

Experimental Evidences for the Fallacy of the STR Version in the Physics Textbooks¹

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ABSTRACT

The article presents experimental proofs² of falsity of the generally accepted version of the SRT studied in physics textbooks and truth of its alternative version. It is explained that the practical activity of radio engineers all over the world daily proves the principle of physical reality of imaginary numbers. Therefore, the postulate of not exceeding the speed of light was refuted actually even before the creation of SRT. And very complicated and expensive experiments OPERA and ICARUS in order to disprove this postulate of STR were not really necessary and are explained only by serious deficiencies in physics education, which ignores the need for knowledge of radio engineering. It is shown that if the generally accepted version of STR was true, then our world would be very different, because there would be no television, no mobile telephony, no radar, no GPS trackers, we would know neither the physical law of Ohm in Steinmetz interpretation, nor the physical phenomenon of resonance, we would hear neither bell ringing nor piano music, in nature there would be no tsunami, no 'Indian summer' and much more. Even children's swing wouldn't sway after being pushed by parents. Therefore, it is concluded that the sections of physics textbooks related to relativistic physics, astronomy and astrophysics require correction.

Keywords: Imaginary numbers; Special theory of relativity; Relativistic formulas; Ohm's law; Resonance; Transient processes; Dark matter; Dark energy; Invisible universes; Multiverse; Portals; Anomalous zones.

INTRODUCTION

Relativistic formulas given in the version of the special theory of relativity (SRT) presented for study in physics textbooks are known to be its main scientific result. However, in cases a physical body moves at superluminal speed, the formulas take on imaginary values, physical sense of which could not be explained by authors of the SRT. And this is not surprising, since no one has known so far how to explain physical sense of imaginary numbers discovered 400 years before creation of the SRT. Indeed, everyone knows what, for example, 3 kg, 2 sec or 7 km is, but no one, including even physicists, knows what 3^i kg, 2^i sec or 7^i km, where $i = \sqrt{-1}$, is.

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² In the Thirty Years' War Cardinal Richelieu, prompted by similar considerations, ordered to inscribe upon cannons the following text: "Ultima ratio regum". And the last argument of scientists is experiments.

Actually no one needs such knowledge in our everyday human life. This knowledge is useless even when solving quadratic equations at school algebra lessons.

However, authors of the SRT really needed that knowledge, as they had to completely explain relativistic formulas, the result obtained in this theory. Otherwise, no one would have needed a theory, which couldn't be explained even by its authors. And the solution to this issue was found. It turned out to be elementary simple and seemingly obvious. It is as follows: if results of any measurements are never expressed by imaginary numbers, then imaginary numbers doesn't exist.

And this was the concern of mathematicians, not physicists, that mathematicians invented some operational calculus and some theory of functions of a complex variable. Mathematicians didn't mind. But they didn't even need to know physical sense of imaginary numbers. This is how the postulate (that is, an unproven assumption), called the principle of light speed non-exceedance, appeared in the SRT.

Nevertheless, there remained some doubts about the truth of the principle of light speed non-exceedance due to the lack of its proof and/or experimental validation.

In particular, the doubts were raised by the discovery of Cherenkov radiation, emitted when charged particles are moving through a transparent medium *faster than the speed of light* in that medium [1]. In 1958, its authors Pavel Alekseevich Cherenkov, Igor Evgenievich Tamm and Ilya Mikhailovich Frank even received the Nobel Prize for their discovery. However, later confidence in the SRT was restored by specifying that the principle of light speed non-exceedance implies movement of a physical body only in a vacuum.

In 2011, the principle of light speed non-exceedance was just about refuted again. This time it was OPERA experiment [2] at the Large Hadron Collider. But six months later the OPERA experiment was refuted by the ICARUS experiment [3], which, however, neither confirmed nor refuted the principle of light speed non-exceedance. It only revealed some errors in the OPERA experiment and demonstrated how extremely complex the experiment was. Thus, it was shown that the issue was very difficult to solve and therefore there were doubts about whether it needed to be solved at all.

EXPERIMENTAL PROOFS OF FALSITY OF THE VERSION OF THE SRT PRESENTED FOR STUDY IN PHYSICS TEXTBOOKS

Around the same time, in 2008-2010, there were publications about the results of radio engineering experiments [4]-[8] that successfully proved physical reality of imaginary numbers and therefore made the question of truth of the principle of light speed non-exceedance and the OPERA experiment unnecessary. Since existence of multiplicity of sciences is explained only by limited intellectual capacity of people, then different sciences should not refute each other. After all, Nature is integral. Therefore, Science is also integral. And mathematics is the single universal language of all exact sciences. Thus, correct mathematical interpretation of radio engineering and any other experiments is indisputably convincing for all other exact sciences, including physics. Norbert Wiener wrote in this regard: *"Important work is sometimes delayed*

by the unavailability in one field of results that may have already become classical in the next field”.

However, since the principle of physical reality of imaginary numbers proved by radio engineering experiments [4]-[20] in physics refuted the principle of light speed non-exceedance and thereby refuted the generally accepted version of the SRT [21]-[23], physical community wasn't satisfied with this result. And therefore, *students have still studied an outdated and erroneous version of the SRT [24]-[33] presented in physics textbooks and based on the refuted principle of light speed non-exceedance.*

In order to substantiate this statement and to gain the moral right to propose replacing the erroneous version of the SRT built on the postulates in physics textbooks with the alternative version confirmed experimentally, let's give a description of the experiments.

