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Key Aspects of Relative Motion in Historical Retrospective and Absolute Motion in Scientific Perspective

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Abstract- Motion in a reference frame seems as a cornerstone of physics for many centuries. Classical mechanics were abandoned by Relativity because of "inability" to explain "strange" behavior of light and its constant speed in the observer's reference frame.

However, Relativity itself has a number of problems which appeared last decades. Those are new observations staying in contrary to the theory and theoretical research leading beyond "the human comprehension".

This article explains philosophical roots of many controversies. It shows the possibility to move out of them and discover a new way to promote science.

Index Terms- Motion, Trajectory, Relativity, Twin Paradox, Z-Theory, Absolute motion, Zero Level Reference Frame

I. INTRODUCTION

The human mind has not any problem giving a description of motion, making definition and manipulation of its aspects under ordinary circumstances. That aspect of physics was ever seen as the easiest one from the time of "mechanical Universe". They describe each process in the mechanical Universe by means of some changes in mutual location between two or more physical bodies.

"Motion in physics is change *with time* of the position or orientation of a body. Motion along a line or a curve is called *translation*. Motion that changes the orientation of a body is called *rotation*. In both cases, all points in the body have the same velocity (directed speed) and the same acceleration (time rate of change of velocity). The most general kind of motion combines both *translation and rotation*.

"All *motions are relative* to some frame of reference. Saying that a body is at rest, which means that it is not in motion, merely means that it is being described with respect to a frame of reference that is moving together with the body. For example, a body on the surface of the Earth may appear to be at rest, but that is only because the observer is also on the surface of the Earth. The Earth itself, together with both the body and the observer, is moving in its orbit around the Sun and rotating on its own axis at all times. As a rule, the motions of bodies obey *Newton's laws of motion*. However, motion at speeds close to the speed of light must be treated by using *the theory of relativity*, and the motion of very small bodies (such as electrons) must be treated by using *quantum mechanics*."[1]

The key aspect of citation mentioned above is that. "For example, a body *on the surface of the Earth* may appear to be at rest, but that is only because the observer is also on the surface of the Earth. The Earth itself, together with both the body and the observer, is moving in its orbit around the Sun and rotating on its own axis at all times."

Moreover, as soon as ""all motions are relative to some *frame of reference*" (see above) the reference frame plays a key role in the description of each motion. What is a reference frame?

"Reference frame**,** *also called* ***frame of reference*** in dynamics, is system of graduated lines symbolically attached to a body that serve to describe the position of points relative to the body. The position of a point on the surface of the Earth, for example, can be described by degrees of latitude, measured north and south from the Equator, and degrees of longitude, measured east and west from the great circle passing through Greenwich, England, and the poles."[2]

The same aspect of motion, in relation with a reference frame, hides true motion from the observer's point of view. To understand motion with a reference frame an observer should see his/her motion (or be able to recognize that motion) by means of any possible observation. Otherwise, the observer was unable to make distinguish between his/her state at rest and in motion.

The first step on that way was done at the end of the Middle Ages. Before that period, the human mind was deluded with an idea that *the Earth is at rest*. In other words, they have imagination of the Earth as about an immovable object instead of a planet. It was something (in their mind) that they understood as a flat surface covered with the sky. The system was originated by Claudius Ptolemaeus. "Ptolemy, Latin in full Claudius Ptolemaeus, was an Egyptian astronomer, mathematician, and geographer of Greek descent who flourished in Alexandria during the 2nd century AD."[3]

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[1] **motion**. (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition.* Chicago: Encyclopædia Britannica..

[2] **reference frame.** (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition.* Chicago: Encyclopædia Britannica.

[3] **Ptolemy**. (2008). Encyclopædia Britannica. Encyclopaedia Britannica 2008 Deluxe Edition. Chicago: Encyclopædia Britannica.

It is a highly significant aspect. The system has its founder who created the system. Despite of many people lived on the Earth at the same period of time, only *Ptolemaeus* became able to make the system.

"*Ptolemaic system is* ***a mathematical model*** *of the universe* formulated by the Alexandrian astronomer and mathematician *Ptolemy* about AD 150 and recorded by him in his Almagest and Planetary Hypotheses. The Ptolemaic system is a geocentric cosmology; that is, *it starts by assuming* that the Earth is stationary and at the centre of the universe. The "natural" expectation for ancient societies was that the heavenly bodies (Sun, Moon, planets, and stars) must travel in uniform motion along the most "perfect" path possible, a circle. However, the paths of the Sun, Moon, and planets as observed from the Earth are not circular. Ptolemy's model explained this "imperfection" by *postulating* that the apparently irregular movements were a combination of several regular circular motions seen in perspective from a stationary Earth. The principles of this model were known to earlier Greek scientists, including the mathematician Hipparchus (c. 150 BC), *but they culminated in an accurate predictive model with Ptolemy*. The resulting Ptolemaic system persisted, with minor adjustments, until the Earth was displaced from the centre of the universe in the 16th and 17th centuries by the Copernican system and by Kepler's laws of planetary motion."[4]

There is an excellent formulation in the quotation given above "*The Earth was displaced from the centre of the universe in the 16th and 17th centuries by the Copernican system…*" That is the best example of the human way of thought. They think that a human point of view (*that commonly appears as a misconception that roots in the human mind*) has power of the law of the Universe. Moreover, any attempt of liberation from that illusion shook the human mind to its core. Many men were prosecuted by Inquisition for the same reason. They shared the point of view that stays in the contrary with *the official point of view*.

"Inquisition is, in Roman Catholicism, a papal judicial institution that *combatted heresy* and such things as alchemy, witchcraft, and sorcery and wielded considerable power *in medieval and early modern times*. The name is derived from the Latin verb inquiro ("inquire into"), which emphasizes the fact that the inquisitors did not wait for complaints but sought out heretics and other offenders."[5]

The best example of the situation was fate of Giordano Bruno. "Bruno, Giordano, *original name* ***Filippo Bruno,*** *byname* ***Il Nolano*** was Italian philosopher, astronomer, mathematician, and occultist whose theories *anticipated modern science.* The most notable of these were his theories of *the infinite universe* and the multiplicity of worlds, in which *he rejected the traditional geocentric (or Earth-centred) astronomy* and intuitively went *beyond* the Copernican heliocentric (Sun-centred) theory, which still maintained *a finite universe with a sphere of fixed stars*. Bruno is, perhaps, *chiefly remembered* for the tragic death he suffered at the stake because of the tenacity with which he maintained his unorthodox ideas at a time when both the Roman Catholic and the Reformed churches were reaffirming rigid Aristotelian and Scholastic principles in their struggle for the evangelization of Europe."[6]

Obviously, the primary struggle between new and old ideas was a battle for their influence *on the human mind*. Universe itself has not any idea about the existence of a man and the human mind.

