Space, Time and Units – Fundamental Vision

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Abstract

The change of the units between two "time-spatial domains" with different gravitational potentials is analyzed in the article, as a consequence of the nature of space and time which are mutually connected with each other in the warped space-time of the Universe.

The main topic of the article is:
New definition of the postulate "*invariance of the speed of light*" - "*<u>uncertainty principle of the macro-world</u>*".

Other topics concerned:

- The change of the SI base units *(second* and *metre)* and the *speed of light* in the Gravitational Field are analyzed while discussing of the article of Albert Einstein "On the Influence of Gravitation on the Propagation of Light".
- The change of the SI base units *(second* and *metre)* in Field without Gravity is analyzed, and then conclusion about Special Theory of Relativity is made.
- A new universal hierarchical structure of the SI System is proposed, where the "*second*" and "*metre*" stay at the highest level. The main principle of the hierarchical place of any unit is also proposed.

The consequences of this article directly reflect on cosmology and give explanations of a lot of problems (such as: "the accelerated expansion of the Universe", "the problem with the dark matter", etc.).

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Contents:

Introduction

"The formulation of a given problem is far more essential, than its decision that could be simply a question of mathematical or experimental skills. In order to bring up new questions, to indicate new capabilities, to look at old problems under a new angle, a creative imagination is required. That is what marks the real advance in science".

Albert Einstein, Leopold Infeld, *"Evolution of Physics ", 1938*

The main approach in this article was to be written in the most simple and understandable way. The professional would say: "It is too simple, to be a truth!"
Too many complex articles with big mathematical skills were written after the Special Theory of Relativity, but they have not "mark the real advance in science". The Special Theory of Relativity is based on the postulate "Invariance of the speed of light". But the change of the speed of light can not be determined in the "small space-time area", where the SI based units for time and length have been defined and where the experiment is carried out. In the article are specified the reasons why the change of the speed of light can not be determined.

The next major consequences of this article can be marked:

- The simple solutions of problems like "the accelerated expansion of the Universe", and "the dark matter in the Universe", which were and are research subject from a long time.

- If the Law of Conservation of Energy is reconsidered from the point of view of this article - the simple explanation of some "miracles", like "the birth of the energy/matter from the nothing" can be given.
- The main consequence of this article will be: "the science to be directed to the discovery of new ways of obtaining and producing energy".

Indeed:
1. Some courage is needed to say that too much work of too many great scientists turns out to be in vain and wasted, although it is not true.
2. Too much money were lost, and unfortunately will be lost for solution of the above mentioned problems.

That is why, many people might overlook the main idea of this paper.

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Our units are only for our "small time-spatial domain". Furthermore, the "time-space" continuously changes in each "time-spatial domain" (the Universe is not static), but it cannot be understood. The space and time are intimately and mutually connected with each other in the warped space-time of the Universe.

A lot of cases of contradictory results, which are often named "*singularity*" or "*strangenesses"* are a result of not specifying:

- the standards and units in the location of the experiment and in the location of the Observer (their distinguishing);
- the way of the unit definitions of the SI base units *second* and *metre* (of the *time* and *length*);
- what are the initial conditions and their influence on the results.

1. Definition of the SI base units *"metre"* according to its definition in 1960 year, but using electromagnetic radiation of the last definition of the "*second*" in the International system of units SI

No discrepancy and/or contradictions will be encountered, if the SI base units *second* and *metre* (of *time* and *length*) are defined as a result of an experiment on the base of one *"standard electromagnetic radiation"*.

This way of definition of the SI base units *second* and *metre* is convenient when the standards in different time-spatial areas (domains) with different gravitational potential are comparing, what is done below in the article as an approach.

1.1. About definitions of the SI base units in the framework of general relativity

Overall, the definitions of standards in "SI" in the framework of general relativity is written in the „*SI brochure 8^th^ edt./BIPM 2006"*:

"The definitions of the base units of the SI were adopted in a context that takes no account of relativistic effects. When such account is taken, it is clear that the definitions apply only in a small spatial domain sharing the motion of the standards that realize them. These units are known as proper units; they are realized from local experiments in which the relativistic effects that need to be taken into account are those of special relativity.“ [1)]

1.2. Definitions of the SI base units "second" and "metre" (of time and length) in the International System of Units "SI"

- *The second,* the SI base unit of time.

