The hypothesis of the superelastic vacuum

Introduction

What can be connection between theory of general relativity and theory of quantum field? M-theory describe time like dimension of space (n+1 dimensional theories), but theory of Einstein describe space-time like one duality substance. Perhaps, a "link" between theories can be geometrical.

This work is an attempt to explain the phenomena of time and gravity with a model of the following structure:

The concept of a superelastic vacuum on the macroscale of space and the concept of a superfluid vacuum on the Planck scale are connected into one concept by a geometric transformation, which is a model of the phenomenon of time within the framework of Einstein's theory. On the other hand, the properties of space on the Planck scale determine the properties of space, in particular gravity, on the macro scale.

The phenomenon of the impact of mass and space on each other, described by the General Theory of Relativity, is determined by the properties of space on the macro scale.

Just as in the case of materials resistance, the properties of a steel beam under mechanical load are determined by the structure of its atomic lattice, the presence and characteristics of alloying elements, and the carbon content. Similarly, the properties of spacetime at the quantum and string (loop) levels determine its behavior when bending under the influence of inertial mass on a macroscopic scale.

To understand the properties of space-time on the quantum level and how they determine its gravitational properties on the macro scale, we need to consider the relationships between these properties and other interactions. We need to take all three quantum interactions into account as part of the vacuum fluctuations within the context of a single model - the concept of Grand Unified Theory.

A Grand Unified Theory (GUT) is any model in particle physics that merges the electromagnetic, weak, and strong forces (the three gauge interactions of the Standard Model) into a single force at high energies:

- The electromagnetic force, which acts on particles that have a fundamental electric charge to them, and which can be either attractive or repulsive. The photon is the only particle that mediates the electromagnetic force.
- The weak interaction can be both attractive and repulsive. It plays a role in radioactive decays, nuclear fission, and thermonuclear fusion. It also changing the flavor of quarks and leptons. There are three particles, the two charged W bosons and the neutral Z boson (W^+, W^-, Z^0), that mediate the weak force.
- And the strong nuclear force, which binds quarks into clusters, forming larger particles. The strong force has the odd property of exerting a negligibly small force at very small distances ($r << 10^{-15}$ m.), but of having the force grow very large when the distance between particles increases: a property called asymptotic freedom. Quarks interact weakly also at high energies. It keeps all particles made of quarks and/or antiquarks bound together, and there are eight gluons that mediate it.

Some particles, like the quarks, can experience all three of these interactions. Other particles, like the electron, muon, and tau, can only experience the electromagnetic and weak nuclear forces. Still others, like the neutrinos, can only experience the weak force, while the photon can only experience the electromagnetic force. This overlap is why we don't simply have three separate theories for the three fundamental forces, but rather one overarching theory — the Standard Model — that explains how all of them work in cahoots with one another.

One of the important realizations that occurred in the early 1960s was the realization that the electromagnetic force and the weak force couldn't be described as completely independent of one another, but rather that there's an interplay between the two of them. You cannot just explain the weak force with weak isospin and the electromagnetic force with electric charge, but rather there needs to be a new quantum number that ties the two of them together: weak hypercharge, which was first introduced by Shelly Glashow in 1961.

In string theory, particles can be considered as "excitations" that correspond to string rotations to a greater degree of freedom than the sum of the sets of quantum numbers of the carrier particles of all three interactions.

This work suggests looking at the phenomenon of gravity a little differently than is usually accepted. Gravity is not an interaction, it is a property of space-time, the property of space as a superelastic matter to stretch by mass, which is accompanied by deformation of both space itself and the passage of time.

Quasi-geometry concept

If you are standing in one place, you have the opportunity to take a step forward-backward, left-right or jump but if you don't have time you won't move, you don't have degrees of freedom. On a Euclidean scale, space-time has the form of three dimensions given by the time.

On the scale of Planck space, the same phenomenon occurs at different speeds in opposite directions at the same time [1]. Time vectors can be represented as vectors of a single magnitude in a spherical coordinate system with different values of angles. Imagine a rubber membrane stretched horizontally, well stretched, with a heavy ball in the center. If the ball has been lying in the center for a long time, and then we remove this ball, then the membrane will gather into a fold in the place where the ball was. Let's assume that the membrane is ideally isotropic. So, after we remove the ball, in the vicinity of the point on the membrane above which the center of the ball was located, there will be a force inverse to the tension force. The vectors of this force will be located radially from the center of the neighborhood in the direction from the center. Now I propose to imagine a vacuum in a state of zero energies as the same membrane, but having zero tension - this tension with a very small amplitude and high frequency fluctuates relative to zero. (This example will be discussed in more detail in section "The concept of a superelastic vacuum model").

