Twisted Space Model (TSM)

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This investigation is a new model which unites space, time and matter as one whole. The model is based on two basic principles: 1) Limitation of Existence; 2) Space is structure and matter is phase states of the structure. The result of the investigation corresponds to the visible world and discloses reasons of space, time and matter properties.

Key Words: twisted space model, space structure, phase states of the structure

Модель скрученного пространства (МСП)

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Данное исследование – это гипотеза, представленная в виде модели, объединяющей время, пространство и материю. Модель построена на двух постулатах: 1. Ограниченность Бытия. 2. Структурированность пространства: утверждается, что пространство – это структура, а всё, что наполнят протяжённости пространства (развёрнутую структуру), есть различные фазовые состояния этой структуры (материя).

Ключевые слова: модель скученного пространства, структура пространства, фазовые состояния пространства

Introduction

The idea of this study is to try to understand the principles of Genesis existence by using only the fundamental postulates, not looking at the existing stereotypes and logically analyzing observed Genesis.

1. Principle of causality

Something exists only if it can be observed. Observability of anything implies the possibility of direct or indirect interactions between something that can be observed and what (or who) can observe.

Since only the process of interaction can define the existence of something, interaction creates a sequence of the observer and different states of the observed. The sequence is the order of these states. Each successive term of the sequence is a consequence of the previous one, which is the cause for the next term of the sequence.

It means there is only subject to causation. Indeed, an object or phenomenon cannot be the cause of something (sequences of interactions or changes that can be observed) if the object or phenomenon is not subject to causation. So, no one and

nothing in the world will ever know of the existence of the object or phenomenon. It means that something is not accidental, but has its own reason if this something exists.

2. Space

Physical space will be defined as the space of the real universe in which we exist, and everything that surrounds us exists.

Physical space is observable in the form of spread of the objects that fill it and the distances between these objects. Observability of anything is a consequence of causality.

It means that physical space must obey by the principle of causality or transformation of the space has to create conditions which determine causality of Genesis.

3. Space dimension

Dimension – a property of an object to be extended in several (major) directions.

Arbitrary set of basic directions (vectors) in space is called a space basis if all other directions in this space can be represented as a linear combination of these basic directions.

Number of main directions in the space basis determines the size of the space dimension [Basis].

Dimension of the space is observable, which means it has to have a cause.

The reason for the limited set of possible directions of extension in space may only be the structure of the space, which is the space itself.

The structure of three-dimensional space can be a matrix of a set of basic elementary cells that fill the space without a permit. Set of forms of such cells for a plane three-dimensional space bounded by three regular polyhedra: tetrahedron, cube, octahedron, where cube is the most universal form of the structure of space because the tetrahedron and the octahedron can fill three-dimensional space without a gap only when packing them in a sequential combination [Polyhedron].

4. Terms of unambiguity of causality

When one of the basis vectors is chosen, a well-defined sequence of passing of other basis vectors exists in any arbitrary basis of three-dimensional space, as well as in spaces with smaller dimensions, which does not apply to the four-dimensional space. Spaces with dimension d>3 have different options for bypassing of its vectors, planes and spaces. [D'Amateur].

It means that three-dimensional space is a space with the biggest dimension where causality is fully determinate because the causality is based on unambiguous space transformation.

Consequently, a relationship between cause and effect cannot be unambiguous in spaces that have more than three dimensions (there is a variety of consequences for every single reason). The concept of Probability in the sequence of causal interactions becomes fundamental for such spaces with dimension d>3 (for example: d=4).

Probability is the degree of predictability or unpredictability of events observed under certain conditions.

Existence probabilities (uncertainty) does not deny the principle of causality, it just fixes our limited possibilities for perception.

5. The Prime Cause

The Finiteness of Existence postulate had been first introduced within the theory of the "Big Bang". According to this theory, the universe was created from a singular point as a result of an explosion of universal proportions [The Big Bang].

Based on the Finiteness of Existence postulate, one can suggest that the sequence of transformations of physical space and substance has a beginning, which means that its Prime Cause should exist, which is the cause of Everything. Accordingly, the world that surrounds us is the result of a sequence of interactions and transformations generated by the Prime Cause.

The Prime Cause, being the cause of Everything, cannot fall under the principle of the causality principle itself, otherwise the Prime Cause should be a consequence of another cause and, therefore, it would not be the Prime Cause.

Hence, in case of the finiteness of the Existence, there should be a Prime Cause that is positioned outside of the physical space and that serves as the cause of its existence.

This means that there should be a state where the space does not exist.

6. Substance, Space, Time

If **substance** is defined as the aggregate of everything that fills up the physical space, then one can suggest that the world that surrounds us consists of three-dimensional physical space and the substance.

The substance cannot displace the space, accordingly, not only is it positioned in the space, but it also consists of the space.

Therefore, a generalized notion of the **Space** must include not only the physical space, but also the substance that fills it up.

Time can be observed as a relational and sequential change of position of material objects in the space, hence, if substance is a form of space, then time is a property of the space related to its transformation.

7. Absolute emptiness

Absence of Space can be defined as "**Absolute emptiness**".

Absolute emptiness cannot have dimensions, mass, direction, or any other geometrical or physical characteristics, hence, such emptiness can be considered a space with dimension of d=0.

- Indeed, a space with dimension of d=0 does not have a spread and, accordingly, cannot possess any geometrical or physical characteristics because all of such characteristics are relative and the relativity can exist only where it is possible to compare something, which means there is a way to separate something from something else. But one can separate something from something else only if there is a spread.
- Absolute emptiness is completely motionless, since motion is a change of distance between objects and, accordingly, absence of spread implies absence of any motion.
- The definition of absolute emptiness is universal, which means that the absolute emptiness is single. The presence of something excludes the existence of the absolute emptiness since it implies certain characteristics not inherent to absolute emptiness.

