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The Epistemological concept of the True Space-Velocity Detector

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Abstract- Light and its properties intrigued mankind for centuries. This paper gives answers on several questions related to light and its propagation through space. Famous Michelson-Morley experiment analyzed from the new point of view. New interpretation of experimental data of that observation is proposed.

Index Terms- the speed of light, Michelson-Morley experiment, theory of relativity, the true space-velocity detector, Z-Theory.

I. INTRODUCTION

Development of science, as well as development of human society, looks like a motion by a huge spiral. Almost each generation meets the same number of questions that was presented by nature to their parents, and each generation tries to provide answers on many questions that stimulate human progress for centuries. Science makes answers on those questions continuously but sometime a solution causes more advanced questions than provide explanations. The greatest problem that intrigued the humankind from its child days is the question about the nature of light.

"This part of Aristotle's views about knowledge is an extension of what he says about sensation. According to him, sensation occurs when the sense organ is stimulated by the sense object, typically through *some medium, such as light for vision* and air for hearing."[1] That was a key method for human thought for many centuries. In other words, everything that makes physical sense needs something (some medium) to propagate through it. There is a logical conclusion from that point of view. Any *interaction* between a human sense organ and a sense object is impossible without *specific medium that is responsible for some sort of connection between a sense object and a sense organ*.

As it was found later with vacuum experiments, sound follows that point of view precisely, but light propagate through vacuum. Hence concept of air as a suitable medium for *light and sound* became inconsistent with the experimental data. They need a new idea and another point of view on the nature of light. Here, they met two different questions. What is light and what is medium that light uses to propagation? First question was answered shortly.

"In 1873 the *Scottish physicist James Clerk Maxwell* showed that light is an electromagnetic wave with oscillating electrical and magnetic components. Maxwell's equations predicted that electromagnetic waves would travel through *empty space* at a speed of almost exactly 3×10^8 metres per second (186,000 miles per second)—i.e., *according with the measured speed of light*. Experiments soon confirmed the electromagnetic nature of light and established its speed as a fundamental parameter of the universe."[2]

In the late 19th century that decision caused no questions from anybody because theoretical approach meets exactly with experimental data that based on "*measured speed of light*". To make that measurement they used a sophisticated device that was invented at the same century.

"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,

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

"**epistemology** is the study of the nature, origin, and limits of human knowledge. The term is derived from the Greek epistēmē ("knowledge") and logos ("reason"), and accordingly the field is sometimes referred to as *the theory of knowledge*. Epistemology has a long history, beginning with the ancient Greeks and continuing to the present. Along with metaphysics, logic, and ethics, it is one of the four main branches of philosophy, and nearly every great philosopher has contributed to it." (from **epistemology.** (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition.* Chicago: Encyclopædia Britannica.)

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

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*."[3]

"In 1849 *Armand Fizeau* sent light pulses through a rotating toothed wheel. A distant mirror on the other side reflected the pulses back through gaps in the wheel. By rotating the wheel at a certain speed, each light pulse that went through a gap on the way out was blocked by the next tooth as it came around. Knowing the distance to the mirror and the speed of rotation of the wheel enabled Fizeau to obtain one of *the earliest measurements of the speed of light*."[4] To make that experiment distinguishable from the other experiments (with light), I call it a *Linear Detector Experiment* and the device used in that experiment - a *Linear Detector* (LD). Obviously, any device that uses the same principle of operation becomes a Linear Detector.

"The German-born American physicist A.A. Michelson set the early standard for measurements of the speed of light in the late 1870s, determining a speed within 0.02 percent of the modern value."[5]

Everything went well. Number of experiments gave to scientists possibility to make experimental support for a finite value of the speed of light. The Maxwell's theory makes excellent support for the same idea and stays in full agreement with experimental data. However, the next attempt to understand the nature of light has made *tremendous discrepancy between theory and practice*.

"Maxwell's remarkable result answered long-standing questions about light, but it raised another fundamental issue: if light is a moving wave, what medium supports it? Ocean waves and sound waves consist of the progressive oscillatory motion of molecules of water and of atmospheric gases, respectively. But what is it that vibrates to make a moving light wave? Or to put it another way, how does the energy embodied in light travel from point to point?

"For Maxwell and other scientists of the time, the answer was that light traveled in a hypothetical medium called the ether (aether). Supposedly, this medium permeated all space without impeding the motion of planets and stars; yet it had to be more rigid than steel so that light waves could move through it at high speed, in the same way that a taut guitar string supports fast mechanical vibrations."[6]

As soon as an idea of a hypothetical medium existed, they try to get experimental support to prove that idea and perform measurement of relative motion between *the Earth and the ether*.

"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 high-frequency 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. While there is no reference to the properties of a supporting medium in the mathematics of Maxwell's electromagnetic theory, *even he subscribed to the ether's existence*, writing an article on the subject for the 9th edition of *Encyclopædia Britannica* in the 1870s. (*See* the Britannica Classic "Ether.") In 1887 Michelson, in collaboration with American chemist Edward Morley, completed a precise set of optical measurements designed to detect the motion of the Earth through the ether as it orbited the Sun.

The measurements in the Michelson-Morley experiment were based ***on the assumption*** that an observer at rest in the ether would determine a different speed from an observer moving through the ether. Because the Earth's speed relative to the Sun is about 29,000 metres per second, or about 0.01 percent of the speed of light, the Earth provides a convenient vantage point for measuring any change in the relative speed of light due to motion. Using a Michelson optical interferometer, interference effects between two light beams traveling parallel to, and perpendicular to, the Earth's orbital motion were monitored during the course of its orbit. The instrument was capable of detecting a difference in light speeds along the two paths of the interferometer as small as 5,000 metres per second (less than 2 parts in 100,000 of the speed of light). No difference was found. If the Earth indeed moved through the ether, that motion *seemed to have no effect on the measured speed of light*."[7]

The measurement of the speed of light in that experiment was done by *a specific device*. "The Michelson interferometer consists of a half-transparent mirror oriented at a 45° angle to a light beam so that the light is divided into two equal parts (*A* and *B*), one of which is transmitted to a fixed mirror and the other of which is reflected to a movable mirror. The half-transparent mirror has the same effect

[3] **light.** (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition.* Chicago: Encyclopædia Britannica.
[4] **light.** (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition.* Chicago: Encyclopædia Britannica.
[5] **light.** (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition.* Chicago: Encyclopædia Britannica.
[6] **relativity.** (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition.* Chicago: Encyclopædia Britannica.

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

on the returning beams, splitting each of them into two beams. Thus, two diminished light beams reach the screen, where interference patterns can be observed by varying the position of the movable mirror."[8] To make that device distinguishable from the others, I call it a *Planar Detector* (PD). General Idea of the device was that. The Planar Detector used two Linear Detectors to make a comparison between their readings. The process of comparison was done using light interference on the screen.

