

# CORPUSCLE-SIMPLE THEORY OF EVERYTHING (PHYSICAL MODELS)

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Categories: nucl-th, hep-ph, astro-ph.CO

## ABSTRACT

A physical model of the quantum of space-time is proposed, equivalent to the properties of the modern Theory of physical vacuum (TFV) and the Theory of Lorentz ether (TLE), on the basis of which, as a consequence, physical models of virtual photons, lines of force of electric and magnetic fields, vortices of electromagnetic radiation (EMR), preons (protoparticles of substance) are built, elementary and fundamental particles of substance, atomic nuclei, basic nuclear reactions, including LENR, neutron matter, central objects of Black holes, the cosmological stages of the formation and evolution of the universe, the great unification of fundamental interactions.

TAGS: Theory of everything, great unification of interactions, corpuscular model of the physical vacuum, dipole-dipole lines of force of electric and magnetic fields, preons model of substance matter, Dark matter, Dark energy.

## INTRODUCTION

Modern physics has accumulated a number of unsolved problems related to the structure of matter and models of fundamental interactions. Here are just a few of them:

- mutual transformation of quarks and leptons in  $\beta$ -decay reactions;
- formation of a charge of elementary particles;
- Dark matter;
- The nature of Dark Energy;
- experimental detection of gravitons;
- the scheme of exchange interaction, by "exchanging" different bosons between particles, raises many questions.

Physicists have already developed a need and understanding of the need to form a THEORY of EVERYTHING that combines all 4 types of fundamental interactions and explains the mechanism of formation of all fundamental particles. There is already a certain consensus that in order to build such a theory, it is necessary to return to the concept of the physical environment from which all matter was formed, and through which all kinds of fundamental interactions are carried out.

The article presents physical models of the CORPUSCLE-SIMPLE THEORY (CST) [1], which can be considered as a variant of the THEORY OF EVERYTHING.

## MODELS OF THE PHYSICAL ENVIRONMENT

In modern physics, the model (theory) of the PHYSICAL VACUUM (TPV) has been adopted as a model of the physical environment, in which the basic quantum numbers equal zero – momentum, angular momentum, electric charge, etc. At the same time, it is believed that a physical vacuum can reproduce various quantum fields, including electric and magnetic fields, which is confirmed by the presence of the parameters  $\epsilon_0$  and  $\mu_0$ . Gravity in TPV is explained by the presence of a quantum gravitational field, the theory of which has not yet been fully developed.

It should be noted that 130 years ago, the LORENTZ ETHER THEORY [2] already existed with similar properties - stationary ether and the presence of E- and H-components in ether, as well as a  $\beta$ -factor for length and local time. A significant difference between LET and TPV is the explanation of

gravity in LET by a negligible excess of the elementary forces of attraction of opposite charges over the forces of repulsion of charges of the same name (electrogravity according to Zellner [3]).

It is not difficult to notice a certain similarity between these two models of the physical environment, at least in terms of the presence of a stationary environment with properties of the formation of electric and magnetic fields. Meanwhile, in official physics (in its separate sections), the idea of a stationary ether is still categorically rejected, with reference to Michelson's experience. Everyone knows that this experiment was based on the BIDIRECTIONAL propagation of light in a supposed ethereal environment, which causes fair criticism. And only recently, after more than 100 years, it became possible to conduct an experiment with UNIDIRECTIONAL propagation of light at different directions and magnitudes of the ether wind. We are talking about the international ILRS (laser satellite location) experiment. According to reports and publications by ILRS researchers from the Crimean Laser Observatory and the All-Russian Scientific Research Institute of Physic-Technical and Radio Engineering Measurements, in order to hit the satellite's reflectors, you always have to aim and "shoot" a laser pulse with a certain angle of displacement relative to its visual marker, both forward and backward, or sideways from satellite trajectories [4, 5].

The figure shows the distribution of the directions of the light displacement vector relative to the satellite's visual marker, taking into account the orbital motion of the Earth-satellite system around the Sun per year.

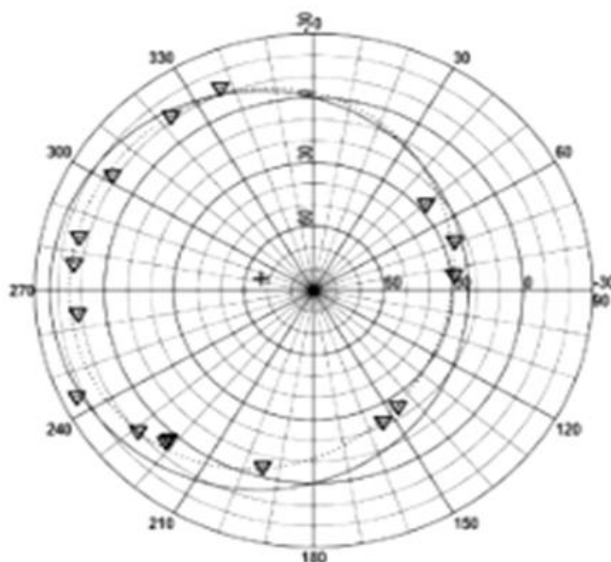


Fig. 1. Distribution of the directions of the light displacement vector.

The participants in the experiment come to the conclusion that the most likely explanation for the results of their measurements is a one-year change in the magnitude and vector of the ether wind associated with the movement of the Earth around the Sun.

#### THE QUANTUM NATURE OF THE ETHER

There is another significant difference between TPV and LET — this is the quantum nature of TPV, which was simply not known at the time of the development of LET. If we take into account the ability of the ether to reproduce electric and magnetic fields, then the conclusion suggests itself that the quanta of the ether should have a dipole electric moment and a dipole magnetic moment, or rather, be quadrupole.

#### THE PHYSICAL MODEL OF THE ETHER IN CST

According to CST, *the quanta of such ether can be corpuscles consisting of two connected elementary vortices of Planck size, mutually generating each other in an endless cyclic process, one cycle of which is an elementary tick of time. Such corpuscles can be called quanta of space-time.*

The main and only property of such an ether is its ability to form E- and H-dipole-dipole chains of corpuscles.

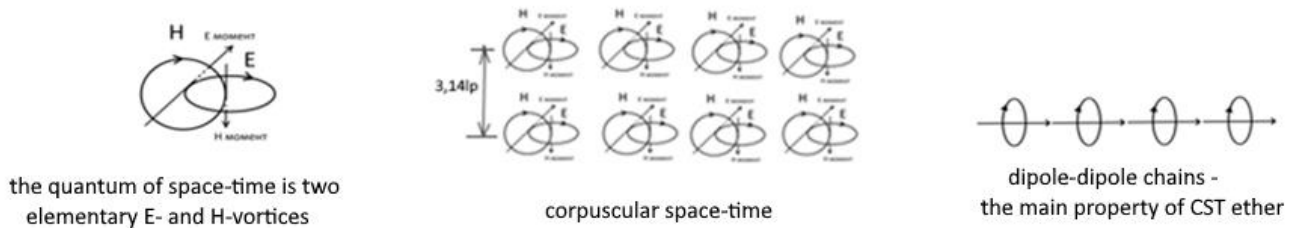


Fig. 2. The model of corpuscular space.

Four types of objects can be formed in such ether.

1) FLUCTUATIONS are the random alignment of electric or magnetic moments of corpuscles into closed E- or H-dipole-dipole chains of vortices of VIRTUAL PHOTONS (without momentum).



Fig. 3. The model of E- and H-virtual photons.

2) VORTICES OF ELECTROMAGNETIC RADIATION (EMR), consisting of the same closed E- and H-dipole-dipole chains (vortices), only having electrodynamic momentum. The rate of formation of dipole-dipole chains of vortices is 1.57 times the speed of light.

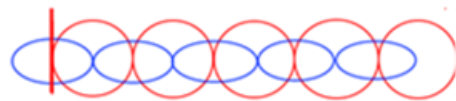


Fig. 4. The model of coupled vortices EMR.

3) In free ether, the E- and H-moments of the corpuscles have an arbitrary direction. When charges or magnetic moments are introduced into the ether, the process of polarization of the ether begins – changing the orientation of the moments of the corpuscles and building LINES of FORCE (LF) from E- or H-dipole-dipole chains. And if we recognize EMR as one of the types of matter, then LF must also be recognized as material. In this case, the MODEL of INTERACTION of electric and magnetic charges through the exchange of virtual photons is replaced by the model of interaction of lines of force, their reconnection, or repulsion.

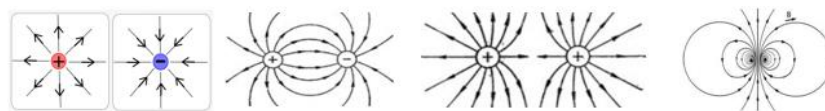


Fig. 5. Lines of force of electric charges and magnetic dipole.

4) The formation of PREONS-SIMPLES – the substance of the Universe

The problem of the lack of a model for the mutual transformation of quarks and leptons into each other in  $\beta$ -decay reactions was known back in the 60s. That is why the PREON THEORY appeared in the 70s, according to which all quarks and leptons consist of single protoparticles – preons. STRING THEORY, which appeared in the late 80s, pushed the Preon theories into the background. However, in the late 90s, the first crisis in String Theory began, and the Preon theory was revived again. In 1997, the theory Preon Trinity appeared [6]. In total, there are currently more than a dozen different Preon theories

(hypotheses). To avoid confusion, preons are given different names in different theories, for example: subquarks, rishons, gelons, ribbons, etc.

The idea of forming preons-simples was inadvertently suggested to me by academician Rubakov V.A., having mentioned at one of his seminars the trivial truth that an electron in a magnetic field begins to move in a spiral. According to the CST, the model of preon-simple formation is the stretching of a powerful short-term magnetic field of an electric vortex of a virtual photon into a spiral vortex, followed by its folding into a bagel vortex, such as anapole Zeldovich [7]. A distinctive feature of the formed bagel vortex from Zeldovich's anapoles is the presence of an additional azimuthal electric vortex, which gives them a magnetic moment and an electric charge. That is why these particles were given a different name – simple.

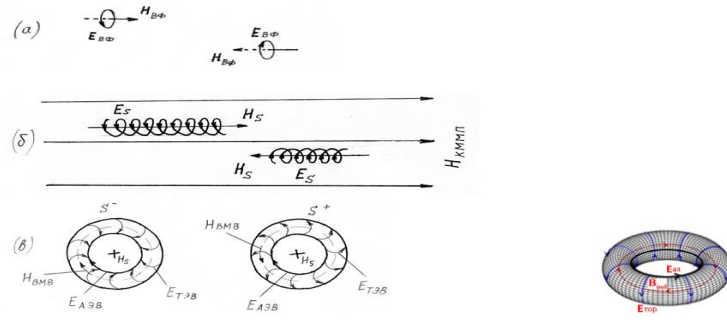


Fig. 6. The model of preon-simple formation.

From this model of simple, it can be concluded that fundamental material particles are not points, but rather "bodily" objects in the form of tori, which make up all the elementary and fundamental particles of substance. This leads to a fundamental conclusion about the absence of particles with zero dimensions, and the disappearance of the problem of infinite energy growth as the particle size tends to zero.

#### THE MODEL OF FORMATION OF ELECTRIC CHARGES OF SIMPLES

As noted, the presence of an additional azimuthal electric vortex in simples, in full accordance with classical electrodynamics, gives them a magnetic moment. But not only that. The presence of an additional azimuthal electric vortex at the simples allows us to construct a model of the formation of an electric charge of the simples. This happens as a result of the interaction of orthogonally directed electric moments of the toroidal electric vortex and the azimuthal electric vortex at each point of their intersection. The interaction of two orthogonal moments generates a third moment orthogonal to both of them, which serves as a source of polarization and orients the corresponding electric moment of the nearest ether corpuscle, which is transmitted to the next ether corpuscle, etc. As a result, a bundle of chains of corpuscles (electric field lines) is built up from the area of the inner circle of the bagel, which, meeting in the central part of the bagel with poles of the same name, repel each other, forming a well-known radial pattern of field lines of single electric charges. The charge sign of the lines of force at their ends is determined by the direction of connectivity of the toroidal and azimuthal electric vortices, which initially depends on the direction of projection of the magnetic moment of the virtual photon in the direction of the vector of a short-term powerful magnetic field (SPMF), which stretched this virtual photon into a simple.

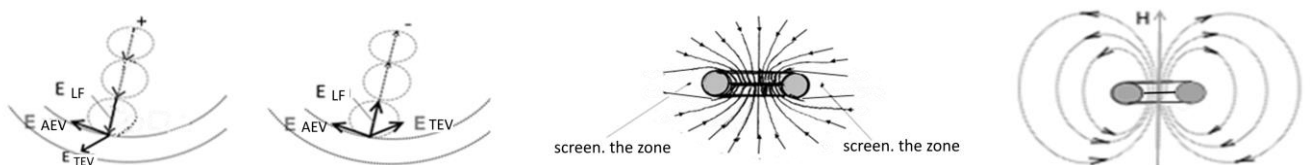


Fig. 7. Model of formation of lines of force of "+" and "-" simple charges.

Lines of force electric field and magnetic field lines of force.

### PAIRING OF ELECTRONS WITH OPPOSITE SPINS AND MOMENTS

As will be shown below, the topology of electron vortices is also a bagel. Accordingly, the model of the formation of electric field lines and the magnetic moment of an electron is completely similar to similar models of simple bagel. At the same time, the unidirectional electric field lines unfold due to their mutual repulsion into a known radial topology with the envelope of the body of the simple, which leads to the formation of a shield around the body of the screen zones in which there is no electric field and Coulomb interaction. This circumstance may contribute to the formation of pairs of electrons with opposite spins (and magnetic moments) when reconnecting and contracting the lines of force of their magnetic fields in the type of a Nikolaev magnet.

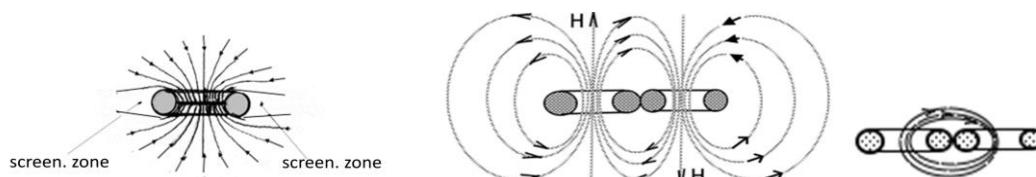


Fig. 8. The screen zones of electric fields and pairing of two electrons

### THE RATE OF EMR PROPAGATION AND THE RATE OF LINES OF FORCE FORMATION

EMR vortices are formed by changing the orientation of the moments of stationary ether corpuscles, respectively, and the EMR vortices themselves are stationary relative to the ether. The propagation of EMR at the speed of light occurs due to the displacement of vortices relative to each other by half the diameter (in Fig. all EMR vortices are conventionally depicted in the same plane).

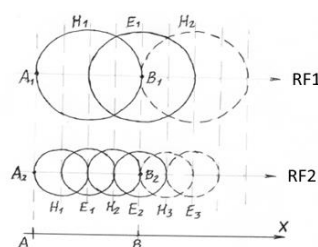


Fig. 9. The EMR propagation velocity does not depend on the frequency.

In this model, the speed of EMR propagation relative to the stationary ether does not depend on the diameter of the vortices (EMR wavelength), but will be determined only by the speed of EMR vortex formation (polarization of the ether), which is 1.57 times the speed of light (short-range action). This can be verified experimentally by measuring in parallel the speed of propagation of the light signal and the speed of formation of a rectilinear magnetic signal line in the direction of the poles of the solenoid when it is switched on.

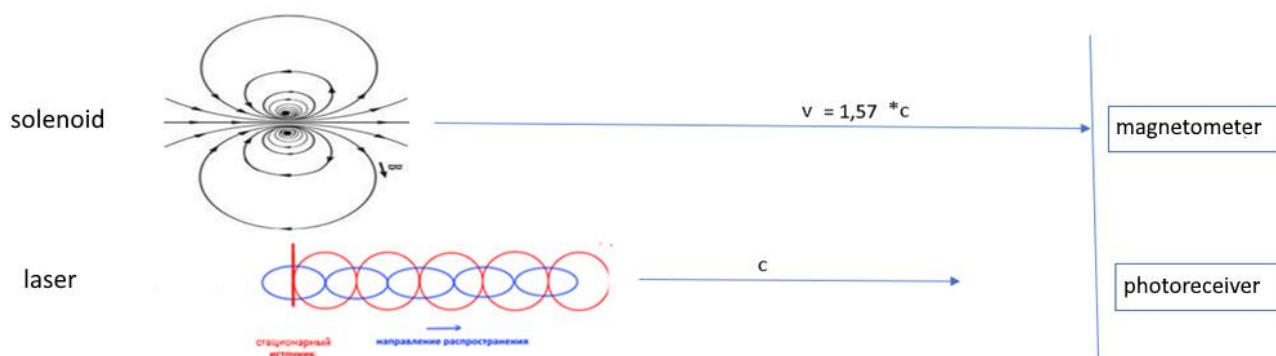


Fig. 10. The scheme of the experiment to check the rate of formation of lines of force.

