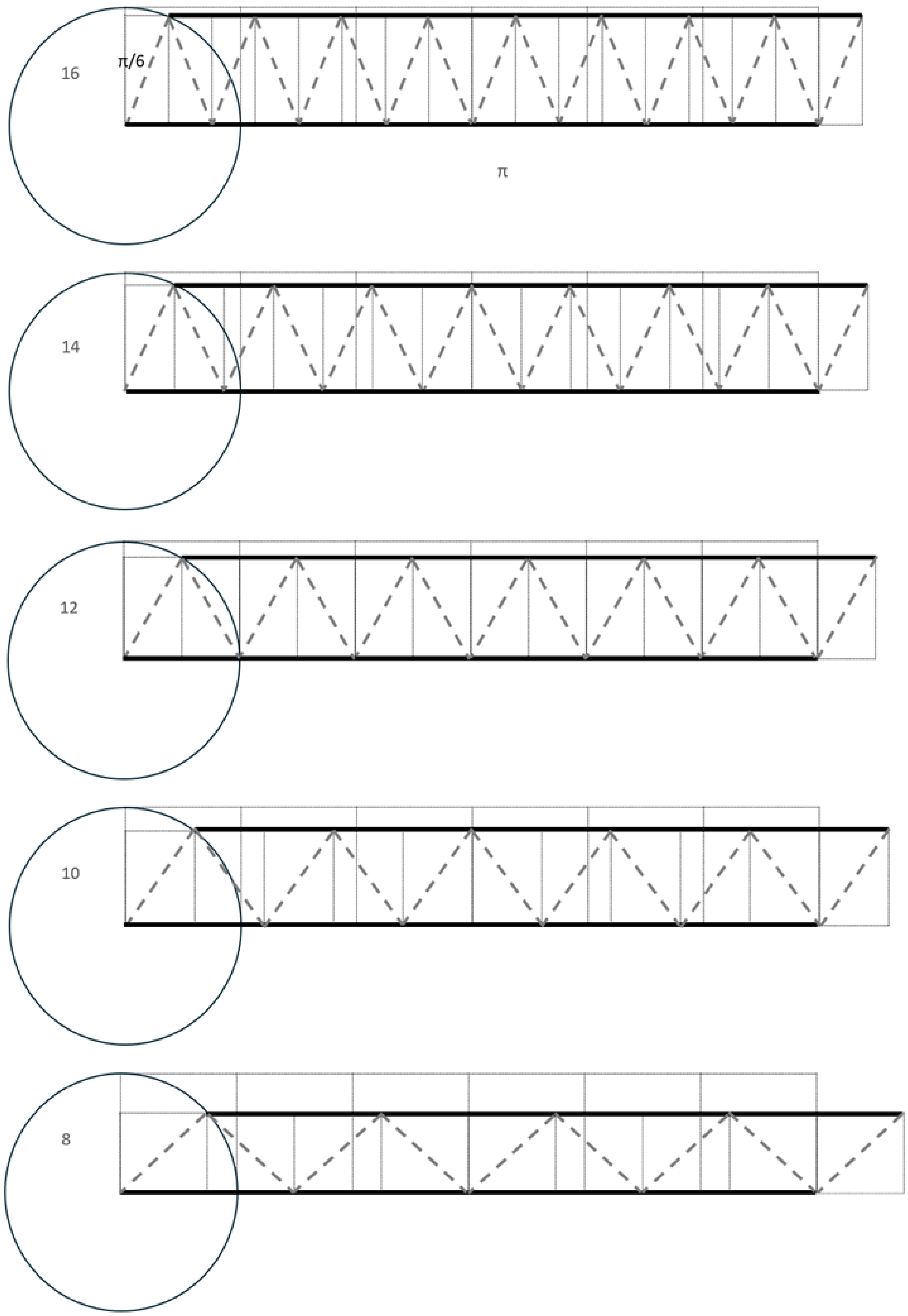

Figure 9. Five foldable shapes depending on the tilt angle. The “internal wavelength” is shown as a gray dotted line, and the “amplitude” is shown as a thick black line.

About the tetrahedral shape that is thought to be the shape of the Proton.

