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FRACTAL THEORY OF PROTON MASS: Fractal Proton. The origin of the constant mp/me = 1836.1526... The law of baryogenesis. Fractal mechanism of baryonic asymmetry.

Abstract: *Using the proton fractal, the mechanism of baryogenesis has been revealed. From the mechanism of baryogenesis the law of baryogenesis is deduced. From the fractal mechanism, beautiful and simple mathematical equations which display the mechanism of proton formation are obtained. The equations allow us to obtain the fundamental constants of the proton. The proton fractal shows that there are many yet undiscovered elementary particles with masses in the range from the mass of the electron to the mass of the proton. A prediction of the mass spectrum of new elementary particles for their detection in experiments is given. The fractal theory of proton mass makes it possible to obtain the most important dimensional and dimensionless fundamental constants of elementary particles by calculation. These constants could not be obtained within the standard model. The law of baryogenesis was obtained as a generalization of the proton's structural genesis law. The proton fractal leads to the solution of the antimatter problem and reveals the mechanism of baryonic asymmetry. The proton fractal and the mechanism of baryogenesis reveal the fallacy of the conclusion about the predominance of matter over antimatter in the modern Universe.*

Keywords: *law of baryogenesis, proton fractal, origin of proton mass, mass defect, matter, antimatter, electron, positron, molecular positronium, electro-positron catalysis, catalytic baryogenesis, baryon asymmetry.*

1. Introduction

The proton was discovered over 100 years ago. The proton is part of the nuclei of the elements and is the basis of all material formations of the universe. The world owes its existence to the proton. Since the discovery of the proton, many efforts have been made to clarify the internal structure of this particle [1, 2]. However, there is still a lack of understanding of how the mechanism of proton formation occurs. Because of this, the proton has many unsolved mysteries. For 100 years it has not been possible to discover the mechanism of its origin. The reason for its stability is unknown. The internal structure of the proton is not revealed. The nature of its mass, equal to 1836.152,673,43 electron masses, is not explained.

In [3] a fractal mechanism of proton structural genesis was proposed. This mechanism is based on the interaction of electrons and positrons with the formation of positronium. Further growth of mass occurs due to joining of electrons and positrons to positronium. Electrons and positrons act as reagents and catalysts in the reaction of baryosynthesis. The proton fractal made it possible to calculate the most important dimensionless fundamental constants of elementary particles, which could not be obtained within the standard model.

During the construction of the proton fractal, the Wheeler hypothesis that positronium not only annihilates, but also forms complex matter structures was used [4]. In 2007 Wheeler's hypothesis

received experimental confirmation.It was confirmed that the fate of positronium does not necessarily end in annihilation. Experimentally observed the formation of complex matter structures with a larger mass than that of positronium - molecular positronium [5, 6, 7].

2. Proton fractal.

Proton fractal looks like (Fig. 1) [3]:

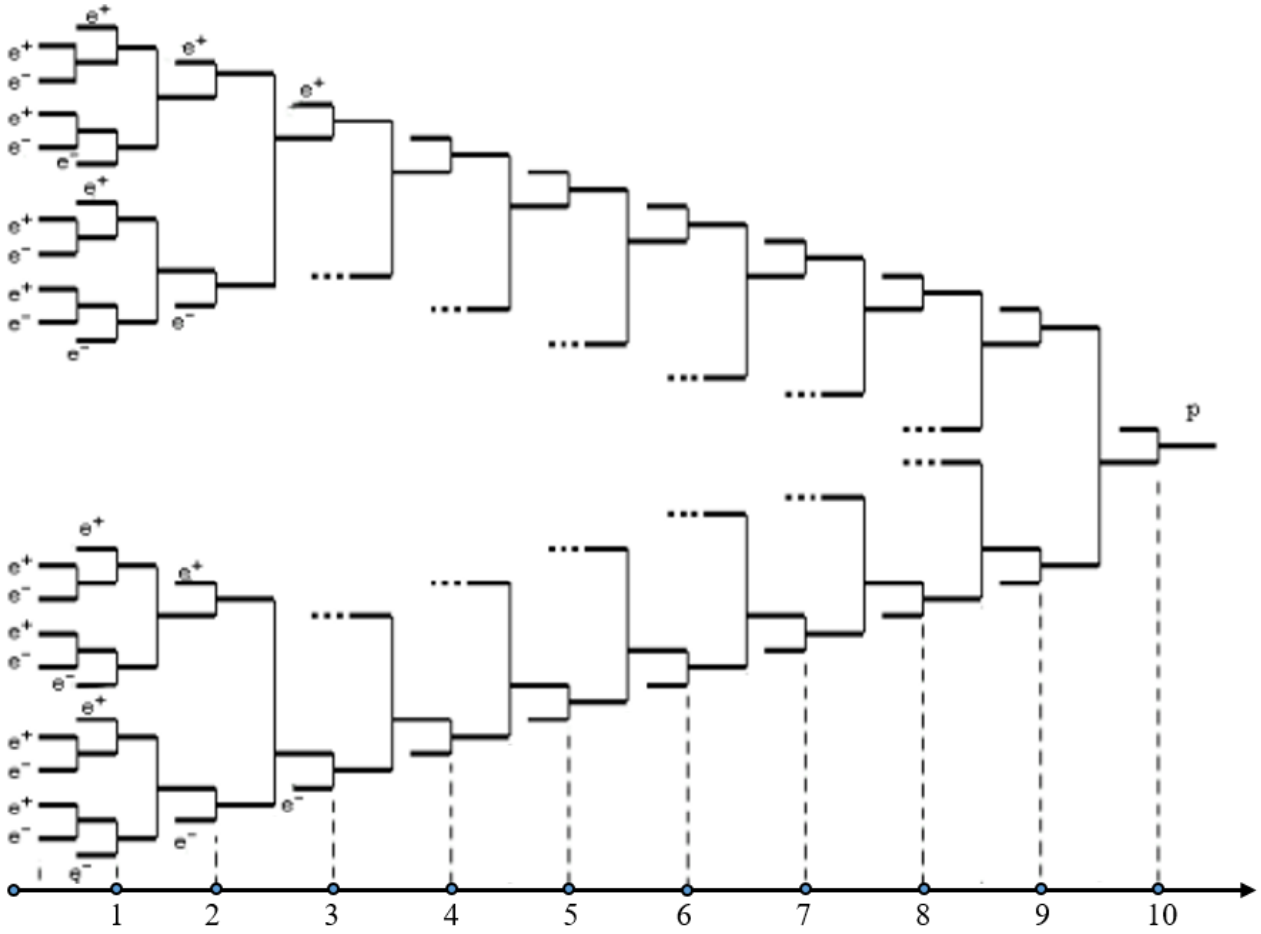

Fig. 1. Fractal of the proton. e- - electrons, e+ - positrons, p - proton.

Proton formation occurs during ten stages of baryogenesis. This process is represented in dynamics by the proton fractal. The fractal originates from elementary cells of the fractal. Elementary cells of the proton fractal represent the first charge-conjugate matter formations after positronium (Fig. 2). There are two kinds of fractal elementary cells. Some elementary cells display the formation of particles by two electrons and one positron. Other unit cells display the formation of particles by two positrons and one electron. These are symmetric structures. They show the process of formation of charge-conjugate particles. Dynamics of formation of charge-conjugate particles is represented by elementary cells of fractal (Fig. 2).

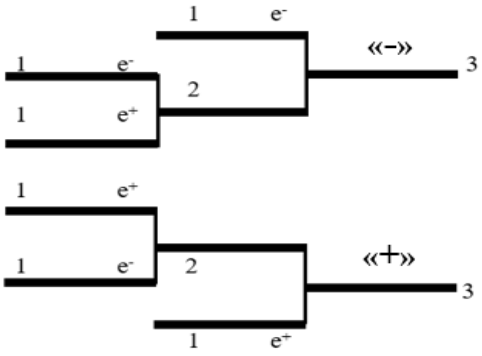

Fig. 2. Conjugate mirror-symmetric elementary cells of the proton fractal. e- - electrons, e+ - positrons.

Proton fractal is a self-similar geometrical structure. Nodes and branches of geometric structure are identified with particles and antiparticles (Fig. 3). The proton fractal reflects the proton formation dynamics. The full proton fractal is formed by consecutive replication of the unit cell on an increasing scale. At the next stage there is a doubling of the previous structure.Proton fractal depicts the sequence of formation of all unstable particles from electron to proton. The process is completed with the appearance of the first stable particle - the proton. Fractal dynamics of matter structure-genesis is a fundamental property of matter organization on the level of elementary particles.

