

GLOBAL JOURNAL OF SCIENCE FRONTIER RESEARCH: A PHYSICS AND SPACE SCIENCE Volume 16 Issue 6 Version 1.0 Year 2016 Type : Double Blind Peer Reviewed International Research Journal Publisher: Global Journals Inc. (USA) Online ISSN: 2249-4626 & Print ISSN: 0975-5896

# Physics and Philosophy of Wave Reference Frames in A Retrospective of 20-th Century Findings and Illusions

By Allan Zade

*Abstract-* Physics of 20-th century based on the most famous theory named Relativity. Postulates of that theory look fine for many decades until the power of measurement devices reach the critical level and they show many "impossible" data coming from them.

This paper gives answers on all questions of those "impossible phenomena" and their relationship with the underlying process of signal propagation in Wave Reference Frame.

Keywords: aurora effect, comprehension horizon, inertial reference frame, relativity, SMA, wave reference frame.

GJSFR-A Classification: FOR Code: 240501p



Strictly as per the compliance and regulations of :



© 2016. Allan Zade. This is a research/review paper, distributed under the terms of the Creative Commons Attribution. Noncommercial 3.0 Unported License http://creativecommons.org/licenses/by-nc/3.0/), permitting all non commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

# Physics and Philosophy of Wave Reference Frames in a Retrospective of 20-th Century Findings and Illusions

#### Allan Zade

Abstract Physics of 20-th century based on the most famous theory named Relativity. Postulates of that theory look fine for many decades until the power of measurement devices reach the critical level and they show many "impossible" data coming from them.

This paper gives answers on all questions of those "impossible phenomena" and their relationship with the underlying process of signal propagation in Wave Reference Frame.

Keywords: aurora effect, comprehension horizon, inertial reference frame, relativity, SMA, wave reference frame.

#### I. INTRODUCTION

o start research in any area, a researcher needs to define basic categories applicable in the area of research. In case of motion, that determination includes two basic categories of velocity and reference frame.

In common understanding, velocity makes no problem in definition and explanation. The famous equation of velocity shows this.

$$v = \frac{s}{t} \tag{1}$$

It has two variables determining by spatial relocation (S) and duration of the process (usually associated with time, t).

In case of mechanical motion, they determine velocity V of a moving object usually by a two-way test. For example, a fast car uses a measurement mile with two sensors installed at the beginning and the end of the mile.

The car runs twice the mile in two opposite directions to reduce an influence of many low-level physical factors like wind, etc. In that case, the car uses the same physical distance (of the measurement mile) by continuing physical interaction of the car and the ground. In other words, the car changes a condition of its internal mechanical elements to go forward. Those changes include motion of the pistons, rotation of the crankshaft, elements of transmission and so on, as well as rotation of wheels which make physical interaction with the road. The car cannot move without all those internal mechanical motion.

Such observations were known for many ages and led the humankind to the idea of mechanical motion. In case of that motion, relocation of an object becomes possible only by interaction with another object and stops immediately as soon as that interaction brakes.

For example, the car cannot move forward if its wheels make not any interaction with the road because of ice. In that case, ice covers the road and blocks the mechanical interaction between the wheels and the road surface. As a result, the wheels rotate, but the car does not move.

That point of view led to a creation of the paradigm of mechanical motion and became the dominated one in the human mind from the ancient times. Everything looked fine until an ancient engineer had invented a ballista.

A ballista is an ancient heavy missile launcher designed to hurl javelins or heavy balls. A smaller ballista was basically a large crossbow fastened to a mount. The huge and complicated Roman ballista, however, was powered by torsion derived from two thick skeins of twisted cords through which were thrust two separate arms joined at their ends by the cord that propelled the missile. The largest ballistas were quite accurate in hurling 60-pound weights up to about 500 yards. (Ballista. (2008). Encyclopedia Britannica)

The mechanical paradigm has not any explanation of ballista operability because the mechanical interaction between the device and the ball ends as soon as the ball leaves the ballista. In that case, according to the mechanical paradigm, the ball should drop down right in front of ballista without any chance "to be hurled up to 500 yards".

Some ancient thinkers thought this. The air spreads out in front of the ball hurled from the ballista and shrinks behind the ball. As a result, the air pushes the ball from the back. However, such "explanation" raises one serious question about other objects. They show no motion in the same air. Therefore, the explanation fails its applicability to the physical events.

Moreover, a ballista-man sees motion of the ball staying next to the ballista. He holds his ground physically and philosophically because all his

Author: Independent Researcher, Rostov-on-Don, Russian Federation. e-mail: allanzadeuk@gmail.com

speculations about motion begin from his *immovable location next to the ballista*.

No one of them associated himself with the ball hurled from the ballista because no one of them can image his motion riding the hurled ball. A new problem appeared here as soon as *an engineer crushed a theoretical framework of philosophers*.

# II. The Refence Frame Problem

A ballista-man associated himself with the ballista started the problem of the observer. He observes all events related to the ballista from his location next to the same ballista.

As a result, he says this. "The largest ballistas were quite accurate in hurling 60-pound weights up to about 500 yards" (see above). No one of them says another idea that "The 60-pound weight hurls the ballista up to about 500 yards." Such statement looks weird at first glance because the discussing process involves mechanical interaction with one more massive object that we call Earth.

Strictly speaking, every mechanical interaction appears at some level as interaction with the Earth. Therefore, the mechanical paradigm works fine only in case of final reduction of all mechanical interactions to mechanical interaction with the Earth.

For example, a ballista-man makes the following statement. "A ballista hurls a ball."That statement looks correct, but it is wrong. The ballista makes interaction with two objects in that process. Those are the ball and the Earth because the ballista installed firmly on the ground. As a result, the ballista makes interaction with the ball and keeps mechanical interaction with the Earth during the process of hurling. The observer who stays on the ground next to the ballista maintains mechanical interaction with the Earth too.

That mechanical interaction causes the fixed location of the observer and the ballista before, during and after the process of hurling. As a result, the observer falls under an oppressive illusion that only the ball moves relative to the ballista and all other objects remain static during the process of hurling.

That point of view became dominated one for many centuries. The Earth became the center of the Universe "because it is so heavy that it cannot move anywhere." In that paradigm, every motion appears only as relative motion to the Earth surface. That surface can be easily found everywhere, and the problem looks like solved one for many centuries.

From that point of view, all objects fall into two groups of "immovable" objects and "movable" one. Later, a *logical generalization* of all objects staying immovable relative to the observer during an experiment forms *the Observer-Bound Reference Frame (OBRF)*. A reference frame, also called frame of reference, in dynamics, is a 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. (Reference frame. (2008). Encyclopedia Britannica)

It is easily noticeable that a reference frame (here and later - RF) has a strong relationship with a body by definition. In other words, an observer should determine "the object" to apply a reference system to it. As a result, it looks impossible to make a reference frame without an object by definition of a reference frame.

That point of view raised a huge problem of comprehension since the time of Copernicus. The idea that the Earth moves relative other celestial bodies looked weird for the Earth population for many decades. The humankind lost the notion of "absolute rest" for the first time.

The problem comes from the human philosophy and the paradigm of mechanical motion that explains every motion in a relationship with the Earth surface. As soon as the Earth becomes movable, every motion becomes relative to some other "reference frame associated with another celestial body that can be used as the body at rest."

The problem persisted for a few centuries until Sir Isaac Newton introduced his point of view by means of forces which come from a new paradigm of physics.

# III. The Age of Newton

Newton was involved in solution of the celestial mechanic's problem that comes from motion of celestial bodies

The formulation of the law of gravitation was his best achievement. That law led to some consequences in physics which changed imagination of reference frames. According to the law of gravitation, every celestial body makes interaction with every other celestial body by some force. That force is independent of direction and depends on masses of the bodies and distance between them.

The result of that interaction appears in the form of a deviation of a trajectory from the straight line. In case of enough magnitude of interaction, a trajectory of a celestial body comes to an ellipse. As a result, a body with lesser mass becomes a satellite of a body with greater mass.

That point of view explained motion of the planets of the Solar System around the Sun and put the Sun in the center of the Universe. In other words, that way has created a new reference frame associated with another (motionless) celestial body (the Sun).

Everything looks fine at the beginning until "fixed stars" become movable. Humankind faced the same problem again. The "fixed ground" for all humanmade speculations disappeared again as a mist among billions of stars of the Universe.

The situation became critical for the humankind and its philosophy because a human-made point of view on the Universe needs something "at rest" at every point in space as the earth surface to the earth-bound observer. Otherwise, the situation becomes terrible because an absence of such thing at rest eliminates the idea of motion. In such case, an observer can take the Sun or a planet as the origin of the reference frame and make all observations in his reference frame in complete disagreement with other observers. Celestial mechanics and physics would be paralyzed that way.

For example, an observer on every planet can take his planet as the origin of a reference frame and describe motion of all other bodies around the planet. Strictly speaking, the law of gravitation becomes false in this situation because it can be proven only by comparison of masses of the celestial bodies. Otherwise, an observer takes any celestial body with lesser mass, treat it as the origin of the reference frame and see how a body with higher mass changes its trajectory around the body with lesser mass.

In other words, that situation comes back to the observation of a ballista-man. The observer (the ballistaman) can describe motion of the hauling ball only if he associates himself with a ballista instead of a ball. That idea supports the same comparison of masses. Otherwise, a ball-bound observer describes motion of the earth and all other things on the earth surface in the ball-bound reference frame after interaction of the ball and the ballista.

Worse than that, in case of gravitation, that ballbound observer makes an observation of "the Earth falling on the ball by gravitational interaction between two bodies (the Earth and the ball)."

Those two observers can fight for ages defending observations in two different reference frames until they conduct an edge experiment that shows the preferred reference frame to them. What is an edge experiment?

An edge experiment in a given area of science is the experiment that uses a different way of experimentation and shows a different data, unlike other experiments in the same area of science.

#### (Statement A)

In case of observers mentioned above, they use two other observers to conduct an edge experiment. Those are another ballista-man and another ball-bound observer. The experiment begins. Two ballista hurls two balls in different directions at the same time. Two ballista men reported motion of balls relative to each ballista. Two ball-bound observers reported motion of the Earth surface in some direction.

In that case, observations of ballista men become compatible with each other because they share the same Earth-bound reference frame.

Unlike them, observations of both ball-bound observers remain correct for a given observer but become contradictory in comparison with the view of another ball-bound observer.

Comparison of their observations leads to this. The Earth surface moves in two different directions *simultaneously* after ballista-ball interaction. Such observations lead to a physical *controversy* because a physical object keeps only one condition of motion at a given moment. For example, a rotating object remains one and only one axis of rotation. It is physically impossible for an object to keep more than one axis of rotation at a given moment.

The same statement is correct about motion. The same object keep only one way of motion because a physical object has only one location at a given moment. Therefore,

If two or more observers "detect" simultaneously different conditions of motion of the same physical object then they use different reference frames in condition of relative motion to each other.

#### (Statement B)

In case of two balls mentioned above, those observers determine their mutual motion because they "detect" more than one condition of motion of the same physical object (the Earth) *simultaneously*.

That conclusion terminates they fight about the best reference frame because

In case of many reference frames, the best one reduces controversy in observation of motion of any observer by determination of motion of the same observer regarding that reference frame.

#### (Statement C)

In other words, all controversies caused by any number of ball-bound observers moving relative to the Earth can be eliminated by the introduction of the earthbound reference frame. That reference reframe is the better one for them because it destroys all illusions of motion of those observers.

