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Method for determining the absolute velocity in the electromagnetic Ether

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The thesis accounts for the results of a research of the Doppler effect in an accelerating, rectilinearly moving frame of reference; namely, it:

1) examined some key physical processes and phenomena, allowing to distinguish between such states of the inertial system as before the start and after the end of the process of velocity change;
2) provided a solution of the task of determining of the absolute velocity of a reference frame in a wave medium by using the Doppler effect, under condition that the wave transmitter and the receiver are placed within the reference frame at a fixed distance to each other;
3) provided experimental data indicating a possibility of an instrumental registration of not just relative but the absolute speed in the *ether* medium.

Key words: wave medium, *ether*, absolute velocity, phase, phase advance, frequency, frequency difference, the speed of light, wavelength, lag time, Doppler effect, acceleration, instantaneous velocity, reference signal, interference, Michelson interferometer, homodyne interferometer.

The issues of the absolute speed and direction of motion in *ether* are not limited to the physical parameters only: they form the backbone of entirely different mechanisms and technology. Emergence of equipment based on the new principle would make the entire fleet of navigation satellites, just like many other things, for example, completely obsolete.

The book was translated into English and registered with the US Library of Congress.

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Doppler effect in the accelerating reference systems, and its application to determine the absolute speed

Introduction

Since 1881, attempts have been made to measure the absolute speed of the Earth in *ether*, which on the whole proved unsuccessful [3,8]. Since the emergence of the special theory of relativity (SR) in 1905, the issue of experimental discovery of the absolute motion has taken a back seat, almost disappeared from the focus of scientific interest. Still some scientists haven't abandoned the idea of discovering the elusive *ether*.

So modern scientific community is now facing the situation when, on the one hand, it has no experiments to prove the nonexistence of *ether*, on the other, there are no experiments unequivocally supporting its existence. A situation when one has to rely on one's faith: some believe in *ether*, others don't. And this clash of faiths has lasted for more than a century. The dispute can be solved only by an experiment, theoretically well substantiated, and corroborated in independent laboratories.

Henceforth, the problem is examined within the framework of the philosophy and physics existing prior to 1905 (SR), and the term '*ether*' will be used as a due payment of respect to historical tradition. This must be done to either bring science back to the fold of classical physics, or (if the experiment is not corroborated by independent labs) to finally bury the classic ideas of our predecessors, and thereby entrench the existing positions of modern science.

The present thesis does not endow *ether* with any exotic properties beyond those suggested by C.Huygens and H.Lorentz.

Physical phenomena and effects this work is based on

The property of physical bodies to resist any changes in velocity, i.e. to react to acceleration, is called *inertia.*

Inertia. The existence of inertia means that if the force causing the change in the velocity of a body (as a system) is applied, not only the body's mechanical reaction to the acceleration must take place but also changes in the behavior of its wave component should be observed [1], [5]. It was partly proved by the Sagnac-Garres experiment showing that wave processes do react to acceleration [2].

The Doppler effect. The Doppler effect is impossible without a wave medium. The effect is observed both in acoustics and electrodynamics, and in both cases it has the same mathematical description.

Wave nature of matter. The presence of wave ties between the elements of condensed bodies implies that the Doppler effect must also be observed at the atomic level of the organization of matter. And should the speed of those bodies be brought to change, the Doppler effect is to manifest itself as a case of *inertia.* In this sense, the Doppler effect could be viewed as a root-cause of the bodies' inertia.

Basic provisions

The present research and calculus were conducted within the framework of the following provisions:

- existence of a wave medium, i.e. a carrier of a wave disturbance, an all-pervasive and immobile;
- transfer of any material system is performed in a wave medium, relative to it, without a possibility of a medium being dragged in by the moving system;
- the speed of waves in a wave medium and relative to it is always constant;
- in a moving system, the speed of waves is added up with the speed of the system.

