
Why Dark Matter and Dark Energy Are Invisible

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Abstract: New objects of astrophysical studies – dark matter and dark energy – have been called so as they are invisible and incomprehensible. Including, they are incomprehensible from the standpoint of physical optics. This article explains that their invisibility is caused by the compliance of the imaginary physical entities, the reality of which has already been proven.

Keywords: Dark Matter, Dark Energy, Dark Measurements, Imaginary Numbers, Multiverse

1. Introduction

In order to answer the question posed in the title of the article, we should first, obviously, answer another question: what is the dark matter and dark energy, what is their physical nature?

Therefore, let us remember what we know about them. Dark matter was discovered in 1932-33 by Jan Hendrik Oort and Fritz Zwicky, and dark energy in 1998-99 by Nobel Prize winners Saul Perlmutter, Brian P. Schmidt and Adam G. Riess [1]. And the main thing known about them is that:

- they do not absorb, emit or reflect electromagnetic radiation in its entire range;
- they were found by the gravitational lensing effect;
- no chemical element known to us has been found in their composition, which seems to destroy the existing understanding of the term ‘matter’;
- their mass-energy is tens times greater than the mass-energy of the visible universe (which has been considered as the entire universe until very recent).

All of this is very unusual and incomprehensible. Exactly due to the incomprehensibility and even invisibility, these astrophysical objects were named as dark.

Currently, the phenomenon of the dark matter/the dark energy has been attempted for explanation in astrophysics exclusively within the concept of the Monoverse, which corresponds to the second postulate of the current version of the special theory of relativity (STR). These attempts were in vain.

Also, many alternative concepts of the multiverses [2-12], proposed to date, were unable to explain this phenomenon. Though it would seem that the most obvious explanation for

the phenomenon of the dark matter/dark energy could be precisely the concept of the Multiverse, all the universes of which are mutually invisible. The task of explanation of the invisibility of the universes proved to be no easier than explanation of the problem of invisibility of the dark matter and the dark energy.

Therefore, it is permissible to assume that it would be useful to give requirements for indispensable correspondence of the explanation of the phenomenon of the dark matter/dark energy to the second postulate of STR.

2. About the Second Postulate of STR

But why the second postulate of STR is not good? Why after publication by Albert Einstein of his fundamental work [13], in which he introduced the second postulate of STR, this second postulate has been amended and corrected? Why the original wording of the second postulate, which is now called as the principle of the constancy of the speed of light, was consequently amended with two more formulations that were not identical with the original:

- about physical unreality of imaginary numbers and.
- about non-exceedance of the speed of light (due to the supposed physical unreality of imaginary numbers)?

Nevertheless, the second postulate of STR even in its final formulation is not satisfactory for the following reasons [14].

First of all, because it does not meet the criteria, which such terms as a postulate, an axiom, or a scientific law should be compliant with in the science. These concepts should not allow for their different interpretation.

Additionally, the second postulate is generally in contradiction to the common sense: inability to overcome any

barrier (such as the state border, for example) does not mean that there is nothing behind this barrier.

It should be also borne in mind that the creators of the STR required additional formulations for its second postulate only because of their inability to explain the appearance of the imaginary mass, imaginary time, etc. at the hyperlight speeds in the relativistic formulas. That was the reason why the non-exceedance of the speed of light has been postulated. Though, it was not convincingly argued with inability to overcome the light-speed barrier. In fact, the inability to overcome the light barrier corresponding to the relativistic equations does not exclude, as it is shown below, the existence in the nature of other mechanisms of penetration through this barrier. Even at home, we can freely move from one room to another not through the walls separating rooms, but through doors and hallways.

Therefore, the existing broad interpretation of the second postulate of STR seems unconvincing. Even many physicists recognized such formulation as unconvincing. Therefore, they conducted complex multi-year experiments MINOS at the American Tevatron collider and OPERA experiments at the European Large Hadron Collider, the purpose of which was to detect the existence of neutrinos moving with hyper-light speed and to prove physical reality of imaginary numbers. Thus, to refute the existing interpretation of the second postulate. However, the physics community ignored these experiments, finding them as not enough reliable. They did not proceed with such experiments in order to obtain more reliable results.

3. Brief History of Imaginary Numbers

In this regard it would obviously be appropriate to remember what we know about the imaginary numbers.