If this experiment confirms the superluminal rate of polarization of space and the formation of magnetic field lines, then this will confirm the presence of a stage of cosmological inflation - the superluminal growth rate of the simple plasma cloud during the formation of the Universe. We will return to this issue in more detail in the Cosmology section.

### GRAVITY, THE GRAVITON MODEL

An essential feature of the proposed quadrupole model of corpuscular ether, in contrast to V.S. Leonov's quadrupole ether [8], is the constant cyclic change of one dipole moment to another in each corpuscle, which determines the virtual nature of the lines of force formed from them. This gives a certain decoupling of the core of particles consisting of simples and, a virtual fur coat of field lines from their charges and magnetic moments. This circumstance implies that the interaction through the lines of force is not continuous, but pulsed, and with respect to gravity, it becomes possible to formulate a physical model of the GRAVITON in the form of a quasi-particle representing the difference between the impulses of attraction and the impulses of repulsion of the lines of force of electric charges and magnetic moments of neutral bodies, equal to the calculations of Petrov V.M.  $10^{-37}$  relative units, and resulting from the difference in the length of the lines of force of attraction and repulsion. Such a small difference in forces cannot be measured using electromagnetic methods [9].

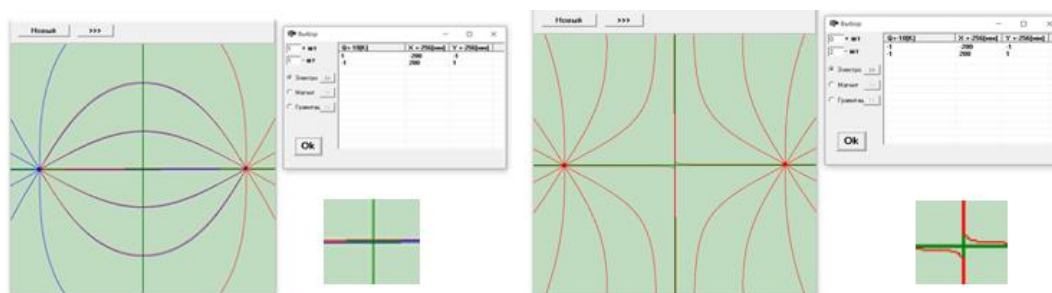


Fig. 11. The difference in the length of the attraction and repulsion lines of force.

In accordance with this model of gravity, Einstein's curvature of space-time is the polarization of the ether (building a fur coat of lines of force of electric charges and magnetic moments around neutral bodies).

Considering the equality of the number of opposite electric charges of neutral bodies, they can be conditionally divided into pairs of dipoles and their lines of force can be integrated in directions. In this case, the coat of lines of force of neutral bodies can be represented as a set of lines of force of electric and magnetic dipoles.

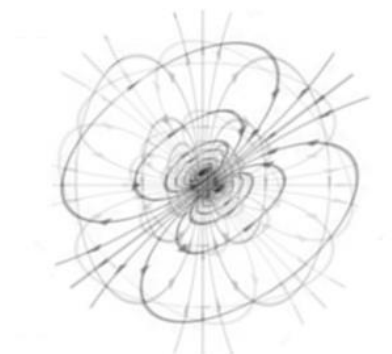


Fig. 12. The fur coat of lines of force of neutral bodies (the curvature of space-time).



We draw attention to the fact that the Planck dimensions of the lines of force cross-section allow opposing lines of force to simultaneously coexist at a certain distance from each other without interaction (lines of force are interact only in neighboring corpuscles), but measuring the field strength in a certain area of space with our macro devices with macro detectors will necessarily "hook" the opposing lines of force and show the field value equal to zero. But this does not mean that there are no field lines of force in this area, and this is probably the reason for the phenomenon of experiments measuring the vector potential of EM fields.

In this model, taking into account the MATERIALITY, DECOUPLING, and a certain temporal and spatial INDEPENDENCE of the fur coat of the lines of force from the core of the body, it is possible to construct a model of the occurrence of inertia forces during acceleration or deceleration of the core of the body, due to LAGGING dynamics of the fur coat of the lines of force.

If the separate lines of force of two coats of two neutral bodies are reconnected, then during in-phase regeneration of the moments of all corpuscles, the "tugging" at one end of the finished common the lines of force (without the need for its sequential formation) can be transmitted to the other end of the lines of force almost instantly at a speed of  $v \gg c$  (long-range effect), which is observed in a number of experiments [10].

### THE GRAVITATIONAL LENSING MODEL

Electric and magnetic vortices of EMR light also generate magnetic and electric moments in their centers. When light propagates in the gravitational field of massive objects (or a collection of objects), lines of force from the electric charges and magnetic moments of these objects interact with the moments of the vortices of light, while the impulses of attraction slightly exceed the impulses of repulsion, and the light is deflected towards these massive objects.

### MATERIAL-WAVE DUALISM

The model of material particles from the core and the lines of force fur coat can also explain the resulting diffraction and interference effect when this structure passes through a system of two slits, which is experimentally investigated in detail in the article by Demyanov V.V. [11].

### ENERGY OF THE LINES OF FORCE

Lines of force of electric and magnetic fields, as vortices EMR, must have energy due to their materiality, as evidenced by the deviation of gamma radiation from the blazar as it passes through the voids with remnants of the relic magnetic field [12].

The authors of the article believe that weak magnetic fields in the voids are remnants of a powerful relic magnetic field that took place at the birth of the universe, which corresponds to the model of the formation of a simple cloud under the influence of short-term powerful magnetic field (SPMF).

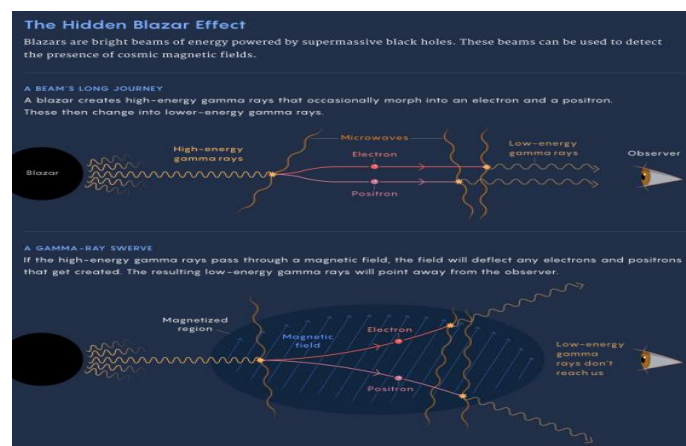


Fig. 13. Deviation of gamma radiation from a blazar as it passes through void.

## THE SPECTRUM OF RESONANT SIMPLE LENGTHS

Spiral vortices initially had a continuous spectrum of lengths from 0 to  $L_{\max}$ , depending on the angle of rotation of the vortex of the virtual photon to the vector of the external magnetic field (the length of the spiral vortex is zero if the plane of the vortex is located along the vector of the external field, and the length of the spiral vortex is equal to  $L_{\max}$  if the plane of the vortex is located orthogonally to the vector of the external field). After "turning off" the external magnetic field, the spiral vortices, having open ends, lose energy to radiate their own internal magnetic field into the surrounding space, which leads to shortening of the spiral vortices to 6 resonant lengths.



Fig. 14. Shortening of spiral vortices to resonant lengths.

The number of 6 resonant lengths is determined based on the presence of 6 stable elementary particles with mass of Standard model. These are, in descending order of length, tau-neutrinos ( $S\tau$ ), mu-neutrinos ( $S\mu$ ), electrons ( $Se$ ), d-quarks ( $Sd$ ), u-quarks ( $Su$ ), electron-neutrinos ( $Sv$ ), and the same number of corresponding antiparticles. At the same time, u-quarks and d-quarks in the free state do not exist alone, but they are stable as part of the triad of quarks of nucleons, and, accordingly, the simples corresponding to these quarks can be considered quasi-stable.

The minimum length in the spectrum of resonant lengths of spiral vortices, corresponding to electron-neutrinos ( $Sv$ ), has a special place in the topology of simples. It is obtained by shortening spiral vortices shorter than  $Su$  to a "zero" length consisting of several electric toroidal vortex turns, which are embraced at the last moment by a shortening azimuthal electric vortex, which prevents these spiral vortices from disappearing completely and stops the shortening process. Two such tiny remnants of spiral vortices with opposite electric charges combine together into a double wheel, and form a neutral particle, the electron-neutrino.

All other elementary particles of the Standard Model with mass (4 heavy quarks, muons and taons, W and Z bosons, and the Higgs boson) are unstable particles and decay to form these 6 stable particles and massless bosons. That is, additional stable simples corresponding to these unstable massive particles in nature missing.

The uniform nature of all these 6 simples allows them to transform into each other in certain circumstances - to lose part of their length and shorten to the resonant length of shorter simples. Or, on the contrary, under the influence of magnetic moments at the ends of spiral vortices, they can attract to each other and form blocks that can fold into new bagels. This simple transformation mechanism allows nuclear, subnuclear, "elementary" and fundamental particles to transform into each other during various nuclear reactions, which fully corresponds to the initial concept of the Preon theory.

An essential circumstance of the process of folding spiral vortices into bagel-simple is the presence of a certain critical length of spiral vortices, less than which they cannot curl into a bagel-simple, but represent certain resonant segments of spiral vortices bent by the attraction of magnetic poles at their ends into arcs. A comparison of the known particle masses and their corresponding simple topologies makes it possible to determine that the specified critical length is slightly less than the length of the mu-simples.

At the first stage, before combining short simples into blocks, only mu-simples and tau-simples are folded into bagels.



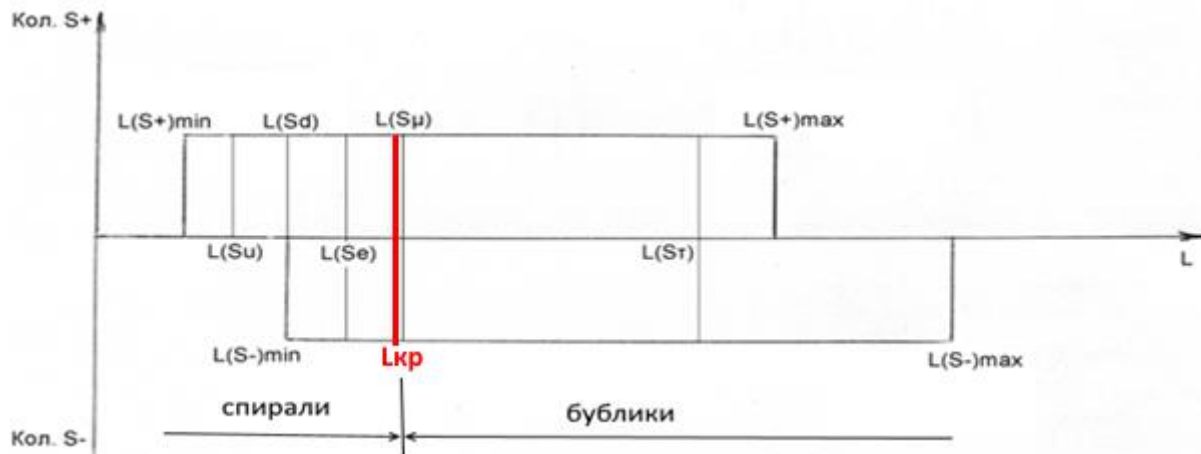


Fig. 14. The spectrum of simple lengths.

The second circumstance affecting the spectrum of lengths of the simples is the already mentioned direction of projection of the magnetic moment of the virtual photon onto the direction of the vector of a short-term powerful magnetic field, which determines the electric charge of the simple, but not only. The addition and subtraction of these magnetic moments affects the different minimum and maximum stretching lengths of positive and negative simples. They are offset relative to each other, as shown in the figure above.

The data on the topology and relative sizes of the simples are sufficient to determine the initial composition of the particles after the first stage, which includes stretching spiral vortices, shortening spiral vortices to resonant lengths, folding tau-simples and mu-simples into bagel-simples, and combining two eponymous bagel-simples with opposite charges into twin wheels of neutral particles tau-neutrino, mu-neutrino, electron-neutrino.

At the next stage, short simple-spirals Su, Sd, Se begins to interact with each other through their magnetic moments at the ends of the simples and form blocks of new particles. The consequences of this will be discussed below.

The ideal further result of this physical model would be the calculation of the resonant lengths of simples, their masses, and electric charges and magnetic moments before and after folding the spiral vortices into bagels. Based on these parameters, it would be easier for us to start building models of the formation of elementary and larger fundamental particles (nucleons) from simples.

However, we do not know any of these parameters of the simples, and therefore we will have to build models of particles based only on the topology of the simples we have determined, the qualitative ratio of the lengths of the simples (more /less), and knowledge of the topology of the field lines of their electric charges and magnetic moments. This approach is initially multivariate, however, knowing the final parameters of the particles known to us allows us to discard unacceptable model variants, and ultimately determine the values of the basic parameters of all the simples. We will not present all these arguments and calculations in this article, they are too voluminous, they can be found in our original work [1]. The resulting topologies and simple composition of the 6 specified stable elementary particles of the Standard Model are given below, as well as a table of the main parameters of the simples.

#### THE COMPOSITION OF THE FIRST ELEMENTARY PARTICLES

The driving force behind the assembly of simples into basic elementary particles is the interaction forces of the field lines of their electric charges and magnetic moments.

The composition of six stable elementary particles with mass from simples:

- 1) tau-neutrino =  $S\tau^- + S\tau^+$  (double bagel);
- 2) mu-neutrino =  $S\mu^- + S\mu^+$  (double bagel);
- 3) electron = 6 Se- (a bagel from a block of 6 spiral-simples Se-);
- 4) d-quark = 2 Sd- (a block of 2 Sd- spiral-simples);
- 5) u-quark = 4 Su+ (a block of 4 Su+ spiral-simples);

6) electron-neutrinos =  $S_v^- + S_v^+$  (a double mini-bagel made up of the remnants of the shortening of the spiral vortices  $S^-$  and  $S^+$  to almost "zero").

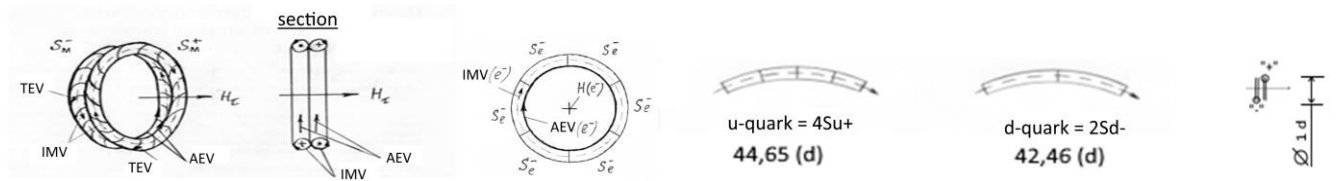


Fig. 15. Topology of tau- and mu-neutrinos, electrons, d- and u-quarks, and e-neutrinos.

#### THE TABLE OF THE MAIN PARAMETERS OF THE SIMPLES

Designation of simple	$S_{\tau^-}, S_{\tau^+}$	$S_{\mu^-}, S_{\mu^+}$	$S_{e^-}, S_{e^+}$	$S_{d^-}, S_{d^+}$	$S_{u^+}$
Simple form	bagel	bagel	spiral	spiral	spiral
Simple mass (MeV/c <sup>2</sup> )	7,733128152	0,092914675	0,085166485	0,072133125	0,037926625
Electric charge of the simple	-/+ 1/6	-/+ 1/6	-/+ 1/6	-/+ 1/6	+ 1/6
Simple length (fm)	1,340978222	0,016112051	0,014768461	0,012508386	0,006576741
The outer diameter of the simple torus (fm)	0,427435833	0,005717825	-	-	-
Simple density (g/cm <sup>3</sup> )	$3,77 \cdot 10^{19}$	$3,77 \cdot 10^{19}$	$3,77 \cdot 10^{19}$	$3,77 \cdot 10^{19}$	$3,77 \cdot 10^{19}$
d - the diameter of the simple body (fm)	0,0005892	0,0005892	0,0005892	0,0005892	0,0005892

#### THE STAGE OF FORMATION OF BLOCKS OF SHORT SPIRAL SIMPLES

According to the CST, if the Big Bang is considered the sudden appearance and spread of a short-term powerful magnetic field in a certain area of space (ether) the reason for which we will analyze further, then the resulting cloud of simple plasma in this area of space can be considered the beginning of the existence of our Universe. We have already analyzed the nomenclature of the formed simples, and presented a list of the first elementary SM particles that can be formed from these simples.

The above model of formation of simples not kinetic, but electrodynamic in nature. The original virtual photons (embryos of simples) had no momentum (they were stationary relative to the ether). A short-term powerful magnetic field, according to our model, is a set of lines of force - polarized magnetic chains of ether corpuscles formed by changing the orientation of the magnetic moments of these corpuscles, while all these corpuscles also remain stationary relative to the ether. The very process of stretching virtual photons into spiral vortices is also electrodynamic, and does not impart kinetic momentum to the resulting simples. All this together means that all the resulting simples are cold, including tau-simples and mu-simples, from which the relic tau neutrinos and mu neutrinos were formed, which together, as will be shown below, make up 92% and 8% of the mass of Dark Matter. At this stage, the entire simple plasma had a temperature conditionally equal to zero, and the critical length of folding of spiral vortices into bagels indicated above corresponds only to this temperature.

