One-way Measurement of the Speed of Light – the Factual Analysis

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Abstract. The article starts with a general introduction to the problem in modern physics about the constancy of the speed of light for all frames of reference. In the "General Introduction", besides presenting the used terms and definitions, the fundament of a real solution about all "unexpected" and "inexplicable" results of the experiments related to the measurement of the velocity of light in the time-spatial region "on the Earth surface" is given. The presented analysis of the experiments with "One-way measurement of the speed of light" is based on the classical mechanics and Galilean relativity, which are indisputably valid and legitimate in our local time-spatial domain "on the Earth's surface". The experiments undoubtedly show that in the frame of reference related to the Earth's surface, the measured velocity of light in the "East-to-West" direction is higher, and in the direction "West-to-East" it is lower than the speed of the light in vacuum. The difference is equal to the linear velocity of the Earth's surface at the latitude where the experiment is carried out. Despite the obvious fabricated explanation of the results of the experiments by the supporters of the special theory of relativity (using the inadmissible but convenient implausible clock synchronization convention) - the real conclusion is that these experiments are actually irrefutable proof that the measured speed of light in a local time-spatial region with a uniform intensity of the gravitational field is not the same for all inertial frames of reference.

KEY WORDS: special theory of relativity; speed of light postulate; one-way measurement of the speed of light.

1 General Introduction - Used Terms and Definitions

1.1 Concerning the used frames of reference and the speed of light

1.1.1 Frames of reference

The reference system (frame of reference) is a concept in physics (usually associated with the movement) to denote the point of view of the observer.

When we talk about a frame of reference (reference system), we usually imagine it as a coordinate system and we talk about an observer or an experimenter associated with. When an observer is attached to a frame of reference, this frame is stationary for the observer.

Coordinate systems.

The reference frames used in dynamics are known as coordinate systems. The most widely used is the Cartesian coordinate system which consists of an

origin and three axes. The axes are fixed lines, sized/dimensioned with numbers, corresponding to the same unit of length, perpendicular to one another, and with direction for each axis. The common point where the axes cross is known as the origin of the coordinate system.

Using the Cartesian coordinate system, in a time-spatial region with constant measurement units (a region with a uniform intensity of the gravitational field), the location of any point in the space can be described, as well as the change into the time of the location of any point.

As a consequence, in the experiment, we distinguish two main frames of reference:

1) Reference system related to the Earth's surface. This is the frame of reference we usually use. In this frame of reference (for an observer, positioned at a point on the Earth's surface) – any object immovably fixed on the Earth's surface is stationary. This frame of reference is fixed to the moving surface of the Earth and it is moving in the stationary space due to the rotating of Earth around its axis in the stationary space.

2) Stationary reference system. Celestial bodies and space. Everything in the Universe possessing mass moves. The gravitation is the driving force. It is caused by the masses of celestial bodies and it sets them into motion. Therefore, a stationary reference system cannot actually exist because we cannot actually connect the "origin" of a stationary coordinate system to a stationary material point. Also, we cannot give exact directions to the axes because we cannot orient them to theoretically non-existing stationary points. However, for most of the cases under consideration, we can use the following approximately stationary frames of reference:

• *"Earth-centered inertial (ECI) coordinate system"* which can be considered in our time-spatial region as a stationary coordinate system in relation to the stationary space.

The origin of this coordinate system is at the center of the Earth (which is not stationary) and its axes are approximately stationary in the space (aimed at very distant astronomical objects).

In other words, we can say that the "Earth-centered inertial (ECI) coordinate system" is related to the space itself where the Earth rotates…, where the photons are born and propagate. If an observer is positioned at a point in this coordinate system, he/she will be stationary in relation to the space near the Earth's surface and will see that the Earth's surface moves (as a result of the Earth's rotation around its axis) in the stationary space with a certain linear velocity (the velocity of a point of the Earth's surface in the stationary space, at the respective latitude). Every point of the Earth's surface always moves in the eastern direction. The magnitude of the linear velocity (i.e., the speed) of a particular point of the Earth's surface, depends on the latitude and is the speed at which the point is moving along its path in the stationary space. It is approximately 0.46 km/s for any point on the equatorial line and is zero at the points of intersection of the axis of rotation of the Earth with the Earth's surface, which points coincide with the north and south poles.