Proof of physical reality of imaginary numbers as a result of study of transient processes in linear electric circuits

Since power is the energy derivative with respect to time, energy stored in inductors L and capacitors C cannot change instantly in electric LCR circuits, when changing their operating mode (for example, switching them). Consequently, infinitely large power that actually doesn't exist might correspond to an instantaneous change in energy. And therefore, transient processes always arise in such electric circuits, if no special measures are taken to suppress them. These processes are usually regarded as unwanted. And therefore, ways of suppressing rather than using them are studied.

However, studying transient processes in this article, we shall try to solve a very important scientific issue – to find out whether the above-mentioned version of the SRT implying that imaginary numbers are not physically real is true. That is, we shall try to solve a mathematical issue – to prove or refute physical reality of imaginary numbers – that couldn't be solved for 500 years, by radio engineering experiments. This physics issue turned out to be so important that the Large Hadron Collider was even used in the OPERA experiment to solve it. But this proved a failure.

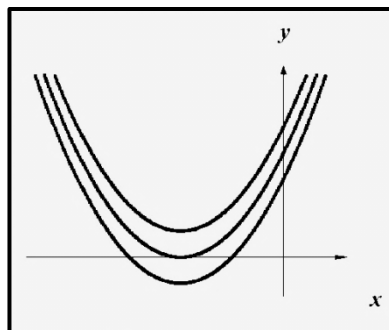


Fig. 1. Graphical solution to the equation (2) on the set of real numbers corresponding to the intersection points of the line $y=0$ and the parabola $y=ax^2+bx+c$

Analysis of transient processes in linear LCR-circuits allowed solving this issue in the following way. Processes occurring in the electric circuits are known to be described by linear differential equations usually of not higher than the second order. Their solution contains two components

$$y(t) = y(t)_{forc} + y(t)_{free} \quad (1)$$

where $y(t)_{forc}$ is the forced component of response (or output signal);

$y(t)_{free}$ is its free (or transient) component;

t is the time.

In this case, the transient component $y(t)_{free}$ that is of interest to us is found as a result of solving an algebraic characteristic equation of the same order (for example, second) as the original differential equation

$$ax^2 + bx + c = 0 \quad (2)$$

where x is the additional variable that is called a complex frequency in radio engineering, if it is actually a complex number.

And then, depending on the result of solving the equation (2), the function $y(t)_{free}$ corresponding to this solution shall be found.

In algebra, solutions to the equation (2) can be on the set of both real and complex numbers. In the first case, the equation (2) can have either no or one or two real solutions (see Fig. 1) depending on the value of the coefficients a, b, c . In the second case, there are always only two solutions (see Fig. 2). Moreover, the two roots are different in Fig. 2a and 2c, and equal in Fig. 2b.

However, this case defies common sense, since two different decisions cannot be simultaneously true. One of them must be false. So where is the truth? Which of these solutions is true?

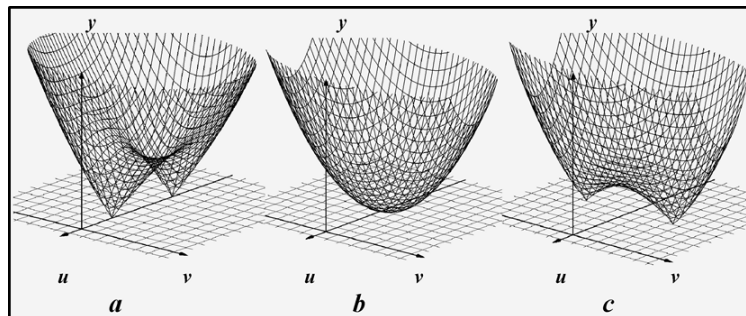


Fig. 2. Graphical solution to the equation (2) on the set of imaginary numbers, corresponding to

the tangent plane point $|y| = 0u + i0v$ **and tangent surface point** $|y| = |ax^2 + bx + c| = |a(u + iv)^2 + b(u + iv) + c|$

Mathematics could not answer this question. Therefore, let us turn back to the analysis of transient processes in radio engineering. The following facts are well known in radio engineering.

- When the discriminant $b^2 - 4ac$ is positive, and therefore the roots of the characteristic equation (2) are real and different, the transient process is aperiodic;
- When the discriminant $b^2 - 4ac$ is equal to zero, and therefore the roots of the characteristic equation (2) are real and equal, the transient process is critical;
- When the discriminant $b^2 - 4ac$ is negative, and therefore the roots of the characteristic equation (2) are different and complex-conjugate, the transient process is oscillatory.

As can be seen, radio engineering claims that transient process always exists. But this situation takes place only for solutions to the characteristic equation (2) on the set of complex numbers. For solutions on the set of real numbers, there can be a result in the form of complex conjugate numbers. Thus, if the solutions on the set of real numbers were correct, and therefore, *if the principle of light speed non-exceedance were true*, then oscillatory transient processes would not exist. That is, *there would be no tsunami and Indian summer; no church bells and grand pianos would sound; children's swings would not sway after being pushed by parents and no shock oscillations would exist at all*.

Therefore, we have to conclude that the only correct solution to algebraic equations (not only characteristic, but to all) are solutions in the form of complex numbers. In that case complex (and, therefore, imaginary) numbers have to be recognized as physically real.

Proof of physical reality of imaginary numbers as a result of study of linear electric circuits using Ohm's law in the interpretation of Steinmetz

In accordance with Ohm's law in the interpretation of Steinmetz, not only resistors, but also inductors and capacitors have electrical resistance. However, unlike the value of resistors R that does not depend on the frequency of voltage applied to them and is measured by real numbers R , the value of reactance of inductors L and capacitors C is measured by imaginary numbers $X_L = j\omega L$ and $X_C = 1/j\omega C = -j/\omega C$ opposite in sign and depends on the frequency ω of voltage applied to them. Imaginary unit is designated here as j , since designation i in the theory of electrical circuits is used for electric current.