Indeed, if we presume that two of absolute emptinesses exist, then they must differ from each other, hence, there should be space between them, which would mean that absolute emptiness does not exist.

- From here, the insularity of any space that can appear from absolute emptiness becomes obvious.

Indeed, if such space is insular, it must be limited by the absolute emptiness. However, since the space has a spread and the absolute emptiness does not, then an indefinite set of absolute emptinesses limiting such a space should exist, which, as we have concluded already, is not possible.

Accordingly, if a method of packing our Universe into a space with dimension of d=0 (complete degeneration of space) exists, then such space is an absolute emptiness even when it contains our entire Universe.

8. Resiliency of the Space and Energy

Since the space appears from the absolute emptiness, the cause of space transformation must be within the space itself. Therefore, the cause of expansion of the space is an internal characteristic of the space that we will define as its *resiliency*.

Resiliency of the space is a prerequisite for its evolution because only the resiliency of the Space can be the cause for its transformation.

If tightly packed (degenerated) space expands under the influence of its own resiliency, then the state of balance for such space is its expanded, not degenerated, state.

Accordingly, the structure of a tightly packed space unfolds into the three-dimensional space like a clasp-knife that has numerous blades hidden inside, until it reaches the state of balance in orthogonal basis.

Disintegration of degenerated dimensions of the space represents actualization of the main feature of the space – the spread.

Energy within the frame of our model (TSM) is a measure of space transformation, i.e. the measure of transition of the space structure from degenerated states to expanded and vice versa.

Accordingly, degenerated states of the space possess potential energy that actualizes during the process of evolution of the space into the spread.

Thus, energy can be measured as spread (three-dimensional volume), which is packed within degenerated states of the space.

9. Rotation

Rotation is a circular motion of an object during which one or a number of points remain motionless relative to a rotating object.

In plane space, an object rotates around a point (center) of rotation.

In three-dimensional space, only one axis (line) orthogonal to the plane exists, thus, rotation of an object in three-dimensional space takes place only around that axis.

In four-dimensional space, two axes orthogonal to the plane exist, thus, rotation in orthogonal space is equivalent to simultaneous rotation around these two axes orthogonal to the plane of rotation, or rotation around a plane, since two of such orthogonal axes create an orthogonal, in the four-dimensional sense, plane of rotation.

10. Super compact state of the space

We will define the super compact state of the space as the state of the space where it is equivalent (very close) to the state of the absolute emptiness.

Repulsion of degenerated dimensions of the space must lead to rotation of the structure of the space, since this is the only method of its expansion.

Accordingly, the only method of packing it down to a super compact state is the twisting.

If the space has no thickness, it can be packed down to the super compact state by turning it into a Point.

Such Point has no surroundings, since it contains the entire space, unlike a point of a multi-dimensional space (space with dimension of d>0), which always has a surrounding with dimension of d, no matter how minor it might be.

An object of any dimension has no thickness in the space, the size of which is greater by one than the dimension of the object. For example, a straight line has no thickness in the plane, and the plane has no thickness in a three-dimensional space. Thus, any object of the space that has dimension smaller than the space itself, can be turned down into a one-dimensional object, and, after that, into a point object (an object with zero dimensions).

To illustrate such a process, we can use a roll of paper on a rotating axel. A roll of paper is a model of a two-dimensional twisted unlocked space, which, as a result of three-dimensional rotation (unrolling), turns into a plane two-dimensional space.

If we assume that the thickness of the paper equals zero, and the radius of the rotation of the roll also has zero dimension (i.e. the axis of rotation lays within the plane of the surface that is being rolled down), and the packing of the paper in the roll is absolutely compact, such roll of paper will represent a one-dimensional object.

And a one-dimensional object, compactly rolled around an axis that is orthogonal to it, will be a point.

The smaller the radius of twisting the Space is (r 0), the closer the super compact state of the space to the absolute emptiness will be.

11. Wrapping of the space

Unwrapping of the space must occur as a result of a sequence of rotations, where the space that is to be unwrapped has relatively no thickness. Due to that, the space in its wrapped state is not exposed to deformation (compression/expansion) of its basic structural elements, and is only exposed to the degeneration of the spread.

Three-dimensional space has no thickness relative to four-dimensional rotation (rotation around a plane). Accordingly, four-dimensional rotation is a possible method of wrapping down a three-dimensional space.

A space that is wrapped down into a Point with a dimension of d=0 cannot be structured, since a structure of the space can only appear when the space is no longer a Point and has a certain surrounding.

Thus, the disappearance of the absolute emptiness, i.e. appearance of a spread in a completely degenerated space is a phase transition from Nonexistence to Existence, as a result of which the absolute emptiness gets structured into a closed twisted space.

It is obvious that an "infinite" number of rotations would be required to pack a space into a Point, since the radius of rotations required to twist the space down to a point must tend to zero.

Since the space has a structure, the minimum radius of space rotation cannot be less than the fundamental spread of structural elements of the space.

12. Geometry of the space

Observable features of physical space and characteristics of the space, defined within the frame of this model (TSM), limit possible variety of geometries of the physical space.

Certainly, a physical space should possess the following characteristics:

1. **Closeness of the space**. *As we established above, the space has to be closed if the Existence has a beginning, and finiteness of the Existence is the main postulate of the model under study.*

2. **Finiteness of the space**. *The statement about finiteness of the space is a consequence of the statement about its closeness.*

3. **Uniformity and isotropism of the space**. *Observable areas of the Universe with dimensions of 100 Mpc or larger all look the same (uniformity) while having no defined directions within the visible Universe (isotropism)* [Universe].