Therefore, when we are located in our local region "near the Earth's surface" and talk about the speed of light "in vacuum" or "in the empty space" – this

will mean that the speed of light is measured in relation to the "Earth-centered inertial (ECI) coordinate system".

• *"Heliocentric Inertial (HCI) coordinate system"* also can be considered in certain cases as stationary in relation to the space. *The origin* of this coordinate system is at the center of the Sun (which is not stationary) and its *axes* are approximately stationary in the space (aimed at very distant astronomical objects). An observer positioned stationary in the HCI frame will see how the planets orbit around the Sun (the Earth moves in its orbit around the Sun at approximately 30 km/s); how the plasma of the Sun rotates (at the equator the solar plasma rotation period is about 24.5 days and is almost 38 days at the poles).

> ***Note**: In this paper, the designation "frame of reference related to the space itself" is used as a generalized designation of "stationary in relation to the space coordinate system". For the sake of precision, the term "velocity" is used when referring to the vector $\vec{V}$ (with its magnitude and direction); and the term "speed" is used when referring to only the scalar magnitude $|\overrightarrow{V}|$ of the vector.*

Difference between the mechanical and the optical experiments carried out on the surface of the Earth

• In the mechanical experiments, due to the force of gravity, the material bodies in the atmosphere are involved in the rotation of the Earth around its axis.

• In the optical experiments, however, the photons are not involved in the Earth's rotation around its axis because they do not have a mass and the gravitational force of attraction for the photons is equal to zero – (see Newton's law of universal gravitation). Therefore, the speed of the photons is constant in empty space (in vacuum, in the frame of reference related to the space itself /in the ECI frame of reference). The measured speed of light in the reference system related to the moving surface of the Earth in the stationary space, however, is not equal to the speed of light in the empty space and this was proven by the experiments. The stationary space is actually the medium of the electromagnetic and gravitational fields.

1.1.2 On the speed of light in different frames of reference

The two major frames of reference, where we will consider the measurement of the speed of light (of the electromagnetic radiation), are "the frame of reference related to the Earth's surface" and the "Earth-centered inertial (ECI) frame of reference" – the system that, in the considered case, is stationary relative to the space itself.

> *For the contemporary physics, there is no difference between "the speed of light in the frame of reference related to the Earth's surface" and "the speed of light in the Earth-centered inertial (ECI) frame of reference, which is the speed of light in vacuum". This is because the modern physics wrongly has accepted that the speed of light is the same in all inertial frames of reference. The factual analysis of all experiments will convince anyone that this claim is a big blunder.*

Anyone would ascertain the following fact – that all experiments undoubtedly prove that there is a difference between the measured velocity of light in the

"frame of reference related to the Earth's surface" and the speed of light "in the empty space" (in the "Earth-centered inertial (ECI) frame of reference"). The only exception is the conceptually incorrectly designed Michelson-Morley experiment, in which, due to the inappropriate idea (the two-way measurement of the speed of light), used in the Michelson's interferometer, this difference is completely compensated, which fact is presented in a separate manuscript.

1.1.3 Two important statements as a consequence of Newton's law of universal gravitation

The electromagnetic field exists on the space. The hypothetical "luminiferous aether" (the medium for the propagation of the electromagnetic radiation) turns out to be the warped space-time by the celestial bodies themselves.

Newton's law of universal gravitation states that in the Universe any particle or body with a mass m_1 attracts any other particle or body (with a mass m_2) with a force that is directly proportional to the product of their masses (m_1 and m_2), and inversely proportional to the square of the distance between their centers (r), where G is the gravitational constant:

$$F = G\frac{m_1 m_2}{r^2} \qquad (1)$$

We have to be aware that space cannot be affected by the gravitational forces (cannot be attracted, because space has no mass. Therefore, Newton's law of universal gravitation has another important meaning:

First statement:

From this law, it becomes clear that the space is stationary – that means "the vacuum is stationary". This is undeniable, because space has no mass, and the gravitational forces do not attract it (the space does not rotate along with the Earth, but only the material bodies and the molecules in the atmosphere).