The *implicit* application of the same method led Newton to the idea about better reference frame for the Solar System where the Sun should be used as the point of origin of the better reference frame. That reference frame eliminates all problems in understanding of planetary orbits and gives the easiest way of calculation of mutual location of any planet to any other one by their location in the same reference frame instead of two different planetary-bound reference frames.

The next step was done in research of waves.

# IV. The Idea of Wave

There is one more way of motion known in physics. That is a propagation of waves. The easiest wave can be found in water.

A wave on a body of water is a ridge or swell on the surface, normally having a forward motion distinct from the oscillatory motion of the particles that successively compose it.(Wave. (2008). Encyclopedia Britannica.)

As soon as a wave makes motion (or propagation) location of wave changes continuously and looks similar to motion of an object. Suppose this. A wave and an object use the same direction of motion. Is it possible to apply equation (1) to a wave? It looks like the question has an obvious positive answer. However, there is a complex meaning of an "obvious" answer.

The equation (1) has not any restriction in a thing that was involved in measurement. In other words, the mentioned equation shows some mathematical abstraction (as any other equation) that distinguishes the equation from the physical world and physical entities. An observer can determine the speed of a wave using that equation, but he faces one major problem.

In case of the Earth surface, location of an object and its motion can be easily traced by a mutual location of the object and a lot of other objects. All those objects have physical interaction with the Earth and keep their locations continuously without any change regarding the Earth surface. Therefore, the Erath surface can be used easily as a reference frame. Researchers used that advantage for ages to conduct a lot of experiments on the Earth surface. Some of them include determination of speed of waves in various substances (and in water in a particular case).

To make a measurement of the speed of a wave in a given substance they put a wave source in a tank filled with that substance. That easy operation has one hidden side effect.

A motionless substance in a tank shares the same Earth-bound reference frame for the signal and the observer.

#### (Statement D)

In other words, to conduct any speed measurement experiment an observer explicitly brings a given substance in his Earth-bound reference frame.

That operation looks so "obvious" that no one pays any attention to it. However, that means "unification" of reference frames.

Unification of reference frames means the operation of determination their reciprocal motion and orientation.

#### (Statement E)

Strictly speaking any knowledge of motion of a given thing in a moving reference frame becomes reachable only in Unified Reference Frames (URF). If a researcher fails to make unification of reference frames then he fails any understanding of motion regarding the observer-bound reference frame.

The two balls example mentioned above is the best one that shows a failure of unification of two ballbound reference frames that raises a controversy in description and understanding of motion. Therefore,

Unification of given Reference Frames is possible only by a Preferred Reference Frame (PRF) at rest that incorporates other Moving Reference Frames (MRF).

#### (Statement F)

Otherwise, observers reach unsolvable controversies in any attempt to detect or describe/comprehend motion. Therefore, URF by an isolated motionless volume of a given substance helps an observer to use his instruments in a lab for signals as well as for all other things including physical objects.

In that case, the observer "detects" and "understands (comprehends)" motion of the signal in observer-bound reference frame (OBRF) as any other motion *in the same reference frame*.

That point of view is so "obvious" that an observer dislikes to make any analysis of physics beyond his measurements and falls under some critical illusions.

The first illusion is the illusion of a reference frame (or Reference Frame Illusion, RF-I). The observer comprehends the observer-bound reference frame as the only one RF that is possible to exist in a signal propagation measurement.

He thinks this. The signal moves *relative to his measurement device* (a ruler for example) but he forgets another thing that a signal exists only in an *artificial* environment of a lab and such motion of a signal becomes a result of application of the observer's point of view on the measurement.

Strictly speaking, a signal in a tank makes propagation through a given medium regardless of presence or absence of an observer. The signal just makes physical interaction with a given medium and spends some duration to cover some distance. Moreover, a signal as a wave follows Huygens' Principle.

In most real cases, a wave originating at some source does not move in a straight line but expands in a series of spherical wave-fronts. The fundamental mechanism for this propagation is known as Huygens' Principle, according to which every point on a wave is a source of spherical waves in its own right... The insightful point suggested by the Dutch physicist Christiaan Huygens is that all the wavelets form a new coherent wave that moves along at the speed of sound to form the next wave in the sequence. In addition, just as the wavelets add up in the forward direction to create a new wave-front, they also cancel one another, or interfere destructively, in the backward direction, so that the waves continue to propagate only in the forward direction.(Sound. (2008). Encyclopedia Britannica)



That is the second illusion of the observer who mistakes the spherical motion of the wave-front with a linear motion of an object along the ruler.

Fig.1 shows Huygens' Principle graphically. The point S is the source of wave signal in the figure. The circle ABC shows a location of the wave front after some duration of wave propagation in a medium. According the figure, the same wave-front becomes detectable *simultaneously* at every point of the circle ABC and others because the wave-front reaches those points with *physical simultaneity*.

Strictly speaking, an observer mentioned above, uses only one direction of wave propagation (SA, for example) and pays no attention to other directions of wave propagation like SB, SC, and others. In other words, he *reduces spherical wave propagation to linear propagation*. Why does it happen?

In case of a physical object, it moves along the ruler that an observer uses to detect and determine motion shown by continuously changing location of the object that the observer comprehends as motion in the observer-bound reference frame.

In case of a signal, the signal moves along the ruler that an observer uses to detect and determine motion shown by continuously changing location of the signal wavefront that the observer comprehends as motion in the observer-bound reference frame. In other words,

An ordinary observer comprehends motion only as a linear relocation of a given thing in an observerbound reference frame.

#### (Statement G)

That point of view leads to serious consequences explained in the next section.

# V. The Inertial Reference Frames

Newtonian mathematics needs a specific reference frame to be applicable in that frame.

Strictly speaking, Newton's laws of motion are valid only in a coordinate system at rest with respect to the "fixed" stars. Such a system is known as a Newtonian, or *inertial reference, frame*. The laws are also valid in any set of rigid axes moving with constant velocity and without rotation relative to the inertial frame; this concept is known as the principle of Newtonian or Galilean relativity. A coordinate system attached to the Earth *is not an inertial reference frame because the Earth rotates and is accelerated with respect to the Sun*. Although the solutions to most engineering problems can be obtained to a satisfactory degree of accuracy by assuming that an Earth-based reference frame is an inertial one, (reference frame. (2008). Encyclopedia Britannica)

Newton's first law states that, if a body is at rest or moving at a constant speed in a straight line, it will remain at rest or keep moving in a straight line at constant speed unless it is acted upon by a force. This postulate is known as the law of inertia. (Newton's laws of motion. (2008). Encyclopedia Britannica.)

The best example of such motion is gun-bullet interaction. Suppose an observer has a charged gun. The gun and the bullet inside the gun follow the law of inertia because both objects remain at rest and keep zero speed in an observer-bound reference frame. Moreover, their trajectories coincide in that reference frame.

The experiment begins. The observer aims the gun at a target and shoots. The bullet in the gun possesses some acceleration by chemical reaction of the load that pushes the bullet out of the gun by the barrel. As soon as the bullet leaves the barrel, the pressure of gases that pushes the bullet forward drops to zero. As a result, acceleration of the bullet drops to zero as well. The gun and the bullet come again to the observer-bound *inertial reference frame*. In that condition the bullet keeps motion along a straight line until another force (of impact) changes its velocity. Figure two shows that case graphically.



There are three observers A, B and O represented in the figure by their points of location. Observers A and B have their original positions  $A_1$  and  $B_1$ . They are located motionlessly to each other. Each observer also has a gun identical to the gun of another observer.

The experiment begins. The observer A shoots a bullet toward the target located next to the observer B. The bullet covers the distance  $A_1B_1$  in a duration  $D_{A1B1}$ . The observer A calculates the speed of the bullet by the equation (1) and has the result  $V_{B1} = S_{A1B1}/D_{A1B1}$ .

The observer B makes the same test shooting a bullet toward the target located next to the observer A. The bullet covers the distance  $B_1A_1$  in a duration  $D_{B1A1}$ . The observer A calculates the speed of the bullet by the same equation (1) and have the result  $V_{B2} = S_{B1A1}/D_{B1A1}$ . In that case, both observers agree that the speed of a bullet in both directions equal to each other  $(V_{B1} = V_{B2})$ .

Moreover, the observer O that keeps motionless location during both experiments agrees with the point of view of the observer A and the observer B because all observers share the same reference frame.

The next experiment uses the observer O in motion. That observer makes some acceleration and possesses some velocity that appears as  $V_{\rm R}$  or velocity of the reference frame associated with the observer O.

Observers A and B make the same tests again. In that case, the observer O detects motion of the bullet toward the observer B as motion by the trajectory  $A_1B_2$ . Despite greater distance  $(A_1B_2 > A_1B_1)$  the experiment shows the same duration of the bullet travel to the target. That happen because

A physical object has the only one value of any physical attribute at a given moment.

#### (Statement H)

That means the basis of physical measurements. If an object shows more than one value of the same attribute *simultaneously*, *physical measurements become impossible*.

The observer O understands this. The trajectory  $A_1B_2$  appears as a result of his motion relative to observers A, B, and the bullet. All those elements "affected" by his relative velocity  $V_R$  and show some trajectories that exist *only in the reference frame bound to the observer O*. Moreover, all velocities are also affected by the same velocity  $V_R$ . As a result, the observer O detects some "projection" of physical motion of other objects on his reference frame.

As a result, motion of the observer O has no impact on duration of experiment in other reference frame because that motion makes not any physical interaction with anything in another reference frame. Moreover, appearance of the reference frame bound to the observer O depends on previous acceleration of the observer O. Therefore, that reference frame depends on



some force applied to the observer O without any changes in motion of other physical objects. In other words,

A physical action applied to an observer does not change condition of other physical objects

#### (Statement I)

Therefore, the bullet experiment mentioned above is independent of any number of observers and their inertial frames created after acceleration finished its action (acceleration is applied to a given observer).

In other words, every observer creates his inertial reference frame as soon as the observer stops acceleration applied to him. That way of thoughts led Newton to the idea of an infinite number of *comparable inertial reference frames*(or URF) which describe any motion by recalculation regarding their relative velocities.

Everything looks fine, and Sir Isaac Newton became a famous person of his time. The situation had no changes until wave nature of light was confirmed.

# VI. THE WAVE REFERENCE FRAME

Huygens, Christiaan (also spelled Christian Huyghens, born April 14, 1629, The Hague died July 8, 1695, The Hague) was a Dutch mathematician, astronomer, and physicist, who founded the wave theory of light, discovered the true shape of the rings of Saturn, and made original contributions to the science of dynamics—the study of *the action of forces on bodies*. (Huygens, Christiaan. (2008). Encyclopedia Britannica.) Later research made by another scientist James Clerk Maxwell led him to formulation of his famous equations.

"A manipulation of the four equations for the electric and magnetic fields led Maxwell to wave equations for the fields, the solutions of which are traveling harmonic waves. Though the mathematical treatment is detailed, the underlying origin of the waves can be understood qualitatively: changing magnetic fields produce electric fields, and changing electric fields produce magnetic fields. This implies the

2016

possibility of an electromagnetic field in which a changing electric field continually gives rise to a changing magnetic field, and vice versa.

