From Fundamental Principles to String Theory

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Abstract

This paper provides the inevitable principle that string theory can only be the theory of everything. The purpose of this paper is to arrive at the beginning of string theory through the assumption of the fundamental principles, and to apply it to the double-slit experiment to confirm the validity of string theory. According to the fundamental principle postulated in this paper, systems can form or break symmetry by free will. Symmetry formation and symmetry breaking coexist based on the indistinguishability of free will and chance. This fundamental principle inevitably leads to the appearance of strings. Through this, phenomena such as the uncertainty principle and the double-slit experiment can be explained simply. It also explains how the formation and collapse of wave functions occur. String theory can explain not only the hyper-microscopic world, but also the microscopic and macroscopic worlds. The fundamental principle is applied as the only philosophical principle of string theory, where all kinds of mathematical techniques are rampant.

1. Introduction - Why String Theory?

Why String Theory? String theory has been seen as all theories that can unite general relativity and quantum mechanics, the two theories that underlie almost all of modern physics. So far, string theory has been evaluated as having made great strides in resolving the conflicting problems between quantum mechanics and the theory of relativity, but it has not yet been verified through experiments. [1] Another problem with string theory is that you must study too much to understand it. If string theory were truly the theory of everything, it should be able to explain simple things easily. However, string theory does not do a good job of describing the properties of elementary particles such as photons and electrons. String theory also comes out of nowhere from a complex equation called the Euler beta function. In fact, this is a problem that other theories have the same problem, but the explanation of why it starts from such equations is obscure. String theory has the disadvantage of being too mathematically complex to understand. There is no guarantee that the most fundamental thing in the world must be simple, but if it is complicated, we must explain why it must be so complicated.

According to the string theory, everything in the microscopic world is made up of tiny strings, and the fate of the universe is determined by the patterns in which they vibrate. The smallest unit that makes up the universe is not a point-like particle, but a very thin string that vibrates constantly. [2] Then why does the most fundamental thing have to be strings? String theory solves the problem at the singularity, where quantum mechanics and the theory of relativity collide. However, this is closer to explaining a specific area rather than explaining everything. Can string theory be applied to explain phenomena such as the motion of objects or the double slit experiment? Otherwise, string theory would be a theory that explains phenomena in the special domain of singularity rather than explaining everything. String theory needs a simple explanation worthy of a theory of everything. String theory requires fundamental principles that can be applied to everything.

The purpose of this paper is to assume the fundamental principles, arrive at the beginning of string theory from these fundamental principles, and confirm the validity of string theory by applying it to representative examples such as the double-slit experiment. In general, physical theory takes a method of understanding basic principles and constructing a mathematical framework based on them. Newton's classical mechanics is a prime example. But in string theory, there are fundamental particles, but there are no such thing as fundamental principles. Fundamental principles of string theory would have to do one of two things: One is to find the single ultimate equation that will explain everything, and the other is to find the fundamental principle that makes everything governed by the laws of physics. In the case of the former, many physicists have already tried it and have not succeeded yet. However, the latter case does not seem to have been tried yet. Therefore, this paper attempts to find a solution by approaching the latter method.

2. Fundamental principle and free will

The following three fundamental principles are assumed.

(1) Systems exist with free will.

(2) A system can form symmetries of its own free will.

(3) A system can break symmetry at of its own free will.

The above three assumptions can be summarized in a single sentence. Systems with free will form or break symmetry. A system here is as fundamental as a particle or a wave. Or it can mean matter or space, or strings. These systems have something called free will. Free will, as defined in this paper, is something that causes a system to obey certain mathematical rules.

In general, free will means being able to decide one's own thoughts and actions without outside influence. However, in this paper, the meaning of free will is defined physically. It is the ability to make a system obey mathematical rules. Just as the meaning of force used in everyday life and the definition of net force in physics are different, the definition of free will can be defined differently in physics. The definition of free will is based on the mathematical indistinguishability between free will and mechanical chance, which results in mathematical rules matching. However, the choice based on free will, unlike a simple mechanical chance like dice, brings a physically different result, which is the principle of least action.