Second Statement:

The gravitational force affects the space by contracting it.

Experiments show that the propagation of the electromagnetic radiation and the electromagnetic properties of the atoms depend on the intensity of the gravitational field (on the density of this medium /on the contraction of the space/).

• In the regions with weaker gravitation, the energy density of the medium of the propagation of the photons (the vacuum) is lower. This means that the wavelength and frequency of any electromagnetic radiation are higher (photons will jump easier – farther and faster). This means that the "meter" becomes longer, and the "second" is shortened. Therefore, the speed of propagation of the photons (of the electromagnetic quanta) is higher $(c=\lambda v)$. And vice-versa:

• In the regions with stronger gravitation, the energy density of the medium of the propagation of the photons (the vacuum) is higher. This means that the wavelength and frequency of any electromagnetic radiation are lower (which means that the "meter" becomes shorter, and the "second" becomes longer).

Therefore, the speed of propagation of the photons (of the electromagnetic quanta) is lower $(c=\lambda\nu)$.

In his article *"On the Influence of Gravitation on the Propagation of Light"* (see the reference number [1]), Einstein discussed the change of the speed of light in vacuum (proposing a formula without deriving it), when the light enters the regions with a different gravitational potential which actually are regions with different intensity of the gravitational field:

"If we call the speed of light at the origin of co-ordinates co, then the speed of light c at a place with the gravitation potential Φ 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 the one that usually underlies the ordinary theory of relativity." [**1**]

In the same article Einstein also points out that the frequency of any electromagnetic radiation changes depending on the gravitational potential:

$$\nu = \nu_0\left(1+\frac{\Phi}{c^2}\right) \qquad (2)$$

This equation, however, was deduced on the basis of the acceptance that the photons (quanta) have mass and consequently the conclusions are wrong. For example, if the photon is losing energy when overcoming the star's gravity (as Einstein "proves"), then the photon will lose a different amount of energy depending on the mass of the star – i. e. the "redshift" will be different and the spectral series of the emission spectrum of the hydrogen atom will be shifted depending on the mass of the star! But there is no such dependence… and no astronomer has observed it!

The frequency of certain electromagnetic radiation defines the base unit of time "second". Therefore, the base unit of time "second" also changes in places with different gravitation potential (with different intensity of the gravitational field) because the duration of the same number 9,192,631,770 time-periods of the used particular electromagnetic radiation will change (see the definition of the "second" since 1967, Ref. [2]). This means that in regions with weaker gravitation (where the frequency increases) the base unit of time "second" becomes shorter (with shorter duration). In this paper, Einstein does not discuss the change in the wavelength of electromagnetic radiation. However, in other articles related to the general theory of relativity it is discussed that in regions with higher gravitation the base unit of length "metre" is contracted (the wavelength of any electromagnetic radiation is shortened) – see the definition of the "metre" in SI accepted in 1960, Ref. [3].

It is clear, however, that the space is stationary but the contraction of the space (changed density of the medium of propagation of the electromagnetic radiation) is moving along with the celestial bodies. All celestial bodies (as well as the Earth) are traveling through the space-time of the Universe along

with the distortion (contraction) of the contiguous, warped by the bodies themselves (and belonging to them) time-spatial domains, which we can name *"near the surface of the celestial bodies"*.

The misunderstanding of the dominant part of the physical society consists in the fact that the contraction of space moves along with the celestial bodies, but the space remains stationary!

The intensity of the gravitational field *"near the surface of the celestial body"* remains practically the same during the travel of the celestial body through the space, because the intensity of the gravitational field is determined (dominated) by the mass of the celestial body. The speed of light in vacuum (in the stationary empty space), in any particular time-spatial domain, corresponds to the intensity of the gravitational field in this time-spatial domain.

Therefore, during the travel of the celestial body through the space the constant intensity of the gravitational field "near the surface of the celestial body" determines the constant "speed of light in vacuum" there.