The 13th CGPM (1967-1968, Resolution 1) replaced the definition of the second by the following:
"The second is the duration of 9 192 631 770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the caesium 133 atom." [2)]

At its 1997 meeting, the BIPM affirmed that:
"**This definition refers to a caesium atom at rest at a temperature of 0^0K.**" [3)]

<u>Convention</u>***: Let's name this radiation in the article as "standard radiation", and ν_s and λ_s are the frequency and wavelength of this "standard radiation".***

- *The metre,* the SI base unit of length.

Since 1983, by the 17th CGPM (Resolution 1) *the metre is* replaced *as:*

"The metre is the length of the path traveled by light in vacuum during a time interval of 1/299 792 458 of a second." [4)]
This definition is based on the postulate "Invariance of ***c*** (speed of light)".
The symbol $\mathbf{c_0}$ (or sometimes simply **c**), is the conventional symbol for the speed of light in vacuum.

The value of the *speed of light* is recommended in 1975 by the 15th CGPM in its Resolution 2: **"recommends the use of the resulting value for the speed of propagation of electromagnetic waves in vacuum *c* = 299 792 458 metres per second."** [5)]

1.3. Definitions of the SI base units "metre" and "second" by means of an identical experiment, with the same "standard radiation"

As a matter of principle, the *unit definition* means that exact definite experiment is carried out at exact definite initial conditions. As a result of this experiment, a certain NUMBER is fixed, which is defined as *unit* and is given a *name*.

The definition of *metre* in force since 1889, based on the international Prototype of platinum-iridium, is abrogated with Resolution 6 of the 11th meeting of CGPM (1960). The definition of the metre was replaced by the following:

"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." [6)]

No discrepancy and/or contradictions will be encountered, if the SI base unit of length "*metre*" is defined on the basis of the same *"standard radiation"*, which we use for definition of the *second.* Or for convenience of the statements in the article – let us define the *metre* as:

„the length, equal to 30.66331899 wavelengths of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the caesium 133 atom in a vacuum, at rest at a temperature of 0^0K. "

By means of determining of 30.66331899 wavelengths of this *"standard radiation"*, we define our *unit* of length, and we call it a *„metre".* Or *one metre* we match with the number 30.66331899 as a result of the same exact definite experiment.

In this way, if the number of periods per *second* is N_s=***9 192 631 770*** and the number of wavelengths per *metre* is N_m=***30.66331899***, for the constant "*speed of light"* remains the same value (number):

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

2. The postulate "*invariance of the speed of light*" - two reasons why the change of the *speed of light* cannot be determined. *"Uncertainty principle"* for the macro-world

Two reasons why the change of the speed of light cannot be measured and determined are analyzed below.

2.1. (Well known) Assumptions:

- "The wavelength and the frequency of the emitted radiation corresponding to the transition between the same levels of any atom, <u>are in correspondence (synchronous) with gravitational potential (time-space distortion, curvature) of the time-spatial area (domain) where the atom is located.</u>"

It is true for any transition of any atom (and for the *"standard radiation"*).

If it was not true, then different lines of absorption (such as those of the hydrogen) from stars with different masses at approximately the same distance from the Earth would be observed. If emitted radiation is not in sync, then at the stars with different masses will have different "gravitational red shift" and therefore different shift of absorption lines.

- "The wavelength and the frequency of any emitted electromagnetic radiation <u>change</u> (when passes through small time-spatial domains) <u>synchronously with their space-time distortion</u>."

If this was not true, then <u>we would observe different lines of absorption</u> of (such as those of the hydrogen) from stars with approximately the same masses, but at different distances from us (and light travels to us through different traces, through local space-time areas with different space-time distortion).

Summary: ***At the emission and spreading of any electromagnetic radiation its frequency and wavelength are in synchrony with gravitational potential of the space-time domains.***

2.2. *Reason 1: The „way of definition" of the SI base units of length and time ("metre" and "second")*

The case under consideration:

2.2.1. Initial conditions

1. Let's look at two local small time-spatial areas (domains) - one is $\mathbf{D_1}$, and the other is $\mathbf{D_2}$, in the real warped time-space of our Universe. Let them generally have different gravitational potential (different time-space distortions) and the gravitational potential of $\mathbf{D_2}$ is higher than gravitational potential of $\mathbf{D_1}$, or ($\mathbf{\Phi_2>\Phi_1}$).

