Applied Physics Research; Vol. 4, No. 4; 2012
ISSN 1916-9639 E-ISSN 1916-9647
Published by Canadian Center of Science and Education

Awareness of Special and General Relativity and Local and General Physical Reality

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Received: June 25, 2012 Accepted: July 24, 2012 Online Published: October 22, 2012

doi:10.5539/apr.v4n4p126 URL: http://dx.doi.org/10.5539/apr.v4n4p126

Abstract

The paper is based on the awareness of the conformity of Special Relativity Theory with the nature of our local physical reality, and on the awareness of the conformity of General Relativity Theory with the nature of the global physical reality. It includes two discussions – about Special Relativity and about General Relativity. The root cause analysis of the results of Special and General Relativity shows the real physical nature of the Universe what is a base of new ideas for advance in the physics.

As a summary about the real physical nature of the Universe – it is the perception of a local certainty in any time-spatial domain (the domain of existence) and the real uncertainty in both micro-world (quantum level) and macro-world (Universe level). This is actually a new model of uncertainty of the Universe, that gives explanations of a lot of problems (such as: "the accelerated expansion of the Universe"; "the dark matter and the dark energy in the Universe"; the answer of the question about "the origin of the energy", etc.), which have been under research for a long time.

Keywords: Special Relativity, General Relativity, speed of light, Lorentz transformation, uncertainty principle, dark matter, dark energy, expansion of the universe

1. Introduction

"The task is not so much to see what no one yet has seen, but to think what no body yet has thought about that which everyone sees." (Arthur Schopenhauer, 1788-1860).

For the desired result of any idea and/or hypothesis - a perfect mathematical model can be created. For this purpose appropriate assertions can be postulated as initial conditions. But the scientific method requires that the outcome of this model (the result) matches the physical reality. Only then that hypothesis becomes a proven theory and marks the real advance in the science.

In the first part of this paper, the characteristics of our local physical reality (on the surface of the Earth and the space in the immediate vicinity) are given. The Special Theory of Relativity (STR), as a mathematical model, is based on two postulates - the *principle of relativity* and the *postulate of constancy of the speed of light*. The awareness of the essence of these two postulates shows the level of their conformity with our local physical reality. Furthermore, the analysis shows that the results of STR contradict the postulates, which are the initial conditions of the mathematical model of the STR.

The second part of the paper outlines a new model of the Universe based on the ideas of General Theory of Relativity (GTR) and the Uncertainty principle of the macro-world.

Notes about used terms:

- In this paper are used the terms "space-time" and "time-spatial domain", because the time and the space are like two sides of the same coin.
- The term "our local physical reality" includes the Earth's surface and space in the immediate vicinity.
- In this paper the term "awareness" is used as the exact alignment of all known facts. This means arranging the facts on the right place in the logical hierarchy of the knowledge in order to obtain realistic pictures - in this case a picture of our local physical reality and a picture of the physical reality of the whole Universe.

- Often, instead of the term "intensity of gravitational field" is used the term "gravitational potential". In this paper is accepted that a higher "gravitational potential" corresponds to lower "intensity of gravitational field", or to weaker gravitational field, or to a higher level of expansion of the space-time.

2. Awareness of the Local Physical Reality and Its Main Characteristic - the Perception of Local Certainty (Definiteness)

In order to realize the nature of our „local physical reality", we should consider it as a "local small time-spatial domain". This "local small time-spatial domain" with all physical reality in it, undergoes changes due to the omnipresent motion of the Universe, due to the changing intensity of the gravitational field, which exerts influence on it.

2.1 The Existence of Two Main Reference Systems in Our Local Physical Reality and the Principle of Relativity Formulated by Galileo

At the basis of the logical analysis of our local physical reality lies the awareness about the reference systems. The basic reference system is associated with the space itself, where the Earth, planets and stars move and warp the space around, where all material bodies, molecules, particles, photons exist and propagate … and where we establish the existing physical laws. Usually, however, we use as a main reference system – the reference system associated with the Earth's surface, and we are accustomed to the fact that all phenomena are referred to it.

Nicolaus Copernicus was the first to become aware of the reference systems in his work "On the Revolutions of Celestial Spheres" (*"De revolutionibus orbitum coelestium"*). There he lays out his theory of heliocentrism - that the space with the stars and the Sun do not revolve around the Earth but definitely the opposite - that the Earth rotates around its axis and orbits the Sun in the space.

As a result of his observations, Galileo establishes that the laws of mechanics are the same in all inertial frame of reference in our local physical reality (actually, because the natural phenomena occur in the common space).

Generalizing these observations Galileo postulates his relativity hypothesis:
"any two observers moving at constant speed and direction with respect to one another will obtain the same results for all mechanical experiments." (It is understood that the apparatuses they use for these experiments move with them).

Hence, it follows that it is impossible to determine by any mechanical experiment carried out in any inertial system, whether the given system is at rest or it is moving uniformly and rectilinearly… (but it is uncertainty).

- Galileo does not specify, but we should definitely add, that the above formulated principle of relativity is valid in homogeneous gravitational field, because our local physical reality is in field with almost the same gravitational intensity.