Therefore, in accordance with Ohm's law in the interpretation of Steinmetz the value of current $i(t)$ flowing through LCR -circuit of any configuration, to which an alternating voltage $u(t)$ is applied, would be equal to $i(t) = u(t)/|Z(j\omega)|$, where $Z(j\omega)$ is the complex resistance of the electric circuit under study. However, it wouldn't depend on the frequency ω of this voltage, if the so-called imaginary reactances X_L and X_C do not physically exist. Otherwise it would. Any experiment can confirm this dependence, and, thereby, physical reality of imaginary physical entities – imaginary values of reactances of inductors and capacitors.

So, resonance and various electrical filters can exist due to physical reality of imaginary values of reactances of inductors and capacitors in electric circuits. Therefore, *if the generally accepted*

version of the SRT and its statement about physical unreality of imaginary numbers were true, existence of television, radiolocation, GPS trackers, mobile phones, or radio equipment in general would be impossible.

Thus, the evidence of physical reality of imaginary numbers that couldn't be obtained by physicists within the framework of the OPERA experiment at the Large Hadron Collider turned out to have been de facto obtained³ long ago by millions of radio engineers all over the world and is daily confirmed by their practical activities in all radio electronic laboratories. Notably, this plain evidence of the principle of physical reality of imaginary and complex numbers that is possible due to measuring the value of resistance of electrical circuits with devices available in any radio engineering laboratory – for example, testers (see Fig. 3), oscilloscopes, frequency-response analysers, etc. – is the most convincing.

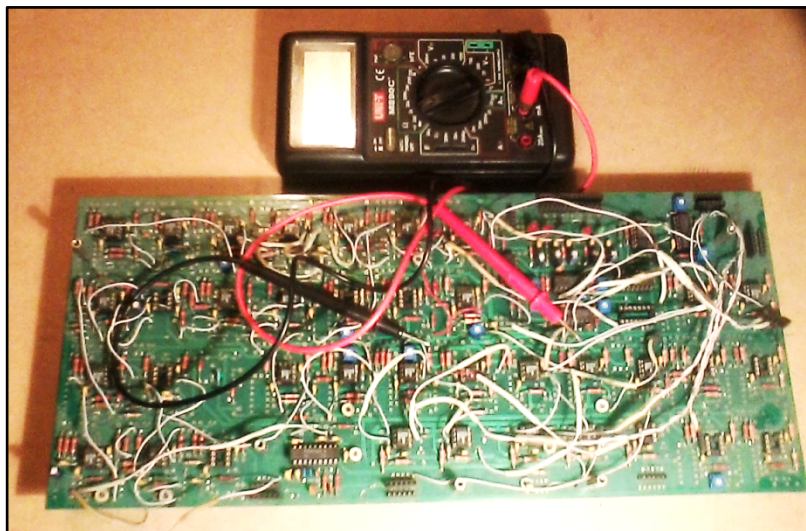


Fig.3. This is all that is needed instead of the Large Hadron Collider for the experimental proof of physical reality of imaginary numbers.

After all, it is exactly the ability to register by devices X-ray, radioactive, ultraviolet and infrared radiation, infra and ultrasound, magnetic field, atoms and subatomic particles, as well as many other physical entities that are not registered by the human senses, proves their physical reality. Therefore, to prove physical reality of imaginary numbers there is no need to conduct the unique and expensive OPERA and ICARUS experiments at the Large Hadron Collider involving a large number of professors of physics instead of a simple and cheap radio engineering experiment using a tester (see Fig. 1) and involving only one engineer.

Thus, since the principle of physical reality of imaginary numbers in the SRT has been experimentally proved, there's no longer any necessity for the postulated principle of light speed non-exceedance, but it becomes necessary to correct relativistic formulas that allow explaining the SRT at superluminal velocities.

³ *Consequently, the generally accepted version of the SRT could have been refuted back in the 19th century, i.e. before its creation*

ALTERNATIVE VERSION OF THE SRT

Thus, the principle of physical reality of imaginary numbers can be considered proven and the principle of light speed non-exceedance can be considered refuted as it is useless. What have we achieved by this? What new knowledge have we received? To answer these questions, let's analyze a relativistic formula graph. For example, the graph of the Lorentz-Einstein formula

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

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

m is the relativistic mass of a moving body;

v is the velocity of a body;

c is the speed of light.

As can be seen, the section $0 \leq v < c$ of the graph of function (3) in Fig. 4a corresponds to our visible universe, and the section $c \leq v$ of the same graph – in accordance with the principle of physical reality of imaginary numbers – corresponds to some other invisible universe, since it is beyond the event horizon. However, this invisible universe does not exist, because the process $m(v)$ corresponding to the formula (3) is unstable at the section $c \leq v$. Actually, if we assume that velocity v of a moving body has increased, for some reason, in the section $c \leq v$ of the graph in Fig. 4a, then this should lead to a decrease in its mass m , and a decrease in mass m should lead to a further increase in velocity v , and so on. If we assume that velocity v of a moving body has decreased, for