Each action of the Universe depends only on its physical behavior regardless of the human attitude to the action. Therefore, an action of the Universe cannot be "right" or "wrong", "good" or "bad", "natural" or "unnatural". It can be only *predictable* if a man has enough knowledge about the process or *unpredictable* in any other case.

For the same reason, the Earth cannot be "displaced" from its location in the Universe by means of any change in the human attitude to its location or motion (see reference given above). Before the time when the Copernican system took its power in the human mind, the Erath makes its way through the Universe regardless of human illusion of the Earth immobility.

"*Copernican system* is, in astronomy, *model* of the solar system centred on the Sun, with Earth and other planets moving around it, formulated by *Nicolaus Copernicus*, and published in 1543. It appeared with an introduction by Rhäticus (Rheticus) as *De revolutionibus orbium coelestium libri VI* ("Six Books Concerning the Revolutions of the Heavenly Orbs"). The Copernican system gave a truer picture than the older Ptolemaic system, which was geocentric, or centred on Earth. It correctly described the Sun as having a central position relative to Earth and other planets."[7]

Comparison between two systems mentioned above (geocentric and heliocentric) leads for change in the definition of the Earth, in the human mind. Definition from the geocentric system is that:

The Erath is the motionless center of the Universe (A)

Definition from the heliocentric system is that:

The Earth is an typical planet of the Solar system moving by its trajectory around the Sun (B)

The key difference between those definitions is that. The Earth loses its uniqueness and becomes one of many planets of the Solar system. The same method became the most useful one for entire science since the time of Nicolaus Copernicus.

[4] **Ptolemaic system.** (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition.* Chicago: Encyclopædia Britannica.

[5] **Inquisition.** (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition.* Chicago: Encyclopædia Britannica.

[6] **Bruno, Giordano.** (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition.* Chicago: Encyclopædia Britannica.

[7] **Copernican system.** (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition.* Chicago: Encyclopædia Britannica.

Basic principle of the method eliminates uniqueness of *a property of an object* associated with the property by the *human definition* and makes the connection of the universal property with the same property of the object by *a new definition* (C)

It was a bright and extremely useful concept. It gives a way to reduce basic properties of the Universe in numbers and complexity of their definitions.

However, the heliocentric system has one problem. Copernicus was unable to give an answer on the question about property of the Sun that makes motion of planets around it possible.

If the Sun takes position of the central body of the Solar system, then it should contain some property that holds it there. Planets of the Solar system should have lesser value of the same property. As a result, they are unable to "move" the Sun from its central location in the Solar system.

Answer on that question was given later by a very famous man. His name was Sir Isaac Newton. "The analysis of circular motion in terms of these laws[8] yielded a formula of the quantitative measure, *in terms of a body's velocity and mass*, of the centripetal force necessary to divert a body from its rectilinear path into a given circle. When Newton substituted this formula into Kepler's third law, he found that the centripetal force holding the planets in their given orbits about the Sun must decrease with the square of the planets' distances from the Sun. Because the satellites of Jupiter also obey Kepler's third law, an inverse square centripetal force must also attract them to the centre of their orbits. Newton was able to show that a similar relation holds between the Earth and its Moon. The distance of the Moon is approximately 60 times the radius of the Earth[9]. Newton compared the distance by which the Moon, in its orbit of known size, is diverted from a tangential path in one second with the distance that a body at the surface of the Earth falls from rest in one second. When the latter distance proved to be 3,600 (60 × 60) times as great as the former, he concluded that one and the same force, *governed by a single quantitative law*, is operative in all three cases, and from the correlation of the Moon's orbit with the measured acceleration of gravity on the surface of the Earth, he applied the ancient Latin word *gravitas* (literally, "heaviness" or "weight") to it. The *law of universal gravitation*, which he also confirmed from such further phenomena as the tides and the orbits of comets, states that every particle of matter in the universe attracts every other particle with a force that is proportional to the product *of their masses* and inversely proportional to the square of the distance between their centres."[10]

Each piece of matter in the Universe possessed it own mass and exact value of *interaction* with any other piece of matter by formulated the law of universal gravitation. Mass of a body becomes responsible for its interaction with other bodies and its motion by a trajectory through the Universe.

It was the exact answer on the question about the Solar system. As soon as the Sun holds its position in the center of the Solar system the Star should have the mass incomparable with any planet of the Solar system.

It was an outstanding achievement in knowledge of physical processes, which are responsible for celestial motion of a body. However, the same conclusion has one side effect that appears in the human logic. As soon as the massive body in space becomes the center of motion for many bodies with lesser masses, *the frame of reference has the tendency to be associated only with the most massive body*.

Willingly or not, the human mind made one more revolution and got back to its initial state of understanding of relative motion. From the beginning of the human consciousness, motion was understood as relative one in comparison with location of the immovable Earth. In that case, the human mind understands motion of each object only if *a person sees displacement of an object relatively to the Erath surface during observation*. In other words, they understood motion of an object (with mass incomparable to the mass of the planet) *relatively to the planet*.

For example, a man drops an apple to the ground. He understands that experiment as motion of the apple toward the Earth. Nobody says "The Erath falls on the apple". Obviously, the man understands the Erath as the object bound to the frame of reference and location of the man associated with the same reference frame. The man understands the reference frame as *a frame at rest because of his association with the frame*. It is an old idea that can be put in words by the following way. The man says "I am at rest because I do not any motion by myself. Hence, everything else is in the state of motion relatively to me."

Newtonian work makes propagation of the same idea - the celestial body with lesser mass moves around the body with the greater mass. As a result, a body with the great mass becomes the point of origin for the frame of reference in any celestial system from the human point of view. However, that is not quite correct because gravitational interaction causes displacement of each body in the Universe and each body "falls" on each other. For that reason, each frame of reference bound to any celestial body cannot be the absolute one because of its motion by gravitation with the body. *Therefore, a frame of reference at rest cannot be found as a physical reality in connection with any celestial body*. A person can only make logical connection between a frame of reference and a celestial body. A man can use the frame as a frame at rest as long as there is not any contradiction between his observation and philosophy.

II. One-way and two-way experiment

They used Copernican system for many years without any problem. However, the problem rises as a huge disturbance of

[8] Newton's three laws of motion

[9] The distance of the Moon is approximately 60 times (greater than) the radius of the Earth

[10] **Newton, Sir Isaac.** (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition.* Chicago: Encyclopædia Britannica.

the human mind as soon as nature of light, and its propagation was put under question.