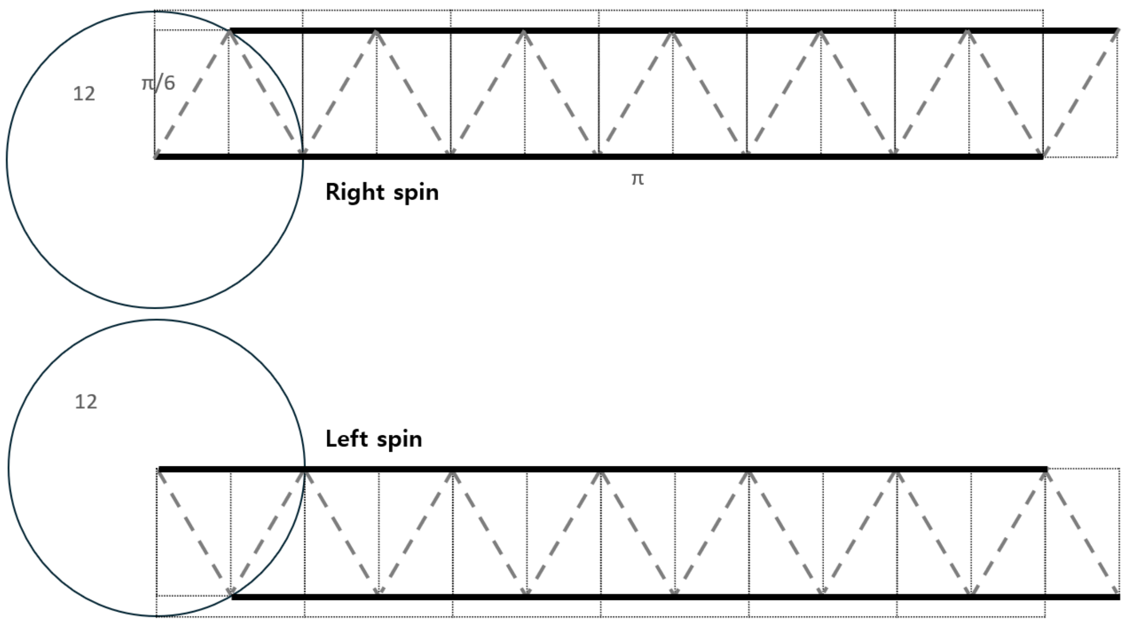

Figure 10. Floor plan created by 12 equilateral triangles. The top has a right spin and the bottom has an opposite spin. If the top is a proton, the bottom is an antiproton.