4. **Uniform curvature of the space**. *Uniformity of relict radiation observable in the Universe is only possible when the space has uniform curvature.*

5. **Physical space must be an orientable space**. *Physical space cannot be an analogue of a one-sided surface of the Moebius, since we are suggesting that it is impossible, while moving in a physical space, to return to the motion start point and find there a mirrored copy of what was there before the start of the motion.*

6. **Irretractability of fundamental spreads**. *Fundamental spreads of unwrapped structural elements of the space must be uniform in all of its areas, otherwise, it would be impossible to wrap the space down into a Point.*

The hyperspherical form (geometry) of three-dimensional space meets all of the above requirements.

13. Quasi (Imaginary) space

A closed, compactly twisted, resilient three-dimensional space, within the scope of this concept (TSM), must untwist due to its own resilience, while creating a constantly expanding hypersheric surface, hence, beside the space concentrated on the surface of the hypersphere, a non-structured quasi (imaginary) space inside the sphere should appear.

The quasi space does not possess the structure of a physical space, consequently, it has no material spread of dimension.

Therefore, we cannot consider a three-dimensional physical space as a four-dimensional object contained inside the quasi space.

Accordingly, the quasi space exists only as a part of hyperspheric space defining the geometry of physical space.

Physical space is the cause of quasi space and of all of its observable features.

Since physical space has non-zero dimension, we can suggest the existence of a quasi radius-vector R of the hypershere.

Additionally, the increase of this quasi radius-vector ΔR is observable and, thus, existent.

Indeed, the mutual repulsion of degenerated spreads of the space causes their unwrapping and an increase of general spread of the physical space, i.e. the increase of radius-vector ΔR of the hypersphere, which is observable as an extension of the space.

Example: Hubble's Law.

Accordingly, hyperspheric space is four-dimensional and includes three-dimensional physical space and the vector of quasi space, which is orthogonal to the surface of the hypersphere at each point of the hypersphere and is directed from the

center of the hypersphere towards its periphery (into the direction of hypersphere expansion).

14. Twisted space

As we established above, twisting of a piece of three-dimensional space is related to two sequences of rotations:

1. Four-dimensional rotation around a plane for wrapping a piece of a three-dimensional space into a one-dimensional object.

2. Three-dimensional rotation around an axis to wrap a one-dimensional object down into a point.

Consequentially, unwrapping of a wrapped down fragment of a three-dimensional space should take place in the opposite order:

1. Three-dimensional rotation around an axis.

2. Four-dimensional rotation around a plane.

Three-dimensional rotation, if it takes place within a physical space, must be observable as a spin (rotation around an axis) of the twisted fragment.

Four-dimensional rotation may be observable within the physical space only as a projection of this motion onto the surface of the hypersphere, since the motion (rotation) of unwrapping degenerated three-dimensional space around the plane will always go outside the limits of the three-dimensional space, i.e. will have a component in the fourth dimension ("ripples" on hyperspherical surface).

15. Point objects

If we assume that fundamental spreads of structural elements of the space are incompressible, then such space can be wrapped down only when it is plane (not convex).

Accordingly, only plane fragments of a convex space can be wrapped down, i.e. a convex space should consist of a plurality of plane fragments (cells) the same way a soccer ball consists of a number of flat polygons.

Then, each plane element of such space can be wrapped down into a point.

A closed three-dimensional space can be wrapped down into a Point as a plurality of objects with dimensions of d=0.

A point object will be defined as a compact object that represents a fragment of the space wrapped down into a point with its own surrounding tending to zero.

A point object, as a result of repulsion of its degenerated spreads, should unwrap into its own surrounding until the space around this surrounding starts unwinding around an axis, i.e. transforming into a space twisted around a plane.

We will call this observable borderline of transition of the space from its twisted around three axes state into the twisted around a plane state a ***particle surface***.

Accordingly, a ***phase transition*** of the space from degenerated state of being twisted around three orthogonal axes (dimension d=0) into less degenerated state of being twisted around a plane (dimension d=1) occurs on the particle surface.

Twisting of the space of the particle around three orthogonal axes localizes it in the structural matrix of the physical space, since the three axes of particle space twisting create an orthogonal basis for localization that coincides with the basis of physical space.

16. Fragmentation of the twisted space

Closed three-dimensional space in the state of absolute emptiness is a point object which, upon unwrapping, must break into a hierarchical multitude of "smaller" point objects. If such hierarchical order of point objects has a limit, then an elementary point object must exist.

We will be calling a non-elementary (composite) a ***glome space***.

It is obvious that in order to wrap down into a point, the fragment of the space that includes a multitude of connected point objects, such fragment must be a plane.

Therefore, each of the connected point objects that belong to said fragment of the space must carry a specific part of general curvature of the fragment (pull the space together).

Consequently, the number and the type of point objects in the glome space is not random, and the glome space can possess not only the space of those point objects contained in it, **but also its own space**.

A point object packed inside of a glome space does not have its own surrounding. For this reason, it cannot be observable in such a state.

Exterior surface of the surrounding of a glome space, where phase transition of the space from its state of being twisted around three axes into the state of being twisted around two axes, creates an observable surface of a ***particle*** of a glome space, the same was as it does with a point object.

We will be calling a particle of a glome space a **core**.

17. Substance distribution in the Universe

The Prime glome space of the Universe had to immediately fragment into a plurality of glome spaces and the spread of its own space, since only in this case the Universe could become a symmetrical closed convex surface.