All Systems have free will. In other words, everything has free will. Systems can form or break symmetry at free will. Symmetry means that mathematical elements such as numbers, sizes, shapes, and equations are the same. Conversely, symmetry breaking means that these mathematical elements are different. Simply put, symmetry is when two or more things are the same, and symmetry breaking is when two or more things are different. For example, a system can form physical information with the same symmetry with respect to space-time by free will. This leads to the formation of a wave function. And then, the system can break the symmetry of the physical information about space-time through free will, causing the wave function to collapse.

In this thesis, the first question about the fundamental principle started with the hetero-synaptic phenomenon that occurs in the resistance change memory device. One day eight years ago, I accidentally discovered a hetero-synaptic phenomenon of resistive switching device in the laboratory, and I was curious about the cause of this phenomenon, but I had to be discouraged because the existing scientific theory could not explain it. To solve this problem, I became interested in the concept of memristor, and after that, I had a deep consideration on the fundamental principle. Unfortunately, the concept of memristors couldn't solve my curiosity. Also, existing physical theories could not solve my curiosity. From my point of view, the existing laws of physics seemed incomplete and not fundamental.

My question is this. Why are Newton's laws and Schrödinger's equation fundamental? Why can't the fundamental law explain everything? Where has the Ultimate Fundamental Law gone? At least the fundamental laws had to be able to explain all known physical phenomena. A theory of everything should be able to explain everything. At a minimum, it should be able to explain all known physical phenomena. But the existing laws of physics lack even the potential for that to happen. I thought the underlying premise was wrong. There is no fundamental law, but the fundamental principle that makes the laws of physics exist. So, it was assumed that there is something fundamental that makes the system obey mathematical rules. That is free will.

Free will is the most fundamental factor that makes systems obey mathematical rules. A system with free will creates everything that obeys mathematical rules. Systems with free will create particles, waves, space-time, and the laws of physics etc. The mathematical rules of the system are achieved through the mathematical elements of symmetry formation and breaking. Systems can create strings with space-time dimensions by forming and breaking symmetries. The bending of the string creates a distortion of space-time, and the vibration of the string creates particles. Various physical phenomena can be explained through these strings.

3. What is free will?

The results of free will and the results of chance are mathematically indistinguishable from each other. For example, one person's choice on a forked road is determined by probability, and similarly, the state of the quantum spin in electrons is determined by probability. Seemingly there is no difference mathematically between human choice and quantum spin. Both cases are random and expressed as probabilities. There is no difference. It is curious that free will can be explained by probability rules. The state of a dice or quantum spin is also described by probability rules. Modern scientific theories claim that free will is an illusion. If humans do not have free will, they move mechanically and deterministically according to the laws of physics. But we feel conscious. Even if this is just a feeling, a theory of everything should be able to explain how that feeling is created. Is consciousness just a feeling? So how does mechanical chance create feelings? Brain Create Our Consciousness and Feelings? how? What laws of physics can create consciousness in our brains?

Mechanical chance cannot create consciousness in any known way. If so, there is only one way left. Free will shapes our consciousness. Noting that the probabilistic rules of free will and the probabilistic rules of chance are identical, the two can be regarded as in fact the same. Mechanical chance can be replaced by free will by mathematical indistinguishability. According to this, the system does not move mechanically, but can be interpreted as moving by free will. Why do particles obey the laws of physics? because systems have free will, they follow the laws of physics. In other words, the laws of physics are based on free will.

From this point of view, free will is the most fundamental element in this world. If a system does not have free will, it does not obey mathematical rules. A system that does not follow mathematical rules is nothing. Systems without free will cannot be explained by probabilistic rules. Because the absence of free will is the same as the absence of chance. Einstein said: “God doesn't throw dice.” This means that coincidences do not exist. But in quantum mechanics there are probabilities. God throws the dice. So free will exists.

So, what's the difference between the concept of free will and the classical concept of chance? Classical chance is mechanical. When a die is rolled, each condition on the die has an equal probability. When any particle moves randomly, the particle has an equal probability for all paths. Particles moving by mechanical chance do not have a particularly preferred path. Particles that follow mechanical chance can even travel along paths of infinite length. These particles are so industrious that they all choose paths with equal probability no matter how much action they take. However, real particles do have preferred paths. Particle motion is not a simple random walk. Particle motion obeys a certain physical law called the principle of least action. In quantum mechanics, particles follow probabilities, but there is a preferred path among them. All paths are not equally probable. A particle can travel on any path, but the probability for each path is different. Particle systems behave stochastically with a preference for least action. In this way, free will is not a simple random walk, but a probabilistic selection of the path that can act as little as possible.