2. The SI base units - *second* and *metre* are defined in $\mathbf{D_1}$ and $\mathbf{D_2}$ through the same experiment (under *1.3.*) **-** using the *"standard radiation"*, corresponding to the transition between the same two hyperfine levels of the *Cesium-133* atom**.**

2.2.2. Analysis

- Let us name the unit of time, obtained by measuring the duration of N_s=***9 192 631 770*** periods of the *"standard radiation"* in $\mathbf{D_1}$ "*second-1", and in $\mathbf{D_2}$ – respectively "*second-2*"**.**

Obviously "*second-1"* will be with longer duration than "*second-2",* because the gravitational potential of $\mathbf{D_2}$ in relation to $\mathbf{D_1}$ is ($\mathbf{\Phi_2 > \Phi_1}$) - or the time in $\mathbf{D_1}$ passes more slowly.

But if someone measures the frequency $\mathbf{\nu_s}$ of the *"standard radiation"* ($\mathbf{\nu_{s1}}$ in $\mathbf{D_1}$ and $\mathbf{\nu_{s2}}$ in $\mathbf{D_2}$) with their own units (defined in their time-spatial domains), he will obtain the same value.

If it is marked in the following way:

<u>Convention</u>: ***„The subscript indicates in what domain the measurement is carried out and the superscript indicates the domain where the unit is defined".***

, then it can be derived:

$$\mathbf{\nu_{s1}^{\ 1} = \nu_{s2}^{\ 2}} \qquad (2)$$

although the frequency of *"standard radiation"* in $\mathbf{D_1}$ is less than in $\mathbf{D_2}$**.**

- Let us name the unit of length, obtained by measuring the length of N_m=***30.66331899*** wavelengths of *"standard radiation"* in $\mathbf{D_1}$ "*metre-1",* and in $\mathbf{D_2}$ – respectively "*metre -2*"**.**

Obviously "*metre -2"* will be longer than "*metre -1",* because the gravitational potential of $\mathbf{D_2}$ in relation to $\mathbf{D_1}$ is $\mathbf{\Phi_2 > \Phi_1}$ - or the space in $\mathbf{D_2}$ is more expanded than the space in $\mathbf{D_1}$ **.**

But if someone measures the wavelength of the *"standard radiation"* ($\mathbf{\lambda_{s1}}$ in $\mathbf{D_1}$ and $\mathbf{\lambda_{s2}}$ in $\mathbf{D_2}$) with their own units (defined in their time-spatial domains), he will obtain the same value, or:

$$\mathbf{\lambda_{s1}^{\ 1} = \lambda_{s2}^{\ 2}} \qquad (3)$$

although the wavelength of the *"standard radiation"* in $\mathbf{D_1}$ is shorter than in $\mathbf{D_2}$**.**

- In either of the two cases, if someone measures *speed of light* in the two domains ($\boldsymbol{c_1}$ in $\mathbf{D_1}$ and $\mathbf{c_2}$ in $\mathbf{D_2}$ in our example) with their own units defined in their time-spatial domains, he will obtain the same value (will have the same number), or:

$$\boldsymbol{c_1^{\ 1}}=\mathbf{c_2^{\ 2}}=N_s/N_m=9192631770/30.66331899=299\ 792\ 458\ \ [m/s] \qquad (4)$$

Summaries of the analysis:

- In spite of the fact that the SI base units (*metre* and *second*) are different in two domains with different gravitational potential, the measurement results for the frequency and wavelength of the *"standard radiation"* will be the same. This is because the SI base units (*metre* and *second*) are defined on the base of identical experiments by means of the same electromagnetic radiation.

- The difference of *speed of light* cannot be determined in the domains with different gravitational potential, because the change of the base units of the SI (*second* and *metre*) cannot be determined when they are defined on the base of the same experiment through specific electromagnetic radiation.
- Further more, if we choose another, *"new standard radiation"*, different from previous electromagnetic radiation and if we define the SI base units of time and length (the *second* and *metre*) through the same experiment, fixing the same numbers N_s and N_m (1) - we will measure the same values (numbers) for the frequency and the wavelength of this *"new standard radiation"*, and the same result for the *speed of light* in spite of the fact, that the units *metre* and *second* are different.
- Because of it follows and that the change of *speed of light* cannot be determined in case of changing the gravitational potential of the domain where the observer is located and where the units are defined.