Secondary glome spaces that appeared in the early Universe also had to fragment into "smaller" glome spaces, but, unlike the prime glome space, their fragmentation happens sequentially, since they, when they fall apart, do not create a close surface, in the four-dimensional sense of it.

Accordingly, the Universe should be similar to "honeycombs" from accumulations of the substance with the maternal core in the center of each accumulation.

Each accumulation of the substance is a fragmented glome space, which in the prime Universe was twisted into a Point.

Therefore, the substance, as a result of the fragmentation of its maternal glome space, must be submerged into an area of plane (in the four-dimensional sense) space, since otherwise this space with the substance that feels it could not be packed into one glome space in the early Universe.

Thus, the most convex (in the four-dimensional sense) space must be concentrated in areas between accumulations of the substance.

Consequently, the curvature of the space between accumulations of the substance must be substantially higher than inside of these accumulations.

18. Field

Earlier, we defined ***Substance*** as the totality of everything that fills the physical space.

If we understand space as only the spread, then the filler of the physical space, substance, can be considered as any degenerated states of the space that exist within it.

The type of substance that represents space twisted around a plane that appeared as a result of interaction of physical space with a particle (or an aggregate of particles) will be referred to as *field*.

19. Dynamic balance

The twisted space of particles must be in dynamic balance with the surrounding physical space.

The concept of dynamic balance means that the effect of physical space (its filling – the field) onto the surface of a particle and the effect of the twisted space inside the particle must be balanced, otherwise the particles would turn into point objects or would fully actualize into a spread.

We are using the term *dynamic balance* because the balance between physical space (field) and internal space of the particle is not static.

Let's run an imaginary experiment to understand why and how the state of dynamic balance is achieved between a particle and a physical space (field). For this purpose, let's observe a point object placed into a confined space free of degenerated states.

20. Point object in confined space

Let's imagine a point object that is placed inside a *confined space free of degenerated states*, i.e. possessing only a spread and limited only by absolutely non-deformable closed wrap.

A point object in such a *space* must first transform into a particle, and then the particle, through untwisting the space wrapped inside of it, must fill up this confined space with a field (degenerated state of the space – space wrapped around a plane).

«Pumping» of a confined space with a field must happen before the balance of the pressure of the space inside a particle and in its surrounding is achieved.

In such a closed system, the balance is static, since, once it is achieved, it will not change.

21. Wrapping down degenerated spreads in space
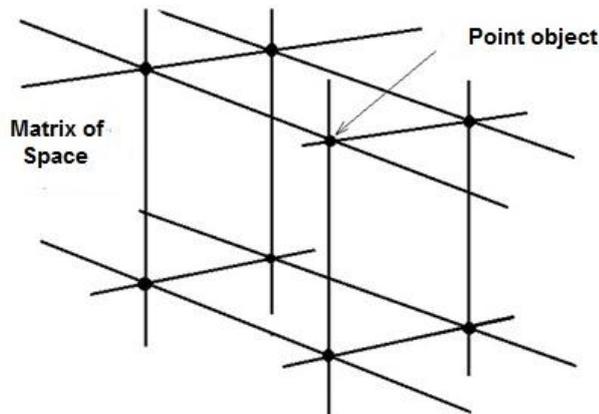
A space twisted around three axes must be a Point (d=0), and this Point must be localized in the structural matrix of the space, accordingly, a space inside a particle twisted around three axes can be concentrated only in the peaks of the cells of the structural matrix of unwrapped space.

Fig. 1.

And a degenerated space unwrapped as a result of rotation of a particle around an axis (field) should represent a linear object (d=1) that can be packed only along the frames of the cells of the structural matrix of unwrapped space.
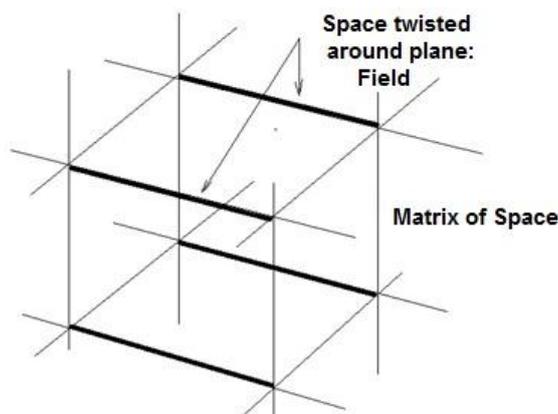

Fig. 2.

Accordingly, the untwisting of the degenerated space within a particle and its surrounding should not lead to an increase of the general extension of the space.

It is important to note that the field in the surroundings of the particle is twisted only around a plane, hence, it is localized only within that plane, which means that it can shift in a wave movement within the structural matrix of the space along the axis orthogonal to the plane of twisting. Furthermore, the shifting direction of the field along this axis is defined by the direction of its twisting, since the direction of the twisting of the space defines the direction in which such a twisted space can untwist.

I.e. a space that is twisted around a plane into a linear object (field) will tend to untwist around the plane and it will be able to do so if there is a degeneration-free space available in the direction of its untwisting, which, upon untwisting of this linear object into a spread, will be twisted into the same linear object, etc.

Hence, "pumping" of the field (space twisted around a plane) into the surrounding of the particle takes place through the surface of the particle.

Accordingly, the density of the field untwisted by a particle must distribute within the surrounding of the particle inversely proportional to the areas of surfaces of the virtual spheres described around the center of the particle, i.e. the density of field distribution within the surrounding of the particle should decrease inversely proportionally to the square distance from it r^2.

22. Recurrence of states of the Universe

The physical space, together with the substance that fills it, is a System that periodically goes through all of the states we described in the example above.

