

# Explaining the Phenomenon of Dark Matter and Dark Energy by Existence of the Hidden Multiverse

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**Abstract** The article presents substantiation of the principle of physical reality of imaginary numbers and explanation of their physical nature. It is shown that imaginary numbers in relativistic formulae of SRT are indicative of presence in the physical world we live in of other invisible parallel universes in addition to our universe. Therefore, the Multiverse containing them is referred to as hidden. It is shown that the phenomenon of dark matter and dark energy is explained by existence of plenty of mutually invisible parallel universes in the Multiverse. And, on the other hand, the phenomenon of dark matter and dark energy is an experimental proof of existence of the hidden Multiverse. Reasonableness of the proposed hypothesis is confirmed by observation data obtained from WMAP and Planck spacecrafts.

**Keywords:** *multiverse, imaginary numbers, special theory of relativity, dark matter, dark energy, dark dimensions*

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## 1. Introduction

A new astrophysical object, referred to as dark matter, discovered in 1932-33 by Jan Hendrik Oort and Fritz Zwicky, appeared to be so fundamentally important, that Saul Perlmutter, Brian P. Schmidt and Adam G. Riess was awarded a Nobel Prize for their successive discovery of dark energy made in 1998-99.

This phenomenon has been called dark matter /dark energy [1,2] not only because a real physical object of study, corresponding to it, is invisible, but also because it is totally incomprehensible. It is insomuch incomprehensible that it seems to destroy the modern understanding of the term ‘matter’.

It is incomprehensible, because this new object of study does not fit into the Procrustean bed of the ruling principles of modern physics.

Therefore, the logical conclusion is as follows: since modern physics turned out to be unable to explain new physical realities, it should give up on some outdated scientific postulates and use new physical principles instead. This is the prerequisite to explanation of the dark matter and dark energy phenomenon.

## 2. Dark Matter, Dark Energy and Dark Dimensions

So, what new principles can be used to explain the dark matter/ dark energy phenomenon?

To date, many attempts have been made to explain this phenomenon. However, they turned out to be unsuccessful,

because no fundamentally new ideas that would be beyond the current version of the STR have been proposed.

In this situation, explanation of dark matter and dark energy suggesting existence of the Multiverse, which consists of invisible parallel universes, would seem the most natural and convincing. Although a large number of unusual Multiverse hypotheses have been so far suggested, some of which being described in [3-8], explanation of Multiverse invisibility appeared to be no easier task than explanation of dark matter and dark energy invisibility.

Anyway, a little something on the problem of Multiverse invisibility still can be said. For this purpose, let us analyse the Euler's formula

$$e^{ix} = \cos x + i \sin x \quad (1)$$

where  $x$  is the independent variable;

$i = \sqrt{-1}$  is the imaginary unit.

This formula describes both damped and undamped oscillations of any physical nature: mechanical (e.g. pendulum oscillations), acoustic (e.g. in the form of audible and inaudible sounds), hydraulic (e.g. in the form of waves on the water surface), electromagnetic (e.g. in electric circuits, referred to as oscillatory circuit) etc.

Formula (1) has a deep physical meaning, which, however, hasn't still been explained. It follows from the formula that if there are any oscillations corresponding to the real component  $\cos x$ , there are as well oscillations corresponding to the imaginary component  $\sin x$ .

However, is there anybody who has ever seen or otherwise perceived oscillations of this imaginary component  $\sin x$ ?

Nobody has ever seen or perceived them. So far the explanation has been as follows: no real physical entities

correspond to imaginary numbers. Therefore, people do not somehow perceive these physical entities. Actually the same is confirmed by the third statement of the extending interpretation of the second STR postulate [9]. However, the answer is unconvincing, since people as well do not feel radioactivity and magnetic field, do not see black holes and dark matter, cannot touch atoms and molecules and do not hear infra and ultrasounds, though this physical entities actually exist.

It is proved below that such STR statement is wrong, since concrete imaginary numbers actually exist.

This statement can be proved, for example, as follows [10,11]. As it is known, in electric LCR-circuits referred to as a series oscillatory circuit, the ratios of voltage drops across the resistor  $R$ , capacitor  $C$  and inductor  $L$  to electric current flowing through them are electrical resistances as according to the Ohm's law. However, these resistances are significantly different. Resistor resistance is measured by real numbers, whereas resistances of capacitor and inductor are measured by heteropolar imaginary numbers depending on oscillation frequency. When frequency of sinusoidal voltage, affecting such an electric circuit, changes, the values of inductive and capacitive resistances also change, so that their algebraic sum changes and according to the Ohm's law the value of electric current flowing in such a circuit as well changes. And if the imaginary physical entities corresponding to inductive and capacitive resistances did not actually exist, electric current would not depend on them and would be determined only by resistance value  $R$  as according to Ohm's law.