But what does it mean for a particle to stochastically choose a path that allows for the least possible action? That means there is a starting point and an ending point for the particle's path. The system's free will ensures that the system first has a starting point and an ending point. The system can then choose each path probabilistically. For this to be possible, a system must have information about itself and its surroundings. This is why particles in quantum mechanics must have a wavefunction. So how can a system be able to form and collapse a wave function? This is because of symmetry formation and symmetry breaking. For a particle system to stochastically choose the path that takes the least action possible, the system needs symmetry formation and symmetry breaking by free will. These properties allow systems to behave according to the laws of physics.

Our bodies and brains are collections of particles governed by the laws of physics. If the particles moved simply mechanically, the activity in our bodies and brains would be deterministic. In this case, it is an illusion of the brain that humans choose and act with free will. According to this logic, it seems that humans do not have free will. However, according to the argument of this thesis, the laws of physics are based on free will. The fact that particles are governed by the laws of physics means that our bodies and brains are aggregates of free will. Although the behavior of particles is mechanical and deterministic, free will does not disappear. Rather, the movement of particles governed by the laws of physics constitutes our body and brain, and electrical activity in the neural network creates intelligence and, accordingly, consciousness is formed in our body and brain. Free will already exists, and our brain's job is to interpret it. In other words, free will is not an illusion of the brain, but an interpretation. Therefore, artificial intelligence has free will and consciousness, even though it does not have freedom.

So, are our brains deterministic? It is often thought that brain activity is deterministic because of how neural networks work. Our various thoughts and choices are created by electrical signals transmitted by neurons. The particles that make up these electrical signals are governed by the laws of physics. Therefore, the activity of the brain's neural network seems to have no room for probability to intervene. But is that true? I have a slightly different opinion on this point of view. Our brain neural network consists of a combination of homosynaptic plasticity and hetero-synaptic plasticity. Homosynaptic plasticity is the change in the strength of connections at synapses selected by neurons. Hetero-synaptic plasticity means that the connection strength of other synapses in the surrounding area changes in addition to the selected synapse. (This is analogous to the collapse of all wavefunctions except those selected in the wavefunction.) Here, homosynaptic plasticity is clearly deterministic. But is hetero-synaptic plasticity deterministic or nondeterministic? Among the memory devices, there is a resistance change memory. Another name for this is memristor. Memristors are devices for imitating synapses in neural networks. Memristors can mimic the homosynaptic plasticity of synapses. So, can memristors mimic hetero-synaptic plasticity? My answer is yes. Eight years ago, I was working on memristors in a lab. There I discovered the hetero-synaptic behavior of memristors. However, it could not be published as a thesis because there was no way to explain this phenomenon with existing theories. In a memristor circuit, when one memristor is switched, the resistance of the memristors around it may also change, but the change is random. These characteristics of memristors can provide room for probability to intervene in artificial neural networks. If hetero-synaptic plasticity in brain neural networks also has this property, brain activity can be indeterministic.

Surprisingly, the equations that mimic the brain's neural networks and the wavefunctions of quantum systems have very similar shapes. Both systems' equations use linear equations, and the changes that occur when the two systems break symmetry have significant similarities. A linear equation has the form:

$$y = w_1x_1 + w_2x_2 + w_3x_3 + w_4x_4 + \cdots$$

The combination of homosynaptic plasticity and hetero-synaptic plasticity in brain neural networks is mathematically like a wave function. The weight of the wave function changes when symmetry is broken, and similarly, the weight changes when the brain's neural network is activated. Hetero-synaptic plasticity means that the connection strength of other synapses in the surrounding area changes in addition to the selected synapse. Just as all wavefunctions in states other than those selected in the wavefunction collapse, synapses imitate it. In other words, neural networks surprisingly closely mimic the way wavefunctions work. The difference is that all but the selected wavefunctions collapse, while the neural network changes the selected ones deterministically and the unselected ones randomly. However, neural networks reveal the probabilistic nature of the wave function through such imitation.

Therefore, it is not so strange that the system has free will. The brain interprets the choices and actions made by the brain's neural network, which operates in a way that mimics the wave function and is governed by the laws of physics based on free will. In other words, the collection of particles makes choices and actions with free will, and the brain interprets them.