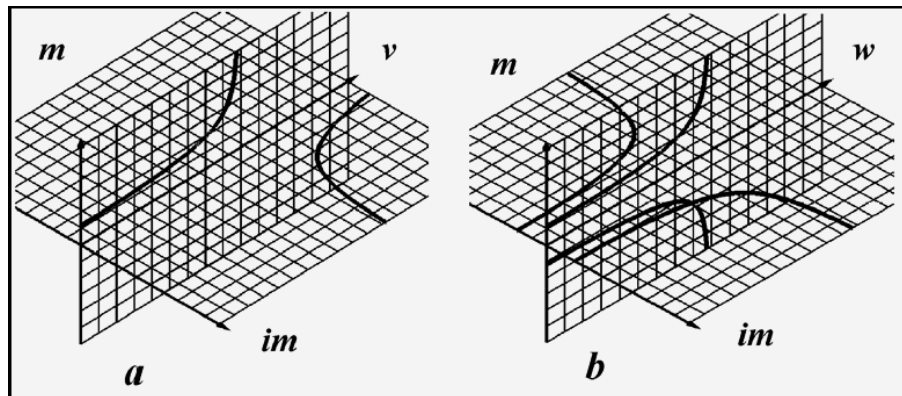


Fig. 4. Graphs of functions $m(v)$ corresponding to the formulas (3) and (4)

some reason, then this should lead to an increase in its mass m , and an increase in mass m should lead to further decrease in velocity v , and so on. Consequently, there can be no physical content in the section $c \leq v$ of the graph in Fig. 4a. And that's why the relativistic formula (3) is incorrect, since its derivation has not been completed.

To complete its derivation, we should reason as follows. Invisible universes together forming the hidden Multiverse could exist in the section $c \leq v$ of the graph in Fig. 4a, if the graph of function $m(v)$ had many intervals $c \leq v < 2c, 2c \leq v < 3c, 3c \leq v < 4c$, etc., on each of which it would

take the same form as on the interval $0 \leq v < c$. Therefore, for the hidden Multiverse the graph of function $m(v)$ should generally have the form shown in Fig. 4b. Hence, the function can be written as follows

$$m = \frac{m_0 i^q}{\sqrt{1 - (v/c - q)^2}} = \frac{m_0 i^q}{\sqrt{1 - (w/c)^2}} \quad (4)$$

where $q = \lfloor v/c \rfloor$ is the “floor” function of argument v/c in discrete mathematics; its integer values⁴ correspond to different mutually invisible parallel⁵ universes.

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

v is the velocity measured relative to our visible universe.

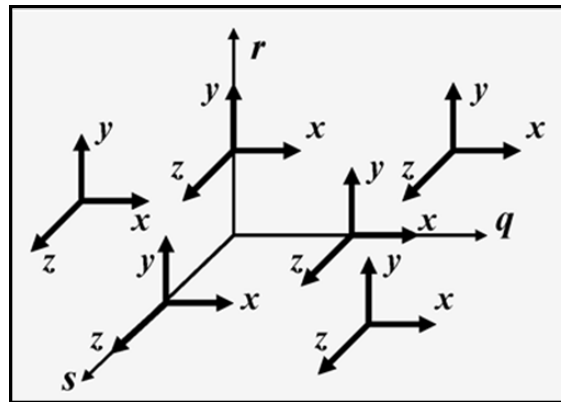


Fig. 5. Six-dimensional space of the hidden Multiverse

However, as shown in [34]-[36], the six-dimensional metric of the hidden Multiverse (see Fig. 5) is more complex than the three-dimensional metric of our visible universe. And therefore, the Lorentz-Einstein formula ultimately takes the following form

$$m = \frac{m_0 (i_1)^q (i_2)^r (i_3)^s}{\sqrt{1 - [v/c - (q + r + s)]^2}} = \frac{m_0 (i_1)^q (i_2)^r (i_3)^s}{\sqrt{1 - (w/c)^2}} \quad (5)$$

where i_1, i_2, i_3 are the imaginary units in hyper-complex numbers [37] called quaternions:

q, r, s are the extra dimensions:

v is the velocity measured relative to our visible tardyon universe:

c is the speed of light;

$w = v - (q + r + s)c$ is the local velocity of the universe corresponding to the coordinates q, r, s , that can take values only in the range $0 \leq w \leq c$.

⁴ It takes non-integer values in the portals considered below, where the value q varies by one from a portal entry to its exit under the influence of physical factors that haven't yet been studied

⁵ Called as such because they never intersect despite their infinity

Other relativistic formulas can be corrected in a similar way. *The corrected relativistic formulas allows for creating a version of the SRT [38]-[50] alternative to the incorrect version presented in physics textbooks.*

EXPERIMENTAL PROOFS OF TRUTH OF THE ALTERNATIVE VERSION OF THE SRT

In order to substantiate this statement and to gain the moral right to propose replacing the erroneous version of the SRT built on the postulates in physics textbooks with the alternative version confirmed experimentally, let's give a description of the experiments.

Dark matter and dark energy phenomena prove existence of invisible universes

The phenomenon of dark matter was discovered by Jan Hendrik Oort and Fritz Zwicky in 1932-33, and the phenomenon of dark energy was discovered by Saul Perlmutter, Brian P. Schmidt and Adam G. Riess, who received the Nobel Prize for this discovery, in 1998-99.

These phenomena [51]-[53] are referred to as such for their incomprehensibility. It is unclear why they are invisible and neither emit nor reflect nor absorb nor refract electromagnetic oscillations in any range and therefore can be detected only indirectly by their gravitational manifestations. It is even more incomprehensible why any molecules, atoms or subatomic particles haven't yet been found in dark matter and dark energy, although their total mass is more than twenty times greater than the mass of all objects of our visible universe. This circumstance even raises doubts about correctness of modern understanding of the term 'matter'. And the subsequent long-term and very intensive studies of the phenomena of dark matter and dark energy have not brought scientists closer to understanding their sense.