Imaginary numbers were first introduced about 500 years ago by Scipione del Ferro, Niccolò Fontana Tartaglia, Gerolamo Cardano, Lodovico Ferrari and Rafael Bombelli [15]. And Paolo Valmes, who supposedly discovered them even earlier, was sent by the Inquisitor Tomas de Torquemada to the stake [16].

However, the perfect theory of functions of a complex variable was created in the subsequent years, which, however, did not reveal the physical reality of imaginary numbers. Although, imaginary numbers are widely used now in other exact sciences, such as optics, electronics, and others, they do not explain the physical reality of imaginary numbers.

But, unlike physics, it is not denied by these sciences.

4. Physical Reality of Imaginary Numbers

So, are the imaginary numbers physically real or not? Can we get a demonstrative answer to this question?

It turns out, we can. There are even several evidences for the physical reality of imaginary numbers. We will present only one of them in order to save the time of readers [17].

We believe that the evidence based on Ohm's law that was discovered in 1826 and is known to all at the present time, is quite convincing. A so called symbolic method is used together with this law to calculate the linear electric circuits under the influence of sinusoidal voltage. According to this method inductive and capacitive resistance is measured with imaginary numbers of different polarities, and resistance of resistors is measured with real numbers.

But it is commonly believed that the mentioned imaginary capacitive and inductive resistance are not physically real, but they are only some certain mathematical conventions, suitable for practical use.

However, it is not true. Oliver Heaviside claimed that "Mathematics is an experimental science". Therefore, it is possible to claim that the imaginary capacitive and inductive resistance is physically real and it proves the physical reality of all imaginary numbers.

Indeed, since the value of the imaginary inductive and capacitive resistance depends on the frequency, in accordance with Ohm's law, the value of the current flowing through the circuit should change with the change of the frequency of sinusoidal voltage if the imaginary capacitive and inductive resistances are physically real, and should not be changed in other case. The experiment, which will answer this question, can be performed in any radio and electronic laboratory (in addition to the experiments, which were conducted by engineers every day in the course of their practice for the last one hundred and more years). Therefore, this experiment, in contrast to MINOS and OPERA experiments, are absolutely reliable and conclusive to prove the physical reality of imaginary numbers.

As a side note, if the inductive and capacitive imaginary resistance were not physically real, resonance, which was discovered by Galileo di Vincenzo Bonaiuti de'Galilei in 1602 [18], would not exist in electrical circuits.

Also other evidences of physical reality of imaginary numbers are published [19-21].

5. Principle of Physical Reality of Imaginary Numbers

Nature is uniform, which, unlike science, due to the limited intellectual capabilities of people is divided into a large number of different scientific disciplines. Therefore, all theories and hypotheses within such disciplines should be mutually consistent. And if some of them (for instance, the theory of relativity and quantum mechanics in physics) contradict each other, then at least one of them is wrong. Hence, principle of physical reality of imaginary numbers, which was proved in the theory of linear electrical circuits, should be recognized as generally scientific, and all scientific theories existing in optics, quantum mechanics, theory of relativity and other exact sciences should be adjusted accordingly.

6. Physical Reality of Imaginary Numbers: Dark Measurements

Since the imaginary numbers are used in different cases to describe different objects of study, the real physical effects, which correspond to such numbers, will, obviously, be different. Thus, it was shown above that in the theory of electric circuits imaginary inductive and capacitive resistances correspond to such numbers. It will be further shown that the dark matter and the dark energy, the physical nature of which will be explained, correspond to such numbers in astrophysics.

The dark measurements also include the imaginary component $i \sin x$ in Euler's formula

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

which can be used to describe oscillatory processes (both damped and undamped) of any physical nature: sea waves, oscillations of a pendulum, audible and inaudible sounds, electromagnetic waves, etc. But what physical meaning has the imaginary component $i \sin x$, for example, for mechanical oscillations of a pendulum, is even more incomprehensible than the dark matter and the dark energy. Until now it was thought that there was no meaning, because the imaginary numbers in the nature do not have any real physical content. But it is not true according to the principle of physical reality of imaginary numbers that was proved above. Therefore, the imaginary component of the pendulum's oscillation exists, but we still have to understand its physical content.

For now we can only say that since any numbers are used for measurements (for example, it is well understood what the real numbers measure when we are talking about ten steps, thirty minutes, two books, one kilogram, etc.), then we should call imaginary physical entities, since they are always invisible, as dark measurements similar to the dark matter and dark energy [22].