String physics considers space at this scale to be 26-dimensional for bosons and 10-dimensional for fermions. How can it be connected into one whole with a model of space on the Euclidean scale - that is, with the space that we directly observe? How can space and time be connected into one whole - space-time, a phenomenon described by the General Theory of Relativity?

The form of an isotropic n-dimensional space on the scale of zero-vacuum fluctuation energies is inextricably transformed into the form of a three-dimensional Euclidean space associated with time. n-3 dimensions are compacted into a "superdimension" that synchronizes all processes and interactions occurring at the quantum level in one direction in the Euclidean scale of space. This direction is the direction of time, and the "superdimension" is time itself. The space on the Plank scale is formed by a basis of n linearly independent vectors. The space on a larger scale is formed by a basis of k linearly independent vectors, where $k<n$. The remaining $l=n-k$ vectors are compactified in time, resulting in k+1 dimensional spacetime. In addition, we will have to abandon integer discreteness, which will be discussed in more detail un this paper. [*]

In Euclidean scale of space, time is a physical process as an integrated state of all processes in a given area of space. In the n-dimensional Planck scale of space, the same phenomenon occurs at different speeds in opposite directions simultaneously, but as the scale increases, the correlation between the n-3 dimensions appears and they become interconnected unidirectional time.

Therefore, time sets the possibility of moving objects along the other three dimensions in the space of Euclidean scale.

Time is a geometric compactification of a set of dimensions of space, which determines the possibility of objects to moving through the remaining dimensions of space.

Time is an element of the form of space of the Universe.

But we have not tried to answer another question - how are space and time related to each other?

Using the simple reasoning presented above, we have come to the conclusion that the connection between space and time in space-time depends on the scale of space-time. Perhaps this symmetry between space and time is a loop symmetry. On the Planck scale, according to the Bilson-Thompson concept [2], the ribbon shape defines the quantum of space and the quantum of time in the quantized spacetime. However, on a larger scale, this symmetry changes its form. Therefore, when observing quantum phenomena through sensors, devices and ourselves like observers that are of a completely different scale of space-time, we observe the same phenomena in different ways. This effect is known as the observer effect. It is convenient to describe the observer effect as a violation of loop symmetry.

The appearance of the asymptotic freedom effect may also be associated with a change in the symmetry between time and space at different orders of the spacetime scale. Thus, the value of the spacetime scale less than 10^{-15} meters (the value of the diameter of hadrons) is a conditional boundary at which the symmetry between time and space changes.

Doctor Sabine Hossenfelder has suggested considering two alternative candidates for the "theory of everything": string theory and loop quantum gravity, as two sides of the same coin. In accordance with her position, in order for loop quantum gravity not to contradict the special theory of relativity, it is necessary to introduce interactions that are similar to those considered in string theory.

The concept of a superelastic vacuum model

What happens to space when objects with mass begin to influence it? Imagine a thought experiment: we pull a two-dimensional rubber membrane horizontally and put a heavy metal ball in its center. It will create a funnel. Let's launch a light plastic ball along a straight tangent line to the funnel. Its trajectory will curve towards the funnel. This is a classic illustration of the general theory of relativity.

Now we simultaneously put two heavy balls on the membrane at a distance from each other comparable to the size of the balls. The balls will roll towards each other. The stronger the tension of the membrane, the faster the balls will come closer. The ball whose inert mass is smaller will move faster. Both balls will move with positive acceleration.

The balls come closer to each other due to the tension of the membrane: between the balls it will be stretched more than around them and the membrane tends to reverse the compression process, pulling the balls together.

Now imagine that the "speed" of the passage of time in some epsilon surroundings of space depends on the gravity of such a "ball": the heavier it is, the more the membrane will strive to return to normal when you remove the ball from the membrane.

The tension force will be greater, which means that the acceleration of the movement of an arbitrary point in this epsilon surroundings will be correspondingly greater. The faster time "flows" in such an epsilon surroundings. Let's move on to a more popular analogy: you are traveling from Earth to an area of space located much closer to the center of the galaxy. You come back - centuries have already passed on

Earth. That is, for a short period of time next to a supermassive object, for example, a much longer period of time passes away from such an object.

In such experiments, the tension of the membrane will limit the movement of the balls along a two-dimensional surface to a one-dimensional trajectory.

On the other hand, on the surface of any planet, we are also limited in three-dimensionality by gravity: our vertical movement is not free and the degree of freedom in vertical movement is not an integer dimension. It takes a value between 0 and 1.

The elasticity of physical space as matter limits translational motion in n-dimension to n-1 dimension. On the surface of objects such as planets, this restriction is partial and we are in a system of degrees of freedom between 2 and 3. [*]

On the Euclidean scale, the phenomenon of compactification of dimensions into one super dimension-time - does not cease to manifest itself.