At the next stage, short spiral simples that cannot curl into bagels individually begin to assemble into blocks due to their magnetic moments at the ends. When spiral simples with opposite charges meet, their azimuthal electric vortices are oriented towards each other, which leads to their annihilation with the formation of high-energy photons (see Fig. 16 (a)), which increase the plasma temperature. The number of such annihilating short spiral simples is less than 1% of the mass of all simples (as opposed to 99.999999999% of annihilating matter and antimatter, according to the SCM - Standard Cosmological Model  $\Lambda$ CDM).

When spiral simples with charges of the same name meet, their azimuthal electric vortices are directed in one direction, and these spiral simples are combined into a single block (see Fig. 16 (b)).

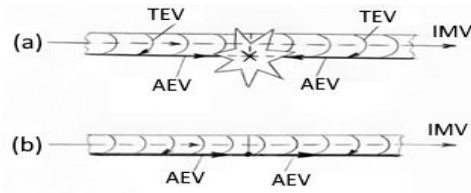


Fig. 16. Annihilation and formation of spiral simple blocks.

An increase in plasma temperature as a result of the annihilation of part of the short spiral simples creates two additional effects. First, an increase in plasma temperature limits the length of the resulting blocks of simples-spirals with the same charges. Our estimate based on the known composition of the future substance particles shows that the maximum length of the blocks formed should not exceed 50d. This value includes blocks of 4 simple spirals Su, and blocks of two simple spirals Sd. But even two simple spirals of Se with the same charges, having a length of 25.07d each, cannot combine into a block. This leads to the fact that all simples Se with opposite charges are annihilated at this stage of the formation of blocks of short spiral simples, without the formation of electrons and positrons.

Theoretically, at this stage, other blocks of short simples with a length in the range of 50d (for example, 2Su + 1Sd) can be formed. However, as shown in [1], all these other blocks cannot participate in the formation of stable hadrons for various reasons, and all of them eventually annihilate.

The second additional effect of bagel formation is that as the temperature of the simple plasma increases, the critical length of the folding of the spiral simples or blocks into bagels increases to 130d.

Thus, at the end of the stage of formation of blocks of short simples, we have a plasma in the following composition (excluding electron-neutrinos):

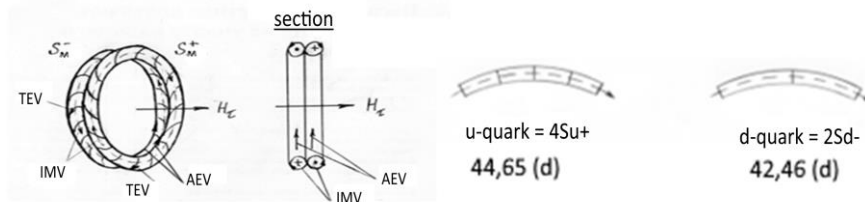


Fig. 17. Plasma composition before hadronization (tau- and mu-neutrinos, u- and d-quarks).

## THE STAGE OF FORMATION OF RELIC NEUTRONS

According to classical electrodynamics, the more turns there are in the solenoid, then the higher the magnetic moment of a solenoid. Thus, the magnetic moment of the tau- and mu-neutrinos is generated by two turns of azimuthal electric vortices of two bagel-simples. But the end magnetic moments of u- and d-quarks are generated by a significantly large number of turns of toroidal electric vortices of the simple spiral blocks that make up these quarks. That is, the end magnetic moments of quarks are many times higher than the axial magnetic moments of tau- and mu-neutrinos. Thus, conditions arise in plasma when, as a result of the magnetic dipole-dipole interaction, u- and d-quarks string on themselves mu- and tau-neutrino bagels like the rods and bagels of children's pyramids, forming bi-coaxial aggregates. A simple calculation shows that 20 mu-neutrinos can fit into the length of a d-quark, and 21 mu-neutrinos can fit into a u-quark due to its longer length. Considering that the diameters of tau-neutrinos exceed the diameters of mu-neutrinos by almost two orders of magnitude, the difference in the magnetic field strengths of quarks at this distance is leveled, and 20 pieces of tau-neutrinos are strung onto each quark.

At the next stage of the process, two such bi-coaxial blocks with a d-quark and one bi-coaxial block with a u-quark are pulled together, forming an electroneutral toroidal aggregate. In this case, the magnetic moments of the tau- and mu-neutrinos are combined into a single closed magnetic vortex,

which generates an axial small electric moment of the toroidal aggregate. According to the composition of quarks, this aggregate corresponds to a neutron, we will call these aggregates relic neutrons.

We would like to draw your attention to the fact that such an aggregate of three bi-coaxial blocks with two u-quarks and one d-quark, corresponding in quark composition to a proton, could not have been formed due to the imbalance of their electric charges and the occurrence of unbalanced Coulomb repulsion forces.

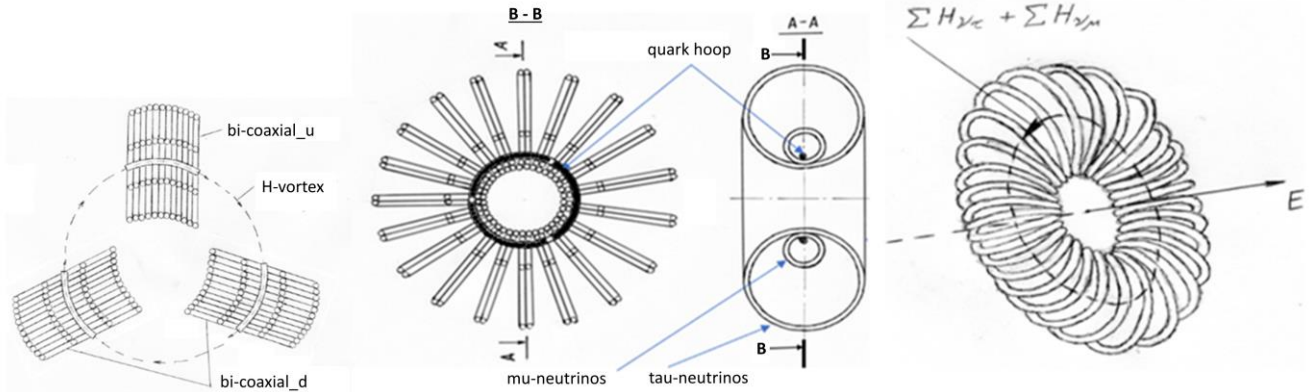


Fig. 18. The relic neutron model.

Here are the composition and some parameters of the relic neutron (RN):

60 pieces of tau-neutrinos;

61 pieces of mu-neutrinos;

2 pieces of d-quarks;

1 piece of u-quark.

gaps in the quark hoop = 1 d

Please note that a hoop of three quarks has formed in the relic neutron, separated by gaps equal to 1d, which prevents the contact and annihilation of quarks with opposite charges, and at the same time ensures a constant tightening and stable state of the toroidal aggregate.

The calculation shows that the mass of such a relic neutron is 939.75120755 MeV, which is more than the mass of reference neutrons (939.5653782 MeV) by 0.18882935 MeV, which corresponds, according to our calculations, to the mass of one mu-neutrino (see Table simples). As will be shown below, the presence of this additional mu-neutrino in the relic neutrons allows the process of primary nucleosynthesis of the entire spectrum of isotopes according to the Gamow scheme to be realized in a single cycle at the next stage.

#### THE DECAY MODEL OF RELICT NEUTRONS and other FREE NEUTRONS

75% of the relic neutrons decay into protons and electrons (the future hydrogen atom). The reason for the decay of free neutrons is the spontaneous displacement of quarks in the quark hoop. So, if two d-quarks shift towards the u-quark by 0.5d, then the gap between the two d-quarks will increase to 2d, into which one mu-neutrino will immediately fall, which will fall into a strong end magnetic field between the two d-quarks, which will disrupt the orientation of the dipole electric moments of the bagel vortices of mu-neutrinos, and they will destroy. We call this process an intra-nucleon microburst. In this case, both d-quarks and several more neighboring mu-neutrinos are destroyed. Next, the process of shortening and partial annihilation of these destroyed simples is started, and new particles are formed from the remaining simples – an electron, and a pair of new u- and d-quarks, which restore the quark hoop and turn the original relic neutron into a reference proton. It should be noted that the overall stability of the toroidal aggregate during the entire process is maintained by a single internal total magnetic vortex of tau-neutrinos, which do not participate in these transformations.

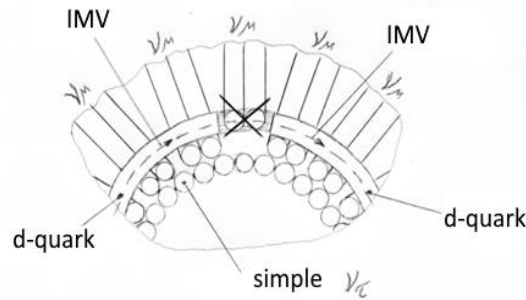
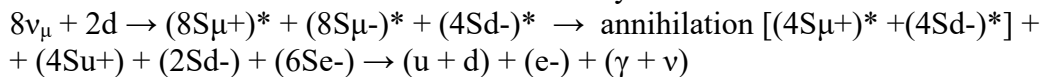


Fig. 19. Relic neutron decay model.

The S-formula of reaction of relic neutron decay:



This scheme of formation of protons and electrons in the universe guarantees an absolutely equal number of them, which modern physics agrees with, but it does not explain this fact in any way.

Free protons cannot decay according to this scheme, because u-quarks are longer than d-quarks, and therefore the nominal size of the gaps in the hoop of quarks in protons is  $0.27d$ .

#### CORRELATION OF THE PREON-SIMPLE AND QUARK MODELS OF NUCLEONS

The modern quark model of nucleons, based on the results of the HERA experiment, includes a triad of valence quarks and a sea of quark-antiquark pairs connected to each other by gluon "springs".

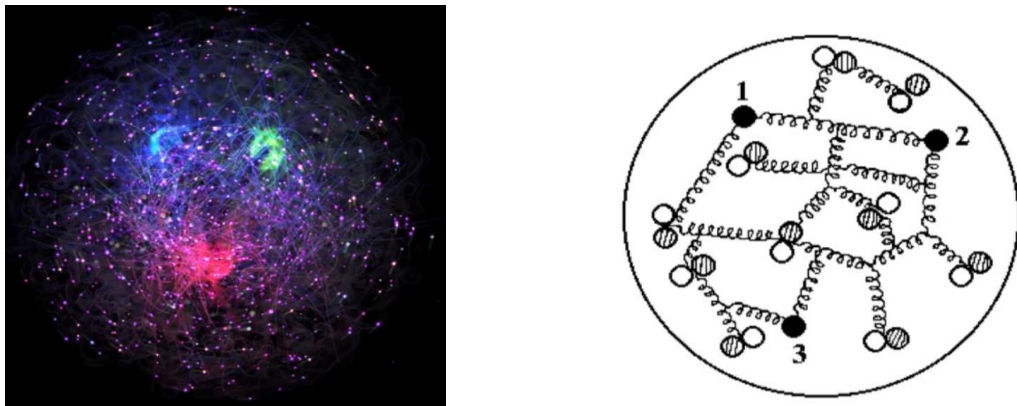


Fig. 20. Visualization of the HERA experiment, and the quark model of nucleons.

In this experiment, protons were bombarded with high-energy electrons, and the composition and internal structure of proton elements were modeled based on the analysis of their reflection angles. It should also be noted that sea pairs of particles with positive and negative charges were identified with quarks based only on Occam's razor on minimizing the number of necessary entities. This has not been proven experimentally.

Now let's look at the results of this experiment from the standpoint of the CST. According to the CST, the shape of all "elementary" particles with mass, incl. neutrinos, electrons, and valence quark hoops are tori-bagels. Moreover, all neutrinos are double wheels of positive and negative simple-bagels. Purely electrodynamically, such neutrinos in the specified experiment can manifest themselves similarly to a quark-antiquark pair of particles with opposite charges. Thus, from the point of view of the results of the HERA experiment, we can talk about the correlation of our preon-simple and modern quark models of nucleons. PRIMARY NUCLEOSYNTHESIS OF ALL ISOTOPES BY TO THE GAMOW SCHEME

With the appearance of the first protons in the plasma, an electrically neutral mechanism is triggered for combining protons (and other nuclei) with relic neutrons according to the Gamow scheme, and the formation of the entire spectrum of nuclides as a result of this process. This process consumes the remaining 25% of the relic neutrons. At each step of the reaction, the attached relic neutron turns into either an intranuclear proton or an intranuclear neutron, while a certain number of mu-neutrinos are destroyed, and occur (or does not occur) the corresponding rearrangement of the quark hoop. It is the destruction of mu-neutrinos that is the main and integral element of all nuclear reactions, and represents the physical realization of the occurrence of a mass defect during all nuclear reactions [13].

We performed a sequential calculation of the addition reactions of relict neutrons according to the Gamow scheme, and determined the number of destroying mu-neutrinos at each step. Below are graphs of the average number of destroyed mu-neutrinos per one nucleon of stable valley isotope nuclei and all known isotopes of the isotope cloud.

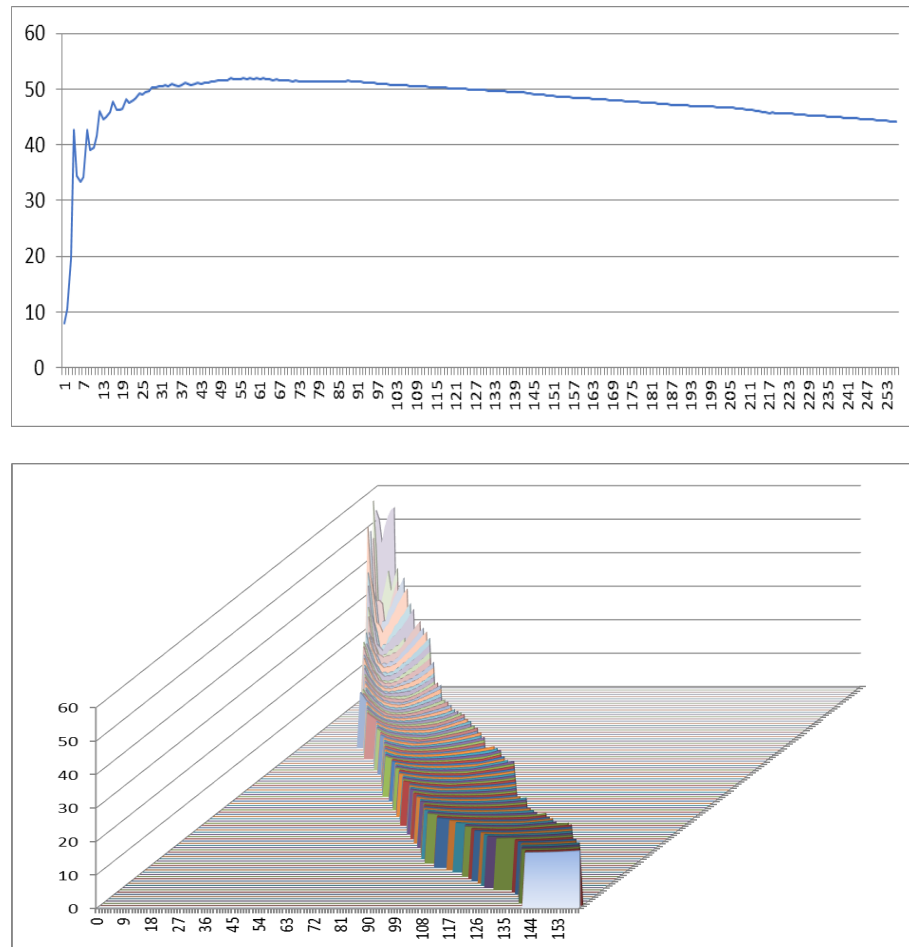


Fig. 21. The number of mu-neutrinos remaining intact in the isotope cloud.

As you can see, the upper graph fully correlates with the graph of the binding energy of nucleons in the valley of stability nuclides.

We have turned over the lower graph for clarity, it shows the average number per nucleon of the remaining intact mu-neutrinos from their initial number of 61 pieces in relic neutrons. The nucleons in the  $^{56}\text{Fe}$  nucleus have the smallest number of mu-neutrinos remaining intact, with 9 mu-neutrinos remaining in all nucleons, 3 for each quark, which ensures that the nucleon structure remains stable. The mass of these nucleons is about 1% less than the reference mass of protons and neutrons:

$$\text{mass p(ref)} = 938.272013 \text{ MeV}$$

$$\text{mass n(ref)} = 939.5653782 \text{ MeV}$$

$$\text{mass p}(^{56}\text{Fe}) = 930.0955216 \text{ MeV } (-0.87\%)$$

$$\text{mass n}(^{56}\text{Fe}) = 930.08808135 \text{ MeV } (-1.03\%)$$



It turns out that during all nuclear reactions, the nuclides seem to slide downhill, striving for the minimum number of intact mu-neutrinos.