Therefore, that is the reason why there is no variation in "the speed of light in vacuum" when the Earth moves in its orbit around the Sun and together with the Solar System in the Galaxy.

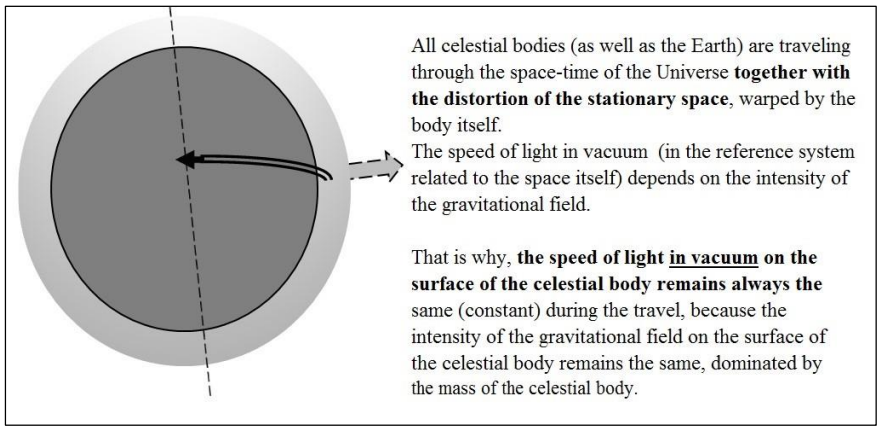

Figure 1. Movement of the celestial bodies together with the distortion of their "own time-spatial domain"

As a consequence, we have to be aware that the behavior of the electromagnetic radiation in vacuum must be considered in two aspects:

- in regions with different intensity of the gravitational field.
- in regions (local time-spatial domains) with a uniform intensity of the gravitational field;

The local physical reality is a "local time-spatial domain". It is any time-spatial domain with a practically uniform (the same) intensity of the gravitational field in the vicinity of any celestial body which remains constant in the general motion of the celestial bodies in the Universe and where the base units of time and of space (length) can be considered to be constant. Our local physical reality can be named "near the Earth's surface".

1.2 The speed of light in regions with different intensity of the gravitational field

The speed of light in vacuum depends on the intensity of the gravitational field. In regions with different intensity of the gravitational field, the speed of light in vacuum (in relation to the stationary space) is different and this has been proven by experiments:

1) The speed of light in vacuum is higher in regions with weaker gravitation.

In the regions with a weaker intensity of the gravitational field, the electromagnetic waves will not be so suppressed by the gravity – they will oscillate more freely (easier). This means that they will oscillate with a higher frequency ν – the "time period" of the electromagnetic oscillations will be of shorter duration. This means that the "spatial period" (the wavelength λ) of the electromagnetic oscillations will also be greater (they will "jump" with larger wavelength). Therefore, the increased frequency and the increased wavelength of each electromagnetic radiation determine not only the shortening of the "second" and the lengthening of the "meter" but also increase in the speed of light in vacuum ($c=\nu\lambda$). That was proven by the registered anomalies in the accelerations 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 the Earth turns out to be much more than the real travel time. So we register backward attraction (acceleration) of the ship to the Sun." [4].

The new higher speed will be valid again for the entire electromagnetic spectrum – it will be again a local physical constant. This logic coincides with the idea of the general theory of relativity.

2) The speed of light in vacuum is lower in regions with stronger gravitation.

Experimentally, using the units of measurement defined on the Earth's surface, a slower speed of radar electromagnetic signals has been experimentally measured in the region with strong gravitation (near the Sun) by the American astrophysicist Dr. Irwin I. Shapiro (Shapiro time delay effect), reported in 1964 (see Ref. [5]). The result of this experiment was confirmed later much more precisely using controlled transponders aboard the "Mariner-6" and "Mariner-7" spacecrafts as they orbited the planet Mars.

1.3 The speed of light in regions with a uniform intensity of the gravitational field

In regions with a uniform intensity of the gravitational field, the speed of light in vacuum (in relation to the stationary space) is a local constant in any local time-spatial domain with a uniform intensity of the gravitational field, and this concerns the whole spectrum of electromagnetic radiation.