We should not be surprised with the fact that they are not available for immediate registration with our senses. People do not sense the x-rays, do not hear infra and ultrasounds, do not see the dark matter, people can not touch the atoms and molecules, etc., but they know about all that due to the indications of the instruments that convert information that is inaccessible by our senses to its accessible form. Therefore, sooner or later, the instruments will be created for registration of imaginary physical entities.

And devices for measurement of imaginary resistance in electrical circuits are already created.

7. Explanation of Invisibility of the Dark Matter and the Dark Energy

Now we shall show how the STR should be adjusted with due account for the principle of physical reality of imaginary numbers [23]. How it will allow us to explain invisibility of the dark matter and the dark energy

But first, let's note that, in addition to theoretical and experimental evidence for fallaciousness of the principle of non-exceedance of speed of light mentioned above, there is also another experimental evidence obtained previously in the form of Cerenkov radiation, for the discovery and explanation of which Pavel Alekseyevich Cherenkov, Igor Evgenyevich Tamm and Ilya Mikhaylovich Frank received the Nobel Prize in 1958 [24].

As for the STR, it should be actually used to explain the relativistic formulas for superluminal speeds $v > c$. For example, the formula of Lorentz-Einstein:

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

where m_0 is the rest mass of the moving body;

m is the relativistic mass of the moving body;

v is the speed of the physical body;

c is the speed of light.

It can be seen from the formula (2) that at $v > c$ relativistic mass of the moving body becomes imaginary. In the current version of the STR it was concluded that since the relativistic mass can not be imaginary, $v > c$ can not occur either. Insofar as the physical reality of imaginary numbers was proven, we can make another conclusion: the relativistic mass can be imaginary and the physical body, for instance, tachyons [25, 26], with such mass exist not in our universe, but in some other place, which we should call a tachyon universe for clarity. Herewith, this tachyon universe according to the first postulate of the STR is an inertial reference system, in which the same laws of physics apply as in our universe, which we should call as tardyon universe (from the name of the elementary particles that exist at sub-light speeds). But due to the condition $v > c$, this tachyon universe is behind the horizon of events and is invisible from our universe. Consequently, the Multiverse, which includes these universes is also invisible [27]. Therefore, let us call it hidden.

As it is seen, the formula (2) does not correspond to the first postulate. Therefore, we should adjust it as follows

$$m = \frac{m_0 \exp(iq\pi/2)}{\sqrt{1 - (v/c - q)^2}} = \frac{m_0 \exp(iq\pi/2)}{\sqrt{1 - (w/c)^2}} \quad (3)$$

where $q = \lfloor v/c \rfloor$ is the discrete function "floor" of the argument v/c :

$w = v - qc$ is the local speed for each universe, which can assume values only within the range $0 \leq w \leq c$;

v is the speed measured from our tardyon universe, which we should call as tardyon speed;

$\exp(iq\pi/2)$ is the Euler's formula of the discrete argument q .

Other relativistic formula of the existing version of the STR can be corrected in a similar manner.

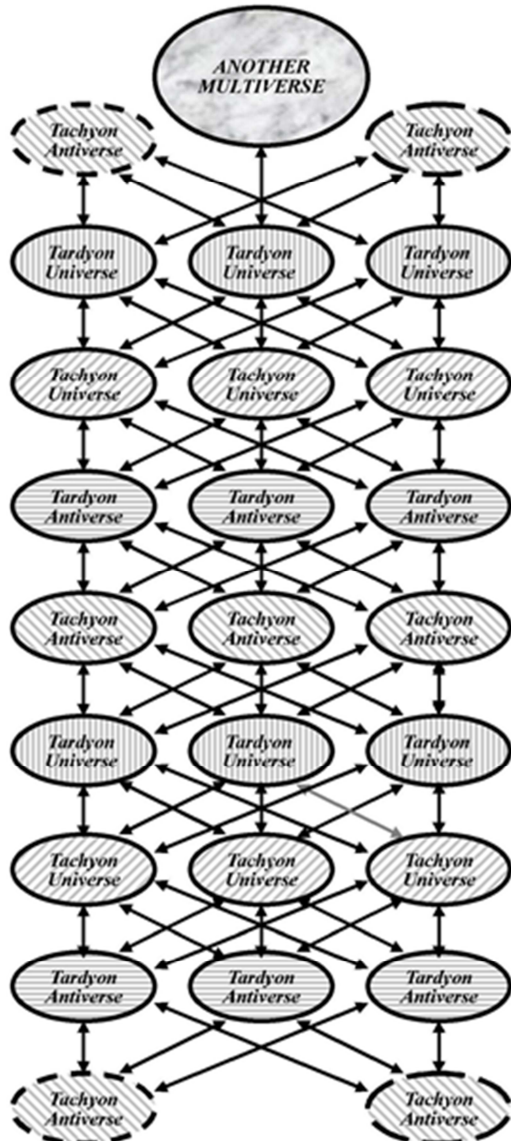


Fig. 1. Probable structure of the hidden Multiverse.