As it mentioned above "No difference was found". That mysterious condition disturbed scientific community. Some physicists began to call that observation as the most famous "failed" experiment. Failure of that experiment can be described simply. Despite all precautions about the accuracy of the experiment, its result stays in vivid disagreement with theory of ether. We need to make a detailed analysis of both experiments to achieve the answer on that question.

II. Liner Detector. The early appearance.

To understand the principle of operation of any device we should describe it action step-by-step. According to the point of view that was dominated one in the 19th century, light in a light beam moves relatively to the source that emits that light, *just like a bullet moves relatively to a gun after shot*. It is extremely easy to make imagination that way of a light beam that travels through the space or ether from any source to any observer. Because of a relative nature of motion, that source of light and the observer forms the only one possible frame of reference in which all observations become possible.

To make measurement of the speed of light in that frame of reference, they need to make familial experiment. It was the same experiment that gives the answer on the question about speed of any other object moving relatively to an observer. They had a definition of speed. "If a point moves a certain distance along its path in a given time interval, its average speed during the interval is equal to the distance moved divided by the time taken. A train that travels 100 km in 2 hours, for example, has an average speed of 50 km per hour."[9] It can be written mathematically by a well known equation:

$$V = \frac{S}{t} \tag{1}$$

In the equation given above, S is a distance moved and t is the time taken by a moving point to cover that distance. Hence estimation of the speed of a train has two consequent steps. First step includes measurement of length of the route, using for estimation, before experiment. Second step includes movement of a train by the same route that was measured before the experiment. After the experiment, the observer makes comparison between length of the route and time taken by a train to move from the first point of the route to its final point between which measurements of time were taken. After those measurements, value of distance divided by the time gives to the observer *numeric value of average speed* of the train. The same way was used to make measurement of the speed of light at the end of 19th century.

In case of a Linear Detector, we have situation shown in the figure 1.

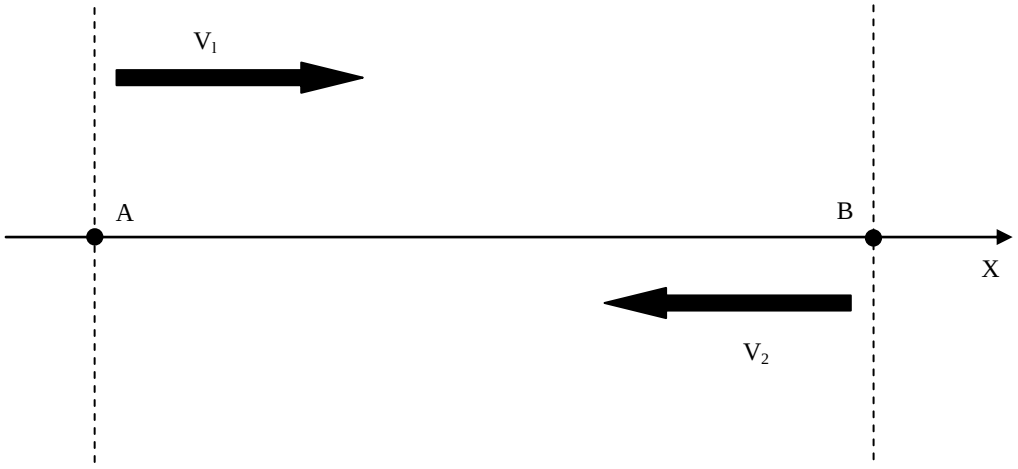

Fig. 1

[8] **Michelson-Morley experiment.** (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition.* Chicago: Encyclopædia Britannica.
[9] **velocity.** (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition.* Chicago: Encyclopædia Britannica.

A linear detector has a light source located at the point A (see fig. 1) and a mirror located at the point B. Distance between those points is well known because it is a critical value for the experiment. Additionally, an observer has one device to make measurement of duration of the whole experiment, i.e., duration between the moment of emitting of light and its return after bouncing back from the mirror.

According to methodology of the experiment, the speed of light should be calculated as its travel for distance A-B-A that doubled the length of a physical device between points A and B. As a result, the speed of light should be calculated by the following equation:

$$V = V_1 = V_2 = \frac{2S}{t} \quad (2)$$

In that equation, S is the distance between points A and B. Because an observer has information from the experiment only by the time that was spent by the light beam to travel by the route A-B-A, and the distance of that route, an observer is able only to make estimation of *the average speed of light* in that experiment. The *basic assumption* of the experiment is that. ***Average speed of light taken as an experimental data from the experiment has the same value as the physical speed of light relatively to the device***. Relative speed of light between a light beam and the observer should have the same value because the observer has null speed of motion relatively to the device.

Later, that assumption raised another fundamental question about relative motion between the Earth and the ether. To see that problem in details and reach answers on some fundamental questions, we need to make one more thought experiment[10].

III. THE STREAM THOUGHT EXPERIMENT.

Suppose someone (an observer) is examining motion of a boat powered by an engine. The person likes to make estimation of the speed of the boat in a lake. In that case, the observer should put the boat in the lake and mark some distance at the shore to use it for the experiment. Using the same way for the speed estimation that was mentioned before for a train, the observer told the boat driver to start motion from the first mark, reach the second mark, turn around and go back to the first mark again. At the observer's start signal, the boat rushes forward and soon comes back again. The observer makes estimation of duration of the entire trip of the boat and makes the calculation of its *average* speed *relatively to the observer* by the equation (2). According the fig. 1 the boat starts from point A goes to the point B and moves back to the point A at the same speed $V = V_1 = V_2$.

The observer understands that a moving boat makes *interaction* between its propeller and water to move *relatively* to the water. Moreover, as soon as the water in the lake has not any motion relatively to the shore (and the observer that has zero relative motion to the same shore) speed of the boat looks the same relatively to the observer and to the water of the lake. More than that, in that case, average speed of the boat has the same value as its true speed relatively to the water.

Using the same considerations, the observer likes to make measurement of the speed of the nearest stream. The person makes the same preparations on the shore of the stream (made two marks with a certain distance between them) and asks the boat driver to go by the circle route again up and down the stream. The observer makes measurement of duration of the entire experiment again. Figure 2 shows that experiment in details.

[10] *Gedankenexperiment* in German language.