"The "speed of light in empty space" is the correlation between the frequency and the wavelength for the whole electromagnetic spectrum, which is a local constant for our and for any other local time-spatial domain, where the intensity of the gravitational field is uniform." [**6**].

However, in regions with a uniform intensity of the gravitational field (as in the region "near the Earth' surface"), the experiments register different velocity of light in relation to the moving frames of reference in the stationary space. This reality is confirmed by:

• the experiments "One-way measurement of the speed of light", (see Ref. [7] and Ref. [8]);

• the "Sagnac experiment" (Ref. [9];

• the experiment "Michelson-Gale-Pearson" (Ref. [10, 11].

All of the experiments related to the speed of light measurement have their real explanation (see Ref. [12]) in accordance with the classical mechanics and the Galilean relativity (which are indisputably valid and lawful in our local time-spatial domain "on the Earth's surface").

The exception is only the Michelson-Morley experiment… The analysis of the Michelson-Morley experiment shows (see Ref. [12]) that the inappropriate conceptual design, used in the construction of the Michelson interferometer (the advanced version of which is used in the famous Michelson-Morley experiment, held in 1887), 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 special theory of relativity. The difference in the velocity of light (in the frame of reference related to the moving Earth's surface in the stationary space) between the two light beams, traveling in two opposite directions on the same arm, is completely compensated if the "two-way light beam interferometer" is used.

"Actually, if even the "ether wind" exists (caused by the Earth's motion through the stationary luminiferous ether) – the difference in the speed of light between the two light beams, traveling in two opposite directions on the same arm, is completely compensated. It is true for any arm in any direction! In other words, if the projection of the velocity of the "ether wind" on the direction of one of the light beams is (+V), then the projection of the velocity of the "ether wind" on the direction of the reflected light beam (traveling in opposite), will be exactly (-V)." [**6**].

The "unexplained anisotropy of the light velocity", depending on the direction of the light beam in the "one-way measurement of the speed of light" experiments performed using the GPS system, has its explanation that corresponds to the physical reality. The results of the experiments "One-way measurement of the speed of light", of the "Sagnac experiment", of the "Michelson-Gale-Pearson experiment", of the "Michelson-Morley experiment" and of the Fizeau experiment are analyzed in detail in the monograph [12]. Moreover, the essence of the so-called "fundamental tests of the special theory of relativity", which have been considered as three major types, are revealed there. This monograph includes the analysis of the article *"On the Electrodynamics of Moving Bodies"* (see Ref. [13]) presenting the

special theory of relativity and **shows exactly where and how** the claim *"the speed of light is the same in all inertial frames of reference"* was applied. It is also presented in *"Thesis on the behavior of the electromagnetic radiation in the gravitational field of the Universe"* (in 10 Statements), which actually rejects the postulate of the constancy of the speed of light for all frames of reference and shows a solution of other big problems in physics today, such as: *"the accelerated expansion of the Universe"* and *"the dark matter and the dark energy in the Universe"*.

2 Analysis of the Experiments "One-way Measurement of the Speed of Light"

2.1. Initial conditions for the experiments.

1) The experiments are carried out in our local physical reality – i.e. in the time-spatial region "in the vicinity of the Earth's surface", where the intensity of the gravitational field is uniform (the same) and where our primary physical constants – the base units for measurement of time and length are constant.

2) The two frames of reference for examining the experiments are:

- The "frame of reference related to the Earth's surface". In this frame of reference (for the observer, located in this frame of reference), the Earth's surface is stationary;
- The "Earth-centered inertial (ECI) coordinate system", which in most of the considered cases is actually a "frame of reference related to the stationary space itself".

3) In the local time-spatial region *"near the Earth's surface"*, the electromagnetic radiation propagates in vacuum at a constant speed equal to ***c***. This means that in the "Earth-centered inertial (ECI) coordinate system" the speed of light in vacuum is constant and equals to 299,792,458 m/s. This numeric value was accepted by the General Conference on Weights and Measures (Resolution 2 of the 15th CGPM, 1975 – Ref. [14]).