"Electromagnetic waves do not represent physical displacements that propagate through a medium like mechanical sound and water waves; instead, they describe propagating oscillations in the strengths of electric and magnetic fields. Maxwell's wave equation showed that the speed of the waves, labeled c, is determined by a combination of constants in the laws of electrostatics and magnetostatics—in modern notation:

$$c = \frac{1}{\sqrt{\varepsilon_0 \mu_0}} \tag{2}$$

"Where  $\epsilon_0$ , the permittivity of free space, has an experimentally determined value of  $8.85\times10^{-12}$  square coulomb per newton square meter, and  $\mu_0$ , the magnetic permeability of free space, has a value of  $1.26\times10^{-6}$  newton square seconds per square coulomb. The calculated speed, about  $3\times10^8$  meters per second, agreed with the known speed of light." (Light. (2008). Encyclopedia Britannica.)

They had a lot of attempt to determine the speed of light. One of early attempt includes the following experiment.

"Measurements of the speed of light have challenged scientists for centuries. The assumption that the speed is infinite was dispelled by the Danish astronomer Ole Rømer in 1676. French physicist Armand-Hippolyte-Louis Fizeau was the first to succeed in a terrestrial measurement in 1849, sending a light beam along a 17.3-km round-trip path across the outskirts of Paris. At the light source, the exiting beam was chopped by a rotating toothed wheel: the measured rotational rate of the wheel at which the beam, upon its return, was eclipsed by the toothed rim was used to determine the beam's travel time. Fizeau reported a light speed that differs by only about 5 percent from the currently accepted value. One year later, French physicist Jean-Bernard-Léon Foucault improved the accuracy of the technique to about 1 percent. (Light. (2008). Encyclopedia Britannica.)

Those experiments gave definite value of the speed of light. However, no one of them answered the question about physical way of light propagation.

"From the first speculations on the wave nature of light by *Huygens* through the progressively more refined theories of *Young, Fresnel, and Maxwell*, it was assumed that an underlying physical medium supports the transmission of light, in much the same way that air supports the transmission of sound. Called the *ether*, or the *luminiferous ether*, this medium was thought to permeate all of space. The inferred physical properties of the ether were problematic—to support the highfrequency transverse oscillations of light, it would have to be very rigid, but its lack of effect on planetary motion and the fact that it was not observed in any terrestrial circumstances required it to be tenuous and chemically undetectable." (Light. (2008). Encyclopedia Britannica.)

That point of view describes clearly the 19-th century paradigm of waves. According to that paradigm, every wave should have *mechanical interaction* with some medium that supports propagation of that wave. Light is not a mechanical wave. Therefore, such restrictions are not applicable to light.

Moreover, equation (2) uses two constants  $\varepsilon_0$ , the permittivity of free space and  $\mu_0$ , the magnetic permeability of free space. Both of them have reference to physical attributes of free space and there is not any reference here on any physical attributes of so-called "luminiferous ether".

That problem led to a serious dispute at the late 19-th century because researchers of that time make measurements of physical attributes associated with free space looking for something beyond that free space.

If they like to make measurements of physical attributes of luminiferous ether they should measure attributes of that ether instead *attributes of space*.

Science meets that situation ever when the humankind meets something from a new paradigm but tries to explain that thing in categories of the old paradigm. In a given case, they try to use categories of a physical substance different from pure space to describe propagation of light waves through space.

That way leads ever to nonplus because old categories do not work in a new paradigm. Sometimes it's hard to a researcher to understand that he faces a new paradigm and his previous experience becomes *entirely inapplicable* to the new paradigm. However, that is a standard task for a philosopher to refine and change categories in his mind to reach categories of another paradigm.

They also raised another question about a reference frame that supports propagation of light. That question seems a strange one because any wave makes propagation regarding the medium that supports propagation of a given wave.

Therefore, if the speed of light depends on known attributes of free space it makes propagation relative to that free space. That easy conclusion looks weird to physicists of the 19-th century because free space has nothing to apply a reference frame in which the speed of light can be determined. All Earth-bound experiments give the only observer-to-light measurement of that value without any reference to the actual speed of light *regarding free space*.

The problem comes from the idea of reference frame by itself and becomes more philosophical than physical. Free space has not any reference for application and orientation of a traditional reference frame in the understanding of 19-th century scientists. They need a physical object to "attach" a reference frame to it.

As mentioned above, "A reference frame, also called frame of reference, in dynamics, is a system of graduated lines symbolically attached to a body that serves to describe the position of points relative to the body." That is a cornerstone of 19-th century scientific point of view. To set up a reference frame, they need a body to be associated with that reference frame. Usually, that body becomes the point of origin of the reference frame and orientation of the body sets directions of "graduated lines symbolically attached to a body." Therefore,

Application of a reference frame in 19-th century physics paradigm requires a body to serve as the point of origin for the reference frame.

#### (Statement J)

A strange question appears here. Is it possible to define a reference frame without any relationship with an object? Such reference frame should remain intact regardless any object and any motion of other physical objects. In other words, that reference frame should be a physical self-consistent reference frame in which any motion depends on pure motion of an object regarding (relative to) that reference frame.



The existence of such unique reference frame seems impossible at first glance. However, it is physically possible to define that reference frame. Figure one gives the answer on that question.

According to the figure, the body placed in water produces a sound wave at the point S. That wave makes propagation through a given medium (water) and forms the exact sphere at the wave front. The figure four transforms the figure one to a Reference Frame.

The figure four shows propagation of the signal wave front originated at the point S through a given medium (water for example).

This wave front covers the same distance in every direction with the same duration. Therefore, if some observers have a duration measurement device they detect the same wave front simultaneously at the same distance from the point of origin. Moreover, the same wave front spends the same duration to cover the same distance in every direction. That makes the distance AB equal to the distance DE and CF.

In a lab experiment, an observer usually reduces the entire experiment to the propagation of the wave front in a given direction (SF, for example) and forgets other directions of signal propagation. That leads to a serious misunderstanding of some aspects of signal propagation.

Moreover, suppose this. The object crated two different signals at the point S (fig. 4). Each signal has a different speed of propagation in a given medium. As a result, both signals have a different wave front after the same duration of emission.

According the lab observation those signals would be detected at the points A and B simultaneously and the observer has the following conclusion. The signal B that detected at the point B simultaneously with the signal A at the point A has greater speed of propagation in the same medium because it uses the same duration of propagation to cover a greater linear distance from the point of signal emission (S).

It is also possible to determine the ratio of signal speed the following way

$$R = \frac{V_B}{V_A} \tag{3}$$

In other words, if the signal A spends duration D to cover a given distance, the signal B covers R-times greater distance spending the same duration.

Suppose now this. An observer uses a mirror of any kind to reflect the signal inside the medium. According the Huygens' Principle, "every point on a wave is a source of spherical waves in its own right..." Therefore, after reflection, the signal has the same law of propagation as from the source of the signal (S). Figure five shows that case.

There is the source (S) of two signals with different speed of propagation in the same medium in the medium-bound reference frame. The observer S punts the mirror M at the point M and sends both signals in the medium *simultaneously*.

The observer gives signals some duration D to make propagation in the medium. After that he has the situation shown in the figure five. The wave-front of the first signal (the signal A) forms the circle ABC in the figure plane (and the perfect sphere in the medium).Distance between the signal source S and any point of that circle is the same and equal to  $S_A$ .

The wave-front of the second signal (the signal B) spending the same duration reaches the mirror M (at

the point M) makes physical interaction with the mirror, reflects from the mirror and forms the sphere DEF.



Those signals follow the equation (3) therefore. Distance covered by wave-front of signals has the same ratio R despite trajectory that a signal uses.

Strictly speaking, a linear motion of those signals is an illusion of the observer who likes measurements of motion in a linear way by comparison of distance covered by a signal and a physical ruler that an observer uses to make measurements in *his* reference frame.

In general case, a linear trajectory of a signal played no role in the propagation of wave-front of the signal and associated with an observer's point of view that a signal makes propagation in the form of linear rays.

In other words, regarding the figure five, distance SMD is R times greater than distance SA (SMD = R(SA)) as well as SME = R(SB), SMF = R(SC) and etcetera to infinity. Therefore,

In case of two signals which make propagation regarding the same medium-bound reference frame, a signal that R-times faster than another signal covers Rtimes greater distance in any given duration regardless of trajectories that signals use in that reference frame.

#### (Statement K)

In other words, an observer that uses a reflected signal from a mirror uses only a particular case of signal propagation. In general case, the observer can use any number of mirrors with the same result. In any case, a ratio of distances covered by mentioned signals by the same duration of an experiment *keeps constant value*.

Statement K has a logical conclusion for two identical signals in the following way.

In case of two identical signals which make propagation regarding the same medium-bound reference frame, both of them cover the same distance in any given duration regardless of trajectories that signals use in that reference frame.

#### (Statement L)

Statement L helps the observer to determine the full length of a signal path. If two identical signals emitted from the same point simultaneously come back to the same observer simultaneously, then both signals use the same length of their different paths. Paths of those signals can be *different*, but full length covered by each signal (by its wave front) *becomes equal to each other in that case*.

Suppose now this. An observer remains location at the point S motionless regarding the medium that support propagation of signals (Fig. 6). That is the experiment A.



The observer emits one signal from his point of location. However, that single signal coincides with an infinite number of wave-front points that makes propagation in the medium. Every point of that wave front is independent of other points by Huygens' Principle.

There are also two mirrors located at the points A and B equidistant from the point S. Wave front of the signal reaches both mirrors simultaneously makes physical interaction with them and creates two new signals. Those signals make propagation in the same medium and *the same medium-bound reference frame* as well as the original signal. Each of them has one point of their wave fronts moving toward point S. Both mirrored (new) signals spend the same duration D to cover equal distance AS and BS. As a result, the observer detects both mirrored signals *simultaneously*.

In that case, the observer falls under an illusion that the experiment gives him an "unavoidable prove" of his motionless location relative to the medium. However, that is only an illusion. Figure Seven explains that illusion.

In figure seven, the observer shares the same straight line with two mirrors A and B. Both mirrors located equidistant from the observer during the entire experiment. Unlike the previous case, the observer and the mirrors move in the perpendicular direction to the straight line that connects them. Figure seven shows some consequent locations of all elements.

Motionless location of both mirrors regarding the observer means their motionless location in the observer's *inertial reference frame* (IRF) because no force affect those mirrors. Therefore, they have zero acceleration and keep zero observer-to-mirror speed of relative motion during the experiment. That is the experiment B.



#### Fig. 7

The observer begins the experiment the same way by emitting a signal in the medium from the point  $S_1$ . The signal spends some duration  $D_M$  to reach points of mirror location in the medium-bound reference frame. Those are points  $A_1$  and  $B_1$ . Everything coincides now with the previous experiment.

The signal does not make any interaction with mirrors at the points  $A_1$  and  $B_1$  because booth mirrors move forward with the observer by observer-to-medium

relative motion. The signal forms the circle  $C_M$  at that moment. Therefore, the signal spends some extra duration and reach mirrors at points  $A_2$  and  $B_2$  spending duration  $D_N$  and forming the circle  $C_N$ .

After interaction with mirrors, two reflected signals move by Huygens' Principle again using mirrors as points of origin of two new signals. Those signals reach the observer at the point  $S_3$ simultaneously. Therefore, the observer has two reflected signals simultaneously again and become unable to separate his motion relative to the medium in experiment A and B. In other words, the observer is unable to detect his motion relative the medium that way.

Moreover, experiment B has one more side effect. The mirrored signals reach the point  $S_1$  (the original location of the observer at the beginning of the experiment) simultaneously as well as the point  $S_3$ .