Einstein extends the principle of relativity and applies it to electrodynamics and optics.

- Secondly, we should be aware that each mechanical experiment or any kind of motion actually occurs in the common space for all the frames of reference – in other words in the basic reference system, associated with the space itself. But we always read the results of the experiments (position, velocity, type of trajectory of any material point) in coordinates of the reference systems, connected directly or relatively to the Earth's surface. Mathematically, the relationship between the readings in the different reference systems is expressed through Galilean transformations.

Here we should realize the same above-mentioned and important fact that the birth, the distribution and the absorption of electromagnetic radiation occurs again in the common space itself.

2.2 The Perception of "Absoluteness" of the Time and Space in Our, and Within Each Local "Time-Spatial Domain" in the Universe, Is the Base of Our Perception of "Constancy" of the Speed of Light

We should underline that Galileo accepts the units of time and length (space) as constants – or that the time and space are absolute. We have also assumed, due to our perception - that all the units in our local reality are the same for all the inertial frames of reference.

Newtonian classical mechanics adds several other concepts to the principle of relativity, including laws of motion and gravitation that are valid for our local time-spatial area. Newton similarly accepts that space and time are absolute, which is the perception in each local time-spatial domain. The perception of "absoluteness" of the time and space is the result of the irrefutability of all "mathematical and experimental evidence" in our local space-time domain about the constancy of all the local units, as well as about the unchangeability of all the local constants. So we are misled to accept also all the local constants as universal.

So, the most significant reason for the adoption of the "absoluteness" of both time and space - that Newton had no opportunity to know, is the "uncertainty principle of the macro-world":

"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 are defined), 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 units in the remote domain are uncertainly different." (Sharlanov, 2012).

For example, this delusion of absoluteness applies also to the constant "the speed of light" which was adopted as a global constant for the entire Universe. That is why, "*Indication, from Pioneer 10/11, Galileo, and Ulysses Data, of an Apparent Anomalous, Weak, Long-Range Acceleration*" (Anderson et al., 1998) cannot be explained by scientists.

2.3 The Perception of Certainty (Definiteness) Is a Main Characteristic of Our Local Physical Reality

Let us see an example of an exact certainty in our local physical reality:

If we examine a ball thrown vertically upward in the reference system associated to a train, moving rectilinearly with a constant speed – the ball has exactly vertical trajectory and different, but certain speed at any moment. In relation to the reference system connected to the Earth's surface - the ball also has an exactly definite trajectory and a precise speed at any moment (though it differs from the ones, reported in the reference system connected to the train). If we go on - the thrown ball has also an exactly definite path and an exactly precise speed (although quite different), and in the reference system associated to the space near the Earth's surface, where (in relation to this reference system) the Earth's surface moves at a fixed linear velocity depending on the latitude… Finally, summarizing the example, one should realize that the movement of the ball is a movement actually in the space. Depending on the different movements of the different reference systems to the space, the movement of the ball is read in different ways, but obeys to the same laws - the laws of Newton…

Or the laws of mechanics, electrodynamics and optics in our local reality are the same for all frames of reference, because all physical phenomena actually occur in their own common space. The reported results in different reference systems are different, but exactly expressed by Galilean transformations. The possibility of the all physical phenomena to be described exactly with mathematical equations is "irrefutable confirmation" of our perception of perfect certainty in our local physical reality.

The perception of certainty in our local physical reality is based on the perception of "absoluteness" of the time and space.

Thus, as a conclusion we should definitely be aware that our acceptance that "everything in our local physical reality is exactly definite" is not real - it is only perception, based on the perception of "absoluteness" of the time and space, on the perception of "absoluteness" of our local reality.

3. Discussion 1: The Local Physical Reality and Special Theory of Relativity (STR)

In the STR Einstein examines two Galilean coordinate systems in "stationary space", (in a homogeneous field without gravity), moving with a constant velocity towards each other at the matching axes "x" and "x`"(the axes "y" and "y`" are parallel; the axes "z" and "z`" are parallel too). Einstein applies two postulates as initial conditions for these two Galilean coordinate systems - the *principle of relativity* and the *postulate of the constancy of the speed of light*.

3.1 Analysis and Awareness of the Postulates of the STR in Accordance to Our Local Physical Reality

To extract the remarkable formulas of the Special Relativity, Einstein extends the Galileo's principle of relativity, adding that the laws of electrodynamics and optics are also the same in these two systems. Einstein defines two postulates - the "Principle of Relativity" and the "Constancy of the Speed of Light" in the following way:

"*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.*" (Einstein, 1905)

Let us analyze the conformability of the postulates with our local physical reality:

• Statement 1: Firstly, we should realize that in spite examining the readings about time and length in the two moving reference systems - the propagation of the light, actually, carries out in the common of the two-systems' space.

• Statement 2: It can be shown that "the postulate of the constancy of the speed of light" is a consequence of the "principle of relativity". The prove is the following:

According to the postulated "Principle of Relativity", for each system moving rectilinearly with a constant velocity - the laws of mechanics and electrodynamics are the same. It follows that a specific electromagnetic radiation (emitted in the common space at a transition of an electron from one specific orbit to another /of a definite atom/) – will have the same wavelength and the same frequency in the common of both systems space (named by Einstein "*empty space"*), and the same values for the wavelength and frequency in the "*empty space*" will be registered in the both systems.

