The Theory of Relativity by Albert Einstein & the Physical Society – Part I

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Version 4 in the e-Print archive "rxiv.org"

DOI: 10.13140/RG.2.1.1962.1602

ABSTRACT

This review is an attempt to close one important page of the 20th century physics – the "Theory of Relativity". The background of the research is (1) analysis of all "unexpected" and "inexplicable" results of the most famous experiments related to the measurement of the speed of light and (2) the published articles "The Speed of Light and Uncertainty Principle of the Macro-world" and "Awareness of Special and General Relativity and Local and General Physical Reality". The research results are "MODEL OF UNCERTAINTY OF THE UNIVERSE" and "THESIS ABOUT THE BEHAVIOR OF THE ELECTROMAGNETIC RADIATION IN GRAVITATIONAL FIELD", which actually replaces the postulate of invariance of the speed of light formulated by Albert Einstein. The conclusion about the theory of relativity is given as a result of awareness of the physical reality (also based on Einstein's citation - when "the relativity theory could not be maintained…").

Keywords*: Theory of Relativity, Speed of light postulate, Special Relativity, Michelson-Morley experiment, Sagnac experiment.*

PACS: 04.20.Cv - "Fundamental problems and general formalism";
04.20.Ex - "Initial value problem, existence and uniqueness of solutions";
06.20.F - "Units and standards";

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0. PREFACE BY THE AUTHOR

The present article "The Theory of Relativity by Albert Einstein & the Physical Society – Part I" will be submitted for publication in physics journals with a high impact factor but with a title "The Theory of Relativity by Albert Einstein – Awareness of the Physical Reality". The discussions (or the silence) of the editorial boards of these journals, (which can belong to the orthodox part of the physical society) will be publicized in the next article "The Theory of Relativity by Albert Einstein & the Physical Society – Part II".

1. INTRODUCTION

The "Theory of Relativity" usually encompasses both theories by Albert Einstein: the "*Special Theory of Relativity*" and the "*General Theory of Relativity*". The word "relativity" can also be used in the context of an older theory - that of the Galilean relativity. Galileo Galilei first described the principle of relativity in 1632. This principle states that the laws of motion are the same in all inertial frames of reference. Historically, after the development of Maxwell's theory of electromagnetism, have arisen the questions about the velocity of light and what medium supports the transmission of the electromagnetic waves. For James Clerk Maxwell and other scientists of that time, the answer was that light travels in a hypothetical medium called luminiferous ether. Albert Michelson (the so-called master of light) made his first experiment in 1881 in order to determine the rate of the motion of the Earth relatively to the stationary luminiferous ether. The result was that the hypothesis of stationary ether is incorrect. It was confirmed in 1887 by the "famous" Michelson-Morley experiment. FitzGerald, as well as Lorentz, attributed the "null result" of the experiments to a hypothetical contraction of the physical quantity "length", affecting the path traveled by the light. On the base of this idea, Albert Einstein proposed the complete explanation theory "Special Theory of Relativity" in his article "*On the Electrodynamics of Moving Bodies*"[1].

2. MODEL OF UNCERTAINTY OF THE UNIVERSE

The results of the most famous experiments related to the measurement of the speed of light show that the model of the physical reality in the Universe has to be considered in two aspects – in "the local physical reality" and in "the global physical reality".

2.1. Used Definitions and Acceptations

Time and space are mutually connected. The electromagnetic field exists on the gravitational field. The characteristics of the electromagnetic field μ_0 (permeability of free space) and ε_0 (permittivity of free space) are only local constants, and they are changing together with the change of the gravitational field intensity. In fact, the wavelength and the frequency of electromagnetic radiation are its spatial- and time-characteristics respectively. Space-time itself is often called "vacuum" or "empty space" and it actually exists on many levels. It lays among the elementary particles of matter, among all the planets, stars and

galaxies. All these levels are interconnected, depending on each other, and changing in perfect but not yet discovered synchrony.

2.1.1. General Definition of the Universe

On the basis of awareness of the physical reality, the following general definition of the Universe can be given:

> *"The Universe is warped by matter time-spatial gravitational force-field, on which other fields exist (such as the electromagnetic field), and where the energy accumulates and transforms."*

2.1.2. Definition of GRULW (Global Relative Universe Level of Warping) of a time-spatial domain

Any time-spatial domain of "empty space" in the Universe has a certain intensity of gravitational field. Clearly, "absolute" intensity of gravitational field does not exist, but we can compare the intensity of a gravitational field among time-spatial domains or to a certain reference. Different local areas in the Universe can be characterized by their GRULW (Global Relative Universe Level of Warping), which is actually a "relative local space-time level of expansion/contraction".[1]

2.1.3. Definition of time-spatial domain "Local Physical Reality"

> *"The local physical reality is any time-spatial domain with equal intensity of the gravitational field. Our local physical reality can be named "on the Earth's surface"".*

2.1.4. Definition of "Global Physical Reality" in the Universe

> *"The Global physical reality in the Universe is actually an infinite set of local time-spatial domains among the celestial bodies (and on the celestial bodies' surfaces). Generally, the time-spatial domains are with different intensities of the gravitational field."*

2.2. Model of the Physical Reality in the Universe

The Model of the Physical Reality in the Universe is based on the nature of existence of the electromagnetic field on a gravitational field.

2.2.1. Behavior of the electromagnetic radiation in local time-spatial domain

> *The celestial bodies (like the Earth) are rotating in the stationary (surrounded, contiguous, warped by the celestial body itself and belonging to it) local "time-spatial domain".*

[1] In this paper it is accepted that "empty space" or "vacuum", corresponds to the "reference system related to the space itself", as well as the "Earth-centered inertial (ECI) coordinate frame" which has its origin at the center of the Earth and it is stationary in the space.

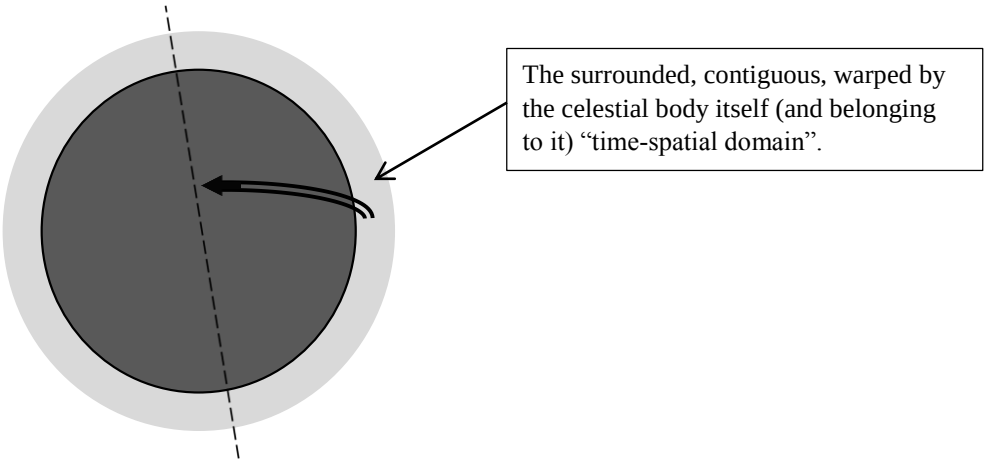

Fig.1. Rotation of the celestial bodies in the stationary space of the “local time-spatial domain”

In the local time-spatial domain “on the Earth’s surface”, the speed of light in the ECI reference frame (in the “empty space”) is a constant that corresponds to the local intensity of the gravitational field. However, in the frame of reference related to the Earth’s surface “light speed anisotropy” is a real fact due to the rotation of the celestial body in the stationary “empty space”.

Confirmation: In the case of “One-Way Light Speed Determination” in the reference system related to the Earth’s surface – the measured speed of light in direction “East-to-West” is higher than the measured speed of light in direction “West-to-East”. This difference corresponds to the linear speed of the Earth’s surface at this latitude [see subsection 4.1].