In the singularity of a black hole, all dimensions are compactified into one superdimension, no translational motion is possible.

In the experiment with a rubber membrane, there is no interaction between the balls, they are attracted due to the properties of the membrane. Similarly, **the gravitational force calculated by Newton's formula - is an imaginary force** (like a centrifugal force) **due to acceleration imparted to an inert mass through vacuum tension.**

The phenomena of quantum physics of vacuum fluctuations determine the properties of space as a superfluid matter [3] having the properties of superelasticity in the macroscale of space. We can also say that **gravity is not an interaction, it is a property of space-time**: the property of space to be stretched by the mass of superelastic matter, which is accompanied by deformation of both space itself and the passage of time. Due to the geometry of the connection of space dimensions described above, physical processes and phenomena of the microcosm create phenomena in the macrocosm, in particular, the phenomenon of gravity.

Due to the property of superelasticity, space cannot be divided into two unrelated volumes, as it could be done with a piece of ordinary matter. Because of the same property, space bends into a spiral due to the rapid rotation of supermassive objects, the rotation of several supermassive objects around a common center of gravity causes elastic gravitational waves that persist over long distances.

Also, since the same property, space "attracts" objects to each other that stretch space with their mass.

Let's imagine such a phenomenon: a quantum particle, for example, a neutrino or a photon, flies near a black hole with a non-constant gravitational field ("hairy" black holes with extreme angular momentum) or near a binary black hole system that emits high-frequency gravitational waves. Due to gravity, it accelerates so much that it reaches the maximum possible speed, and then falls into an area with a lower gravitational potential. This movement of particles is similar to the movement of molecules inside a stream of water flowing through a sharply expanding pipe.

The volume of mathematical space that the particle leaves in motion along its trajectory is filled with a physical vacuum that exhibits the properties of a superfluid. The vacuum seems to "flow" into the place just vacated by the particle. The vacuum around a particle accelerated by the gravity of a massive body does not receive momentum. Therefore, the vacuum does not have time to "flow" into the volume of mathematical space left by the particle at a speed that has reached the light barrier. Thus, a "dark spot" is formed behind the particle, where there is "not enough" energy. By analogy with electron holes, which are formed due to a lack of an electron in the valence orbital of an impurity atom in an alloyed semiconductor with p-conductivity. The electron hole has opposite charges and effective masses compared to electrons.

It is logical to call the phenomenon - quantum cavitation, in analogy with the phenomenon in hydrodynamics.

Imagine a rubber membrane stretched horizontally, well stretched, with a heavy ball in the center. If the ball has been lying in the center for a long time, and then we remove this ball, then the membrane gathers into a fold in the place where the ball was. Let's say the membrane is ideally isotropic. So, after we remove the ball, in the vicinity of the point on the membrane above which the center of the ball was located, a force will arise that is the reverse of the tension force. The vectors of this force will be located radially from the center of the neighborhood in the direction from the center.

This also probably means that time in such dark spots goes in the opposite direction.

On the other hand, dark matter and dark energy particles have not been observed to interact with ordinary matter or antimatter. These regions of "negative tension" in the vacuum are gravitationally symmetric to ordinary matter, while antimatter has a charge symmetry. Particles of dark matter and dark energy have no charges. This means that large clusters of such cavitation regions should generate an interaction that is the opposite of gravity and should repel each other at an accelerated rate. Near supermassive objects, such as black holes, neutron or quark stars, there is a high density of particle flux and this effect of quantum cavitation can occur in a cascade, creating huge areas of "dark spots". If these "dark spots" are dark matter and dark energy, then given that the universe consists of more than 80 percent dark energy, it becomes obvious why the universe is expanding with positive acceleration.

This could also explain the problem of the cosmological constant: dark energy and matter gravitationally "straighten" space, serving as an anti-gravity lens.

The collision of particles in a collider at high energies can help to produce muon neutrinos at nontrivially high energies. If such particles are passed through an artificially created inhomogeneity of the gravitational field, the registration of the occurrence of dark matter can partially prove this hypothesis about the nature of dark matter and the concept of a superelastic vacuum.

It is possible that this hypothesis about the nature of black energy and matter is supported by the findings of experiments conducted using the phonon model of a black hole, although it is not fully confirmed [4]. In one such experiment, Jeff Steinhauer created quantum entangled pairs of phonons. When a phonon was absorbed by a phonon black hole, another phonon with opposing properties appeared on the event horizon, traveling away from the black hole.

Perhaps particles of dark matter and dark energy also possess negative momentum values with respect to ordinary matter.

The speed of light in a vacuum determines the yield strength of the vacuum and the limit of its elasticity.