In other words, an observer that keeps motionless location relative to the medium-bound reference frame in experiment B (the point  $S_1$ ) detects no difference in the experiment from the moving observer because both observers detect both mirrored signals simultaneously (at points  $S_1$  and  $S_3$ ). Moreover, both observers detect the same duration of the experiment B equal for  $2D_N$ .

What is the value of  $2D_N$ ? That is the duration of the signal propagation in "ray mode" that comes from the imagination of the observer. That path appears as wave-front propagation by  $S_1A_2S_3$  trajectory for the mirrored signal A and  $S_1B_2S_3$ trajectory for the mirrored signal B.

In general case, the same observer conducts the experiment C in which the observer and the mirrors have a casual direction of motion in a given medium regarding the straight line connecting the mirrors. Figure eight shows that case.



Fig. 8

Experiment C begins like experiments A and B by an emission of a signal from the initial location of the observer at the point  $S_1$ . The signal begins propagation in the medium by Huygens' Principle as usual.

The signal spends some duration of propagation and meets the mirror A at the point A<sub>2</sub>. The wave front of the signal forms sphere in the medium represented in the figure as the circle  $C_A$ (center S<sub>1</sub>). The observer takes location S<sub>2</sub> at that moment relative to the medium-bound reference frame. The mirror B takes location at the point B<sub>2</sub> at the same moment relative to the medium-bound reference frame.

The signal and the observer-bound mirrors continue their motion. The wave-front of the signal spreads further and meets the mirror B at the point  $B_3$ . The observer takes location  $S_3$ , and the mirror A takes location  $A_3$  at the same moment.

The signal reflected from the mirror A at the point  $A_2$  makes propagation in the medium as well as the original signal. It spreads in every direction and meets the observer at the point  $S_4$ . The signal forms sphere in the medium represented in the figure as the circle  $C_c$  (center  $A_2$ ).

The signal reflected from the mirror B at the point  $B_3$  makes propagation in the medium as well as the original signal. It spreads in every direction and meets the observer at the point  $S_4$ . The signal forms sphere in the medium represented in the figure as the circle  $C_D$  (center  $B_3$ ).

As a result, the observer detects both mirrored signals simultaneously again.

That happens because the signal spends the same duration to cover the same distance by any trajectory (see statement L). Experiment C has two pairs of equal elements. Those are circles  $C_A$  with the circle  $C_C$  and the circle  $C_B$  with the circle  $C_D$ .

Mutual location of their centers in the mediumbound reference frame depends on observer-to-mirror distance in the observer-bound reference frame and velocity of observer-to-medium relative motion in the medium-bound reference frame.

Duration if each circle (sphere) formation depends on the speed of the signal in the mediumbound reference frame and some moment when a signal makes interaction with the observer or a mirror in the medium-bound reference frame.

As a result, the observer ever meets the same observation

$$R_{CA} + R_{CC} = R_{CB} + R_{CD} \tag{4}$$

However (in general case),  $R_{CA} \neq R_{CC}$  and  $R_{CB} \neq R_{CD}$ . As soon as the observer changes a direction of his velocity, circles (spheres) represented in figure eight change their ratio of radiuses and adjust themselves so as the full duration of propagation of a signal in experiment C remains constant regardless direction of observer-to-medium relative motion (see statement L).

Those experiments (A, B, and C) depend on physical signal propagation in the medium-bound reference frame. Independence of that reference frame of any motion of observer's bound reference frame and any other observer-bound object gives that reference frame *the priority* in a description of any motion of the observer regarding that reference frame. That unique reference frame becomes the Wave Reference Frame (WRF). There is only one Wave Reference Frame in any given medium that supports propagation of waves (signals) because

The existence of another Wave Reference Frame in the same medium is physically impossible. (Statement M)

# VII. The Elliptical Law

Signal propagation shown in figure eight can be transformed to the observer-bound reference frame. Figure nine shows the result of that transformation.

Corresponding points with similar names have the same meaning in both figures. The equation (4) leads to some shape in the Wave Reference Frame (WRF) that follows the law represented by the equation.

In case of a reference frame bound to a medium that supports propagation of a wave (a measuring signal), a moving transducer remains locations in two focuses of an ellipse at the moments of sending and receiving the measuring signal. Location of a body that mirrors the measuring signal and keeps the same distance from the transducer by a duration of a both-way propagation of a measuring signal forms an ellipse that depends on the transducer-to-medium uniform relative motion and a given distance between the transducer and the body mirroring the signal.

#### (Statement N)

Statement 'N' is *the Elliptical Law of a Mirrored* signal in a Moving Medium or (ELM) for any measuring signal moving through any medium. (Zade Allan, 2016)



Figure nine shows that ellipse  $SMS_xN$ . ELM explains the situation with an observer moving in a medium. The observer sends signals to a mirror and rotates mirror around the source of the signal. As a result, both signals (the initial signal and the reflected one) form an ellipse in the observer-bound reference frame. The same signals use way of propagation in the medium-bound reference frame shown in figure eight in case of a variable angle between the direction to a mirror and the direction of motion of the observer.

ELM gives the observer the same duration of any experiment with transmitted and reflected signals in any direction. Therefore,

In case of constant speed of the observer in the wave reference frame and constant distance between the observer and the object mirroring the signal total duration of the experiment (that consist sending of initial signal and receiving a reflected signal) remains constant despite an angle between direction of observer's motion regarding the medium and the direction to the mirroring object.

#### (Statement N)

ELM gives also a mind blowing experience to the observer that conducts such experiment. From the observer's point of view, his motion relative to a medium gives him a constant result that coincides with the result obtained in his motionless location in the medium.

In that case, the observer comprehends the experiment as an experiment in static medium and sees the distance between the observer and the mirror as a *constant* distance DE in any direction (fig. 9)

In other words, ELM makes the Mirroring Ellipse (ME) and *the equivalent Mirroring Circle*(MC) determined by the duration of a round-trip experiment *indistinguishable* from each other.

Is there any physical experiment that shows an application of ELM? That question has many positive answers. One of them comes from Norbert Feist's acoustic experiment.

# VIII. THE NORBERT FEIST EXPERIMENT

An ultrasonic range finder was mounted on a horizontally rotatable rail at fixed distance, S, to a reflector on the top of a car. The change of the distance reading, S, determined the two-way velocity of sound as a function of the car's velocity and direction. As a result of this experiment, the out and back velocity  $C_2$  was determined to be *isotropic* – as in the optical case of the Michelson-Morley experiment. Within the experimental error, the velocity was found to vary as  $C_2 = (C^2-V^2)/C$ . (Feist Norbert, 2010).

A range finder sends a signal to an object and waits for a reflected signal. Distance between the range finder and the object determines as

$$S = \frac{1}{2}(VD)$$

(5)

Where V is the speed of sound in air and D is the duration of the measurement. The most critical parameter here is V because it should be measured in a lab before a range finder becomes operable. A rangefinder becomes useless without that value.

The next critical aspect is ratio 1/2. It comes from the human suggestion that both elements of measurements (the range finder and the object) remains motionless in the medium (air). That coincides with the old human illusion that only Earth surface can be used as the "right" reference frame. In that case, the measuring signal spends the same duration moving from the range finder to the object and from the object to the range finder. Therefore, the signal covers the distance twice. As a result, distance should be "recalculated" and reduced twice regarding data coming from the measurement (duration of the experiment).

Feist's experiment shows application of ELM in air. The range finder determines the circle E (fig. 9) regardless observer-to medium relative motion.

The experiment shows one more thing. The full duration of the experiment has inverse proportion to the speed of observer-to-medium motion. That is easily explainable by ELM (fig. 9)

There are two constants in the Feist's experiment. Those are sound-to-air speed and the given distance between the range finder and the mirroring object. The speed of observer-to-medium becomes variable.

In that case, distance  $S_1 - S_4$  depends on observer-to-medium relative motion. However, the speed of sound in the wave reference frame remains constant. As a result, wave-front of the signal uses different ways of propagation in the observer-bound reference frame and ratio of V/C becomes lesser. The figure ten shows that graphically.



Suppose an observer conducts two experiments A and B in acoustic environment. The

speed of observer-to-medium (observer-to-air) relative motion has greater value at the second experiment ( $V_{S2} > V_{S1}$ ).

Experiment A begins. The observer sends a signal from the point  $S_1$  in the wave reference frame that makes propagation in the medium (air) and meets the mirroring object (a reflector) at the point  $A_2$  in the wave reference frame (the medium-bound reference frame). The signal makes interaction with the reflector and makes backward propagation. The wave-front of the mirrored signal meets the observer at the point  $S_4$  of the wave reference frame. The experiment shows the duration  $D_A$  for that round-trip wave propagation. Rotation of the reflector around the observer does not change the duration of the round-trip experiment because of ELM that makes the Mirroring Ellipse  $N_1FM_1G$ . As a result, the duration remains constant ( $D_A$ ).

After the first experiment, the observer increases his speed of observer-to-medium relative motion to  $V_{S2}$ and conducts another experiment. The observer sends a signal from the point  $S_5$  in the wave reference frame that makes propagation in the medium (air) and meets the mirroring object (a reflector) at the point  $B_3$  in the wave reference frame (the medium-bound reference frame). The signal makes interaction with the reflector and makes backward propagation. The wave-front of the mirrored signal meets the observer at the point  $S_6$  of the wave reference frame. The experiment shows the duration  $D_{\rm B}$  for that round-trip wave propagation. Rotation of the reflector around the observer does not change the duration of the round-trip experiment because of ELM that makes the ellipse  $NSMS_x$ . As a result, the duration remains constant  $(D_{\rm B})$ .

The increased speed of the observer in the wave reference frame causes greater duration of experiment B because the wave front of the signal covers greater distance to reach the reflector and to come back to the observer. Distance  $S_5S_6$  becomes greater than  $S_1S_4$  because the speed of the signal in WRF (Wave Reference Frame) remains constant, but the speed of observer in the same reference frame increased. That also changes the ratio of the signal to observer speed of motion (equation 3) and the ellipse NSMS<sub>X</sub> becomes more *elongated* than the ellipse N<sub>1</sub>FM<sub>1</sub>G.

Despite the increased speed, the observer sees the same ELM that shows *another constant value of duration* of the experiment in any direction ( $D_B$ ). In other words, the observer detects a given duration of a round-trip experiment at any given speed of the observer in the WRF.

Feist's equation

$$C_2 = (C^2 - V^2)/C$$
 (6)

Shows also this.  $C_{\rm 2}$  = C in case of V = 0. In other words,

The speed of the signal measured by a roundtrip experiment become identical in the observer-bound reference frame (OBRF) and the wave reference frame (WRF) only in case of motionless location of the observer in the wave reference frame.

#### (Statement O)

Otherwise, "the speed of the signal" measured in the observer-bound reference frame become affected by the speed of observer-to-medium relative motion.

As mentioned above, *the Elliptical Law of a Mirrored signal in a Moving Medium* (ELM) works in any signal-medium combination because Huygens' Principle is applicable to all of them.

Misunderstanding of that law led to a huge problem in 20-th century physics.

### IX. The Michelson-Morleyexperiment

That experiment was "an attempt to detect the velocity of the Earth with respect to the hypothetical luminiferous ether, a medium in space proposed to carry light waves. First performed in Berlin in 1881 by the physicist A.A. Michelson, the test was later refined in 1887 by Michelson and E.W. Morley in the United States.