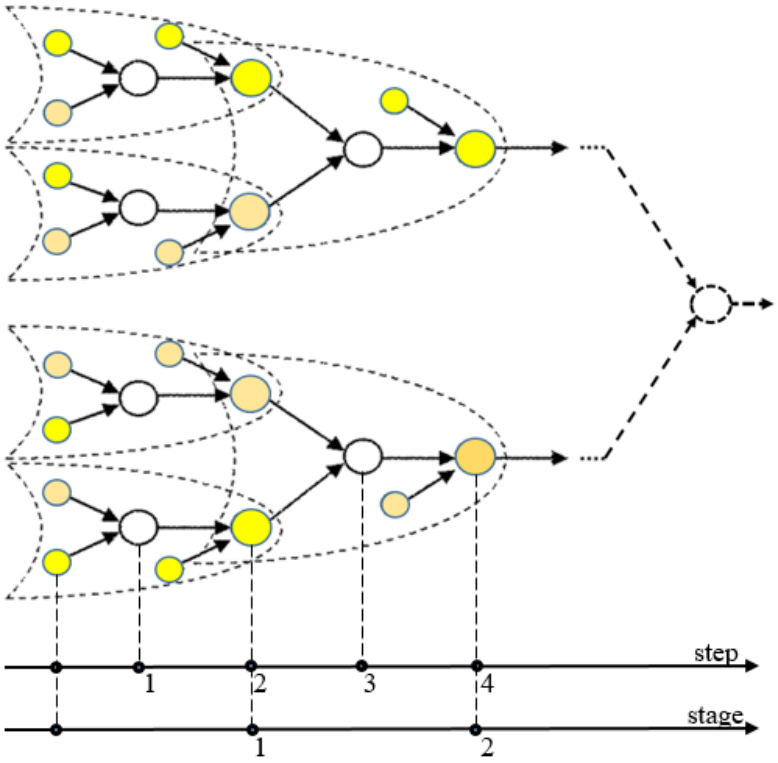

Fig.3. Replication of self-similar fractal structures by the doubling principle. Yellow - particles with a negative charge - electrons (matter); orange - antiparticles with a positive charge - positrons (antimatter).

Proton fractal consistently forms 10 self-similar structures.They repeat to scale the unit cell of the fractal according to the 2^n law.

3. Structurogenesis of the proton with participation of matter and antimatter.

At the initial stage of proton structural genesis matter (electrons) and antimatter (positrons) participate. The association of electrons with positrons leads to the formation of charge-neutral positronium particles (stage 1, step 1). These are unstable particles. The lifetime of parapositronium is 0.1244 ns, the lifetime of orthopositronium is three orders of magnitude greater than 138.6 ns. For elementary particles this is a huge time interval. During this time an electron or positron can join the positronium, which leads to the formation of a new particle or antiparticle (stage 1, step 2). Attaching an electron to positronium leads to the formation of an electrically charged particle with a negative charge. Attaching a positron to positronium leads to the formation of an electrically charged particle with a positive charge. The electrically charged particle interacts with each other due to the electric force. As a result, a second charge-neutral substance is formed (stage 2, step 3). Attaching an electron to the charge-neutral particle leads to the formation of a new electrically charged substance with a negative charge. Attaching a positron to the charge-neutral particle leads to the formation of an electrically charged substance with a positive charge.

Two charge-conjugate particles interact with each other due to the Coulomb force.As a result, a third charge-neutral substance is formed (stage 3). The larger scale process copies the smaller scale process. The smallest scale is a unit cell of proton fractal (Fig. 2). The replication process continues until the formation of a stable part - the proton. It occurs at the tenth step of structural genesis (Fig. 1).

The proton fractal shows that positronium together with electrons and positrons can generate more complex particles than molecular positronium. The complexity of matter structures increases according to the fractal algorithm from positronium to proton [3]. The particle mass increases according to 2^n law. The fractal mechanism of proton structural genesis reflects the formation of complex structures of non-molecular type. Electrons (matter) and positrons (antimatter) take part in particle formation.

The fractal mechanism of proton structural genesis displays the formation of particles and antiparticles. Such structures are more complex than the molecular positronium. Electrons and positrons as catalysts and reagents of baryosynthesis are involved in the construction of particles with a larger mass than that of positronium. Instead of annihilation, matter and antimatter organically complement each other in the process of baryosynthesis. Matter and antimatter create new particles. In such new constructions (*matter + antimatter = elementary particle*) nuclear forces act. In the interaction of particles and antiparticles there is a large mass defect.

4. The fractal formula of the proton.

In [3] mathematical models which display the dynamics of proton structural genesis have been obtained.The basis of these mathematical formulas is the fractal (topological) formula of the proton. It has the form [3]:

$$P_p = 2(2(2(2(2(2(2(2(2+1)+1)+1)+1)+1)+1)+1)+1)+1 \qquad (1)$$

Fig. 4. Fractal (topological) formula of the proton.

The fractal formula shows ten stages of proton's structural genesis. The fractal formula of the proton gives an important characteristic - the proton number 2047. The fractal formula is based on a construction of the form (2+1).It corresponds to a graphical form (Fig. 5) which is called a unit cell of proton fractal [3]:

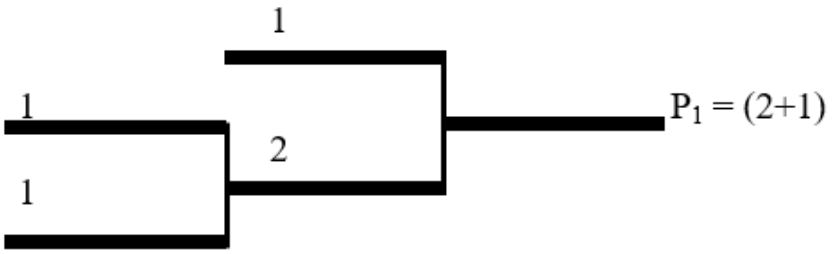

Fig. 5. Elementary cell of proton fractal.