Albert Einstein explained the reason for incomprehensibility of the phenomena of dark matter and dark energy in the existing version of the SRT very clearly: *"Insanity: doing the same thing over and over again and expecting different results"*. That is, astrophysicists themselves have created all these incomprehensibilities by wrong statement of the task. They sought explanation for the phenomena that should certainly correspond to the version of the SRT presented in physics textbooks. This version of the SRT implies that we live in the Monoverse. However, since no macro-objects corresponding to the concepts of dark matter and dark energy were found in the Monoverse, it was quite logical to seek an explanation for these phenomena in the microcosm. And they failed again. Nevertheless, scientists considered any alternative explanations for the phenomena irrelevant. And therefore, even those few hypothetically possible structures of the Multiverse published in [54]-[61] have always been commented on as fundamentally unverifiable.

However, if we change the statement of the task and seek an explanation for the phenomena of dark matter and dark energy in the invisible universes of the hidden Multiverse existing along with our visible universe, explanation becomes obvious [62], [63]:

- Dark matter and dark energy are merely certain images⁶ (rather gravitational, than optical and still less electromagnetic), a kind of a shadow, of invisible universes of the hidden Multiverse, rather than some real physical entities located in the microcosm or in the macrocosm;

⁶ Whose formation mechanism remains to be understood

- Dark matter is evoked by invisible parallel universes of the hidden Multiverse adjacent to our visible universe;
- Dark energy is evoked by the rest of invisible parallel universes of the hidden Multiverse, which are more distant from our visible universe;
- Notably, images corresponding to dark matter and dark energy do not contain⁷ any chemical substances. This alone suggests and proves existence of the Multiverse, rather than the Monoverse.

This explanation meets the Occam's razor criterion and therefore is quite plausible. And since, in accordance with this explanation, the phenomena of dark matter and dark energy are evoked by existence of invisible universes, it can be assumed that experimentally registered *dark matter and dark energy are experimental evidence of existence of invisible universes, which proves the truth of the alternative version of the SRT.*

How to see invisible universes?

The truth of the alternative version of the SRT can also be confirmed by direct astronomical observation of constellations that have never been seen in the starry sky of Earth [64], [65]. Moreover, this is the only way to reliably identify invisible universes (like people by ID photos), since stars in the skies of different universes are obviously spread in extremely different ways. It is also obvious that these other constellations can only be seen in these other universes, which are invisible from our universe on most of the Earth's surface.

However, it turns out that our Earth has numerous areas called anomalous zones [66], At least some of them are entrances to passages to other universes, called portals [67]. These passages are analogous to the passages in our dwellings that lead from one room to another. We can usually see only one of the rooms entirely, the room we are in now. Any other room can also be partially visible, if we adjourn to it or at least look inside through an open door.

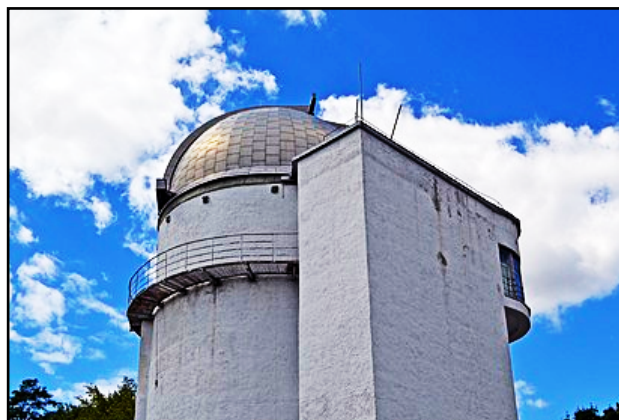


Fig. 6. Main Astronomical Observatory of the National Academy of Science of Ukraine located in an anomalous zone

⁷ Try to find at least one molecule in any shadow

Therefore, an adjacent invisible universe can be looked into from any portal of our visible universe in a similar way. Entering a portal one can observe as the star map of one universe is gradually replaced by the star map of the adjacent universe. And it would seem to the observer moving along the portal that these are constellations of our starry sky moving, disappearing and appearing. Moreover, the deeper one enters the portal, the more changes one actually sees. But people avoid visiting anomalous zones and try not to enter deep into the portals, and rightly so. Portals are labyrinths invisible to us and once you are in, it is easy to get lost and not to find the way back. Therefore, in order to safely perform astronomical observations in portals, first it is necessary to create portal orientation devices (similar to marine compass).

Even with a slight penetration into a portal, while still remaining at its entrance in an anomalous zone, one can observe some changes in the constellations known to astronomers. This would also be an irrefutable experimental proof of existence of other universes that are invisible outside the portals. Moreover, *such an experiment, similar to the experiment conducted by Sir Arthur Stanley Eddington [68] in 1919, would be quite low-cost and simple, since the main thing required is to place a telescope in an anomalous zone, all the rest is available.*