Moreover, these imaginary resistances at the frequency  $\omega_0 = 1/\sqrt{LC}$  are equal in absolute magnitude, whereby their algebraic sum makes zero. As a result, value of electric current flowing in such a circuit takes a maximum value. Apparently, it is impossible to see or otherwise perceive the relation described by Ohm's law. However, it is surely detected by devices. Therefore, physical phenomenon referred to as resonance exists in electric LCR-circuits and proves physical reality of imaginary capacitive and inductive resistances. And if imaginary capacitive and inductive resistances were not physically real, resonance in a circuit wouldn't exist.

There are also other cases of existence of certain imaginary physical entities, the nature of which requires its explanation. For example, they include invisible Multiverse described below which corresponds to relativistic formulae of SRT at superluminal speeds.

Thus, since any numbers are ultimately used for measurements, let us call real invisible components of physical processes and entities, corresponding to imaginary numbers, dark dimensions [12].

Therefore:

- imaginary capacitive and inductive resistances are dark dimensions fully explained in the theory of linear electric circuits;
- an imaginary component in the Euler's formula is a dark dimension yet not explained;
- dark matter and dark energy corresponding to invisible parallel universes in the hidden Multiverse are dark dimensions explained below in this article.

### 3. Physical Reality of Imaginary Numbers

Let us proceed now to the evidence of the physical reality of imaginary numbers which have been mentioned above as applied to the Euler's formula.

Over 500 years ago imaginary numbers were discovered by Scipione del Ferro, Niccolò Fontana Tartaglia, Gerolamo Cardano, Lodovico Ferrari and Rafael Bombelli. In subsequent years, such prominent mathematicians, as Abraham de Moivre, Leonhard Euler, Jean Le Rond D'Alembert, Caspar Wessel, Pierre-Simon de Laplace, Jean-Robert Argand, Johann Carl Friedrich Gauss, Augustin Louis Cauchy, Karl Theodor Wilhelm Weierstrass, William Rowan Hamilton, Pierre Alphonse Laurent, Georg Friedrich Bernhard Riemann, Oliver Heaviside, Jan Mikusiński and many others, have developed a comprehensive theory of functions of a complex variable [13], which, however, has not explained physical nature of imaginary numbers.

Almost 200 years ago Felix Savary [14] discovered alternating current, and then Charles Proteus Steinmetz [15] suggested using complex numbers to describe it. However, physical nature of complex numbers has still remained unexplained both in the electric circuit theory [16,17,18] and in other exact sciences, such as optics, mechanics, hydraulics etc.

Just over 100 years ago Joseph Larmor, Nobel Prize winner Hendrik Antoon Lorentz, Jules Henri Poincaré, Nobel Prize winner Albert Einstein and other prominent scientists developed the special theory of relativity [19,20,21]. Its formulae, describing relativistic effects at superluminal speeds, also had imaginary numbers which, however, couldn't be explained. Besides, in order to avoid the necessity to explain it, the negation of physical nature of imaginary numbers in STR has been postulated, and the second postulate to the original statement suggested by Albert Einstein – “the speed of light is independent of motion of the source” [22] – has since been extended by two more statements [9]:

- on non-exceedance light speed and
- physical unreality of imaginary numbers.

However, such simple solution to a complex problem has failed to satisfy everyone. Therefore, in the 21<sup>st</sup> century MINOS [23] and OPERA [24] experiments were conducted at the American Tevatron Collider and European Large Hadron Collider accordingly. The aim of these experiments was to register neutrinos moving at superluminal speed and, therefore, to prove physical reality of imaginary numbers. However, physical society considered these experiments not reliable enough.

Still in the 21<sup>st</sup> century other experiments [25,26] were conducted and they confirmed the physical reality of imaginary numbers. Nobody could refute them. These experiments were done in the course of study of oscillation processes in linear circuits, and unlike MINOS, OPERA and ICARUS [27] experiments, they may be reproduced and verified by any engineer and physicist. Therefore, such evidences are uncontested.

#### 3.1. The First Evidence of the Physical Reality of Imaginary Numbers

Oscillation processes in linear circuits of any physical nature are described by differential equation

$$\begin{aligned}
 & a_n \frac{d^n y}{dt^n} + a_{n-1} \frac{d^{n-1} y}{dt^{n-1}} + \dots + a_0 y \\
 & = b_n \frac{d^m x}{dt^m} + b_{n-1} \frac{d^{m-1} x}{dt^{m-1}} + \dots + b_0 x
 \end{aligned} \quad (2)$$

where  $x(t)$  is the input action (or the input signal);

$y(t)$  is the response to the action (or the output signal);

$a_n, a_{n-1}, \dots, a_0, b_m, b_{m-1}, \dots, b_0$  are constant coefficients;

$n, n-1, n-2, \dots, 1, 0, m, m-1, m-2, \dots, 0$  is the order of derivatives.

Solution of the differential equation (2) contains two summands

$$y(t) = y(t)_{free} + y(t)_{forc} \quad (3)$$

where  $y(t)_{free}$  is the free (or transient) component of response;

$y(t)_{forc}$  is the forced component of response.

The analysis of both components can be used to prove the physical reality of imaginary and complex numbers.