1) If the frequency of any electromagnetic radiation in the both systems is the same (in fact, in their common space) - then the measured duration of a fixed number of periods of a specific electromagnetic radiation in the two systems will be the same. As an example, it will be also true for „the radiation corresponding to the transition between the two hyperfine levels of the ground state of the caesium 133 atom in a vacuum", and let this number of periods is $\mathbf{N_s}$= 9,192,631,770 (3^{th} meeting of the CGPM, *Resolution 1,* 1967/68). Therefore, the unit of time in the both systems is the same.
2) If the wavelength of any electromagnetic radiation in the common space of the both systems is the same (regardless of their rectilinearly movement with a constant velocity in their common space) - then the measured total length of an exact number of lengths of a specific electromagnetic radiation in the both systems will be the same. As an example, it will be also true for „the radiation corresponding to the transition between the two hyperfine levels of the ground state of the caesium 133 atom in a vacuum", and let this number of wavelength is $\mathbf{N_m}$=30.66331899. Therefore, the unit of length in the both systems is the same too.
3) Of course, it follows:

$$\boldsymbol{c} = \boldsymbol{N_s} / \boldsymbol{N_m} = 9,192,631,770 / 30.66331899 = 299,792,458\ [m/s] \quad (1)$$

Obviously, the result is:
"The speed of propagation of the electromagnetic radiation in the common of the two-systems' space, (*in empty space*), is the same."

Obviously, it is the clear conclusion that the first postulate, the "Principle of Relativity", includes in itself the second postulate - the "Constancy of the Speed of Light ".

• Statement 3: Thirdly, we should realize, as was proved above, that: It turns out, as initial conditions of the STR – that the units of time and length are the same in the both frames of reference, and it is as a consequence of the "principle of relativity", and regardless of their rectilinearly movement with a constant velocity.

• Statement 4: Another conclusion of the above analysis is the awareness, that the obtained results of the STR "about the change of the units of length and time" are actually results of observation (or results of calculation) of Observers, located in the two reference systems - about "what happens in the neighbor system". Or in other words, the results of the STR about the change of the units of length and time are actually results of observation or results of calculation - but not a real change of the units!

3.2 Analysis and Awareness of the Discrepancy between Our Local Physical Reality and the Mathematical Model Used in the STR

Let's look again at the formulation of the postulate of the constancy of the speed of light:
"*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*" (Einstein, 1905),

Obviously, this formulation is fully consistent with the described above real picture of our local physical reality:

- In the formulation of the postulate is claimed that the speed of light is constant „*in empty space*", or in the reference system connected to the space itself. Indeed, it is true within our local area of physical reality, which is with approximately the same gravitational potential… in vacuum, but not for all frames of reference.

- Furthermore, the speed of light is "*independent of the state of motion of the emitting body*" - independent of the motion of the moving source, because the speed of the emitted photon at the transition of an electron from one orbit to another, does not depend on neither the motion of the atoms, nor the motion of the electrons.

In the formulation of the postulate is not mentioned anything about the independence of the measured speed of light from the motion of the Observer's reference system, where the speed of light is measured. Before, it is mentioned "*for all frames of reference"*, but this concerns the validity only of the laws of electrodynamics and optics:

"*The same laws of electrodynamics and optics will be valid for all frames of reference for which the equations of mechanics hold good.*" (Einstein, 1905).

Here we should point out that there was a mistake in using the Lorentz transformations instead of Galilean transformation in the examination of the two moving Galilean coordinate systems. The Lorentz transformations actually are the mathematical solution of the task "the speed of light must be the same, measured in the co-ordinates of all frames of reference", but this does not correspond to our local physical reality. Historically, since almost one hundred years, experiments have been made, which unambiguously demonstrate, that the measured speed of light in the reference system connected with the Earth's surface is different in different directions. This is obviously because of the movement of the Earth's surface to the reference system of the space, where the light is born (emitted), spreads and absorbs. Some of the most significant experiments are described by (Sagnac, 1914; Michelson & Gale, 1925; Miller, 1933; Marmet, 2000; Ashby, 2003; Kelly, 2005; Gift, 2010). They prove that Galileo's transformations are valid when the speed of light is measured in the reference system connected to the Earth's surface. On one hand, the linear velocity of the earth's surface is different at each point of the earth's surface depending on latitude, and on the other hand the light traverses in the space different distances when the speed of light is measured between two points on surface in different directions (if the direction does not coincide with meridian). Taking in account these two facts, the speed of light measured in the basic reference system connected with the space itself, "*in empty space*", turns out to be constant. Or generalizing - the speed of light turns out to be constant in the basic reference system connected with the space itself, in each time-spatial domain, where the gravitational potential is equal, (or where the level of contraction / expansion of space-time is equal).

Analysis and explanation (based on the awareness of the above-mentioned facts) of the results of "one-way", "two-way" and "multiple-way" speed of light determination experiments are made in (Sharlanov, 2011).