We must emphasize again that in our local physical region "near the Earth's surface" every mechanical or optical experiment actually takes place in the common stationary space of the two above-mentioned frames of reference.

2.2 Some of the experiments performed

The *Global Positioning System (GPS)*, is a satellite-based radio-navigation system that provides the determination of high-precision geolocation and time information (and synchronization) about objects anywhere on or near the Earth's surface, where there is an unobstructed line of sight to four or more GPS satellites.

Based on the GPS, Marmet makes measurements and reports in *"GPS and the Constant Velocity of Light"* (Ref. [7]) that an electromagnetic signal takes about 28 nanoseconds longer when traveling eastward from San Francisco to New York than when traveling westward from New York to San Francisco. Using GPS, Kelly also determined that an electromagnetic signal takes 414.8 nanoseconds more time to circumnavigate the Earth eastward near the equator

than when travelling westward around the same path (Ref. [8]). Both researchers concluded that the observed travel-time differences in different directions arise because the electromagnetic radiation (the light) travels relative to the surface of the Earth at a speed $(c-V)$ eastward, and at a speed $(c+V)$ westward, where V is the linear velocity of the Earth's surface at the respective latitude, and $\boldsymbol{c}$ is the speed of light in vacuum.

Now we will analyze in the two aforementioned reference systems both of the cases – the case *"Eastward Transmission"* and the case *"Westward Transmission"*. In both cases, the transmitter and the receiver are fixed on the Earth's surface and are stationary in the reference system related to the Earth's surface.

What the observers will see (located in the two aforementioned frames of reference)?

For the observer, situated in the frame of reference related to the Earth's surface, the transmitting and receiving stations, fixed on the Earth's surface, are stationary.

However, the observer situated in the approximately stationary in relation to the space "ECI coordinate system", will observe how the Earth is rotating and that every point of the Earth's surface is moving. The observer will see that the transmitting and receiving stations, positioned steadily on the ground surface, move eastward (along with the ground surface), at the linear velocity V for the respective latitude.

2.3. The case "Eastward Transmission". Analysis of the results of the measurement of the velocity of an electromagnetic signal by observers located in the two considered frames of reference.

The case "Eastward Transmission". Station B is located precisely east of station A. Let the fixed position of station A and the fixed position of station B on the Earth's surface at moment t be $X_A(t)$ and $X_B(t)$, respectively. The ground distance between station A and station B is equal to D.

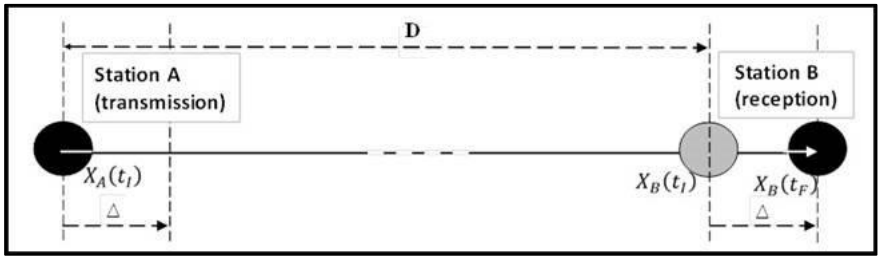

Figure 2. One-way measurement of the speed of light – eastward transmission

Station A transmits an electromagnetic signal (light beam) eastward at time t_I to station B, which receives it at time t_I. The time interval of the light beam travel is $(t_F - t_I)$. During this time interval, each point of the Earth's surface has moved in the stationary space at a distance $\Delta = V(t_F - t_I)$, where V is the linear velocity of movement of the Earth's surface in the stationary space for the respective latitude.

Analysis of the results of the measurement of the speed of the electromagnetic signal (or of a light beam) by observers located in the two aforementioned frames of reference.

- *In the stationary in relation to the space "Earth-centered inertial coordinate system" (the ECI frame of reference).*

The observer-1, located in the stationary in relation to the space frame of reference, will see how the fixed on the ground transmission and reception stations are moving eastward in the stationary space with the linear velocity ***V*** of the Earth's surface for the respective latitude.