This constant, the speed of light, makes it possible to derive formulas for the fluidity of the vacuum and for the Young's modulus of the vacuum. We can use the formula for the acoustic Reynolds number:

$$\mathbf{Re_a = \rho c_0 V / \omega b,}$$

where ρ is the density of the medium;
v is the amplitude of the oscillatory velocity;
ω is the circular frequency;
c_0 is the speed of sound in the medium;
b is the dissipation parameter.

For wave propagation in vacuum, this formula will have the same form, where ρ is the density of absolute vacuum; v is the amplitude of the oscillatory velocity of a quantum particle; ω is the circular frequency of the wave corresponding to this particle; c is the speed of light in vacuum; b is the dissipation parameter in vacuum fluctuations.

To determine the absolute vacuum density in a certain bounded region, it probably makes sense to use the formula for the energy of this vacuum region as a superfluid:

$$\mathbf{U = (n/2)*k*T,}$$

where n is the number of translational degrees;
k is the Boltzmann constant;
T is the absolute temperature in Kelvins.

Since the vacuum is a fluctuationally arising and annihilating particles, it is possible for phonons to propagate from between such particles, or in other words, a phonon longitudinal wave.

Based on this, we can use the formula of the velocity of propagation of a longitudinal wave in a thin rod:

$$\mathbf{c = \sqrt{(E/ \rho)},}$$

where ρ is the density of the medium;
E is the Young's modulus.
For vacuum the same formula will have the form:

$$\mathbf{E = (c^2)*\rho,}$$

where ρ is the density of absolute vacuum;
c is the speed of light in vacuum;
E is Young's modulus.

The formula of the absolute vacuum density for a limited volume V of space at an average absolute temperature T (with insignificant and permissible temperature deviations over a given area of space):

$$\mathbf{m*c^2 = (n/2)*k*T}$$

$$\mathbf{\rho*V*c^2 = (n/2)*k*T}$$

$$\mathbf{\rho = (n*k*T)/(2*V*c^2)}$$

Young 's modulus formula for a limited volume V of space at an average absolute temperature T (with insignificant and permissible temperature deviations over a given area of space):

$$\mathbf{E = (n*k*T)/(2V)}$$

On the other hand, Einstein equation:

$$\mathbf{R_{ab} - Rg_{ab}/2 = 8\pi GT_{ab}/c^4 - \Lambda g_{ab}}$$

demonstrates that at $\Lambda \neq 0$, empty space creates a gravitational field (i.e., the curvature of space-time described by the left side of the equations) such as if matter with a mass density:

$$\mathbf{\rho_\Lambda = c^2\Lambda/8\pi G,}$$

and energy density:

$$\mathbf{\varepsilon_\Lambda = c^4\Lambda/8\pi G}$$

Using the derived formulas for the characteristics of the fluidity and elasticity of vacuum and the formula for the density of absolute vacuum as an energy substance, we can describe the state of a limited area of space in space through the concept of elastic energy. The stress at the point of the material is compared with the gravitational potential at the point of physical space. Just as in the resistance of materials, tensors of compression and tension stresses arise in space. Differential equations can describe the displacement of a point of physical space from vacuum stretching and the bending angles of space under the action of an inert mass.

The gravitational potential can be correlated with the voltage at the point of superelastic matter - at the point of absolute vacuum. Then the equation of motion of a particle under the action of gravitational forces:

$$\mathbf{q'' = grad(\varphi),}$$

where q is the generalized coordinate of the particle;
φ us the gravitational potential of the field.

On the other hand, the components of the tensors of the theory of relativity, that is, the components of the metric of space, can be taken as arguments for differential equations describing the deformation of physical space.

Having made the appropriate calculations for the stretching of physical space in a certain area of space, it is possible to compare the calculated value of the Hubble constant with the calculated value by the redshift method of the same constant.

Meson invariant of hadron string theory
(string-loop concept)

When an open string rotating around its bending center receives energy from vacuum fluctuations, it begins to rotate in another dimension - around the diameter of its plane rotation. Let's briefly assume, as a priori, that the string has positive energy - later we will consider where this energy comes from. So, due to the non-simultaneous distribution of the entire string along the circumference of the plane rotation, with additional rotation around the diameter, the axis of this rotation has a precession:

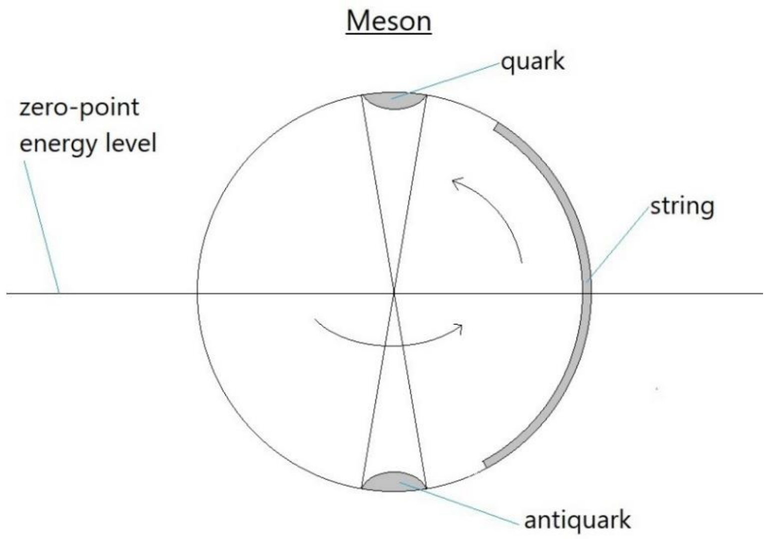


Figure 1

The regions at the poles bounded by the rotating axis are the quark and the antiquark arising in the confinement.

The amplitude of the nutation, the precession frequency, and the radius of curvature of the string can determine the mass and charge numbers of quarks that occur when the string vibrates.

The quark and the antiquark exist in the region of positive energy, with the level of the zero-point energy value between them inside the bound state membrane. Due to this, the strong interaction does not attract the quarks to each other. Since the distance between quarks does not decrease, they are not released from confinement through asymptotic freedom, and remain bound by a spatial membrane formed by string vibrations.

The displaced center of precession of the axis of rotation defines a pair of quark-antiquark of different masses. Depending on the ratio set by the displaced center, charged pions, kaons, etc. are formed:

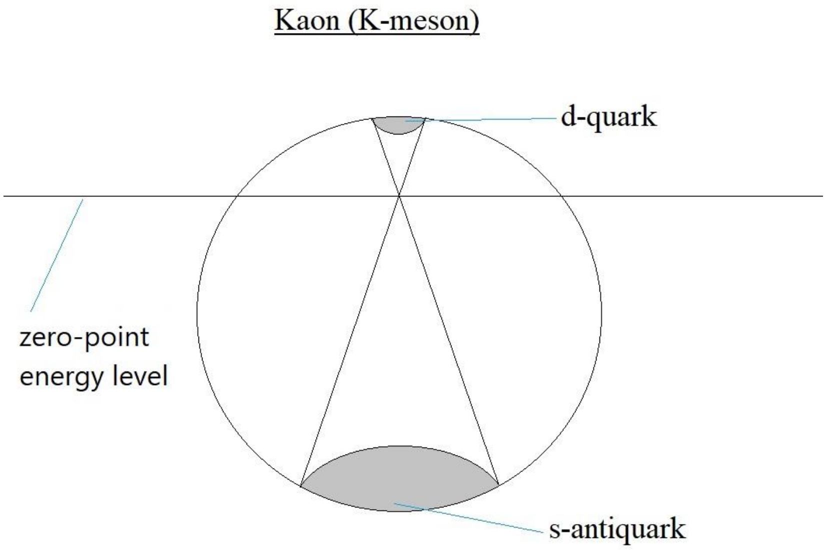


Figure 2

The lifetime of the meson consists between the intermediate and the last states of the vacuum region in which the meson arises (Figure 3):