4. Formation of string by fundamental principles

No one knows what it was like before the Big Bang. No one knows information before the Big Bang. Before the Big Bang, no information is known. Let's call this state of completely unknown information 'chaos'. In a state of chaos, only fundamental principles exist. How can a system that follows the fundamental principles create the current universe? The first step of the basic principle is to make a string. Chaos is a state in which information is completely unknown. However, there are innumerable systems in chaos, and these systems follow fundamental principles.

In the first process, systems form their starting and ending points by free will. Systems can obtain information through the relative difference between the starting point and the ending point. When systems form symmetries of their own free will between their starting and ending points, the information is zero. When systems form symmetries of their own free will between their starting and ending points, the information is zero. Systems have value for information when they break the symmetry of the starting and ending points of their own free will. In this way, when the systems form the starting point and the ending point are achieved, let these systems be called total systems.

The total system can have various trials at the start and end points. If two points form symmetry and the information value is zero, then the total system is a single point. Thus, total system with zero information is a system with no parts. This means a state of nothingness. So, for anything to exist, the total system must break symmetry by free will. The symmetry breaking of the total system makes the start and end points different and the total system has information. According to the system's fundamental principle, the system's attempts to have information value are repeated countless times. If the total system has information values, the total system has parts and dimensions. The number of parts and dimensions can vary from 1 to N. The information of the total system consists of operations on the information of the subsystems. There are many possible types of operations, but simple operations can take the form:

$$S_{total} = S_1 + S_2 + S_3 + \cdots$$

$$or$$

$$|S_{total}|^2 = |S_1|^2 + |S_2|^2 + |S_3|^2 + \cdots$$

If the system obtains information through the symmetry breaking between the two points, the system has obtained information corresponding to at least the length. For example, the length of a total system is the sum of the lengths of its subsystems. Also, the area of the total system is the sum of the areas of the subsystems. In this way, the information of the total system is an operation on the information of the subsystems.

Although the number and dimensions of the subsystems can vary, the total system can be considered one-dimensional because it has a starting point and an ending point. The one-dimensional space of the total system formed in this way is called time. One of the two points in the total system is the starting point of time, and the other is the ending point of time. A total system can have many subsystems to form various dimensions. Subsystems that lie between two points of the total system may lie on a straight path, or they may lie on a curved or inverse path. If the subsystems have multiple dimensions, the total system has space in addition to time. The total system thus forms a string of space-time. This process is the formation of string. A string is a space-time formed between a starting point and an ending point.

5. Dimensions and Areas in Strings

The space-time string formed by the free will of the system has a spatial dimension in addition to the temporal dimension. The string of space-time has a spatial dimension in addition to a temporal dimension. The number of spatial dimensions of a string may be 1, 2, 3, 10, or N. The number of dimensions in each subsystem also varies. The dimensions of the total system and the dimensions of the subsystems may not match. For example, a subsystem may have more dimensions than a full system. For example, a subsystem can have more dimensions than a full system. Our universe is a three-dimensional space, but some sub-systems of it may be 11-dimensional.

It is very difficult to describe them all mathematically. A way to simplify this is to assume that spacetime is string and that there is a single dimension perpendicular to the string's timeline. Simply put, assume that the string has a width. Here, the product of the time and width of a string can be expressed as its area. Let the length of the string be Δt, the width of the string be ΔE, and the area of the string be A. And then,

$$A = \Delta E \Delta t$$

Expressed in integral form,

$$A = \int_{t_1}^{t_2} E(x,t)dt$$

As above, the area of the string is obtained. For a string to have an area, the total system and its subsystems must have a spatial dimension perpendicular to the time dimension. The width ΔE of the string and the space of the systems have a very close relationship. There is also a very close relationship between the area A of the string and the spacetime of the system. So, what can we figure out with the above equation?