Problem statement and solution

The determination of a direction of motion of a system in *ether*, as well as its absolute speed is a major part of the problem solution. This thesis, too, is devoted to this problem solution. Which in turn, implies solution of a range of specific interim tasks:

1) determination of the system's mode of motion*, in which the Doppler effect becomes manifest; 2) determination of relation between the system's instantaneous speed and the Doppler effect;
3) development of the ways and means of the Doppler effect registration for the above-mentioned conditions.

* In the system, the waves' transmitter and receiver are set up at a fixed distance relative to each other (Fig.1).

In order to understand how the Doppler effect manifests itself in the system, moving rectilinearly with acceleration, let's examine the acoustic analog of the situation – a moving platform, where the transmitter of waves and the receiver are located at a fixed distance (Fig.1). The following questions must be answered:

5. If the platform's velocity equals zero (V=0), then what does the wave pattern between the transmitter and the receiver look like?
6. If the platform moves uniformly and rectilinearly (V>0), then how will the wave pattern between the transmitter and receiver change?
7. How do the waves look like during the process of velocity change from V=0 to V>0?
8. Will the system have a frequency shift of the received signal if the system moves with acceleration while the emitted signal is reflected from the receiver/mirror and returned back to the transmitter*?

* In order to distinguish this effect from the classical Doppler effect, henceforth, we'll call it 'the Radar effect'.

Conventional signs:

V – system's velocity in the wave medium
V_0 – initial velocity of the system

a – acceleration
t – time
c – velocity of wave propagation
f_0 – frequency of the transmitter O ($f_0 = const$)
λ – wavelength of the travelling wave

1. If the platform is motionless (V=0), then the wavelength of the wave, radiated and located at OM section (Fig.1), is equal to

$$\lambda_1 = \frac{c}{f_0} \qquad (2.01)$$

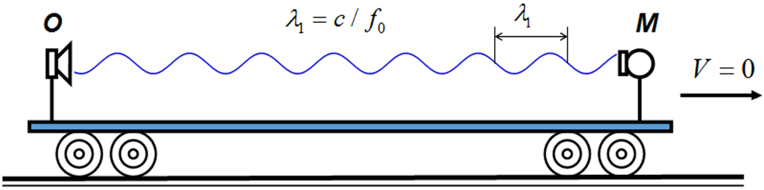

Fig.1 Installed on the mobile platform, are: transmitter O, the frequency of which is constant ($f_0 = const$), and receiver M

The velocity of the platform is equal to zero (V=0). This wave will come to the receiver with the same frequency with which it was emitted

$$f_M = \frac{c}{\lambda_1} = f_0 \qquad (2.02)$$

2. If the velocity of the platform is more than zero (V>0) the wavelength is changed

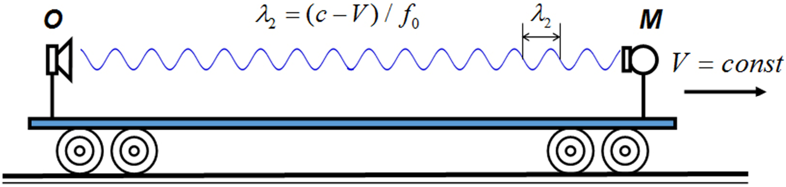

Fig.2 The velocity of the platform is above zero (V>0)

$$\lambda_2 = \frac{c-V}{f_0} \qquad (2.03)$$

But the frequency, with which the wave reaches the receiver, will not be changed

$$f_M = \frac{c-V}{\lambda_2} = f_0 \qquad (2.04)$$

3. Between the first mode – absence of the velocity ($V = 0$) and the second mode – motion ($V > 0$) there exists the third mode – change of the velocity, i.e. the platform is moving with acceleration (Fig.3). This means that the wave emitted at one speed reaches the receiver in a time interval, during which the velocity of the platform changes, in our case becomes greater. The change of the velocity affects the frequency of wave reception. The Doppler effect becomes manifest in the system. Let’s examine such option in greater detail.