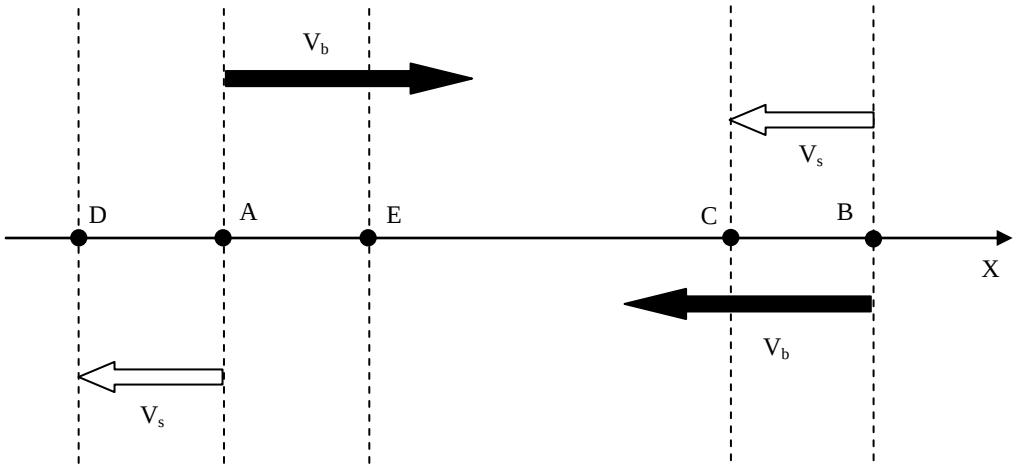

Fig. 2

In the figure 2, point 'A' is the start point for the boat; point B is the point of return; vector V_b shows speed of the boat and vector V_s shows the speed of the stream. From the common point of view, duration of the experiment should depend on speed of the stream, and the observer shares that point of view too before experiment.

However, close observation of the physical processes gives us some intriguing result. The experiment has two phases. The first one is motion of the boat up the stream (shown above X-axe in the fig. 2) and the second one is motion of the boat down the stream (shown below X-axe in the fig. 2).

In case of the stream as well as in case of the lake *physical interaction* between the boat and the water *has no changes*. Hence entire process observable as one physical process can be split into *two independent physical processes*. First process is motion of the boat relatively to the stream by its interaction with the water. Second process is motion of the water of the stream relatively the shore and the observer. Because the observer has not any motion relatively the shore, the person and the stream have the same relative speed. The observer holds his\her position at the point A. The experiment begins.

The boat moves up the stream. It covers distance AB relatively to the water with the some duration that is equal to the duration of forward motion for the same boat in the lake (in the motionless water). That duration is calculable by the following equation:

$$D_{AB} = \frac{S_{AB}}{V_b} \tag{2}$$

However, the stream has one more process of motion that moves the water relatively to the shore with the speed V_S. As a result, process of forward motion of the boat has two components and the entire process can be split in three logical steps. Each step can be described separately, and physical result of forward motion of the boat can be understood taking those steps in sequence:

1. The boat spends duration D_{AB} to cover the distance AB relatively to the water.
2. The water uses the same duration D_{AB} to drag the boat from the point B to the point C
3. The boat should spend some additional duration to move distance CB.

How long can be the duration of the last step (mentioned above)? Obviously it depends on the speed of the boat relatively to the water, the speed of the stream relatively to the shore and distance AB that the boat should cover. To calculate that duration, we need to make estimation of distance CB. Under described circumstances, it can be shown mathematically the following way:

$$S_{CB} = V_S \cdot D_{AB} \tag{3}$$

Using equation (3) duration of the step number 3 (mentioned above) possess the following value:

$$D_{CB} = \frac{S_{CB}}{V_b} = \frac{V_S \cdot D_{AB}}{V_b} \tag{4}$$

Duration of the entire process of the upstream motion of the boat can be expressed the following way:

$$D_{UP} = D_{AB} + D_{CB} = \frac{S_{AB}}{V_b} + \frac{V_S \cdot D_{AB}}{V_b} = \frac{S_{AB} + V_S \cdot D_{AB}}{V_b} = \frac{S_{AB} + V_S \cdot \frac{S_{AB}}{V_b}}{V_b} = \frac{\frac{S_{AB} \cdot V_b + S_{AB} \cdot V_S}{V_b}}{V_b} = \frac{S_{AB} \cdot V_b + S_{AB} \cdot V_S}{{V_b}^2} = \frac{S_{AB} \cdot (V_b + V_S)}{{V_b}^2} \quad (5)$$

Expression (5) shows that clearly, the duration of upstream motion of the boat depends on distance (S_{AB}), the speed of the boat relatively to the water (V_b) and the speed of the stream relatively to the shore (V_S).

As soon as the boat reaches the point B it turns around and goes back in the downstream direction. In that case, entire process uses the same steps as the process of upstream motion with the same meaning:

1. The boat spends duration D_{BA} to cover the distance BA relatively to the water.
2. The water uses the same duration D_{BA} to drag the boat from point A to the point D
3. Some duration should be excluded from duration D_{BA}

Step 3 is the most compelling one in the entire process of the boat downstream motion. Duration D_{BA} is equal to duration D_{AB} because booth durations are necessary for the boat to cover distance AB = BA in upstream and downstream motion *with the same speed of the boat*.

The same duration caused additional relocation of the boat relatively to the shore (AD). As a result, the boat should reach the point D. That is a logical conclusion from the motion of the boat. Physically the boat needs not to go to the point D. The experiment itself finishes as soon as the boat reaches the point A (the start point of the experiment). Hence some duration should be excluded from the duration D_{BA}. That duration can be calculated the same way as additional duration for the upstream motion, but, because of the same direction of the river stream and the boat, that duration *should be excluded* from the duration D_{BA}. In that case, equation (5) can be written for the duration of the downstream motion of the boat:

$$D_{DOWN} = D_{BA} - D_{AD} = \frac{S_{BA}}{V_b} - \frac{V_S \cdot D_{BA}}{V_b} = \frac{S_{BA} - V_S \cdot D_{BA}}{V_b} = \frac{S_{BA} - V_S \cdot \frac{S_{BA}}{V_b}}{V_b} = \frac{\frac{S_{BA} \cdot V_b - S_{BA} \cdot V_S}{V_b}}{V_b} = \frac{S_{BA} \cdot V_b - S_{BA} \cdot V_S}{{V_b}^2} = \frac{S_{BA} \cdot (V_b - V_S)}{{V_b}^2} \quad (6)$$

Duration D of the whole experiment that includes upstream and downstream motion of the boat can be expressed the following way:

$$D = D_{UP} + D_{DOWN} = \frac{S_{AB} \cdot (V_b + V_S)}{{V_b}^2} + \frac{S_{BA} \cdot (V_b - V_S)}{{V_b}^2} = \frac{S_{AB} \cdot V_b + S_{AB} \cdot V_S + S_{AB} \cdot V_b - S_{AB} \cdot V_S}{{V_b}^2} = \frac{2 \cdot S_{AB} \cdot V_b}{{V_b}^2} = \frac{2 \cdot S_{AB}}{V_b} \quad (7)$$

Equation (7) shows that:

<u>Duration</u> of the boat trip in <u>a circular route</u> with upstream and downstream motion is independent of the speed of the stream. (A)

Hence the observer could not detect any difference in duration of that motion despite all his/her attempts. In other words, there is not any possibility to estimate speed of relative motion of the stream and the observer using that method of estimation. It is quite possible for the observer to be puzzled by such "unexpected" or so called "null result".

Moreover, equation (7) shows a relation between duration of the full process and speed of the boat. In case of constant distance and speed of the boat relatively to the water, that equation gives the constant result for the observer despite the speed of the stream. Worse than that, the duration becomes ever equal *to the duration of the round trip of the boat in the lake*. As a result, the observer could make a false decision about *ever constant speed of relative motion* between the observer and the boat in the lake and *the violent stream*.