The observer-1 will that the electromagnetic signal passes in the stationary "empty space" a definite distance – 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 *Figure 2*). They will measure that the distance travelled by the electromagnetic signal is equal to the distance between the two stations *D* on the ground, plus the distance $\Delta = V(t_F - t_I)$, which the station B passes during the travel-time of the electromagnetic signal $(t_F - t_I)$ with the speed *V* (the linear velocity of the Earth's surface in the stationary space at the respective latitude).

Therefore, the observer-1 (located in the stationary in relation to the space frame of reference) will measure the speed of the electromagnetic signal (which can be a light beam) and will confirm that it is equal to ***c*** *(the speed of light in vacuum):*

$$c_{ECI} = c_1 = \frac{D + \Delta}{(t_F - t_I)} = c_{vacuum} \qquad (3)$$

- *In the frame of reference, related to the Earth's surface.*

The observer-2, positioned on the Earth's surface will see that the electromagnetic signal passes for the same interval of time $(t_F - t_I)$ exactly the distance D (the distance between the fixed on the ground transmission and reception stations). Therefore, the observer-2 (located in *the frame of reference, related to the Earth's surface)* will measure the speed of the electromagnetic signal (or of the light beam) and will get:

$$c_2 = \frac{D}{(t_F - t_I)} \qquad (4)$$

Obviously, the measured speed by observer-2 is lower than that the measured by the observer-1 (equation (3)), and the difference is equal to the linear velocity of the Earth's surface at the respective latitude:

$$c_1 - c_2 = \frac{D + \Delta}{(t_F - t_I)} - \frac{D}{(t_F - t_I)} = \frac{\Delta}{(t_F - t_I)} = \frac{V(t_F - t_I)}{(t_F - t_I)} = V \qquad (5)$$

This theoretical result corresponds exactly to the results of the above-mentioned experiments made by Marmet [7] and Kelly [8], using GPS:

the measured velocity of the electromagnetic signals in the reference system related to the Earth's surface in the direction "from West to East" is equal to $c_2 = (c_{vacuum} - V)$,

where c_{vacuum} is the speed of light in vacuum, and V is the linear velocity of the Earth's surface in the stationary space at the respective latitude.

2.4. The case "Westward Transmission". Analysis of the results of the measurement of the velocity of an electromagnetic signal by observers located in the two considered frames of reference.

The case "Westward Transmission". The scenario is the same:

Station A transmits an electromagnetic signal (light beam) at time t_I, but now westward to station B, which receives it at time t_F. During this time interval, each point of the Earth's surface again has moved in the stationary space at a distance $\Delta = V(t_F - t_I)$, where V is the *linear velocity* for the respective latitude. The time interval of the signal travel is $(t_F - t_I)$, but it is smaller than the travel time interval $(t_F - t_I)$ of the electromagnetic signal in the case "Westward Transmission". This is because, in this case, the receiving station approaches the transmitting station, rather than moves away from it.

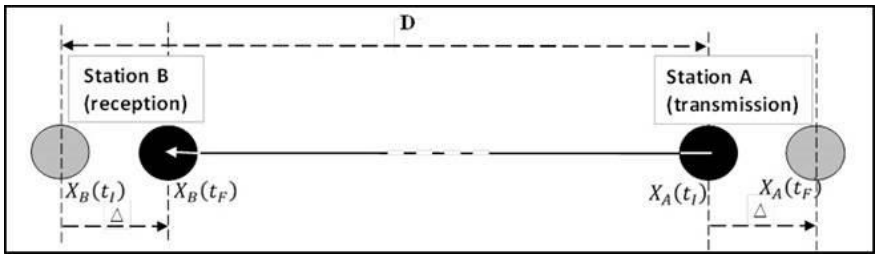

Figure 3. One-way measurement of the speed of light – westward transmission

Analysis of the results of the measurement of the speed of the electromagnetic signal (or of a light beam) by observers located in the two aforementioned frames of reference.