Moreover - these facts are used in practice: Today the GPS utilizes a clock-synchronization procedure based on invariance of $\boldsymbol{c}$ in vacuum and "Sagnac correction". This procedure is developed on the base of published standards and synchronization rules.

3.3 A Thought Experiment Shows How the Insertion of an Element of Uncertainty (in Our Case in a Model Based Only on the First Postulate - the Principle of Relativity) Leads to a Discrepancy between the Result and the Initial Condition"

So, let's do the following thought experiment for a demonstration of the origin of discrepancy with an insertion of an element of uncertainty in a Reality with a complete certainty. We will analyze the obtained information on two identical events by Observers, located in two moving in parallel each other Galilean systems with constant velocity **V** in the common for the two systems space (within the constructs of Newtonian physics), or in other words: *"Obtaining information about the time interval Δt between two events occurred in the same place in the common for the both systems space".* The experiment takes place in homogeneous gravitational field (like our local physical area), where the principle of relativity is valid. It means that all physical laws are the same in the two reference systems. As was argued in 3.1, in the both systems, the units *second* and *metre* and the constant *speed of light* are the same.

Scenario:
The experiment demonstrates two reference systems K and K' (Figure 1 and Figure 2), moving uniformly and rectilinearly relative to each other along the axes X and X' (the axes "Y" and "Y'" are parallel; the axes "Z" and "Z'" are parallel too). At the beginning of the coordinate systems two observers are located – respectively Observer O in the origin of the coordinate system K, and Observer O' in the origin of the coordinate system K'.

The element of uncertainty is: „For each Observer his own system is stationary, but the other system moves - or it is not determined which system actually moves in the space."

Thus for the observer O system K' is moving with constant velocity in the common space "$\vec{V}$ ", and for the observer O' the system K is moving with constant velocity "-$\vec{V}$ ". At the time of coincidence of the origins of the coordinate systems, observers synchronize their clocks (the clocks measure the same second's duration).

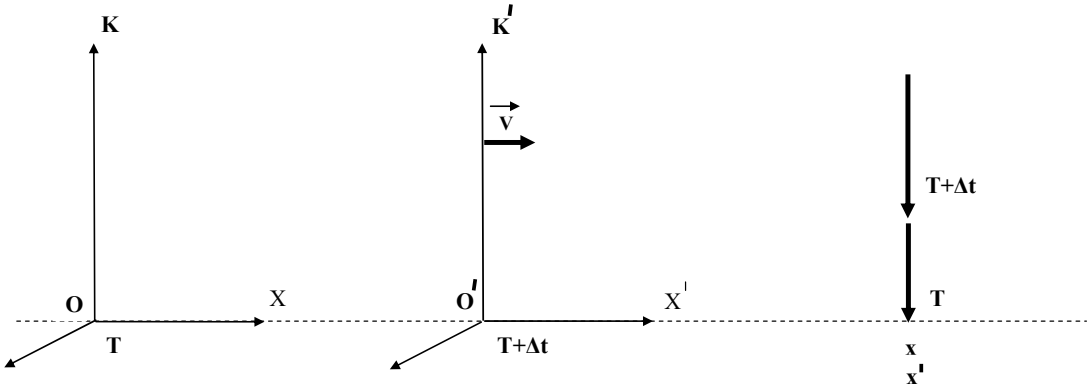

Figure 1. The point of view of Observer, located in the origin of the system **K**

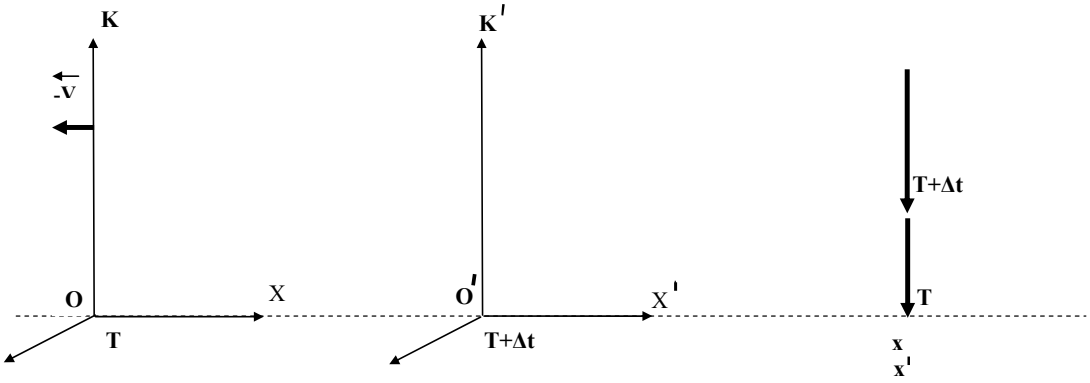

Figure 2. The point of view of Observer, located in the origin of the system **K**'

Events, analysis:

So let's imagine that at time T and at time (T + Δt) in the common space for the both systems and at the point with coordinates (x,0,0) for the system K, or (x',0,0) for the system K' - we have two events "*light flashes*" with an interval of time between them Δt. Since the events occurred in the common space, for observer O the system K' is moving with constant velocity "$\vec{V}$" toward the point of the events, and for observer O' the system K is moving with constant velocity "-$\vec{V}$", or in opposite direction of the point of the events.