2.2.2. Behavior of the electromagnetic radiation in the Global Physical Reality of the Universe

All celestial bodies (as well as the Earth) are traveling through the space-time of the Universe ***together with*** *the contiguous, warped by the body itself (and belonging to it) “time-spatial domain”.*

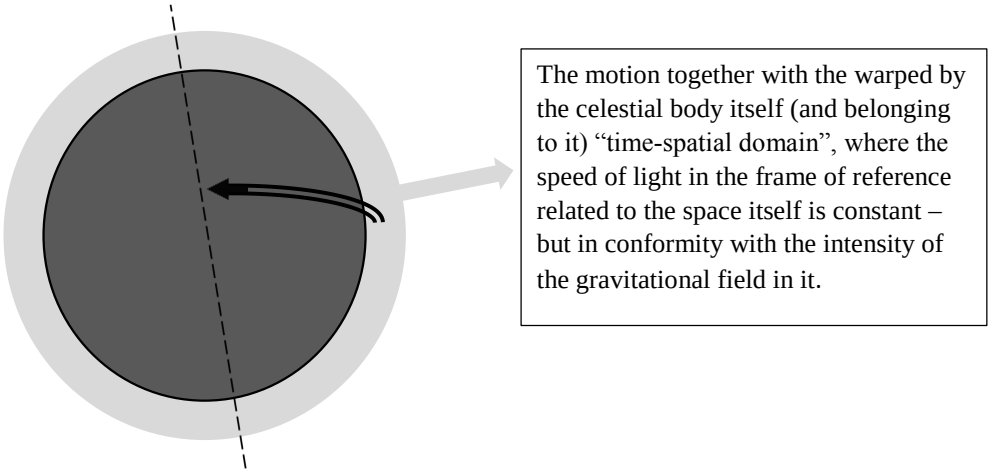

Fig.2. Moving of the celestial bodies together with their “own time-spatial domain”

This is the reason why it is no variation in the speed of light due to the motion of the Earth around the Sun and in the Galaxy. The speed of light in the “empty space” on the Earth’s surface remains always the same and corresponds to the equal intensity of the gravitational field in the local time-spatial domain “on

the Earth's surface". At the entrance toward the increasing intensity of the gravitational field of the time-spatial domain surrounding the Earth, photons are losing energy, which is absorbed by the gravitational field. The frequency and the wavelength of the photons are decreasing, therefore the speed of the photons is decreasing ($c=\nu.\lambda$) in conformity with the level of the gravitational field intensity. However, with the change of the frequency and the wavelength, the base units of time "second" and of the length "metre" are changing too, because they are defined by means of the frequency and the wavelength of the electromagnetic radiation. So, the measured value of the changing speed of light remains always the same, because it is measured with the changing units of time and length (circular reference). In this sense, one can say that the speed of light in "empty space" is a constant in all frames of reference... and moreover, that the speed of light is a fundamental constant in the Universe. It is a big delusion, because actually the speed of light in "empty space" is different in areas with different intensity of the gravitational field and it is changing in synchrony with the measurement units of time and length [2].[2]

On the base of this "Model of the Physical Reality", the suggested "Thesis about the Behavior of the Electromagnetic Radiation in Gravitational Field" [section 3] actually replaces the postulate of invariance of the speed of light formulated by Albert Einstein. As a result, all "unexpected" and "inexplicable" results of the famous experiments related to the measurement of the speed of light obtain their genuine explanations [section 4].

Some subsequent delusions:

- As a consequence, the reader will logically come to a conclusion that the astronomical unit of length "light year" is a big delusion.
- The "red shift" or the "blue shift" of the frequency of the electromagnetic radiation due to the "Doppler effect" is actually another big delusion. Moreover, this delusion has caused other big problems in the physics today to be generated (such as: "the accelerated expansion of the Universe"; "the dark matter and the dark energy in the Universe", etc.), which have been under research for a long time…
- In areas with equal intensity of the gravitational field: With the change of the energy (frequency) of the electromagnetic radiation, the wavelength is changing too, but in a way that the correlation between them (the speed of light) remains the same. This is the case of the "radar gun", when the momentum (the energy) of the photon is changing at the contact with a moving object. Therefore, the explanation that the change of frequency of the photons is due to the "Doppler effect" is another delusion.

2.3. Uncertainty in the Macro-World

The characteristics of the electromagnetic field are changing together with the change of the gravitational field intensity; the properties of the atoms are also changing; all the measurement units and physical constants are changing… all physical reality is changing in synchrony, but in a still undiscovered way.

[2] The accepted in contemporary physics behavior of the photons in the gravitational field is erroneous and does not correspond to the physical reality.

We can receive information from the Universe only by means of the electromagnetic radiation. The electromagnetic signals travel to the Earth for an uncertain period of changing time, cover an uncertain distance of warped space at an uncertain speed.

> *"The uncertainty of the macro-world consists in the fact, that we cannot measure or calculate in our local time-spatial domain (where the units of time and length are defined by means of the characteristics of the electromagnetic radiation), neither the change of the defined by us units, nor the change of all our local constants, because they all change in perfect synchrony with the change of the entire physical reality. Also, we cannot measure or calculate any change in the entire physical reality in another remote time-spatial domain with different level of contraction/expansion of the space-time, because the measurement units in the remote domain are uncertainly different."* [2].

In other words, **if** all units of the physical quantities are changing in synchrony with the change of the gravitational field intensity, **then**:

1) in time-spatial domains with different intensity of the gravitational field – all physical equations (representing the physical laws) will be the same. Thus, the values of all the local physical constants will be measured the same too, because the measurement units will differ exactly in correspondence to the intensity of the gravitational field in these time-spatial domains.

2) in time-spatial domain with equal intensity of the gravitational field (equal in every point), but where the intensity of the gravitational field is varying (in the same way in any point)– the laws of physics will remain the same. As a result, all the local physical units and physical constants will vary in synchrony, and we will not be able to register whatever change. Therefore, the perception of "absoluteness" will be perfect, and the delusion will be "irrefutable".

3. THESIS ABOUT THE BEHAVIOR OF THE ELECTROMAGNETIC RADIATION IN GRAVITATIONAL FIELD

As a logical consequence of the presented "Model of uncertainty of the Universe", the following "Thesis about the behavior of the electromagnetic radiation in a gravitational field" is formulated. It replaces the postulate of invariance of the speed of light formulated by Albert Einstein.

3.1. In Areas with Equal Intensity of the Gravitational Field (the Local Physical Reality)

Statement 1) *The speed of the electromagnetic radiation is a local constant in the "reference system related to the space itself", (in "empty space").*

In a "time-spatial domain" where the intensity of the gravitational field is the same, the speed of the electromagnetic radiation is a constant and depends only on the intensity of the gravitational field. However, it is only a local constant, because if we measure it using the units of time and length defined in another "time-spatial domain" with a different intensity of the gravitational field – the measured value for the speed of the electromagnetic radiation will be different. [2]

Statement 2) *The speed of the electromagnetic radiation in the "reference system related to the space itself" does not depend neither on the velocity of the body of the source of electromagnetic radiation, nor on the velocity of the body of the detector (the Observer).*

This is because the electromagnetic radiation is a vibration, which occurs at a quantum level and does not depend on the speed of the body to which the atom belongs (the atom which emits or absorbs the photons).

Statement 3) *The measured velocity of the electromagnetic radiation in areas with an equal gravitational field intensity is not the same in all frames of reference.*

Mathematically, in areas with an equal gravitational intensity, the relationship between the readings in the different reference systems is expressed through Galilean transformations - it is a subject of Newtonian mechanics. This fact is actually proved by the experiments "One way light speed determination", "Sagnac's experiment" and "Michelson-Gale-Pearson Experiment".

3.2. In Areas with Different Intensity of the Gravitational Field (the Global Physical Reality in the Universe)

Statement 1) *The speed of the electromagnetic radiation in vacuum (in the reference system related to the space itself) depends on the intensity of the gravitational field and it is different in the time-spatial domains with different intensity of the gravitational field. The speed of the electromagnetic radiation in vacuum changes when it passes through areas with different intensity of the gravitational field.*

In more details, the speed of the electromagnetic radiation increases in areas with a weaker gravitational field and decreases in areas with a stronger gravitational field. This fact is actually proved by the Shapiro time-delay effect [3].

Statement 2) *The properties of the atoms (photon emission and absorption) are different in areas with different intensity of the gravitational field. The energy of the emitted and absorbed photons, what means the frequency and wavelength (at a transition between the same hyperfine levels) are in conformity with the intensity of the gravitational field in the area where the atom is located.*

This is so, because the electromagnetic field exists on the gravitational field.

4. GENUINE EXPLANATION OF ALL THE "UNEXPECTED" AND "INEXPLICABLE" RESULTS OF THE FAMOUS EXPERIMENTS RELATED TO THE MEASUREMENT OF THE SPEED OF LIGHT

Initial conditions:

- The experiments are carried out in our local physical reality – in the time spatial domain "on the Earth's surface", where the intensity of the gravitational field is equal (the same), and where the units of the time and length are defined by means of the characteristics of the electromagnetic radiation.
- The two frames of reference, which we are considering are: the first one, related to the Earth's surface and the second one, related to the space itself. As mentioned above, the "reference system related to the space itself", corresponds to the "Earth-centered inertial (ECI) coordinate frame" which has its origin at the center of the Earth and is stationary in the space.