In reality, zones of physical space "pumped up" with the field unwrapped from particles, when in contact, should interact with one another, thus limiting themselves.

Consequently, a zone of physical space, "pumped up" with a field which is the surrounding of one particle, is limited by similar zones in from surroundings of other particles.

If the interaction of such zones of physical space does not lead to the expansion of total spread of the physical space, then the space and the substance in such system remain in the state of static balance, similar to what we showed in the example of a system with *confined space*.

And the other way around if any interaction between the zones of physical space leads to continuous untwisting of new spreads from those zones, then the substance in such a system should, without any remainder, transform into a spread.

If the Universe has the shape of a hyperspheric surface, such states should exist in it in the form of a recurrent (repeating) sequence.

Indeed, the hyperspheric surface of the Universe has a positive curvature (protuberance), so interaction of zones of physical space in it should have a constituent directed orthogonally to hyperspheric surface towards the increase of its radius-vector R.

If such a constituent is great enough to unwrap new spreads from the interacting zones of the physical space, such interaction should lead to an increase of the radius of the hypershere R by certain value ΔR.

In addition, new, free of field areas of space should appear as a result of unwrapping of such new spreads, separating areas filled with a field, which should lead to the disappearance of interactions between fields and to the decrease of the pressure of physical space (field) on the surfaces of particles.

Disappearance of the interaction between zones of physical space is the cause for the stopping of unwrapping of new spreads from them.

The pressure decrease of a physical space (field) of the surface of particles should lead to unwrapping of new portions of space twisted around a place from the particles.

Unwrapping of a degenerated space (field) from particles should continue until a balance between action of the space inside of the particles and action of "pumped up" with field space in their surroundings is achieved again, etc.

The Universe is similar to a pendulum of a clock, which reaches the highest spot of its motion only to stop there for a moment and then continue it's motion.

23. Interaction of fields

As it has already been shown above, the fields interact not just with the surfaces of particles, but also with each other. And the result of such an interaction is defined by the curvature of the surface in the area of their interaction.

Interaction of fields in a plane space cannot lead to the appearance of new spreads of physical space, since it does not have the constituent capable of unwrapping new spreads from interacting fields.

Accordingly, interaction of fields in plane space must represent a super position of such fields.

While the **interaction of fields in protuberant space must lead to** the unwrapping of new spreads of physical space from these fields, i.e. to **phase transformation of space from its field state** (twisted around a plane) **into the state of spread** – the state of inner balance with zero potential energy.

Thus, a field inside an accumulation of substance represents a super position of fields of material objects included into the accumulation. And interactions between accumulations of the substance cause the expansion of physical space.

24. Movement

The creation of new spreads of physical space should be the cause of transformations of super positions of fields within an accumulation of the substance, since new "free" from degenerated states spreads disturb the balance in the System.

Transformation of super positions of fields is a wave shift of the field, or to be more specific, of the energy accumulated inside of it (degenerated states of the space), which shifts within the matrix of space with every increase of the physical space. We will be referring to such movement as *absolute movement*, since it represents real shift within the structure of the space.

The transformation of super positions of the fields within an accumulation of the substance must lead to a change of distribution of spreads relatively to material objects (particles or their aggregates).

Change of spread between material objects is the *movement*.

Movement of material objects is a ***relative movement***, since it is ***not*** related to a shift within the structural matrix of the space, but rather to distribution of spreads of the physical space relatively to material objects.

It is obvious that relative movement occurs only when fields of material objects are relatively asymmetric, since only the asymmetry of fields can be the cause of asymmetrical distribution of new spreads relatively to those material objects, which in turn is the cause of their relative movement.

Indeed, the field in the surrounding of each point possesses a certain density of degenerated states of the space, while the distribution function of such a density should be equal to the vector, which is not just characterizing the density of degenerated states of the space in a specific point, but also indicates the direction of its increase (or decrease).

Consequently, the sum of such *field vectors* in the surrounding of every material object is a vector (if the field of a material object is absolutely balanced, it's a zero vector). The difference of such resulting vectors for two material objects is also a vector, which defines the disturbance (convergence) of symmetry between their fields. We will be calling such a vector ***relative velocity***, and its change – ***acceleration***.

If symmetries of fields (resulting vectors of fields) of material objects ***coincide***, the distribution of spreads in their surroundings does not differ, hence, such material objects are motionless relatively to each other (relative velocity equals zero).

And vice versa – if symmetries of fields of material objects don't coincide, (the difference between resulting vectors is not equal to zero vector), it means that the distribution of new spreads relatively to such objects is also asymmetrical, i.e. such material objects are in motion relatively to each other.

To illustrate the relative motion of material objects, we shall review diagrams of "Relative movement of material objects" and ""Movement" of relative motionless objects":
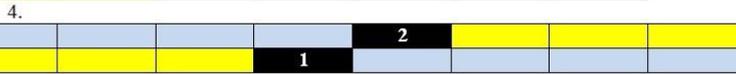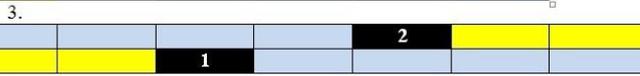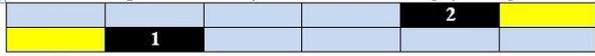
Relative movement of material objects

1.,2.,3.,4.,5.,6.,7…   a sequence of elementary transformations of physical space

1. **Material objects** 1 and 2 marked by black color.
   The length of the space at the beginning of observation is indicated in blue.
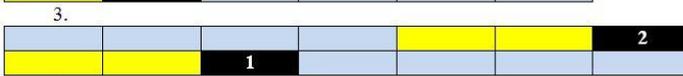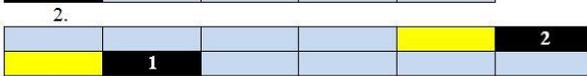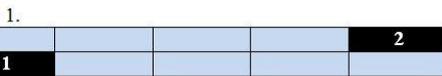
2. **Distribution of new lengthes** relatively material objects 1 and 2
   during each elementary transformation of the physical space marked by yellow color.