Scientists of Newtonian time understood light as something that makes its propagation thought the Universe by a specific medium that is undetectable by any mechanical interaction. They call the medium as ether.

"Ether, *also spelled aether, also called luminiferous ether, is*, in physics, *a theoretical*, universal substance believed during the 19th century to act as the medium for transmission of electromagnetic waves (*e.g.*, light and X rays) much as sound waves are transmitted by elastic media such as air. The ether was assumed to be weightless, transparent, frictionless, undetectable chemically or physically, and literally permeating all matter and space. The theory met with increasing difficulties as the nature of light and the structure of matter became better understood; it was seriously weakened (1881) by the Michelson-Morley experiment (*q.v.*), which was designed specifically to detect the motion of the Earth through the ether and which showed that there was no such effect."[11]

However, an article titled *The Epistemological concept of the True Space-Velocity Detector*[12] that was published in 2012 (a century later than the experiment had place) shows the low level problem associated with that experiment for many decades. The Michelson-Morley experiment was *two-way experiment*. Such experiment is suitable for determination of the speed of light *relatively to underlying space* and cannot be used to make detection of relative motion between the source of light (an observer) and a beam of light. Entire experiment based on the assumption that one-way speed of light has the same value as two-way speed of light. It was easy and false assumption.

In other words, the article, mentioned above, gives another explanation for the experiment as well as for any experiment that uses the same method (like Kennedy–Thorndike experiment and others). The explanation, given in the article, needs not any new category that was used in Relativity.

III. Roots of illusion

Relativity tries to make appropriate interpretation of something that stays "beyond" human comprehension as they believed in 19th century. Appearance of the theory in the form of an article in 1905 put many scientists to nonplus. Ideas of *length contraction* and *time dilation* were so "incapable for the human mind" that many scientists refused them at the first glance.

Entire theory used some logical framework that was not used ever before. That was Gedankenexperiment[13] (famous today). The starting point of the entire theory was Einstein's imagination of relative motion of two light beams.

"Einstein described how at age 16 he watched himself in his mind's eye as he rode on a light wave and gazed at another light wave moving parallel to his. According to classical physics, Einstein should have seen the second light wave moving at a relative speed of zero. However, Einstein knew that Maxwell's electromagnetic equations absolutely require that light always move at 3×10^8 metres per second in a vacuum. Nothing in the theory allows a light wave to have a speed of zero. Another problem arose as well: if a fixed observer sees light as having a speed of 3×10^8 metres per second, whereas an observer moving at the speed of light sees light as having a speed of zero, it would mean that the laws of electromagnetism *depend* on the observer. But in classical mechanics the same laws apply for all observers, and *Einstein saw no reason why the electromagnetic laws should not be equally universal*. ***The constancy of the speed of light and the universality of the laws of physics for all observers are cornerstones of special relativity***."[14]

The quotation given above has one key problem. Motion in physics means relocation in a frame of reference. As soon as an observer chooses his/her reference frame (or change one frame to another one) notion of motion (or motionlessness) of an object changes dramatically.

For example, "The constancy of the speed of light and the universality of the laws of physics for all observers are cornerstones of special relativity." The statement looks fairly. However, there are some questions. What is the frame of reference in which light does its motion? If a light beam moves forward, then there is a reference frame that supports motion of light. What is the frame? Where is it?

From the Einstein's point of view, there is not any universal frame at rest. As a result, any motion of an object in any frame of reference should change the moving object so as any law of physics becomes applicable to any chosen frame of reference. Moreover, all physical law should have the same form in each frame of reference. As a result, any experiment taken in one frame of reference should have the same result in another frame of reference *regardless of its motion*.

"The unique absolute frame of rest with respect to which light waves had velocity *c* according to the prerelativistic viewpoint was often regarded, before Einstein, as being at rest *relative to a hypothesized all-pervading ether*. The vibrations of this ether were held to explain the phenomenon of electromagnetic radiation. The failure of experimenters to detect motion relative to this ether, together with the widespread acceptance of Einstein's special theory of relativity, led to the abandonment of the theory of the ether."[15] As it mentioned above, source [3] eliminates that problem. There are number of strong reasons which gave way for Relativity. Those are:

[11] **ether**. (2008). Encyclopædia Britannica. Encyclopaedia Britannica 2008 Deluxe Edition. Chicago: Encyclopædia Britannica.
[12] See source [3].
[13] Thought experiment in German language (it was Einstein's native language).
[14] **relativity.** (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition.* Chicago: Encyclopædia Britannica.
[15] **relativity.** (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition.* Chicago: Encyclopædia Britannica.

1. Wrong *assumption* about the speed of light relatively to a moving observer in one-way and two-way experiment.
2. *Coincidence* between the speed of light *relatively to space* and the speed of light *calculated* by duration of the light beam travel on a two-way experiment.
3. Wrong interpretation of the Michelson-Morley experiment.
4. Absence of *a different way of theoretical explanation* of the Michelson-Morley experiment.
5. Strong aspiration to achieve justification for the Michelson-Morley experiment *by any means*.

There is a perfect example for the fifth reason. "Scientists such as Austrian physicist *Ernst Mach* and French mathematician *Henri Poincaré* had critiqued *classical mechanics* or contemplated the behaviour of light and the meaning of the ether before *Einstein*. Their efforts provided *a background* for Einstein's unique approach to understanding the universe, which he called in his native German a *Gedankenexperiment*, or "thought experiment.")"[16]

Einstein had his own point of view on each experiment. "In developing special relativity, Einstein began by accepting what experiment and *his own thinking showed to be the true behaviour of light*, even when this contradicted classical physics or the usual perceptions about the world."[17]

From that point of view, each observer moving at the speed of light sees any beam of light, moving relatively to the observer, at the same constant speed (the speed of light). It was a strong illusion made by the wrong interpretation of the Michelson-Morley experiment[18].

Moreover, "contradiction with classical physics or the usual perceptions about the world" makes Relativity as some sort of god in physics because only transcendental nature of a god stays beyond the human comprehension and understanding. In that way, Einstein himself became the god father and the creator of unquestioning theory.

IV. Comprehension versus transcendental principle

There is one more fancy shared with Einstein. It was an illusion that roots deeply in the human mind. It remained for ages and was destroyed only in 2012 by the article titled *Human's delusion of time*[19].