4.1. One-Way Light Speed Determination

Based on GPS timing, Marmet [4] observed that a light signal takes traveling eastward from San Francisco to New York about 28 nanoseconds longer than traveling westward from New York to San Francisco. Using GPS, Kelly [5] shows that the light signal takes 414.8 nanoseconds longer to circumnavigate the Earth eastward at the equator than the light travelling westward around the same path. Both researchers concluded that these observed travel time differences in each direction arise because light travels at speed *(c-V)* eastward and at speed *(c+V)* westward, where *V* is the linear speed of the Earth's surface at the corresponding latitude.

Here, we will examine the both cases - the case "Eastward Transmission" and the case "Westward Transmission". The transmitter, the receiver and the propagation path (the path of light) are located in a time-spatial domain with equal intensity of the gravitational field (on the surface of the Earth). In the "ECI coordinate frame", the transmitting and receiving stations are moving towards East (together with the Earth's surface) at the speed *V* for the corresponding latitude. The position of station A in the ECI coordinate frame at time *t* is $X_A(t)$ and the position of the reception station B is $X_B(t)$. The distance on the ground surface between station A and station B is equal to *D*. According to the thesis [subsection 3.1], in areas with equal intensity of the gravitational field (our local physical reality), the speed of light in "empty space" (in relation to the ECI coordinate frame) is constant.

4.1.1. The case "Eastward Transmission"

Station A transmits a signal eastward at time t_I to station B, which receives it at time t_F.

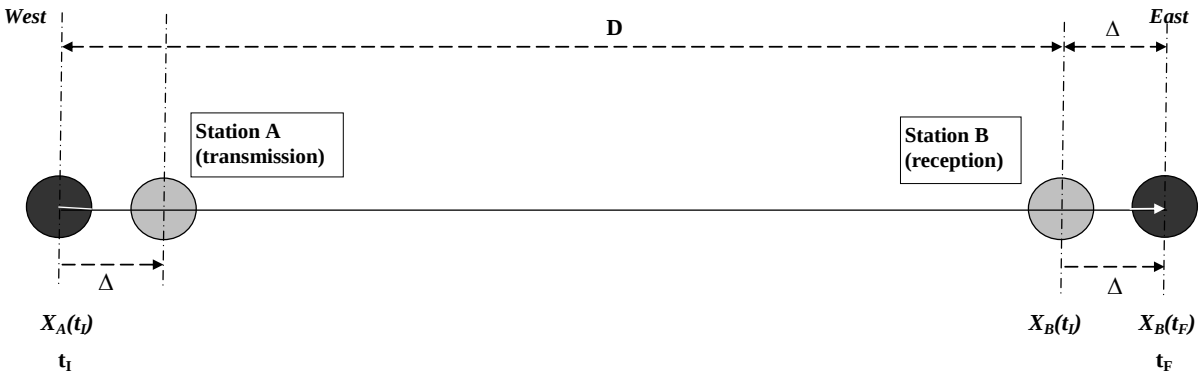

Fig.3. One-way light speed determination – eastward transmission

Explanation of the experiment in conformity with the physical reality:

- In the Earth-centered inertial system (ECI):

The light passes a certain distance in "empty space" - from the position $X_A(t_I)$ of station A at the moment of transmission t_I , to the position $X_B(t_F)$ of station B at the moment of receiving t_F (see Fig.3). This distance is equal to the distance between the two stations D plus the distance Δ, which station B passes during the time interval of $(t_F - t_I)$ at a speed V (as the surface of the Earth). The time interval between the transmitting and receiving is:

$$(t_F - t_I) = \frac{Path}{c} = \frac{D + \Delta}{c} \qquad (1)$$

, where c is the local constant "speed of light" in "empty space" in our local physical reality "on the Earth's surface".

- However, in the reference system related to the Earth's surface, the obtained result is:

The light passes the exact distance equal to D for the time interval ($t_F - t_I$) and the measured speed of light in the case "Eastward transmission" is equal to (c - V):

$$(t_F - t_I) = \frac{D}{c - V} \tag{2}$$

As the reader can see, the expression (2) is the same as (1), but Δ is replaced with $\big(V(t_F - t_I)\big)$.

4.1.2. The case "Westward Transmission"

Station A transmits a signal at time t_I, to station B, but westward, and station B receives electromagnetic signal at time t_F.

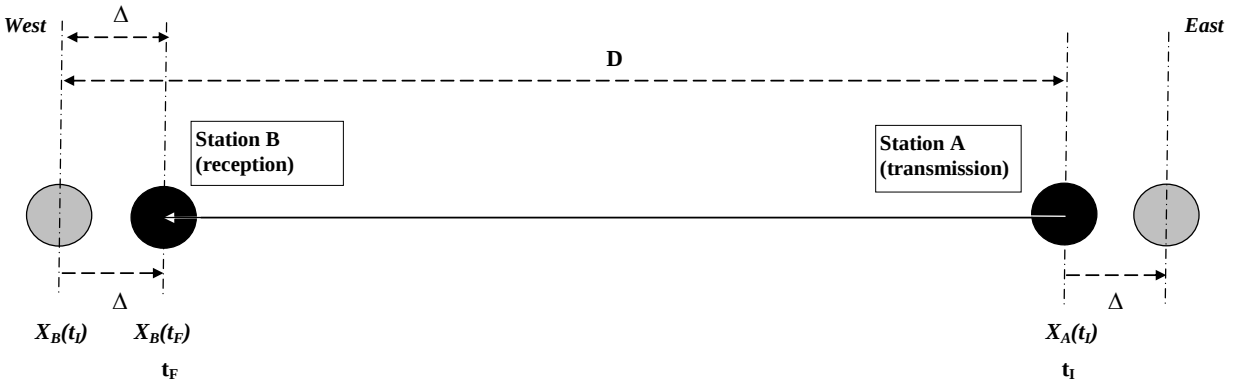

Fig.4. One-way light speed determination – westward transmission

Explanation of the experiment in conformity with the physical reality:

- In the Earth-centered inertial system (ECI):

The light passes a certain distance in the "empty space" - from the position $X_A(t_I)$ of station A at the moment of transmission t_I , to the position $X_B(t_F)$ the station B at the moment of receiving t_F (see Fig.4). However, this distance is equal to the distance between the two stations D minus the distance Δ, which the station B passes during the time interval of ($t_F - t_I$) at a speed V (as the surface of the Earth). The time interval between the transmitting and receiving is:

$$(t_F - t_I) = \frac{Path}{c} = \frac{D - \Delta}{c} \tag{3}$$

- Respectively, in the reference system related to the Earth's surface, the obtained result is:

The light passes the exact distance equal to D for the time interval ($t_F - t_I$) and the measured speed of light in the case "Westward transmission" is equal to (c + V):

$$(t_F - t_I) = \frac{D}{c + V} \tag{4}$$

Again, the expression (4) is the same as (3), but Δ is replaced with $\big(V(t_F - t_I)\big)$.

4.1.3. Conclusion related to the experiments "One-Way Light Speed Determination"

Therefore, the experiments "One-Way Light Speed Determination" are irrefutable evidence that:

> The speed of light in the local time-spatial domain with equal intensity of the gravitational field is not the same in all the frames of reference.

4.2. Sagnac's Experiment

George Sagnac, French physicist, constructed a device "ring interferometer", also called "Sagnac interferometer". The light source, collimator, beam-splitter, light pencils and 4 mirrors of the interferometer (Fig.5), were all mounted on a spinning disc (0.5 m in diameter). In this way, they are all rotating in the reference system associated to the space itself -"in empty space".

Description of the experiment: A monochromatic light beam is split and the two beams are designed to follow the same path but in opposite directions around a polygonal mirror course. The two recombined beams are then focused on a photographic plate, permitting measurement of fringe shifts with a high accuracy, as was described by Sagnac [6]. The observed effect is that the displacement of the interference fringes is changing with the change of the velocity of the disk rotation.