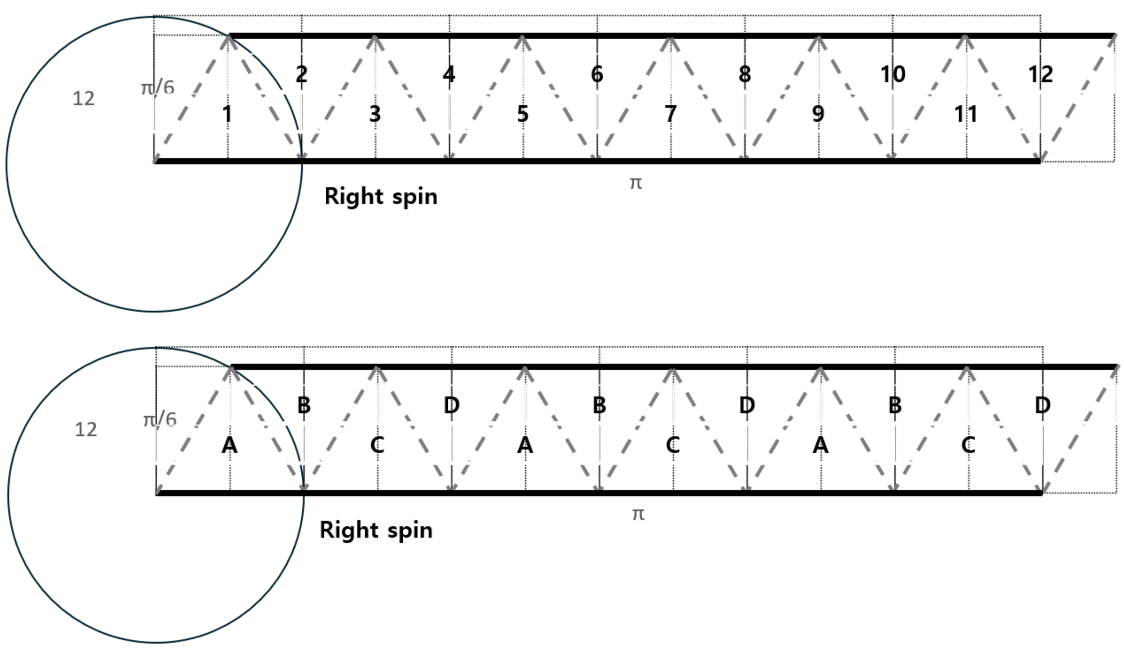

Figure 11. In the top view of the proton, the folding order and overlapping surfaces are indicated with capital letters.

Side A: 1 > 5 > 9

Side B: 2 > 6 > 10

Side C: 3 > 7 > 11

Side D: 4 > 8 > 12

The resulting tetrahedron folds each face three times, forming a stable structure that does not tilt.

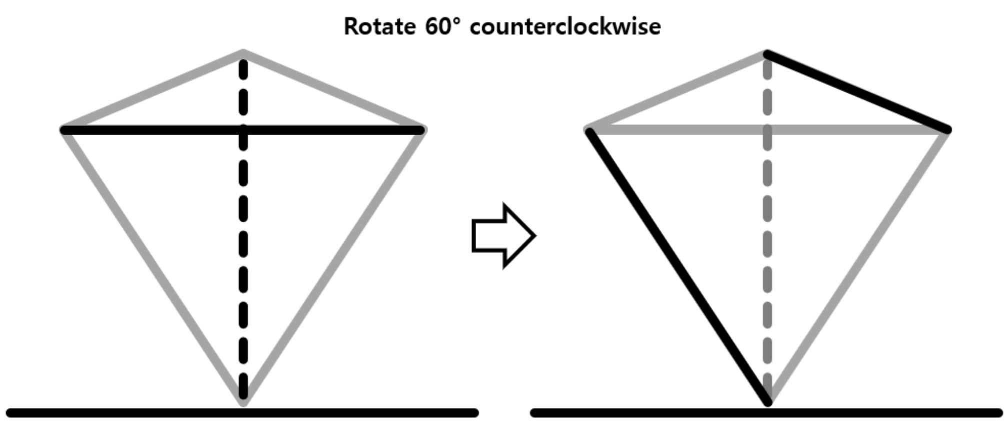

Figure 12. When folded in plan view, internal waves are formed in a wedge-like shape. This shape creates the mass of the proton. (Amplitude: black band, internal wavelength: gray band)

Why do I think this shape is a proton?

1. The reason it has no charge is because all folded surfaces are the same.
2. The shape itself can be used to explain things like quarks and gluons.
3. That shape can explain the ½ spin of the proton.
4. Characteristics of strong

In Chapter 2, when explaining superstring theory, I mentioned the formula that explains the strength of the combination of Euler's beta function and the strong force. The formula for Euler's beta function is as follows.

$$\mathrm{B}(x,y) = \int_0^1 t^{x-1}(1-t)^{y-1}\,dt$$

The strong coupling strength is the same as the Euler beta function. And the range of 0<1 means the force inside one substance.

Its strength is very strong within the range, but it drops off sharply when it goes out of range. These characteristics suggest that there is only one substance that forms the strong force.

About the triangular hexahedron that is thought to be the shape of the Electron.