- *In the stationary in relation to the space "Earth-centered inertial coordinate system" (the ECI frame of reference).*

The observer-1, situated in the stationary in relation to the space frame of reference, will see again that the fixed on the ground transmission and reception stations are moving eastward in the stationary space with the velocity ***V*** of the surface of the Earth for the respective latitude. However, in this case, they will find that the distance, traveled by the electromagnetic signal, will be equal to the distance D between the two stations on the ground, minus the distance $\Delta = V(t_F - t_I)$. Here, Δ is the distance that the station B passes during the travel-time of the electromagnetic signal $(t_F - t_I)$ with the linear velocity V of the Earth's surface in the stationary space at the respective latitude.

Therefore, the observer-1, situated in the stationary (in relation to the surrounding space) frame of reference, will measure the speed of the electromagnetic signal (the light beam) and will confirm again that it is equal to $\boldsymbol{c_{vacuum}}$ (*the speed of light in vacuum*):

$$c_1 = \frac{D - \Delta}{(t_F - t_I)} = c_{vacuum} \qquad (6)$$

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

The observer-2, positioned on the Earth's surface, will see again that the electromagnetic signal will pass for the same interval of time $(t_F - t_I)$ exactly the distance *D* (the distance between the fixed on the ground transmission and reception stations). Therefore, the observer-2 (located in the *frame of reference, related to the Earth's surface*), will measure a higher speed of the electromagnetic signal (or of the light beam):

$$c_2 = \frac{D}{(t_F - t_I)} \qquad (7)$$

Obviously, the measured speed by the observer-2 is higher than that measured by the observer-1 (equation (6)), and the difference is equal to the linear velocity of the Earth's surface in the stationary space at the respective latitude:

$$c_2 - c_1 = \frac{D}{(t_F - t_I)} - \frac{D - \Delta}{(t_F - t_I)} = \frac{\Delta}{(t_F - t_I)} = \frac{V(t_F - t_I)}{(t_F - t_I)} = V \qquad (8)$$

This theoretical result again accurately corresponds to the results of the above-mentioned experiments made by Marmet [7] and Kelly [8], using GPS that:

> *the measured velocity of the electromagnetic signals in the reference system related to the Earth's surface in the direction "from East to West" is equal to* $c_2 = (c_{vacuum} + V)$,

where c_{vacuum} is the *speed of light in vacuum*, and ***V*** is the *linear velocity of the Earth's surface* in the stationary space at the respective latitude.

3. Conclusion

The experiments "One-way measurement of the speed of light" demonstrate that the measured speed of light is not the same in different directions in the reference system related to the Earth's surface.

> *These experiments are actually irrefutable proof that the measured speed of light in a local time-spatial region with a uniform intensity of the gravitational field is not the same for all inertial frames of reference.*

The accepted by modern physics delusion that the speed of light is the same for all frames of reference is the fundament of the special theory of relativity. Therefore, the logical conclusion about the special theory of relativity is obvious, **that the special theory of relativity is actually the biggest blunder in physics of the 20th century**. The main reason for this delusion is the accepted by the modern physics false claim that *the speed of light is the same for all inertial frames of reference*, that in turn, turns out to be **a consequence only of *the inappropriate conceptual design of the interferometer of Michelson*,** which fact is presented in a separate manuscript.

Many scientists have given evidence that the *"Light Speed Invariance is a Remarkable Illusion*" [15]. However, this is avoided to be formally discussed by the physical society.

Nowadays, the value of the speed of light in vacuum is recommended by the CGPM *(Conférence Générale des Poids et Mesures)* in the following way:

"[CGPM] recommends the use of the resulting value for the speed of propagation of electromagnetic waves in vacuum c = 299 792 458 metres per second." [**14**].

3.1 An important note can be made to BIPM (Bureau international des poids et mesures)

It is clear that if we are located on the Earth's surface (in the frame of reference related to the Earth's surface) and we have to measure the "speed of light in vacuum": it must be taken the arithmetic mean of the measured speed of light in two opposite directions (from East to West) and (from West to East).

This note also relates to the currently accepted definition of the base unit of length *"meter"* through the speed of light:

"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." [**16**].

CONSEQUENCE. The definition of the base unit of length "meter" through the unregulated measurement of the speed of light in vacuum carries the problem over the whole area of applied physics and technology!

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