### OTHER NUCLEAR REACTIONS

If the above average number of mu-neutrino destroyed into nuclides of the stability valley is recalculated into the total mass defect of these nuclides, the following graph is obtained.

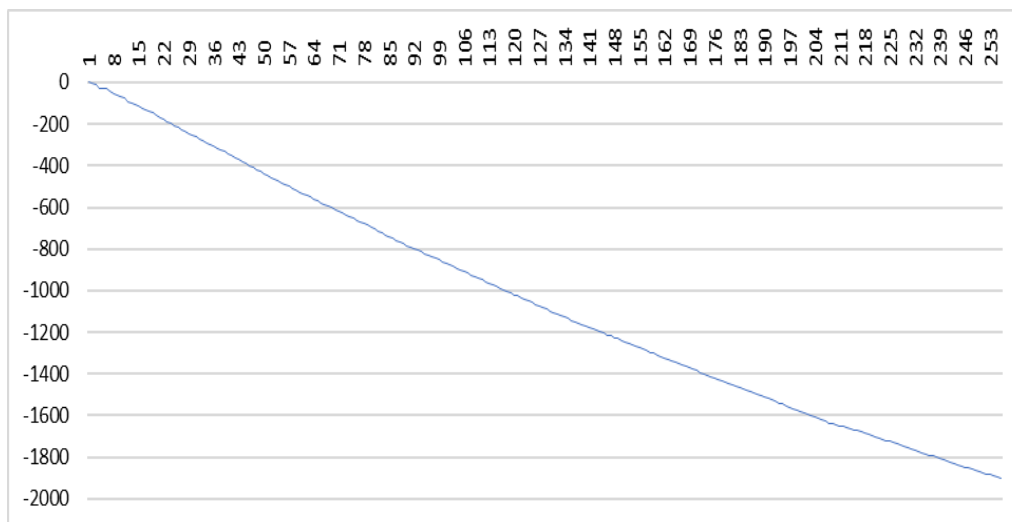


Fig. 22. The total number of destroyed mu-neutrinos.

It shows that during all nuclear reactions, the mass defect of nuclides only increases and never decreases. In other words, during all nuclear reactions, mu-neutrinos only destroy, and never recover. This fact suggests that at the level of nuclear reactions, the arrow of time has only one direction. Note that this does not mean that during the chain of nuclear reactions, some nuclide with a certain number of protons and neutrons cannot reappear. But at the same time, the total number of mu-neutrinos in it will necessarily be less than their initial number. Examples of such reactions are given in [1]. This paper [1] also provides the prerequisites for mu-neutrino destroying in different reactions, physical models, and S-formulas for all major nuclear reactions: all types of  $\beta$ -decay,  $\alpha$ -decay, p- and n-decay, fission reactions of  $^{235}\text{U}$ , and a variant for optimizing the  $4\text{He}$  synthesis reaction. It is shown that in all these reactions, the resulting mass defect, the energy released, and the formation of new particles leaving the nuclides correspond with very good accuracy to the number of destroying mu-neutrinos. One of the significant results in this case is a rigorous physical and mathematical explanation of the paradox of an increase in the total masses of the resulting particles in the  $\beta^+$ -decomposition reaction compared with the initial particles. According to the CST, the explanation, or rather the correction of this "paradox", is destroying of mu-neutrino in the initial proton, as a result of which the remaining number of mu-neutrinos and the mass of the resulting neutron are less than in the initial proton.

### STRONG NUCLEAR-NUCLEAR INTERACTION

Due to the gaps between the quarks in the hoop of the quarks of the nucleons, the azimuthal electric vortices of the quarks do not contact each other, but at the same time each vortex must close, otherwise it will not be stable. To close, azimuthal electric vortices of quarks find a path along unidirectional toroidal electric vortices of mu-simples and tau-simples, forming 42 pairwise-opposite-directed magnetic moments (MM) for each quark. Reducing the number of mu-neutrinos to three for each quark in a nuclide  $^{56}\text{Fe}$  does not violate this pattern (topology), thus, in all nucleons, the total number of magnetic moments of the three quarks is 126.

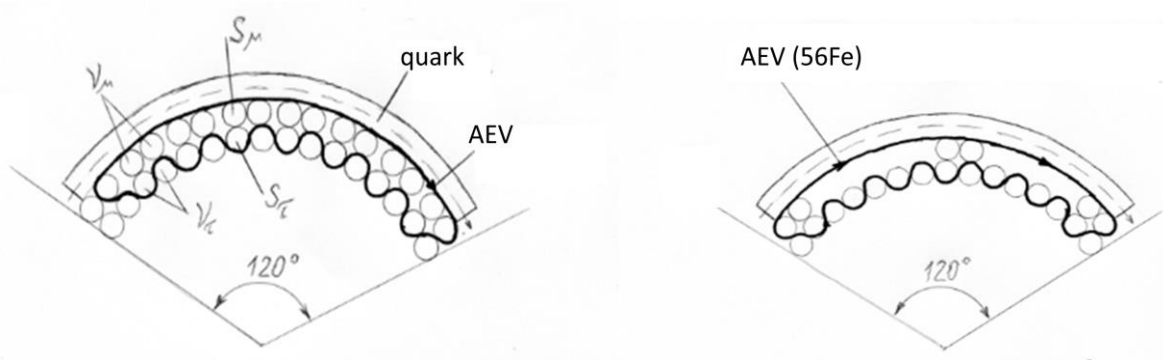


Fig. 23. Closure of azimuthal vortices of quarks and formation of 46 MM.

At a far distance of the nucleons from each other, the lines of force of these MM are reconnected in pairs inside the nucleon and do not create nuclear forces of interaction between the nucleons. When nucleons approach, the 126 MM lines of force of three quarks of neighboring nucleons join and pull the nucleons together, thus realizing the action of the forces of the STRONG NUCLEAR INTERACTION.

This mechanism fully corresponds to the mechanism of interaction of nucleons through the means of elementary particles – GLUONS, which, according to this model, are quasi-particles consisting of interaction pulses of MM quarks.

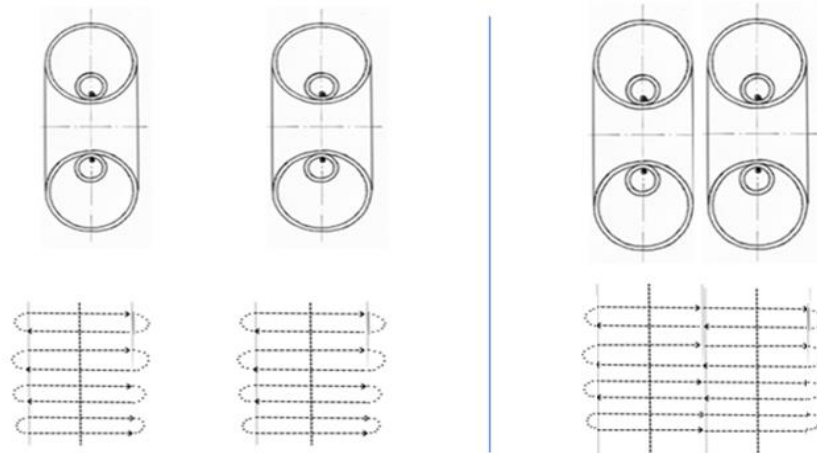


Fig. 24. A model of reconnection of lines of force of MM-quarks of two nucleons at a far and at a close distance.

When nucleons pull, the points of application of forces are azimuthal vortices of quarks, as a result, hoops of quarks are pulled to each other, which are pulling along the mu-neutrino bagels, which practically do not change their shape due to the rigidity of the critical radius of their convolution. But the outer bagels of tau neutrinos, due to their much larger diameter and greater flexibility, deform, as shown in Fig. 25, thus forming groups of four nucleons. The fifth nucleon simply can no longer "fit" under the last fourth nucleon. When nucleons alternate in a group in the order p-n-p-n or n-p-n-p, such groups correspond to the  $4\text{He}$  nuclide, called  $\alpha$ -particles, and have the maximum binding energy between the nucleons, due to the minimum distance between their quark hoops, which is only slightly larger than the outer diameter of the mu-neutrino. The distance between the hoops of quarks of neighboring groups of nucleons ( $\alpha$ -particles) is much greater, which reduces the binding energy between them. Confirmation of such a linear chain of nucleon compounds into nuclides is a mathematical experiment on modeling the rotation of the oxygen-16 nucleus using the Hartree-Fock method performed by physicists at Kyoto University [14].

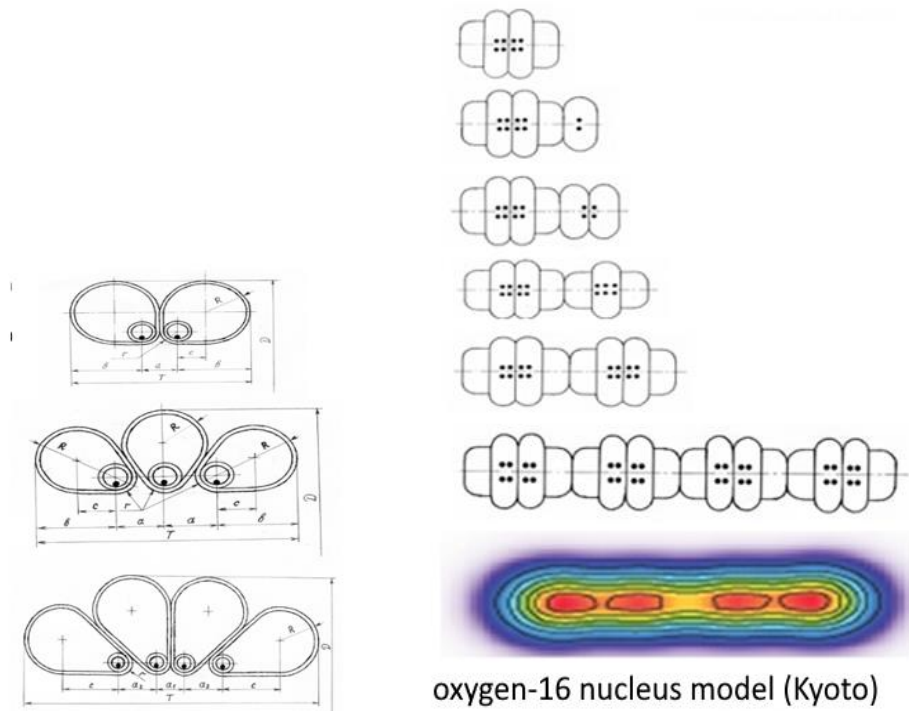


Fig. 25. Models of nucleon bonding in nuclide nuclei.

It should be noted here that due to the multidirectional nature of the azimuthal electric vortices of u- and d-quarks, when two identical nucleons are connected to the nucleus, all 126 MM are connected unidirectionally and the nucleons are connected coaxially. But when two different nucleons (a proton and a neutron) connect, the lines of force of the 2 extreme pairs of MM of two different quarks of two connecting nucleons mate in different directions and repel, while the remaining 124 MM of quarks attract. As a result, the connection of different nucleons occurs with a slight bend in the axis of conjugation of nucleons. Given that each nucleon has three quarks, the fracture of the conjugation axis occurs in different planes, as a result of which the chains of nucleons of the nuclei twist into a ball. In [1], the calculation of the angle of twisting of the ball is given, which is approximately  $2^\circ$ . With this value of the twisting angle, the "winding" of the ball is very loose, with large gaps between the coils of the ball. The connection of two ends of a chain of nucleons with a number of more than 310 nucleons it leads to the closure of the second turn of the nucleon chain, which gives a rigid structure to the nuclei, which belong to the hypothetical island of stability.

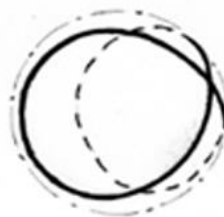


Fig. 26. The core of the hypothetical island of stability.

Another consequence of this model of the strong nuclear interaction of nucleons is the correlation of the binding energy graph with the number of destroyed mu-neutrinos. The maximum binding energy of the nucleons in the nucleus corresponds to the  $^{56}\text{Fe}$  nuclide, in which 52 mu neutrinos destroyed in each nucleon, leaving only 9 mu neutrinos (3 for each quark).

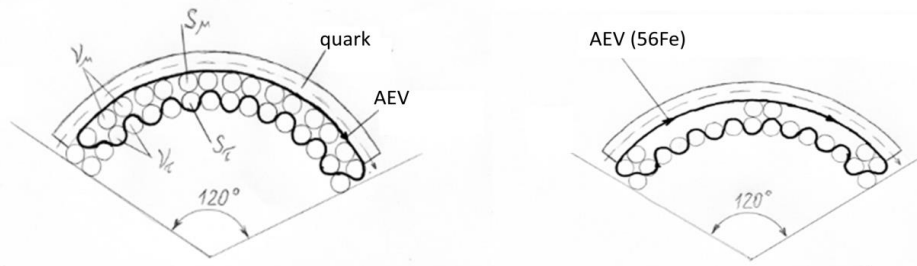


Fig. 27. The binding energy of nucleons correlates with the number of "holes" from destroyed mu-neutrinos.

In this regard, our proposed concept of reducing the mass of nucleons during all nuclear reactions as a result of the destruction of mu-neutrinos acquires an additional physical meaning. When mu-neutrinos are destroyed, peculiar "holes" are formed in the nucleons in their place, which are filled with chains of MM quark lines of force over the shortest distance, which increases the energy of the strong interaction of the nucleons (binding energy). With a further decrease in the specific number of destroying mu-neutrinos per nucleon in the region of heavy nuclides (after 56Fe), the specific number of "holes" per nucleon also decreases, and the binding energy of nucleons in the nucleus decreases accordingly, which affects the growth of spontaneous and forced decay reactions in heavy isotope nuclei. It can be assumed that the "holes" from destroyed mu-neutrinos are the main "holders of shares" in the binding energy of nucleons in isotope nuclei, acting as channels for chains of field lines of MM quarks.

Simples from destroyed mu-neutrinos are the building material for electrons, positrons leaving nuclides, rearrangement of the triad of valence quarks of nucleons involved in the reaction, as well as the annihilation of excess simples with opposite charges that remain unused, with the formation of radiant energy of photons, neutrinos and antineutrinos carrying away the external energy of nuclear reactions.

### WEAK INTERACTION

When spiral vortices are folded into mu- and tau-bagel-simples, when short spiral-simples are assembled into quark blocks, when 6 Se- spiral-simples are assembled into blocks and folded into electron and positron bagels, when a hoop of nucleon quarks is constructed from a triad of quarks that constricts the toroidal structure of nucleons, In all these cases of the formation of stable simple structures, the main force of all these processes is the attractive forces of the opposite magnetic poles at the ends of the spiral simples. We draw attention to the fact that the stability of these simple structures is ensured by the ideal coaxial coupling of the ends of the simples, which ultimately form correct bagel-tori.

These magnetic forces of attraction at the ends of spiral-simples with opposite magnetic poles can also to shape unstable particles with mass, both included and not included in the Standard Model.

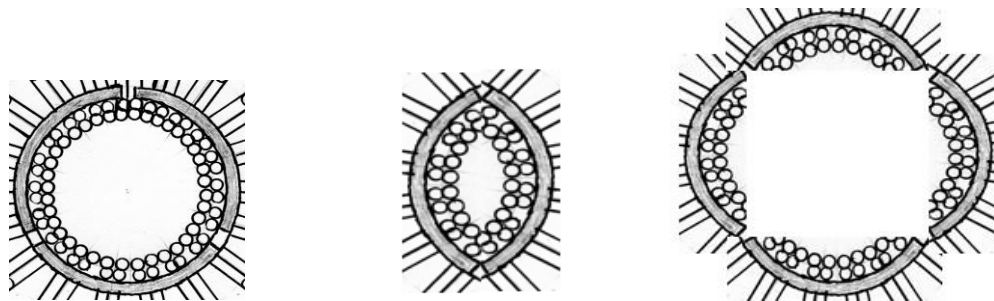


Fig. 28. The hoop of a triad of nucleon quarks, the hoop of two meson quarks, the hoop of tetraquark.

As we can see, the instability of mesons and tetraquarks is associated with the misaligned conjugation of the ends of the spiral simples, which leads to radiation and loss of energy of the simples, followed by the destruction of these particles.

Historically, these forces were first discovered and are associated with beta-decay reactions, during which all these transformations of simples occur. Without knowing the simple structure of the particles and the mechanism of their connection, these forces were given the name WEAK INTERACTION. The main focus of the mechanism of these reactions was on the short-lived  $W^{+/-}$  and  $Z^0$  massive bosons discovered during these reactions. What are these structures? We remember that during, for example, the decay reaction of a relic neutron, two d-quarks and 8 mu-neutrinos are destroyed, from the simples of which an electron is formed, two new u- and d-quarks, and a photon with antineutrinos. In the interval between these two reaction stages, a plasma clot of spiral simples exists in the inner nucleon cavity for some time, surrounded by a certain number of tau-neutrinos that are not affected by the reaction. The magnetic dipole-dipole attraction of tau-neutrinos to each other keeps them from leaving the nucleon. We believe that this temporary group of quasi-free tau-neutrinos and simple-spirals is detected by nuclear physics detectors during this reaction, which is interpreted by modern physics as the formation of short-lived  $W^{+/-}$  and  $Z$  massive bosons.