3.

4.

5. etc.

"Movement" of relative motionless objects

1.

2.

3.

4.

5. etc.

It becomes obvious from the diagrams above that if the geometry of the field of a material object doesn't change (relative velocity is permanent), then the at-rest state and the motion state of such an object are identical (see object 1).

25. Time

Time is observable in the space as a sequential change of positions and states of the Substance that fills it in.

The sequential change of positions and states of the Substance is a result of a sequence of transformations of the Universe, where each member represents an elementary transformation of the physical space.

The sequence presumes a possibility to determine the position of any member, which means that they can be compared, i.e. it is possible to determine which ones appear (originate) earlier and which ones later.

It is the sequence that defines the cause and the consequence. And the number of members in such a consequence defines the **duration**.

If we compare movements of two objects, then the movement that required more basic transformations of physical space would take longer.

To establish what happened in the physical space earlier and what happened later, one must compare the beginning of specific process with the global sequence of transformations of the entire physical space.

Since each elementary transformation of the physical space leads to an increase of its spread, i.e. to an increase of the quasi radius-vector of hyperspheric surface R by a certain value ΔR, consequently, whatever corresponds with the lower value of the radius-vector R takes place "earlier".

Ongoing increase of the radius-vector ΔR that corresponds to ongoing elementary transformation of the physical space, соответствующее текущей элементарной трансформации физического пространства characterizes the transition from the past to the future, i.e. basically represents the "present".

26. Properties of packing of the core

If the core can be fragmented into the point objects that it consists of, then each of those point objects must produce a particle with its own surface in the physical space.

The surface of a particle is the one place of interaction between the field packed inside of the physical space and point objects packed (within the spread) inside the particle.

Interaction is an exchange of energy: degenerated states of the space.

Such exchange between two phase states of the space (field and particle) remains in dynamic balance and takes place through the spread of the particle surface, which consists of elementary spreads of structural elements of the space.

Consequently, the number of degenerated states of the space within the outer surrounding of a particle must be proportional to the surface of the particle.

Therefore, if the total area of surfaces of the particles that appear as a result of core fragmentation is more than the surface area of the fragmented core, then the total field of such particles is greater than the field of the core, and vice versa.

Accordingly, the core is stable if the area of its surface is less than the total area of the surfaces of the particles that can be fragmented from it, since additional energy is required for particles to exit the core. I.e. the physical space should be "pumped" with degenerated states of structural elements of the space.

And inversely, if the area of the surface of the core is greater than the total area of surfaces of the particles that can be fragmented from it, the core will be unstable, i.e. it will break apart.

It is obvious that a spontaneous breakdown is characteristic to cores that include degenerated space of point objects packed within them as well as their own.

Such a breakdown should be accompanied by the appearance of a *non-connected field* (energy, not connected to a particle), which is excessive for created particles, since those particles are not capable of keeping it in the form of their own field.

Therefore, a *non-connected field* can appear as a result of core synthesis from particles and, vice versa, from core fragmentation into particles. This field does not participate in the process of dynamic balance with newly created particles or synthesized cores.

27. Non-connected field

Non-connected field is localized only within the plane of its rotation.

The rotation of a *non-connected* field defines the direction of its unwrapping and, thus, the direction of its undulating movement within the structural matrix of the space.

Therefore, if a *non-connected* field has a "free" spread within the direction of its unwrapping, such a spread will be wrapped down by the field.

Non-connected field, while wrapping down a spread, turns into a spread itself. It creates a wave that moves orthogonally to the plane of rotation of a non-connected field.

The motion of the field is related to an increase of the physical space, since free from degenerates states spreads can only appear as a result of the expansion of the physical space that can be wrapped down by the field.

Since the expansion of the physical space takes place in the form of cyclic sequence, non-connected field should be discrete.

I.e. it can spread only in **quanta** (portions).

It is obvious that the number of degenerated states of elementary structures of the space in each quantum of a *non-connected field* depends on the tension of the "maternal" field at the time when the **quantum of a non-connected field** appears.

We will be calling the *quantum of a non-connected field* a **photon**.

The movement of a *photon* occurs as a result of its shift within the structural matrix of the space for the value of the expansion of the physical space in the direction defined by its rotation.

Such motion is the result of rotation of the field around the plane.

Rotation around a plane goes beyond the limits of the three-dimensional physical space, hence, it can be observable in the physical space only as a projection, i.e. as a **plane of intersection** of non-connected field with hyperspheric surface.

We will be referring to such a projection as an **electromagnetic wave**.

The velocity of movement (shift) of *electromagnetic wave* equals to the expansion of the physical space.

c – the spread of the expansion of the physical space in a given direction.

Since we consider the physical space to be isotropic, the expansion of the physical space in all directions is the same, which means that the velocity of electromagnetic wave is the same in any direction.

c = const

The velocity of electromagnetic wave is the same for all material objects (particles, cores or their accumulations), since it is not relative.

28. Connected field

Connected field always remains within the surrounding of the particle participating in the process of dynamic balance, unlike *non-connected field* that constantly moves within the structural matrix of the physical space while shifting for the increase of the spread of the physical space with its every elementary transformation.