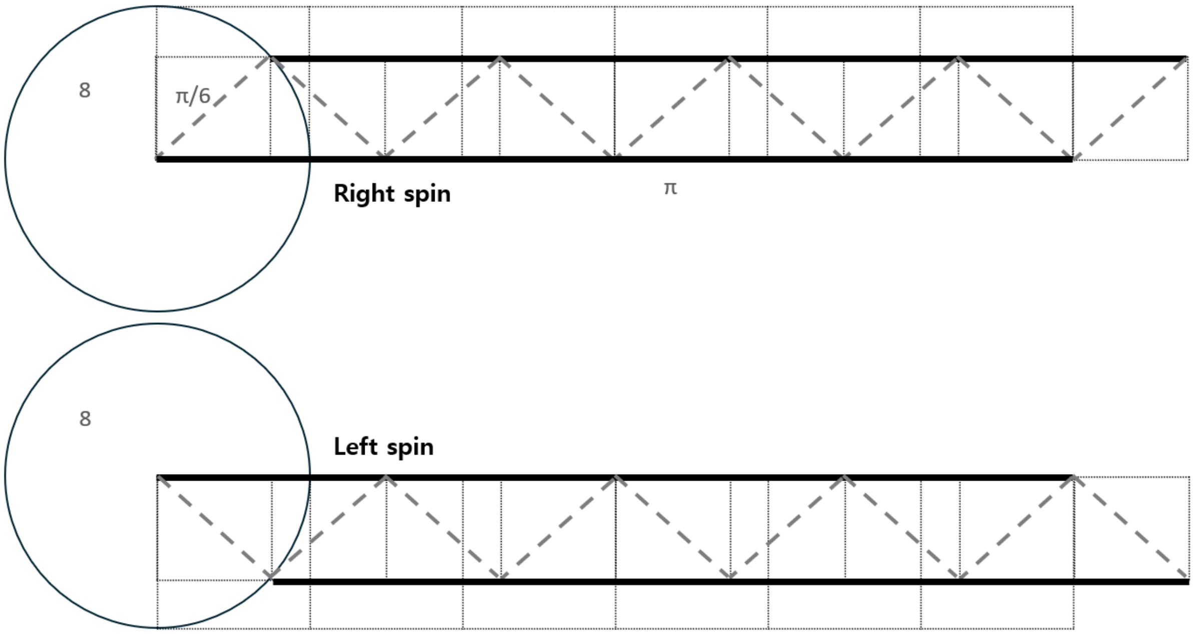

Figure 13. A top view made of 16 right triangles. The top has a right spin and the bottom has an opposite spin. If the top is an electron, the bottom is a positron.