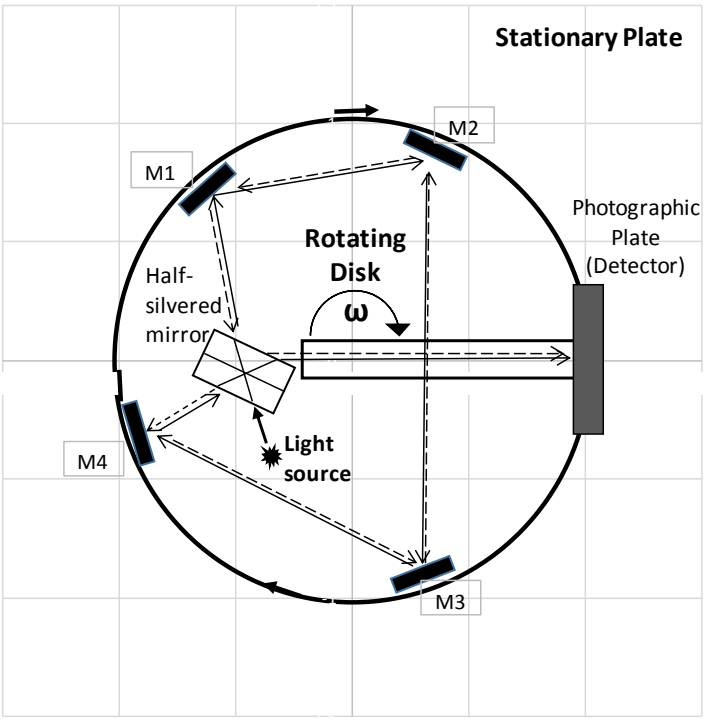

Fig.5. Schematic representation of the Sagnac interferometer

The reported result by George Sagnac is:

> *"The result of these measurements shows that, in ambient space, light propagates with a velocity V_0 , independent of the collective motion of the source of light O and the optical system. This property of space experimentally characterizes the luminiferous aether. The*

interferometer measures, according to the expression $\frac{1}{4}z\lambda V_0$ *, the relative circulation of the luminiferous aether in the closed circuit."* [6]

This result is in correspondence with the aforementioned thesis for areas with equal intensity of the gravitational field [subsection 3.1]. The difference is that the real fact "the speed of light is not the same in all the frames of reference", has been explained with a relative circulation of the luminiferous ether in the closed circuit.

4.2.1. Explanation of the experiment in conformity with the physical reality

It is appropriate to consider the Sagnac's experiment in a Disk-Centered Inertial (DCI) coordinate frame, which is stationary in the space (similarly to ECI frame), where the disk is rotating (instead of the Earth). The plane of the disk represents the x,y plane and the origin of the DCI coordinate frame is the center of the disk.

- Examination of the Sagnac's experiment in the frame of reference related to the space itself – in the so named DCI frame of reference:

According to the thesis [subsection 3.1, paragraph 1], in areas with equal intensity of the gravitational field (like our local physical reality), the speed of light in relation to the stationary DCI frame is constant, equal to *c*. However, all the apparatuses mounted on the spinning disc are rotating (moving) in the stationary DCI frame of reference. The two light beams travel in opposite directions. Therefore, in this frame of reference, the pathlengths, which the two light beams actually cover in the space, are different. It is due to the movement of the target's mirrors in the space during the travel time of the light. Thus, the path length of one of the light beams is shortening and the pathlength of the other light beam (which travels in the direction of the disk rotation) is extending. As a result of the change of the pathlengths of the two light beams due to the different velocities of the disk rotation - different phases between the two beams are created.

Therefore, the conclusion for this frame of reference is that the displacement of the interference fringes is due to the change of the pathlengths covered by the two light beams, which in turn is dependent on the velocity of the disk rotation.

- Examination of the Sagnac's experiment in the frame of reference related to the rotating disk:

In this frame of reference, the mirrors, the light source and the photographic plate are stationary and the pathlengths of the beams (the distances among the mirrors) are not changing when the disk is rotating. As a result, the speed of the two light beams in the reference system related to the spinning disk is different and depends on the velocity of rotation: the speed of the beam which travels in the direction of rotation decreases *(c-V)*, where *V* is the linear speed of the mirrors, but the speed of the other beam which travels opposite to the direction of rotation – increases *(c+V)*.

Therefore, the conclusion for this frame of reference is that the displacement of the interference fringes is due to the change of the speed of the two light beams, which in turn is dependent on the velocity of the disk rotation.

4.2.2. Derivation of the equation commonly seen in the analyses

The Sagnac effect manifests itself in a setup called a ring interferometer. The equation commonly seen in the analyses of rotation ($\Delta t = 4A\omega/c2$), can be derived on the base of the above presented explanation. For that purpose, we can examine a simple ring interferometer (a single fiber-optic coil mounted on the rotating disk). The two light beams are travelling in opposite directions in the same fiber optic circle (Fig.6).

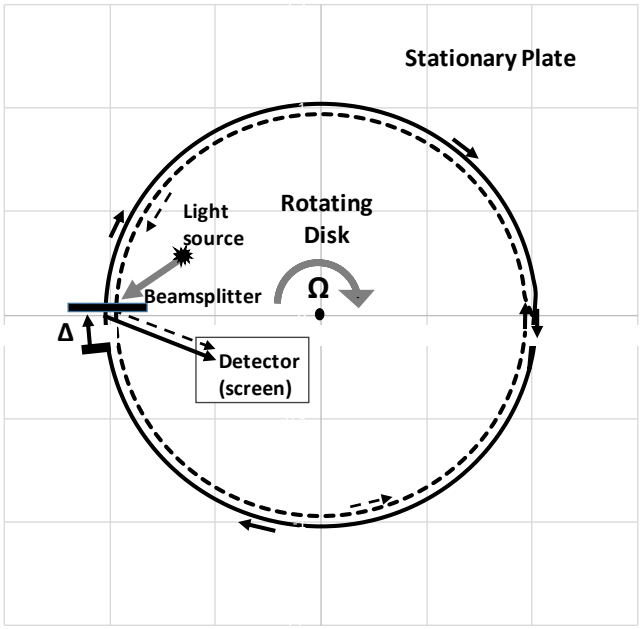

Fig.6. Schematic representation of a fiber optic interferometer

Let us analyze one cycle of each of the two beams (from the moment of splitting - until the moment of directing them to the screen-detector). Each point of the optical circuit moves during the rotation at a linear speed equal to R.Ω, where R is the radius of the optical circuit, and Ω is the angular velocity of rotation.

1) For one cycle, for the light beam "1", which travels in the direction of the rotation:

- In the Disk-Centered Inertial (DCI) coordinate frame:

The light beam reaches the beamsplitter after a time t_1 and actually the covered path will be longer than the circumference with ($\Delta = R\omega t_1$), because of the movement of the beamsplitter (due to the disk rotation) during the light beam traveling:

$$t_1 = \frac{2\pi R + R\omega t_1}{c_o} \tag{5}$$

where c_o is the speed of light in the "fiber optic medium" (where the speed of light is constant) and the covered distance of the light beam in the rotating in DCI coordinate frame (in the "fiber optic medium") is $2\pi R+R\omega t_1$.

- In the frame of reference related to the rotating disk:

$$t_1 = \frac{2\pi R}{c_o - R\omega} \tag{6}$$

where the covered distance of the light beam is $2\pi R$, and the speed of light in this frame of reference in the direction of the rotation is equal to (c_o - $R\omega$).

2) For one cycle, for the light beam "2", which travels in opposite direction of the rotation:

- In the Disk-Centered Inertial (DCI) coordinate frame:

The light beam reaches the beam splitter after a time t_2 and actually the covered path will be shorter than the circumference with ($\Delta = R\omega t_2$), because of the movement of the beam splitter (due to the disk rotation) during the light beam traveling:

$$t_2 = \frac{2\pi R - R\omega t_2}{c_o} \tag{7}$$

where c_0 is the speed of light in the "fiber optic medium" (where the speed of light is constant) and the covered distance of the light beam in the rotating in DCI coordinate frame (in the "fiber optic medium") is $2\pi R\text{-}R\omega t_2$.

- In the frame of reference related to the rotating disk:

$$t_2 = \frac{2\pi R}{c_o + R\omega} \tag{8}$$

where the covered distance of the light beam is $2\pi R$, and the speed of light in this frame of reference in opposite direction of the rotation is equal to ($c_0 - R\omega$). The observed "light speed anisotropy" in the Sagnac experiment is similar to the "light speed anisotropy" in the case of the experiments "One-Way Light Speed Determination".