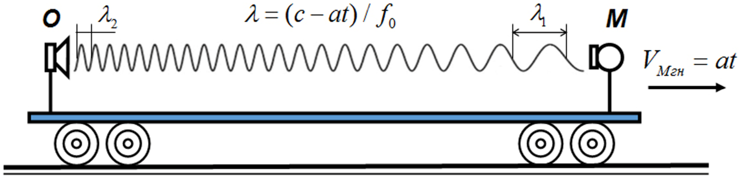

Fig.3 The platform is moving with constant acceleration

Let the velocity be changed according to the rule $V=at$. The transmitter O started to emit waves in the direction to the receiver M at the beginning of the motion ($V=0$). The wavelength of the first wave was

$$\lambda_1 = \frac{c}{f_0} \qquad (2.05)$$

In the time t period of wave λ_1 motion from O to M, the platform has moved a certain distance and its speed has reached $V=at$. This means that the wave λ_1 will come to the receiver M, moving away with the velocity (relative to the receiver) $c' = c - at$, thus the received frequency of the wave λ_1 in point M will be

$$f_M = \frac{c - at}{\lambda_1} \qquad (2.06)$$

where: f_M – wave frequency λ_1, changed wavelength (Doppler effect) as a result of increased velocity of receiver M.

Taking into consideration the formula 2.05 we get

$$f_M = f_0(1 - \frac{at}{c}) \qquad (2.07)$$

It is obvious that $f_M < f_0$, and $\Delta f = f_0 - f_M \neq 0$, so the Doppler effect is present.

To have a more detailed evaluation of the Doppler effect, let's examine Fig.4.

4. In order to evaluate the Doppler effect and the Radar effect, it is necessary to determine the velocity of the transmitter O when the signal was emitted (V_0), the velocity of the receiver M when this signal was received/reflected (V_{M1}) and the velocity of the source O when the reflected signal came back to it (V_{O2}).

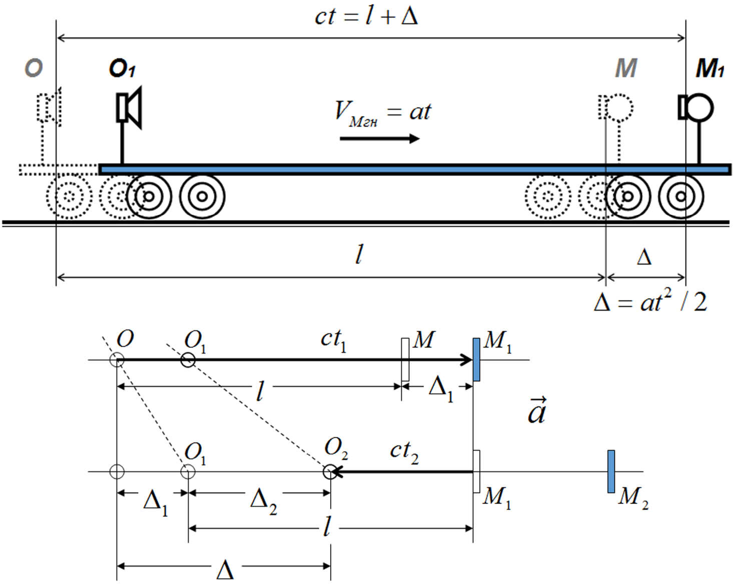

Fig.4 The diagram for calculating the Doppler and the Radar effects

Let the signal move from the point O to the point M and over the time t_1 cover the distance of ct_1. For the same time interval the receiver M moves to the distance of Δ_1:

$$ct_1 = l + \Delta_1$$

$$\Delta_1 = V_0 t_1 + \frac{at_1^2}{2}$$

$$\frac{at_1^2}{2} - (c - V_0)t_1 + l = 0$$

where:

t_1 – time interval over which the signal travels from the point O to the point M_1

ct_1 – distance between the transmitter and the receiver over which the wave travels.