Before publication of the article, everybody *believed in actual reality of Time*. However, nobody was able to answer the easiest question. *What is Time*? The best example of such a situation is that. "Time appears to be more puzzling than space because it seems to flow or pass or else people seem to advance through it. But the passage or advance seems to be unintelligible. The question of how many seconds per second time flows (or one advances through it) is obviously *an absurd one*, for it suggests that the flow or advance comprises a rate of change with respect to something else—to a sort of hypertime. But if this hypertime itself flows, then a hyper-hypertime is required, and so on, ad infinitum."[20]

From the new point of view on the nature of Time, there are a number of definitions which are suitable for any area of question mentioned above. Two of them are useful for the subject. Those are:

> ***Logical Definition***: Time is a logical link *in human mind* to any physical process that has *observable duration*. (D)

> ***Physical Definition:*** Time does not exist (and never existed) as *a physical property of the Universe*. (E)

Those definitions can be seen as a very strange for the unprepared human mind. However, explanation given in the article is quite enough to accept both definitions. That matches the situation with the definition of the Erath. The definition was changed from definition A to definition B (see above). As a result, (in the human mind) the Erath has jumped from its secure stationary position and begins macabre dance through space. Many people are unable to believe that concept even today because it stays in contrary to their everyday experience.

The difference between two examples mentioned above is that. They have not *any definition* of Time before definition E (along with detailed step-by-step explanations) was shown publically. As a result, theoretical research shown in the article makes all time-dependent theories out-of-date. There is one more side effect of definition E.

> ***Anything that does not exist as a part of physical reality of the Universe cannot be expanded, contracted, dilated, bent or altered any other way*** (F)

It makes one more shock wave in the human mind. Once again a well established reference frame was destroyed utterly. Relativity leaves some hope to the human mind. It only changes the definition of reference frame. Z-Theory (and source [4] as its consistent part) destroys the old framework completely.

"Transcendental" nature of Relativity makes the theory self inconsistent in number of cases. The most famous one is so called Twin Paradox.

"The counterintuitive nature of Einstein's ideas makes them difficult to absorb and gives rise to situations that seem

[16] **relativity.** (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition.* Chicago: Encyclopædia Britannica.
[17] **relativity.** (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition.* Chicago: Encyclopædia Britannica.
[18] See source [3] for more details.
[19] See source [4] for more details.
[20] **time.** (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition.* Chicago: Encyclopædia Britannica.

unfathomable. One well-known case is the twin paradox, a seeming anomaly in how special relativity describes *time*.

"Suppose that one of two identical twin sisters flies off into space at nearly the speed of light. According to relativity, time runs more slowly on her spacecraft than on Earth; therefore, when she returns to Earth, she will be younger than her Earth-bound sister. But in relativity, what one observer sees as happening to a second one, the second one sees as happening to the first one. To the space-going sister, time moves more slowly on Earth than in her spacecraft; when she returns, her Earth-bound sister is the one who is younger. How can the space-going twin be both younger and older than her Earth-bound sister?

"The answer is that the paradox is only apparent, for the situation is not appropriately treated by special relativity. To return to Earth, the spacecraft must change direction, which violates the condition of steady straight-line motion central to special relativity. A full treatment requires general relativity, which shows that there would be an asymmetrical change in time between the two sisters. Thus, the "paradox" does not cast doubt on how special relativity describes time, which has been confirmed by numerous experiments."[21] Strictly speaking, there is not an object in the Universe that keeps "condition of steady straight-line motion". Special Relativity becomes only *speculative theory* that way because it loses its connection with *physical reality*.

The point of view that uses "condition of steady straight-line motion" comes to Relativity from the same experiment. In the Michelson-Morley experiment, a beam of light has "condition of steady straight-line motion" from the observer's point of view. However, data from the experiment depends on motion of the light beam in both directions instead of one. As a result, two-way motion of the light beam *cannot be understood and used as equivalent for one-way motion*[22]. Special relativity never analyzed backward mouton of the light beam in the experiment. That was the critical mistake in understanding of the experiment. Classical mechanics *have made the same mistake*.

V. The Martin-Berta experiment

According to relativity, "The body becomes shorter along its direction of motion; that is, its *length contracts*. Time intervals become longer, meaning that time runs more slowly in a moving body; that is, *time dilates*. In the train example, the person next to the track measures a shorter length for the train and a longer time interval for clocks on the train than does the train passenger. The relations describing these changes are

$$T = \frac{T_0}{\sqrt{1 - \frac{V^2}{C^2}}} \qquad (1)$$

$$L = L_0\sqrt{1 - \frac{V^2}{C^2}} \qquad (2)$$

where L_0 and T_0, called proper length and proper time, respectively, are the values measured *by an observer on the moving body*, and L and T are the corresponding quantities as measured by a fixed observer."[23]

More than that, "Einstein made the constancy of the speed of light for all observers a postulate of his new theory. *As a second postulate, he required that the laws of physics have the same form for all observers*. Then Einstein extended his postulates to their logical conclusions to form special relativity."[24]

The second postulate, mentioned above, makes twin paradox. According to Relativity, "*the laws of physics have the same form for all observers*". For that reason, any observer is free to choose any reference frame as a frame at rest. Moreover, each experiment in any reference frame should give the same result to an observer. From the Einstein's point of view, the Michelson-Morley experiment gives the best experimental support for that idea because an observer moving with the Earth was unable to detect relative motion between the planet and the beam of light[25].

However, the same postulate requires exact equality of *any physical experiment conducted by any given observer in any reference frame*. In other words, if an observer changes his/her reference frame and conducts the same experiment in another reference frame, both experiments *should give the same result for the observer*.

It is time to make one more *Gedankenexperiment.* Suppose there are twins with names Martin and Berta. They wish to conduct a clock experiment. Martin likes to conduct the experiment on board of a rocket. Bertha likes to conduct the same experiment on the Earth. They take two identical clocks and make their synchronization on the Earth surface before the experiment.

The experiment begins. Martin takes a rocket and flies out of Berta at full speed with his clock. Berta stays at the Earth and makes comparison between indications of her clock and Martin's clock. According to equation (1) she has result in accordance with Relativity. She is satisfied that way because from her point of view, the theory works perfectly and Martin's clock runs more slowly.

Martin is busy with the same activity. He knows Relativity and understands that. He is free to use his reference frame as a frame at rest as well as Berta uses her reference frame as a frame at rest.

[21] **relativity.** (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition.* Chicago: Encyclopædia Britannica.
[22] See source [3] for more details
[23] **relativity.** (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition.* Chicago: Encyclopædia Britannica.
[24] **relativity.** (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition.* Chicago: Encyclopædia Britannica.
[25] Source [3] eliminates that problem

He makes measurement and sees the same result that coincides with equation (1). He is satisfied that way because from his point of view, the theory works perfectly and Berta's clock runs more slowly. Everything is acceptable as long as Martin continues his space flight.