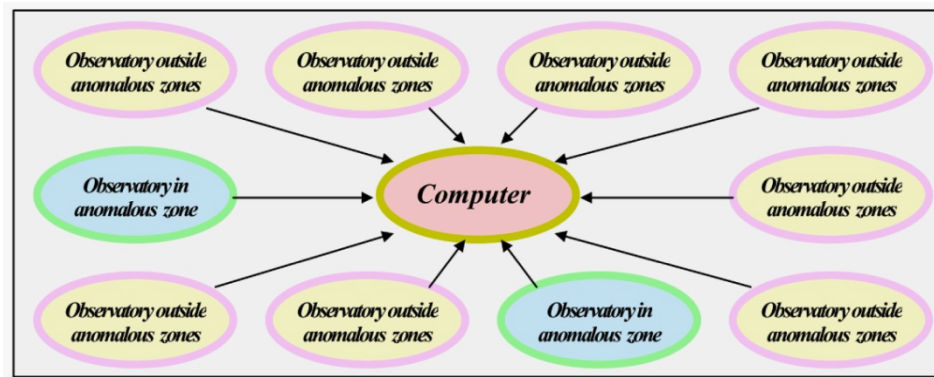


Fig. 7. Scheme of an experiment in detecting invisible universes

And since constellations observed in the starry sky using such a telescope may sometimes differ very slightly from constellations observed using other telescopes placed outside the anomalous zones, some astronomical observatories could already have been, by chance, located in anomalous zones. For example, the Main Astronomical Observatory of the National Academy of Sciences of Ukraine located in the Holosiivskyi Forest, just 12 km from the centre of Kyiv, the capital of Ukraine. This means that the whole experiment would involve comparing, and detecting differences in, positions of stars located at the same fragment of the starry sky observed by different observatories. This presupposes that the information obtained should be transferred by observatories of the same region to a single computing centre (Fig. 7) and processed to detect the differences.

CONCLUSION

Let's summarize. All the experiments described above refute the generally accepted version of the SRT. This occurs in a different way. Collectively all these refutations are even more convincing. Thus, the proofs of physical reality of imaginary numbers given in sections 2.1 and 2.2 undoubtedly refute the principle of light speed non-exceedance and thereby the whole existing SRT. Section 4.2 offers a description of an experiment that has not yet been performed,

but is very demonstrative. The experiment allows discovering invisible universes. Section 4.1 mentions the experiments that were conducted in the last century. They allowed discovering the phenomena of dark matter and dark energy that are actually evoked by invisible universes. Although one experimental proof is usually enough to refute other theories, the existing version of the SRT has not been refuted. The erroneous version of the SRT is even presented for study in physics textbooks, which must contain only unconditionally correct theories. Hence, authors of the textbooks create the impression that the generally accepted version of the SRT is also unconditionally correct, although there already have been published dozens of articles, proving that it can be refuted by existence of television and radiolocation, GPS and mobile telephony, musical instruments and children's swings created by humans, as well as tsunami and 'Indian summer' created by nature, resonance, Ohm's law in the interpretation of Steinmetz and many other things.

For all that, why then the incorrect version of the SRT hasn't still been refuted? Why, for example, decisions on banning criticism of the SRT were made by Soviet Government three times: in 1934, 1942 and 1964? It hasn't still been criticized. The author of the article does not know answer to these questions. However, authors of the textbooks might not have read my articles. Or, if they have read, they haven't believed and verified it. Anyway, this needs to be done. And textbooks need to be corrected, because it is immoral to provide outdated and unimproved knowledge to students [24]-[33]. After all, Albert Einstein wrote: "There is no single idea, which I would be sure that it will stand the test of time".

An alternative version of the SRT confirmed experimentally is described in publications [38]-[50].

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References

- [1]. Čerenkov, P. A (1937) Visible Radiation Produced by Electrons Moving in a Medium with Velocities Exceeding that of Light. *Physical Review*. 52(4), 378-379. doi:<https://doi.org/10.1103/PhysRev.52.378>
- [2]. Adam T., Agafonova N., Aleksandrov A. et al. (2012). Measurement of the neutrino velocity with the OPERA detector in the CNGS beam. *arXiv:1109.4897v4 [hep-ex]*.
- [3]. Antonello M., Baibussinov B., Boffelli F. et al. (2012). Precision measurement of the neutrino velocity with the ICARUS detector in the CNGS beam. *arXiv:1208.2629v2 [hep-ex]*.
- [4]. Antonov A. A. (2008). Physical Reality of Resonance on Complex Frequencies. *European Journal of Scientific Research*. 21(4). 627-641.
- [5]. Antonov A. A. (2009), Resonance on Real and Complex Frequencies. *European Journal of Scientific Research*. 28(2). 193-204.
- [6]. Antonov A. A. (2010). Oscillation processes as a tool of physics cognition. *American Journal of Scientific and Industrial Research*. 1(2). 342-349. doi:10.5251/ajsir.2010.1.2.342.349
- [7]. Antonov A. A. (2010). New Interpretation of Resonance. *International Journal of Pure and Applied Sciences and Technology*. 1(2). 1-12.