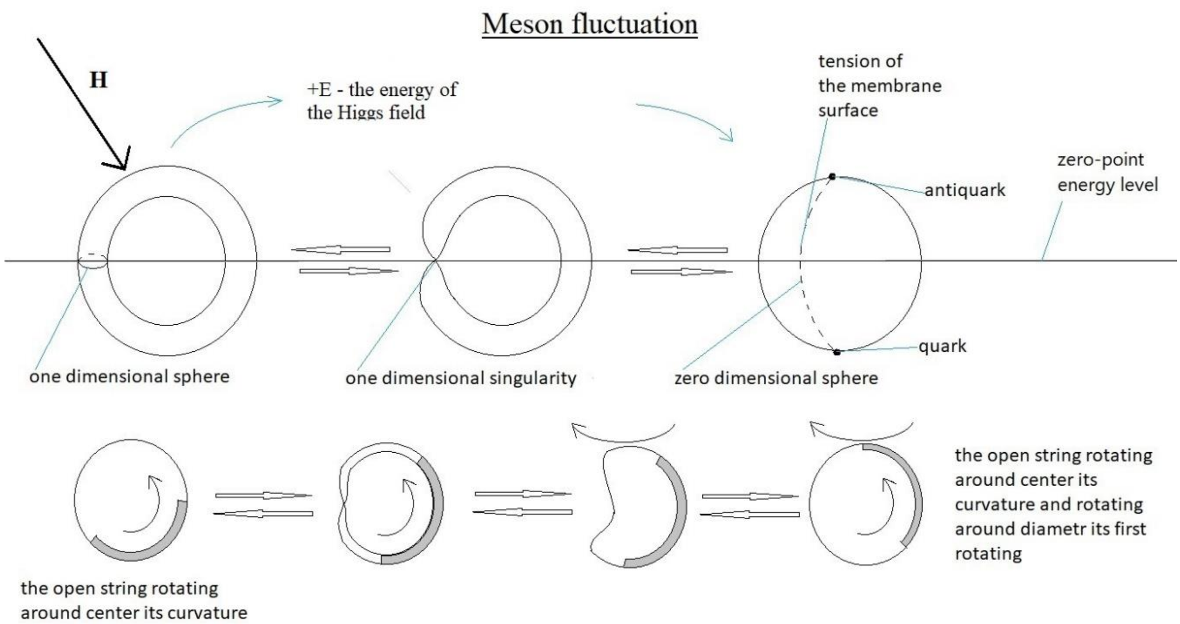


Figure 3

Classically, the string is represented as an elongated cylinder with a length of 10^{-33} m. and a diameter of 10^{-35} m. Imagine the same cylinder, but strongly compressed perpendicular to the length so that its bases are pronounced ellipses, and the shape of the cylinder itself is close to the shape of the thin plate. This plate can be twisted by rotating one base relative to the other parallel to the bases. Such an elastic plate as a particle is capable of transmitting the moment of rotation when interacting with other similar plates, since it has a preliminary tangential stress. In the process of chaotic interaction of such plates with each other, two regions close to the ends of one plate can transmit different values of tangential stress.

Let's imagine such a "compressed" string as an absolutely thin elastic plate. Then the "twisting" of such a plate sets the unit volume due to the fact that the shape becomes spatial. On the other hand, the time step is set, since the elastic plate, receiving a tangential stress, tends to straighten: its straightening determines the unit of time. When a twisted plate is rotated, an open string forms in the shape of an elongated cylinder.

The two surfaces of such plate are a pair of gluons; the rotation of the plate-string causes the strong interaction between quarks. A single gluon may correspond to a closed ribbon twisted an odd number of times in a spiral. This results in a single-surface tape that is shaped a Mobius strip. When the ribbon-string rotates during the lifetime of the meson and moves from one side of the quark to the other, their mutual arrangement changes and, accordingly, their color charges change. The same membrane can be formed by several loop strings rotating along a common orbital, thus forming several pairs of gluons.

The twisted plate has potential energy, which is responsible for the energy of the string. The string, in turn, forms a membrane that has surface tension energy.

On a scale of approximately 10^{-33} meters, spacetime can be described as follows: space consists of what could be called "pixels of space" and "pixels of time" [2], where each pixel of time has a vector associated with it. These time vectors have different directions depending on the domain, which is similar in scale to the size of hadrons.

To illustrate this idea, we can compare it to the crystal lattice of a non-magnetized ferromagnet. In this analogy, the atomic lattice consists of domains, in each of which the electron spins have a random orientation. When a particle with rest mass appears through vacuum fluctuations, it "magnetizes" the area of space occupied by this particle and equally orients the vectors of time pixels.

Both particles (Figures 1, 2) are connected to each other by the tension of the membrane surface, which tends to collide the particles with each other (the meson decays, according to Feynman diagrams; Figure 4). The shape of the confinement is symmetrically transformed, releasing the energy of the bound state. Losing energy, the string ceases to rotate by one degree of freedom (Figure 3).

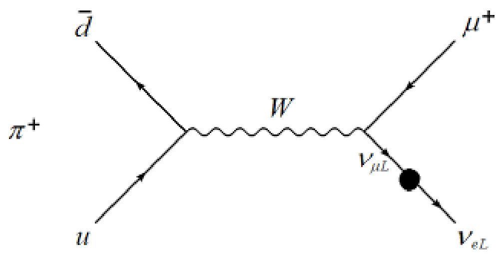


Figure 4

The shape of the vacuum section before the particles fluctuating in it has an n-dimensional puncture (three-dimensional in this case), the time is not determined, since there are no particles, interactions and processes in this vacuum section. With the appearance of particles having a rest mass, the shape of this vacuum section has an n-1 dimensional puncture (2-dimensional in this case).

The total energy of mesons is significantly greater than the total energy of their decay products:

π^0 [(uu¯–dd¯)/sqrt(2)]: m = 134,9770(5) MeV/c^2; decay particles: 2γ (no rest mass)

π^- [dū]: m = 139,57061(24) MeV/c^2; decay particles: $\mu^+ + \nu_\mu$
(105,6583745(24) MeV/c^2 + < 0,28 eV/c^2)

K^- [sū]: m = 493,667(16) MeV/c^2; decay particles: $\mu^+ + \nu_\mu$; $\pi^+ + \pi^0$; $\pi^+ + \pi^+ + \pi^-$;
$\pi^0 + e^+ + \nu_e$ ($m(e^+)$ = 0,51099895000(15) MeV/c^2)

Some of this "missing" energy is due to the surface tension of the membrane. In addition, strings can vibrate translationally, creating a probabilistic cloud around the center of the brane. Changes in the energy of these vibrations may contribute to the interaction between nucleons through mesons during nuclear processes.