2.3. Reason 2: The „synchronous change" of physical units and standards at changing the gravitational potential (curvature of space-time)

Perceptions:

- If the whole spectrum of electromagnetic radiation does not change synchronously its parameters (frequency and wavelength) with the change of the gravitational potential, the change in the *speed of light* could be determined.
- If all physical realities do not change synchronously with the change in gravitational potential, a change could be determined not only of the constant *speed of light*, but we could fix a change of the other physical constants.

2.4. New variant of the postulate "invariance of the speed of light". Definition of "Uncertainty principle" for the macro-world

It is not possible to measure a change of *speed of light* because of the next two reasons:

- The *„way of definition"* of the SI base units (*metre* and second) is based on identical experiments through electromagnetic radiation, and on interrelated characteristics of the electromagnetic radiation (of the light).
- The *„synchronous change"* of all physical standards at changing the gravitational potential (curvature of space-time).

Or we can not fix any change of *speed of light* because of the nature of space and time which are intimately mutually connected with each other in the warped space-time of the Universe.

Conclusions:

1) A new variant of the postulate "*invariance of the speed of light***"** should be considered:

"It is not possible to prove by measurement, carried out at a certain time, that the speed of light has changed in the time-spatial domain where physical standards are defined."

Due to the above mentioned reasons, it is not possible to determine the change of *speed of light* by Michelson-Morley experiment. Now, all results of Michelson-Morley experiment can be explained in different way. By means of this experiment, a change of the *speed of light* or *shift of frequency* cannot be determined, because the source of light, the mirrors and the detector are fixed - they do not move relative each other. If they are moving - it would bring asynchronism and we will fix a shift of frequency.

2) The "uncertainty principle" for the macro-world can be drawn:

> ***"It is not possible to demonstrate or prove by measurement that any physical constant (the speed of light, Planck's constant, etc.) has changed in the time-spatial domain where physical units are defined."***

3) Generalization:

> ***All of the physical world in „our time-spatial domain" changes synchronously with the changes of global time-space of the Universe as a whole (all SI based and derived units, as well as all physical constants), and it cannot be demonstrated or proven by experiment.***

The assumptions of Alexander Friedmann that „the Universe looks identical in whichever direction we look, and that this would also be true if we were observing the Universe from anywhere else" create the *"Border of the Experimental Provability"*. These assumptions can not be proved by experiment.

It can be added that the Universe looks the same regardless of change of curvature of time-space in the point where we are located.

3. Analysis of the changing of the SI base units (*metre* and *second*), and the local constant *speed of light* in the Gravitational Field

3.1. Two cases under consideration

Analysis is based on changing the results, when the measurement is carried out in the certain "small time-spatial domain", but with the units defined in another "small time-spatial domain" with different gravitational potential.

For this purpose we can mentally measure the frequency and the wavelength of our *"standard radiation"* in certain domain, but with standards (units) defined in the other domain (the initial conditions are the same – see 2.2.1) **:**

- *Case 1*

"Measuring the frequency and the wavelength in domain $\mathbf{D_1}$, but with the units "*second-2"* and "*metre-2"* defined in domain $\mathbf{D_2}$, where $\mathbf{\Phi_2 > \Phi_1}$" – the obtained results will be (ν_{s1}^2 and λ_{s1}^2).

When measuring the frequency and the wavelength of the *"standard radiation"* in $\mathbf{D_1}$ with the units defined in $\mathbf{D_2}$ (where the *metre* is longer, but the *second* is shorter than those in $\mathbf{D_1}$), the results (values) will occur to be smaller than those measured with their own units defined in time-spatial domain $\mathbf{D_1}$:

$$\nu_{s1}^2 < \nu_{s1}^1 \quad \text{and} \quad \lambda_{s1}^2 < \lambda_{s1}^1 \tag{5}$$

The resulting value (number) of measurement of the *speed of light* in domain $\mathbf{D_1}$ with the units defined in $\mathbf{D_2}$, will be much less if we were using the units defined within the domain $\mathbf{D_1}$ **:**

$$c_1^2 = \nu_{s1}^2 \,.\, \lambda_{s1}^2 \ll \nu_{s1}^1 \,.\, \lambda_{s1}^1 = c_1^1 = 299\,792\,458 \quad [\text{m/s}] \tag{6}$$

- *Case 2*

"Measuring the frequency and the wavelength in domain $\mathbf{D_2}$, but with the units "*second-1"* and "*metre-1"* for domain $\mathbf{D_1}$ - ($\mathbf{\Phi_2 > \Phi_1}$)" – the obtained results will be (ν_{s2}^1 and λ_{s2}^1).