Proton fractal is formed in 10 stages. This is the process of replication of the fractal elementary cell.Sequence of fractal formulas is represented by "fractal triangle" (Fig. 6) [3].

$$P_1 = 2+1$$
$$P_2 = 2(2+1)+1$$
$$P_3 = 2(2(2+1)+1)+1$$
$$P_4 = 2(2(2(2+1)+1)+1)+1$$
$$P_5 = 2(2(2(2(2+1)+1)+1)+1)+1$$
$$P_6 = 2(2(2(2(2(2+1)+1)+1)+1)+1)+1$$
$$P_7 = 2(2(2(2(2(2(2+1)+1)+1)+1)+1)+1)+1$$
$$P_8 = 2(2(2(2(2(2(2(2+1)+1)+1)+1)+1)+1)+1)+1$$
$$P_9 = 2(2(2(2(2(2(2(2(2+1)+1)+1)+1)+1)+1)+1)+1)+1$$
$$P_{10} = 2(2(2(2(2(2(2(2(2(2+1)+1)+1)+1)+1)+1)+1)+1)+1)+1$$

Figure 6. Fractal formulas show ten stages of structural genesis from positronium to proton.

The first step is the formation of positronium P_s. This is followed by the attachment of the electron (positron) to the positronium. This completes the first stage of baryogenesis P_1. On the proton fractal these events correspond to the elementary cells of the proton fractal (Fig. 1, Fig. 2). The fractal triangle (Fig. 6) consists of fractal formulas for self-similar conjugate geometric structures. Inside the self-similar geometric structures there is an intermediate state (step 1, step 3, Fig. 3). This state represents a neutral particle. These states are quantitatively represented by corresponding fractal formulas. Fractal formulas of charge-conjugate particles and fractal formulas of neutral particles are presented in Fig. 7.

Fractal formula	Number
$P_s = P_{1\text{-}1} = 1+1$	2
$P_{1\text{-}2} = 2+1$	3
$P_{2\text{-}1} = 2(2+1)$	6
$P_{2\text{-}2} = 2(2+1)+1$	7
$P_{3\text{-}1} = 2(2(2+1)+1)$	14
$P_{3\text{-}2} = 2(2(2+1)+1)+1$	15
$P_{4\text{-}1} = 2(2(2(2+1)+1)+1)$	30
$P_{4\text{-}2} = 2(2(2(2+1)+1)+1)+1$	31
$P_{5\text{-}1} = 2(2(2(2(2+1)+1)+1)+1)$	62
$P_{5\text{-}2} = 2(2(2(2(2+1)+1)+1)+1)+1$	63
$P_{6\text{-}1} = 2(2(2(2(2(2+1)+1)+1)+1)+1)$	126
$P_{6\text{-}2} = 2(2(2(2(2(2+1)+1)+1)+1)+1)+1$	127
$P_{7\text{-}1} = 2(2(2(2(2(2(2+1)+1)+1)+1)+1)+1)$	254
$P_{7\text{-}2} = 2(2(2(2(2(2(2+1)+1)+1)+1)+1)+1)+1$	255
$P_{8\text{-}1} = 2(2(2(2(2(2(2(2+1)+1)+1)+1)+1)+1)+1)$	510
$P_{8\text{-}2} = 2(2(2(2(2(2(2(2+1)+1)+1)+1)+1)+1)+1)+1$	511
$P_{9\text{-}1} = 2(2(2(2(2(2(2(2(2+1)+1)+1)+1)+1)+1)+1)+1)$	1022
$P_{9\text{-}2} = 2(2(2(2(2(2(2(2(2+1)+1)+1)+1)+1)+1)+1)+1)+1$	1023
$P_{10\text{-}1} = 2(2(2(2(2(2(2(2(2(2+1)+1)+1)+1)+1)+1)+1)+1)+1)$	2046
$P_p = P_{10\text{-}2} = 2(2(2(2(2(2(2(2(2(2+1)+1)+1)+1)+1)+1)+1)+1)+1)+1$	2047

Fig. 7.Full fractal triangle for all steps and stages of proton structural genesis.

Each fractal formula corresponds to its "magic" number. The fractal triangle contains quantitative information about all intermediate unstable particles in the range from positronium to proton.

5. Magic numbers of the proton fractal

The proton fractal is characterized by the following numerical sequence (Fig. 8):

M = 1, 1, 2, 3, 6, 7, 14, 15, 30, 31, 62, 63, 126, 127, 254, 255, 510, 511, 1022, 1023, 2046, 2047

Fig. 8.Magic numbers of the proton fractal.