The first evidence analyzes a physical resonance phenomenon, discovered over 400 years ago by Galileo di Vincenzo Bonaiuti de' Galilei [28]. This phenomenon is described below with regard to linear oscillatory circuits.

In the theory of electric circuits, resonance is usually explained as a change of forced oscillation parameters  $y(t)_{forc}$  in case of change of real external action frequency  $x(t)$ , which is characterized by:

- extreme value of forced oscillation amplitude at real resonant frequency  $y(t)_{forc}$  ;
- zero phase difference between forced  $y(t)_{forc}$  and forcing oscillations  $x(t)$  at real resonant frequency;
- real balanced frequency of the so-called free oscillations, i.e. oscillation transient process frequency and real resonant frequency.

However, this resonance theory appears to be wrong. Or, rather, it is true only with regard to electric LC-circuits, which are of limited practical interest. In a general way, it is approximately true with respect to electric LCR-circuits. A detailed mathematical analysis of even the simplest second-order oscillatory LCR-circuits revealed a number of still unexplained [25] and preposterous aspects of such supposedly resonance process. Thus, in any second-order electric LCR-circuits:

- different resonance frequencies correspond to different attributes of resonance mentioned above;
- almost always there are two real resonance frequencies rather than one, as follows from the approximate analysis;
- formulae for real resonance frequencies in different electric circuits, in contrast to the results of the approximate analysis, appear to be different;
- real frequency of free oscillations is never equal to any of the real resonance frequencies.

Numerous examples of experiments confirming these statements are presented in publications [25].

However, it should be noted that the above-mentioned differences between results of accurate analysis and

approximate analysis are quite insignificant and do not exceed the value of permissible experimental error. That is why some engineers know nothing about it. And those who know use in their calculations approximate and simpler but still sufficiently accurate formulae for practical application.

Nevertheless, these differences do exist and require explanation. In this regard, it would be appropriate to recall that differences between the speed of neutrinos and light in the OPERA experiment were also insignificant and did not exceed the value of permissible experimental error. Over the next few months after publication of results of the OPERA experiment dozens of scientific publications were devoted to the search of opportunities to disprove this experiment, which later on resulted in the ICARUS experiment, disproving it after all. Although both cases aimed at solving one and the same problem, concerning confirmation or disproof of the physical reality of imaginary numbers, no comments on or refutations of radio-electronic experiments described in [25] have appeared over the past few years.

However, let us continue to give evidences of the physical reality of imaginary numbers. Owing to the use of vector diagrams at complex frequencies and Cassini ovals, the above-mentioned publications have proved that resonance actually occurs at complex frequency  $-\sigma \pm i\omega$  rather than at real frequencies  $\omega$ .

And the theory of resonance at complex frequencies is, in contrast to its interpretation at real frequencies, consistent and completely clear of all the disadvantages mentioned above. The theory of resonance at complex frequencies is also confirmed by numerous experiments, which are, by the way, unexplainable when we use interpretation of resonance at real frequencies.

Therefore, resonance at complex frequencies, as well as complex frequencies themselves and its derivative quantities, i.e. complex impedance and admittance, complex voltage and electric current, complex power and energy, should be recognized as physically existing. And since resonance can as well take place in oscillating systems of other physical nature, other complex parameters of such systems will be also recognized as physically existing.

Consequently, both complex and imaginary numbers are physically real.

### 3.2. The Second Evidence of the Physical Reality of Imaginary Numbers

The second evidence is even simpler than previous one [26]. This evidence is based on the analysis of the transient (or free) component of response  $y(t)_{free}$  to external action  $x(t)$ . To determine a particular type of a transient component of response, we need to solve a characteristic algebraic equation, corresponding to the initial differential equation (2)

$$a_n p^n + a_{n-1} p^{n-1} + \dots + a_0 = 0 \quad (4)$$

where  $a_n, a_{n-1}, \dots, a_0$  are the same constant coefficients as in equation (2);

$n, n-1, n-2, \dots, 1, 0$  are exponents with value equal to the order of the corresponding derivatives in differential equation (1);

$p$  is the variable that, in case it takes on values in the form of complex numbers  $-\sigma \pm i\omega$ , is often referred to as a complex frequency.

For the purpose mentioned, algebraic equation (3) is solved by engineers over the set of complex numbers, whereas mathematicians actually solve it over the set of both real and complex numbers.

Why?

The point is that solution over the set of complex numbers exists always and has a number of roots equal to the degree of the algebraic equation. However, solution of the algebraic equation over the set of real numbers depending on the particular combination of coefficients  $a_n, a_{n-1}, \dots, a_0$  may have a different number of roots: from zero to the value equal to the degree of the algebraic equation. That is to say, solutions of algebraic equations over the set of real numbers do not always exist. As one can see, these solutions are mutually exclusive. Therefore, only one of them is correct.