"The procedure depended on a Michelson interferometer, a sensitive optical device that compares the optical path lengths for light moving in two mutually perpendicular directions. It was reasoned that, if the speed of light were constant with respect to the proposed ether through which the Earth was moving, that motion could be detected by comparing the speed of light in the direction of the Earth's motion and the speed of light at right angles to the Earth's motion. No difference was found. This null result seriously discredited the ether theories and ultimately led to the proposal by Albert Einstein in 1905 that the speed of light is a universal constant." (Michelson-Morley experiment. (2008). Encyclopedia Britannica.)

The initial ideas of the experiment that belong to Michelson and rest on his speculations that a wave moving in a medium regarding an observer moving in the same medium has a different duration in propagation in different directions.

Michelson made calculations based on his speculations and built a physical device later to make physical measurements. The device *failed* to show anything close to his thoughts and falsified his point of view with all his predictions and reasoning for the experiment.

Despite that so-called Null result Michelson made two critical mistakes as a researcher. He never conducted the same test in other signal-medium combination. Physically, he had not any restriction to conduct the same experiment in air or water with acoustic signals. Those experiments (like Feist experiment) show the same so-called "null result" for a constant speed of the observer in Wave Reference Frame (WRF).

The second grave mistake was this. The interferometer he used shows not any theoretically predicted data. In other words, a physical test destroyed the theory and Michelson's speculations *immediately*. However, Michelson falls under illusion that his thoughts and calculations are correct and the physical device is "wrong" because the interferometer "refused" to show the result he expected.

That is a human mind related problem. Strictly speaking, that problem has not any relationship with science but affects science whenever a researcher puts *his human understanding higher that results of physical tests*. That contradicts the scientific method because that method requires physical tests as support for theories (not vise versa).

In case of Michelson's experiment, he forgot that he uses a round-trip experiment instead of one-way experiment and the speed of the observer in the medium affects both signals in different ways. As a result, everything that increases the duration of forward propagation of an initial signal reduces the backward propagation of a reflected signal. Mathematics proposed to support his speculation makes support only for his illusion. As a result, physical test destroyed all illusions *immediately*.

Willingly or not, the Michelson interferometer confirmed ELM for light propagation with the best possible precision (as an optical device).

The device also confirms the constant speed of the observer in some reference frame that light uses for propagation (or in Light Wave Reference Frame, LWRF). In that case, ELM gives the observer no chance to detect observer-to-medium motion by a round-trip experiment.

To reach the result, the observer should split a *round-trip experiment for two one-way experiments* and determines the duration of those experiments *separately*. That idea exceeded the imagination of 19-th century researchers because "light has such a great speed of propagation that a one-way experiment is impossible."

That is another one human-related point of view based on a technical possibility of 19-th century physical devices. Technological progress of the last century offers many devices which exceed the imagination of 19-th century researchers. Atomic clock is one of them.

### X. DE WITTE FINDINGS AND AURORA EFFECT

In 1991 Roland De Witte carried out an experiment in Brussels in which variations in the oneway speed of RF (radio frequency) waves through a coaxial cable were recorded over 178 days. The data from this experiment shows that De Witte had detected absolute motion of the earth through space (Cahill Reginald, 2006)

In a 1991 research project within Belgacom, the telecommunications company, Belgium another (serendipitous) detection of absolute motion was performed. The study was undertaken by Roland De Witte. This organization had two sets of atomic clocks in two buildings in Brussels separated by 1.5 km and the research project was an investigation of the task of synchronizing these two clusters of atomic clocks. To that end 5MHz radio frequency (RF) signals were sent in both directions through two buried coaxial cables linking the two clusters. The atomic clocks were cesium beam atomic clocks, and there were three in each cluster: A1. A2 and A3 in one cluster, and B1, B2, and B3 at the other cluster. In that way the stability of the clocks could be established and monitored. (Cahill Reginald, 2006)

Synchronization of two or more clocks is not an easy task especially when they have high-frequency oscillators. That problem did not exist in ancient times because any pair of sundials were ever "synchronized" by the location of the sun in the sky.

The situation changed dramatically as soon as a man "invented" an escapement clock that uses an internal recurrent physical process to emulate motion of the Sun in the sky. Such clocks need not any relationship with the sun. As a result, the humankind faced a full-scale philosophical problem with the meaning of clock indication and "synchronous operation (indication)".

In common understanding, a clock should have some "right" indication. That indication depends on human imagination about the location of the Sun in the sky regarding the location of the person (the observer). Moreover, such "indication" should "magically coincide" with the indication of a sundial at a given point of the earth surface.

That "right" indication should show the same "indication" of two or more clocks that coincides with the human expectation. Strictly speaking, that point of view *contradicts* the scientific method because a physical device operates by itself without any relationship with the human imagination or thoughts.

They usually make a solution of the problem of clock "synchronization" by sending a signal from one clock to another one. That method has one critical issue. A signal spends some duration to reach another clock. Therefore, any attempt to make synchronization that way faces the same problem of a definite duration of signal propagation between "clocks."

They proposed an easy method of clock synchronization to make a solution of that problem. They claimed this. A signal spends equal duration going from the clock A to the clock B and from the clock B to the clock A because the signal is "very fast." That method worked perfectly for mechanical clocks synchronized by acoustic or electromagnetic signals. However, precision

2016

atomic clocks faced a serious problem. Figure eleven shows that problem graphically.



#### Fig. 11

Suppose an observer likes to make synchronization of two clocks which use high-frequency oscillators. The observer moves with one clock by the straight line  $S_1$ - $S_4$ . He sends the signal toward clock 'A' that moves in a straight line  $A_1$ - $A_4$  and keeps a constant distance from the observer  $L_A = S_1A_1$  (Fig. 8) in the observer-bound reference frame.

The signal meets the clock 'A' at the point  $A_2$  as explained above. That coincides with the line  $S_1A_2$  in both figures (shown in the fig. 11). The clock 'A' sends the signal back immediately. The signal moves in the medium as explained above and meets the observer at the point  $S_4$ . From the observer's point of view, the reflected signal covers the distance  $A_2S_4$  by a straight line. That is the line of propagation of *the detectable signal*. The full signal forms a sphere in the wave reference frame as explained above.

The observer also has no idea about the duration of forward and backward propagation of a signal. Instead of a detailed investigation of that problem he makes the easiest *postulate* that the duration of signal propagation in both directions has the same value.

As a result, he postulates this. The signal meets the clock A at the point  $A_N$  *simultaneously* with the moment when the observer-bound clock takes location at the point  $S_N$ . Backward propagation of the signal uses the same way, and the observer meets the reflected signal at the point  $S_4$  in the Wave Reference Frame.

That way of Signal-Based Synchronization (SBS) uses a human-made postulate of signal-toobserver propagation. The illusion of such "simultaneity" for a moving observer can be easily seen in any medium including water and air. However, 19-th sentry scientists paid no attention to them.

The next step of "synchronization" includes some "information to the clock 'A' that the clock should set "the right time" of  $M_A$  as soon as the clock detects the signal from the observer-bound clock.

At the next step of "synchronization" the clock 'A' sets the indication  $M_A$  and waits for the signal from the observer-based clock. That observer-based clock sends a signal toward the clock 'A' from the location  $S_1$ in the wave reference frame. The clock 'A' detects that signal at the point  $A_2$ sets indication  $M_A$  and sends a signal back to the observer-based clock. That signal meets the clock at the point  $S_4$ .

The observer thinks now this. Each clock has the same indication at any given moment. However, that is an illusion because the clock 'A' had location  $A_2$  at the moment when the signal reached the clock. From the observer's point of view, the clock 'A' had the location at the point  $A_N$  "because the signal spends the same duration in forward and backward motion." However, the signal "does not know" the observer's point of view and makes propagation by physical interaction with the medium instead of physical interaction with the observer's mind.

As a result, the clock 'A' has indication  $P_A$  (Fig. 11, band 'P') shifted to the value  $\Delta N$  = N  $_A$  –  $N_2(P_A$  =  $N_A$  –  $\Delta N$  =  $N_2)$  according to indications of the observerbound clock.

However, the observer's illusion persists because every round-trip experiment gives the same difference between indications of the clock 'A' and the observer-bound clock.

Suppose now this. The observer likes to conduct synchronization with another clock 'B' equidistant from the observer and stays on the same straight line that connects clocks A, B and the observer (Fig. 8, line  $A_1S_1B_1$ ) The observer uses the same way of signal-based synchronization (SBS).

The observer sends the signal from the point  $S_1$  (Fig 11). The signal meets the clock 'B' at the point  $B_3$  in the wave reference frame. The clock detects the signal and sends the signal back to the observer. The mirrored or retransmitted signal meets the observer at the point  $S_4$  in the wave reference frame.

The next step of "synchronization" includes some "information to the clock 'B' that the clock should set "the right time" of  $M_A$  as soon as the clock detects the signal from the observer-bound clock.

At the next step of "synchronization" the clock 'B' sets the indication  $M_A$  and waits for the signal from the observer-based clock. That observer-based clock

sends a signal toward the clock 'B' from the location  $S_1$  in the wave reference frame. The clock 'B' detects that signal at the point  $B_3$  sets indication  $M_A$  and sends a signal back to the observer-based clock. That signal meets the clock at the point  $S_4.$ 

The observer thinks now this. Two clocks have the same indication at any given moment. However, that is an illusion because the clock 'B' had location  $B_3$  at the moment when the signal reached the clock. From the observer's point of view, the clock 'B' had the location at the point  $B_N$  (that coincides with the point  $A_N$  in the fig, 11) "because the signal spends the same duration in forward and backward motion." However, the signal "does not know" the observer's point of view and makes propagation by physical infarction with the medium *instead of physical interaction with the observer's mind*.

As a result, the clock 'B' has indication  $Q_A$  (Fig. 11, band 'Q') shifted to the value  $N_3$  -  $N_A$  according to indications of the observer-bound clock.

However, the full duration of the experiment with the clock 'B' coincides with the full duration of the experiment with the clock 'A.' That *numerical coincidence* puts the observer under the illusion that both experiments are identical and all three clocks have the same indications *simultaneously*.

Everything looks fine until the observer tries to make synchronization of clocks in backward direction sending the signal from the clock 'A' to the observerbound clock.

At the previous step of signal-based synchronization the clock 'A' possessed the indication P =  $N_A - \Delta P = N_A - (N_A - N_2)$  as explained above. The clock 'A' sends the signal to the observer-based clock from the point  $A_2$  of the wave reference frame. The signal meets the observer at the point  $S_4$ . The duration of signal propagation by  $A_2S_4$  has the same value ever because of the equidistant location of clocks 'A' from the observer in the observer-based reference frame and constant sped of propagation of the signal in the wave reference frame.

The observer detects the signal at the point S<sub>4</sub>. After that, the observer analyses information about the indication of the clock 'A' at the moment of signal emission. The observer expects the value M<sub>A</sub> equal to N<sub>A</sub> that he was set *artificially* in the previous circle of synchronization. To his surprise, he takes P<sub>A</sub> = N<sub>A</sub> -  $\Delta$ N = N<sub>2</sub>.

The presence of stable deviation of N put the observer to nonplus. From his point of view, two clocks lost their synchronous operation. However, another attempt of *forward synchronization* shows a perfectly synchronous operation of both clocks.

The observer thinks for some time and tries the experiment of backward synchronization again. To his surprise deviation (4N) changes its value and shows another stable value. The observer cannot explain such "strange" behaviors of clocks from his point of view

based on his imagination about observer-bound reference frame.