The solution of this equation allows to establish the velocity V_{M1}, which is necessary for determination of the frequency of the signal, which had been emitted at the point O and which then reached the receiver M_1:

$$V_{M1} = V_0 + at_1 = c - \sqrt{(c - V_0)^2 - 2a \cdot l}$$

$$f_{M1} = f_0 \frac{c - V_{M1}}{c - V_0} \qquad (2.08)$$

$$f_{M1} = f_0 \sqrt{1 - \frac{2al}{(c - V_0)^2}} \qquad (2.081) \qquad \left\{ f_{M1} = f_0 \sqrt{1 \pm \frac{2al}{(c \pm V_0)^2}} \right\}$$

$$\Delta f_1 = f_{M1} - f_0$$

where V_0 and V_{M1} – instantaneous velocities of the system when the signal was emitted by the transmitter and when the signal reached the receiver correspondingly.

It is clear from expression 2.08 that when the platform moves with acceleration, the Doppler effect becomes manifest, and it can be measured. It follows from the results of calculations that when the velocity of the signal, coming to receiver M_1, is increasing, its frequency is decreasing.

When the signal is reflected from the point M_1 and returns back to the transmitter O, which changes its position to point O_2 over this time interval, then the frequency of the returned signal changes again. The cause of such change is that the system moves with acceleration and the velocity is equal to V_{O2} when the signal arrives.

$$\frac{at_2^2}{2}+(c+V_{M1})t_2-l=0$$

$$V_{O2}=V_{M1}+at_2=\sqrt{(c+V_{M1})^2+2a\cdot l}-c$$

$$f_{O2}=f_{M1}\frac{c+V_{O2}}{c+V_{M1}}=f_0\frac{(c-V_{M1})(c+V_{O2})}{(c-V_0)(c+V_{M1})} \tag{2.09}$$

$$f_{O2}=f_0\sqrt{(1-\frac{2al}{(c-V_0)^2})(1+\frac{2al}{(2c-\sqrt{(c-V_0)^2-2a\cdot l})^2})} \tag{2.091}$$

where:

f_0 – frequency of the transmitter ($f_0=const$)
V_0 – velocity of the transmitter O when the signal is emitted
f_{M1} – frequency of the received/reflected signal
V_{M1} – velocity of the receiver M when the signal is received/reflected
f_{O2} – frequency of the returned signal
V_{O2} – velocity of the transmitter O when reflected signal returns to it.

Here the Doppler effect is partly cancelled out by the acceleration of the system, but the frequency of the wave returning to the transmitter O will anyway differ from the frequency of the wave emitted by this transmitter before.

$$\Delta f=f_0-f_{O2}\neq 0$$

This difference determines the value of the Radar effect and is described by the formula

$$\Delta f = f_0 - f_{O2} = f_0(1 - \frac{(c - V_{M1})(c + V_{O2})}{(c - V_0)(c + V_{M1})}) \qquad (2.10)$$

It is obvious from the formulas that if the velocity of the platform is constant (V=*const*), then V_0=V_{M1}=V_{O2}. Then f_{O2}=f_{M1}=f_0, i.e. Doppler and Radar effects are absent.

If the platform is moving with the acceleration a, then V_{O2}>V_{M1}>V_0, which results in a difference between the reference signal frequency f_0 and the received signal frequency f_{O2}:

$\Delta f_1 = f_{M1} - f_0 \quad f_{M1} < f_0$ (direct Doppler effect)

$\Delta f = f_0 - f_{O2} \quad f_{O2} < f_0$ (Radar effect)

$\Delta f_1 > \Delta f$

Formulas 2.09 and 2.10 are universal and can be applied for evaluation of the Doppler effect in any wave medium, both in the acoustics and in optics. In comparison with the acoustics, the situation in optics is more complicated because the Doppler effect is very small, which is evident from the calculations, shown in Table 1.

