The hypothesis of the superelastic vacuum concept

Introduction

What can be connection between theory of general relativity and theory of quantum field? Why it is not physical? Probably, it's impossible because 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.

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. It can be thought of as three points moving back and forth in a straight line.

The form of an isotropic 26-dimensional (or 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. 23 (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. 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 26-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 23 dimensions appears and they become interconnected unidirectional time. Therefore, time sets the possibility of moving objects along the other three dimensions in the Euclidean space of weightlessness.

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.

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 film will strive to return to normal when you remove the ball from the film.

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 a 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 [1] 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 higher gravitational potential in the crest of the gravitational wave.

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. Gravity is capable of acting on a particle, but does not act on a region of physical space. 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 in an alloyed semiconductor with p-conductivity, a region with virtual particles with inverse values to the values of particles arising from vacuum fluctuations in the epsilon surroundings of this region is formed.

It is logical to call the phenomenon - quantum cavitation, in analogy with the phenomenon in hydrodynamics. The appearance of a region with "dark spots" is similar to the appearance of a Mach cone in aerodynamics. Presumably, the shape of such an area takes the form of an Alcubierre. Experiments with the Casimir effect conducted by Harold White in 2021 has been observed that quantum particles in identical quantum states at very small distances from each other are affected by the Casimir force. Probably, two identical particles under the action of the Casimir force, with a decrease in the distance between them, accelerate so much that the effect of quantum cavitation is manifested, due to which the particles move forming crests of the Alcubierre wave in front and behind them.

Other material particles located at a distance from this region comparable to the size of this region receive additional acceleration. 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". Such "dark spots" are not observed as astrophysical objects, but they can noticeably accelerate the movement of observed astrophysical objects. This phenomenon explains the paradox of dark matter, on the other hand, gives an important constant for describing the properties of vacuum as 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:

$$\mathrm{Re_a} = \frac{\rho c_0 V}{\omega b},$$

where ρ is the density of the medium;
v is the amplitude of the oscillatory velocity;
ω is the circular frequency;
c 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 vibrational 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:

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:

$$c = \sqrt{\frac{E}{\rho}},$$

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

E = (c^2)*ρ,

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):

m*c^2 = (n/2)*k*T

ρ*V*c^2 = (n/2)*k*T

ρ = (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):

E = (n*k*T)/(2*V)

On the other hand, Einstein equation:

$$R_{ab} - \frac{R}{2} g_{ab} = \frac{8\pi G}{c^4} T_{ab} - \Lambda g_{ab}$$

demonstrates that at Λ≠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:

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

and energy density:

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

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:

q" = grad(φ),

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. 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:

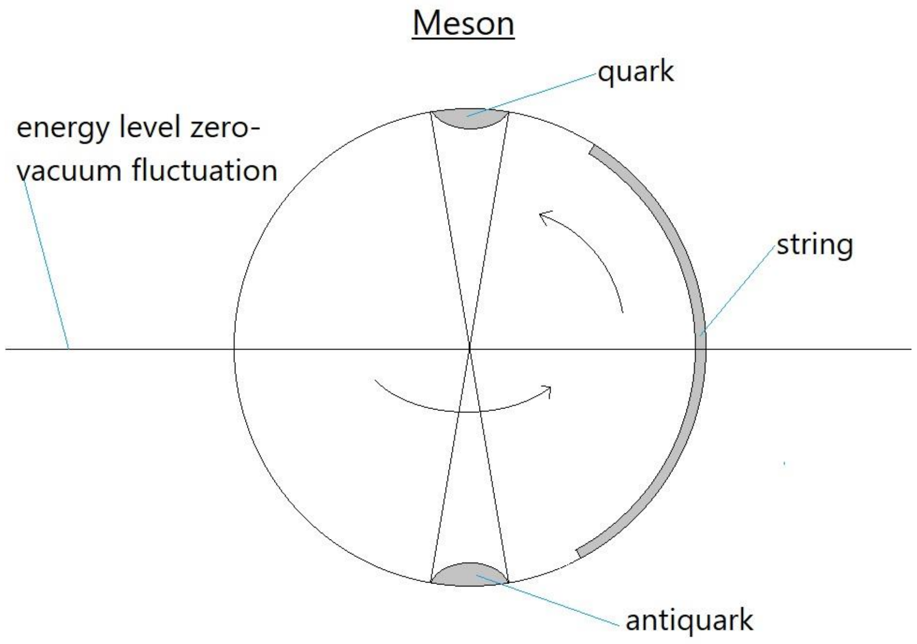


Figure 1

The regions at the poles bounded by the rotating axis are the quark and the antiquark arising in the confinement, their total energy is the energy of the precessional rotation of the string. The frequencies of string vibrations and their ratios determine the quantum numbers of quarks. The order of the precession velocity probably determines the order of mass, which means the generation of the particle:

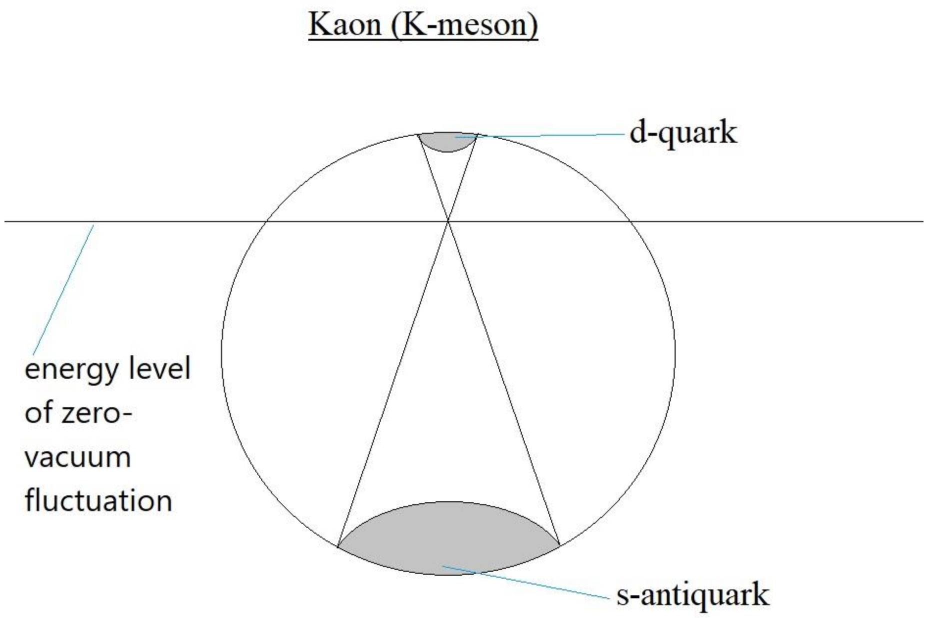


Figure 2

The amplitude of the nutation and or the string radius of curvature can determine which particular fermion particle occurs when the string vibrates.

Both particles are connected to each other by the tension of the membrane surface, which tends to collide the particles with each other. Shifting to each other, the particles annihilate and the shape of the confinement is symmetrically transformed, releasing the full energy of both particles. Losing energy, the string ceases to rotate by one degree of freedom. 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. Time is singular. 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). Time gets a direction.