However, Martin was unable to be in a space craft constantly. After some time, he returns to the Earth and likes to make a comparison between indications of both clocks. Berta actually likes to see the result of comparison too. What should they see as soon as Martin brings his clock to Berta's one?

The result of such comparison exceeds the human imagination because Reactivity expects the same way of action for both clocks before the experiment, during the experiment and after the experiment!

Both clocks were synchronized before the experiment and showed the same indications. Both clocks share the same way of action during the experiment showing so called time dilation according to equation (1). Hence, ***they should follow the same law of indication after the experiment***. For that reason, both clocks should have ***the same indication after the experiment***!

That makes conflict with common sense. In human experience, two clocks can be synchronized or not synchronized. In case of synchronized clocks, they show the same indication.

If clocks are not synchronized they show different indications. In case of any pair of clocks without synchronization one device shows a "greater time" ant next device shows a "lesser time". It is impossible from the human point of view to see two clocks which stay left *to each other simultaneously*. Even Relativity and Einstein himself was unable to exceed that deficiency of the human common sense. As a result, so called twin paradox appeared as soon as Relativity takes place in the human mind.

However, the answer on the question is quite easy. Both clocks must show the same way of action *at any stage of relativistic experiment* (i.e. before, during and after the experiment). The only one possible way for action is that.

> ***Two previously synchronized clocks should have the same indications after any relativistic experiment and stay in synchronization after any relative motion at any speed after any duration of the experiment.*** (G)

It looks impossible. However, the solution is that. Equation (1) shows *only illusion of relative motion without any reference to a physical process inside clocks*. In that case, twin experiment loses its contradictory nature. It becomes self consistent, consistent with postulates of the theory and consistent with a *Gedankenexperiment.* Moreover, twins embrace each other at the same age after the experiment first time for many decades *and Martin becomes not the older (or younger) brother for Berta*.

VI. THE HAFELE–KEATING EXPERIMENT

The clock experiment has one more side effect. Equation (2) shows that length of an object has some variations during the relativistic experiment. However, as soon as an object comes back to the same reference frame length as its physical property restores its initial value. As a result, any measurement of length gives not any way for decision about a relativistic experiment. In other words:

> ***An object involved in a relativistic experiment restores any of its <u>real property</u> as soon as it comes back to the initial reference frame despite any number of reference frames it changes during the relativistic experiment*** (H)

That is the essence of Relativity postulates and cornerstone of the Theory. The Martin-Berta experiment described above follows that way *perfectly*.

Suppose now that. There is a property of an object that does not obey the law of statement (H). In that case, an observer becomes able to make measurement of that property and make a decision about *relative motion of two reference frames*. Moreover, analysis of difference between the same property of on an object before and after a relativistic experiment gives information about the difference in two ways of action of the *identical* physical process in two *different* reference frames. In that case, *both frames become unequal to each other in complete disagreement with the postulate of relativity*. Therefore, as soon as an observer finds that property of an object or a process the property *crushes the cornerstone of Relativity*. For that reason, Relativity rejects any possibility of presence of such property in *any physical experiment.*

Despite of such limitation, there is an experiment that makes the property possible to observation. That is the *Hafele–Keating experiment.* The description of the experiment shows these details.

"The Hafele–Keating experiment was a test of the theory of relativity. In October 1971, *Joseph C. Hafele*, a physicist, and *Richard E. Keating*, an astronomer, took four cesium-beam atomic clocks aboard commercial airliners. They flew twice around the world, first eastward, then westward, and compared the clocks against others that remained at the *United States Naval Observatory*. When reunited, the three sets of clocks were found to disagree with one another, *and their differences were consistent with the predictions of special and general relativity*."[26]

"According to special relativity, the rate of a clock is greatest according to an observer who is at rest with respect to the clock. In a frame of reference in which the clock is not at rest, the clock runs more slowly, as expressed by the Lorentz factor. This effect, called time dilation, has been confirmed in many tests of special

[26] The citation was taken from Wikipedia. (en.wikipedia.org)

relativity, such as the Ives–Stilwell experiment and time dilation of moving particles. Considering the Hafele-Keating experiment in a frame of reference at rest *with respect to the center of the earth*, a clock aboard the plane moving eastward, in the direction of the Earth's rotation, had a greater velocity (resulting in a relative time loss) than one that remained on the ground, while a clock aboard the plane moving westward, against the Earth's rotation, had a lower velocity than one on the ground."[27]

The key aspect of the experiment mentioned above is that "*in a frame of reference at rest with respect to the center of the earth*". Wait a minute! Why did the experiment has a place in that frame of reference? According to Relativity, each reference frame is equal to any other reference frame. That is a cornerstone of relativity.

However, the Hafele–Keating experiment refers to the other frame of reference that is unknown *for any set of clocks*! That is a tremendous disagreement between theoretical framework of Relativity and physical experiment. In other words, Relativity describes physical phenomena for two reference frames in the state of relative motion to each other. Observable phenomena belong to *the moving frame*. *The reference frame at rest* is the frame with an observer. *The moving frame* is the reference frame that moves relatively to an observer. If an observer changes reference frame, the new frame with observer *become the frame at rest*. In other words, an observer *is unable to go out of the frame at rest*! That is principle of Relativity and the mind-blowing aspect of the Theory. For the same reason, an observer is unable to make a decision about third reference frame. An observer is able only to discover relativistic phenomena between the frame at rest (his/her frame) and a moving frame of reference.

That considers with Einstein's point of view on motion. According to that point of view (mentioned above) an observer moving forward at the speed of light sees another beam of light *in relative motion to his/her reference frame at the speed of light*.

That is correct for any number of light beams moving relatively to an observer. However, as soon as an observer changes the reference frame and continues his/her motion with another beam of light the beam of light of his/her previous location immediately changes its speed to the speed of light *relatively to the observer*. Under such circumstances, the observer is unable to make any conclusion about relative speed between any other light beams. He/she is able only to make measurement of the speed of light between a beam of light and his/her reference frame. For the same reason, an Einstein's observer is unable to use categories which make a comparison between any other reference frames.