IV. THE TROUBLE OF MOTION.

In some cases, description of motion does not make any problem to an observer. In the experiment with a train, mentioned above, an observer calculates speed of the train using data of distance and time taken to move that distance. Speed of the train appears as a result of calculation by equation (1). That is an easy experiment, and that methodology was in use for many centuries. It helps them to determine speed and make understanding of motion, i.e., *its relative nature*.

In the usual case of motion, they described motion itself relatively to the ground. In that case, the Earth surface thought to be at rest and any objects (material points) do their motion relatively the Earth surface. In case of the boat mentioned in the section 3 of this paper, motion of the boat and the stream was described relatively to the shore of the lake or stream. Obviously the shore was used as a frame of reference at rest because it is a part of the Earth surface.

We have quit different situation in case of light. The light makes its propagation through space, but empty space has not anything that seems to be used as a possible frame of reference for that motion. Moreover, Maxwell's description of electromagnetic waves and law of their propagation has no answer on easy question: What is the frame of reference for moving light?

"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:

$$C = \frac{1}{\sqrt{\varepsilon_0 \mu_0}} \tag{8}$$

where ε_0, the permittivity of free space, has an experimentally determined value of 8.85×10^{-12} square coulomb per newton square metre, and μ_0, the magnetic permeability of free space, has a value of 1.26×10^{-6} newton square seconds per square coulomb. The calculated speed, about 3×10^8 metres per second, *agreed with the known speed of light*. In an 1864 lecture before the Royal Society of London, "A Dynamical Theory of the Electro-Magnetic Field," Maxwell asserted:

> *We have strong reason to conclude that light itself—including radiant heat and other radiation, if any—is an electromagnetic disturbance in the form of waves propagated through the electro-magnetic field according to electro-magnetic laws.*

Maxwell's achievement ranks as one of the greatest advances of physics. For the physicist of the late 19th century, the study of light became a study of an electromagnetic phenomenon—the fields of electricity, magnetism, and optics were unified in one grand design."[11]

Many experiments showed that the speed of light depends on physical properties of a transparent medium. Moreover, a beam of light changes its speed of propagation as soon as light changes medium.

"In the same year (1849), Foucault showed that the speed of light in water is less than its speed in air by the ratio of the indices of refraction of air and water:

$$v_{water} = \frac{\eta_{air}}{\eta_{water}} \cdot v_{air} \approx 0.75 \cdot v_{air} \tag{9}$$

This measurement established the index of refraction of a material as the ratio of the speed of light in vacuum to the speed within the material."[12]

Later, Maxwell's equation (8) showed that the speed of light in a transparent medium depends directly on permittivity and magnetic permittivity of that medium. More than that, equation (8) shows that clearly - free space, i.e., physical vacuum follows the same law of light propagation and the speed of light in a vacuum depends on the same physical properties of that medium. Hence we have the following conclusion:

> ***The speed of light in any medium depends only on certain physical properties of that medium.*** (B)

From the one hand, light has determined finite speed in any transparent medium. From the other hand, light has certain finite speed in the vacuum. Hence, we should consider physical vacuum, in case of light propagation, *as some physical medium despite the absence of any substance in it*. That leads us to the same idea that describe so called luminiferous ether.

In the 19th century, they need some specific medium, that "can be used" by light to propagate through it. In their mind, physical properties of that ether and empty space (physical vacuum) had significant difference. They used the concept of luminiferous ether to make light propagation comparable with the human mind because they were unable to make imagination of something that propagates through the empty space (or nothing). Hence it was ***a transition idea*** that makes *the human mind* able to understand the propagation of

[11] **light.** (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition.* Chicago: Encyclopædia Britannica.
[12] **light.** (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition.* Chicago: Encyclopædia Britannica.

light through the empty space by filling that empty space with the hypothetical "substance". That consideration leads us to the following statement:

Physically, light needs not any additional medium in the space to propagate through it. As well as in the case of transparent substance, light makes interaction with the space itself in the case of motion through the space. That interaction determines the speed of light relatively to the space. (C)

As soon as the medium (including empty space) is responsible for the definite value of the speed of light, that speed should not have any connection with anything else *except of permittivity and magnetic permittivity of any given medium*. Figure 3 shows an example of a different speed of light in a different medium.

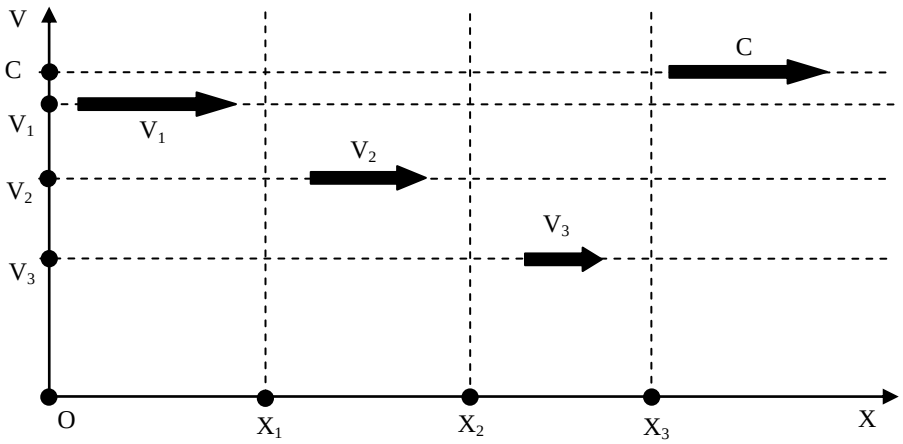

Fig. 3

Figure 3 shows a case of light propagation through some number of medium with different *permittivity and magnetic permittivity each.* Beam of light goes from the point O (the point of origin) alongside X-axis. Y-axis presents values of the speed of light.

First medium, located between points O and X_1 is air. The speed of light in that medium equals to some speed V_1. As soon as light reaches point X_1 it meets interface and goes from air to water. According equation (8) after interface the speed of light changed and became equal to speed of light in water according the equation (9). In further propagation, light reaches another interface with transparent medium at the point X_2. Permittivity and magnetic permittivity of that medium have some variation from the same physical parameter of water. As a result, speed of light in that medium drops to value V_3.

Light keeps that value of its speed as a *constant* one as long as physical properties of the medium keep constant. Nothing changes in light propagation until it reaches the point X_3. Light meets another interface at that point again. After that interface light goes to the empty space (vacuum) and immediately restores its maximal speed of propagation that is equal to C. This experiment shows an excellent example for the statement B and C (see above). Moreover, equation (8) as well as statement C has not any relation to relative motion between an observer and light. How it is possible? To answer that question, we should come back to *the stream thought experiment* that described in details in the section 3 of this paper.