Let us analyze what Observers will register or calculate in the two systems.

a) The Observer in system K will register in his own system (stationary according to him):

- the first light flash on his clock at the moment (T + x/c), where x is the coordinate of the events on the *X* axis and **c** is the speed of light (the same for both systems).
- the second light flash - at the moment (T+Δt + x/c) - (Observer O knows, that his own system is stationary in the common space).
- the time interval between the two events will be:

$$\Delta\theta_O^K = (T + \Delta t + \frac{x}{c}) - (T + \frac{x}{c}) = \Delta t \tag{2}$$

*b) The Observer in system **K`** will fix in his own system (also stationary according to him):*

- the first light flash on his clock at the moment (**T+x`/c**), where **x`** is the coordinate of the events on the ***X`*** axis, and **c** is the speed of light **(**the same for both systems).

- the second light flash – at the moment (**T+Δt + x`/c**) - (Observer **O`** knows, that his own system is stationary in the space).
- the time interval between the two events that the Observer **O`** will register in his own system ***K`*** will be also:

$$\Delta\theta_{O'}^{K'} = (T + \Delta t + \frac{x`}{c}) - (T + \frac{x`}{c}) = \Delta t \tag{3}$$

The result is: for both Observers the time interval between the two events is the same and is equal to Δt. If this interval is equal to one second, then in the two systems will be registered that this interval is equal to one second. If Δt = 0, then in the two systems will be registered simultaneousness of the events occurring at that point.

c) What will the Observer O (in the system K) calculate about the question: "when the observer O`(in the system K`) will register the two events"?

According to the Observer O:

- "Observer O` in the system *K`* moving with constant velocity $\vec{V}$ in a direction towards the event's point", will register the first light flash in his own system *K`* at:

$$T_{1O}^{K'} = T + \frac{x - TV}{c + V} \tag{4}$$

- the second light flash, at:

$$T_{2O}^{K'} = T + \Delta t + \frac{x - (T + \Delta t)V}{c + V} \tag{5}$$

- or the time interval between the two events, which the Observer O calculates after his responding to the question "what the Observer O` located in the origin of the system K` will register" is:

$$\Delta\theta_{O}^{K`} = T_{2O}^{K`} - T_{1O}^{K`} = \frac{\Delta t.c}{c + V} \tag{6}$$

Or if this interval is one second (Δt = 1s), then according to Observer O: the time in the system K' will "run" faster, because the second will be shorter with "c/(c+V)". So, if the observed system moves towards the place of the event - it will be calculated, that the unit "*second*" is with a shorter duration, or the time in this system will "run" faster.

If $\Delta t=0$, then and $\Delta\theta_O^{K`}=0$, or the simultaneousness of events occurring in one point again remains the same.

d) What will the Observer O` (in the system K`) calculate about the question: "when the observer O (in the system K) will register the two events":

According to the Observer O`:

- "Observer O in the system *K* moving at the speed / with velocity $-\vec{V}$ in a opposite direction of the event's point", will register the first light flash in his own system *K* at:

$$T_{1O`}^{K} = T + \frac{x`+TV}{c - V} \tag{7}$$

- the second light flash, at:

$$T_{2O'}^{K} = T + \Delta t + \frac{x`+(T + \Delta t)V}{c - V} \tag{8}$$

- Or the time interval between the two events, which the Observer O` calculates after his responding to the question "what the Observer O in the system K will register" is:

$$\Delta\theta_{O`}^{K} = T_{2O`}^{K} - T_{1O`}^{K} = \frac{\Delta t.c}{c - V} \tag{9}$$

Or if this interval is one second (Δt = 1s), then according to Observer O`: the time in the system K will "run" slower, because the *second* will be with longer duration - with "c/(c-V)". So, if the observed system moves in the opposite direction from the place of the event - it will be calculated, that the unit "second" is with longer duration, or the time in this system will "run" slower.

If $\Delta t=0$, then and $\Delta\theta_O{}^K=0$, or the simultaneousness of events occurring in one point again remains the same.

So, summarizing the last two cases - (c) and (d): it occurs that the two Observers register a change of the unit of time in the neighbor observation system, although the unit of time is the same in the both systems as initial condition.

Without deepening in further analysis (for the perception of "change" in length of the unit "metre"), this experiment clearly demonstrates that as a consequence of the accepting an element of uncertainty, that "we cannot say which one of the two systems actually moves in the space" - discrepancy is obtained not only between the two observers' results but also between their results and the initial condition. In our local physical reality, we have perception of full certainty (definiteness). To sum up, if we tolerate an uncertainty - the unrealistic results will be obtained (discrepancy between the results and initial conditions).

4. Conclusions about the Local Physical Reality and Special Theory of Relativity

4.1 Conclusion about Our Local Physical Reality (the Time-Spatial Region near the Earth's Surface)

To summarize, we should define that in our local physical reality (with approximately the same intensity of the gravitational field) exists:

- perception of local absoluteness against the background of global relativity in the Universe, or
- perception of complete local certainty against the background of overall uncertainty in the Universe.