Table 1. Doppler effect and Radar effect in acoustics and optics

Acoustics	**Optics**
Given: a = 9,8 m/s^2 l = 10 m c = 330 m/s $f_0 = 1000 Hz$ $V_0 =$ 0 m/s **Solution:** $f_{M1} = 999,099 Hz$ $\Delta f_1 = f_{M1} - f_0 = -0,9 Hz$ $(V_0 = 0\ m/s)\ \Delta f = 0,0032 Hz$ (V_0=30 m/s) Δf = 0,335787Hz	**Given:** a = 9.8m/s^2 l = 10 m c = 300000000m/s $f_0 = 564000000000000 Hz$ $V_0 = 0\ m/s$ **Solution:** $f_{M1} = 563999999999999{,}386 Hz$ $\Delta f_1 = f_{M1} - f_0 = -0,614 Hz$ $(V_0 = 0\ km/s)\ \Delta f = 2,67 \cdot 10^{-15} Hz$ (V_0=30 km/s) Δf = 2,46$\cdot 10^{-4}$$Hz$

What's important is that the Radar and Doppler effects depend not just on the system's acceleration, which can be constant, but on the instantaneous speed too, $V_0=at$. For example, for $V_0=0\,m/sec$ in acoustics, the Radar effect is $\Delta f=0{,}0032\,Hz$, while for $V_0=30\,m/sec$, its value is by two orders of magnitude higher, being $\Delta f=0{,}3358\,Hz$. In other words, the higher the initial velocity is, the greater is the value of the Radar effect. It's this relation which makes possible to estimate the so-called absolute speed. This also applies to the system's motion in the *ether*. Let's examine the situation in greater detail.

A method for measuring the absolute velocity in a stationary medium

To understand how to determine the absolute velocity of the system, it is necessary to examine in 2.08 and 2.10 the dependence of Δf_1 and Δf on V_0. It is obvious that the parameters for the case $V_0>0$ will be greater than the parameters for $V_0=0$. The greater initial velocity V_0 the greater the frequency difference for both cases: the direct Doppler effect (2.08) and the Radar effect (2.10). By comparing values obtained during the experiment, with the similar values for $V_0=0$ the absolute velocity of the system in the wave medium can be calculated.

The simplest method to specify velocity of a system in a wave medium is to experimentally measure the Radar effect and to determine the corresponding velocity using the graph (Fig.5). This velocity will be the absolute velocity. For an example, in acoustics (for conditions covered by Table 1), assuming the measured value of the Radar effect be equal to $2\,Hz$, in this case both the calculations and the graph show that the instantaneous velocity of the system equals $131\,m/s$. If the value of the Radar effect is equal to $0{,}78\,Hz$, the instantaneous velocity will be almost half of those ($66\,m/s$). It's worth noting that with $V_0=0$ the value of the Radar effect amounts to a mere $0{,}0032\,Hz$.

The Doppler effect and the Radar effect are much less noticeable in optics than in acoustics, and therefore there is a problem of their measurement. One of the available methods is the phase interferometry. Homodyne interferometers, heterodyne interferometers and classical

Michelson interferometers with elongated arms can measure these effects. Microelectronics, no doubt, can offer other means of measurement, as accelerated motion affects all electrodynamic processes without exception. One of such effects was discovered when the experiment with a homodyne interferometer was conducted.