- [8]. Antonov A. A. (2010). Solution of algebraic quadratic equations taking into account transitional processes in oscillation systems. *General Mathematics Notes*. 1(2). 11-16. http://doi.org/10.17686/sced_rusnauka_2010-887
- [9]. Antonov A. A. (2013). *Unpredictable discoveries*. Lambert Academic Publishing. Saarbrücken, Deutschland.
- [10]. Antonov A. A. (2013). Physical Reality of Complex Numbers. *International Journal of Management, IT and Engineering*. 3(4) 219 – 230. http://doi.org/10.17686/sced_rusnauka_2013-898
- [11]. Antonov A.A. (2015) The principle of the physical reality of imaginary and complex numbers in modern cosmology: the nature of dark matter and dark energy. *Journal of Russian physical and chemical society*. 87(1). 328-355. In Russian.
- [12]. Antonov A. A. (2015). Physical reality of complex numbers is proved by research of resonance. *General Mathematics Notes*. 31(2). 34-53. http://www.emis.de/journals/GMN/yahoo_site_admin/assets/docs/4_GMN-9212-V31N2.1293701.pdf
- [13]. Antonov A. A. (2015). Adjustment of the special theory of relativity according to the Ohm's law. *American Journal of Electrical and Electronics Engineering*. 3(5). 124-129. doi: 10.12691/ajeee-3-5-3
- [14]. Antonov A. A. (2015). Ohm's law explains astrophysical phenomenon of dark matter and dark energy. *Global Journal of Physics* 2(2). 145-149. http://gpcpublishing.com/index.php?journal=gjp&page=article&op=view&path%5B%5D=294&path%5B%5D=pdf_14
- [15]. Antonov A. A. (2016). Ohm's Law is the general law of exact sciences. *PONTE*. 72(7) 131-142. doi: 10.21506/j.ponte.2016.7/9
- [16]. Antonov A. A. (2016). Ohm's law refutes current version of the special theory of relativity. *Journal of Modern Physics*. 7. 2299-2313. <http://dx.doi.org/10.4236/jmp.2016.716198>
- [17]. Antonov A. A. (2016). Ohm's Law explains phenomenon of dark matter and dark energy. *International Review of Physics*. 10(2). 31-35. <https://www.praiseworthyprize.org/jsm/index.php?journal=irephy&page=article&op=view&path%5B%5D=18615>
- [18]. Antonov A. A. (2016). Physical Reality and Nature of Imaginary, Complex and Hypercomplex Numbers. *General Mathematics Notes*. 35(2). 40-63. http://www.geman.in/yahoo_site_admin/assets/docs/4_GMN-10932-V35N2.31895146.pdf
- [19]. Antonov A.A. (2017). The physical reality and essence of imaginary numbers. *Norwegian Journal of development of the International Science*. 6. 50-63. <http://www.njd-iscience.com>
- [20]. Antonov A. A. (2014). Correction of the special theory of relativity: physical reality and nature of imaginary and complex numbers. *American Journal of Scientific and Industrial Research*. 5(2). 40-52. doi:10.5251/ajsir.2014.5.2.40.52
- [21]. Antonov A. A. (2019). The special theory of relativity was not and, moreover, could not be created in the 20th century. *Journal of Russian physical and chemical society*. 91(1). 57-94. In Russian. <http://www.rusphysics.ru/magazine/1207/>
- [22]. Antonov A. A. (2020). Albert Einstein was ahead of his time: the existing version of the special theory of relativity was not completed by him due to the lack of experimental data obtained only in the 21st century. *Journal of Russian physical and chemical society*. 92(1). 39-72. In Russian. http://www.rusphysics.ru/files/Antonov_Albert_92-1%20.pdf
- [23]. Antonov A. A. 2021. Relativistic formulas of the existing version of the special theory of relativity are incorrect, they are incorrectly explained and incorrect conclusions are drawn from them. *German International Journal of Modern Science*. 4(1). 38-47.

- [24]. Antonov A. A. (2021). The special theory of relativity presented in physics textbooks is wrong. International scientific conference of Eurasian Scientific Association "Theoretical and practical issues of modern science". Moscow. 7(77). 11-15. DOI: 10.5285/zenodo.5168528
- [25]. Antonov A.A. 2021 Special theory of relativity, which is studied in physics textbooks, is incorrect. German International Journal of Modern Science. 16. 49-53. DOI: 10.24412/2701-8369-2021-16-49-53
- [26]. Antonov A.A. 2021 Special theory of relativity, taught in physics textbooks is wrong. Journal of science. Lyon. 23. 52-57. <https://www.joslyon.com/>
- [27]. Antonov A.A. 2021 Special theory of relativity, taught in all physics textbooks is incorrect. Annali d'Italia. 21. 39-44. <https://www.anditalia.com/>
- [28]. Antonov A.A. 2021 Special theory of relativity presented in physics textbooks is wrong. Norwegian Journal of development of the International Science. 68(1). 3-7. <http://www.njd-iscience.com>
- [29]. Antonov A.A. 2021 In all physics textbooks an erroneous version of special theory of relativity is given. International independent scientific journal. 31. 34-38. <http://www.iis-journal.com>
- [30]. Antonov A.A. 2021 Version of special theory of relativity that is studied taught in all physics textbooks is incorrect. Österreichisches Multiscience Journal (Innsbruck, Austria). 43(1). 17-22. <http://osterr-science.com>
- [31]. Antonov A.A. 2021 Special theory of relativity, which is studied in all physics textbooks is incorrect. Danish Scientific Journal. 51(1). 31-35. <http://www.danish-journal.com>
- [32]. Antonov A.A. 2021 Generally accepted version of the special theory of relativity contained in physics textbooks is incorrect. The scientific heritage. 73(2). 39-50. web: www.tsh-journal.com
- [33]. Antonov A.A. 2021 All physics textbooks study incorrect special theory of relativity. Sciences of Europe (Praha, Czech Republic). 79(1). 30-34. web: www.european-science.org
- [34]. Antonov A. A. (2015). Quaternion Structure of the Hidden Multiverse: Explanation of Dark Matter and Dark Energy. Global Journal of Science Frontier Research: A Physics and Space Science. 15(8). Version 1. 8-15.
- [35]. Antonov A.A. (2017) Nature of Dark Matter and Dark Energy. Journal of Modern Physics, 8, 567-582. <https://doi.org/10.4236/jmp.2017.84038>
- [36]. Antonov A. A. 2020. Einstein was wrong: according to WMAP and Planck spacecraft research we live in a six-dimensional hypercomplex space. Österreichisches Multiscience Journal (Innsbruck, Austria). 35(1). 61-72. <http://osterr-science.com>.
- [37]. Kantor I.L., Solodovnikov A.S. (1989). Hypercomplex numbers. Springer Verlag. Berlin.
- [38]. Antonov A. A. 2020. Comparative Analysis of Existing and Alternative Version of the Special Theory of Relativity. Journal of Modern Physics. 11(2), 324-342. DOI: 10.4236/jmp.2020.112020
- [39]. Antonov A.A. (2016) What Physical World do We Live in? Journal of Modern Physics, 7(14) 1933-1943 <http://dx.doi.org/10.4236/jmp.2016.714170>
- [40]. Antonov A. A. 2021 What is our physical world. 71 International scientific conference of Eurasian Scientific Association "Science and modernity". 1-9. Moscow. ESA. (in Russian) DOI: 105281/zenodo.4526585
- [41]. Antonov A.A. 2021 Antimatter, Anti-Space, Anti-Time. Journal of Modern Physics. 12(05). 646-660. DOI: 10.4236/jmp.2021.125042
- [42]. Antonov A. A. 2021 Antimatter, anti-space and anti-time. 75 International scientific conference of Eurasian Scientific Association "Strategies for stable development of world science". 1-4. Moscow. ESA. (in Russian) DOI: 105281/zenodo.4926585
- [43]. Antonov A. A. 2021 Do antimatter, anti-time and anti-space exist in nature. Annali d'Italia. 20(1). 14-24. <https://www.anditalia.com>