However, they try to explain the result of the Hafele–Keating experiment wrong way. In that case, an Erath bound observer uses his/her native reference frame as a reference frame at motion (not at rest)! *That is a serious violation of the cornerstone of Relativity.*

If an observer becomes able to detect motion of his/her inertial reference frame by any experiment relatively to anything else, then all frames become unequal to each other immediately. In that case, an observer has an option to change *a reference frame*, to conduct an experiment and use experimental data to make a decision about speed of motion of the reference frame in relation with other frames. Such possibility of an observer *violates postulates of Relativity*.

Despite of the *theoretical limitation* mentioned above, observers in the Hafele–Keating experiment have the unexpected result. All clocks were synchronized before the experiment. In that condition, three sets of clocks show the same indication and change their indications simultaneously[28].

After the experiment, all three sets of clocks show different indications in *conflict with* the Martin-Berta experiment. As a result, each observer of the Hafele–Keating experiment becomes able to detect motion of his reference frame relatively to other frames. Comparison between clock indications gives a way to calculate speed of relative motion in each reference frame. More than that, experimental data shows agreement in clock indications with relative speed *with respect to the center of the Earth*. As a result, all observers have *experimental support* of the idea that their motion appears *with respect to the center of the Earth.* In that case, all sets of moving clocks use the center of the *Erath as the reference frame at rest. That is impossible in theoretical framework of Relativity because all reference frames should be equal to each other according to Einstein's ideas and no one of them can be used as a frame of true motion.*

Data of the Hafele–Keating experiment remain in conflict with theoretical framework of Relativity (I)

VII. ABC-GEDANKENEXPERIMENT

There is one more obstacle in Relativity. Figure 1 shows the problem. That is the ABC-*Gedankenexperiment*. The experiment has connections with one more famous equation from Relativity

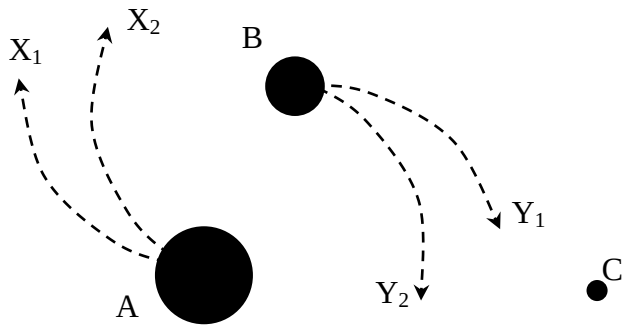

Fig. 1

"To derive further results, Einstein combined his redefinitions of *time and space* with two powerful physical principles:

[27] The citation was taken from Wikipedia. (en.wikipedia.org)

[28] Any number of synchronized clocks follows that law.

conservation of energy and conservation of mass, which state *that the total amount of each remains constant in a closed system*. Einstein's second postulate ensured that *these laws remained valid for all observers in the new theory*, and he used them to derive the relativistic meanings of mass and energy.

"One result is that the mass of a body *increases with its speed*. An observer on a moving body, such as a spacecraft, measures its so-called rest mass m_0, while a fixed observer measures its mass *m* as

$$m = \frac{m_0}{\sqrt{1 - \frac{V^2}{C^2}}} \quad (3)$$

which is greater than m_0. In fact, as the spacecraft's speed approaches that of light, the mass *m approaches infinity*. However, as the object's mass increases, so does the energy required to keep accelerating it; thus, it would take infinite energy to accelerate a material body to the speed of light. For this reason, no material object can reach the speed of light, *which is the speed limit for the universe*. (Light itself can attain this speed because the rest mass of a photon, the quantum particle of light, is zero.)"[29]

Suppose there are two bodies in space A and B with different masses. They move freely through space. There are three observers A, B and C. Observers A and B associate themselves with reference frames which bound to bodies A and B respectively. The observer C associates himself with his reference frame C. He likes to see physical appearance of Relativity in motion of two bodies A and B.

According to Relativity, all reference frames are equal to each other. An observer is free to choose a reference frame, and use it as a reference frame at rest because the chosen frame has not any difference from any other reference frame. For the same reason, each observer, mentioned above, uses his/her reference fame as *a frame at rest*.

Bodies A and B have different masses (M_A and M_B) and follow the way of gravitational attraction according to the famous law of gravitation. "Newton's law of gravitation is the statement that any particle of matter in the universe attracts any other with a force varying directly as the product of the masses and inversely as the square of the distance between them. In symbols, the magnitude of the attractive force *F* is equal to *G* (the gravitational constant, a number the size of which depends on the system of units used and which is a universal constant) multiplied by the product of the masses (m_1 and m_2) and divided by the square of the distance *R:*

$$F = G\frac{m_1 m_2}{R^2} \quad (4)$$

Isaac Newton put forward the law in 1687 and used it to explain the observed motions of the planets and their moons, which had been reduced to mathematical form by Johannes Kepler early in the 17th century."[30]

All observers begin their observations. In the reference frame 'A' the body B has velocity V_{BA}. According to the equation (3) the body B possesses the mass $M_B(V_{BA})$. The body A keeps its rest mass M_A from the observer A's point of view. As a result, gravitational interaction between those bodies becomes equal to

$$F_1 = G\frac{M_a M_B(V_{BA})}{R^2} \quad (5)$$

The force F_1 changes state of motion of both bodies and makes the observer A to see motion of the body 'B' by the B-Y_1 trajectory.

There is the same situation in the reference frame 'B'. The body A has velocity $V_{AB} = V_{BA}$. According to the equation (3) the body A possesses the mass $M_A(V_{AB})$. The body B keeps its rest mass M_B from the observer B's point of view. As a result, gravitational interaction between those bodies becomes equal to

$$F_2 = G\frac{M_B M_A(V_{AB})}{R^2} \quad (6)$$

The force F_2 changes state of motion of both bodies and makes the observer B to see motion of the body 'A' by A-X_1 trajectory. Everything looks perfect so far.

The observer 'C' steps in to the experiment. From his point of view, (in his reference frame 'C') the body A has speed V_{AC} and the body B has speed V_{BC}. According to the equation (3) the body 'A' posses its masses M_{AC} and body 'B' possesses its mass M_{BC}. As a result, force of gravitational interaction between those bodies in the reference frame 'C' becomes equal to:

$$F_3 = G\frac{M_{AC}(V_{AC})M_{BC}(V_{BC})}{R^2} \quad (7)$$

According to the law of gravitation, the force affects motion of both bodies and makes their motion by trajectories A-X_2 and B-Y_2.

In the general case, forces in equations 5, 6 and 7 are unequal to each other ($F_1 \neq F_2 \neq F_3$). Therefore, they affect motion of each body unequally. As a result, in the reference frame 'C' each body *should have more than one trajectory*. ***We have reached contradiction***. The following statement shows basic physical aspect of a trajectory.