Respectively, when measuring frequency and the wavelength of the *"standard radiation"* in $\mathbf{D_2}$ with the units for $\mathbf{D_1}$ (where the *metre* is shorter, but the *second* is longer than those in $\mathbf{D_2}$), the results (values) will occur to be bigger than those measured with their own units defined in time-spatial domain $\mathbf{D_2}$:

$$\mathbf{\nu_{s2}^{1} > \nu_{s2}^{2}} \qquad \text{and} \qquad \mathbf{\lambda_{s2}^{1} > \lambda_{s2}^{2}} \tag{7}$$

When the measurement of the *speed of light* in domain $\mathbf{D_2}$ is made with the units defined in $\mathbf{D_1}$, the resulting value (number) will be much bigger if we were using the units defined within the domain $\mathbf{D_2}$:

$$\mathbf{c_2^{1} = \lambda_{s2}^{1}.\nu_{s2}^{1} >> \lambda_{s2}^{2}.\nu_{s2}^{2} = c_2^{2}} = \mathbf{299\,792\,458} \ [\mathrm{m/s}] \tag{8}$$

3.2. Conclusion about the change of the local constant "speed of light" in the gravitational field

Thus, measuring speed of light in two domains with different gravitational potentials, respectively Φ_1 of D_1 and Φ_2 of D_2, ($\Phi_2 > \Phi_1$), but with the units defined in only one of domains, <u>the much greater speed of light in D_2 will be confirmed in the two above mentioned points of view (the two cases)</u>.

This is due to both the increased frequency and increased wavelength of electromagnetic radiation in $\mathbf{D_2}$ than in $\mathbf{D_1}$.

3.3. Discussion

In the article [7], Einstein deduces equations on the base of the equivalence of the physical laws in a stationary system in homogeneous gravitational field (acceleration of gravity γ) and the physical laws in a system moving with uniform acceleration (γ) in a space free of gravitational fields.

Einstein marks in this article, that in locations with different gravitational potentials, different standards (units), "clocks of unlike constitution for measuring time" have to be used:

"… we must use clocks of unlike constitution for measuring time at places with differing gravitation potential.

For measuring time at a place which, relatively to the origin of the co-ordinates, has the gravitation potential $\mathbf{\Phi}$, we must employ a clock which – when removed to the origin of co-ordinates – goes $\mathbf{(1 + \Phi/c^2)}$ times more slowly than the clock used for measuring time at the origin of co-ordinates." [8]

The frequency in a location which has the gravitation potential $\mathbf{\Phi}$ relatively to the origin of the co-ordinates will be higher, but measured by the standards (using units) defined in the origin of the co-ordinates):

$$\nu = \nu_0\left(1+\frac{\Phi}{c^2}\right) \quad [8] \tag{9}$$

Here the *speed of light* c is a constant. Further in the article, Einstein states:

„If we call the *speed of light* at the origin of co-ordinates c_0, then the *speed of light* c at a place with the gravitation potential $\mathbf{\Phi}$ will be given by the relation:

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

The *principle of the constancy of the speed of light* holds good according to this theory in a different form from that which usually underlies the ordinary theory of relativity." [8]

<u>However, in this article the change of wavelength depending on the gravitational potential has not been analyzed:</u>

"The relations here deduced, even if the theoretical foundation is sound, are valid only to a first approximation." [8]

Or when using " $h\gamma = \Phi$ ", the change of both the "h " and the „γ" according to the gravitational potential is not taken into account. However, if it is taken into account not only the increasing of the frequency of the light in the point with higher gravitational potential, but and the increasing of the wavelength - then for Observer in the beginning of the co-ordinates, the increasing of the *speed of light* will be greater.

Due to the "synchronous change" of all of the units of SI, all physical constants, and the entire physical world, we cannot measure directly the "*gravitational redshift*". The "gravitational redshift" is possible to be fixed if asynchronism is used (such as the relative movement between the source of the electromagnetic radiation and the receiver). Brilliant example is the Pound–Rebka experiment. In this experiment asynchronism was used and the presence of "the gravitational redshift" was tested successfully.