However, as engineers know, transient processes always exist. And that's why engineers need only solution over the set of complex numbers, which would allow them to determine any of the transient processes which always exist. Otherwise, should the characteristic equation be solved over the set of real numbers, engineers would have to argue that oscillation transient processes are nonexistent in nature, because they have no corresponding solutions in the form of real numbers.

But oscillation transient processes do exist!

To be sure, one need not conduct any experiments, as they include such common natural oscillation transient processes as sound of church bells, tsunami and even a kid's swing being pushed by parents to get a swinging motion.

Consequently, solution of algebraic equations over the set of complex numbers is the only true solution that always has a physical correspondence, once again proving the physical reality of these numbers, including imaginary numbers.

### 3.3 The Third Evidence of the Physical Reality of Imaginary Numbers

It should be noted that, as shown above, the description of relation between electric sinusoidal voltage applied to LCR-circuit and electric sinusoidal current flowing across such a circuit, corresponding to Ohm's law, is further proof of the physical reality of imaginary numbers. And what is more, it's the simplest evidence, known to anyone from school times.

But, strangely, Ohm's law has not been yet realized in physics as evidence of the physical reality of imaginary numbers, although, unlike MINOS, OPERA and ICARUS experiments, it is experimentally confirmed by engineers and physicists every day in the course of their work.

### 3.4. General Scientific Principle of the Physical Reality of Imaginary Numbers

Since the Nature is one whole, the Science, striving to cognize it, should also be consistent and non-contradictory. Therefore, mathematics, being a tool of all sciences, must be understood and used in the same way. Consequently, different theories and hypotheses in all sciences and

especially within one science (e.g. theory of relativity and quantum mechanics in physics) should be mutually agreed and adjusted in accordance with the mathematical principle of physical reality of imaginary numbers, proved in the theory of electric circuits.

Let us show, how it can be used particularly in STR. First of all, it is evident that the third statement of the extending interpretation of the second STR postulate about physical unreality of imaginary numbers should be acknowledged as absolutely incorrect. However, the second statement of the extending interpretation of the second STR postulate about the principle of non-exceedance light speed appears to be wrong as well [9]. Let's see for ourselves.

## 4. Physical Nature of Imaginary Numbers: Structure of the Multiverse

Proving physical reality of imaginary numbers might not be enough to understand their physical nature. It should be also explained what physical entities they correspond to. And as shown above, in different sciences these physical entities, corresponding to dark dimensions, are different, and even partially learned. The task of understanding the nature of dark dimensions won't supposedly be solved soon.

However, the task of understanding the nature of dark matter and dark energy is an instance of cosmology. It may be solved right away in the course of adjustment of the current version of STR [29]. For this purpose, adjusted STR taking into account the principle of physical reality of imaginary numbers should evidently explain relativistic formulae at superluminal speeds. For example, the Lorentz-Einstein formula

$$m = \frac{m_0}{\sqrt{1 - (v/c)^2}} \quad (5)$$

where  $m_0$  is the rest mass of a moving entity (e.g. elementary particle);

$m$  is the relativistic mass of a moving entity;

$v$  is the velocity of a moving physical entity;

$c$  is the speed of light.

It can be done as follows. As can be seen from the formula (5), at subluminal speeds, where  $v < c$ , the mass of elementary particles referred to as tardyons (or bradyons) is measured with real numbers, and at superluminal speeds, where  $v > c$ , the mass of elementary particles referred to as tachyons [30,31] is measured with imaginary numbers. It is notably that tachyons cannot be detected from our parallel universe (let us call it a tardyon universe), because they are found in some other place. However, since according to the principle of physical reality of imaginary numbers they do exist, this other invisible place can be referred to as a tachyon universe.

Therefore, the existence of tachyon universe besides our tardyon universe confirms the existence of Multiverse, which is, however, invisible and by virtue of this fact is referred to as a hidden Multiverse [32].

And with regard to this physically existing hidden Multiverse, Lorentz-Einstein formula is false. Indeed, since  $v > c$  in the tachyon universe, the electromagnetic

radiation, having escaped from it, cannot reach our tardyon universe. Therefore, tachyon universe is unobservable for an 'external observer' in tardyon universe, as a factor that has been taken into account in derivation of relativistic formulae of the current version of STR. Just as astrophysical objects of our expanding universe receding at superluminal speed which have passed beyond the event horizon are invisible for him/her

Thus, the current version of STR refers to the processes taking place only in our tardyon universe and the extending interpretation of its second postulate [9], which states that our universe is a Monoverse, is false. In fact, it follows from the principle of physical reality of imaginary numbers that there is invisible Multiverse, rather than Monoverse.

Therefore, the Lorentz-Einstein's formula should be adjusted (therefore, the present research clarifies and develops STR rather than disproves it) in consistence with the principle of physical reality of imaginary numbers, as follows:

$$m = \frac{m_0(i)^q}{\sqrt{1-(v/c-q)^2}} = \frac{m_0(i)^q}{\sqrt{1-(w/c)^2}} \quad (6)$$

where  $q = \lfloor \frac{v}{c} \rfloor$  is the discreet 'floor' function of argument  $\frac{v}{c}$ ;

$w = v - qc$  is the local velocity, for each universe, which can take values only in the range  $0 \leq w \leq c$ ;

$v$  is the velocity measured from our tardyon universe, which, therefore, can be called a tardyon velocity.