After subtraction:

$$\Delta t = t_1 - t_2 = \frac{4\pi R^2 \omega}{c_0^2 + (R\omega)^2} \cong \frac{4A\omega}{c_0^2} \tag{9}$$

, where

$$c_0^2 \gg (R\omega)^2 \tag{10}$$

In this way it is clear that the derivation of the equation commonly seen in the analyses of rotation, is in accordance with the above mentioned thesis about the behavior of the electromagnetic radiation

Nowadays, the result of this experiment has very significant implications and applications in practice. It is used for various purposes, such as the fiber optic gyroscope in the aviation, the space navigation, the everyday needs for positioning purposes on the Earth… where no one observes any "unit anisotropy".

4.2.3. Conclusion

The observed effects of change of the interference fringes in the case of "Sagnac's ring interferometer", as well as "light speed anisotropy" in the case of "one-way light speed measurement" clearly demonstrate that:

The speed of light in the local time-spatial domains with equal intensity of the gravitational field is not the same in all inertial frames of reference.

Actually, it is irrefutable evidence about the invalidity of the special theory of relativity [see section 5]. That is why it is understandable that these evidences do not match with the opinion of the orthodox part of the physical society…

4.3. The First Michelson's Experiment

Albert Michelson designed an experimental apparatus (later known as a Michelson interferometer) and made his first experiment in 1881, in order to determine the change of the speed of light due to the motion of the Earth through the stationary luminiferous ether.

4.3.1. Michelson's expectations

If the stationary luminiferous ether exists, the motion of the entire Solar system and the motion of the Earth along its trajectory around the Sun will result in a summary effect of the "ether wind" on the speed of light. The effect of the "ether wind" will differ at night and at the day and will be different at different points of the Earth's orbit.

4.3.2. The Michelson interferometer

The designed by Michelson experimental apparatus, illustrated in Fig. 7, uses two-way path of light propagation on two perpendicular arms and consists of a light source, detector, "SSM" (Semi-silvered mirror) and two mirrors (A and B), which are horizontally located (at the same gravitational potential). The Michelson's expectations were that the change of the speed between the two light beams would cause different shift of the interference fringes.

Using a wavelength of about 600 nm, Michelson expected that there would have been a shift of about 0.04 interference fringes. However, the expected shifts of the interference fringes were not observed.

The results were reported by Michelson:

"The small displacements -0.004 and -0.015 are simply errors of experiment." [7].

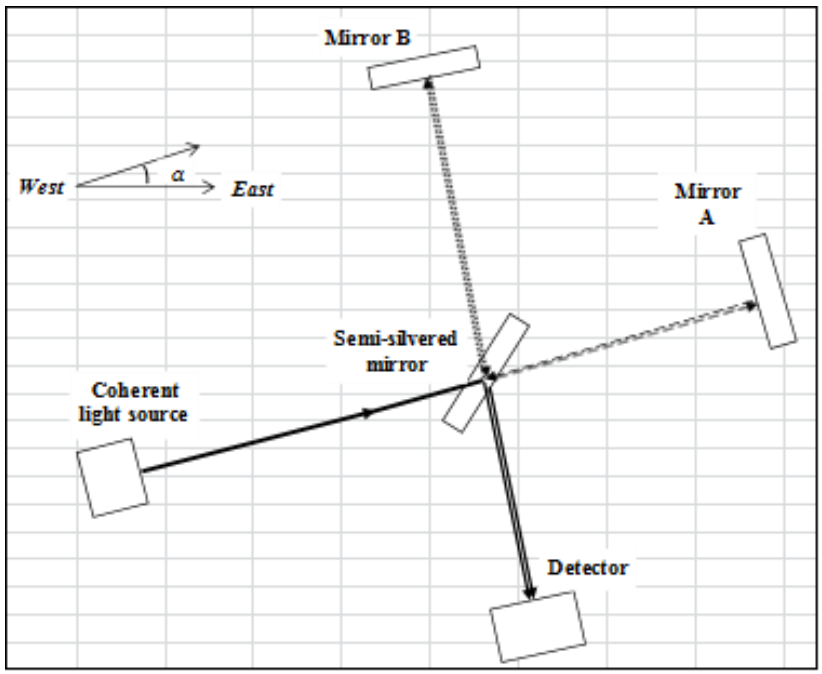

Fig.7. Scheme of the Michelson interferometer

The Michelson's conclusion was:

> *"The interpretation of these results is that there is no displacement of the interference bands… The result of the hypothesis of a stationary ether is thus shown to be incorrect, and the necessary conclusion follows that the hypothesis is erroneous."* [7].

4.4. Michelson-Morley Experiment

The famous Michelson–Morley experiment was performed in 1887. Albert Michelson, with the collaboration of Edward Morley, constructed a new improved interferometer. As in the first experiment, the improved interferometer used two-way path of light propagation on two perpendicular arms. But by using multiple mirrors, the light pathlength was about 10 times longer. The light was repeatedly reflected back and forth along the arms of the interferometer, increasing the light pathlength to 11m. Thus, according to the intention, there was more than enough accuracy to detect the ether-hypothetical effect of the Earth's motion. At the pathlength of 11m, the expected shift should have been about 0.4 fringes. To eliminate thermal and vibration effects, the Michelson and Morley's interferometric apparatus was assembled on the top of a large block of sandstone, about a foot thick and five feet square, which was then floated in a pool of mercury.

4.4.1. The results

The result of the experiment was entirely unexpected and inexplicable again - the apparent velocity of the Earth around the Sun through the hypothetical ether was practically zero at any time of day or night, at all times of the year in different points of the Earth's orbit. The reported results were given by Michelson:

> *"It seems fair to conclude that if there is any displacement due to the relative motion of the earth and the luminiferous ether, this cannot be much greater than 0.01 of the distance between the fringes."* [8].

Although repeated over the next 40 years with even greater precision, this experiment proved the same negative result and earned Michelson the Nobel Prize in 1907.

4.4.2. Reasons for the "unexpected" result of the "Michelson-Morley experiment"

Here, it could be mentioned again that the efforts of this experiment were directed to register the change of the speed of light due to the motion of the Earth through the stationary luminiferous ether.
The reasons of the unexpected result are:

- "All the celestial bodies (and the Earth) are traveling through the space-time of the Universe together with the surrounded, adjacent, warped by the body itself (and belonging to it) "time-spatial domain". [see picture 1 in the subsection 2.2].
- The speed of the electromagnetic radiation in the "empty space" (in the frame of reference related to the space itself) in the surrounding Earth "time-spatial domain" depends only on the intensity of the gravitational field determined dominantly by the Earth.
- In our local physical reality "on the Earth's surface", which is an area with equal intensity of the gravitational field, the measured speed of light is not the same in all the frames of reference. However, in the frame of reference related to the Earth's surface, the speed of light anisotropy

could not be registered by the Michelson-Morley interferometer, because the usage of two-way path of the two beams on the arms eliminates this possibility. This is because the difference in the speed of light in the two directions for each arm is completely compensated. However, the speed of light anisotropy is registered with the "Sagnac experiment", "Michelson-Gale-Pearson Experiment" (see below), and with all the "One-Way speed of light measurements".

4.4.3. Conclusion related to the "Michelson-Morley experiment"

The badly designed Michelson-Morley experiment can be classified as a very big mistake if we mean more than hundred years delusions. In summary:

The "Michelson-Morley experiment" is actually the primary root cause for the great delusion that "the speed of light is the same in all inertial frames of reference", which is the core of the theory of relativity.

4.5. Michelson-Gale-Pearson Experiment

This is the next experiment, which actually proves the validity of the "Thesis about the behavior of the electromagnetic radiation in areas with equal intensity of the gravitational field", especially in our local physical reality [see subsection 3.1].

4.5.1. The ring interferometer

The "Michelson-Gale-Pearson experiment" (Fig. 8) uses a very large rectangular ring interferometer (a perimeter of 1.9 kilometer - 612,648m x 339,24m).