It should be noted that the adjective is WEAK, as it is understood in Russian, it does not quite correspond to this type of interaction. Our calculations show that the number of destroying mu-neutrinos in individual  $\beta$ -decay reactions is no less, and in some cases even more, than in known nuclear fission reactions.

### THE GREAT UNIFICATION OF ALL FUNDAMENTAL INTERACTIONS

Thus, taking into account the above models: models of ELECTROMAGNETIC INTERACTION through LINES of FORCE, models of GRAVITATIONAL INTERACTION in the form of a difference in the momenta of attraction and repulsion of lines of force of electric charges and magnetic moments of neutral bodies, models of STRONG NUCLEAR INTERACTION between the magnetic moments of quarks of neighboring nucleons, and models of WEAK INTERACTION between the magnetic poles at the ends of spiral simples, we can draw a conclusion, that the GREAT UNIFICATION of all four fundamental interactions is based on ELECTROMAGNETIC INTERACTION.

### LENR REACTION MODEL (HYPOTHESIS)

In modern theoretical physics, there are several fields in which there are certain experimental results, but there is no generally accepted theoretical explanation for these results. One such example could be the so-called low-energy nuclear reactions (LENR). Skipping a review of the experimental results and various variants of their theoretical interpretation, we note that for several decades the existing approaches of modern nuclear physics and elementary particle physics have not allowed to build a generally accepted theory of LENR. Below is a model of LENR reactions based on a simple concept of the structure of material matter. Considering the possible practical significance of LENR reactions, let's consider our model in more detail and step by step (four steps of LENR reactions):

Step 1: formation of pairs- and multi-electrons.

Step 2: LENR fission reactions with absorption of electron pairs by the nucleus.

Step 3: reactions of LENR synthesis of nuclei involving multi-electrons.

Step 4: formation of particles of strange radiation.

#### STEP 1: FORMATION OF PAIRS- and MULTI-ELECTRONS.

Let us repeat in an abbreviated form the drawing of the CST-model of electron pair formation.

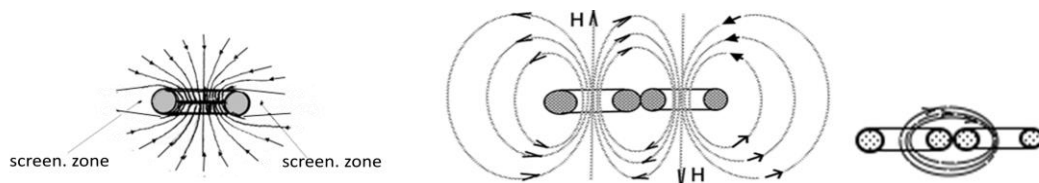


Fig. 29. Pairing of two electrons with opposite spins

The reason for this pairing of electrons with opposite spins is probably the "shake-up" of the electron shells of atoms in LENR reactors due to external influences (discharge, heating, vibration, ultrasound, particle impact, cavitation, etc.).

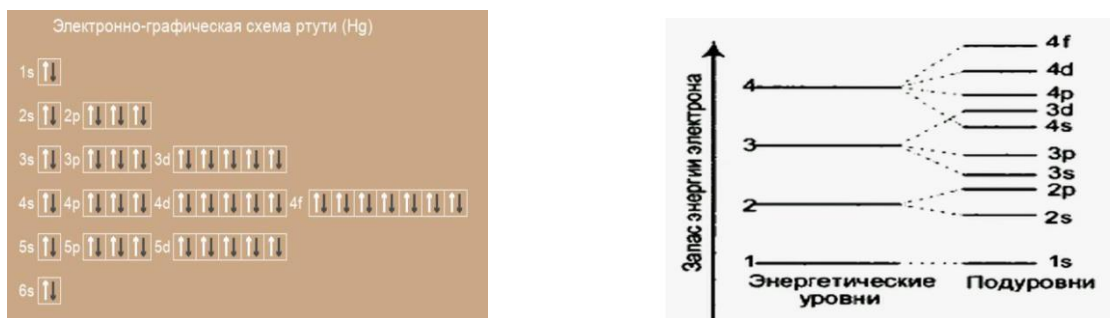


Fig. 30. The structure of electronic orbitals.

Given that up to 7 pairs of electrons with opposite spins are contained in different orbitals of atoms, as well as the overlap of individual sublevels of the orbitals, the formation of multi-electrons with charges from -2 (pair-electron) to -14 (tetra-code-electron) is possible during "shake-up" of the electron shells.

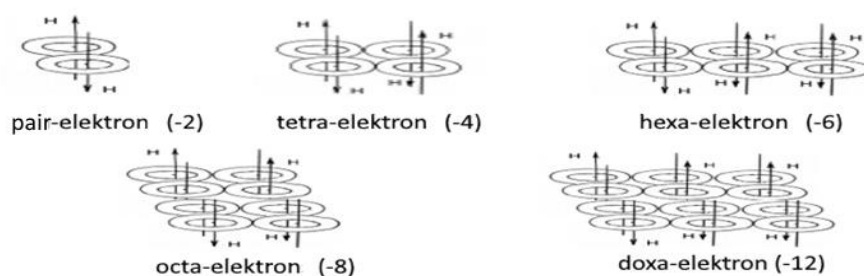


Fig. 31. Multi-electrons models.

## THE MECHANISM OF SUPERCONDUCTIVITY ACCORDING TO THE CST

The magnetic field lines of pairs- and multi-electrons with opposite spins and opposite directions of magnetic moments reconnect, and resemble a Nikolaev magnet, which lacks a magnetic field at macro distances. Such pairs- and multi-electrons, if they are formed in an external orbital, can break away from their atoms (by analogy with free electrons). Free pairs- and multi-electrons, moving along the channel between the nuclei of the crystal lattice, do not experience resistance to their movement in the form of magnetic interaction with the magnetic moments of the nuclei and the orbital magnetic moments of the electrons, which stimulates the transition of materials to the superconductivity mode.

In August 2024, the article "Computer Scientists Prove That Heat Destroys Quantum Entanglement" [15] was published, which mathematically proves that with increasing temperature, the spin-spin coupling of electrons into pairs (entanglement and reconnection of magnetic moments), which determines the phenomenon of superconductivity, collapses.

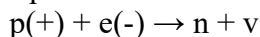
This may mean that pairs- and multi-electrons at normal and even higher temperatures are unstable objects (oppositely directed forces of attraction and repulsion are constantly fighting in them). That is why superconductivity is observed in the low temperature range, and there is no superconductivity in the temperature range of LENR reactions, since it requires the presence of stable pairs- and multi-electrons. But for the implementation of LENR reactions, the lifetime of pairs- and multi-electrons at these temperatures is sufficient. This is indirectly confirmed by the fact that LENR reactions are not avalanche-like, but individual in nature, and the rate of their implementation is completely determined by the rate of external influences stimulating the formation of new pairs- and multi-electrons.



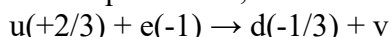
The question of the absence of LENR-reactions at low temperatures in superconductors remains open. Probably, low temperatures somehow "extinguish" the LENR-reactions. This issue requires additional research.

## STEP 2: LENR FISSION REACTIONS WITH PAIR-ELECTRON ABSORPTION

Pairs-electron formed in the lower orbitals come out from their orbitals and are captured by atomic nuclei by Coulomb attraction forces (similar to the capture of single electrons in E-capture reactions). The equation of the reaction of a single E-capture looks like this:



At the quark level, this reaction looks like this:



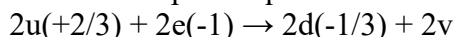
Thus, the triad of valence quarks of the proton ( $u+u+d$ ) turns into the triad of valence quarks of the neutron ( $u+d+d$ ). The atom in the table of elements is shifted by one position.

Sometimes there is a double E-capture (of two single electrons). In this case, two intranuclear protons turn into two intranuclear neutrons, and the atom in the table of elements is shifted by two positions.

Please note that the Standard Model does not explain the mechanism of particle transformation during these reactions.

In the case of LENR reactions, it is not about capturing two single electrons, but about capturing a pair-electrons (a single block of two electrons). Such a single block of electrons cannot be captured by two protons, it can react with only one proton, or rather with two u-quarks of this proton.

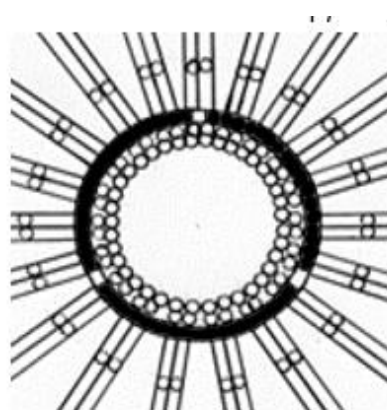
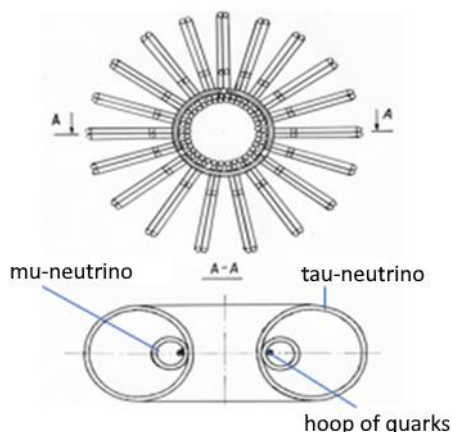
Let's make up the equation of electron pair capture by a proton:



That is, the triad of valence quarks of the proton ( $u+u+d$ ) turns into a triad of quarks ( $d+d+d$ ) of a new unknown nucleon. In modern physics, such nucleons are not known, which means that they cannot exist and must decay ("disappear").

At the level of the simple structure of nucleons, the reason for the "disappearance" of the proton is the shorter length of d-quarks compared to u-quarks, as a result, gaps increase in the hoop of the triad of valence quarks of the formed non-standard nucleon (up to 5.19d in total), into two of which two mu-neutrinos simultaneously fall and destroy, which it leads to the destruction of the entire hoop of quarks, and all other mu-neutrinos. This is followed by the process of shortening and annihilation of the formed spiral simples, after which 6 Se- simples remain, from which an electron is formed, which either leaves the nucleus or is captured by some proton of the nucleus, realizing the reaction of a single E-capture.

But this is not the end of the reaction. After all mu-neutrinos and a hoop of valence quarks disappear in the nucleon, which pulls the entire block of nucleon simples into a toroidal aggregate, a neutron-like block of 60 tau-neutrinos remains from the proton, making up 99% of the mass of the nucleons. This block of tau neutrinos straightens out, but does not break up into separate tau-neutrinos, and under the influence of the dipole-dipole magnetic interaction of magnetic moments, the tau-neutrino retains its unity.



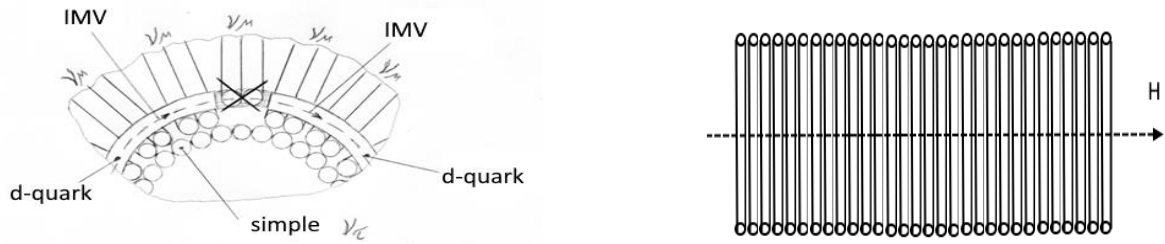


Fig. 32. Components of the LENR fission reaction.

Given the neutral charge of this block, its subnuclear dimensions (diameter 0.43 fm, length 0.07 fm), and the absence of quarks responsible for nuclear interaction in its composition, this block freely leaves the nucleus of an atom, leaving a "hole" in it, which leads to the division of the nucleus into two parts.

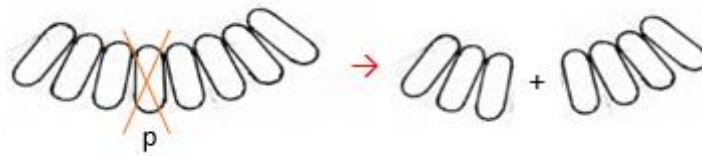


Fig. 33. Nuclear fission into two fragments during the "disappearance" of a proton

The removal of one proton from the chain of nucleons of the nucleus leads to its rupture, i.e. to the division of the nucleus into two fragments. Moreover, the chain of nucleons of the nucleus can break anywhere on any proton, which gives a wide range of options for pairs of fragments.

S- formula for the absorption of a pair of electrons by a proton, and the division of the nucleus into two parts:

The 1st stage of the reaction is the interaction of 2 u-quarks and 2 electrons:

$$2(u)+2(e^-) = 8(Su+^*) + 12(Se-^*) \rightarrow \text{annihilation } [8(Su+^*) + 8(Se-^*)] + 4(Sd-) \rightarrow 2(d) + 1.03 \text{ MeV}$$

The 2nd stage of the reaction is the annihilation of 3 d-quarks and 9 mu-neutrinos:

$$3(d)+9(\nu_\mu) = 6(Sd-^*)+9(S\mu-^*)+9(S\mu+^*) \rightarrow \text{annihilation } [6(Sd-^*)+3(S\mu-^*) + 9(S\mu+^*)] + 6(Se-) \rightarrow 1(e^-) + 1.54 \text{ MeV} + 1(60 \text{ tau-neutrino block})$$

The energy of annihilation is carried away by photons and neutrinos. We cannot measure the neutrino energy. The photon energy is much lower, it is largely converted into heat Q.

The total reaction parameters look like this:

$$A1 + A2 = A0 - 1; Z1 + Z2 = Z0 - 1; N1 + N2 = N0; +(e^-); + \text{tau-neutrino block}$$

The resulting electron either participates in the E-capture reaction, converting one proton into a neutron, or is embedded in the electron shell of one of the fission fragments.

According to these formulas, the susceptibility of 256 nuclides of the stability valley to fission reactions during pair-electron capture was calculated. The calculation results shows that only heavy nuclides starting from 93Nb are susceptible to this type of reaction (it has 3 fission variants). The next nuclide 94Mo gives 6 fission variants. The maximum number of fission variants of 658 gives the nuclide 192Pt. The 235U nuclide gives 521 fission variants, which means that the fission of the 235U nuclide is possible not only by capturing a neutron, but also by capturing a pair-electron.

#### SCHEME FOR CHECKING THE "DISAPPEARANCE" OF PROTONS IN LENR-FUSION

Our conclusion about the destruction of internuclear protons during LENR fission reactions and the disappearance of the entire mass of the proton from the nuclide is too radical. It has not previously been found in any nuclear reaction, and it cannot but manifest itself in experimental results. After all, the amount of mass reduction per LENR fission reaction should be 100% of the mass of one proton and one electron, and not about 1% of the mass of a nucleon, as in other nuclear reactions. Such a result should

manifest itself on the aggregate data in the form of a corresponding decrease in the mass of the test sample in which LENR fission reactions occur. This decrease in mass should depend on the amount of LENR fission reaction, i.e. on the duration of the reactor operation time. With a long reactor operating time, a decrease in the mass of the sample should accumulate, which can be measured instrumentally.

### STEP 3: REACTIONS OF LENR SYNTHESIS OF NUCLEI

As already noted, pairs- and multi-electrons formed in the upper orbitals can break from their orbitals and be located in the gaps between the nuclei of atoms, shielding their charge, which initiates reactions synthesis (convergence and fusion of nuclei).

According to the calculations of M.P. Kashchenko [16], for the convergence and fusion of nuclei with charges of  $+q$ , it is enough to place a multi-electron with a charge of  $-q/4$  between them. In M.P. Kashchenko's models, multi-electrons have an orbital structure, and the fusion of nuclei occurs in the center of this structure, without affecting the electrons themselves.