It is evident from the formula (3) that other corresponding $q > 1$ parallel universes can exist in the hidden Multiverse in addition to the corresponding $q = 0$ and $q = 1$ tardyon and tachyon universes. So, the tardyon antiuniverse will correspond to $q = 2$, tachyon antiuniverse will correspond to $q = 3$, other tachyon universe in will again correspond to $q = 4$, and other tachyon universe will correspond to $q = 4$. And so forth. Our calculations using the data obtained by space stations WMAP and Planck, allow us to claim that our hidden Multiverse probably contains twenty two parallel universes. Three tachyon universes and three tachyon antiuniverse neighbor our tardyon universe [28]. Moreover, despite the existence of universes and antiuniverses in the hidden Multiverse, their annihilation is reliably prevented by the above mentioned order of alternation.

Possible structure of a Multiverse is shown in Fig. 1. As it is seen, it has the shape of screw ring that is not completely closed. Universes, which simultaneously serve as the

beginning and end in such ring are shown by the phantom line. But, apparently, some universes appear on the edge of such structure, which gives a rise to the inevitable question: what is behind the edges of our multiverse? The answer is not known to anyone. But we can assume that there are other multiverses that might be somehow linked with our universe. Or they might not be linked. But anyway they together form a Supermultiverse, which is not detectable not only in electromagnetic, but also in gravitational manifestations. Which we would, therefore, call hidden too.

Such relative position of all parallel universes and a multiverse in a corresponding multidimensional space is stabilized by some process of automatic control which is not known to us and in the result of which the parallel universes and multiverses slightly move with relation to each other, and sometimes they even slightly permeate into each other. And then, in these places (shown with two-sided arrow on the Fig. 1), which are called as stargates or portals, occur the possibility of transition from one parallel universe to another without need to overcome the light-speed barrier for elementary particles and living inhabitants, but not for galaxies, stars, and even not for planets. Otherwise, astronomical observations would have registered unexplained disappearance or appearance of these astrophysical objects in the space. Moreover, since these portals even on the Earth are many, the mass-energy of different parallel universes is approximately the same.

This structure of our hidden Multiverse allows us to simply and logically explain all (incomprehensible when the hypothesis of monouniverse is used) characteristics of the dark matter and the dark energy [29, 30]. Indeed:

- Dark matter and dark energy are invisible parallel universes of the hidden Multiverse. Therefore, they are invisible. Moreover, dark matter and dark energy serve as experimental evidence for existence of the hidden Multiverse.
- Dark matter is the parallel universes adjacent to our universe, which can be permeated into through the portals located on the Earth. Therefore, they were discovered earlier.
- Dark energy is the other parallel universes, existent in the multidimensional space behind the dark matter. Therefore, they were discovered later.
- The chemical composition of the contents of the dark matter and the dark energy can not be determined because the instruments are located in one place (in our universe) and an object of study is located in another place (in other parallel universes).
- But when the earth scientists will permeate into other universes with their equipment through the portals, they will be able to determine chemical composition of their contents.

8. Conclusion

Thus, it follows from the principle of the physical reality of imaginary numbers that many physical objects of study

(inductive and capacitive resistance of electrical oscillatory systems, parallel universes, etc.) can be both visible and invisible depending on the circumstances that remain unknown for us for now.

Therefore we can assume that if we learn to manage these circumstances, i.e. if we understand the mechanism of operation of such portals, people will have the possibility to travel not only in multi-dimensional space of the hidden Multiverse, but also in the hidden Supermultiverse, and even in time.

Knowledge of the processes of transformation of visible images (and corresponding physical entities) into invisible, and vice versa, i.e. knowledge of the mechanism of operation of the portals should become the new challenge for physical optics. It is obvious that in order to solve this challenge, it would be useful to examine the portals naturally existing on the Earth that appear to be so-called anomalous zones [31].

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