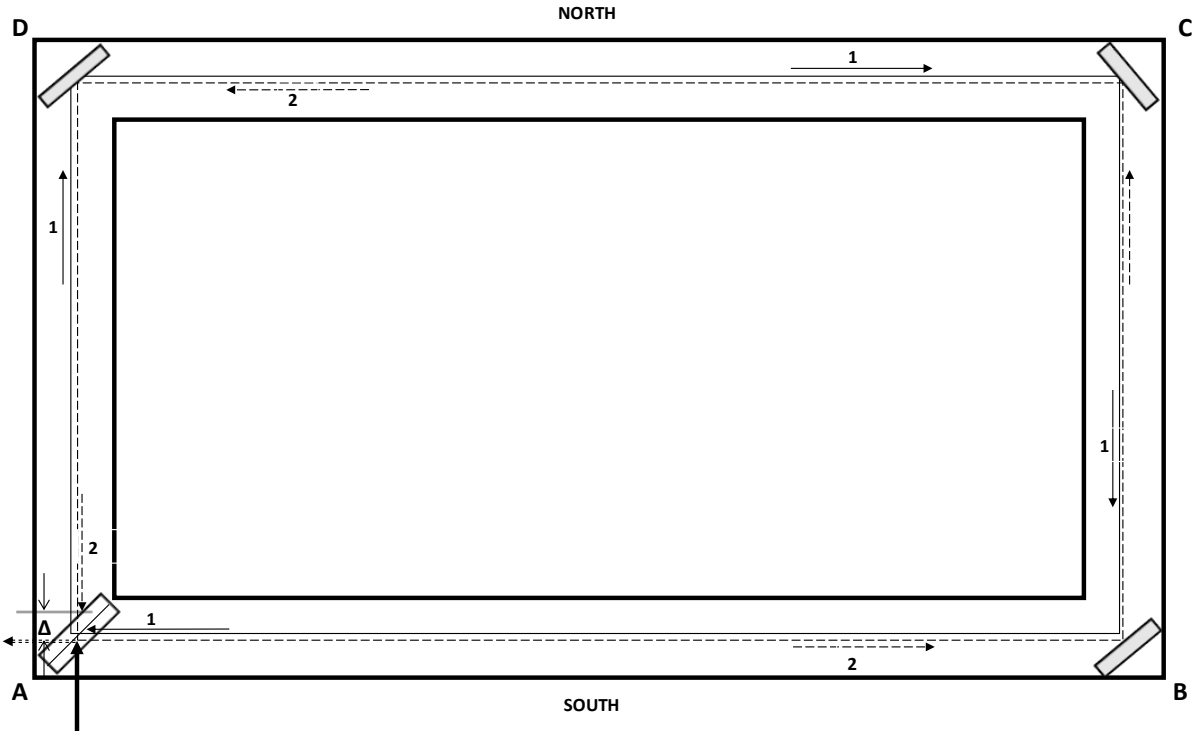

Fig.8. Scheme of the Michelson-Gale-Pearson experiment

The experiment was made in the northern hemisphere at a latitude (41° 46'). A beam of light was split in half and the two beams are sent in opposite directions in an evacuated tube. Mirrors located in each corner of the rectangular are reflecting the two beams. When the two beams were reunited, they were out of phase.

The experiment is similar to that of George Sagnac, but the moving plate (with the interferometer and the detector) is the Earth's surface itself, which moves with the linear velocity at the certain local latitude. It was reported by Michelson (1925):

> *"Air was exhausted from a twelve-inch pipe line laid on the surface of the ground in the form of a rectangle 2010x1113 feet. Light from a carbon arc was divided at one corner by a thinly coated mirror into direct and reflected beams, which were reflected around the rectangle by mirrors and corners. The two beams returning to the original mirror produced interference fringes".* [9].

4.5.2. Explanation of the experiment in conformity with the physical reality

Let us examine in details the movement of the two beams (fig.8), taking in account that the two sides of the rectangular ring interferometer (AB and CD) are parallel to the equator. All the parts of the pipe line (with the mirrors), are moving with the linear velocities of the latitudes corresponding to their location. Since the experiment was carried out in the northern hemisphere, the linear velocity of mirrors A and B (located at the South side of the rectangle) will be higher than the linear velocity of mirrors C and D (the Northern side). We will try to examine the experiment in terms of both reference systems: in the reference system related to the Earth's surface, and in the reference system related to the space itself (the ECI coordinate frame). As was shown in fig.8, beam "1" travels in a clockwise direction, and beam "2" travels in a counter-clockwise direction.

- In the system related to the space itself (in the stationary ECI frame of reference).

In this reference system (where the speed of light is constant), the two beams cover different total travel-paths, due to the different advance (movement) of the mirrors located on the southern and northern latitude, during the travel-time of the beams. If we designate the pathlengths in ECI reference frame, covered by beam "1" and beam "2" on side AB respectively as $|BA|_1$ and $|AB|_2$; the pathlengths covered by beam "1" and beam "2" on side CD respectively as $|DC|_1$ and $|CD|_2$, then:

$$(|AB|_2 - |BA|_1) > (|DC|_1 - |CD|_2) \qquad (11)$$

In other words, the difference between the travel-path of beam "2" in the direction "East-to-West" and the travel-path of beam "1" in the direction "West-to-East" on side AB, will be greater than the difference between the travel-path of beam "1" in the direction "East-to-West" and the travel-path of beam "2" in the direction "West-to-East" on side CD. This is because the linear velocity of the mirrors on the south side is higher. As a result, when beam "1" is back to point A, beam "2" will be at a distance "Δ" before point A. Actually, this is the interference fringes displacement.

- In the frame of reference related to the Earth's surface:

The two beams are moving in opposite directions and cover the same total travel-path. However, if we measure the speed of light in this reference system, we will register different speed in the directions "East-West" and "West-East" [see subsection 4.1]. However, this difference in the speeds of the beams will be higher on the South side in comparison with this difference on the North side, due to the higher linear

speed of the Earth's surface at the South side. As a result, the two beams are out of phase when they return to point A.

In the reference system related to the Earth's surface, we can make calculation for the time difference:

If l_1 is the northern pipe line length (latitude ϕ_1), where the linear velocity of the Earth's surface is v_1; and l_2 is the southern pipe line length (latitude ϕ_2), where the linear velocity of the Earth's surface is v_2, then:

the time necessary for beam 1 (clockwise direction) to travel on the northern and on the southern sides is:

$$T_1 = \frac{l_1}{c - v_1} + \frac{l_2}{c + v_2} \tag{12}$$

and the time required of the beam "2" (counter-clockwise direction) to travel on the northern and on the southern sides is:

$$T_2 = \frac{l_2}{c - v_2} + \frac{l_1}{c + v_1} \tag{13}$$

It is so, because in the reference system related to the Earth's surface:

- the speed of light in the northern side in the direction "East-to-West" is actually (c + v_1) and in the direction "West-to-East" is (c - v_1); and
- the speed of light in the southern side in the direction "East-to-West" is actually (c + v_2) and in the direction "West-to-East" is (c - v_2).

If we ignore the small difference between the travel-time of the two beams on side BC and side AD, the time-difference will be:

$$T_2 - T_1 = \frac{2l_2v_2}{c^2 - v_2^2} - \frac{2l_1v_1}{c^2 - v_1^2} \tag{14}$$

This equation is the same as what Michelson shows in [9, part I]:

"If l_1 is the length of path at latitude ϕ_1 and l_2 that at latitude ϕ_2, v_1 and v_2 the corresponding linear velocities of the earth's rotation, and V the velocity of light, the difference in time required for the two pencils to return to the starting-point will be:

$$T = \frac{2l_2v_2}{V^2 - v_2^2} - \frac{2l_1v_1}{V^2 - v_1^2} \tag{15}$$

As a conclusion, it is clear that Michelson implicitly assumes that in the reference system related to the Earth's surface the speed of light is different in the directions "East-to-West" and "West-to-East", and this difference depends on the different velocity of the Earth's surface at the different latitude.

The successful completion of this experiment was reported with the final displacement, expressed as a fraction of a fringe: 0.230+- 0.005 obs. | 0.236+-0.002 calc.

"The displacement of the fringes due to the earth's rotation was measured on many different days, with complete readjustments of the mirrors, with the reflected image sometimes on the right and sometimes on the left of the transmitted image, and by different observers". [9]

4.5.3. Conclusion related to the "Michelson-Gale-Pearson experiment"

The conclusions are two:

- Michelson-Gale-Pearson experiment proves the same reality as the Sagnac's experiment - that the speed of light is not the same for all frames of reference.
- The outcome of the experiment was that the angular velocity of the Earth as measured by astronomy was confirmed to within measuring accuracy. The ring interferometer of the Michelson-Gale experiment was not calibrated by comparison with an outside reference (which was not possible). Therefore, the experiment turns out to be one more proof that the speed of light in vacuum (in the reference system, related to the space itself) is constant in our local time-spatial domain on the Earth's surface.