In CST, all the electrons in pairs and in multi-electrons are closely adjacent to each other, and form a single block without "voids" between the electrons. This block of electrons is located on the line of convergence of the nuclei, and it cannot just "slip out" somewhere sideways. There is an unforeseen prospect of the participation of a multi-electron in the synthesis reaction, which "confuses all the cards" of the standard synthesis reaction. The result of the reaction becomes uncertain; using the example of the fusion of two  $^{27}\text{Al}$  nuclei, we have the following picture:

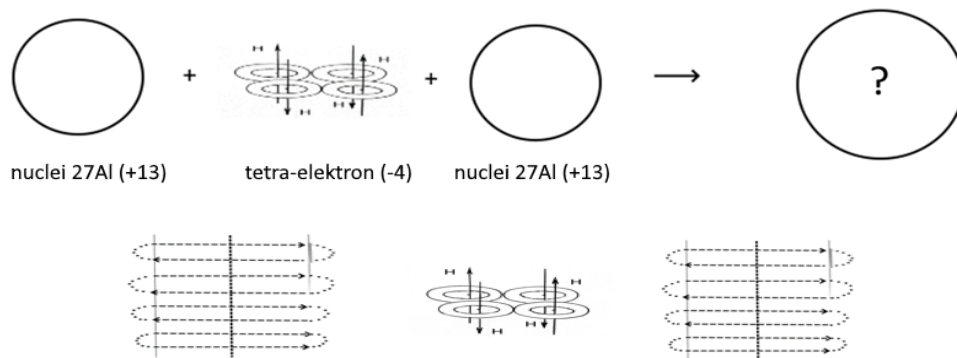


Fig. 34. Diagram of the beginning of the LENR reaction of the synthesis of two aluminum nuclei.

Let's analyze this process in more detail. It has already been noted that the contraction of nucleons into the nucleus is carried out by the magnetic moments (MM) of quarks, the distance between the axes of which is 0.0005892 fm. The MM data has the opposite direction in pairs. At a distant distance of the nuclei from each other, the lines of force of these MM extreme nucleons of aluminum nuclei reconnect to each other in pairs inside the nucleons (there is no nuclear interaction between the nuclei).

But when the nuclei approach, the lines of force of the MM quarks of the extreme nucleons reconnect and begin to pull the nucleons together.

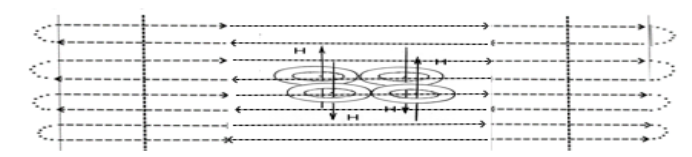


Fig. 35. Reconnection of the MM-quark field lines of two nucleons that have come closer together.

Accordingly, our tetra-electron, which promotes the convergence of two aluminum nuclei, will at some point find itself in the strong magnetic field of the reconnected  $126+126=252$  MM hoops of quarks of two nucleons. According to the previously cited article [15], this strong magnetic field will tear apart the tetra-electron into individual electrons, and under the influence of Coulomb electrostatic repulsion,

all four electrons will fly apart from each other and "slip out" of the region of contraction of the two nuclei. The process of contracting and merging the cores will be completed without interference, as in the standard scheme of synthesis.

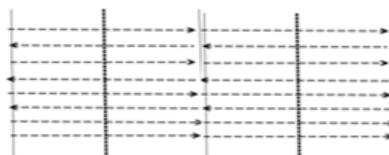


Fig. 36. Reconnection of the field lines of MM quarks after nuclear mergers.

At the same time, the electrons into which the tetra-electron decayed can leave the nucleus, however, the positive charge of the nuclei will slow down these electrons, and some of them from 0 to 4 can be captured by intranuclear protons, resulting in up to 4 single E-capture reactions, as a result of which these intranuclear protons will transform into intranuclear neutrons.

The result of the LENR synthesis reaction will look like this:

$$A_3 = A_1 + A_2; Z_3 = Z_1 + Z_2 - K; N_3 = N_1 + N_2 + K, \text{ where } K = \text{from } 0 \text{ to } 4$$

For the fusion of two  $^{27}\text{Al}$  nuclei, taking into account the possible reactions of proton capture of single electrons, 5 nuclides can be formed:  $^{54}\text{Fe}$ ,  $^{54}\text{Mn}$ ,  $^{54}\text{Cr}$ ,  $^{54}\text{V}$ ,  $^{54}\text{Ti}$ .

The calculation shows that LENR synthesis reactions initiated by multi-electrons are available only to light nuclides up to creptone-69.  $^{27}\text{Al}$  nuclides are susceptible to such reactions, but they cannot produce nuclides lighter than  $^{27}\text{Al}$ , but they are present in result of LENR synthesis reaction [17].

#### LENR SYNTHESIS + FISSION REACTIONS ACCORDING TO THE SCHEME $2 \rightarrow 2$ , $2 \rightarrow 3$ , ...

In real LENR reactors, the set of nuclides produced is much wider than could be calculated using the LENR fission and LENR synthesis reactions described above. Solving this "puzzle", a number of researchers came to the conclusion about the existence of LENR reactions according to the  $2 \rightarrow 2$  scheme, when two, for example, identical or different nuclides, transform into a pair of other nuclides while maintaining the mass number (number of nucleons).

In A.G. Parkhomov [17], the neutrino environment controls the process of such reactions, while in Kashchenko [16] this reaction was controlled one or more pairs of electrons. For both authors, the main arguments in favor of such reactions are the conservation of the total number of nucleons in both pairs of nuclides before and after the reaction, as well as the laws of conservation of mass-energy and charge balances. But the mechanism of such reactions itself is not disclosed in any way. Outwardly, these reactions look like protons and neutrons "jumping" from one nuclide to another, which is physically impossible to explain. And we have not found any experimental evidence for just such a set of reaction products, with an equal number of nuclide pairs formed, in the authors' works.

Without denying the presence of  $2 \rightarrow 2$  reactions in LENR reactors, it seems to us that their real physical mechanism includes two stages:

stage 1 is the fusion of two nuclides with the participation of a multi-electron, as described above, to form an excited intermediate third nuclide.

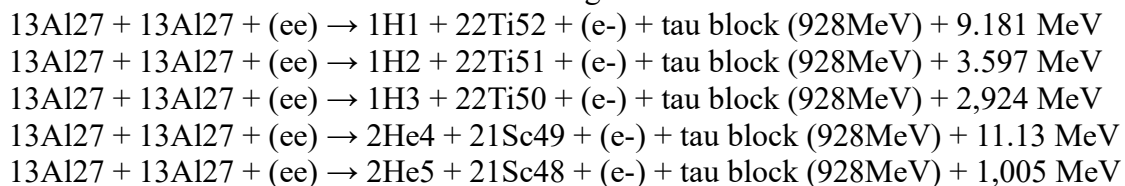
Stage 2 is the division of this intermediate nuclide into two new nuclides with the participation of an pair-electron.

The only additional and necessary condition for the implementation of such a reaction mechanism should be the rupture of a multi-electron by a strong magnetic field of quarks not only into single electrons, but also at least one pair-electrons, which immediately triggers the reaction of LENR fission of an intermediate nuclide according to the scheme described above. The generalized formulas of the reaction  $2 \rightarrow 2$  with the participation of a tetra-electron take the following form:

$$A_3 + A_4 = A_1 + A_2 - 1; Z_3 + Z_4 = Z_1 + Z_2 - K; N_3 + N_4 = N_1 + N_2 + (K-1);$$

+ (e-); + the tau-neutrino block, where  $K = \text{from } 1 \text{ to } 3$  (taking into account the possible two E-reactions)

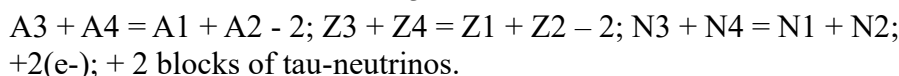
An essential feature of the  $2 \rightarrow 2$  reactions is that it is not a reference intermediate nuclide that is divided, but an excited intermediate nuclide with a larger mass equal to the sum of the masses of the two initial nuclides, and therefore such reactions can be carried out. Thus, for two initial  $^{27}\text{Al}$  nuclides, 5 additional reaction variants are available according to the scheme  $2 \rightarrow 2$ :



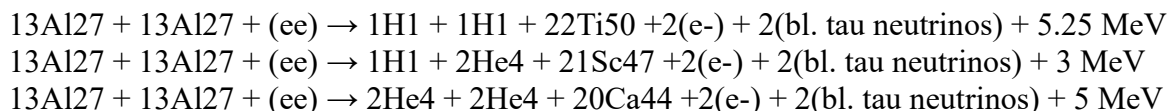
Taking into account the additional reactions of capture of one or two single electrons by the nuclei of the resulting fragments, the total number of reaction variants can reach 10 types.

#### LENR REACTIONS OF TWO $^{27}\text{Al}$ NUCLIDES ACCORDING TO SCHEME $2 \rightarrow 3$

A tetra-electron can be torn by a magnetic field into two pairs-electrons, which will lead to the rupture of the chain of nucleons of the intermediate nuclide in two places into three fragments. Generalized reaction formulas  $2 \rightarrow 3$  take the form:



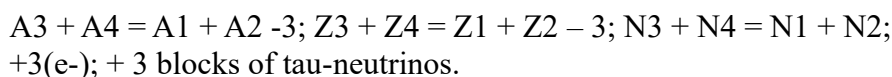
The calculation of variants for  $^{27}\text{Al}$  nuclides according to this scheme gives 3 more reaction variants.:



No single electrons are formed during this tetra-electron decay, so there will be no additional reaction options associated with E-capture.

#### LENR REACTIONS OF TWO $^{27}\text{Al}$ NUCLIDES ACCORDING TO SCHEME $2 \rightarrow 4$

The electron shell  $^{27}\text{Al}$  in the  $2p$  orbital contains three pairs-electron, respectively, there is a possibility of the formation of a hexa-electron, which can also initiate a synthesis reaction, and which will decay into three electron pairs, which will lead to the rupture of the chain of nucleons of the intermediate nuclide in three places into four fragments. The generalized reaction formulas  $2 \rightarrow 4$  in this case take the form:



The calculation of reaction variants for two  $^{27}\text{Al}$  nuclides according to this scheme did not yield positive results.

**STEP 4: FORMATION OF STRANGE RADIATION PARTICLES** The neutron-like block of 60 tau-neutrinos formed during LENR fission reactions has its own dipole magnetic moment equal to the sum of 60 magnetic moments of tau-neutrinos. After leaving the nuclei of prototype and the reactor volume, the block of 60 tau-neutrino unit enters an environment filled with gas from various atoms, molecules, and dust particles with their own dipole magnetic moments. The dipole-dipole magnetic interaction takes effect, which attracts all these particles to the tau-neutrino block. As a result, macro-objects up to several tens of nanometers in size are formed, leaving tracks and craters on surrounding surfaces.

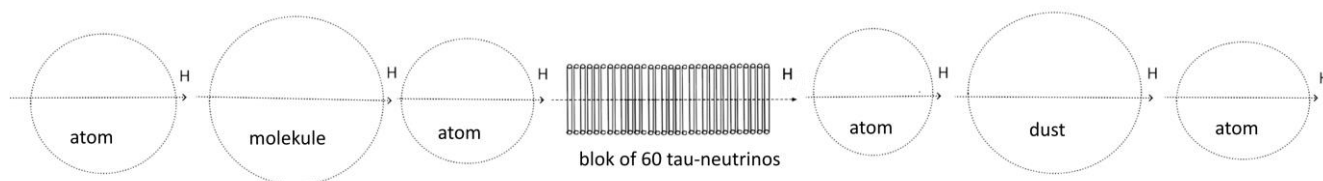


Fig. 37. Model of formation of particles of strange radiation.

PS: An example of such a magnetic contraction of matter is the process of planet formation. In the article "Astronomers Find Secret Planet-Making Ingredient: Magnetic Field" [18]. The authors show that the Earth could not have formed from a protoplanetary cloud only with the help of gravitational forces in 4.5 billion years. In order for the formation of the Earth to meet such a deadline, an additional ingredient is needed – a local source of a magnetic field.

Such local sources of MF in the formation of planets (and stars, and asteroids too), according to the theory of Novosibirsk physicist Belozerov I.M., are the embryos of neutron matter with a strong magnetic field and giving the primary magnetic field to the formed astronomical objects [19]. If we recall the effects of the magnetic field of planets and stars, and the fact that Uranus has its MF axis shifted from the center of Uranus by 1/3 of the radius and rotated 60 degrees relative to the axis of rotation of Uranus, it becomes clear that no magneto-dynamo is capable of generating such a magnetic field of the planet, but a piece of neutron matter in the center of planets can do it all. Seismic sounding of the Earth's core during earthquakes inside the iron-nickel core of the Earth revealed a smaller "core" of higher density [20]. According to Belozerov's theory, it consists of neutron matter. Neutrons separating into a free state from these neutron "nuclei" located in the center of the planets decay into a proton and an electron, which form a hydrogen atom with a  $10^{16}$ -fold increase in the volume of matter, which leads to the "inflating" of the Earth, and triggers a series of LENR reactions inside the Earth according to the scheme of addition of protons, which are not considered here, but which cannot do without the participation of pairs- electron either.

#### ENERGY OF LENR REACTIONS

In nuclear fission reactors using neutron absorption, this process can start spontaneously and turn into an avalanche-like process that has already been learned to control.

In LENR reactors, all reactions are individual, they are not initially causally related to each other, and the intensity of their course depends only on the intensity of external influences, which, however, can have positive feedback through closed circuits of various reactor systems and switch to the auto generation mode of external influences. In this case, the results can be unpredictable, up to emergencies similar to regular fires and more serious emergencies at nuclear power plants.

The issue of positive feedback and auto generation of impacts leading to LENR reactions requires additional theoretical and experimental studies.

#### OPTIONS FOR CHECKING THE PREON STRUCTURE OF SUBSTANCE

According to the CST concept, during all nuclear reactions, part of the mu-neutrino bagels and block simples of valence quarks are destroyed into simples (preons), some of which form new quarks (restoring the hoop of the nucleon quarks), and other particles (electrons, positrons, photons, neutrinos) are formed from the remaining part of the preons, leaving the nucleon and nucleus. The latter leads to a decrease in the mass of nucleons involved in nuclear reactions and to a defect in the mass of the nucleus as a whole.

It follows from this scheme that a nucleon participating in a nuclear reaction must lose part of its mass, which can be verified experimentally. The simplest laboratory method of such an experiment is the "weighing" using precision mass spectrometers of  $\alpha$ -particles or protons leaving the nuclei during spontaneous  $\alpha$ -decay and p-decay reactions of heavy nuclide nuclei. Calculations show that their masses should be less than the reference masses of these particles by up to 1%, which may well be detected by modern mass spectrometers.

#### LOST HOPE FOR JWST

The second option is to check the simple (preon) structure of substance. The mass defect mechanism described above, if applied to all nuclear reactions retrospectively (until the early cosmological epoch of the formation of relic neutrons), means that the first nucleons in the universe were not reference protons and neutrons, but high-mass relic neutrons with 61 mu-neutrinos. Further, 75% of these free relict neutrons decayed to form protons and electrons in equal amounts, and 25% of the relict neutrons



participated in the primary nucleosynthesis of all isotopes in a single cycle according to the Gamow scheme, by sequentially adding relic neutrons.

Primary nucleosynthesis according to the Gamow scheme of the entire spectrum of nuclides from relic neutrons means that the clouds of the first galaxies should have contained metals (the entire spectrum of elements) even before the explosion of the first supernovae. This is partially confirmed by the instrumental detection of metal spectra by the Hubble Space Telescope and other ground-based telescopes in the spectra of galaxies up to 13.4 billion light years (400 million years after the Big Bang) in the galaxies GN-z11 and UDFj39546284. However, modern physics is constantly shifting the time limit of the explosion of the first supernovae beginning from 1 billion years old, to 500 million years old, and further 250 million years old from BB, which does not allow us to assert that these metals were formed during primary nucleosynthesis. The JWST space telescope was supposed to look into the range of distances up to 100 million years from BB. If he had seen metals there (even before the explosion of the first supernovae), this could have been a decisive argument in favor of the existence of high-mass relic neutrons and the primary nucleosynthesis of the entire spectrum of nuclides according to the Gamow scheme, which would confirm the concept of the preon theory. However, the loss of the planned sensitivity by the MIRI JWST interferometer as a result of damage to the telescope mirror by micrometeors [21] does not allow us to hope for obtaining this result. Now we will have to wait for the appearance of new, more advanced (and more expensive) telescopes.

### NEUTRON MATTER

During a supernova explosion, the neutron matter (NM) of neutron stars (NS) is formed, with their inherent powerful magnetic field. According to the CST, this is due to the coaxial coupling of neutrons into chains, while adding their electric and magnetic moments.