These are the magic numbers that follow from the proton fractal and from the fractal formulas. They show how many electrons and positrons took part in forming the corresponding particle or antiparticle. Magic numbers are constants of elementary particles. These numbers allow you to calculate the masses of elementary particles. The number 2047 is the "magic" number of the proton. It is the constant of the proton. This number shows how many electrons (matter) and positrons (antimatter) were involved in the formation of the proton. From the proton fractal it follows that the number of electrons needed to form the proton is 1023. The number of positrons needed to form the proton is equal to 1024.

6. Proton mass defect

Proton fractal shows that proton is formed step by step and stage by stage from primary matter particles (electrons) and antimatter particles (positrons). At each step and stage a new particle or antiparticle is synthesized. These particles and antiparticles precede the proton. The synthesized

particles and antiparticles are not a simple sum of the original substances. Particles synthesized from electrons and positrons are new independent particles. Their synthesis is accompanied by a mass defect. The proton mass defect consists of mass defects of intermediate particles and antiparticles that precede the proton. The proton mass defect is a new proton constant. The value of the proton mass defect is directly calculated from the proton fractal. For each elementary particle there is its own mass defect constant. This most important constant does not exist in the standard model or in the theory of relativity. Particle mass defect constants keep the main secrets of elementary particles.

7. Obtaining the fundamental constant mp/me = 1836.1526... from the proton fractal

Proton fractal and proton fractal formula allow to obtain new fundamental constants of proton and value of proton mass.The number 2047 is the "magic" number of the proton.It is a new proton constant.It directly follows from the proton fractal.This number shows how many particles of matter (electrons) and antimatter (positrons) were involved in the formation of the proton.The proton mass law contains the magic number of the proton 2047 and has the form:

$$m_p = 2047 \bullet m_e - \Delta m_p \quad (2)$$

where: m_e is the mass of the electron, 2047 is the magic number of the proton, Δm_p is the proton mass defect.

The magic number 2047 is calculated by the proton fractal formula (1). The proton mass defect follows from the proton fractal and is calculated by the formula:

$$\Delta m_{p1} = m_e \bullet [\sum_{i=1}^{11} (2^i - 1) \bullet (1 - k_{sp1}^{12-i}) + 1] \quad (3)$$

where: m_e is the mass of the electron, Δm_p - proton mass defect, k_{sp1} is the constant specifying the proton mass defect.

The parameter in the proton mass defect formula (3) is the constant k_{sp1}.The mass defect of elementary particles sets the constant 1/137 together with the number π [8, 9]. Equivalent formulas for calculating the constant k_{sp1} are as follows:

$$k_{sp1} = \frac{133.395907639...}{137.03599908...} = \sqrt[10]{D_0} \bullet \alpha^2 = \frac{\alpha}{\sqrt[20]{\pi \bullet 10^{-43}}} = 0.9734369693 \quad (4)$$

where: k_{sp1} is the first constant specifying the mass defect, α - the fine-structure constant, 1/133 is the physical equivalent of the number π , D_0 is the large Dirac number (D_0 = 4.16561...x 10^{42}).

The value of k_{sp1} is represented by the ratio of two constants 133/137. The constant 1/133 follows from the number π and is the physical equivalent of the number π [8, 9]. The relation 133/137 characterizes transition from electromagnetic interaction to strong interaction.

The assumption that the fine structure constant α (1/137) is somehow related to the nuclear mass defect was first suggested in 1922 by Chicago physicist Arthur Lunn [10]. In QED, for large distances (> 10^{-15} m) the constant 1/137 is used. For small distances (< 10^{-15} m) the constant 1/129 is used [11, 12]. The two ratios of the two constants 129/137 and 133/137 specify the mass defect of elementary particles. Equivalent formulas for calculating the constant k_{sp2} look like :

$$k_{sp2} = \frac{129.85250805}{137.03599908...} = (\sqrt[10]{D_0} \bullet \alpha^2)^2 = 0.947579533 \quad (5)$$

where: k_{sp2} is the second constant specifying the mass defect of the particle, α is the fine-structure constant, 1/129 is the constant for small distances, D_0 is the large Dirac number (D_0 = 4.16561...x 1042).

Thus, two values of mass defect are associated with each magic number. The first value is given by the parameter k_{sp1} = 0.9734369693. The second value is given by the parameter k_{sp2} = 0.947579533.

Using the constant k_{sp1} = 0.9734369693, equation (3) gives the following value of the proton mass defect:

$$\Delta m_{p1} = 210.7768 \bullet m_e \quad (6)$$

The ratio of the proton mass defect value to the electron mass gives the dimensionless constant:

$$\Delta m_{p1} / m_e = 210.7768 \quad (7)$$

Formula (2) gives this value of the proton mass:

$$m_p = 2047 \bullet m_e - \Delta m_p = m_e(2047 - 210.7768) = 1836.2232 \bullet m_e \quad (8)$$

The value of the fundamental constant m_p/m_e = 1836.2232 obtained from the proton fractal is very close to the experimental CODATA value (m_p/m_e = 1836.152 673 43(11)).