A body has only one trajectory in a reference frame simultaneously. (J)

[29] **relativity.** (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition.* Chicago: Encyclopædia Britannica.

[30] **Newton's law of gravitation.** (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition.* Chicago: Encyclopædia Britannica.

Therefore, there is not any *physical possibility* for a body to keep more than one trajectory simultaneously *in the same reverence frame*.

Moreover, in case of the ABC-*Gedankenexperiment* each body has more than one value for its physical properties *simultaneously*. For example, the body A has rest mass M_A for the observer A. At the same time, it has mass $M_A(V_{AB})$ for the observer B and mass $M_{AC}(V_{AC})$ for the observer C. That is one more contradiction.

The same contradiction appears for the value of length of each body according to the equation (2). In that case, all observers should be in disagreement with each other in evaluation of the length of each body. That condition makes not any disagreement from the Einstein's point of view. It explains the data of the Michelson-Morley experiment and stays consistent with the idea of identical speed of light in any reference frame.

> ***A number of observers can be disagree with each other in value of length of an object. However, they cannot be disagree with the value of the body's mass because mass holds responsibility for the trajectory of the body in any physical experiment.*** (K)

Statement (K) shows the most obvious disagreement between Relativity and the physical Universe. In any observation, a physical body keeps the only one trajectory in gravitational fields of any number of other bodies. Therefore,

> ***All bodies in the Universe should be agree with each other in the value of mass of each piece of matter regardless its state of motion.*** (L)

That is another contradiction with Relativity because it crushes equation (3). Any theory that keeps such number of *controversies* becomes a *self-contradictory theory*.

VIII. The Zero Level Reference Frame

Is it possible to go further with so many controversies in the theoretical framework of physics? Obviously, that is impossible. For many decades, any theoretical research was limited by postulates of Relativity. Those postulates made some *comprehension horizon* on theoretical framework of physics. Anything that stays beyond the horizon looks inaccessible for research and human understanding. New theoretical research reaches the horizon and does something beyond it.

"Everything went well until mankind began to notice some types of phenomena that were they said were "impossible to explain" or "impossible to exist". Neither man nor science have yet any acceptable explanation for such phenomena because the events are in controversy *with modern science's point of view and logic*.

"The causes and reasons of such phenomena lie far away from *the horizon of modern science*. To reach a higher point to where we can understand such phenomena, we need to go "through the horizon" *that now restricts our knowledge and imagination*."[31]

Moreover, instrumental observation gives additional information that remain in disagreement with the earlier theoretical framework. "It is ironic therefore to note that the discovery in 1964 by the American astrophysicists *Arno Penzias and Robert Wilson* of a universal cosmic microwave 3 K radiation background shows that the universe *does indeed possess a privileged inertial frame*."[32] That crushes the cornerstone postulate of Relativity because all reference frames become unequal to each other as soon as *one of them* appears as a privileged reference frame.

"Nevertheless, this does not contradict special relativity because one cannot measure the Earth's velocity relative to it[33] by experiments in a closed laboratory. One must actually detect the microwaves themselves."[34] That is not entirely accurate any longer. The article *The Epistemological concept of the True Space-Velocity Detector* - published at: *"International Journal of Scientific and Research Publications (IJSRP), Volume 2, Issue 11, November 2012 Edition"*[35] describes in details and explains the real possibility to conduct such experiment by a specific device True Space-Velocity Detector (TSVD). The idea of the article shows further development of Z-Theory.

The device uses the concept of operation that stays beyond the *comprehension horizon* of theoretical framework of 20th century science. As a result, such device looks like something that *impossible to exist*. However, that is only a human assumption and *one more postulate*.

The primary reason for the creation of TSVD is that. The device will be able to answer a long lasting question about the existence of *the privileged inertial frame*. Theoretically, a light beam *is bound to the frame*. That is Z-Reference Frame (ZRF) or Zero Level Reference Frame. The following picture shows the relationship between ZRF and other reference frames.

[31] Source [1] page 5.
[32] **"relativistic mechanics."** Encyclopædia Britannica. Encyclopaedia Britannica 2008 Deluxe Edition. Chicago: Encyclopædia Britannica, 2008.
[33] a privileged inertial frame
[34] **"relativistic mechanics."** Encyclopædia Britannica. Encyclopaedia Britannica 2008 Deluxe Edition. Chicago: Encyclopædia Britannica, 2008.
[35] See source [3] for more details

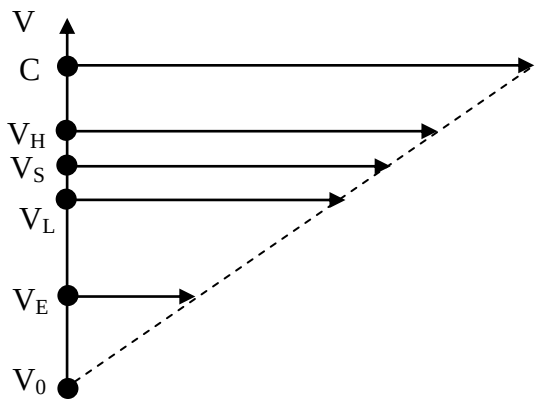

Fig. 2

The vertical axe in the figure 2 shows velocities in relation with some zero velocity (V_0). That is the ZRF. The frame itself appears as a reference frame for light propagation. In other word, a light beam uses the frame (ZRF) to make its motion relatively to *the frame*. *The speed of light C appears as propagation of electromagnetic radiation in the ZRF*.

If an observer uses *a two-way experiment* to detect his\her motion in relation with a beam of light then the duration of travel of the mirrored light beam *hides motion of the observer relatively to ZRF*[36]. However, light keeps its speed C in the ZRF ever. Other physical bodies use different speed of motion relatively to the ZRF.

In case of the Earth, it keeps its motion with some absolute velocity V_E (see fig. 2). That is relative motion between the center of the planet and the ZRF. A point on the Erath surface has some additional speed because of the planet rotation. That is velocity V_S shows in the figure.

Obviously, the trajectory of the point in the Universe appears as a spiral because of the earth rotation. For the same reason, each object that moves in the eastward direction posses some additional speed. That is velocity V_H (the higher absolute velocity). Otherwise, the object has lesser speed that appears as velocity V_L (the lesser absolute velocity). Some unexpected physical phenomena appear that way.

According to the Hafele–Keating experiment, it was done in the reference frame bound to the center of the Earth (see above). That point has velocity V_E in the ZRF (see fig. 2). The earth bound set of clock had velocity V_S. Two other set of clocks had velocities V_L and V_H because of their opposite direction of motion during the experiment.