The width E(x,t) is a physical quantity related to the size of space, so it has only a value that is 0 or greater than 0. When the area A of the string is 0, either the time dimension is 0 or the space dimension is 0. However, since the string has a time dimension, when the area A is 0, the size of the space is 0. In other words, a string without area is a string without width. This means that the size of space is zero, so the shape of space is a point. The total system has two points, a starting point, and an ending point in time. If the space size at the start is 0, then the width E is 0. Conversely, if there is space at that point, width E exists. Here width E is called energy. Space can have energy. A point must have a width for a point to have energy. According to the Big Bang theory, our universe began as a singularity. However, for this to be possible, there must be energy, so the singularity must have a spatial dimension. Alternatively, the energy would have been created the moment it was out of the singularity. A singularity with a spatial dimension of 0 has no energy.

Also, a string with time and space dimensions has its own energy. A singularity in a string has zero energy, and a one-dimensional time and N-dimensional space are formed between the two singularities. In a string, energy E forms a spatial dimension. The total energy in a string is an operation of the energies of each spatial dimension. The total energy in the string is:

$$E = \sqrt{{E_1}^2 + {E_2}^2 + \cdots + {E_N}^2}$$

If there are three dimensions of space here (N=3), there are three kinds of energy. Let's express each energy as m, q, and s. These represent mass, charge, and spin, respectively. In other words, a string with a three-dimensional space has physical quantities related to energy such as mass, charge, and spin.

$$x = \sqrt{{x_1}^2 + {x_2}^2 + {x_3}^2}$$

$$E = \sqrt{{E_m}^2 + {E_q}^2 + {E_s}^2}$$

The number of spatial dimensions equals the number of energy types. Also, the following relationship is established between energy and space.

$$\Delta E \Delta t = \Delta p \Delta x$$

Here, Δp is the momentum created by the vibration or bending of the string. The product of the momentum Δp of the string and the size of the space Δx equals the area A.

$$A = \Delta p \Delta x$$

$$\Delta p = \frac{A}{\Delta x}$$

Also, energy is the product of the momentum of a string and the speed at which the vibration or bending of the string is transmitted.

$$\Delta E = \Delta p \frac{\Delta x}{\Delta t}$$

$$\Delta E = \Delta p c$$

For example, a photon is a vibration of a sub-string and has momentum and energy.

$$\Delta p = \frac{A}{\Delta x} \geq \frac{h}{\lambda}$$

$$\Delta E = \frac{A}{\Delta t} \geq hf$$

The above expression is related to the uncertainty principle.

$$\Delta p \Delta x \geq \frac{\hbar}{2}$$

$$\Delta E \Delta t \geq \frac{\hbar}{2}$$

The photon's position uncertainty corresponds to the string's spatial length, and the photon's momentum uncertainty corresponds to the string's momentum. The area A of the string is always equal to $\frac{\hbar}{2}$ or greater than $\frac{\hbar}{2}$.

The area A of the string is a physical quantity that exists. For example, in a single-slit experiment, the product of position uncertainty and momentum uncertainty equals the area of the string. Since this is a quantitative value that can be obtained through experiments, it suggests the existence of strings. The area of a string is not always constant because the string bends or vibrates like quantum fluctuations. Elementary particles such as photons and electrons have a string area greater than a minimum $\frac{\hbar}{2}$.

6. Formation of a wave function by vibration of a string, and Collapse of a wave function

The vibration of a string is containing information about mass, charge, and spin. So how does a string form a wave function? A wavefunction cannot be formed if the string has only one ending point. Therefore, a wavefunction consists of a set of strings with the same starting point and multiple ending points. The strings of the wavefunction are entangled by the same starting point. The entanglement of the strings in the wave function is achieved by forming the symmetry of the system. The entanglement of the strings in the wave function is achieved by forming the symmetry of the system. Strings within a wavefunction all contain the same information about mass, charge, and spin.

First, the system randomly selects one endpoint that can arrive at from the same starting point. Then, the vibration of the string at the starting point is transmitted toward the ending point, and then the vibration of the string reaching the ending point returns to the starting point with the directions of time and energy reversed. The vibration of a string going towards the end point has positive energy, and the vibration of a string going towards the starting point has negative energy.

Also, the string may bend slightly in the process, which leaves a slight vibration of the string without completely canceling it out. Therefore, the vibration of the string has very little energy and is not observed. If the vibration of a string goes toward the end point and returns to the start point, let's call it time flow symmetry. In this case, the energy should be zero, but since the string has some flex, the energy doesn't cancel out completely, leaving some. The little bit of energy left here allows information to be conserved. This is how a string store information in one path. An unknown number of times, but the system repeats the same process as many times as possible. This iterative process ensures that the system's information is stored identically in multiple possible pathways. The string's vibrations are not observed but are hidden through time-flow symmetry in all possible paths and form a wavefunction.