- [44]. Antonov A. A. 2021 From the alternative version of the SRT it follows that there is not only antimatter, but also anti-space and anti-time. *Norwegian Journal of Development of the International Science*. 62(1). 41-51. DOI: 10.24412/3453-9875-2021-62-1-41-51
- [45]. Antonov A. A. 2021 Antipodes in space. *German International Journal of Modern Science*. 11(1). 15-25. DOI: 10.24412/2701-8369-2021-11-1-15-25
- [46]. Antonov A. A. 2021 There is not only antimatter, but also anti-space and anti-time. *Journal of science*. Lyon. 21. 22-31. <https://www.joslyon.com/>
- [47]. Antonov A. A. 2021 Where are antimatter, anti-space and anti-time? *Österreichisches Multiscience Journal*. 40(1). 43-54. <http://osterr-science.com>
- [48]. Antonov A. A. 2021 Do antimatter, anti-time and anti-space exist in nature? *Danish Scientific Journal*. 50. 64-74. <http://www.danish-journal.com>
- [49]. Antonov A. A. 2021 Antipodes in space. *International independent scientific journal*. 28. 50-61. <http://www.iis-journal.com>
- [50]. Antonov A. A. 2021 How alternative version of SRT explains the existence of antimatter, anti-space and anti-time? *The scientific heritage (Budapest, Hungary)*. 67(1). 11-21. DOI: 10.24412/9215-0365-2021-67-1-11-21
- [51]. Ruiz-Lapuente P. Ed. (2010). *Dark Energy: Observational and Theoretical Approaches*. Cambridge university press. Cambridge, UK
- [52]. Amendola L, Tsujikawa S. (2010). *Dark Energy: Theory and Observations*. Cambridge university press. Cambridge, UK
- [53]. Sanders R.H. (2014). *The dark matter problem: a historical perspective*. Cambridge university press. Cambridge, UK
- [54]. Lewis D. (1986). *On the Plurality of Worlds*. Basil Blackwell, Oxford.
- [55]. Deutsch D. (2002). The structure of the multiverse. *Proceedings of the Royal Society A*. 458, 2911– 2923.
- [56]. Tegmark, M. (2003). Parallel Universes, *Scientific American*, 288(5), 40 – 51.
- [57]. Ellis, G.F.R., Kirchner U. and Stoeger, W.R. (2004). Multiverses and physical cosmology, *Monthly Notices of the Royal Astronomical Society*. 347(3), 921 – 936.
- [58]. Kaku M., (2006) Reprint Edition. *Parallel Worlds: A Journey Through Creation, Higher Dimensions, and the Future of the Cosmos*. Anchor, NY.
- [59]. Carr B. ed. (2009). *Universe or Multiverse?* Cambridge Univ. Press.
- [60]. Lucash V.N. and Mikheyeva, E.V. (2010). *Physical cosmology*, Phymathlit Publishing, Moscow. In Russian.
- [61]. Greene B. (2011). *The Hidden Reality: Parallel Universes and the Deep Laws of the Cosmos*, Knopf.
- [62]. Antonov A. A. (2016). Explaining the Phenomenon of Dark Matter and Dark Energy by Existence of the Hidden Multiverse. *Frontiers of Astronomy, Astrophysics and Cosmology*. 2016. 2(1) 1-9. DOI:10.12691/faac-2-1-1
- [63]. Antonov A. A. 2019. Explanation of Dark Matter, Dark Energy and Dark Space: Discovery of Invisible Universes. *Journal of Modern Physics*. 10. 1006-1028. <https://doi.org/10.4236/jmp.2019.108067>
- [64]. Antonov A. A. 2020. How to See Invisible Universes. *Journal of Modern Physics*. 11(05) 593-607. DOI: 10.4236/jmp.2020.115039
- [65]. Antonov A. A. 2020. Universes Being Invisible on Earth outside the Portals Are Visible in Portals. *Natural Science*. 12(08), 569-587. <http://doi.org/10.4236/ns2020.128044>
- [66]. Chernobrov V.A. (2000) *Encyclopaedia of Mysterious Places of the Earth*. Veche Publishing, Bucharest. In Russian
- [67]. Antonov A.A. *Stargate of the hidden Multiverse*. *Philosophy & Cosmology*. 2016. 6. 11-27

-
- [68]. Dyson, F. W.; Eddington, A. S.; Davidson, C. (1920). A Determination of the Deflection of Light by the Sun's Gravitational Field, from Observations Made at the Total Eclipse of May 29, 1919. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*. 220, 291–333. doi:10.1098/rsta.1920.0009.