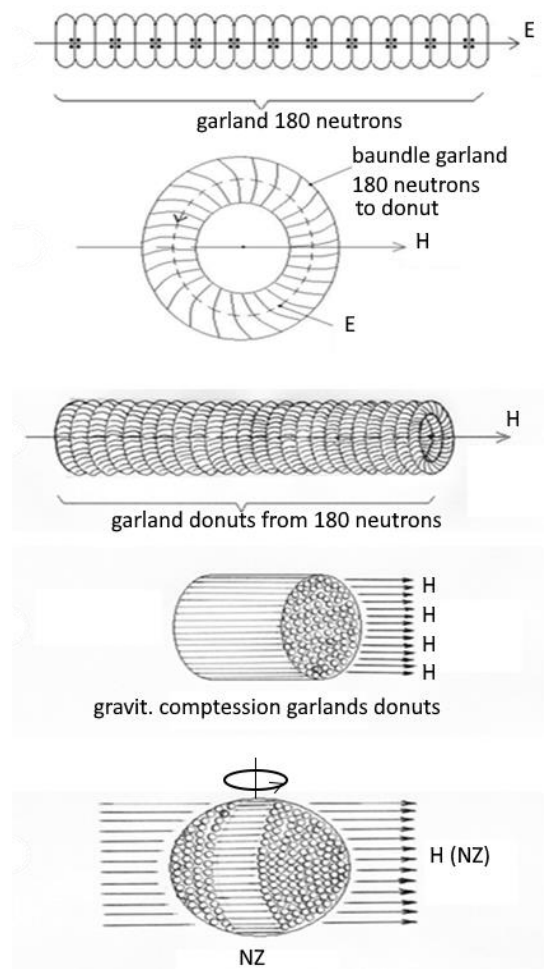


Fig. 38. Model of the formation of neutron matter and neutron stars with powerful MF.

During a supernova explosion, before the completion of the neutrino cooling stage, part of the neutron matter at the boundary with the shell of the star can be ejected as droplets of neutron plasma into the surrounding space, and already freezes there, forming pieces of neutron matter with a strong magnetic field.

In this regard, Belozеров's I.M. model of the formation of planets and stars using embryos from neutron matter, which, with their powerful magnetic moment (MM), attract surrounding matter - atoms, molecules, and dust having their own MM [19], is of serious interest. This idea of magnetic contraction of matter can also be useful to explain the outstripping growth of the first galaxies and super large black hole (SLBH) in the center of these galaxies, under the influence of the relic magnetic field that gave rise to the universe. All the simples formed in this case have their own magnetic moments, and the relic MF gives them the same orientation MM, which is necessary for the dipole-dipole magnetic contraction of matter. The points of contraction in this case are fluctuations in the density of matter with increased MM.

### BLACK HOLES

If the remnant of a supernova explosion (NZ) exceeds three times the mass of the Sun, then the compression of matter continues, which leads to the compression and destruction of tau-neutrino and the formation of a stellar-mass Black hole (SMBH) in the form of a super-simple (quasi-singularity).

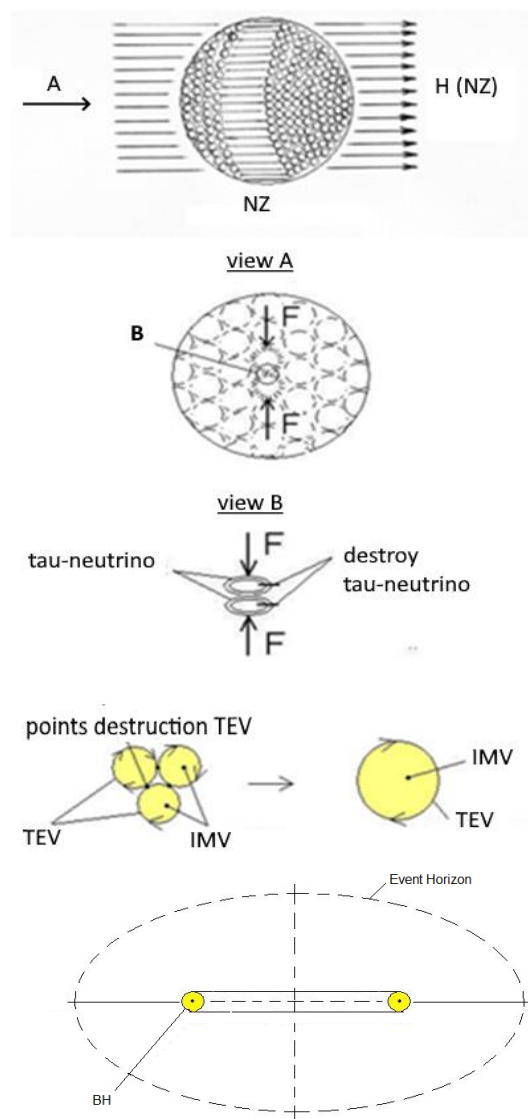


Fig. 39. The model of formation of the central object of the black hole (quasi-singularity).

The super-simple density of all BH is  $3.77 \cdot 10^{19} \text{ g/cm}^3$ , the same as that of "ordinary" simples. That is, all baryonic (simple) matter consists of microscopic Black holes as if. Why doesn't it collapse? It's all about the toroidal shape of the simples. With this shape, in the mass range of the simples, their Event Horizon does not extend beyond the boundary of the simple body, and in the future, the density of matter only decreases with the formation of larger particles and objects.

At this density, the size of a super-bagel of the quasi-singularity with a mass equal to the mass of our Universe will be equivalent to the volume of a ball with a diameter of about 8.5 million km, or about only 6% of the astronomical unit (the distance from the Sun to the Earth's orbit). The event horizon of such a BH will be equal to the size of the universe.

#### FORMATION OF THE FIRST COSMOLOGICAL QUASI-SINGULARITY AND SPMF

Vortices of virtual photons (VP) are formed from the electric or magnetic moments of corpuscles randomly, without momentum, and after a while they disintegrate. This means that single VP could not lead to the formation of quasi-singularities (central objects of Black holes). But nature is a "tricky" thing, and she figured out how to save, collect, and combine VP into a single object. A rarer type of fluctuations can occur in the corpuscular space, when in a certain volume, again, two opposite VP (electric and magnetic) are randomly formed, linked to each other according to the rule of electrodynamics, as a result of which the mechanism of mutual generation starts working. This topology of entangled vortices of VP resembles the topology of entangled elementary vortices of corpuscles, and to some extent is close to the topology of entangled electron-neutrino vortices.

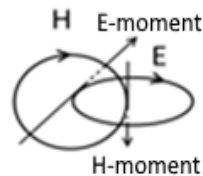


Fig. 40. Accidental engagement of electric VP and magnetic VP.

Such combinations of vortices can transfer energy to each other and are stable. At the same time, they have electric and magnetic moments, which allows them to oscillate and combine like electron-neutrinos into larger blocks that collapse into torus-shaped particles, and clouds form from them, which grow and collapse into micro-quasi-singularities (MQS). The process has been going on for trillions of years, as the MQS pulls together, unites, and eventually forms a Primary Cosmological Singularity (PCS), which grows and reaches a critical mass. What is the critical mass of PCS? This is when the density of lines of force (chains of corpuscles) of electric and magnetic fields of the super-simple of the PCS fills all channels of quantum space at the Planck level, and new lines of force (LF) can no longer be formed. The balance of LF interaction is disrupted, the chains of corpuscles of the super-simple PCS vortices lose their orientation, and the super-simple PCS destroyed. A short-term powerful internal magnetic field (SPMF) of super-simple PCS is splashes out from it into the surrounding space, triggering the formation of simples in the surrounding space. The process of PCS bursting can be considered a BB model. And the process of formation of simples is the birth of the material universe.

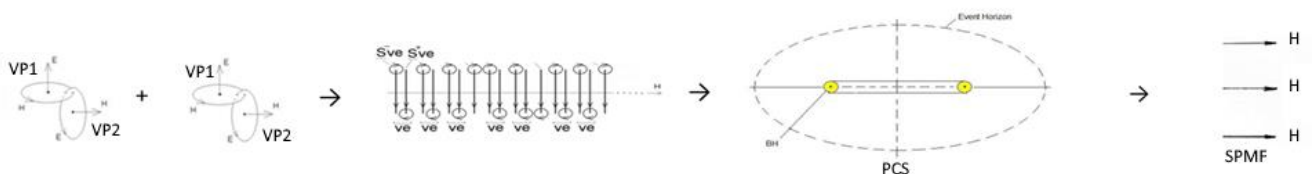


Fig. 41. The model of the formation of the first PCS and SPMF.

Thus, it can be noted that there are two eras in the evolution of corpuscular space and matter: one before the BB, the other after the BB. In total, both of these processes represent a single deterministic process of formation and evolution of the universe.

From the models developed at CST, it can be concluded that the main elements of this deterministic process are the topologies of chains of corpuscles of all participating objects, ranging from single corpuscles of space to Black holes, and probably to the topology of lines of force of the entire universe. The main driving force of all these processes are the forces of electromagnetic interaction of electric charges and magnetic moments of all particles and objects through lines of force from chains of corpuscles. All other parameters of all formed particles and objects are only consequences of these topologies, and of course the initial parameters of elementary vortices and dipole moments of space-time corpuscles, which we have yet to determine.

### QUESTIONS OF COSMOLOGY IN THE CST

Above, when setting out models of interaction and models of the formation and evolution of matter in the universe, we have already touched upon a number of cosmological issues. In order to save the size of the article, we will not list them again. Let's focus on other issues of cosmology, which are hotly debated in modern physics.

### THE BIG BANG, THE BALANCE OF MATTER AND ANTIMATTER

The model of simple formation proposed in the CST solves the problem of the balance of matter and antimatter by simultaneously forming two universes - our Universe and the Anti-universe at the two magnetic poles of the burst primary quasi-singularity. At one pole, our Universe is formed with an excess of negative tau-simples and the formation of relic neutrons. At the other pole, which has the opposite direction of the magnetic field vector, an Anti-universe is formed with an excess of positive tau-simples and the formation of relict anti-neutrons, whose quark hoop consists of two d-antiquarks with charges of  $+1/3$ , and one u-antiquark with a charge of  $-2/3$ .

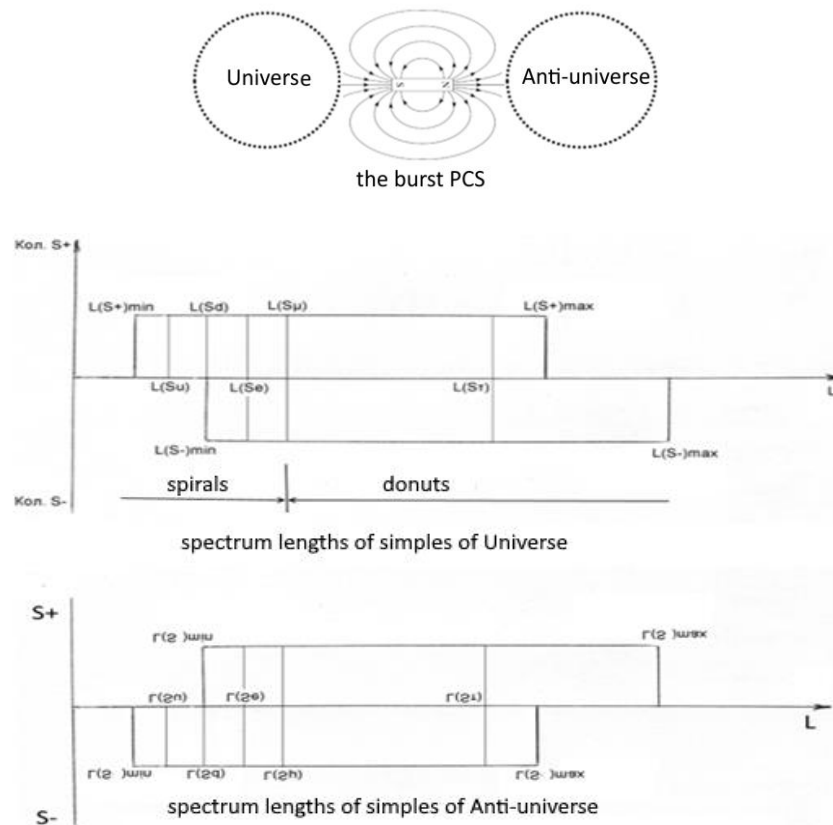


Fig. 42. The model of the formation of the Universe and the Anti-universe.

According to the CST models, the Big Bang was not hot, but cold, without kinetic movement of matter in space. More precisely, the BB was electrodynamic in the form of "splashing" into space of a short-term powerful relic magnetic field (SPMF) and magnetic polarization of the physical vacuum (formation of magnetic lines of force - magnetization of ether). The demagnetization of space from the relic magnetic field (RMF) is exponential, but not instantaneous. The remnants of the RMF are still found in the voids, when observing the passage of gamma-ray quanta from blazars located behind the voids [12]. There are many powerful sources of magnetic fields inside and in the vicinity of galaxies, and there, under the influence of these sources, the space is constantly being remagnetized, which is observed by modern instruments.

Of course, the question raises some interest – how do the two universes behave in relation to each other? Given their opposite charge, it can be assumed that there is an attractive force between them, which spins them in an endless mutual rotation (waltz). However, it is possible that they gradually approach or fly apart from each other as a result of energy loss (flying photons and neutrinos). All this requires additional theoretical research.

### DARK MATTER, DARK ENERGY

Knowing the length of the spiral-simples and assuming the isotropic orientation of the VP in space, it is possible to calculate the number of formed preons (simples) of each type. And knowing the composition of the simples in the relict neutron (RN) model, it is possible to calculate how many simples of each type were spent on the formation of all RN, and how many remained. The calculation shows that the process of RN formation ended with the end of the supply of Sd-simples.



43. Calculation of the amount of formation and consumption of simples by type.

Calculations show that only 14% of the mass of all simples was spent on the formation of RN (future baryonic matter) (yellow in the diagram). 80% of the mass of all simples formed neutral DARK MATTER (gray in the diagram), 92% of this TM are tau-neutrinos, and 8% are mu-neutrinos. The remaining 6% of the mass of all the simples in our universe is an uncompensated excess of negative tau-simples (lilac color in the diagram), which are evenly distributed throughout the universe, and create electrostatic pressure in it, pushing aside this excess of negative tau-simples, while, these scattering tau-simples gravitationally pull 94% of the baryonic and Dark matter of the universe, which is interpreted by modern physics as the action of DARK ENERGY of an incomprehensible physical nature. The red color on the diagram indicates annihilated simples with opposite charges.

### WHY TAU-NEUTRINOS ARE THE BEST CANDIDATES FOR DM PARTICLES

After the experimental discovery of the presence of hidden mass (Dark Matter) in the Universe, the first candidates for the role of Dark Matter particles were neutrinos. However, modern physics very quickly abandoned this idea, since according to cosmological calculations, to which James Peebles made a decisive contribution, at the early stage of the Universe's existence, Dark Matter should have been cold

and played a decisive role in the conglomeration of matter. However, modern physics knows only hot neutrinos of three types, formed in the course of various nuclear reactions. Therefore, neutrinos, claiming to be cold Dark Matter, were rejected.

However, having analyzed the electrodynamic models of the formation of simples, we know that relic tau- and mu-neutrinos were formed cold, which dismisses the misconception of modern physics.

In addition, one more interesting experimental fact can be noted. According to all the canons of particle physics, it is easier to detect heavier particles, especially if they are stable (like three types of neutrinos). However, the first to be discovered were the lightest electron-neutrinos in 1956. Then, in 1962, mu-neutrinos were discovered. And only in 2000, in the DONUT experiment, the heaviest tau-neutrinos were discovered. In this experiment, a beam of protons was directed at a tungsten target, i.e., these protons were actually broken up, and, we remember that, in each proton, according to our S-model, there are 60 tau-neutrinos. Then, a powerful magnetic field was used to filter out all the charged particles, and the remaining beam of neutral fragments was directed into a layered detector made of steel sheets and photographic plates (15 meters in total). Six million particle traces were registered in this detector. Scientists selected only about a thousand candidate events. And only 4 events of them were recognized as genuine evidence of the existence of tau-neutrinos. The question arises - why is tau-neutrino so difficult to detect? The answer to this question is given by the toroidal model of tau-neutrino with a very large ratio of the outer diameter of the tau-neutrino to the cross section of the tau-neutrino body (equal to 725 times). As a result, tau-neutrinos have a very high ability to deform, and like children's toys slime, they easily bend around all obstacles without manifesting themselves in any way. By the way, this circumstance correlates very well with the unsuccessful attempts to detect Dark Matter particles on many DM detectors. And, interestingly, recently, neutrinos of various types have begun to be detected on Dark Matter detectors.

In 2018, CERN announced an open call for proposals to continue research at the LHC. I wrote a letter to CERN and proposed to search for tau-neutrinos at the LHC. The fact is that the LHC detectors study only 10% of the particles produced in the collider, and 90% of the fragments fly into the pipe along the path of the patches, due to the lack of electric charges. In 2021, CERN published a new program, which approved the construction of a layered neutrino detector FPF (launch date 2030), to replace the existing trial layered detector FASER (originally intended to search for dark photons), installed in a side tunnel located tangentially to the LHC ring at a distance of 480 m from the ATLAS detector. At the same time, a program was immediately launched to search for neutrinos in the data set collected by the FASER detector since 2019. In August 2023, an article was published [22] about the detection of 6 mu-neutrinos in the FASER data. The authors predict that the next FPF detector should detect tau-neutrinos and DM particles (New Physics). It can be predicted that by that time modern physics will understand that tau-neutrinos and DM particles are the same thing.

### CST and $\Lambda$ CDM

Thus, all CST models of the cosmological stages of the early Universe basically correspond to the Standard Cosmological Model  $\Lambda$ CDM, while additionally explaining the formation and properties of all its individual elements, and answering unresolved questions.