V. LINER DETECTOR. THE PRINCIPLE OF OPERATION.

Entire situation with relative motion changes significantly as soon as the speed of light in any given medium (including space) depends only on the number of physical parameters of that medium. In that case, space becomes absolute frame of reference that light uses to propagate through it. Moreover, *physical interaction* between the light and the space keeps the speed of light constant as long as light goes through the space.

Mr. Michelson and many other physicists and philosophers used the same way of theoretical approach to the problem, but Mr. Michelson was the first person who conducted the experiment with a physical device – linear detector (see above). Here, his troubles begin.

Figure 4 gives a graphical representation of a linear detector way of action in case of *constant speed of light relatively to the space*.

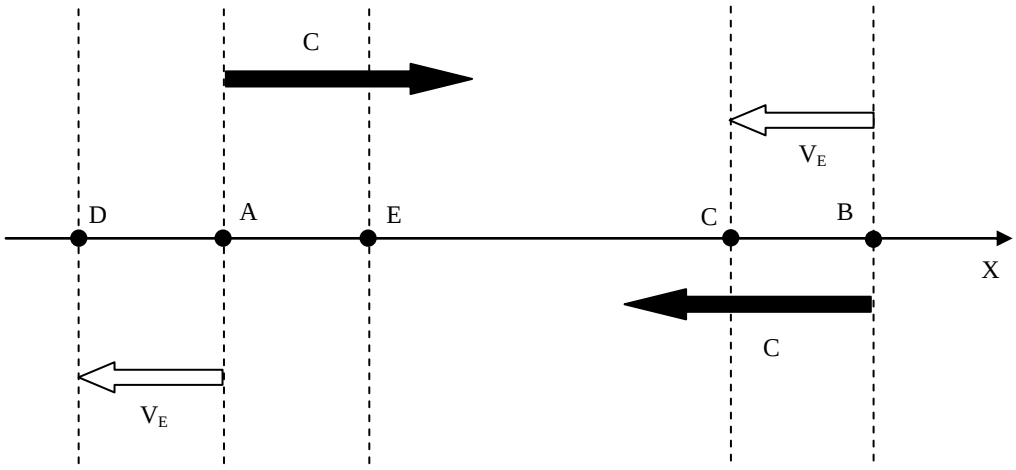

Fig. 4

In that case, an observer uses a linear detector with a rigid frame AB. The person uses a light source at the point A of the detector. That light goes along the rigid body of the detector up to point B and meets a mirror at that point. After interaction with the mirror at the point B, light goes back to the point A. As soon as light comes back to the point A, the observer becomes able to determine the duration of light travel between points A and B. ***A linear detector gives not any other information from that experiment***. In that case, physical frame of the linear detector becomes a frame of reference for the experiment because the observer is unable to use any other references or coordinate system (*experiment is conducted in a closed laboratory*).

Using that method, the observer likes to detect speed of motion of the Earth (V_E) relatively to the space (ether) by analyzing duration of a circle route motion of light between the light source and the mirror of the linear detector. Explanation of the physical process having a place in that experiment coincides with an explanation of *the stream thought experiment* given in the section 3 of this paper. In case of a liner detector, speed of the boat should be replaced with the speed of light C and speed of the stream should be replaced with the speed of the Earth relatively to the space (ether) (V_E).

Using the same way for explanation of this case we have the following equation for measured duration of that process for *any linear detector*:

$$D = D_{forward} + D_{backward} = \frac{L\cdot(C+V_E)}{C^2} + \frac{L\cdot(C-V_E)}{C^2} = \frac{L\cdot C+L\cdot V_E+L\cdot C-L\cdot V_E}{C^2} = \frac{2\cdot L\cdot C}{C^2} = \frac{2\cdot L}{C} \quad (10)$$

In the equation (10), D is the duration of the entire process of circular route for light motion between the source of light (the point A) and the mirror (the point B); L is the length of the rigid frame of the detector that equals to distance AB in the figure 4; C is the speed of light *relatively to the space*; V_E is the speed of the Earth *relatively to the space*.

As soon as the detector becomes to operation it makes measurement of duration D and nothing more. The observer obtains definite value of the speed of light after experiment using equation (2). In other words, the speed of light is calculable value that is available only after comparison between distance covered by light and duration of its travel by the circular route. Saying strictly the linear detector provides two values for equation (2) these are:

1. distance between the source of light and the mirror
2. duration of light travel to and from the mirror

Here, we have the solution of many problems and answer on many questions by the following statement:

> ***Duration of light travel in a linear detector by a circular route depends only on length of light travel and <u>the speed of light relatively to the space</u>. Therefore, measured duration of that process is independent of relative motion <u>between the linear detector and the space</u>***. (D)

Moreover, duration itself (D in the equation 10) has the same value as the speed of light relatively to the linear detector taken in a hypothetical situation when $V_E = 0$. In that case, the Earth becomes immovable *relatively to the space.* Hence, speed of relative motion between *light and the linear detector* becomes equal to the speed between *light and space*.

Obviously, that situation is unreachable practically because each celestial body keeps its motion in space. Despite of that motion, a linear detector ***shows the same value of duration ever*** regardless of its relative motion to the space (*see equation 10*). In other words, duration taken from a linear detector gives the same value ever that is proportional to *the speed of light relatively to the space*. The following equation shows that mathematically:

$$V = \frac{2L}{t} = \frac{2L}{D} = \frac{2L}{2L} \cdot C = C = \boldsymbol{constant} \tag{11}$$

In the equation (11), V is some speed that is calculated by the data from a linear detector; L is the length of the rigid frame of the device; t and D is the duration of the entire process of light circle route motion according to data from the device; C is *the speed of light relatively to the space*. Equation (11) is a result of combination of equations (2) and (10). That is so called "ever constant speed of light relatively to an observer" given by liner detectors.

VI. Planar Detector. The principle of operation.

The principle of operation of a linear detector described in details in the section 5 of this paper was unknown to the physicists of 19th century. Despite of that misunderstanding they try to make practical support for their idea of ether. Mr. Michelson was the man who conducted that experiment mentioned in the introduction of this paper. His objective was relatively straightforward. He made an effort to use a combination of two interacting linear detectors in one device. As a result, he became the first person who has created a planar detector (see introduction). Figure 5 shows the idea of that device.

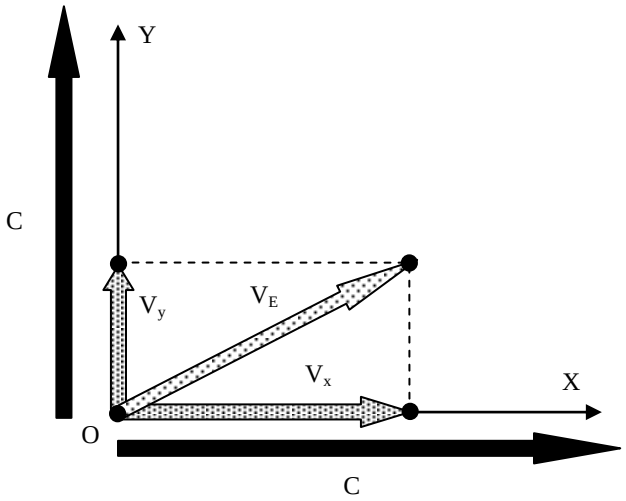

Fig. 5

Two beams of light go from the same point that should be used as the point of origin for the planar detector. In case of Michelson device, it was the location of the half-transparent mirror (see description in introduction). After interaction with that mirror, the light is divided into two parts. In the figure, those are two beams of light moving along X axis and Y axis (black vectors).