We can consider strings that rotate in the one plane (Figure 3, left) to be bosonic, and those that oscillate in two dimensions to be fermionic (Figure 3, right). The energy of the tension of the mesonic (or baryonic) membrane can be thought of as the energy of the strong interaction field. The energy received by a bosonic string is the energy of the string in the Higgs field. When a bosonic string receives this energy, it begins to vibrate on the surface of the membrane, forming regions of precession with particles that have a rest mass.

The topological symmetry between these two forms (Figure 3) is the symmetry between the energy of rotation of a string in one plane, which has no rest mass, the energy obtained from the Higgs field and between the energy of rotation of a string in two planes, which consists, among other things, in the rest masses of two quarks. In other words, this mapping is a supersymmetry. For other bound states, for example, baryons, supersymmetry will be displayed differently, in each case it depends on the shape of the branes.

The diagram shown in Figure 3 corresponds to the decay of neutral pions [π^0 = (uu¯–dd¯)/sqrt(2)] and quarkonium. The same decay products, massless particles photons, correspond to different mesons - particles with a rest mass. This shows a violation of the supersymmetry of elementary particles. Mesons consisting of quarks of different masses are asymmetric (see Figure 2 – K^+, D^0, etc.) and their decay products include particles with a rest mass. In this case, we observe an implicitly expressed supersymmetric mapping between two states: before decay and after. And in this case, the same massless decay products may correspond to different particles.

Both quarks of the same meson are in the field of positive mass and energy relative to the zero-point energy level, but the membrane of their bound state includes a region with zero energy, which creates a charge symmetry between the two poles of the meson. A string that begins to rotate with precession, as in Figure 1, creates regions with positive energy at the poles - this is the energy of the precessional rotation of the membrane, which has energy, since it is formed by the rotation of the string, which has energy.

During this process, the string transitions from a region of zero energy to one of positive energy and then back again as it rotates. Since the string itself has non-zero energy, two potential differences are created in this way - between the poles and the zero-energy field. These differences add up because they are caused by the rotation of the string in one direction. This creates a field with a potential difference, which means that the aromas, electric, and baryon charges of the two quarks in the same bound state are opposite.

In this case, we can consider a membrane in the field of the electroweak interaction. When it rotates in two degrees of freedom, it creates an electroweak field. This field generates two opposite charges. Both regions with baryonic and electric charges have energy due to the precessional rotation of the membrane. This energy in such a field has a rest mass and this a priori can be compared with the Schwinger Effect.

Let's imagine that the Schwinger Effect and the Higgs mechanism describe the same process of the appearance of particles with a rest mass in an Einstein vacuum. The Higgs field is a field of strong-electro-weak interaction. The Higgs boson is the particle that carries this interaction. The Higgs boson can decay in various ways:

- Bottom–antibottom pair (observed)
- Two W bosons (observed)
- Two gluons (predicted)
- Tau–antitau pair (observed)
- Two Z bosons (observed)
- Two photons (observed)
- Two leptons and a photon (Dalitz decay via virtual photon) (tentatively observed at sigma 3.2 (1 in 1,000) significance)
- Muon–antimuon pair (predicted)
- Various other decays (predicted)

Among them (observed): into a pair of quarks and antiquarks, which interact through the strong interaction. It can also decay into W^+ and W^- bosons, which are carriers of the weak interaction. It can decay into a pair of photons, which are carriers of electromagnetic interaction. In addition, it can decay into Z bosons.

Thus, the Higgs field decays into electroweak and strong fields. Or it decays by the cascades into strong, electromagnetic and weak. The Higgs field can decay into various combinations of electroweak and strong forces. This, for its part, explains both the large mass of the Higgs boson and its short lifetime.

A team of physicists from the University of Chicago assembled a device that passes through about half of the incoming phonons, reflecting the remaining ones back [5]. But when only one phonon enters this divider in a period of time, both quantum states of the phonon are realized simultaneously - the reflected and the past divider - interact with each other in the process of interference. After splitting the phonon, both of its variants are subsequently collected back.

Adjusting the installation parameters changed the way the reflected and transmitted parts of the phonon interacted with each other. This allowed the researchers to quantum-mechanically change the probability that the entire phonon will return back to the qubit that launched the phonon, or to the qubit on the other side of the beam splitter.