Other relativistic formulae of the current version of STR have the same disadvantage as the formula (5), and therefore can be adjusted in a similar way.

As can be seen, the formula (6), unlike the formula (5), has two velocities  $v$  and  $w$ . Naturally, this fact requires an explanation.

It is easy to notice that the velocity  $v$  has the same meaning as in the formula (5). But the formula (6) takes into account the fact that when  $v > c$ , all physical quantities in it become imaginary, and therefore the corresponding physical entities find themselves in a different universe, which is beyond the light speed barrier. Due to this fact, it would be wrong to use the 'external observer' factor in derivation of relativistic formulae when  $v > c$ , and, therefore, processes taking place in all parallel universes are determined by its local velocities  $w$ , rather than tardyon velocities  $v$ .

Further, the value  $q$  in the formula (6) clearly defines the remoteness of some or other parallel universe from our tardyon universe that serves as origin of coordinates. Therefore, in the formula (6), our tardyon universe would correspond to the value  $q=0$ , the adjacent tachyon universe mentioned above would correspond to the value  $q=1$ , tachyon antiverse into which one cannot get from our tardyon universe directly, though can get only through tachyon universe (into which one can get through portals described below), would correspond to the value  $q=2$  and tachyon antiverse into which one can get only through tachyon antiverse would correspond to the value  $q=3$ .

Besides, though such Multiverse includes not only universes but also antiverses, their annihilation is absolutely excluded due to alternation (see Fig.1) of different types of parallel universes.

Further, tardyon universe would again correspond to the value  $q=4$ , however it would be quite another universe. As well as another tachyon universe would correspond to the value  $q=5$ . And so on. Therefore, a hidden Multiverse described would have a helical structure shown in Figure 1, where bi-directional arrows show portals.

Besides, if total number of parallel universes in Figure 1 is multiple of four, the structure of Multiverse may be closed and look like a sort of screw collar. To point out this fact, one and the same tardyon universe in Fig. 1, corresponding to the values  $q=0$  and  $q=24$ , is marked with a dashed line and depicted twice. Such a closed structure of the hidden Multiverse is more perfect, while its open structure generates a difficult question to answer, concerning the reasons for existence of Multiverse edges and of what is behind these edges. Although it can be assumed that there is another hidden Multiverse(s) behind the edges, which together with our Multiverse is (are) included into some hidden Supermultiverse, which is even more invisible, as far as it is detected neither by its electromagnetic nor by gravitational manifestations. Just as being in any room (this is an analogy to parallel universe) of our house (this is an analogy to our Multiverse) we couldn't see, hear or otherwise feel and thus be aware of existence of other houses (this is an analogy to other Multiverses) quite remote from us.

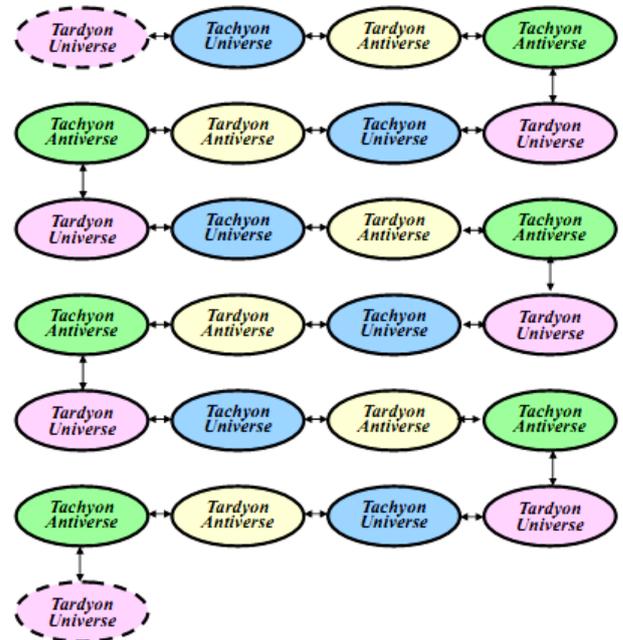


Figure 1. Probable structure of the hidden Multiverse

It should also be noted that parallel universes forming the hidden Multiverse described are somehow automatically held near each other. Otherwise, both our universe and the whole Multiverse would cease to exist long ago. However, in the course of this automatic adjustment, parallel universes gradually change their mutual spatial position in common multidimensional space. As a result, parallel universes can move away from

each other, approach each other, locally touch each other and sometimes even interpenetrate.