5. REVEALING THE ESSENCE OF THE „SPECIAL THEORY OF RELATIVITY"

5.1. Thought Experiment

We can use one of Einstein's favorite experiments to reveal the essence of the „Special Theory of Relativity". Let us imagine an observer standing next to a railway line and a building of a railway station. At that moment a train, moving with a constant velocity $\overrightarrow{V_{tr}}$, passes by the observer. Here, we can examine two cases of a moving object (e.g. a ball):

- First case: "A moving ball in the stationary building of the railway station".

In this case, the ball is moving with a constant velocity $\overrightarrow{V_0}$ in parallel to the railway line, measured in the reference system related to the railway station, which is the stationary frame of reference of the observer.

- Second case: "A moving ball inside the moving train".

In this case, the ball is moving with a constant velocity $\overrightarrow{V_0}$ in parallel to the railway line, but measured in the reference system related to the moving train. The train is moving with a constant velocity $\overrightarrow{V_{tr}}$ relative to the stationary frame of reference of the observer. Therefore, for the observer, the ball inside the train is moving with a velocity ($\overrightarrow{V_0} + \overrightarrow{V_{tr}}$). Or actually, the measured (by the observer) velocity of the object obeys the Galilean transformations between two reference systems moving relative to each other in parallel, with a constant velocity $\overrightarrow{V_{tr}}$.

Here it should be pointed out with a thick line the fact that we have tacitly accepted that the units of length (meter) and time (second) are the same for both reference systems. This is irrefutable reality in our time-spatial domain named "on the Earth surface".

However, let us set an imaginary logical task:

> How the speed of the object V_0 (of the ball) could be measured the same by the observer in the two abovementioned cases? In other words, instead of the measured by the observer speed of the ball moving inside the train ($V_0 + V_{tr}$), the obtained numerical value to be V_0.

From the point of view of mathematics, the only possible answer to this question is:

> It is possible, but when the observer measures the speed of the ball inside the train, he must use units of length (meter) and time (second), which are changing in a manner depending on the relative speed between the two frames of reference (the speed of the train in our case).

In fact the solution of this pure imaginary mathematical task is given by Lorentz.

According to this solution of our imaginary logical task, the observer should use the following different units of time and length, which are depending on the relative speed between the two frames of reference (the speed of the train in our case):

1) $\boldsymbol{S_{tr}}$ (the duration of the unit of time "second" that the observer has to use when he measures the speed of the ball inside the train), should be longer depending on the speed of the train V_{tr} (the relative speed between the two moving in parallel reference systems):

$$s_{tr} = \frac{s_0}{\sqrt{1 - \frac{V_{tr}}{V_0}}} \tag{16}$$

, where S_0 is the duration of the unit of time "second" in the stationary reference system of the observer, (outside the train) and the V_0 is the desired numerical value of the speed of the ball.

2) $\boldsymbol{L_{tr}}$, (the length of the unit "meter" that the observer has to use when he measures the speed of the ball inside the train), should be shortening depending on the speed of the train V_{tr} (the relative speed between the two moving in parallel reference systems):

$$L_{tr} = L_0 \sqrt{1 - \frac{V_{tr}}{V_0}} \tag{17}$$

where L_0 is the length of the unit "meter" in the stationary reference system of the observer, (outside the train) and the V_0 is the desired numerical value of speed of the ball.

Using these changing units of time and length, the observer will always obtain the same value V_0 for the speed of the ball inside the moving train (instead of V_0+V_{tr}).

In order the equations (16) and (17) to be always valid in a real mathematical sense (not in imaginary sense), the speed V_0 of the object must be a limit. In our case, the relative speed between the frames of reference (the speed of the train V_{tr}) must never reach the speed of the object V_0 (the speed of the ball). In the considered by Einstein case in the theory of special relativity, the moving object is a photon (instead of a ball), V_0 is the speed of light and it is always higher than the relative speed between the frames of reference V_{tr}.

The correlation between the imaginary unit of length and the real unit of length is:

$$\frac{L_{tr}}{L_0} = \sqrt{1 - \frac{V_{tr}}{V_0}} = k_L \tag{18}$$

Respectively, the correlation between the imaginary unit of time and the real unit of time is:

$$\frac{S_{tr}}{S_0} = \frac{1}{\sqrt{1 - \frac{V_{tr}}{V_0}}} = k_S \tag{19}$$

Therefore, if we do not want to use the imaginary units, we can multiply the numerical value V_0 by:

$$V_0 . \frac{k_L}{k_S} = V_0 \left(1 - \frac{V_{tr}}{V_0}\right) = V_0 - V_{tr} \tag{20}$$

Obviously, this is the "Galilean result", which is the solution of the Newtonian mechanics (which is the real result).

This simple thought experiment shows that any unspecified object (it can be a photon or a ball) moving with any other speed *"V_0"*, which is *"$V_0 > V_{tr}$"* can be used. Therefore, numerous "special theories of relativity" can be created. All of these theories will be mathematically perfectly true, but they will not correspond to the physical reality.

In fact the thought experiment is an illustration, which shows how the scientific notion about the existing physical reality can be distorted. The usage of the Lorentz transformations is actually acceptance of the wrong statement that the speed of light is the same in all frames of reference.

5.2. The Opinion of Einstein

The above-mentioned task is only an imaginary one which can exist only in the field of mathematics. The special theory of relativity is mathematically true, but the physical reality is totally different.

The fact that the speed of light is not the same in all frames of reference was proved by the Sagnac's experiment in 1913 [6]. This was even before the publishing of the General Theory of Relativity. Too many unreal explanations of this experiment have been published. For example, in the article "The Sagnac effect: correct and incorrect explanations" by Malykin G. B. the distorted explanation is called "the correct explanation" [10]. However, the proponents of the special theory of relativity still cannot find "convenient" explanation of another very important fact:

> Why in case of "one-way measurement" (in the frame of reference related to the Earth's surface), the measured speed of light in direction of "East-to-West" is higher than the measured speed of light in direction "West-to-East"?

The fact that in the case of "one-way measurement", the measured speed of light is different in different directions has been demonstrated repeatedly through using GPS (the global positioning system) [see subsection. 4.1].

Einstein also clearly confirmed the crucial importance of the constancy of the speed of light in all frames of reference. As a matter of fact, Einstein's formulation of the two postulates: (1) "the principle of relativity" and (2) "the constancy of the speed of light" is:

> *"The same laws of electrodynamics and optics will be valid for all frames of reference for which the equations of mechanics hold good. We will raise this conjecture (the purport of which will hereafter be called the "Principle of Relativity") to the status of a postulate, and also introduce another postulate, which is only apparently irreconcilable with the former, namely, that light is always propagated in empty space with a definite velocity* ***c*** *which is independent of the state of motion of the emitting body."* [1].

This formulation does not point directly that the speed of light is the same in all frames of reference. However, the use of the Lorentz transformations demonstrates that Einstein adopted and applied in the special theory of relativity the wrong statement that the speed of light is constant in all inertial frames of reference. That is why the invariance of the speed of light is indeed with primary importance for the veracity of the theory of relativity. **This primary importance** is confirmed by Einstein himself in "*My theory and Miller's experiments*" [11], after the widely discussed Dayton Miller's publication "*The Ether-Drift Experiment and the Determination of the Absolute Motion the Earth*" [12]. There Einstein wrote:

> *"If the results of the Miller experiments were to be confirmed, then relativity theory could not be maintained, since the experiments would then prove that, relative to the coordinate systems*

> *of the appropriate state of motion (the Earth), the velocity of light in a vacuum would depend upon the direction of motion. With this, the principle of the constancy of the velocity of light, which forms one of the two foundation pillars on which the theory is based, would be refuted."* [11].

Actually, *"the velocity of light in a vacuum"* depends *"upon the direction of motion"*, as was shown in [section 4].

5.3. The Logic of the Reality

According to the above illustrated thought experiment, it is clear that the observer is located in the stationary frame of reference, in area with equal intensity of the gravitational field. In this frame of reference, the units of time and length are defined and accepted to be constant. However, the observer must change the units of time and length, when he measures the speed of the ball in the train, in order to obtain the desired numerical value V_0 instead of $(V_0 + V_{tr})$.

There is another claim which is a basis of a very widespread paradox. It is that the units of time and length are really changing in the moving frame of reference. According to that, the length shortens in the moving system (the unit "meter" becomes shorter, but only in the direction of movement) and the duration of the unit of time "second" becomes longer, but the time dilation is in all the directions.

This claim does not correspond to the elementary logic, because in case of two inertial frames (moving uniformly and rectilinearly) - it cannot be determined which of them actually moves. Therefore, if the units of time and length really are changing in the moving frame of reference, it cannot be determined in which of the two frames this change actually happens.