However, the explanation is easy in the wave reference frame. As soon as the observer-bound inertial reference frame (IRF) change its *orientation* regarding the wave reference frame (WRF), ELM changes the duration of one-way propagation of the signal. As a result, full duration of a round-trip propagation of the signal between clocks keeps the same constant value, but each one-way propagation changes its value.

In that case, the observer tries to make a comparison of *his imagination and a physical process*. From the observer's point of view, the signal emitted from him at the point  $S_1$  meets the clock 'A' at the point  $A_N$  because that point coincides the location of the observer at the point  $S_N$ .As a result,

Deviation of the physical location of a remotely located clock from image location of the same clock based on the observer's point of view causes physical deviation of signal based synchronization of two clocks.

#### (Statement P)

In other words, a physical experiment of signal based synchronization shows the mistake of observer's imagination, and value of∆N appears as the difference between the physical location of the clock 'A' and image location of the same clock from the observer's point of view during the experiment. That is the measurement of "illusion in hand."

Deviation  $\Delta N$  has zero value in one condition for an observer moving in wave reference frame. It happens when the observer orientates the line  $A_1B_1$  perpendicular the direction of his motion in WRF (Fig. 7). It is only a particular case. In general case, that deviation persists and becomes observable in every experiment in any signal-medium combination.

The numerical result of the experiment depends on a few aspects:

- The speed of observer-to-medium relative motion
- The speed of the signal in the WRF
- The orientation of inertial reference frame (IRF) (observer bound reference frame) in wave reference frame (WRF).

The last aspect shows significant influence in case of rotation of the observer bound reference frame. In that case, deviation  $\Delta N$  depends on the orientation of the observer-bound reference frame regarding direction of motion of the observer in WRF.

Therefore, deviation  $\Delta N$  should show a solid circle of changes from the maximal to the minimal value that coincides with the duration of the full revolution of the observer bound reference frame in WRF.

Here and later deviation $\Delta N$  referred as Mutual Signal Based Synchronization Deviation (MSBSD) or *Aurora Effect (AE)*. In case of an Earth-bound observer, that phenomenon leads to detection of *sidereal rotation* of the Earth as a result of any attempt of *backward* 

synchronization of two or more atomic clock clusters. That is *White Aurora Effect* that shows the phenomenon immediately.

Sidereal period is the time required for a celestial body within the solar system to complete one revolution with respect to the fixed stars—i.e., as observed from some fixed point outside the system. (Sidereal period. (2008). Encyclopedia Britannica.)

There is one more observable phenomenon in case of forward synchronization. Suppose the observer conducts synchronization of an observer-bound clock and the clock 'A' as described above.

The observer starts observation of both clocks indications after their signal-based synchronization. To his surprise those clocks show some strange phenomenon. Both clocks belong to the observerbound reference frame that changes orientation regarding the direction of observer-to-medium relative motion because of rotation of the Earth.

As a result, duration of one-way propagation of signals between the observer-bound clock and the clock 'A' changes ratio of a duration of forward and backward propagation. From the observer's point of view, that motion changes a location of the clock 'A' regarding the observer-bound clock from  $A_2$  to  $B_3$  (Fig. 11).

Therefore, rotation of the Earth causes slow deviation of indication of previously "synchronized" clocks. That deviation has zero value immediately after clock "synchronization" and changes slowly during Sidereal Period. In general case, each Sidereal Period gives two zero values, the maximum, and the minimum values. The appearance of those values to the observer during Sidereal Period depends on the orientation of the straight line connecting two clocks regarding the direction of their motion in WRF.

For example, the clock 'A' has location  $A_x$  (Fig. 11) at the moment of "synchronization." In that case, the observer sees "synchronous indication" of both clocks only in that orientation. However, the orientation is not static because of rotation of the Earth. That process slowly changes the orientation of two clocks (regarding the direction of their motion in WRF). That coincides with motion of the point A in figure eleven. As long as the point A moves from the point  $A_2$  to  $B_3$  the observer sees that the indication of the clock 'A' looks like "going faster and faster." The clock 'A' goes before the observerbound clock more and more (between points  $A_x$  and  $B_3$ ) until it reaches the maximal positive deviation at the point  $B_3$ .

As long as the clock'A' moves from the point  $B_3$  to the point  $A_2$  the observer sees that the indication of the clock 'A' looks like "going slower and slower." The clock 'A' goes after the observer-bound clock more and more(between points  $A_x$  and  $A_2$ ) until it reaches the maximal negative deviation at the point  $A_2$ .

Positive deviation mentioned above means *Blue Aurora Effect*; negative one means *Red Aurora Effect*. Suppose now this. There is one more observer (the observer 'B') with two more clocks (local and remotely located one) with another orientation regarding the direction of motion of his IRF in WRF. The observer 'B' makes signal-based "synchronization" a bit later (or sooner) than the observer 'A.' It gives him another location of a remotely located clock (for example, location  $A_N$ , Fig. 11) regarding the orientation of *his IRF in WRF*. In that case, he detects "synchronous" indications of his clocks when the observer 'A' sees some *deviation* of indication of a remotely located clock. That coincides some distance  $A_X - A_N$  in figure eleven.

That situation means "synchronous" indication of one pair of signal-based synchronized clocks and some deviation from "synchronous indication" of another pair of signal-based synchronized clocks. That difference means *Green Aurora Effect*.

Strictly speaking,

Aurora Effect eliminates any possibility to see the continuously synchronous operation of two or more clocks after signal-based synchronization (SBS).

# (Statement Q)

Moreover,

Aurora Effectgives independent prove of rotation of the planet without optical observation of the sky.

#### (Statement R)

There is one more critical aspect here. An observer should have an oscillator with enough frequency to detect Aurora Effect (MSBSD). In case of a low-frequency oscillator (Fig. 11, band G) duration of one oscillation is higher that entire process of signal propagation in both directions (duration of a round-trip experiment).

In case of a high-frequency oscillator (Fig. 11, band H) the observer detects the phenomena because the signal spends the duration of two oscillations in forward motion  $(N_1N_2)$  and duration of five oscillations in backward motion  $(N_2N_4)$ .

Therefore, an oscillator can be recognized under given circumstances as a high-frequency one if a physical measurement device based on that oscillator becomes able to detect Aurora Effect.

That phenomenon with critical importance for physics was detected by De Witte because he fulfills *essential requirements* of the experiment mentioned above. He had high-frequency oscillators and enough distance to send signals between measurement devices.

# XI. The Einstein's Illusions

Einstein, Albert was born March 14, 1879, Ulm, Württemberg, Ger.died April 18, 1955, Princeton, N.J., U.S.German-born physicist who developed the special and general theories of relativity and won the Nobel Prize for Physics in 1921 for his explanation of the photoelectric effect. Einstein is generally considered the most influential physicist of the 20th century. (Einstein, Albert. (2008). Encyclopedia Britannica)

The most critical word of the citation given above is *Influence*. Influence (by Merriam-Webster Dictionary) can be recognized as

- 1. an ethereal fluid held to flow from the stars and to affect the actions of humans
- 2. an emanation of spiritual or moral force
- the act or power of producing an effect without apparent exertion of force or direct exercise of command

The second definition is the best one for application to a result of scientist's actions or research. Suppose now this. There are two persons A and B. The person A spent all his life in Amazon jungles. The person B served NASA all his life.

They meet each other on the Bermuda Islands and share their life experience with each other. The person B understands everything that the person A tells him because he has seen a lot of satellite images of Amazon jungles. However, person A does not understand the person B because categories shown by that person like rocketry, thrust, jet engines, space navigation, Apollo Program and many others have no meaning for the person A.

That happens because the person B uses categories which stay beyond the Comprehension Horizon (CH) of the person A. As a result, the person A cannot comprehend any of them because he is unable to make any link between categories known for him and a category shown by the person B.

Strictly speaking, the humankind facesthe Comprehension Horizon Problem (CHP)throw-out all history of the civilization. Every idea that can be recognized as a meaningful should stay inside the Comprehension Horizon. Everything coming from the outside of the Comprehension Horizon looks like a weird idea and usually rejected by the general population.

Science has some relationship with that problem. They usually tell this. A researcher should explain his point of view in "their language" because other categories are not usually understandable for them. That way leads to serious distortion of basic categories in the mind of other people who like to understand something but *do not like to build new categories in their mind*.

The result of such situation appears as some influential people give an explanation of a problem in categories familiar to people looking for such explanation. Therefore, Einstein gave some explanations of "unexplainable experiments" in categories acceptable for scientists of 19-th century.

In Maxwell's time, a mechanistic view of the universe held sway. Sound was interpreted as an undulatory motion of the air, while light and other electromagnetic waves were regarded as undulatory motions of an intangible medium called ether. The question arose as to whether the velocity of light measured by an observer moving relative to ether would be affected by his motion. Albert Abraham Michelson and Edward W. Morley of the United States had demonstrated in 1887 that light in a vacuum on Earth travels at a constant speed which is independent of the direction of the light relative to the direction of the Earth's motion through the ether. (Electromagnetism. (2008). Encyclopedia Britannica.)

As mentioned above, later experiments in other signal-medium combinations show the same so-called "null" results because of ELM *unknown* in 19-th and 20th centuries. Einstein used the same mechanistic view of the universe to create his theory widely known as the theory of Relativity. He was unable to explain some critical aspects of physical phenomena like constant speed of light in the observer-bound reference frame in case of the constant speed of that reference frame in wave reference frame and produced a lot of postulates to avoid questions to his explanations. He started his speculations with "the basic and the most certain aspects known for the people of the 19-th century."

"Let us take a system of co-ordinates in which the equations of Newtonian mechanics hold good. In order to render our presentation more precise and to distinguish this system of co-ordinates verbally from others which will be introduced hereafter, we call it the "stationary system."

"If a material point is at rest relatively to this system of co-ordinates, its position can be defined relatively thereto by the employment of rigid standards of measurement and the methods of Euclidean geometry, and can be expressed in Cartesian coordinates.

"If we wish to describe the motion of a material point, we give the values of its co-ordinates as functions of the time." (Einstein Albert, 1923)

In other words, Einstein associates the observer a-priory with some coordinate system and try to describe motion of other things (including waves) in that reference frame.

Einstein as a man grown in 19-th century shared scientific paradigm of that time. That paradigm requires a mathematical description of motion in Inertial Reference Frames proposed by Newton to his explanation of celestial mechanics based on the gravitational interaction between all celestial bodies.

In other words, Einstein thinks in categories of inertial reference frames associated with physical bodies and denies any further research in that area. Therefore, the idea that a signal can be recognized as a reference frame (WRF, as explained above) looks weird for him as well as for any other person from 19-th century.

From their point of view, there is the only one possibility to describe motion. That is an inertial reference frame like shown in figures two and three. That

2016

inertial reference frame (IRF) has one particular aspect mentioned above. A physical interaction of elements inside IRF keeps the same duration of experiment with a moving body (a bullet) in any direction. That duration keeps the same value for all possible IRF as explained above (see section five)

That phenomenon has an easy explanation. In case of gun-bullet experiment mentioned above, a gun and a bullet exist before the experiment, during acceleration, and after acceleration when all elements come back again to inertial elements in reference to their reciprocal motion.

The notion of acceleration is a critical one in the understanding of IRF. To make (or create) motion in IRF *an inertial object* should apply some force to *another inertial object*. That force according to the second law of Newton produces an *acceleration* of both bodies in inverse proportion to their masses. As a result, a body with lesser mass has greater acceleration. For the same reason of practical application, a bullet is *ever lighter than a gun*.