The second value of the proton mass defect is calculated using the constant k_{sp2} = 0.947579533 using the formula:

$$\Delta m_{p2} = m_e \bullet [\sum_{i=1}^{11} (2^i - 1) \bullet (1 - k_{sp2}^{12-i}) + 1] \quad (9)$$

The mass defect calculated using constant 129/137 is greater than the mass defect calculated using constant 133/137. Formula (9) gives this second mass defect value for the proton:

$$\Delta m_{p2} = m_e \bullet [\sum_{i=1}^{11} (2^i - 1) \bullet (1 - k_{sp2}^{12-i}) + 1] = 421.7 \bullet m_e \quad (10)$$

where: m_e is the mass of the electron, Δm_p - proton mass defect, k_{sp2} is the constant giving the mass defect.

Substituting the value of the second mass defect from formula (10) into equation (2) gives the following value:

$$m_{p2} = 2047 \bullet m_e - \Delta m_{p2} = m_e(2047 - 421.7) = 1625.3 \bullet m_e \quad (11)$$

The value 1625.3 is the mass of some unknown particle. It is possible that there is a "twin" proton, an unstable "light proton". It can decay into several muons. This particle should be looked for in the experiments.

The three constants 1/137, 1/133, 1/129 are related by the following relation:

$$133.3.... = \sqrt{137.03... \bullet 129.8...} = \frac{1}{\sqrt[20]{\pi \bullet 10^{-43}}} \qquad (12)$$

The constant 133/137 in formula (3) allows us to obtain the value of the mass defect for "heavy" particles. The constant 129/137 in formula (9) allows to obtain the value of the mass defect for "light" particles. Each fractal and each fractal formula refers to two particles - light and heavy. Both particles are formed according to the same fractal algorithm. The difference in particle masses is a consequence of different mass defect. The mechanism of formation of light and heavy particles is the same. Fractal (topological) formulas for light and heavy particles are also the same. Accordingly the "magic numbers" of light and heavy particles are the same. The origin of formation of light and heavy particles should be sought in two modifications of positronium (parapositronium, orthopositronium).

Proton constants are given in the table in Fig. 9.

Name	Value
Fractal formula for the proton	$P_p = P_{10} =$ **2(2(2(2(2(2(2(2(2+1)+1)+1)+1)+1)+1)+1)+1)+1)+1**
"Magic" number of the proton	$M_p = 2047$
Number of electrons	1023
Number of positrons	1024
Mass of initial particles and antiparticles	2047 m_e
Proton mass defect	210,7768 m_e
Dimensional constant of proton mass defect	210,7768
Proton - electron mass ratio	$m_p/m_e = 1\ 836{,}2232$
Ratio of mass defect constant to "magic" number	0,103 m_e

Figure 9. Proton constants.

Proton is the basis of all material formations of the Universe. Proton mass defect is a new previously unknown proton constant. The presence of the mass defect in the proton allows the following conclusion: *all the matter of the Universe has a mass defect*. The mass defect constant is the proton's structural genesis constant. Its origin is related to the genesis of matter. This constant has not yet been considered in physics or cosmology. This constant is not known either in the standard model or in the theory of relativity. The law of the universal mass defect is not in physics. But perhaps it hides the nature of gravity. Perhaps the cause of gravity should be sought in the mass defect of the proton. After all, it is not by chance that the large Dirac number ($D_0 = 4.16561...x\ 10^{42}$), which is the ratio of the electric force to the gravitational force, is included in the formula of the *Newtonian constant of gravitation* G [13]. The same number D_0 enters into formulas (3) - (5) to calculate the mass defect of elementary particles. It cannot be a coincidence.

8. The law of baryogenesis

Generalization of the proton mass law and its extension to the masses of other elementary particles makes it possible to obtain a general formula for the law of baryogenesis (Fig. 10):

$$m_j = M_j \bullet m_e - \Delta m_j \qquad (13)$$

Fig. 10. The law of baryogenesis. M_j - magic number of an elementary particle, m_j - mass of a particle, m_e - mass of an electron, Δm_j - mass defect of an elementary particle.

The law of baryogenesis is formulated as follows: "*The mass of an elementary particle is equal to the product of the mass of the electron by the magic number of the particle minus the mass defect constant of the particle*."

The first term in the law of baryogenesis shows how much matter and antimatter was involved in the formation of the elementary particle. The second term shows the value of the mass defect of the elementary particle.

9. Mass spectrum of elementary particles from the law of baryogenesis

Proton fractal and the law of baryogenesis open the possibility of analytical derivation of the mass spectrum from first principles. The formula for the mass spectrum of elementary particles follows from the law of baryogenesis (Fig. 10):

$$m_j = m_e \bullet [(2^{L_j} - 1) - \sum_{i=1}^{L_j} (2^i - 1) \bullet (1 - k_s^{L_j + 1 - i}) - 1] \qquad (14)$$

Where: L_j - follows from the relation: $M_j = 2^{L_j} - 1$, k_s = 133/137 for heavy particles, k_s = 129/137 for light particles.