4.2 Conclusion about Special Theory of Relativity

The special relativity is a great attempt for its time to explain our local physical reality. In spite of its unconformity with our local physical reality, the special relativity broke the scientific thinking about the "absoluteness" of the time and space, about the perception and understanding of our physical reality. It also provides the impetus for creation of General Theory of Relativity and as a contribution it remains an unsurpassable genius creation**.**

5. Awareness of the Global Physical Reality in the Universe

The awareness of the global reality in the Universe is based on the reality of the curved space-time by matter and energy. The total gravitational potential or the intensity of the gravitational field in any small time-spatial domain in the Universe is defined by GULW (Global Universe Level of Warping). The GULW is not absolute too and characterizes the level of contraction/expansion of the space-time in the small time-spatial domain. For example, in any time-spatial domain in the solar system, GULW depends on (GL_P+GL_S+GL_G+GL_U), where GL_P is the level depending on the gravitational potential related to the nearest planet; GL_S is the level depending on the gravitational potential related to the Sun; GL_G is this level depending on the gravitational potential related to the warping of the current location of the solar system in the space-time of our galaxy Milky way; and GL_U is the level depending on the gravitational potential related to the current location of the Milky way in the Universe - in relation to all galaxies.

In this paper, "the lower gravitational potential" corresponds to "the stronger gravitational field", or to "the higher level of GULW" - which means contraction of space (shortening the unit "meter"), delay of the time (prolongation of the unit "second") and decreasing the speed of light. And vice versa, "the higher gravitational potential" corresponds to "the weaker gravitational field", or to "the lower level GULW", which means expansion of the space (stretching the unit "meter"), acceleration of the time (shortening the unit "second") and increasing the speed of light.

5.1 Motion as an Inseparable Property of Matter and Energy

The time and space are like two sides of the same coin – they cannot exist alone. The link between the time and space is the motion. If we need to define the notion of movement rather in global, than in local sense, we should say:

"The movement is actually the SIMULTANEOUS continuous change of the coordinates of space and time of the material body, together with the SIMULTANEOUS continuous change of the units of space and time due to the continuous change of the GULW"… because the Universe is dynamic, not static.

5.2 Some of the Consequences of the "Uncertainty Principle of the Macro-World" (Sharlanov, 2012)

Let us consider obtaining information about a particular event "movement" occurring in a remote time-spatial domain with different level of GULW. Observer, located in the local time-spatial domain will meet uncertainty when registering the event "movement" in the remote domain, because he could not determine exactly:

- the real starting moment of the event "movement" in the other time-spatial area.

Information about the starting moment of the event "movement" (received by means of electromagnetic radiation) comes to Observer after indefinite travel time of the electromagnetic signals. It is because at any point of the trajectory, the unit "second" is with uncertain duration; the unit "meter" is with uncertain length, and therefore the speed of the light is uncertain too;

- the duration or the time interval of the event "movement" in the remote time-spatial domain.

In the remote domain where the event "movement" occurs, the time is running uncertainly (uncertain different GULW). If the time in the remote time-spatial domain runs much faster than in Observer's domain, the duration of the local event's period Δt_L can turn out to be less than the Observer's resolution time. Then this event will be unnoticed. Conversely, if the time of the event in the remote time-spatial domain runs much slower than in the Observer's time-spatial domain, the event with a local duration of one second can turn out to be registered by Observer as hundreds or thousands of years - depending on the difference in GULW;

- the local change of the coordinates in space.

The "movement" cannot be evaluated because of the uncertain difference in the curvature of the space (undetermined difference in metric).

Therefore, it is also unreasonable to evaluate the change of the velocity of movement registered in the remote domain, which has a different GULW.

6. Discussion 2: The Global Physical Reality and General Relativity

6.1 Behavior of the Electromagnetic Radiation

6.1.1 Behavior of the Electromagnetic Radiation In a Local Time-Spatial Domain - Maxwell's Equations

Maxwell's equations apply to our local physical reality, where we register full definiteness. They are accurate and without any perception of uncertainty in any "small time-spatial domain", or in any local physical reality, where the gravitational field is homogeneous, where GULW is the same. As was discussed above, the local units and the local physical constants always remain constant for the local Observer in any local physical reality with the same GULW, where they are defined, although they are changing with the general motion in the Universe.

That is way ε_0 - permittivity of free space (also called the electric constant), μ_0 - permeability of 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 the Maxwell's equations, the relation between electricity, magnetism, and the speed of light can be summarized by the equation:

$$c = \frac{1}{\sqrt{\mu_0 . \varepsilon_0}} \tag{10}$$

However, $\boldsymbol{\varepsilon_0}$, $\boldsymbol{\mu_0}$ and $\boldsymbol{c}$ are not universal constants – they are changing with the change of GULW. But it is not possible to register any change in any constant as well as any change in any unit in a local time-spatial domain, where the units are defined.