According to Michelson's assumption, speed of the Earth motion relatively to the space (V_E) should make extra speed to the device relatively to the space. That extra speed should be added to the speed of light at each beam. However, components of that speed have different values ($V_X \neq V_Y$) because the orientation of the device relatively to the vector V_E is casual. That is correct, because direction and magnitude of that vector was unknown for the experimenter before the experiment.

Result of that experiment is well known. Here, is the explanation of that so called "null result" according to the equation (10) and (11).

$$D_X = D_{X-forward} + D_{X-backward} = \frac{L_X \cdot (C+V_X)}{C^2} + \frac{L_X \cdot (C-V_X)}{C^2} = \frac{L_X \cdot C + L_X \cdot V_X + L_X \cdot C - L_X \cdot V_X}{C^2} = \frac{2 \cdot L_X \cdot C}{C^2} = \frac{2 \cdot L_X}{C} = const \tag{12}$$

$$D_Y = D_{Y-forward} + D_{Y-backward} = \frac{L_Y \cdot (C+V_Y)}{C^2} + \frac{L_Y \cdot (C-V_Y)}{C^2} = \frac{L_Y \cdot C + L_Y \cdot V_Y + L_Y \cdot C - L_Y \cdot V_Y}{C^2} = \frac{2 \cdot L_Y \cdot C}{C^2} = \frac{2 \cdot L_Y}{C} = const \quad (13)$$

$$V_X = \frac{2L_X}{t} = \frac{2L_X}{D_X} = \frac{2L_X}{2L_X} \cdot C = C = \boldsymbol{constant} \quad (14)$$

$$V_Y = \frac{2L_Y}{t} = \frac{2L_Y}{D_Y} = \frac{2L_Y}{2L_Y} \cdot C = C = \boldsymbol{constant} \quad (15)$$

$$C = C = \boldsymbol{constant} \quad (16)$$

Equations (12-16) provide additional support for the statement D. Obviously, any number of linear detectors interacting with each other or operating independently, *provide the same so called "null" result*.

VII. MATTER OF OPINION.

There is something more compelling in the planar detector than just *a new idea*. Mr. Michelson should put that into consideration before running his investigation. That matter puts together the principle of operation of any number of linear detectors and experimental data from them. Figure 6 shows that aspect of a lined detector operation.

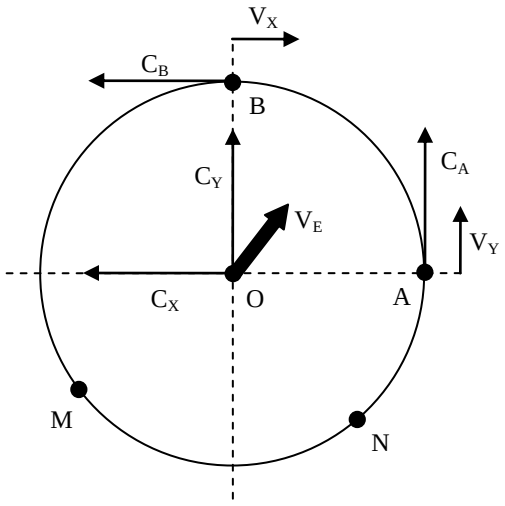

Fig. 6

Figure 6 shows a projection of the Earth on the figure plane. There are two linear detectors at some points of its surface. Those are the points A and B. The linear detectors located at those points have the same names A and B accordingly. The 'A' linear detector uses its light source in direction C_A. The B linear detector uses its light source in direction C_B.

Suppose the Mr. Michelson's planar detector located at the point O. That point is the point of origin for the frame of reference of the fig. 6. According to the experimental data, the speed of light measured at the point A and B has the same value, because that the result is confirmed many times at any Earth-bound laboratory.

Suppose Mr. Michelson begins his experiment at point O. The planar detector sends two beams of light in directions C_Y and C_X. According to the figure direction C_Y is parallel to the direction C_A and direction C_X is parallel to the direction C_B. According to the idea of Mr. Michelson, his device should detect a little difference in the speed of light between two orthogonal beams C_X and C_Y because of motion of the Earth relatively to so called ether. That motion mentioned in the figure by vector V_E. Detection of that vector by its two components V_X and V_Y by their influence on the experiment *is the main objective of Mr. Michelson*.

According to his point of view before the experiment, motion of the Earth through the ether should affect measurable speed of two orthogonal beams of light because the Earth moves through the ether and the light propagates through the ether too. As a result of his imagination, he believed that his planar detector should detect that relative motion. Everybody agreed that point of view *wrongly*!

Everybody forget that there is not only the planar detector of Mr. Michelson. There are a number of the other linear detectors around the globe. As soon as so called motion through the ether affects the planar detector, it must affect each linear detector on the planet

because there is not any uniqueness in construction of the Mr. Michelson's planar detector! It has only combination of two liner detectors (see above).

As a result, motion of the Earth through the ether should affect **EACH** liner detector located on its surface or anywhere else (below the surface or above it). Hence, component vectors V_X and V_Y should be detected at points A and B as well as at the point O. Moreover, their influence on the experimental data of each linear detector should produce the same value of the deviation. Hence, the linear detector A should provide value of the speed of light affected by the motion of the Earth through the ether as well as the planar detector of Mr. Michelson. As a result, the speed of light detected be the liner detector A should have value $V_A = C_A + V_Y$. For the same reason, the linear detector located at the point B should provide value of the speed of light affected by the Earth's motion equal to $V_B = C_B – V_X$.

There were no such evidences *from experimental data obtained by the linear detectors*! That aspect should be used as the main ***counter-argument against the experiment***. However, there was *nobody* who done it.

Mr. Michelson was familiar with data from the linear defectors because measurement of the speed of light was done many times in number of laboratories before his experiment. Despite of that he developed the planar detector and has conducted the experiment. According to his point of view, the device should be able to detect a difference of the speed of light between two light beams and show the result like $V_{OY} = C_Y + V_Y$ and $V_{OX} = C_X + V_X$. Obviously, that should be a tremendous controversy between indications of the planar detector and any number of remote linear detectors. It was one of *the greatest failures of the human mind* that led to a huge controversy in physics in the following century.

Despite *of human failure*, device itself worked perfectly and showed the same speed of light at each direction as well as any other liner detector at any possible location on the Earth. In other words, the detectors ever indicate the same value of the speed of light relatively to the space in *complete agreement between each other*. That is correct, because *a device is free of mistakes of the human mind*.