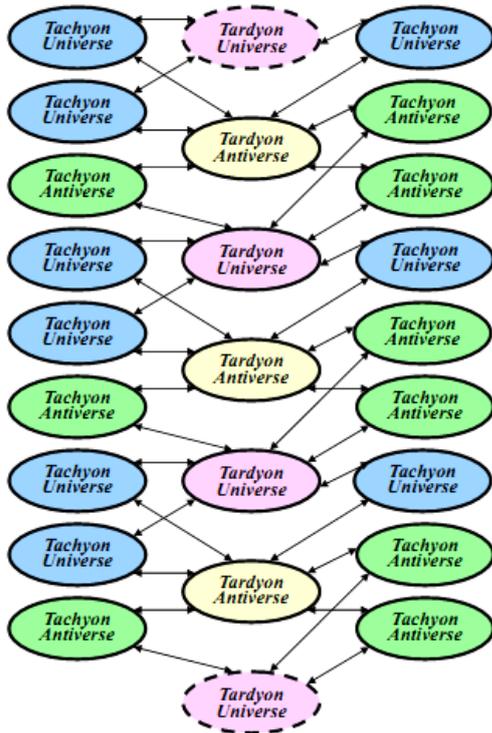


Figure 2. The second probable structure of the hidden Multiverse

And then a sort of numerous adjacent transition zones or portals emerge between the adjacent universes in the point of their interpenetration. In these transition zones and portals, the value  $q$  in the formula (6) changes its magnitude from one integer value to another integer value corresponding to the adjacent parallel universes. This circumstance makes it possible (exactly as in our house: moving from one room to another through doors and corridors is possible, but moving through barriers in the form of walls separating rooms is impossible) for elementary particles and inhabitants and even their relatively large vehicles to transit from one parallel universe into another without overcoming the light speed barrier. However, it is impossible for planets, stars and galaxies. And as there are a great many of portals in the Multiverse, the mass-energy of different parallel universes is approximately the same.

Moreover, since the function  $\exp(iq\pi/2)$  is periodic, the functioning mechanism of portals between different parallel universes, which is remained to be studied, is the same for each parallel universe. But it can be stated that living environment for people in areas on Earth before portals and areas in adjacent parallel universes beyond the portals, should be almost identical. Otherwise, if at least one portal between Earth and space is sometimes opened, according to the law of communicating vessels the Earth would lost its atmosphere and hydrosphere long ago (what might supposedly have once happened on Mars). Therefore, it can be assumed that portals are relatively safe for visiting them by people. Just as, for example, 220 volt household circuits are safe if they are not touched.

Other structures of the Multiverse, in addition to that shown in Fig. 1, are also possible. They include several parallel tachyon (and / or tardyon) universes. The author

has analyzed over hundred such structures. But in order not to overload the article with extraneous information, it presents only three examples of such structures:

- Figure 2 shows the structure of the Multiverse consisting of 24 parallel universes and containing three parallel tachyon universes and three tachyon antiverses in each coil. It can be either closed or open;
- Figure 3 shows the open structure of the Multiverse consisting of 24 parallel universes and containing seven parallel tachyon universes and seven parallel tachyon antiverses in each coil;

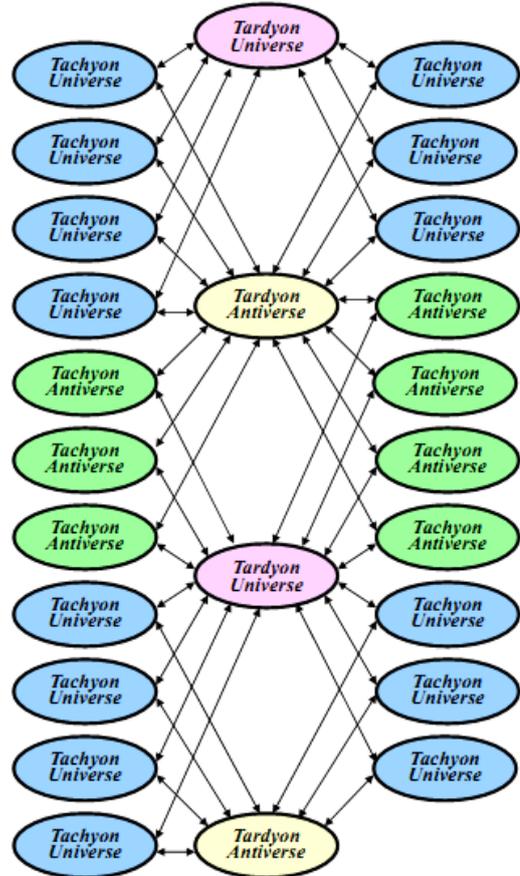


Figure 3. One more probable structure of the hidden Multiverse

- Figure 4 shows the open structure of the Multiverse consisting of 22 parallel universes and containing three parallel tachyon universes and three parallel tachyon antiverses in each coil. This structure is of special interest for the reasons set out below.

Annihilation of same-type universes and antiverses is guaranteed prevented in all these structures due to the same (or reverse) sequence of different parallel universes (tardyon universes, tachyon universes, tardyon antiverses, tachyon antiverses) as in Figure 1.