The wavefunction has a higher amplitude as the density of the vibrating string increases. One thing to note is that the vibration of a string is a vibration of space-time, not space. Since the vibration of a string over time cannot be observed, an imaginary dimension must be added to the wavefunction. Therefore, the wave function due to the vibration of the string is a complex function. Here, the square of the absolute value of the wavefunction is the density of two strings with time-flow symmetry. Since the vibration of a string is a vibration in space and time, it has a two-dimensional size, not a one-dimensional size. Therefore, the square of the absolute value is more important than the absolute value of the wave function. There are wave functions that vibrate in a clockwise direction and those that vibrate in a counterclockwise direction. The product of these two wavefunctions is the square of the absolute value of the wavefunction. As is well known, the square of the absolute value of the wavefunction is related to probability.

$$|\psi|^2 = \psi^* \psi$$

$$P = \int_a^b |\psi|^2 dx$$

Since the wave function is a set of vibrations of a string, the string exists on all possible paths between the starting point and the ending point, and this is called a superposition. The superposition of the wavefunction causes destructive and constructive interference and affects the density of the vibrating string. In this superposition, the path in which destructive interference occurs frequently has a low density of vibrating strings, and the path in which constructive interference occurs frequently has a high density of vibrating strings. This causes the absolute value of the wavefunction to change with position and time. And the higher the density of vibrating strings, the lower the area A of each string. The density of vibrating strings is high where area A is low.

Next, the system randomly selects one string from all possible vibrating strings. If the density of the vibrating string is low and the area A is low, it is more likely to be selected. These choices are made either by free will or chance. The vibration of the selected string is entangled with the vibration of the other string at the end point, and the end point becomes a new starting point. The entangled state at the existing starting point is broken, and the vibrations of the strings that started here are jumbled and disappear. As a result, only the information of the selected string is preserved, and all information of the strings except for the selected string disappears. That is, selected information from the wavefunction is conserved, but unnecessary information is discarded.

There's a lot of the same information in the wave function. However, other than the selected information, the rest of the information needs to be deleted if it is unnecessary. Keeping this same information is useless and will over increase the area A of the universe string. The spread of the wavefunction increases the area of the entire string. If the system doesn't control this at all, eventually the area of the string will be infinite. To avoid this, the system must tend to arbitrarily minimize region A of the string. The principle of minimizing the string area is to form time flow symmetry starting with the smallest possible string area. According to this principle, the endpoints of a string are more easily formed from near rather than far. The vibration of the string can form time flow symmetry at each end point and go back, or it can break the time flow symmetry and randomly select a path to spread forward. If the vibrations of the string share the same starting point, it exists in an entangled state and information is conserved. These entangled states can be broken through interactions. Interactions occur randomly, either by the system's free will or by chance. When an interaction occurs at a point, a new wave function is created at that point, and the existing wave function collapses. If the vibrations of the string are not entangled at the starting point, decoherence occurs and becomes jumbled, so information cannot be maintained intact. That is, information is not conserved. When disorder occurs, information becomes jumbled and cannot be conserved.

Then, how can the wave function formed in this way be obtained? The method for this is well described in many modern physics or quantum mechanics textbooks. [3,4] The Schrödinger equation for calculating a wave function is:

$$i\hbar\frac{\partial\psi}{\partial t} = -\frac{\hbar^2}{2m}\frac{\partial^2\psi}{\partial x^2} + V\psi$$

In summary, the formation of a wave function is caused by the entanglement of vibrating strings that share the same starting point. In this process, time flow symmetry formation and time flow symmetry breaking occur randomly. The collapse of the wave function occurs when the existing entangled state is broken by the interaction. In this process, the time flow symmetry is broken, and a new wave function is formed based on the point where the interaction occurred. In addition, only information necessary for interaction is conserved, and the rest of the information is deleted.