All following experiments with liner or planar detectors show the same value of *the speed of light relatively the space*. The result is caused ever by *the liner detector principle of operation* (see section 5 of this paper).

VIII. "EXPERIMENTAL DATA" AND NEW THEORIES

Complete misunderstanding of experimental data and the linear detector principle of operation led to the creation of many ideas. All of them try to make an explanation of "unusual" behavior of light and its "*constant speed relatively to an observer*". It was key failure of theoretical frame of those theories. All of them used experimental data from a linear detector as the speed of light relatively to the observer. That mistake was caused by comparison between theoretical prediction of the exact value of the sped of light and experimental data from a liner detector. As it shown before (see section 5 of this paper), those parameters have only the same value because of *the linear detector principle of operation and its inability to show its own speed relatively to the space*. As a result, that the device is an inappropriate one to detection of speed of relative motion between *an observer and the light*. However, all physicists from 19^{th} century believed that a linear detector shows true speed of *light relatively to an observer*.

It was key misunderstanding that led to the misconception of a new theory that was born in the beginning of 20^{th} century. Key problem of that theory was that it used data from linear and planar detectors as the speed of light *relatively to observer*. That was not right point of view, because as it shown in the 5^{th} section of this paper those detectors are able to show only the speed of light *relatively to the space*. As a result, they show the same value of the speed of light relatively to the space ever and nothing more despite their actual motion relatively to the space (with the planet).

That theory possessed name 'Theory of relativity'. Its creator had name Albert Einstein. So they usually call that theory as einstein's theory or einstein's theory of relativity.

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

"The fact that the speed of light is the same for all observers is *inexplicable in ordinary terms*. If a passenger in a train moving at 100 km per hour shoots an arrow in the train's direction of motion at 200 km per hour, a trackside observer would measure the speed of the arrow as the sum of the two speeds, or 300 km per hour. In analogy, if the train moves at the speed of light and a passenger shines a laser in the same direction, then common sense indicates that a trackside observer should see the light moving at the sum of the two speeds, or twice the speed of light (6×10^8 metres per second).

"While such a law of addition of velocities is valid in classical mechanics, the Michelson-Morley experiment showed that *light does not obey this law*. This contradicts common sense; it implies, for instance, that both a train moving at the speed of light and a light beam emitted from the train arrive at a point farther along the track at the same instant.

"Nevertheless, *Einstein made the constancy of the speed of light for all observers* ***a postulate*** *of his new theory*. As a second postulate, he required that the laws of physics have the same form for all observers. Then Einstein extended his postulates to their logical conclusions to form special relativity."[13]

It is clearly seen now that Einstein's delusion was caused by misinterpretation of Michelson experiment and experimental data from the other linear detectors. From his point of view, the light has the same measurable speed *relatively to an observer*. Using that point of view Einstein shared delusion of the other physicists of his time.

Light itself ever use its own constant speed *relatively to the space* (see section 4 of this paper). As a result, Maxwell's point of view on the nature of light is precisely correct, and his equations mean *physical process of interaction between the light and space*. One result of that interaction is constant speed of light *relatively to the space*. As it mentioned above, that speed coincided exactly with data from a linear detector and was *mistakenly* accepted as true speed of relative motion between an *observer ant the light*.

The citation given above has some significant ideas. I put them and counter-arguments for them in order below:

1. "The fact that the speed of light is the same for all observers is ***inexplicable*** in ordinary terms." Sections 4 and 5 of this paper eliminate that controversy. Einstein thought that the speed of light is the same *relatively all observers*. That is not correct any longer.
2. Train-arrow experiment is *incorrect example* because the speed of light is constant *relatively to the space*. As a result, it is independent of the speed of a light source (see section 4).
3. "While such a law of addition of velocities is valid in classical mechanics, the Michelson-Morley experiment showed that light does not obey this law." That is incorrect because the speed of light is constant *relatively to the space*. As a result, it is independent of the speed of a light source (see section 4, 5, 6, 7).
4. "Nevertheless, Einstein made the constancy of the speed of light for all observers a postulate of his new theory." Obviously it was ***a wrong postulate*** because it assumes constancy of *the speed of light relatively an observer and light itself*. (see section 4)
5. "As a second postulate, he required that the laws of physics have the same form for all observers." Obviously it was ***a second wrong postulate***. As soon as the speed of light is constant *relatively to the space* (not to an observer), it becomes variable to each observer moving through that space with different speed *relatively to the same space*. Hence the laws of physics should be changed for some extent for those observers.
6. "Then Einstein extended his postulates to their logical conclusions to form special relativity." After all counter-arguments mentioned above, that theory cannot be correct *even in the level of its postulates*.

That is the best example that shows clearly how misinterpretation of the experimental data leads to development of inappropriate theories.

IX. The True Space-Velocity Detector

Many decades later, after publication of theory of relativity, science met some problems that were caused by that theory. One of them is physical possibility for existence of absolute frame of rest.

"The unique absolute frame of rest with respect to which light waves had velocity c according to the prerelativistic viewpoint was often regarded, before Einstein, as being at rest relative to a hypothesized all-pervading ether. The vibrations of this ether were held to explain the phenomenon of electromagnetic radiation. The failure of experimenters to detect motion relative to this ether, together with the widespread acceptance of Einstein's special theory of relativity, led to the abandonment of the theory of the ether. ***It is ironic therefore to note that the discovery in 1964 by the American astrophysicists Arno Penzias and Robert Wilson of a universal cosmic microwave 3 K radiation background shows that the universe does indeed possess a privileged inertial frame.*** Nevertheless, this does not contradict special relativity because one cannot measure the Earth's velocity relative to it by experiments in a closed laboratory. One must actually detect the microwaves themselves."[14]

That is an extremely valuable quotation. It shows something that was done at 1964 and leads to the following conclusion "*the universe does indeed possess a privileged inertial frame*". What is that frame? Section 4 of this paper gives the answer on that question and

[13] **relativity.** (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition.* Chicago: Encyclopædia Britannica.
[14] **relativistic mechanics.** (2008). Encyclopædia Britannica. *Encyclopaedia Britannica 2008 Deluxe Edition.* Chicago: Encyclopædia Britannica.

describes in details that unique frame of reference. That is space itself, and the light makes its propagation through space and *relatively to the space.* As a result, *space itself becomes the unique, absolute frame of rest.*

More than that - "this does not contradict special relativity because one cannot measure the Earth's velocity relative to it (*privileged inertial frame*) by experiments in a closed laboratory". That is not correct *any longer* because we have theoretical possibility to build an unique device that will be able to show the velocity. It will be the True Space-Velocity Detector (TSVD).

Obviously, the device will use a lot of advantage of modern technologies, which were inaccessible a century ago. The device will contain a number of highly computerized modules with some number of light sources and light detectors. All computerized units will be connected to each other by a computer network and use a specific algorithm for calculation and to control each unit. True Velocity of the Earth motion relatively to the space will be detected by its three orthogonal components. Magnitude of that vector will be calculated by a computerized device according to data of all orthogonal components. *The device will not use liner detectors like one described in the section 5 of this paper*.