6.1.2 Behavior of the electromagnetic radiation (frequency, wavelength and speed) in the global space-time – in the Universe

The electromagnetic field exists in the space-time, over the gravitational field. At a strong gravitational field, with higher level of GULW, the "permittivity of free space" (the electric constant $\boldsymbol{\varepsilon_0}$) increases, as well as the "permeability of the free space" (the magnetic constant $\boldsymbol{\mu_0}$) increases – and as a result the speed of light decreases (10). Vice versa – in a weak gravitational field (with higher level of expansion of space), the "permittivity of free space" (the electric constant $\boldsymbol{\varepsilon_0}$) decreases, as well as "the permeability of the free space" (the magnetic constant $\boldsymbol{\mu_0}$) decreases – and as a result the speed of light increases.

According to the general relativity in time-spatial area with a weaker gravitational field (larger "extension" of space, or lower level of warping/distortion GULW), we can say that:

- The time passes faster, which means that the unit "*second*" will be with shorter duration. This actually means that each atom absorbs and emits electromagnetic radiation at a transition of electrons between the same levels – respectively with a higher frequency. So if we consider the definition "*the frequency of the radiation corresponding to the transition between the two hyperfine levels of the caesium 133 atom*" (3th meeting of the CGPM, 1967/68, *Resolution 1)* … of the caesium 133 atom located in the time-spatial domain with lower GULW – this frequency will be higher. So, when fixing the duration of the same 9,192,631,770 number of periods – we will obtain that the unit "second" is shorter.

- The space is "extended", which means that the unit "meter" is longer. This actually means that each atom absorbs and emits electromagnetic radiation with longer wavelength at the transition of electrons between the same levels. So if we consider the definition (11th meeting of the CGPM, 1960, Resolution 6): "*the metre is the length equal to 1650763.73 wavelengths in vacuum of the radiation corresponding to the transition between the levels* $2p_{10}$ *and* $5d_5$ *of the krypton 86 atom",* located in the time-spatial domain with lower GULW – this wavelength will be longer. So, when fixing the length equal to the same 1,650,763.73 wavelengths – we will obtain for the unit meter greater length.

- The increasing the wavelength simultaneously with the increasing the frequency of any electromagnetic radiation, means that the speed of light in the time-spatial domain in weaker gravitational field (with lower level of warping GULW) increases due to the increase of the both ν and λ … (c=λν).

When applying the same logic to the time-spatial domain in stronger gravitational field (with a higher level of distortion GULW, or lower gravitational potential) – we will respectively conclude that the wavelength, frequency and speed of light decrease.

In the article "On the Influence of Gravitation on the Propagation of Light" (Einstein, 1911), the change of the speed of light is also predicted:

$$c = c_0\left(1+\frac{\Phi}{c^2}\right) \tag{11}$$

Einstein constructed this equation on the base of changing the frequency with the changing of the gravitational potential. But the change of the wavelength of the electromagnetic radiation, however, is not taken into consideration. If the change of the unit "*meter*" was set into the expressions of the "**Φ**" and "**c**" – the result would have been uncertainty.

As a proving example, the "Shapiro-time-delay effect" is caused by the lower speed of radar signals passing near a massive object (the Sun) – the radar signals take slightly longer to travel to a target and back, than it would if the mass of the Sun were not present. *"The experiment was designed to verify the prediction that the speed of propagation of light ray decreases"* (Shapiro, 1964). Another result is that in this experiment was not observed gravitational Doppler shift of frequency: "*small a priori uncertainty of the Doppler shift …*".

The most significant experimental proof that the electromagnetic signals increase their speed in areas with weaker gravitational field (lower level GULW) at the border of the Solar system – is the registration of an anomaly in the acceleration of the space probes "Pioneer 10", "Pioneer 11", "Galileo", "Ulysses".

"*The expected travel time of the communicational electromagnetic signals (based on the constancy of the speed of electromagnetic radiation) between the spacecraft and Earth turns out to be much more than the real travel time. As a result, we register backward attraction of the ship to the Sun.*" (Sharlanov, 2011).

Or, we should be aware that:

- "*At the emission, spreading and absorption of any electromagnetic radiation, its frequency and wavelength are in synchrony with the space-time distortion (curvature) of the "space-time domains" where the light emits, passes or absorbs.*" (Sharlanov, 2012).

- Also, "*In the frame of reference associated with the space itself, where the light is actually spreading – it is not possible to prove by measurement (getting true and valid values as a result of this measurement), carried out at a certain time – that there is a change of the value of the speed of light in the time-spatial domain where the SI based units of time and length are defined*" (Sharlanov, 2012).

For example, the frequency is really changing, but the frequency of the emitted radiation (corresponding to the transition between two hyperfine levels of any atom located at a given height) will be measured always the same at any other different height. This is because of the simultaneous and fully synchronous change of the unit of time "second" and the frequency itself. So, any "gravitational frequency shift" is impossible to be registered/measured in the local time-spatial domain, where the units are defined, because of the Uncertainty Principle of the macro-world. Experimental measurements of the so-called "red or blue gravitational frequency shift" are confirmed only by fabricated experiments … after selected corrections.

Another assertion, "the frequency of electromagnetic radiation leaving massive-gravitational-body (e.g. star) decreases" is not in accordance with the presented logic in this paper. The logic in this paper and above mentioned experiments prove that actually the frequency of electromagnetic radiation increases leaving a massive gravitational body.