As a consequence of this claim, the remarkable "twins paradox" was created. However, it can be only a source of interesting, but unreal fantastic stories without scientific meaning.

6. CONCLUSION ABOUT SPECIAL THEORY OF RELATIVITY

The logical and experimental evidence, discussed in this article reveals the essence of the special relativity: that the Special Theory of Relativity is an imaginary hypothesis, which does not correspond to the physical reality. That is why, it is a delusion. The main reasons for this delusion are:

- The "Michelson-Morley experiment" is actually the primary root cause for the great delusion that "the speed of light is the same for all frames of reference". Einstein uses Lorentz's transformations in the special theory of relativity, which are only the mathematical solution of this false claim, but do not correspond to the physical reality. The fact that in our local time-spatial domain "the speed of light is not the same for all frames of reference" is registered by the "Sagnac experiment", "Michelson-Gale-Pearson Experiment" and by all "One-way speed of light measurements".

- The second reason is the lack of understanding of the physical reality that the electromagnetic field exists on the gravitational field. It actually means that the properties of atoms and the characteristics of the electromagnetic radiation (including the speed of light), depend on the intensity of the gravitational field. The hypothetical medium which supports the transmission of the electromagnetic waves turns out to be the space-time itself. All celestial bodies (including the Earth) are traveling through the space-time

of the Universe together with the surrounded, warped dominantly by the body itself "time-spatial domain". On the surface of the celestial body, where the intensity of the gravitational field is constant, the speed of light is a local constant in the frame of reference related to the space itself.

- Not least as a reason for supporting this delusion is the dominant orthodox part of the scientific community for more than one century. The only argument of these scientists is that "if the special theory of relativity is mathematically proven – then this theory is correct…", but "not everyone can understand the Special Theory of Relativity". We all know the anecdote concerning Ludwik Silberstein and Arthur Eddington about – "who are the three men who actually understood the theory of relativity…"

7. CONCLUSION ABOUT GENERAL THEORY OF RELATIVITY

7.1. Awareness: "What Is the Difference between Mathematical and Physical Equation"

- The mathematical equation is actually an assertion for equality of two numeric expressions. The mathematical equation most often expresses the relationship between the given variables, some of them known (a, b, c, d...), and variables that need to be determined - the unknown (x, y, z, w, etc.).

The process of expressing the unknowns in an equation or system of equations, in terms of the known ones, is called solving the equation (or the system of equations).

- In physics, however, the equality of the expressions concerns the links between physical quantities, but this relationship is expressed in an equation, which is written on the basis of a certain system of units of measurement (for example, SI-System).

Here, we must realize that physical equations are based on the assumption that the units of the measurement systems are constant. In such a way, the use of the equality sign between the two expressions is correct.[3]

One correct example: If we calculate tension in a piece of material caused by a force, we use units of a measurement system, which are defined in the time-spatial domain outside the material body. In our case it is our time-spatial domain "on the Earth's surface", where the intensity of the gravitational field is equal and therefore the defined physical units are permanent. As a result, we can say that the physical equations for the tension calculation in a piece of material are correct (the use of the equality sign is correct).

7.2. Einstein's Field Equations

In the scope of Einstein's field equations, however, we must realize that we use physical units of length and time defined inside a "material" named "Universe". This "material" consists of planets, stars and galaxies (instead of atoms and molecules). The intensity of the gravitational field is different in different areas of the space-time of the Universe, therefore the physical units of length and time are different too.

[3] However, the units of the measurement systems are constants, but only in a local physical area, where the intensity of the gravitational field is constant (in time-spatial domains with equal intensity of the gravitational field) [12].

The EFE themselves express the change of the units of time and length. The used units are not permanent in the scope of the equations, and the use of the "equality" sign is not correct. Therefore, Einstein's field equations express only an "idea"! That is why, the equations cannot be subjected to mathematical solving directly.

Brief analysis of the Einstein's modified field equation:

$$R_{\mu\nu} - \frac{1}{2}Rg_{\mu\nu} + \Lambda g_{\mu\nu} = \frac{8\pi G}{c^4}T_{\mu\nu} \qquad (21)$$

7.2.1. Note 1 (concerns the measurement units)

The expression on the left side of this equation represents unknown warping of the structure of space-time: ($R_{\mu\nu}$ is the Ricci curvature tensor, R is the scalar curvature, $g_{\mu\nu}$ is the metric tensor, and Λ is the cosmological constant. The expression on the right side represents the known matter and energy ($T_{\mu\nu}$ is the stress-energy tensor). The gravitational constant G and the speed of light c appear as physical constants and π is a numeric constant.

Therefore the EFE can then be interpreted as a set of equations representing how the matter and energy determine the curvature of space-time, or how the units in particular time-spatial domain are changing by the matter and energy. But as any physical equation, the expressions on both sides of the equation have to be written on the base of the same, unchangeable measurement units. If this equation is not written on the basis of unchangeable units of measurement – the equation simply ceases to be an equation in terms of math and the use of the sign "equality" is not correct.

7.2.2. Note 2 (concerns the physical constants)

There are different ways to prove (although it is already proven by the experiment of Shapiro), that the speed of light in "empty space" changes depending on the intensity of the gravitational field. But not only the speed of light - all physical constants change depending on the intensity of the gravitational field [13]. Unfortunately, our vision of the physical reality in the Universe is based on our local perception of "absoluteness". The perception of "absoluteness" (not only of the time and space) is a result of irrefutability of all the "mathematical and experimental evidence" about constancy of all local physical constants in our local time-spatial domain, what in turn is based on the perception of unchangeability (constancy) of all local units of measurement. However, all local units change with the change of the intensity of the gravitational field. So we are misled to adopt /accept that the local physical constants are fundamental, universal and unchangeable (like the speed of light).

For example, this also applies to Maxwell's equations, which are irrefutably true in our (and in any other) local physical area with equal intensity of the gravitational field where the units of measurement are defined... and where we have a perception of full certainty. Thus, ε_0 – *"the permittivity of the free space"* (also called the *electric constant*), μ_0 – *"the permeability of the free space"* (also called the *magnetic constant*) and "the speed of light" in Maxwell's equations are perceived and adopted as constants, but they are only local constants. In Maxwell's equations, the relation between electricity, magnetism, and the speed of light can be summarized by the equation:

$$c = \frac{1}{\sqrt{\mu_0 . \varepsilon_0}} \tag{22}$$

However, ε_0, μ_0 and c are only local constants – they are changing with the change of the intensity of the gravitational field. But:

> *"In the local "time-spatial domain", where physical units are defined, it is not possible to prove by measurement the change of the value of any physical constant (the speed of light, Planck's constant, etc.)"* [2].

Actually, the physical reality in the Universe turns out to be:

> *„perception of local absoluteness, against the background of global relativity in the Universe"*.

In other words:

> *"perception of complete local certainty against the background of overall uncertainty in the Universe."* [14].

7.3. Final Conclusion about the General Theory of Relativity

- The field equations of the general theory of relativity are a brilliant general idea, which breaks the perception of absoluteness of time and space, but the use of the sign "equality" is not correct.
- The General Theory of Relativity has an extremely great contribution to the humankind – it opens a new page, a new vision of global relativity in the Universe.

8. FINAL GENERAL CONCLUSION ABOUT THE THEORY OF RELATIVITY

The thorough analysis in this article undoubtedly proves that:

THE "THEORY OF RELATIVITY BY ALBERT EINSTEIN" - HAS TO BE RESTARTED!

Which should be the next step of the physical science?

Undoubtedly, the new model of uncertainty of the Universe is a different vision, which not only reveals the essence of Theory of Relativity by Albert Einstein, but also explains a lot of problems in physics today (such as: "the accelerated expansion of the Universe", "the dark matter and the dark energy in the Universe", etc.), which have been under research for a long time.

The big task of the next generation of physicists will certainly be: "How the characteristics of the electromagnetic radiation (and all physical reality) change with the change of the intensity of the gravitational field". This task is a subset of the main task: "How the uncertainty in the macro-world (macrocosm) can be more certain for us"…

COMPETING INTERESTS

The author has no competing interests. Moreover, the author is an INDEPENDENT RESEARCHER, who did not receive any remuneration for his work as researcher.

ACKNOWLEDGEMENTS

The author would like to thank Philip Gibbs for opening the bottle, where the free spirit of the science was closed by the dominant orthodox part of the scientific society.

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