It is the presence of the *connected field* of the particle that gives us the ability to observe all characteristics peculiar to that particle.

Connected field is characterized by the Symmetry and density of degenerated states.

The relativity of connected fields of particles determines the existence of their relative movement, and the density of degenerated states of the space in the field of the particle defines the intensity of its interaction with other particles (their fields).

If connected fields overlap, creating a super position, they disturb the symmetry of each other while changing the initial distribution of spreads that appear with every elementary transformation of the physical space between interacting particles.

A relative change of the symmetry of the fields of particles changes the velocity of their relative motion. Accordingly, particles always accelerate when they interact with each other.

Two particles get closer (move towards each other) if the spread between them is replaced by degenerated states of the space.

Consequently, particles move with acceleration only into the direction of the increase of the density of degenerated states and their *connected fields*. Therefore, relatively motionless particles should move with acceleration towards each other if their *connected fields* overlap.

Indeed, super position of these fields creates an area with increased density of degenerated states, which, as a result of their movement towards each other, is constantly increasing, since the number of degenerated states of the connected field increases as it gets closer to the surface of the particles.

We will be calling such interaction ***gravitational***.

Within the process of elementary transformation of the Universe, a part of the total field of all particles that fill the physical space transfers into a spread of the physical space, hence, the same part of the fieled must be unwrapped from particles to reestablish the balance in the Universe.

Accordingly, only a part of the field of a particle can be actualized into a spread of the physical space within elementary transformation of the Universe.

The field of the particle that actualizes into an increased volume of the physical space has a specific length that we will be calling the ***particle mass***.

And we will be calling the volume obtained as a result of the unwrapping of that mass ***particle energy***.

$E = mc^2$,

where

E – energy of connected field of a particle,

m – particle mass,

c – spread of the expansion of physical space.

29. Photon energy and impulse

Photon is the energy of a field partially actualized into a spread of physical space, which is completely localized only in the directions of the basis of physical space.

Indeed, the photon represents a field (one-dimensional object) that unwraps in the direction determined by its rotation.

I.e. photon is always unwrapped in two directions of the physical space, hence, the degenerated state of the space that is packed into a photon has the dimension of d=2.

The vector value equal to the spread (area) unwrapped by the photon in the physical space in the direction of its motion will be referred to as ***photon impulse***.

Photon does not possess a mass, since it does not possess degenerated states of the space with the dimension of d=1.

Accordingly, the photon energy (three-dimensional volume) equals the product of photon impulse and the length of the expansion of the physical space orthogonal to it:

$E = pc$,

where

E – *photon energy*;

p – *photon impulse*;

c – *spread of the expansion of physical space*.

30. Charge

The phase transition of the space from its state of being twisted around three axes into the state of being twisted around a plane occurs on the surface of the particles.

The sequence of discrete expansions of the spread of the physical space is the cause of a sequence of distortions of the field in the surrounding of particles: unwrapping of the field / wrapping of the spread.

The disturbance of the balance between the field and the particle at the moment of the expansion of physical space should lead to the unwrapping of new portions of degenerated space twisted around a plane from particles until the balance between the field and the particle is achieved.

The transformation of space from a particle into a field is accompanied by an increase by a unit measure of the degenerated space, i.e. the space transforms from its state with dimension of 0 in the particle into a state with the dimension of 1 in the field.

Since a one-dimensional object can be packed into a point only as a result of its twisting around an axis that is orthogonal to it, it is obvious that in three-dimensional space the process must take place in the same manner, but in the opposite order. Accordingly, the particle must rotate with every elementary transformation of the physical space, i.e. it must have a spin.

Thus, the space of a particle, while transforming into a field, must actualize rotation of the particle around its own axis (spin) with each elementary transformation of the physical space (transfer of the degenerated state of the space from d=0 into d=1).

And the newly created field, while rotating around a plane (transition from d=1 into d=2), must create a four-dimensional "ripple" in the surroundings of the particle until the moment when it gets into twisted position in the connected field of the particle (transition from d=2 into d=1).

Degenerated state of the space with dimension of d=2 can exist in the physical space only as an area of overlapping of physical space (hyperspheric surface) with the field that is unwinding around a plane from the field.

Rotation around an axis, theoretically, can have two variations in a hyperspheric space:

1. **Rotation around an axis that lies within the physical space**, and then we are dealing with the rotation of a particle around its own axis (spin).

2. **Rotation around a quasi axis**.

But physical space is constantly shifting along the quasi axis during the process of its expansion, consequently, only a spiral can be twisted around the quasi axis, while a point cannot.

Accordingly, if a ***point object twisted around a quasi axis*** exists, it ***should not experience shifting together with the hyperspheric surface during the process of its expansion***, while always remaining localized in the point of its actualization.

A "Black Hole" can serve as an analogue of such an object.

Hence, only rotation around an axis located within the physical space allows for the space to remain packed into a point while not going outside of the limits of the hyperspheric surface.

Rotation around a plane should be orthogonal to the rotation around an axis, since the space can be packed into a one-dimensional object and then into a point only as a result of the sequence of such orthogonal rotations.

Rotation around a plane is a simultaneous rotation around two orthogonal axes.

The physical space is three-dimensional, thus, there are always two axes within the physical space that are orthogonal to the third one.

Accordingly, the four-dimensional rotation should take place around these two orthogonal axes.

In addition, in physical space, we can only observe a projection of such simultaneous rotation around the plane, i.e. the rotation around each one of the axes that create a plane will be observable in the physical space as a separate rotation.

Each rotation has a direction relative to the movement of the hand of a clock.

Let's label the clockwise movement with a "+", and the counter clockwise movement with a "−".