From the proton fractal it follows that in the mass interval between the masses of the electron and proton there are a large number of as yet undiscovered elementary particles. For each "magic" number (M_j) theory predicts two particles. It is possible to predict the masses for at least 10 pairs (heavy and light) of charge-conjugate elementary particles and at least 10 pairs of charge-free particles. Values of masses of new elementary particles follow from the law of baryogenesis. In Fig. 11 the expected values of masses for some new particles and antiparticles are shown.

"Magic" number	Mass	Note
3	2,5 m_e 2.7 m_e	Light Heavy
7	6,2 m_e 6,6 m_e	Light Heavy
15	11,9 m_e 13,4 m_e	Light Heavy
31	24,6 m_e 27,8 m_e	Light Heavy
63	50,0 m_e 56,5 m_e	Light Heavy
127	100,8 m_e 113,9 m_e	Light Heavy
255	206.7 m_e 228.7 m_e	Light Heavy
511	405,7 m_e 458,3 m_e	Light Heavy
1023	812,2 m_e 917,6 m_e	Light Heavy
2047	1 625,3 m_e	Light
4095	3 251,4 m_e	Light

Fig. 11. Expected values of masses of some elementary particles.

It should not be concluded from the above that the proton "*consists of smaller particles and antiparticles"*. The same erroneous conclusion would be that the elementary particles preceding the proton consist of smaller particles and antiparticles.

At each stage of proton's structural genesis there appears an independent completed particle, not containing discrete particles. These are completed objects, though they are unstable. At the final stage of structureogenesis the proton is formed as a completed object not containing discrete particles. The proton fractal reflects the dynamics of baryogenesis, not the internal composition of the proton.One should not interpret the fragments of the proton fractal with quarks and antiquarks.It would be a mistake to consider the proton as consisting of mesons. This applies equally to positronium. Positronium is formed by the interaction of the electron and positron. But there is no electron and positron inside the positronium. Positronium is a complete particle in its own right. Positronium does not contain electron and positron, although it is generated by them. The mass defect of positronium deprives the electron and positron of the status of complete discrete particles. The mass defect does not allow the electron and positron to be discrete objects inside the positronium.

10. Proton structural genesis as a catalytic process.

In [14-17], a new paradigm of catalysis was proposed based on the concept of "*electron as a catalyst*". This paradigm is based on the fact that in all types of catalysis, the electron acts as a catalyst and is included in the reaction product. The example of baryogenesis shows that baryogenesis follows

the same mechanism as heterogeneous catalysis [18]. The universal law of catalysis [19], when applied to baryogenesis, provides the magic numbers of elementary particles.

The mechanism of catalysis (18) and the mechanism of baryogenesis are very similar and very close. It follows from the proton fractal that the proton formation reaction is catalyzed by electrons and positrons. In the mechanism of baryogenesis, electrons (matter) and positrons (antimatter) are both reactants and catalysts. At the initial stage of baryogenesis, positronium is formed from electron and positron. In terms of catalysis, this means that at this stage the electron and positron are polar reactants. Further, as the particle mass grows, the electron and positron are both catalysts and reactants in the baryosynthesis reaction. Their interaction with particles leads to the formation of polar particles. Such polar particles are capable of fusion under the action of the electric force.

The example of baryosynthesis shows that electronic catalysis as a phenomenon does not only refer to chemical reactions. Catalysis goes far beyond chemistry. Catalysis is a fundamental phenomenon that originated in baryogenesis. Catalysis is the initiation of chemical reactions. Catalysis is the acceleration of chemical reactions. Catalysis is the initiation of a baryosynthesis reaction. Catalysis is the development of the reaction of baryosynthesis. Baryogenesis is a catalytic process at the fundamental level of organization of matter and antimatter. Joint electron-positron catalysis is the basis of baryogenesis. There is a common nature of catalysis and baryogenesis.

Solving the mystery of the proton leads to the universal mechanism of fusion. The mechanism of baryogenesis is a fundamental process. Therefore, the mechanism of baryogenesis must be viewed as a universal mechanism of synthesis. The roots of many fusion processes are in baryogenesis. This fundamental and universal mechanism of synthesis has an extension. It manifests itself as DNA replication, viral replication, photosynthesis, chemical catalysis... The disclosure of the mechanism of baryogenesis creates the prerequisites for the creation of a fundamental theory of catalysis and baryogenesis, a fundamental theory of photosynthesis and baryogenesis...

11. Baryonic asymmetry of the Universe

Why no antimatter is detected in the observable part of the Universe? Where could antimatter go if originally there was symmetry of matter and antimatter? These questions are not answered by physical theories. The mechanism of origin of baryonic asymmetry is unknown. Various hypotheses have been proposed to explain the baryonic asymmetry of the Universe, but the antimatter problem remains unsolved [20-22].