Although these logical conclusions are the result of a general theory of relativity, the inability to identify changes of the speed of light in vacuum in our local physical reality (in a coordinate system connected to the space) mislead us more than a century, that the speed of light is a universal constant in the Universe. Some of the consequences are:

- both the misuse of the unit "light year" and generally the definition of "distances to stars and galaxies";
- considerations such as "one second or minute after the Big Bang" … without asking a simple question: "With our unit "second" you measure seconds or minutes after the Big Bang?"

For example, if GULW at some moment after the Big Bang was 10^{15} times greater than now in our reality, then one second at that time would correspond to more than 30 million present years … That's why, the most accurate statement is that to one "*second*" immediately after the Big Bang corresponds "uncertain duration of time".

- calculations of time as "the Universe exists since 13.75 ± 0.11 billion years".

Surprisingly, it is ignored the fact that for the whole Universe, in all of its points – the duration of the unit "second" undergoes extremely large and uncertain changes.

Actually, it is unawareness that the both – the space and the time are not absolute.

6.2 Einstein's Field Equations (EFE) and Uncertainty Principle for the Macro-world

Let us consider the essence of the matter: "What is an equation?"
An equation is a mathematical statement that asserts the equality of two expressions. The mathematical equations often express relationships among the given quantities, the *knowns (a, b, c, d, ...)*, and quantities yet to be determined, the *unknowns (x, y, z, w, ...)*. The process of expressing the unknowns in terms of the knowns is called solving the equation.

In physics, the equality of the expressions represents relationships between physical quantities, through a certain used system of units (for example – SI system). However, the physical equations are based on acceptance that the units of the measurement systems are constants. That's why, in the physical equations not only the physical constants, but all of the units (basic units and derived units) are accepted to be unchangeable too. It is true, but in a local physical reality, where the gravitational field is homogeneous, where GULW is the same.

Let's see the Einstein's modified field equation:

$$R_{\mu\nu} - \frac{1}{2} R g_{\mu\nu} + \Lambda g_{\mu\nu} = \frac{8\pi G}{c^4} T_{\mu\nu} \tag{12}$$

The expression on the left side of the equation represents *unknown* warping of the structure of space-time ($\boldsymbol{R_{\mu\nu}}$ is the Ricci curvature tensor, $\boldsymbol{R}$ is the scalar curvature, $\boldsymbol{g_{\mu\nu}}$ is the metric tensor, and $\boldsymbol{\Lambda}$ is the cosmological constant. The expression on the right side represents the *known* matter and energy ($\boldsymbol{T_{\mu\nu}}$ is the stress-energy tensor). The Gravitational constant $\boldsymbol{G}$ and the speed of light $\boldsymbol{c}$ appear as universal constants. The EFE can then be interpreted as a set of equations representing how 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 are written on the base of the same, unchangeable measurement units. So, again we come up to the *uncertainty principle of the macro-world*. Thus, if we try to calculate the change of the units in vastly remote time-spatial domain by means of the units defined near the Earth's surface (our local reality), it will be quite inaccurate. Moreover, the speed of light is accepted as a global, universal constant. That's why, for example, if the equations of the General Relativity are used – an anomaly in the acceleration of the spaceships "Pioneer 10", "Pioneer 11", "Galileo", "Ulysses" at the boundary of the solar system is calculated.

7. Conclusions about the Global Physical Reality and General Theory of Relativity

Universe, as a space-time, can be considered as an infinite set of small time-spatial domains. And we should realize that the physical reality in any local time-spatial domain changes in perfect synchronicity with the change of the intensity of the gravitational field which not only influences on the space-time in the local time-spatial domain, but it also means that all physical units and all physical constants change in full synchronicity too.

General relativity represents the distortion of the space-time depending on the matter and energy, but from a local point of view, or "How the distortion would look like, if the physical constants are global and unchangeable for the whole Universe, and if we use our local units as global and unchangeable". Or to have a sign of equality in Einstein's field equation – these two conditions must be met. So, the uncertainty principle of the macro-world does not allow this equation to be valid in a global sense – for the whole Universe."

But General Relativity predicts the general behavior of the Universe with the changing space and time and the entire global physical reality. This article is only a small sequence and development of the ingenious theory of Einstein.

8. Epilogue: Theory of Everything or Theory of Nothingness

Let's consider the behavior of electromagnetic radiation traveling to a "black hole". With the increasing intensity of the gravitational field, the frequency of the electromagnetic radiation falls (to zero), the wavelength shortens (to zero) and, consequently, the velocity of electromagnetic radiation drops (to zero). So, with the propagation of the electromagnetic radiation to "the black hole" - the electromagnetic radiation converts in a stationary point (vanishes in "nothingness").

Let us now consider the behavior of electromagnetic radiation, which escapes at some condition from a "black hole". In that case we register the birth of photons (energy) out of nothing, but in more specific terms - the birth of a particle from the "nothingness".

What is then the Big Bang - may be the birth of matter of the Universe from "a global black hole of the Universe", which actually is "the birth of the matter and energy of the Universe from the "nothingness"…

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