## 5. Dark Matter and Dark Energy: Analysis of Research Results Obtained from WMAP and Planck Spacecrafts

The foregoing demonstrates that the phenomenon of dark matter and dark energy turns out to be inexplicable

solely due to wrong statement of a problem, which follows from the demand to explain the nature of the phenomenon in exact context of existence of the Monoverse, corresponding to the extending interpretation of the second postulate of the current version of STR.

Should this restrictive demand of strict binding to the SRT be given up, it would become clear that dark matter and dark energy are a particular instance of the above-mentioned phenomenon of dark dimensions, **i.e.** its cosmological manifestation. And invisibility of dark matter and dark energy is definitely explained by their correspondence to invisible parallel universes, forming a hidden Multiverse [33,34,35,36]. Besides, dark matter corresponds to our adjacent parallel universe and dark energy corresponds to the rest of parallel universes which are more distant.

And as this explanation for dark matter and dark energy is the easiest and most obvious, it should be recognized as the only true in accordance with the principle referred to as Occam's blade: "Do not multiply entities beyond necessity".

That is why, it is impossible to analyze content, including chemical composition, of these other parallel universes from our universe. Just as the contents of other rooms cannot be visually analyzed directly from any room in our house. But, nevertheless, one can guess of it by other non-visual signs. For example, working TV can be heard from the next room.

The phenomenon of dark matter and dark energy is also an experimental evidence of physical reality of the hidden Multiverse. In particular, this allows for determination of the number of parallel universes within the hidden Multiverse based on the mass-energy ratio of our universe and the whole Multiverse. Due to observations of the WMAP spacecraft [37] this number is equal to  $100\%/4,6\% = 21,7$ , and due to observations of the Planck

spacecraft [38] this number is equal to  $100\%/4,9\% = 20,4$ . That is, the number of universes, which naturally should be an integer, is approximately equal to  $20...24$ .

Relative size of mass-energy of dark matter and dark energy, based on WMAP and Planck space experiments, also allows for determination of the most probable structure of the hidden Multiverse among those considered above. **Table 1** with results of corresponding calculations compares the following cases for the number of parallel universes equal to  $20...24$ :

1. With regard to the Multiverse having a schematic structure shown in Figure 1, our tardyon universe is the first in the chain of universes. Thus, it is adjacent to only one universe.
2. With regard to the Multiverse having a schematic structure shown in Figure 1, our tardyon universe is neither the first nor the last in the chain of universes. Thus, it is adjacent to two universes.
3. With regard to the Multiverse having a schematic structure shown in Figure 3, our tardyon universe is the first in the chain of universes. Thus, it is adjacent to seven universes.
4. With regard to the Multiverse having a schematic structure shown in Figure 2, our tardyon universe is neither the first nor the last in the chain of universes. Thus, it is adjacent to fourteen universes.
5. With regard to the Multiverse having a schematic structure shown in Figure 2, our tardyon universe is the first in the chain of universes. Thus, it is adjacent to three universes.
6. With regard to the Multiverse having a schematic structure shown in Figure 2, our tardyon universe is neither the first nor the last in the chain of universes. Thus, it is adjacent to six universes.

**Table 1. Supposed distribution of mass-energy of parallel universes in the Multiverse**

The results of author's theoretical calculations for different structures of the Multiverse							
Structure of the hidden Multiverse			Relative size of mass-energy				
Type of the Multiverse	Location of our universe in the Multiverse	Number of universes in the Multiverse	For our universe	For dark matter, corresponding to adjacent universes	For dark energy, corresponding to other universes		
Multiverse, corresponding to Figure 2	On the edge of the Multiverse	20	1/20=5,00%	3/30=15,00%	16/20=80,00%		
		21	1/21=4,76%	3/21=14,29%	17/21=80,95%		
		22	1/22=4,55%	3/22=13,64%	18/22=81,82%		
		23	1/23=4,35%	3/23=13,04%	19/23=82,61%		
		24	1/24=4,17%	3/24=12,50%	20/24=83,33%		
	Inside the Multiverse	20	1/20=5,00%	6/20=30,00%	13/20=65,00%		
		21	1/21=4,76%	6/21=28,57%	14,21=66,67%		
		22	1/22=4,55%	6/22=27,27%	15/22=68,18%		
		23	1/23=4,35%	6/23=26,09%	16/23=69,57%		
		24	1/24=4,17%	6/24=25,00%	17/24=70,83%		
		Multiverse, corresponding to Figure 3	On the edge of the Multiverse	20	1/20=5,00%	7/20=35,00%	12/20=60,00%
				21	1/21=4,76%	7/21=33,33%	13/21=61,90%
				22	1/22=4,55%	7/22=31,82%	14/22=63,64%
				23	1/23=4,35%	7/23=30,43%	15/23=65,21%
Inside the Multiverse	24		1/24=4,17%	7/24=29,17%	16/24=66,67%		
	20		1/20=5,00%	14/20=70,00%	5/20=25,00%		
	21		1/21=4,76%	14/21=66,67%	6/21=28,57%		
	22		1/22=4,55%	14/22=63,64%	7/22=31,82%		
	23		1/23=4,35%	14/23=60,87%	8/23=34,78%		
24	1/24=4,17%	14/24=58,33%	9/24=37,50%				
Spacecraft observations							
WMAP			4,6%	22,4%	73,0%		
Planck			4,9%	26,8%	68,4%		