The standard model cannot explain the observed baryonic asymmetry of the Universe. This makes us look for deeper reasons for asymmetry within physics beyond the Standard model [23].

In this paper we show that the mechanism of origin of baryonic asymmetry of the Universe should be sought in the mechanism of baryogenesis. Revealing the secret of the origin of the proton mass and the mass spectrum of elementary particles gives the key to the solution of the antimatter problem.

12. Antimatter in the proton, or where did antimatter "disappear without disappearing"?

According to Dirac's equation, matter and antimatter must be symmetrical relative to each other. Symmetry of matter and antimatter existed in the early Universe. This is due to the symmetry of the birth of electrons and positrons.

The proton fractal shows that the symmetry of matter and antimatter in the process of baryogenesis is not broken. The proton was formed with the participation of 1023 electrons and 1024 positrons. Just as at the initial stage there was symmetry between matter (electrons) and antimatter (positrons), in the process of proton structural genesis the symmetry between matter and antimatter is not broken. The proton fractal shows that electrons (matter) and positrons (antimatter) participate in equal numbers in bariosynthesis. Only at the last (10th) stage the positron (antimatter) completes the proton formation. From the original symmetric composition of electrons and positrons, one electron is left free for each proton.

Therefore, in the present Universe, there is still symmetry between matter and antimatter. It is the symmetry between protons and free electrons. Antimatter, which existed in the early Universe, has not disappeared. Antimatter (positrons) together with matter (electrons) created the proton. The mystery of antimatter was kept by the proton. From the mechanism of baryogenesis it follows that the proton absorbed 1023 electrons and 1024 positrons, which existed in equal quantities in the early Universe. The "superfluous" 1024th electron remained free. Omnipresence of free electrons in the modern Universe is a direct consequence of the proton baryosynthesis mechanism.

13. Baryosynthesis instead of annihilation

Instead of the channel of matter and antimatter annihilation, Nature has chosen the channel of baryosynthesis. Baryosynthesis is impossible without antimatter. Electrons and positrons are the reagents and catalysts of the baryosynthesis reaction. Without the electron and positron no positronium is formed. At the stage of positronium formation, the electron and positron are polar reactants. Next, particles with a larger mass are formed. Particles with a larger mass are formed by attaching additional electrons and positrons to positronium. Further the process develops according to the fractal mechanism.Attachment of electrons and positrons leads to the formation of polar particles. The charge polarity of the particles is a prerequisite for their fusion (unification). The process continues according to the fractal algorithm by doubling and replication of previous structures. According to such a beautiful mechanism matter and antimatter "*amicably, together and from themselves*" created the proton. "*Nature does nothing in vain when less will serve; for Nature is pleased with simplicity and affects not the pomp of superfluous causes*" - Isaac Newton

14. The paradoxical mechanism of baryonic asymmetry of the Universe

The proton owes its birth to antimatter. Without antimatter, protons could not be formed. Accordingly, without antimatter there would be no universe. Nature has skillfully hidden antimatter inside protons! Everything that exists in Nature is half antimatter and half matter. This is an amazing and paradoxical solution to the problem of antimatter in the Universe!

A controversial question arises. Is it correct to call the proton matter? The proton fractal shows that the proton has absorbed the excess positron (antimatter) during the structural genesis. From these

considerations, the proton is rather antimatter than substance. The law of baryosynthesis shows that the number of protons in the Universe must coincide with the number of free electrons in it.

The origin of the erroneous conclusion about the predominance of matter over antimatter in the Universe should be seen not only in the unsolved problem of the origin of elementary particle masses. Imperfect terminology related to the concepts of "matter" and "antimatter", "particles" and "antiparticles" has played a certain role.

15. Conclusions

1. The mechanism of origin of the mass of the proton and other elementary particles has been disclosed.

2. The equation has been obtained, which allows to calculate the mass spectrum of elementary particles from first principles. It follows from the equation that in the mass interval from the mass of the electron to the proton there are many undiscovered elementary particles. A prediction of the mass spectrum of new elementary particles for their detection in experiments is given.

3. The law of biriogenesis as a result of generalization of the law of proton structural genesis has been deduced.

4. The law of baryogenesis makes it possible to calculate the most important dimensional and dimensionless fundamental constants of elementary particles, which could not be obtained within the standard model.

5. The main consequences of the law of baryogenesis are: Baryosynthesis is impossible without antimatter. Without antimatter, protons could not be formed. Nature skillfully hid antimatter inside protons. Antimatter was organically incorporated into protons and neutrons. The ubiquity of free electrons in the modern Universe is a direct consequence of the mechanism of proton baryosynthesis.

6. The reason for the erroneous conclusion about the predominance of matter over antimatter in the Universe was the unsolved problem of the origin of elementary particle masses.

7. The main task of modern physics is to find the reason for the stability of the proton, in the structure of which there is a predominance of antimatter.

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