The result of the experiment was astonished. *Each set of clocks shows direct relationship between their internal physical processes and the absolute speed of their motion during the experiment*.

According to statement (D), indication of a clock depends only on its internal physical process. In that case, difference between clock indications after the experiment can be explained only as a different way of physical processes in a different reference frame. Moreover,

Way of physical processes depends on absolute velocity of the reference frame (M)

Statement (M) eliminates many controversies, mentioned above. For example, as soon as the Earth has its velocity V_E in the ZRF it possesses the "rest mass" observable for an Earth bound observer.

Suppose the observer makes acceleration of a particle beam in an accelerator. He sees "increasing mass" of each particle in the beam according to the absolute speed of the particle in the ZRF. However, an accelerator is unable to slow down the speed of a particle in the ZRF to see "decreasing mass" of a particle.

According to equation (3) a light beam moving at the speed of light should feel mass of each body *in the Universe as infinite one* because in its reference frame speed of each body equals to C (in the opposite direction for the motion of the light beam). In that case, trajectory of a light beam becomes *unpredictable* because the mass of a single proton becomes *infinite in the light reference frame*.

However, in each physical experiment a light beam follows the trajectory that agrees with so called "rest mass of a body" and statement (L) becomes relevant for a light beam, as well.

"Soon after the theory of general relativity was published in 1916, the English astronomer *Arthur Eddington* considered Einstein's prediction that light rays *are bent near a massive body*, and he realized that it could be verified by carefully comparing star positions in images of the Sun taken during a solar eclipse with images of the same region of space taken when the Sun was in a different portion of the sky. Verification was delayed by World War I, but in 1919 an excellent opportunity presented itself with an especially long total solar eclipse, in the vicinity of the bright Hyades star cluster, that was visible from northern Brazil to the African coast. Eddington led one expedition to Príncipe, an island off the African coast, and Andrew Crommelin of the *Royal Greenwich Observatory* led a second expedition to *Sobral, Brazil*. After carefully comparing photographs from both expeditions with reference photographs of the Hyades, Eddington declared that the starlight had been deflected about 1.75 seconds of arc, as predicted by general relativity. (The same effect produces gravitational lensing, where a massive cosmic object focuses light from another object beyond it to produce a distorted or magnified image. The astronomical discovery of gravitational lenses in 1979 gave additional support for general relativity.)"[37] The last phrase makes contradiction with quotation given above (footnote 32). It looks like nobody seen that *controversy* between discoveries of 1964 and 1979.

[36] See source [3] for more details

[37] **relativity.** (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition.* Chicago: Encyclopædia Britannica.

The quotation, given above, (footnote 37) shows that. Gravitational lensing shows gravitational interaction between a light beam that moves at the speed of light and a body (object) with a ***definite mass***. That violates equation (3) in the light reference frame and *theoretical framework of Relativity because*

> ***As soon as the same equation becomes inaccurate in any reference frame the frame loses its equality with other frames*** (N)

However, figure 2 eliminates that problem easily. As soon as the light beam moves at the speed of light its way of *interaction* with a gravitational field agrees with the mass of a body that produces the gravitational field in the reface frame bound to the body. The body has lesser speed in the ZRF. That is the only one way that avoids the *inconsistency* of the ABC-*Gedankenexperiment* (as explained above).

IX. Conclusion

They used wrong interpretation of the Michelson-Morley experiment[38] as physical evidence for Relativity. Strictly speaking, Relativity *disappears* with any different *explanation* of the experiment. ***Explanation*** is the subject of philosophy *not physics.*

Many decades later the Hafele–Keating experiment was used the same way. Once again, they used data incompatible with Relativity as a proof for the theory.

All contradictions mentioned above have the same basis. That is relationship between various reference frames and physical experiments in each frame. According to relativity each physical process in each reference frame should have the same way of action. As a result, an observer has not any chance to choose any preferable reference frame.

Despite of prevalent point of view, a number of experiments show direct conflict between theoretical framework of the theory and the way of action of some physical processes. Obviously, they use the easiest way to make that experimental data consistent with the theory without deeper analysis of relationship between theory and experimental data. They simply "agree" to use data in the same theoretical framework.

Strictly speaking, Relativity uses the Earth and an Earth-bound observer the oldest way. That way holds the planet immovable and denies any chance *to find absolute motion*. That is the best example of *the comprehension horizon* rooted in the human mind.

However, new evidences and experimental data show disagreement with old ideas. New theories brakes through age-old *comprehension horizon* of the human mind and shows "incredible" possibility.

This article shows only a small application of Z-Theory on the same area that was used in the creation of Relativity. Both Z-Theory and Relativity use close categories like *conservative fields* (field of gravitation in one of them), *interaction* between a body and a conservative field, *motion* of a body in a conservative field and etc.

Z-Theory uses some different categories which stay beyond *the comprehension horizon* of 20th century physics. Statement (E) is the best example of those categories. Obviously, many people think that Z-Theory stays beyond *their comprehension*. That is not quite correct because the theory has detailed explanation for each new category. The primary aim of the theory is to make the human mind ***able*** to understand various physical phenomena which are "unexplainable" in any other theory. For example, source [4] presents *detailed step-by-step explanation* of the same philosophical conception mentioned in the chapter *12.7 Operation of Watches and Clocks* of source [1][39].

Further development of Z-Theory shows TSVD creation possibility. Obviously, the device stays beyond *the comprehension horizon* of Relativity. The theory denies theoretical possibility for existence of such a device. However, source [3] describes each theoretical aspect of its way of action.

Nature *has not any contradiction within itself* (see statement K). Internal Disagreement is an embedded aspect of the human mind. Usually, lack of comprehension appears as disagreement between different points of view *on the same subject*. For the same reason, new level of knowledge gives a new way for clarification of a well known phenomenon and leads to the development of a new theory.

Operation of TSVD will have few key reasons:

1. Demonstration of physical possibility of existence of the device
2. Detection of ZRF
3. Determination of the Earth velocity in ZRF (Z-Vector[40]).

As soon as the ZRF will be detected, existence of the frame gives answers on many questions of modern science. According to the Hafele–Keating experiment, *physical processes* use a different way of action in connection with the ZRF.

Using a TSVD, a researcher becomes able to compare and find differences in experimental results coming from any reference frame *regarding absolute velocity of a laboratory located in the reference frame*. The humankind meets new physics that way.

[38] See source [3] for more details

[39] Source [1] page 102.

[40] Velocity of an object in the Zero Level Reference Frame

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