And, as can be seen from Table 1, the fourth case (highlighted) of the theoretically possible variants of various Multiverse structures analyzed above is surprisingly close to the data obtained from WMAP and Planck spacecrafts, concerning the mass-energy ratio of dark matter and dark energy. It corresponds to:

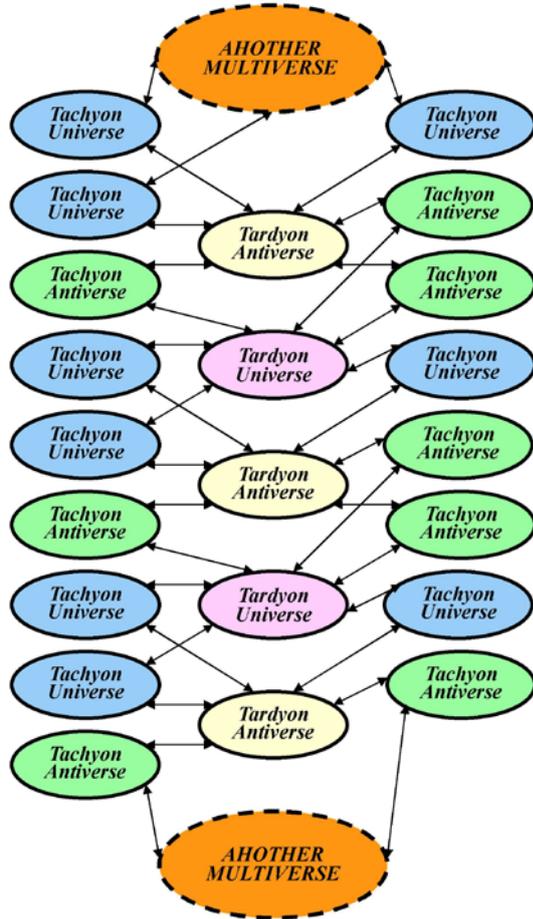


Figure 4. One of the most probable structures of the hidden Multiverse

- The fact of location of our parallel universe inside (rather than on the edge) the Multiverse;
- The fact of existence on Earth of 6 types of portals enabling transition in 6 different adjacent parallel universes.

Besides, in order to find the exact number of parallel universes forming the Multiverse, the fourth case has been subjected to further study, the results of which are shown in Table 2. According to the results of this study, the Multiverse includes 22 parallel universes (highlighted in the table) as follows from Planck data, rather than 24 parallel universes as follows from WMAP data.

The probable closed structure of the hidden Multiverse including 24 parallel universes is shown in Figure 2.

And Figure 4 shows the structure of supposedly existing hidden Multiverse (in which the term “OTHER MULTIVERSE” can be understood both as one and the same Multiverse and as two different Multiverses) including 22 parallel universes. It has other structure than that shown in Figure 2: according to WMAP and Planck data it lacks tachyon universes on the edges of the Multiverse. And since closed structure turned out to be the most likely structure of the hidden Multiverse, this structure, considering it impossible that it has edges

behind which there is nothing, can be treated as proof of existence of the hidden Supermultiverse which is much more invisible than dark matter and dark energy given the lack of not only electromagnetic but also gravitational manifestations.

Table 2. Mean-square deviation of astrophysical research data from theoretically expected results

Space-crafts	Number of universes in the Multiverse				
	20	21	22	23	24
WMAP	6,38%	5,10%	3,96%	2,91%	1,97%
Planck	2,65%	1,39%	0,35%	0,90%	1,84%

Therefore, this hidden Supermultiverse cannot be referred to dark dimensions described above and corresponding to the imaginary component of complex numbers. Otherwise, such a structure would be a part of our hidden Multiverse. Consequently, portals between hidden Multiverses in the Supermultiverse should be of other type than portals between parallel universes of our hidden Multiverse. And the question of what they actually are has to be answered by future researchers.

## 6. Conclusion

Thus, the phenomenon of dark matter and dark energy is an experimentally discovered manifestation of existence of invisible parallel universes forming the hidden Multiverse. And as this Multiverse has already been found, it should be further explored [39]. Development of its resources will significantly accelerate the development of human civilization. In the hidden Multiverse, and especially in the hidden Supermultiverse, mankind will also be able to survive in case of a threat to its existence.

The phenomenon of dark matter and dark energy is a special case of the phenomenon of dark dimensions, which does not yet have any explanation in general. Further study of the phenomenon of dark extra dimensions will allow a better understanding of hidden Multiverse functioning mechanism. The knowledge of this phenomenon will allow, in particular, creating artificial portals between parallel universes, time machines and other useful devices. Therefore, the study of the phenomenon of dark dimensions seems to be one of the most urgent problems of future physics.

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