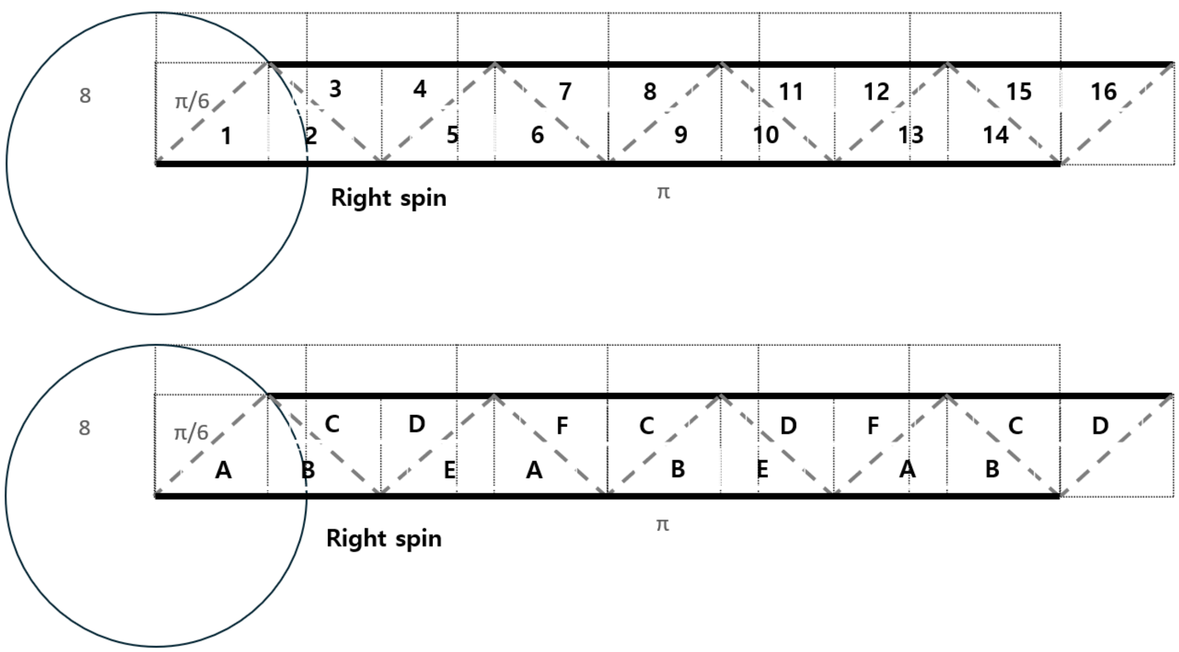

Figure 14. In the electronic plan view, the folding order and overlapping surfaces are indicated with capital letters.

Side A: 1 > 6 > 13

Side B: 2 > 9 > 14

Side C: 3 > 8 > 15

Side D: 4 > 11 > 16

Side E: 5 > 10

Side F: 7 > 12

Unlike the tetrahedron above, the 16 faces cannot overlap in the same number. This difference creates an electron's charge.

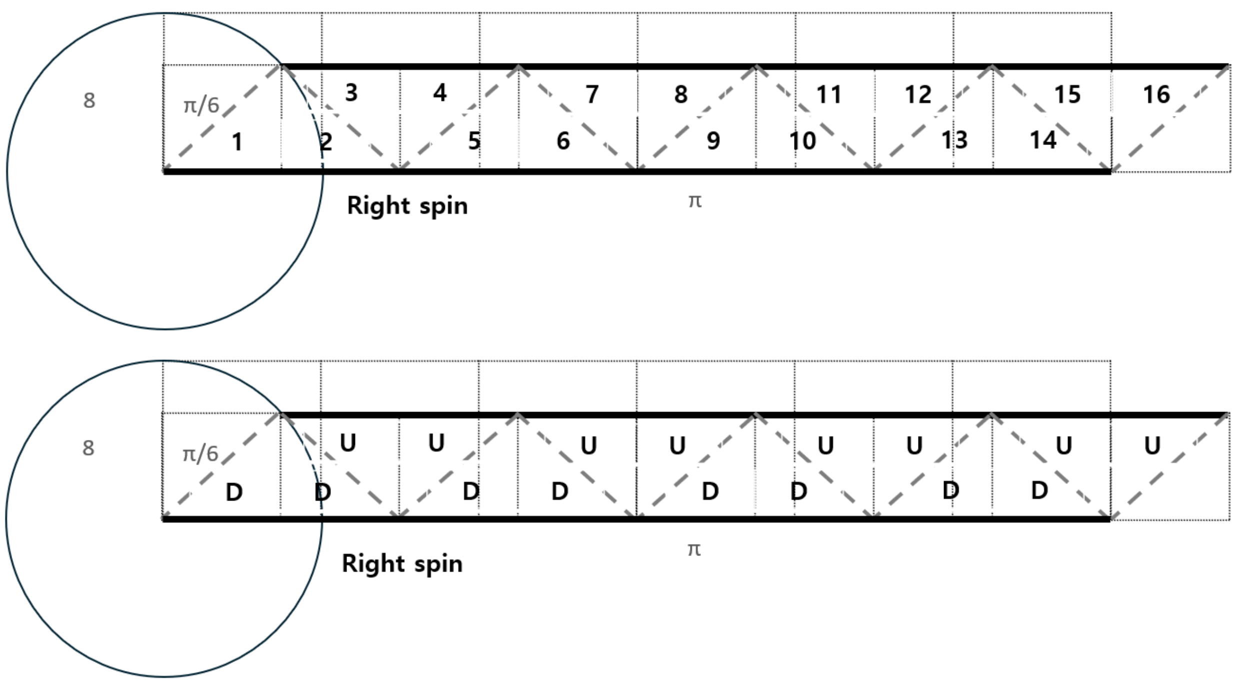

Figure 15. This shape is divided into upper and lower shapes based on the internal wavelength. In the floor plan, the bottom is marked as D (Down), and the top is marked as U (Up). This shape can explain that electrons move directionally.