Unlike object-to-object interaction, object-towave and wave-to-wave interaction have a significant difference:

- A wave does not exist before an experiment. Therefore, motion (or the speed) of a wave before the experiment does not exist also.
- A wave needs not any application of force to make acceleration after creation to reach a constant speed in a medium.
- A wave uses Wave Reference Frame to make propagation in a medium regardless observer-to-medium relative motion.

Misunderstanding of those critical differences of motion of an object and a wave led to great illusions of 19-th century physics. They understand and explain the propagation of light like motion of a bullet. From their point of view, an observer "shoots" light in some direction like a gunner firing a bullet. As a result, observer-to-light speed of relative motion becomes the same in every direction as well as the speed of bullet-togun relative motion in a gunman-bound reference frame. Figure three shows that point of view.

Such speculations led to the following point of view coming from Einstein.

"We have not defined a common "time" for A and B, for the latter cannot be defined at all unless we establish by definition that the "time" required by light to travel from A to B equals the "time" it requires to travel from B to A."

#### (Statement EA)(Einstein Albert, 1923)

That point of view created an illusion in the Einstein's mind that:

$$T_{ABA} = T_{AB} + T_{BA} \tag{7}$$

$$T_{AB} = T_{BA} = \frac{1}{2}T_{ABA} \tag{8}$$

The transformation from (7) to (8) looks really "logical" to Einstein because those equations work perfectly in an Inertial Reference Frame. However, light is a wave. Einstein knew that but applied the law of Inertial Reference Frame to Wave Reference Frame (that was unknown to him).

Strictly speaking, Einstein could not think in categories of Wave Reference Frame as a man grown in 19-th century when ideas of Newton were in full power. Einstein saw his task to make a *mathematical explanation* of a particular experiment (Michelson-Morley experiment) in Theoretical Framework proposed by Newton. Quotations from his famous work mentioned above show that problem of his point of view.

As a result, the following transformation was unreachable for his mind.

$$T_{ABA} = T_{AB} + T_{BA} = (T_{AX} + N) + (T_{BX} - N)$$
(9)

That happened because Theoretical Framework used in 19-th century required only Inertial Reference Frames in a description of any motion. Moreover, equation (9) gives not any possibility of a mathematical solution. Therefore, Einstein proposed a famous postulate (Statement EA).

Einstein faced here the same problem of physical experiments. Physical tests of propagation of signals in a moving medium contradict statement EA. Strictly speaking, Einstein could make those tests by himself. However, he denied any activity in experimental physics (or in a lab).

Moreover, "Einstein could apply directly to the Eidgenössische Polytechnische Schule ("Swiss Federal Polytechnic School"; in 1911, following expansion in 1909 to full university status, it was renamed the EidgenössischeTechnische Hochschule, or "Swiss Federal Institute of Technology") in Zürich without the equivalent of a high school diploma if he passed its stiff entrance examinations. His marks showed that he excelled in mathematics and physics, but he failed at French, chemistry, and biology. Because of his *exceptional math scores*, he was allowed into the polytechnic on the condition that he first finish his formal schooling."(Einstein, Albert. (2008). Encyclopedia Britannica).

In other words, his "exceptional math scores" formed his point of view on mathematics that mathematical calculations could save him from any mistake that can appear by another way of thoughts. Such illusion became the heaviest one in 20-th century physics and turned many researchers from full-scale experiments, thoughts and philosophy to simple "calculations." However,

The numerical coincidence of any given values means not a direct prove of researcher's point of view

until the researcher gives a step-by-step explanation of a physical process and physical interaction of a measurement device and measuring value.

#### (Statement S)

Despite Statement 'S', Einstein try to explain the so-called null result of Michelson interferometer by pure thought experiments and pure mathematical calculations. That happened because he had not permission to enter a lab because Einstein was not a successful scientist after graduation.

"After graduation in 1900, Einstein faced one of the greatest crises in his life. Because he studied advanced subjects on his own, he often cut classes; this earned him the animosity of some professors, especially Heinrich Weber. Unfortunately, Einstein asked Weber for a letter of recommendation. Einstein was subsequently turned down for every academic position that he applied to." (Einstein, Albert. (2008). Encyclopedia Britannica)

The result of such situation appeared almost immediately. "In 1902 Einstein reached perhaps the lowest point in his life. He could not marry Maric and support a family without a job, and his father's business went bankrupt. Desperate and unemployed, Einstein took lowly jobs tutoring children, but he was fired from even these jobs.

"The turning point came later that year, when the father of his lifelong friend, Marcel Grossman, was able to recommend him for a position as a clerk in *the Swiss patent office in Bern.* About then Einstein's father became seriously ill and, just before he died, gave his blessing for his son to marry Maric. For years, Einstein would experience enormous sadness remembering that his father had died thinking him a failure." (Einstein, Albert. (2008). Encyclopedia Britannica).

"With a small but steady income for the first time, Einstein felt confident enough to marry Maric, which he did on Jan. 6, 1903. Their children, Hans Albert and Eduard, were born in Bern in 1904 and 1910, respectively. In hindsight, Einstein's job at the patent office was a blessing. He would quickly finish analyzing patent applications, leaving him time to daydream about the vision that had obsessed him since he was 16: What will happen if you race alongside a light beam? While at the polytechnic school he had studied Maxwell's equations, which describe the nature of light, and discovered a fact unknown to James Clerk Maxwell himself-namely, that the speed of light remained the same no matter how fast one moved. This violated Newton's laws of motion, however, because there is no absolute velocity in Isaac Newton's theory. This insight led Einstein to formulate the principle of relativity: "the speed of light is a constant in any inertial frame (constantly moving frame).

"During 1905, often called Einstein's "miracle year," he published four papers in the Annalen der Physik" (Einstein, Albert. (2008). Encyclopedia Britannica). The quotation given above explains the core illusion of 19-th century physics. "The speed of light remained the same no matter how fast one moved," that is correct for any signal in any medium as explained above. However, that law is applicable only in Wave Reference Frame instead of Inertial Reference Frame (or an observer-bound reference frame).

The situation when Einstein mistakes a Wave Reference Frame with an Inertial Reference Frame caused the greatest problem and controversy in 20-th century science.

"This violated Newton's laws of motion, however, because there is no absolute velocity in Isaac Newton's theory."That statement is incorrect. Newton's laws of motion are applicable only in an Inertial Reference Frame (IRF).An observer should apply some force to change any motion in IRF. Otherwise, a Reference Frame cannot be called or used as *inertial one*.

As mentioned above, a signal has no "acceleration" by any force in a WRF. Therefore, that frame is entirely different from any IRF, and Newton's laws of motion have no meaning in that RF.

"(Einstein) discovered a fact unknown to James Clerk Maxwell himself—namely, that the speed of light remained the same no matter how fast one moved". That is also incorrect because Maxwell's equations describe propagation of EM radiation. They have not any "connection" to a Reference Frame in which that speed does appear.

From Einstein's point of view, that should be only the Inertial Reference frame bound to the observer. However, there is nothing in experimental physics that shows that way of light propagation. That mistake led him to the incorrect formulation of his "principle of relativity" mentioned above that "the speed of light is a constant in any inertial frame (constantly moving frame)." The right statement is this.

The duration of a round-trip experiment with a signal keeps constant value in the observer-bound Inertial Reference Frame as long as an observer keeps a constant speed in the Wave Reference Frame regardless direction of signal propagation in the observer-bound Inertial Reference Frame.

#### (Statement T)

That is a transformation of ELM (Statement N) for an observer with a constant sped of motion in the Wave Reference Frame that makes measurements by a round-trip experiment.

In other words, all postulates of Einstein were understandable for physicists grew in 19-th century. As a result, no one of them put any physical counter arguments against them, and newer conducted Michelson type experiments in a different medium until *Norbert Feist made them himself in 21-th century*.

Is it possible to make counterarguments to basic postulates of relativity by a physical device that

2016

makes physical measurements instead of speculations? Is it possible to make a universal device that changes the human mind forever and give independent physical prove for all experiments and phenomena mentioned above? Such device was proposed in the form of a Signal Medium Motion Measurement Apparatus or SMA (International Patent Application WO/2015/040505).

# XII. THE SIGNAL MEDIUM MOTION MEASURMENT APPARATUS

The apparatus uses no human assumptions of any kind. In other words, it is a pure apparatus that makes operation by itself regardless any illusion that a human being likes to put in a measurement device.

The core of the apparatus comprises an Oscillating Device (OD) and a Counting Device (CD). The oscillating device keeps internal recurrent physical process that makes oscillations. Oscillations make pulses. The counting device counts pulses coming from the oscillating device. All measurements appear as a number of oscillations counted by the counting device. There is no room for any illusion inside that interaction of the devices. There are also two more devices for emitting (ED) and detecting (DD) a signal. Those devices make physical interaction with the Measurement Channel (MC).

To make experiment possible, an observer should use at least two apparatuses. They form a Linear Detector that way. The apparatuses use one more device called Distance Measurement Device (DMD) that give the apparatuses information about the distance that separates them in the observer bound Inertial Reference Frame. That distance can be changed by one apparatus that moves back and forth regarding the other apparatus. The apparatuses have a link in the form of a communication channel (CC).

To make apparatuses ready to work the observer should make synchronization of Counting Devices of the apparatuses that depend on *the purpose of the experiment*. If the observer likes to make measurements of IRF motion in WRF, he uses the Local Synchronization and Remote Operation Method (LSROM).

In that case, the apparatus B goes next to the apparatus A. The apparatus A picks up any suitable value of further indication (N) of its CD and sends that indication to the apparatus B by the Communication Channel (CC). The apparatus B sets that value on its CD and waits for the next signal from the apparatus A by the Measurement Channel (MC). As soon as the indication of the Counting Device of the apparatus A reaches the value N the apparatus emits a signal by the Emitting Device (ED). The signal goes via the Measurement Channel (MC) to the apparatus B. The apparatus B detects the signal by its Detecting Device and connects its Oscillating Device to the Counting Device. In that case, an indication of both Counting Devices become equal to each other because of zero distance between the apparatuses during the procedure of Local Synchronization.

After Local Synchronization, every oscillation coming from the Oscillating Device of the apparatus changes the indication of the Counting Device of the same apparatus. That physical process is identical in both apparatuses. Therefore, the indication of the Counting Device of a given apparatus changes *simultaneously* with the indication of the other apparatus. That means *physical simultaneity* because a signal spends zero duration to cover zero distance in any medium. Therefore, Counting Devices of the apparatuses show the identical indication ever and change them simultaneously with every pulse coming from Oscillating Devices.

After Local Synchronization, the observer separates those apparatuses by a given distance, and they become able to determine a duration of any physical process including motion of anything between them by the right measurement based on physical simultaneity. As a result, the full method that includes synchronization and operation becomes the Local Synchronization and Remote Operation Method (LSROM).Therefore,

Physical simultaneity gives a possibility to conduct a one-way experiment in any medium.

#### (Statement U)

The Comprehension Horizon of 19-th century physicists blocks their attempts to conduct one-way experiments. They used the equation (1) with the one clock and electrical signal coming from the start and the finish points of a moving thing. Actually, the speed of an electrical pulse in a wire many times greater than the speed of other inertial objects and experiments with one clock and two wires give good results for any inertial objects and physical signals except electromagnetic signals (EMS).

In case of EMS, duration of propagation of a signal in a medium (vacuum) becomes equal to the duration of propagation of the same signal in a wire. Figure twelve shows that problem.