4. Analysis of the changing of the SI base units "*metre*" and "*second*", and the local constant "*speed of light*" in field without gravity (according to Special Theory of Relativity)

The Special Relativity is based on two postulates:

- principle of relativity,
- invariance of *c* (the *speed of light)*.

4.1. "Thought-experiment"- result of the special relativity

Two Observers located in two uniformly moving, relatively to each other systems with speed V , in a movement direction will register the same results:

- the length in other neighbour system is reduced (unit *metre* is shorter),
- the time in other neighbour system runs more slowly (unit *second* is with more duration) .

Scenario: **"Both Observers in their systems emit a ray of light (light beam) with the "*standard radiation*" in a direction opposite to the movement of the other neighbour system".** (In the opposite direction to the movement of other neighboring system means that it is in the direction of relative motion of its own system).

According to Special Theory of Relativity, for each Observer the emitted "*standard radiation*" in the other neighbour system will be:

- with lower frequency compared to the frequency of the *"standard radiation"* in its own system:

$$\nu = \nu_0 \sqrt{1 - \frac{V^2}{{c_0}^2}} \tag{10}$$

and with longer unit "*second*" than the "*own second*" in its own system:

$$s = \frac{s_0}{\sqrt{1 - \frac{V^2}{{c_0}^2}}} \tag{11}$$

where s_0 is the unit of time "*second*" and ν_0 is the frequency of the *"standard radiation"* in its own system; V is the relative speed between the systems; and c_0 is *the speed of light,* <u>which is considered to be constant and equal in the both systems</u>.

- with reduced wavelength compared to the wavelength of the *"standard radiation"* in its own system:

$$\lambda = \lambda_0 \sqrt{1 - \frac{V^2}{{c_0}^2}} \tag{12}$$

and shorter unit "*metre*" than "own *metre* " in its own system:

$$m = m_0 \sqrt{1 - \frac{V^2}{c_0^{\,2}}} \tag{13}$$

where m_0 is e the SI base unit of length "*metre*" and λ_0 is a wavelength of the "*standard radiation*" in its own systems; V is the relative speed of both systems; and c_0 is the *speed of light*, <u>which is considered to be constant and equal in the both systems</u>.

<u>The result of the experiment</u>:

Indeed, each of the Observers can calculate the *speed of light* of the "*standard radiation*" in the neighbour system and the result will be different from *speed of light* in its own system (c_0):

$$c = \lambda.\nu = \lambda_0 \sqrt{1 - \frac{V^2}{c_0^{\,2}}}.\nu_0 \sqrt{1 - \frac{V^2}{c_0^{\,2}}}. \neq \lambda_0.\nu_0 = c_0 \tag{14}$$

Or for each Observer, the *speed of light* in the neighbour system will differ from *speed of light* in its own system with:

$$(1 - \frac{V^2}{c_0^{\,2}}) \tag{15}$$

<u>But this is contrary to the used initial condition of the Special Theory of Relativity (postulate of constancy of the speed of light).</u>

4.2. Conclusion concerning the " Special Theory of Relativity"

The Special Theory of Relativity is based on two postulates by applying the Lorentz transformations. <u>It turns out that the result of the above mentioned experiment conflicts with the initial condition - *the postulate of constancy of the speed of light.*</u>

Therefore, the conclusion is:

The *Special Theory of Relativity is the consequence of the "information effect"* due to the adoption of the constancy of the speed of light.

5. Proposal for a new universal hierarchical structure of the SI System

The *new universal hierarchical structure of the SI System* can be created, based on the following rules:

- To set the units of the SI "*metre*" and "*second*" at the top of the hierarchical structure of the SI System, as base units of the time and space (length).

The frequency and the wavelength of electromagnetic radiation are the most significant interrelated characterizations of electromagnetic radiation. They are significant quantities not only because we can communicate in the Universe only by means of electromagnetic signals. All units in the SI system can be expressed through "metre" and "second", and they in turn can be defined based on certain electromagnetic radiation of a specific frequency by fixing one or more constants.

- To set the main principle for the level of each unit in the hierarchical structure of the SI System.

If we accept the rule to define the units of all physical quantities by fixing the value of the most appropriate fundamental physical constant (the closest to the frequency), then this principle can be:

"The closer is the connection of the constant to the frequency, the higher is the level of the unit in the hierarchical structure of the SI System".

In this way all our units will turn over "in space-time floating units"- they will synchronously change according to the space-time warping in any particular point in the Universe. With the change of electromagnetic radiation, we can judge change of all physical Reality.