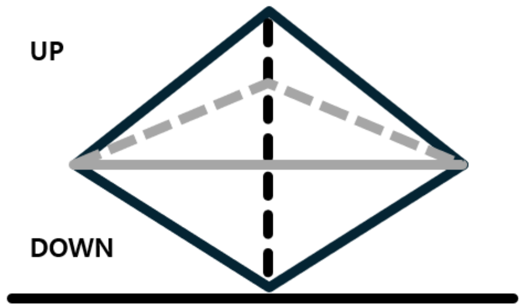

Figure 16. When folded in plan view, downward/upward directions are created based on the shape and internal wave. This shape creates the movement of electrons. (Amplitude: black band, internal wavelength: gray band)

Why do I think this shape is an electron?

1. The reason it has a charge is because the folded surface is uneven.
2. The shape itself can be used to explain the spin of an electron.

Further thoughts

When folded in this manner, the apexes of Up/Down do not align perfectly as in a proton's tetrahedron. The reason for this shape and the characteristics resulting from it are issues that need further consideration.

If we consider the reason for the existence of charge to be due to the imbalance of folding surfaces, then only electrons would have charge. Contrary to what we currently understand as protons being +1, neutrons 0, and electrons -1, it might be more accurate to view protons as having 0 charge, with only electrons carrying a -1 charge.

The reason for the identical magnitude of charge between protons and electrons may not be because they are opposite charges separated by zero, but rather, it's correct to see that only electrons carry a -1 charge while protons do not carry any charge at all. Then, what would be the role of neutrons?

So what about neutrons?

Neutrons are slightly heavier than protons. The mass of a proton is approximately 1.672×10^-27 kg, the mass of an electron is approximately 9.109×10^-31 kg, and the mass of a neutron is approximately 1.675×10^-27 kg. This makes the neutron slightly heavier than the combined mass of a proton and an electron, suggesting that neutrons could be explained as protons with electrons attached to them in terms of mass ratio.

Furthermore, neutrons are very unstable particles with a half-life of about 14 minutes. Neutrons become stable when they are attached to protons, and this stability can be explained through the following configurations.

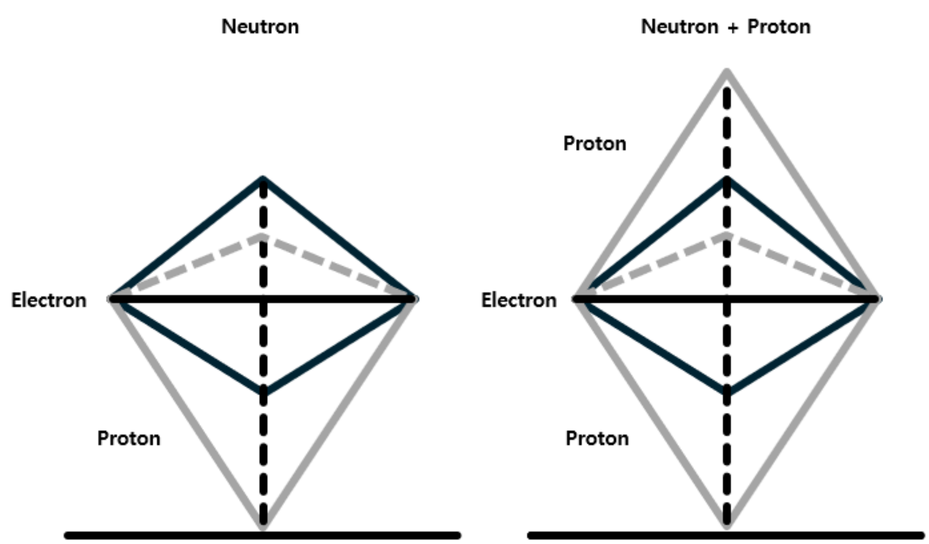

Figure 17. Left: The shape of a proton in the form of a tetrahedron with an electron attached below. Right: In an unstable proton, another proton attaches, maintaining a stable structure. The size of one face of the proton and the internal wavelength of the electron are the same, allowing the proton and electron to naturally merge.

And all three-dimensional materials will largely be composed of these two things.