James Peebles, for his contributions to cosmology, and his decisive participation in the development of the  $\Lambda$ CDM model, received the Nobel Prize in Physics in 2019. In December 2019, I plucked up the courage to write him a letter in which I congratulated him on the prize and outlined my main ideas of CST and its cosmological consequences. James Peebles did not answer me. But in June 2020, his article was published - "Why the universe I invented is right - but still not the final answer". "This is just an approximation to a deeper truth," he says in his article [23].

### CALCULATION OF CORPUSCULE ENERGY AND CORPUSCULAR ETHER DENSITY

For the calculation, we will use the EMR model in the form of coupled electric and magnetic vortices. According to this model, the propagation of EMR at the speed of light is a process of mutual generation of these vortices, with a shift of half the diameter of the vortices. . An essential circumstance of this process and this model is that even when the EMR source is "switched off" (for example, when a



star is fading), the previously emitted train of EMR vortices does not know or notice this, its vortices continue to mutually generate each other, and the train of vortices continues to propagate in the direction of the electrodynamic impulse.

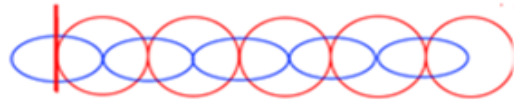


Fig. 44. Model of coupled EMK vortices (repetition of Fig. 4).

We know that EMR vortices consist of stationary polarized chains of corpuscles. In accordance with the known fact that with increasing EMR frequency, its wavelength (vortex diameter) decreases, we modify the EMR model, representing EMR vortices as a twisted clock spring of the same length with connected ends. In this case, the more the spring (chain of corpuscles) is twisted, the smaller its diameter (wavelength), the greater the number of spring turns (frequency) in one vortex, while additional repulsion forces of turns (chains of corpuscles) with parallel moments of corpuscles appear, the more energy in such a twisted spring (one EMR photon). And we already know how to calculate the energy of such a single photon using the formula  $E = h\nu$ . Knowing the vortex energy, the vortex dimensions, the Planck dimensions of corpuscles ( $\ell_p$ ), and the center-to-center distance of corpuscles ( $\pi\ell_p$ ), these data are quite sufficient to make an estimated calculation of the energy of one corpuscle, and accordingly the specific energy of the corpuscular space.

We will calculate for photons with minimum energy, the vortices of which consist of one turn of chains of corpuscles. We take the formula  $E = h\nu$ , put  $\nu = 1$  Hz, and get a photon with an energy of  $6.626E-34$  J and a wavelength of  $299792458$  m. The size of a space cell with one corpuscle is  $5.077E-35$  m. The number of corpuscles in one vortex is equal to  $1.86E+43$  pcs. Then the energy of one corpuscle is equal to  $6.626E-34$  J /  $1.86E+43 = 3.57E-77$  J. Physically, according to the CST, a photon with minimal energy is a vortex of one chain of oriented corpuscles with minimal coupling between the moments of these corpuscles, arising, for example, during a spontaneous change in the orientation of the moments of the corpuscles and the formation of short-lived virtual photons, i.e. a coupling close to or equal to the natural weak coupling between corpuscles in free space. Thus, the value calculated by us can be taken as the energy of one corpuscle of free ether (space-time).

To test the logic of this approach, we can propose a scheme for a cosmic-scale experiment to test the quality factor of receiver-transmitter communication channels in the ultra-long wave range using wire antennas released from spacecraft. Under the assumptions we have made, the last burst of quality factor of this communication channel should be at a wire antenna length of  $299792458$  m. A further increase in the length of the antennas should not give bursts of quality factor of the communication channel. Knowing the energy of one corpuscle ( $3.57E-77$  J), the dimensions of its cell ( $5.077E-35$  m), and the diameter of the VF vortex ( $5.892E-19$  m), we can calculate the energy of one virtual photon. It will be  $3.14 * 5.892E-19 / 5.077E-35 * 3.57E-77 = 1.3E-60$  J. Let us now calculate the specific energy of free corpuscular space. The volume of one cell of space is  $1.31E-103$  m<sup>3</sup>. Each such cell contains one corpuscle. Accordingly, the specific energy of corpuscular space is

$$3.57E-77 / 1.31E-103 = 2.7E+26 \text{ J/m}^3$$

or in equivalent mass it will be  $3E+9$  kg/m<sup>3</sup> or  $3E+6$  g/cm<sup>3</sup> or  $3$  tons/cm<sup>3</sup>. If we recall that the average density of matter in the Universe is  $10^{-29}$  g/cm<sup>3</sup>, then we can conclude that corpuscular space simply “does not notice” the existence of some Universe, at least in its mature age after expansion.

For a photon with maximum energy and minimum vortex diameter of  $5.892E-19$  m and a number of turns of corpuscle chains in one vortex equal to  $5.09E+26$  pcs., with a maximum energy of  $3.373E-07$  J, the energy of one corpuscle of strongly polarized space inside the region of this photon is  $7.2E-56$  J, and the specific energy of strongly polarized corpuscular space in this region is  $7.2E-56 / 1.31E-103 = 5.5E+47$  J/m<sup>3</sup> (21 orders of magnitude higher than the specific energy of free space). Such an increase in energy is associated with the gigantic energy costs of generating such photons.

## DYNAMICS OF MOVEMENT OF SIMPLES THROUGH THE ETHER

As we have already noted, three of the four basic elements formed from chains of space corpuscles (namely, virtual photons, lines of force of electric and magnetic fields, and bound vortices of electromagnetic radiation EMR) are formed by changing the orientation of electric and magnetic moments of stationary corpuscles of space without their displacement. The propagation of EMR vortices, or the displacement of lines of force of moving charges, occurs due to the regeneration of new oriented (polarized) chains of corpuscles, and their displacement relative to old chains, which, upon the disappearance of their generation sources, relatively quickly disintegrate into unbound corpuscles of space. An exception to this rule are the remnants of lines of force of a super-powerful relic magnetic field that stretched virtual photons into simples. The remains of this relic magnetic field are still indirectly registered in voids, by deflecting low-energy gamma quanta from blazars located behind the voids.

And a completely different picture of corpuscle behavior exists during the formation of simples. On the one hand, just like the above-mentioned objects, simples are formed stationary, but at the same time their vortex-chains of corpuscles continuously regenerate each other in one place, are rigidly connected to each other, and as if "taken out" from the corpuscular space (ether). Such a tangle of vortices of rigidly connected chains of corpuscles under the action of external forces can move in space without violating the integrity of its structure.

Some researchers, building their particle models from similar vortex structures of ether quanta (usually hydrodynamic), prefer to assert that when their particles move through the ether, there is an interchange of ether quanta of the particle vortices and the surrounding ether. In such a concept, when all bodies, or even people, move through the ether, there is a continuous renewal of the entire set of ether quanta that these bodies or you and I consist of. In the CST, the process of dynamic movement of bodies (or rather, at the lower level, we are talking about simples) through the ether is considered differently. When corpuscles are aligned into vortices of simples, only the orientation of the corpuscle moments changes, while the sizes of the corpuscles equal to  $\ell_p = 1.616\text{E-}35$  m, and the center-to-center distances between the corpuscles equal to  $\pi\ell_p = 5.077\text{E-}35$  m, do not change. Thus, between two adjacent corpuscles there remain gaps equal to  $5.077\text{E-}35 - 1.616\text{E-}35 = 3.461\text{E-}35$  m, which is more than twice the size of the corpuscle. Accordingly, the corpuscles of free space that are not included in the vortices of the simples are freely "filtered" through the corpuscular structure of the simples (as through a sieve), without hindering their movement. If any corpuscle of free space meets head-on with any corpuscle of the vortices of the simples, then both of them, not possessing mass (the ability to generate interacting lines of force), will freely "bypass" each other, like particles of a superfluid liquid.

## PHOTON AGING HYPOTHESIS

The photon aging hypothesis (decrease in frequency and energy of photons during their propagation in space) is an integral part of many ether theories. Conceptually, this is due to the fact that ether theories do not provide for any spontaneous expansion of space (ether), caused in modern physics by the presence of unexplained (non-physical) Dark Energy in space, which leads, among other things, to an additional stretching of the photon wavelength during their propagation, the so-called cosmological redshift, superimposed on other types of photon frequency (wavelength) shift, such as the classical Doppler shift, relativistic shift due to time dilation, and gravitational shift due to space-time curvature in the zone of action of large gravitational masses.

Let us consider the photon aging hypothesis from the point of view of the CST. Introducing the corpuscular model of virtual photons, we noted that during the next cycles of regeneration of the vortex of a virtual photon (VP), individual moments-dipoles of the corpuscles of this vortex can enter into a side interaction with the moments of third-party corpuscles that are not included in the vortex of the virtual photon, they change their direction, and fall out of the chain of moments of the vortex. As a result, the closed vortex of the VP disintegrates into separate corpuscles that are not connected with each other, and the VP disappears. The VP disappears because its vortex consists of one chain of corpuscles, and pulling out at least one corpuscle from this chain leads to the destruction of the entire chain. A similar situation can arise in the chains of corpuscles that form vortices of real EMR photons. However, all

vortices of real photons consist of several turns of corpuscle chains, the diameter and number of turns of which correspond to the quantization of the frequency and wavelength of real photons. Therefore, when "pulling" one corpuscle from the vortices of a real photon, the vortices do not disappear, but are rebuilt to another quantum frequency (a larger vortex diameter, corresponding to a decrease in the photon frequency by one). The frequency drops, the photon energy decreases. It is logically clear that such third-party interactions of the photon vortices with third-party corpuscles of space, leading to an increase in the diameters of the vortices, should correlate with a certain distance of photon propagation (let's say, one interaction per parsec). Thus, the short lifetime of virtual photons may indirectly testify in favor of the hypothesis of aging of real photons. However, this assumption has an objective objection. The presence of an electrodynamic impulse in real photons should additionally stabilize the orientation of the moments of corpuscles in the vortices of the photon, and maintain the integrity of these vortices, as a result of which the photons will propagate, conditionally speaking, forever, without changing the diameters of the vortices and frequency, in the absence of any other external influences.

The question arises - is it possible to test the hypothesis of photon aging experimentally? At first glance, a scheme with the Pioneer spacecraft immediately pops up. If we have a sufficiently large distance to the Pioneers, atomic clocks on them and on Earth, we know their exact speed and velocity vector relative to Earth, we have a transmitter with a precision frequency on the Pioneer, and we measure the signal of the transmitter on Earth with a precision receiver, then by the difference in frequencies we can try to calculate whether the photon ages or not on the way from the Pioneer to Earth in addition to all the other frequency shifts. The specialists we contacted say that the accuracy of existing devices is not enough for this. Existing devices can measure time with an accuracy of  $10^{-18}$  sec, but need  $10^{-20}$  sec. But not long ago, an article was published called "Intensity Correlation Speckles as a Technique for Removing Doppler Broadening" [24], which describes an experiment measuring two beams from the same quasar that came in different directions as a result of gravitational lensing on a galaxy cluster. In this case, one beam was almost straight, and the second one went around the galaxy cluster. The difference in the paths traveled by the beams was 100 light years.

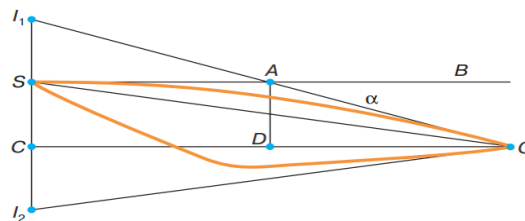


Fig. 45. Two beams of a quasar that traveled different paths around the cluster of galaxies with a path difference of 100 light years.

If the hypothesis of photon aging is correct, then photons of light that traveled different paths should age differently, i.e. their frequency should decrease by different amounts as a result of aging. Scientists managed to measure the difference in the frequencies of these two beams. However, only the average frequency of all quasar emitters was measured, which, strictly speaking, cannot be interpreted as a change in the frequency of two beams from one emitter (from one physical process). But scientists are working on the accuracy of measurements in order to isolate the frequencies of one specific radiating process. Let's wish them luck. If such or a similar experiment confirms the correctness of the photon aging hypothesis, then the significance of this fact is difficult to overestimate. It will be necessary to recheck the calculations of such global constants and conclusions as the values of the Hubble constant for different distances, and the calculation of the parameters of the accelerated expansion of the Universe.

#### OTHER, NOT CONSIDERED CONSEQUENCES OF THE CST

The set of interconnected CST models considered in this article mainly reveals the issues of formation in the ether, subsequent evolution, and interaction of the substance matter of the Universe in the form of simple structures.

Here is a list of a small portion of other issues not covered in this article:

1. The set of physical models of the formation and evolution of the Universe presented in the article is based on the known physical laws of classical electrodynamics. However, as was shown on the models of a number of particles, there is a need to move to topological models of interaction at the level of chains of corpuscles of the lines of force of charges and magnetic moments of these particles. There is a need to calculate the values of micro charges and micro magnetic moments at the ends of the elementary dipoles of corpuscles, the energy of their interaction pulses, in order to construct pulsed electrodynamics of the interaction of lines of force. In fact, we are talking about constructing a new mathematical model of the CST.

2. Analysis of relativistic consequences of the Theory of Relativity as applied to models of the Corpuscular-Simple Theory, which is based on the corpuscular ether.

3. Detailed analysis and calculation of the inflationary stage of the formation of the Universe according to the CST, taking into account the superluminal speed of propagation of the magnetic field, clarification of the interpretation of existing experimental data, and forecasting new experimental data from cosmological research.

Consideration of these and other issues and consequences of the CST is supposed to be carried out in a separate article.

## HISTORICAL BACKGROUND TO THE DISCUSSION OF THE CST. WHAT'S NEXT? → STRINGS!

In 2017, when we finished developing the CST, posted it on the Internet, and started sending it to specialists, we received a completely unexpected reaction. In addition to approval, criticism, analysis and clarification of individual models of the theory, some opponents began to ask us the same question - What do corpuscles, their elementary vortices and moments consist of? At first, this stunned us (guys, we have solved so many pressing physical issues, and you are drowning us in the philosophical question of scaling!). But we had to think about it. In the CST, by and large, there is one form of primordial matter - corpuscles. Corpuscular space consists of them, and all types of matter - virtual photons, EMR, field lines, simples, "elementary" and fundamental particles, all baryonic and dark matter, neutron stars and black holes. At the same time, we analyzed all types of phase transitions from corpuscular space to black holes and back. But the question remained - what are elementary vortices and elementary moments of corpuscles? The question was aggravated by the lack of an acceptable physical model explaining how the process of generation and transfer of internal energy from one elementary vortex to another is carried out (not through emptiness, of course). To follow the path of further structuring of elementary vortices and their moments, and "fill" the internal space of corpuscles with some new environment (as many developers of various ether models do) is a looping of the problem and a dead end. As a result, we have the following: the physical model of corpuscles in the form of coupled elementary vortices that we proposed is very fruitful and allowed us to solve almost the entire spectrum of questions about the formation and evolution of the Universe (at one time we even wanted to replace the name of our theory of CST with the Theory of Coupled Vortices). We believe that it was by jumping over a detailed study of the Theory of coupled vortices that physics entered the zone of quantum and mathematical uncertainty. On the other hand, in this paradigm of coupled vortices, the theory again reaches a dead end. It is necessary to look for a new physical (phenomenological) interpretation of corpuscles and their elements (some new phase transition). The result of these reflections was the conclusion that corpuscles, including their elementary vortices and their elementary moments are single substantial objects that have been developed in physics for several decades - STRINGS, capable of manifesting themselves in the form of closed strings, identical to the elementary vortices of corpuscles, and open strings, identical to the dipole moments of elementary vortices.

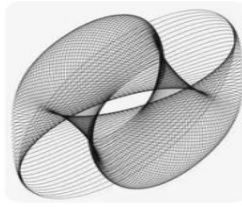


Fig. 46. String.

We have deliberately chosen the simplest of the vast number of string illustrations. Not being experts in String Theory, we think that if we introduce a parameter of the direction of propagation of their internal wave into the process of vibration (pulsation) of strings, this approach will allow us to find an interpretation of strings that will give them the properties of two coupled elementary vortices and two coupled elementary moments. Taking into account the set of models of the formation and evolution of the Universe that we have developed, this would allow us to get rid of the unacceptably large number of  $10^{500}$  landscapes (universe variants) that follow from modern versions of String Theory, and to construct a single deterministic Theory of strings-corpuscles  $\rightarrow$  chains of corpuscles  $\rightarrow$  simples (preons)  $\rightarrow$  fundamental particles.

Additionally, we draw attention to one more element that should be introduced into String Theory - this is a step-by-step process of transition of the original strings into the state of fundamental particles known to us. Nature is economical, it adds only one additional emergent element at each phase transition, and not all at once. Strings cannot vibrate in such a way that a single string immediately produces a proton. Figuratively, our approach can be compared to a multi-stage rocket that allows us to do what a single-stage rocket cannot do. In the approach we propose, there is certainly a connection between String Theory and the Theory of Coupled Vortices, which is actually equivalent to the phase transition of strings into the corpuscles of space that we propose. We refer all further questions directed deeper into this concept to String Theory specialists.

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