Suppose an observer likes to measure a duration of light propagation between points B and C. The 19-th century observer puts a clock at the point A and connects a light emitter B to a clock A and light detector C to the same clock by a wire CDEA.

The experiment begins. The observer sends a signal to the light emitter B from the point A and waits the signal coming back by the wire CDEA. To his surprise, the duration of that experiment becomes constant despite variable distance BC and constant distance AC. In that case, the observer should make a controversial decision that a beam of light covers *any distance by the same "time"* because the experiment shows constant duration regardless distance BC.

The 21-th century researcher understands this. The experiment involves propagation of the signal by round path ABCDE. Each element of that path affects the full duration. *Each element of that path follows ELM*. Therefore, full duration of the experiment shows a constant value regardless of any combination of those elements *or their orientation*.

To make pure measurements the observer should have two measurements devices that show the same values of duration during the experiment simultaneously at the points B and C. That task was impossible in 19-th century. However, further engineering and technological progress offer the possible solution of that problem.

Two SMAs mentioned above after procedure of Local Synchronization show identical readings and change them simultaneously with every pulse of the Oscillating Device. Therefore, the observer can leave one apparatus at a given place and set another one at a remote location. An indication of counting devices of those apparatuses keeps *physical simultaneity* regardless any distance that separates the apparatuses.

Therefore, the observer has two measurement devices with ever equal indications of counting devices separated by a given distance. That is the best condition to make measurements of one-way signal propagation. In other words, Local Synchronization and Remote Operation Method (LSROM) lead to one-way experiments in any medium. In case of LSROM, the apparatuses need not any information about medium or condition. They its physical make physical measurements and give the result to the observer. That destroys a 19-sentury point of view that "a device" can be synchronized only by a signal (signal-based synchronization, SBS).

In case of the experiment with light, apparatus B moves away from the apparatus A to any distance that the observer likes to use in the experiment. After that, the apparatus A sends a signal to the apparatus B and registers the indication of the counting device of the apparatus A ( $CD_{a}$ ).

The apparatus B waits for the signal and registers the upcoming signal by the reading of the counting device of the apparatus B  $(CD_A)$ . The full duration of the experiment can be determined now by difference if indications of their counting devices at the moment of sending the signal from one apparatus and receiving the same signal by the other apparatus. The

full duration of one-way experiment becomes calculable by the following equation.

$$D_{AB} = D_F = CD_A - CD_B \tag{10}$$

Where  $D_{AB}$  is the duration of the one-way experiment (forward propagation,  $D_F$ ) in oscillations of the oscillating devices of the apparatuses,  $CD_A$  and  $CD_B$ are indications of counting devices of the apparatus A and B accordingly.

The same way of measurements is applicable for any signal-medium combination. As a result, the patent application describes all experiments from the same point of view without *any exception*.

At the next step of the experiment, the apparatus B sends the signal back to the apparatus A. The apparatuses make the same measurement described above and determined the full duration of the signal propagation in another direction. From the Inertial Reference Frame bound observer's point of view, those are experiments of forward and backward signal propagation in his reference frame (IRF).

$$D_{BA} = D_B = CD_B - CD_A \tag{11}$$

Comparison of duration of the signal propagation in both directions gives the observer enough information to determine his motion in WRF. As long as the duration of propagation of the signal remains the same value in both directions despite orientation of the apparatuses, the Observer-Bound Inertial Reference Frame (OBIRF) remains motionless location in Wave Reference Frame (WRF). Otherwise, the observer detects and determines motion of IRF in WRF by any calculation he likes. In that case, the observer determines velocity of his motion in WRF.

"To determine a magnitude of the vector, SMA makes easy calculations. It determines two velocities (of forward and backward motion) of the measuring signal  $V_F$  (velocity of forward motion) and  $V_B$  velocity of backward motion along the straight line connecting the apparatuses (AB-line) by the following way.

$$V_F = \frac{L}{D_F} \tag{12}$$

$$V_B = \frac{L}{D_B} \tag{13}$$

"There, L is the length of the measurement line (AB distance),  $D_F$  is a duration of forward motion of the measuring signal,  $D_B$  is a duration of backward motion of the measuring signal.

"By basic equations of the velocities, there are two elements in each case. Those are the speed of signal-to-medium motion (E, or Electromagnetic Signal Space Speed) and the speed of SMA-to-medium motion (observer-to-medium motion) (V)

$$V_F = E + V \tag{14}$$

$$V_B = E - V \tag{15}$$

Global Journal of

"Therefore,

$$V_F = E + V$$
;  $\forall = V_F - E$ ;  $V_B = E - (V_F - E) = 2E - V_F$ ;  $2E = V_F + V_B$ ; (16)

$$\mathsf{E} = (V_F + V_B)/2 \tag{17}$$

"The same way gives the following value of V.

$$V_B = E - V ; E = V_B + V; V_F = (V_B + V) + V = 2V + V_B ; 2V = V_F - V_B ;$$
(18)

$$V = (V_F - V_B)/2$$
 (19)

"Equation (17) shows this. The speed of signalto-medium motion (E) equals to the speed of observerto-signal motion (C) only in one case then  $V_F = V_B$ . That means equal duration of forward and backward motion of a measuring signal ( $D_F = D_B$ ) *in every direction* and coincides with the Einstein's postulate mentioned above. However, that is only a particular case. In general case,  $D_F \neq D_B$  and  $V_F \neq V_B$ , and the same postulate becomes *wrong*."(Zade Allan, 2016)

SMAs confirm their experimental data of motion of IRF in WRF by some consequent experiments with various distances between apparatuses. Variation of distance L leads to increasing (or decreasing) duration of signal propagation on every element of the experiment. However, the result of measurements remains constant because all elements affected equally by the same motion of IRF in WRF that SMA determines. That physical motion cannot be affected by measurements of SMA.

There is one more application of SMA that shows the Wave Reference Frame of Light (LWRF) or the Ghost Reference Frame (GRF) that makes distortion of the human mind and affects badly human philosophy throughout the 20-th century.

#### XIII. THE TRIDENT EXPERIMENT

This experiment shows the same law of signal propagation for various signals in various signalmedium combinations. Figure thirteen shows that experiment graphically.



#### Fig. 13

There are three containers with a couple of SMAs in each of them. All SMAs synchronized by LSROM and keep synchronous changes of their CD

during the experiment. All containers isolated from any influence from the outside.

The container A has water as the substance surrounding the SMA A and the SMA B. Those apparatuses use acoustic transducers to send and receive acoustic signals.

The container B has water as the substance surrounding the SMA C and the SMA D. Those apparatuses use optical emitters to send signals and optical detectors to detect optical signals.

The container C has the vacuum as the substance surrounding the SMA E and the SMA F. Those apparatuses use optical emitters to send signals and optical detectors to detect optical signals.

The experiment begins. Each apparatus sends a signal to another apparatus and receives a signal coming from another apparatus as explained above.

Apparatuses A and B detect their zero motion regarding a given WRF (water) because the duration of propagation of the forward signal equals to the duration of propagation of the backward signal. Therefore, apparatuses keep motionless location in the given medium (water). The full duration of the experiment coincides with other experiments with reflected acoustic signals in water measured by other devices.

Apparatuses C and D detect some motion regarding WRF because the duration of the forward signal becomes unequal to the duration of the backward signal. The full duration of the experiment coincides with other experiments with reflected light signals in water measured by other devices. Therefore, apparatuses detect their motion regarding *the given medium*.

The observer who associates himself with physical objects thinks this. The optical signal in water moves regarding that substance to cover the distance between apparatuses. However, apparatuses C and D shows that illusion for the observer. They detect some constant motion (velocity V, equation 19) regarding some other medium because they keep their motionless location in the physical medium comprehendible for the observer. Therefore, despite observer's speculations, a *light signal uses another reference frame of motion*.

Apparatuses E and F detect some motion regarding WRF because the duration of the forward signal becomes *unequal* to the duration of the backward signal. The full duration of the experiment coincides with

other experiments with reflected light signals measured by other devices in the vacuum. Therefore, apparatuses detect their motion regarding the given medium (vacuum) when "there is nothing to be removed".

Magnitude and direction of velocity V (the speed of IRF in WRF) determined by the apparatuses E and F coincide with magnitude and direction of velocity determined by the apparatuses C and D. Therefore, those apparatuses (C, D, E and F) determine the same medium for light propagation. That is vacuum or pure space because pure space implicitly exists everywhere including all containers of the Trident Experiment.

Despite observer's misunderstanding of that medium, apparatuses detect it without any problem. In other words, despite human's point of view, light make propagation in space making physical interaction with pure space like any other wave in another medium.

An observer can change that speed by variation of fundamental properties of space that affect light propagation. Those are the permittivity and the magnetic permeability known for the modern observer. To detect other aspects which possibly influence the propagation of light, the observer should conduct experiments with SMA in some other place that have some deviation in those parameters.

As mentioned above, " $\epsilon_0$ , the permittivity of free space, has an experimentally determined value of  $8.85 \times 10^{-12}$  square coulomb per newton square meter, and  $\mu_0$ , the magnetic permeability of free space, has a value of  $1.26 \times 10^{-6}$  newton square seconds per square coulomb."

In other words, those known parameters have specific values. They are not zero, and they are not infinite. Therefore, they cause a limited speed of light by its physical interaction with pure space. Deviation of those parameters makes a variation in the speed of light*in space*.

#### XIV. Aftermath

SMA as a physical device destroys all postulates of relativity. A big number of postulates becomes a significant problem of any postulate-based theory. Destruction of one postulate leads to a consequent destruction of other postulates and the entire theory. Moreover, destruction of a theory leads to a consequent destruction of *all theories based on a given one*. That means cascade falsification of all dependent theories.

For example, "Einstein expressed these ideas in his deceptively simple principle of equivalence, which is the basis of General Relativity: on a local scale meaning within a given system, without looking at other systems—it is impossible to distinguish between physical effects due to gravity and those due to acceleration." (Relativity. (2008). Encyclopedia Britannica) In case of SMA, the same observer uses two apparatuses in an isolated laboratory to determine his motion in space or in Light Wave Reference Frame (LWRF). Those are B or C elements of the Trident Experiment mentioned above and the linear mode of SMA. Two apparatuses determine the projection of observer-to-space velocity on the line connecting those apparatuses.

As long as the observer has the same ridings from SMA (a constant observer-to-space velocity) the observer understands this. *The force of gravity in the lab caused by some gravitational fieldinstead of acceleration*. In other words, "principle of equivalence" becomes wrong for the lab with SMA. That experiment puts "principle of equivalence" to the category of postulates and destroys that postulate.

Therefore, SMA (and every element of technology that it uses) becomes the primary device of 21-th century physics because physical measurements of SMA cannot be reached by any other measurement device known ever before.

# References Références Referencias

- 1. Encyclopedia Britannica Deluxe Edition, Chicago, 2008.
- 2. Feist Norbert, "Acoustic Michelson-Morley Experiment with an Ultrasonic Range Finder", proceedings of the NPA, Vol. 6, No. 2, (2010).
- 3. Cahill Reginald T., "The Roland De Witte 1991 Detection of Absolute Motion and Gravitational Waves", *Progress in Physics* 3, 60-65, (2006).
- Zade, Allan. "Philosophy, physics and mathematics of relative and absolute motion". *International Journal of Physical Research*[Online], 4.2 (2016): 27-36. Web. 9 Jun. 2016
- 5. Einstein Albert, "On the electrodynamics of moving bodies", published in a book The Principle of Relativity, Methuen and Company, Ltd., London, 1923.