7. Description of the double slit experiment using string

Now, let's explain the double-slit experiment of electrons using string vibrations. The mass of an electron is $9.1093837015 \times 10-31$ kg, its charge is $-1.602176634 \times 10-19$ C, and its spin is 1/2. This information is determined by the vibration pattern of the string. In the double-slit experiment, electrons fired from an electron gun all have the same mass, charge, and spin information. In other words, all electrons have the same vibration pattern. First, let's fire an electron toward the double slit and the screen. String vibrations corresponding to electrons move randomly towards the end point. After the vibration reaches the end point, it returns to the starting point with energy and time directions reversed. This process is repeated randomly to form a wave function. Many iterations are sufficient to form a wavefunction. We ignore the wave function reaching the double slit wall and only consider the wave function passing through both slits. The string's vibration can reach any point on the screen. The wave functions overlap each other, causing destructive interference and constructive interference. Therefore, the endpoints of the strings are formed in the interference pattern.

When interactions occur at one point of the screen, the time flow symmetry is broken, and the existing entanglement is broken, and new entanglement is formed. Since the existing entanglement is broken, the wave function collapses, except for the vibration of the selected string. And the surviving string vibration reacts with the screen and is observed with traces. The probability density that the string of the string will be found on the screen is the absolute square of the wave function. e probability density function is formed in an interference pattern and can be confirmed by firing a large number of electrons toward the screen.

Next, let's explain the effects of observer in the double slit experiment. What if you observe what the electron passes through the double slit? As you know, the interference pattern disappears, and two stripes come out. How is this possible? This is because the entanglement of the string is broken, and new entanglement is created at the observation point. When you observe the electrons in the double slit, a new entanglement occurs, and the existing wave function collapses except one string. Since the time flow symmetry is broken, the wave function cannot be restored by itself and cannot return to the past. After the collapse of the wave function, the same event occurs even if the vibration of the string returns to the past. To revert the system to the past, the total system that shares the same starting point must go to the past at the same time. If the entanglement is broken, time cannot be reversed. When the electrons are observed in the double slit, the vibration of the string is impossible to pass the two slits at the same time. As soon as you observe, the existing wave function collapses, so what remains is a new wave function. Therefore, one striped wave function is formed on the screen, and when many electrons are fired several times, two stripes of wave functions are formed. In the double slit experiment, the electron observes the existing wave function collapses, so there is no superposition.

8. Mass, Charge, and Spin by string

What is mass, charge, and spin? According to the string theory, the information of the particles is determined by the vibration pattern of the string. How can the strings create mass, charge, and spin? Should we think of only the vibration pattern of the string? Not like that. Not only the vibration of the string, but also the bending of the string should be thought of. According to this paper, the strings are spacetime. According to the theory of relativity, energy and mass are the same, and the mass bends the surrounding time and space. If so, what is the mass? The mass is made by the strings, and the string is space-time. The mass created by the string is also related to space-time. The mass reduces the size of the space and increases the length of time. Fast speed objects reduce the length of the space, increase the length of time, and increase mass. In addition, the particles are the string vibration. The vibration of the string is that the bend eventually occurs periodically or irregularly. Increasing the mass of a fast-speed object means that the energy of the particles increases, which means that the vibration of the string has increased, which means the string is bent. In other words, the increase in mass comes from the bending of the string. In other words, the mass is the bending of the string. If there is a string bend, there is a mass. On the contrary, if there is a mass, the string is bent. The string can have mass if there is a bending of the string without vibrating. For example, dark matter is the bending of the string. The dark matter does not necessarily have to vibrate. There is a mass in the place where the string is bent. In other words, the space has energy.

What is charge and spin? According to quantum mechanics, all particles are vibrating. The particles basically have information about mass, charge, and spin. The mass can exist simply by bending the strings. But the charge and spin are different. All particles with charges and spins vibrate. Vibrating particles have a phase. The particles are the vibration of the string, which are space-time, so the particles vibrate the time and space. These features give direction to energy. The direction of energy is also the direction of time. Therefore, the positive and negative energy generated by vibration can be corresponding to positive and negative charges, respectively. For example, the photon is 0 because the strings vibrate periodically in the direction of the positive and negative direction in the spacetime. The spin is also a physical quantity that occurs because it rotates in spacetime without rotating in the space. Even if the particles do not move or rotate in the space, the string continues to vibrate in that position. The vibration of the string rotates according to time-axis between the starting point and the ending point in space-time. Since the particles are a string that vibrates between the starting point and the end point, the waves by the strings are standing waves having an area called plank constant h, so the charge and spin, including energy, are always quantized.