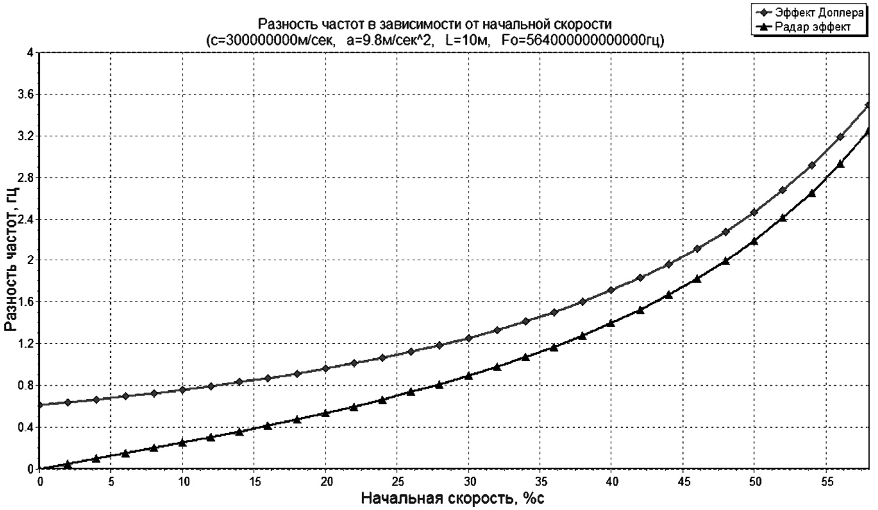

Fig.5 The dependence of the Doppler effect and the Radar effect on the acceleration and the absolute velocity of the system

Experiments and results

Homodyne interferometer

To register the Radar effect a device was assembled, see Fig.6. The device belongs to the class of interferometers, but it differs from its common types by the fact that it has only one elongated arm.

The solid-state single-frequency laser (532*nm*) with frequency stabilization and length of coherence not less than 50 meters is used as the light source. The length of the arm, used to create time delay for the signals, is three meters or more. Video recording device is used in order to subsequently analyze the dependence of the position of interference fringes on the velocity of the system.

The laser beam from the source 1 (Fig.6) reaches the beam-splitter 2, that splits the beam into two and forwards one beam to the system of mirrors 3 and the second beam, the reference beam, to the screen directly. As a result of the superimposition of the repeatedly reflected beam and the reference beam, the interference appears which can be visualized as the interference fringes on the screen 5.

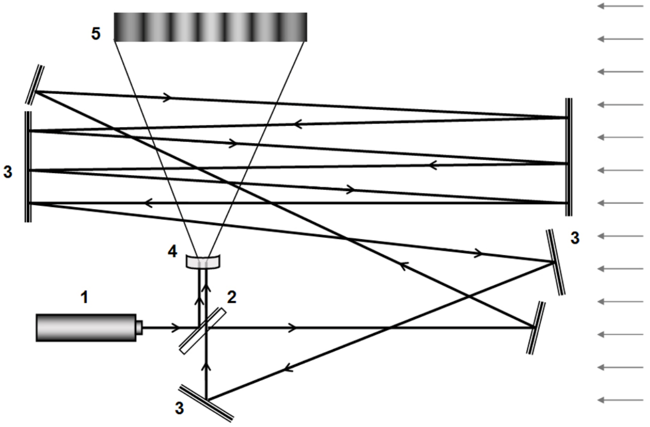

Fig.6 Functional scheme of the device: 1 – laser; 2 – semi-transparent mirror beam-splitter (70/30); 3 – mirrors; 4 – expanding lens; 5 – screen

In this scheme two beams from one source emitted at different times and different velocities of the system interfere. If the velocity of the system, in which the device is located, is equal to zero or constant, then the beams with the same frequencies reach the screen, and phase shift is absent. If the system moves with acceleration along the *x* axis, then the beams of different frequencies reach the screen, which results in the drift of the interference pattern to a certain side, i.e. the Doppler effect is observed. Deceleration shifts the interference pattern to the opposite side. The absolute and relative velocities of the system can be estimated observing the behavior and the position of interference fringes on the screen.

In essence, the waves, emitted by one source but at different times, with wavelengths λ_2 and λ_1 (Fig.3) always interfere in the device. One of the signals has time delay, that allows to compare the current state of the system with the state of the system some time ago. Such comparison is performed by means of phase (frequency difference) measurements and allows to estimate the velocity of the system by observing the shift of interference fringes.

The device is shown on Fig.7. Two problems emerged while operating the device. The first problem was the interferometer's hypersensitivity. Even in its motionless state (*V*=0) the device was registering negligible changes of the laser's own working frequency. Which was evident from a reciprocal drift of interference fringes on the screen. The second problem, when the registration of a 'pure' Radar effect was attempted, was the impact of acceleration on the frequency of the laser itself. Though such impact effect was predicted and described earlier [5].