This experiment leads to an understanding of the phonon as a topological entity of the Planck scale. On the other hand, on the same scale we continue to observe discreteness: we observe two different states of a particle that interfere with each other.

Such interference of phonon states may simply be a string "compressed" into a plate and twisted into a spiral. On the other hand, the same phenomenon can be viewed as a ribbon in accordance with the Bilson-Thompson concept [2]. The ends of the plate twisted with different tangential stress are different states of the phonon, and the phonon itself is a cross-section of this plate, with some probability located near one of the ends.

Conclusion

Supersymmetry is a tensor mapping between modes of a group of strings that, receiving energy from the Higgs field, change modes of vibration. The massless membrane interacts with the Higgs boson, while the modes of the strings forming the Higgs boson change the modes of the strings forming the massless membrane. This occurs when a tangential voltage is transmitted between two loop strings (string-loop concept). When two ribbons twisted into a spiral - a strings - touch the end surfaces, instant concatenation occurs and the vibration modes of both strings receive the same values.

This is how information is transmitted - this is one of the mechanisms of the law of information preservation. After that, the bosonic strings with "updated" vibrations form a membrane of a particle or a bound state of particles with a rest mass. The Higgs boson decays.

Gravity is a property of the Einstein vacuum at the macroscale, which is determined by the Higgs field at the quantum level. On the Planck scale of the Einstein vacuum, time does not flow linearly (quasi-geometry concept), it is multidirectional. Therefore at this scale of space, the period of the early universe, when all interactions were unified, is not a "past", but a variation of the "present". The Higgs field is a variation of such a "present", which corresponds to the state of space in the early universe.

The Higgs field is a field that combines electromagnetic, weak and strong fields into a single field both at high energies and at very small distances, and also displays the state of the Einstein vacuum in the early period of the universe's development.

With some simplification, we can say that the Einstein vacuum at the quantum level is the Higgs field. Therefore, the Higgs field, due to which particles with a rest mass arise, is the only field in quantum physics that has a mass density - it is also the density of vacuum according to Einstein.

However, it is worth remembering that from the Einstein equation it follows that the cosmological constant (Λ) on the right side of the equation has a negative sign, which indicates a negative acceleration of the expansion of the universe. At the same time, it follows from the same equation that a non-zero value of the cosmological constant indicates a non-zero density in mass and energy of the Einstein vacuum. It follows from the same formula that both densities are positive. Additional, both formulas have an average cosmological value.

At the same time, observations have established that the universe is expanding with positive acceleration, which means that the average values of vacuum density in energy and mass are negative. Einstein also couldn't take into account that 81.6% of the universe is dark energy. According to the reasoning given above (the concept of a superelastic vacuum model), the field of dark energy and matter is a field of negative masses and energies. Therefore, Einstein's equation remains true, but describes the vacuum of all matter and energy except dark matter and energy.

Space and time are connected to each other by a special kind of symmetry into a single substance of space-time, described by Einstein in the General Theory of Relativity. For convenience, let's refer to this symmetry as a loop symmetry for now. However, at different intervals of the space-time scale, this symmetry has different forms. So, on the Planck scale, in the range of (10^{-35}; 10^{-15}) meters, this symmetry is described by the concept of loop quantum gravity [2].

On this scale, the fields of all three interactions - electromagnetic, weak, and strong - are represented by a single field known as the Higgs field.

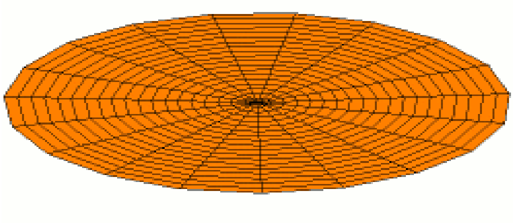
Asymptotic freedom begins to emerge at scales less than 10^{-15} meters, and this value serves as a boundary condition for the loop symmetry. At the boundary value of the space-time scale, the electromagnetic and weak fields represent the electroweak field.

On a scale that exceeds that of complex molecules, excluding polymers, the fields of all three fundamental interactions become a unified whole, forming a superelastic vacuum with the properties of gravity and a conductor for electromagnetic fields.

The cosmological constant is a conditional constant, since it depends on the density of dark matter. As the Earth rotates around the Sun, it periodically approaches and moves away from the center of the galaxy. This means that the density of dark matter around Earth periodically changes. This provides a theoretical opportunity to verify the accuracy of our conclusions.

This theory can be verified by experiments on hadron accelerators for the detection of elastic energy; by calculations of the motion of astrophysical bodies through the concept of elastic energy; by observations of the LIGO system, the Hubble and Webb telescopes.

Perhaps the universe is a standing wave on an elastic three-dimensional disk, oscillating at different modes:



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