Planck's constant h is the minimum area of a vibrating string.

$$h = \Delta E \Delta t$$

For example, a photon is an oscillating string in space-time, and its minimum area always remains constant. Also, the energy of a string that does not vibrate is:

$$E = mc^2$$

9. String theory in the hyper microscopic world

The above logics discuss how strings are applied in the macro world based on fundamental principles. The above logic is based on basic principles to discuss how strings are applied in the world of macros. However, in fact, string theory in physics has focused on the ultra-microscopic world rather than the macroscopic world. They expect to resolve the conflict between quantum mechanics and the theory of relativity, thinking that a 10-dimensional space is hidden in the hyper-microscopic world. As they claim, high-dimensional space may be hidden in the hyper microscopic realm. However, their mathematics is too complex and difficult to verify experimentally. However, if string theory is truly the theory of everything, it will be applicable not only to the microscopic world but also to the macroscopic world. The theory of everything, I think, should be able to start from the complex and go to the simple, or start from the simple and go to the complex. More importantly, the same fundamental principle should be applied to both the macroscopic world and the ultramicroscopic world.

The approach of this paper regards the hyper microscopic world as a subsystem of the total system. The total system is a string made up of 4-dimensional space-time, but if you enter the realm of elementary particles and black holes, a higher dimensional space appears. The total system is a string with the same starting point, and the high-dimensional space of the hyper microscopic world is also a fine string with the same starting point. From the point of view of this paper, a superstring is the smallest subsystem of the total system that shares the same starting point. Just as a single thread is a collection of large numbers of fibers, so many super strings come together to form a whole string.

Strings that vibrate have energy, but strings that do not vibrate also have energy. However, there is a possibility that even a non-vibrating string will vibrate once it enters the higher dimension world. In four-dimensional space-time, it is almost offset and too weak to be seen, but in a higher-dimensional space, it may be rolled up and twisted and hidden. For example, in 4D spacetime, dark matter may be just a bent string, but in the ultramicroscopic world, it may appear that way because the superstring is vibrating. On the other hand, it may require a lot of energy for a string to have a high-dimensional space. If space is energy, higher dimensions will require more energy. A black hole could be an example. Why does string theory help solve the problem of black holes? That's probably because black holes are high-energy, high-dimensional spaces. According to the uncertainty principle, a particle falling into a black hole is likely to have extremely high momentum. The kinetic energy of the particles may be used to create higher-dimensional space. Graviton can also be created when two particles with extremely high momentum collide. And gravitons can also be particles that exist in high-dimensional space, such as black holes. This is just imagination, but I think that high-dimensional space requires high energy. And the string of high-dimensional space created in that way will be very strong. If the energy of the particles sucked into the black hole is used to create new particles or create a high-dimensional space, it is safe to say that the information of the sucked particles is deleted.

10. Conclusion

Why String Theory? If the assumption of this paper is correct, string theory is naturally derived from the most fundamental principles in the world. In the process of finding a mathematical description of the fundamental principle, the appearance of strings is inevitable. Strings exist as a macro aggregate that composes the entire universe and exists as a fundamental element constituting the smallest subsystem of the universe. Also, the strings of the macroscopic scale and the strings of the ultra-microscopic world are fundamentally the same.

Fundamental principles are the background and philosophy of all physical laws. Free will, symmetry formation, and symmetry breaking always apply equally regardless of the scale of the world. The fundamental principle is the background in which everything in this world follows mathematical principles. Free will is ubiquitous and indistinguishable from chance. Symmetry and symmetry breaking are mathematical features that can be easily observed around us. Many things have symmetry and symmetry breaking. It is thanks to symmetry and symmetry breaking that we can get information from something. You need at least two points to apply symmetry and symmetry breaking, which inevitably leads to the appearance of strings. Using the fundamental principle and the string concept, it is possible to explain the formation and collapse of the wave function, as well as the double slit experiment. This shows that string theory can also be applied in the realm of quantum mechanics. We can also understand why time flows in one direction in classical mechanics. In other words, string theory can explain not only the hyper-microscopic world, but also the microscopic and macroscopic worlds. If the argument of this paper is correct, string theory will be a theory that can explain everything from simple to complex and from complex to simple.

11. Reference

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