2. Dimensions, Matter, and Photons

"Make yourself a light. Rely on yourself; do not depend on anyone else. Make yourself a refuge."

In Chapter 3, the hypothesis was proposed that a two-dimensional strip is the fundamental material, and this strip folds to form protons and electrons. Then, what is this two-dimensional strip made of? Before considering the material of this strip, it was necessary to think about dimensions.

We often think of dimensions in terms of space, as conveyed through various mediums, with the concept of space-time being a prime example. But what exactly is space? In mathematics, space is an imaginary expanse where nothing exists, yet in physics, space is somewhere filled with something. So, where does the concept of space-time originate from?

Before Einstein, time and space were considered separate, independent physical realities. That is, time flowed uniformly throughout the universe, and space was considered a static backdrop.
Einstein's Special Theory of Relativity, based on the constancy of the speed of light regardless of the observer's state of motion, argued that time varies relative to the observer's velocity. This led to the emergence of the concept that time and space exist as a single continuum, interconnected with each other.

However, upon further reflection, it's clear that Einstein spoke about how time changes with the velocity of matter, not specifically about space. Therefore, it seems accurate to say that time is bound to matter. "Time-matter" would be a more precise expression. Furthermore, the concept of dimensions should not be seen as bound to space but rather to matter. It's not that there are spaces of 0, 1, 2, or 3 dimensions; instead, it's that only the respective matter exists. The concept of space is an illusion.

As our understanding of dimensions/space has evolved, it has become accepted that spaces of different dimensions exist separately. Many media and even physicists argue that while interaction from a lower dimension to a higher dimension is impossible, interaction from a higher dimension to a lower dimension is possible. This logic unfolds under the assumption that dimensions are thought of as spaces and are separate. Yet, it's believed that higher dimensions can influence lower ones. How is it possible for separate dimensions to interact? If interaction from higher to lower dimensions is possible, why is it impossible for lower dimensions to influence higher dimensions?

Let's avoid falling into the trap of contemplating the concept of space. The concept of space does not exist, and dimensions, as well as time, are all bound to matter. From now on, let's eliminate the concept of space. It's all about matter.

Let's return to the topic of matter. When we draw a line on paper with a pencil, is that one-dimensional? No matter how thin, the graphite added on the paper would still be three-dimensional. Even graphene, which is composed of a single layer of atoms, is a three-dimensional material. Every material with volume is three-dimensional. Let's not think about one or two dimensions as a matter of three-dimensional materials, but truly consider what one and two-dimensional materials would be like.

What if we consider that matter started from a single point, expanding from zero dimensions to one dimension, then to two dimensions, and finally to three dimensions? And since dimensions are not spaces but properties inherent to matter, isn't it possible that one-dimensional, two-dimensional, and three-dimensional materials don't exist in separate spaces but can coexist together?

Imagine one-dimensional materials existing beside us. These materials would have length but no volume, making them imperceptible to us. Without volume, they would also lack mass. However, if such a material exerted influence somewhere, we might be able to detect its traces.

Then, could we perceive two-dimensional materials? Although these materials would also lack volume, they have area, making perception possible. Like one-dimensional materials, they would lack mass. Two-dimensional materials could be perceptible, and, like one-dimensional materials, if they exerted influence, their traces could be detected.

Can we then think of one- and two-dimensional materials in the same way we think of three-dimensional materials? If these materials were beside us, they would be somewhat eerie, seemingly graspable yet elusive.

In Chapter 3, I hypothesized that everything began from a two-dimensional strip-shaped material with the form of pi squared over six. And even without particle physics knowledge, we are aware of a material that can be perceived but has no mass.

This material is known as “**light**”, or “**photons**”.

Figure 18. Photons as Two-Dimensional Material

If photons are the components of all matter, has it been confirmed that matter is composed of photons?

The Breit-Wheeler experiment was proposed in 1934 by American physicists Gregory Breit and John Wheeler, aiming to observe the process of light transforming into matter. The experiment suggests that when the energy is sufficiently high, photons can convert into electron-positron pairs. This was experimentally proven in 1997 at the SLAC National Accelerator Laboratory, where photons were observed converting into electron-positron pairs.