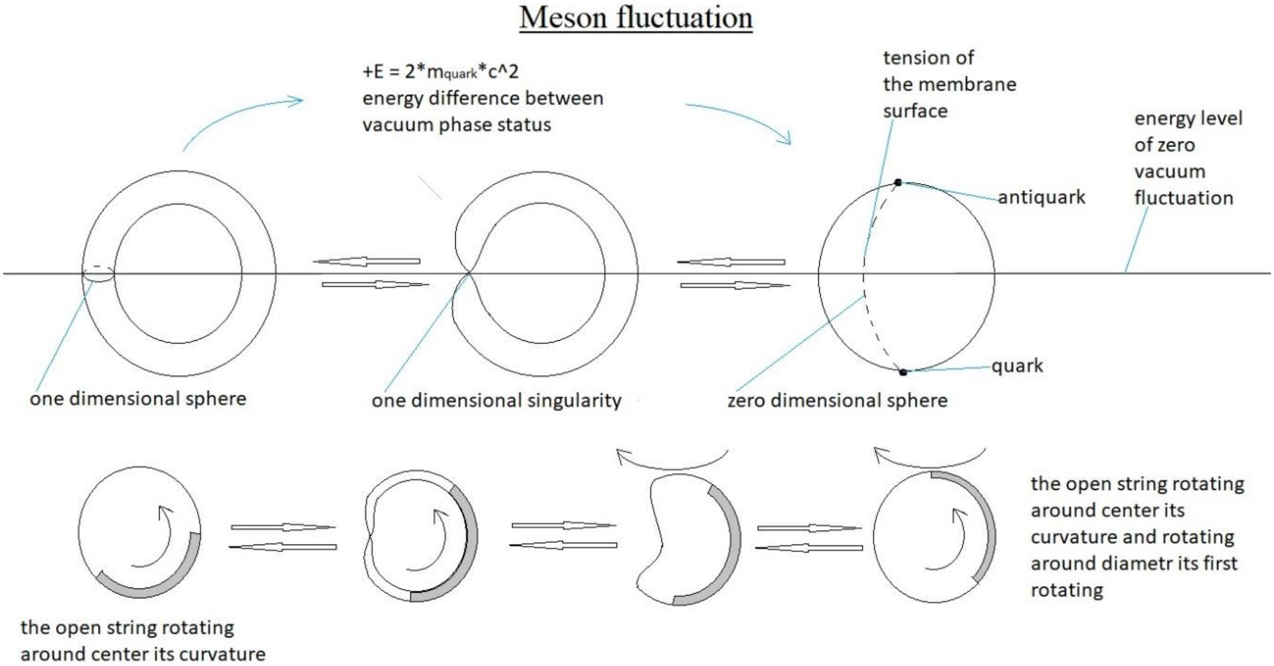


Figure 3

Let's look at the quark-antiquark pair from the quark side in the direction of the antiquark and assume as a priori that the string rotates counterclockwise around the diameter (Figure 1). So, if we look in the opposite direction (symmetrically relative to the energy level of zero vacuum fluctuations, from the negative energy values), then the string will rotate clockwise. All processes will occur in opposite directions: the spin and signs of all the charges of the antiquark will be opposite to the paired quark. Due to the opposite signs for all charge numbers, we can consider a pair of quark-antiquark as a dipole, and a quark as a monopole. A pair of particles and antiparticles annihilate because they are in opposite processes compensating each other. Time in this case is the process itself, and on different sides of the zero vacuum fluctuation energy level, interaction processes occur in opposite directions, and during annihilation time degenerates into a singularity in this region of absolute vacuum.

Probably, the lifetime of the meson consist between the intermediate and the last states of the vacuum region in which the meson arises (Figure 3). Therefore, the membrane tension between the quark and the antiquark is always asymmetrically distributed over the membrane surface, which affects the occurrence of precession and nutation (Figure 1,2). Since the tension of the spatial membrane disappears during annihilation, the elastic energy of the superelastic vacuum must be released (in addition to the total energy of the annihilating particles). However, for one membrane, this energy is very small. Probably, this energy is released quantized (in portions) immediately from a cascade of simultaneous annihilations. If this theory is correct, energy can be detected by experiments on hadron accelerators. Since pentaquarks are several times heavier than mesons, the membrane of such a bound state has greater elastic energy, so it is more convenient to check the presence of elastic energy in bound states on the decay of pentaquarks.

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 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 bases of one plate may have different values of tangential stress.