Consequently, upon unwrapping of the space from a particle, we can have several combinations of rotations:

1. Rotation around own axis: +
Rotation around a plane: + +

2. Rotation around own axis: +
Rotation around a plane: + -

3. Rotation around own axis: +
Rotation around a plane: − +

4. Rotation around own axis: +
Rotation around a plane: − -

5. Rotation around own axis: -
Rotation around a plane: + +

6. Rotation around own axis: -
Rotation around a plane: + -

7. Rotation around own axis: -
Rotation around a plane: − +

8. Rotation around own axis: -
Rotation around a plane: − -

Since we assume that physical space is uniform and isotropic, then, in reality, only two really different combinations exist, since all others can be converted into those two by simple rotation around one of the axes.

Therefore, only two different combinations of rotations of a connected field at the surface of a particle exist:

1. A group of rotations where every variation can be converted into state +++
2. A group of rotations where every variation can be converted into state ---

Each of these combinations of rotations created its own (different/opposite) activated state of the field (four-dimensional «ripples») within the surrounding of the particle, which we will be calling **electromagnetic field of the particle**.

To separate particles with different direction of the field that is untwisting out of them, we will introduce the concepts of **positive charge** for particles from rotation group +++ and **negative charge** for particles from rotation group ---.

31. Electromagnetic field

The process of transition of the space from its state of being twisted around three axes into the stated of being twisted around a plane takes place on the surface of the particle, i.e. at some distance from the axis of rotation of the particle.

Electromagnetic field of the particle represents rotation of the connected field of the particle around the axis of the particle, which, in turn, is rotating around a plane.

Rotation of the space around a plane is a four-dimensional movement.

Consequently, the projection of rotation of the unwinding connected field of a particle around a plane can be observed in physical space as rotation of the field around two orthogonal axes 1 and 2.
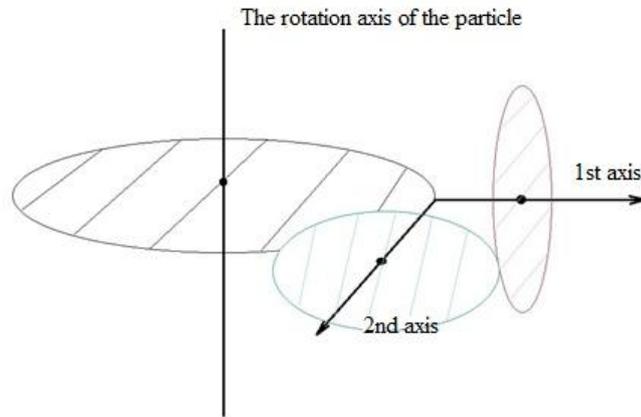
The rotation axis of the particle

1st axis

2nd axis

Fig. 3.

As you can see from the figure above, rotation of the field around axis 2, when it is rotating around the axis of a particle, fills with this rotating around axis 2 field a surface of a torus (bagel).

I.e. this projection of the rotary motion of connected field of a particle must be observable in the physical space in a way similar to imaging of the magnetic field of Earth.

Because of that, we will be referring to the projection of unwrapped connected field onto the rotation plane of axis 2 as a ***magnetic field***. (**B**).

Since the direction of rotation of the magnetic field is locked into the particle, then each particle has two poles with different directions of rotation of the magnetic field.

Rotation of the field around axis 1 during its rotation around the axis of the particle and axis 2 fills in with this rotating around axis 1 field a surface of a sphere (with the particle inside).

As we established above, only two types of charged particles exist:

1. With a positive charge +++
2. With a negative charge ---

If two particles with opposite charges are placed close to each other, so that all of their rotations were opposite, and then one of them is turned 180° around the axis on the rotation of the particle, then, for these two particles, only their rotations around axis 1 will be opposite.

We will call the projection of connected field onto the surface of rotation of axis 1 an ***electric field*** (**E**) or electric charge.

The rotation around axis 1 (electric charge) is not locked towards the particle, hence, for each charged particle, it has only one specific direction: positive or negative.

Accordingly, electromagnetic field of a particle can be formally separated into two fields that are observable as projection of the motion of connected field of the particle onto a three-dimensional space:

1) Electric field or Electric charge (rotation around axis 1);
2) Magnetic field (rotation around axis 2).

Conclusion

This research represents a fundamentally new approach to the study of the nature of the space, time and substance, which is based on two fundamental postulates:

– finiteness of the Existence
– structuredness of the Space

The postulates used in this research, as well as the sequence of logical formations, do not contradict with the observable, i.e. existing objective Reality. The Genesis of the Universe in the presented model (TSM) is fundamentally different from universally adopted concepts about the formation of the Universe, while being in full agreement with what can be observed, for example:

– the presence of compact super massive objects at the most remote parts of the Universe and massive objects in the centers of galaxies,
– the presence of rotation and magnetic fields for particles, planets, stars and galaxies; existence of relic radiation
– the expansion of the Universe...

The mechanism of accelerated expansion of the Universe and "abnormally" fast rotation of outer areas of the galaxies is obvious within the TSM, which means that this model is not facing the problem of searching for the "dark energy" or the "dark substance".

The novelty of this research also consists in a logical step-by-step exposure of the essence (cause) of physical properties of the substance, such as mass, spin, electric charge, etc., which are only being postulated in the traditional model.

Furthermore, the proposed model unravels the cause of a fundamental ambiguity at the micro level of the substance.

Physical terms, such as "mass", "velocity", "acceleration", "charge", etc. were used by the author for this research intentionally to draw parallels between the results obtained in this research and similar concepts used in modern physics.

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