The Standard Model theory explains these results as follows:

1. High-energy photons transform into a pair of virtual photons.
2. One of the virtual photons converts into an electron, and the other converts into a positron.
3. The electron and positron separate and are observed individually.

Simply put, is there a need to involve a pair of virtual photons in explaining that photons can become the material for electrons and positrons?

Is this hypothesis valid? How do other documents represent photons?

In Jim Baggott's book "The Search for Matter," there is a mention of the shape of photons.

According to Einstein's Special Theory of Relativity, as an object's speed increases, time dilates and lengths contract from the perspective of a stationary observer. If we accelerate a spherical light particle, its radius will contract in the direction of motion, transforming the particle into an increasingly compressed ellipsoid. Pushing the light particle closer to the speed of light, the ellipsoid will become more flattened. What happens when it reaches the speed of light? Remember that relativistic length L is given by L_0 / R, where L_0 is the proper length (in this case, the radius of the particle when at rest), and R is $1/\sqrt{(1 - V^2/C^2)}$. As the particle's velocity V approaches C, R becomes infinite, and L becomes 0. From the perspective of a stationary observer, the particle becomes pancake-flat, essentially becoming a two-dimensional existence without any thickness. Of course, photons move only at the speed of light, and this is merely a thought experiment. Physically, this is not reality. Nonetheless, from this reasoning, we can infer that light particles are somewhat 'two-dimensional' in a strange way. Light particles are 'flat.' Whatever that means, light particles have no dimension in the direction they move. Special Relativity forbids them from having any dimension at all.

While it was stated above that photons may appear "two-dimensional" because they travel at the speed of light, could it be the other way around? That is, they possess such speed because they are two-dimensional materials? We sometimes encounter situations where cause and effect are reversed; could this be one of those cases?

If two-dimensional photons are the origin of all matter, then it's easy to imagine that the universe is filled with these two-dimensional photons as a medium, much like water fills the ocean.

Considering the physical facts about photons, that they exist as a medium throughout the universe, let's think about the following.

1. Photons travel at a constant speed of about 299,792,458 meters per second (m/s) in "vacuum," have no mass, and maintain a constant velocity.
   > The constancy of photon speed can be likened to the way sound waves travel through water at speeds determined by the medium. All space is filled with photons, hence the uniform speed. The space we call a vacuum is also filled with photons; it's just less dense with three-dimensional matter. The reason photons are massless is because they are two-dimensional materials.
2. Light exists without a medium.
   > The phenomenon we call "radiation" is theorized to explain the behavior of photons acting without a medium. If the universe is filled with photons, and photons act as the medium for themselves/magnetic fields/electromagnetic waves, then our understanding of energy transfer, what we call "radiation," needs to be revised. The way photons behave as waves can be compared to how water behaves in waves.

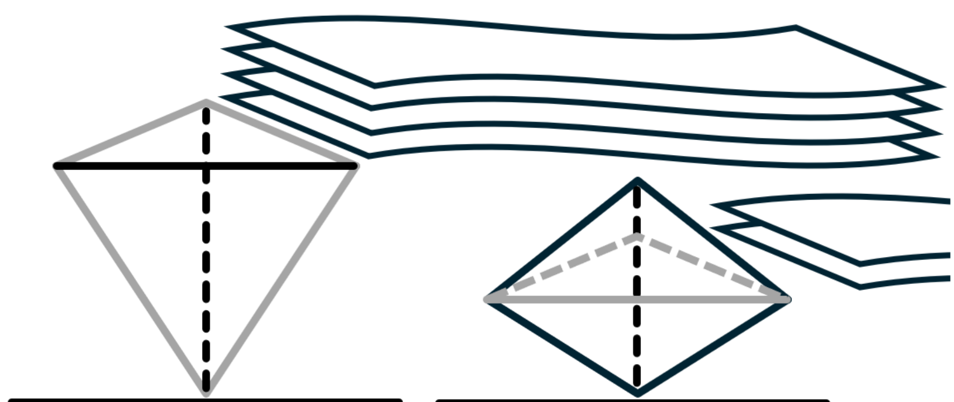

Figure 19: Photons as a Medium