Figure 7 shows image data from some number of such devices.

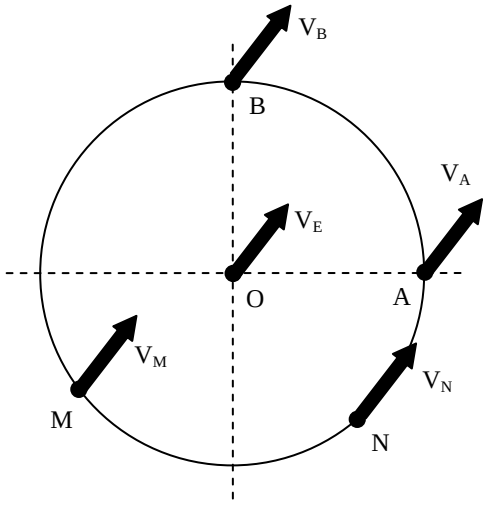

Fig. 7

Figure 7 shows a projection of the Earth on the figure plane. Point O is the projection of the center of the Earth. The other points are some casual locations. There are a number of TSVDs on the surface of the Earth. Each of those devices located at the different point remote from the other devices. V_E is the velocity of the Earth relatively to the space.

Each fully operable TSVD makes measurement of velocity of the Earth relatively to the space at the point of its location. Obviously each TSVD has different values of orthogonal components. Moreover, each TSVD detects different direction of true velocity of the Earth relatively to the ground, but recalculation of those vectors according to data of geographical location of each TSVD gives the same vector V_E. According to the figure $V_E = V_A = V_B = V_M = V_N$. Moreover, at each point of its location, data coming from a TSVD change ever because of rotation of the Earth.

As soon as we make a fully operable TSVD, we have the first and the last artificial and logical counter-argument against the theory of relativity and finish one more great circle of progress of the Earth Civilization.

X. CONCLUSION

Some physicists and philosophers feel that there is something wrong with the theory of relativity, but nobody was able to see the real problem of that theory. Many people with curious minds like to know more about philosophy and physics. They ask a lot of questions about the nature, but they have the same ugly solution that was best formulated by one man.

"Unfortunately, physics *has become infected* with very low standards of *clarity and precision on foundational questions*, and physicists have become accustomed (and even encouraged) to just "***shut up and calculate***," to consciously refrain from asking for a clear understanding of the ontological import of their theories."[15]

[15] Tim Maudlin. *Philosophy of Physics: Space and Time*. Princeton University Press, 2012. ISBN 9781400842339. P.14 from Introduction.

New ideas can be formulated, and new theories can be created only by *the human mind*, because we are not robots to calculate it *without any sign of human imagination*. Any way for any idea without complete philosophical and logical imagination leads to the creation of scientific chimeras. Thus, TSVD will be the best "sword" to save mankind from one of the most powerful "monsters" and persistent attempts of robotization of the human mind.

XI. AFTERWORD

One might ask the following question. How it is possible to make all of these counter-arguments for a well established theory that was in full power for many decades? The answer is extremely simple. Each theory uses some basis for its functionality so to say. That core contains some philosophical concept usually, and logical argumentation or connection between philosophy and experimental data (observable facts of nature).

Each theory exists as long as there is no change in philosophy, that it uses, and experimental data agree with that theory. Obviously, any theory falls as soon as any of those elements change for some extent that becomes *incompatible* with the theory. Anyone who knows the history of science remembers that circle of creation, existence and following failure of many theories. That circle is irresistible from the time of Aristotle for today.

I possessed some interest in the field *of space, time and motion* as soon as I made a fully developed theory called 'Z-Theory'[16]. It becomes able to explain many "unusual" phenomena that persist for ages and are easy to observation by a naked eye. That theory meets any other theory in the level of motion. Unlike the other theories, Z-Theory uses totally new theoretical and philosophical frame that is not familial *to the human mind*. However, the human mind is able to understand that theory and use it for its behalf. The following figure shows a comparison between the elements of the theory of relativity and Z-Theory.

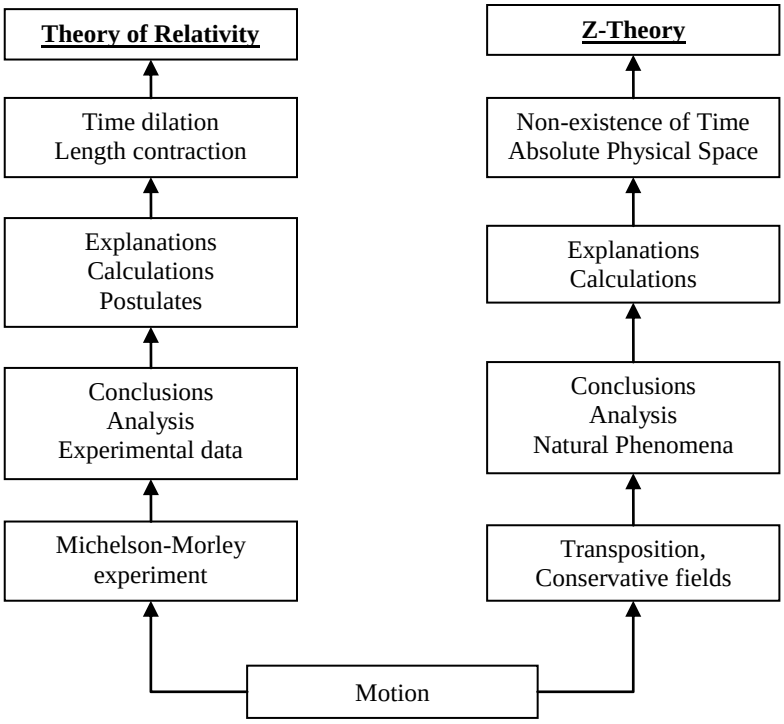

Fig. 8

Unlike many other theories, Z-Theory has *no postulates*. It uses many natural phenomena and gives logical explanations for them. Also, it uses Transposition as a special sort of relocation without interaction between an object and space.

Some elements of Z-Theory were already published in a journal. For example, non-existence of physical Time was explained in details in my article entitled 'Human's delusion of Time'[17]; some aspects of Transposition were explained in my papers entitled

[16] A. Zade, *Z-Theory and Its Applications*. AuthorHouse, 2011, ISBN 978-1452018935

[17] See source [2]

'Matter of navigation'[18] and 'Gravitational fields and Transposition in Australian authenticated case'[19]; my article entitled 'Motion and Transposition in conservative fields'[20] makes a deal with Transposition and non-existence of physical Time. Hence I prefer to use the word Duration instead of Time.

Philosophy and epistemology of Z-Theory goes far away from *the standard feeling* of Space, Time, Motion and many other analytical categories of the human mind and the natural phenomena.

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