Indeed, it has already been working in the direction of this idea.
In the report of the 17th meeting (29 June-1 July 2005) to the International Committee for Weights and Measures, the issue about redefinition of the kilogram, as well as Ampere, Kelvin and mole has been discussed:

"3. REDEFINITION OF THE KILOGRAM, AND POSSIBLY THE AMPERE, KELVIN AND MOLE,

The paper by Mills *et al (Metrologia,* 2005, 42, 71-80) had initiated a lot of debate on the subject of the redefinition of the kilogram. The questions to be considered are:

- Should we recommend action to redefine the kilogram?
- If so, to fix the value of the Planck constant $\hbar$, or of the Avogadro constant, N_A ?
- If so, at what date should we be planning to change the definitions?
- Should we also recommend redefining the ampere to fix the value of the elementary charge e^- ?
- Should we also recommend redefining the kelvin to fix the value of the Boltzmann constant k ?
- Should we also recommend redefining the mole to allow N_A to be fixed without over-constraining the system?" [9)]

Apparently, according to that idea, redefinition of the SI base unit of mass (kilogram) should be done by fixing the Planck's constant. In addition, by fixing the Avogadro's constant, the SI base unit of amount of substance (mole) could be "attached" to the *frequency.* Or even better, a new universal hierarchical structure of the SI System could be created.

6. Main conclusion about Units, Constants and Physical Laws

- Units we define for the main physical quantities.

With the change of "the warping of the space-time" – all standards and units of all physical quantities in any "small time-spatial domain" synchronously change with the change of the gravitational potential within the small "time-spatial domain" where they are defined.

Units in the SI are created as a result of applying certain logic over certain experiment, by means of fixing a certain constant, which also synchronously changes.

- Physical constants (Planck constant, **h** ; Avogadro constant, $\mathbf{N_A}$; Boltzmann constant **k** ; etc.) are only **local constants**. Because of the synchronously change of all units, the values of all constants remain constant because of the fact, that the units themselves are defined by fixing certain constants.
- Physical laws are the same in the any "time-spatial domain" in the "warping of the space-time" of entire Universe and represent the intimate and mutual connections between all physical quantities.

That is why, in the "small time-spatial domain" the all changes in the physical world cannot be understood, because the entire physical world synchronously changes.

The "warping space-time" of the Universe can be considered as a "continuity space", or better "continuity space-time". The "variation laws" at the transition between different "small time-spatial domains" can be considered as continuous functions and the homotopy will represent the relation between any "small time-spatial domain".

It is important for example, the **Law of Conservation of Energy** to be reconsidered from this point of view and correct the "cosmological view" of the total amount of energy in the Universe.

References

1) BIPM SI brochure 8th edt. (2006), *1.5 SI units in the framework of general relativity*:
http://www.bipm.org/utils/common/pdf/si_brochure_8_en.pdf

2) 13th meeting of the CGPM (1967/68) *Resolution 1*:
http://www.bipm.org/en/CGPM/db/13/1/

3) BIPM SI brochure 8th edt. (2006) *2.1.1.3 Unit of time (second)*:
http://www.bipm.org/utils/common/pdf/si_brochure_8_en.pdf

4) 17th meeting of the CGPM (1983) *Resolution 1*:
http://www.bipm.org/en/CGPM/db/17/1/#notes

5) 15th meeting of the CGPM (1975) *Resolution 2*:
http://www.bipm.org/en/CGPM/db/15/2/

6) 11th meeting of the CGPM (1960) *Resolution 6*:
http://www.bipm.org/en/CGPM/db/11/6/

7) A.Einstein: *On the Influence of Gravitation on the Propagation of Light* (1911) [Translation from "Über den Einfluss der Schwercraft auf die Ausbreitung des Lichtes", in Das Relativitätsprincip, 4th edition, originally from Annalen der Physik [35], (1911)]:
http://einstein.relativitybook.com/Einstein_gravity.html

8) A.Einstein: *On the Influence of Gravitation on the Propagation of Light, 3.Time and the Velocity of Light in the Gravitational Field* (1911):
http://einstein.relativitybook.com/Einstein_gravity.html

9) Bureau International des Poids et Mesures, Consultative Committee for Units (CCU) (29 June – 1 July 2005), *Report of the 17th meeting* p.7:
http://www.bipm.org/utils/common/pdf/CCU17.pdf