If such a plate as a string rotates and forms two quarks (Figure 2), then their quantum characteristics will differ from each other according to the difference in the tangential stress at the ends of the string. It is convenient to assume that such a ratio of quantum numbers of such a pair of quarks, as well as their versatile arrangement relative to the energetic level of zero vacuum fluctuation, is a kind of mapping of quantum states that can be a candidate for supersymmetric mapping. Then kaon is a special case of a supersymmetric pair of quarks.

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.

The two surfaces of such a plate are a pair of gluons, the rotation of the plate-string causes the interaction between quarks. When the ribbon-string rotates during the life of the meson and moves from one side of the quark to the other, their mutual arrangement changes and, accordingly, their color charges change.

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 [2]. 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 particles 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.

Probably, such interference of phonon states is 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. 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

The connection between the state of absolute vacuum as a superfluid at the quantum level and the state of vacuum as a superelastic matter at the macroscale is justified by the geometry of the connection of the dimensions of space. This geometry shows the role of time in the dimensions of space and explains the physical meaning of time as a phenomenon in physics. This geometry also shows, physical space, absolute vacuum, as a phenomenon in physics is not a mathematical space.

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.

The concept of a superelastic vacuum does not contradict the concept of loop quantum gravity, both theories agree that time at the quantum level does not exist in the form in which it exists on the Euclidean scale.

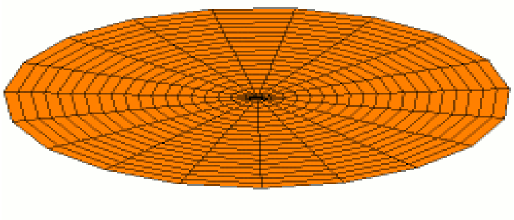
This model gives an idea of how it is possible to create a technology for influencing space in order to move around the Solar System and beyond in cosmological coordinates.

According to modern observations, laboratory studies and concepts of theoretical physics, time is a physical and geometric illusion. Probably, our universe is a standing wave, and its singularity is a Big Bang, its antinode is a Big Gap [3]. This wave has 26 (n?) dimensions, in accordance with the law of conservation of information. Time exists only within each antinode of the wave, all antinodes exist in parallel, which determines the variety of manifestations in quantum physics, since it is at the quantum level that time itself ceases to behave linearly and unidirectionally. The further the energy level is from the level of zero-vacuum fluctuations, the more pronounced the phenomenon of time is. The axis of propagation of this wave can be compared with the energy level of the zero-vacuum fluctuation.

Time on this scale has no pronounced direction due to temporary "interference" fluctuations caused by the annihilation of matter and antimatter.

Antimatter exists in reverse processes of interactions, so the time of the antimaterial world is opposite to our time. When matter and antimatter meet, annihilation occurs, as the opposite processes come into equilibrium, time degenerates into a singularity. Perhaps such a singularity surrounded by a flow of energy creating a funnel in space by the impact on space is black holes, or one of their types.

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



The vibrations of the elastic disc with a string structure excite the vibrations of the strings. String vibrations define the variety of quantum particles of the Standard Model. The nonexcited state of an elastic disk corresponds to the zero tensor of the space metric in the Theory of Relativity. This tensor corresponds to a space-time singularity. At the conditional moment of the Big Bang, the structure of space was just beginning to vibrate and all string vibrations differed slightly from each other, then the differences in string vibrations increased, which corresponds to the cosmological evolution of the Universe.

[1] The state of the superfluid vacuum, the time-varying cosmological constant and nonsingular cosmological models; Sinha K.P., Sivaram C., Sudarshan E. K. G.

[2] Splitting phonons: Building a platform for linear mechanical quantum computing, H. Qiao; É. Dumur; G. Andersson; H. Yan; M.-H. Chou; J. Grebel; C.R. Conner; Y.J. Joshi; J.M. Miller; R.G. Povey; X. Wu; A.N. Cleland.

[3] Phantom Energy and Cosmic Doomsday; Robert R. Caldwell, Marc Kamionkowski, Nevin N. Weinberg.

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