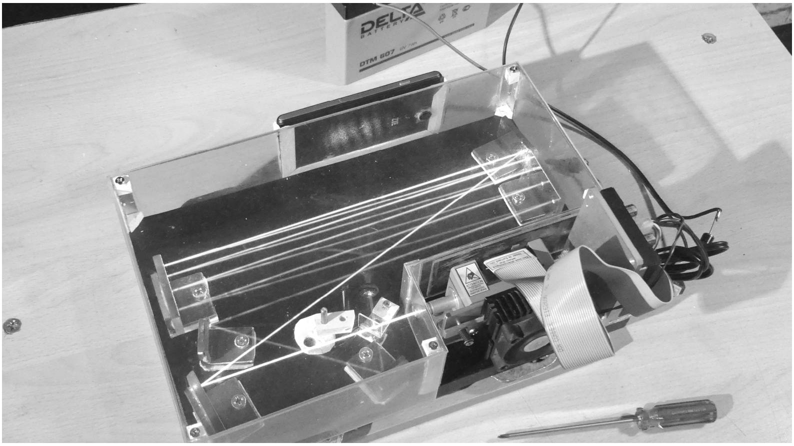

Fig.7 The experimental homodyne interferometer

A mix of at least two effects became manifest in the device presented on the photo: one was the calculated pure Radar effect, the other was dependence of laser frequency on the reaction of its active elements to the velocity change [5]. The drift of interference fringes on the screen means that both effects are present. It is worth noting that pure Radar-effect has a reciprocal shift of fringes while the effect, related to the reaction of laser elements to the change of the velocity, is somehow one-directional. When these effects are summed up, an interesting result is obtained: the drift of interference fringes during acceleration was larger than the drift during deceleration. It is possible only in the case of addition and subtraction of the effects. For this reason the attempts to obtain pure Doppler Radar effect failed. A possible solution is either a replacement of the laser by another acceleration-proof source, or a search for a different experimental scheme.

All attempts to avoid "unwanted" effects, caused by the reaction of the active elements of the laser to the velocity change, failed. It was assumed that the pure effect could be registered if a natural source of light were used, but such a source doesn't provide sufficient coherence length of radiated waves. There are probably other approaches, involving, for example, the usage of femtosecond sources or complicated systems of filtering and control, but they were unavailable.

Multiple experiments were conducted in the trains of Moscow Central Ring which sped up to 110*km/h*. During these experiments stable shifts of interference fringes were observed in cases both of the train acceleration and deceleration. When the velocity of the train became constant, the interference fringes stopped shifting. The fringe shift was explained by the change of the frequency of the signal delayed in time, i.e. integral Doppler effect, and the stabilization of the fringe position indicated the constancy of the velocity of the train. It's worth noting that whenever the velocity of the train became stabilized, the interference fringes kept their new position and didn't return to the initial position that indicates the non-invariance of inertial frames.

Michelson interferometer

The mixture of at least two effects, obtained in the first experiment, is a promising sign for further research, but the goal was to detect the Radar-effect.

Michelson's interferometer with symmetric arms allows to reduce "parasitic", though important, dependence on the source's frequency

[6]. According to the calculations, such a device should not only react to acceleration and register the pure Radar-effect, but by means of its orientation should also make possible determination of the movement's direction in the wave medium (*ether*).

To understand why Michelson interferometer, moving with acceleration, is suitable for absolute velocity determination, calculations were made which showed that the travelling time of a signal in one arm differs from the travelling time in the other arm and depends on orientation of arms (Fig.8) relative to the direction of accelerated motion.

If the arms of the interferometer are positioned at 45 degrees (Fig. 8a) relative to the motion direction, frequency difference between the arms will be absent, as the beams reach the beam-splitter simultaneously.

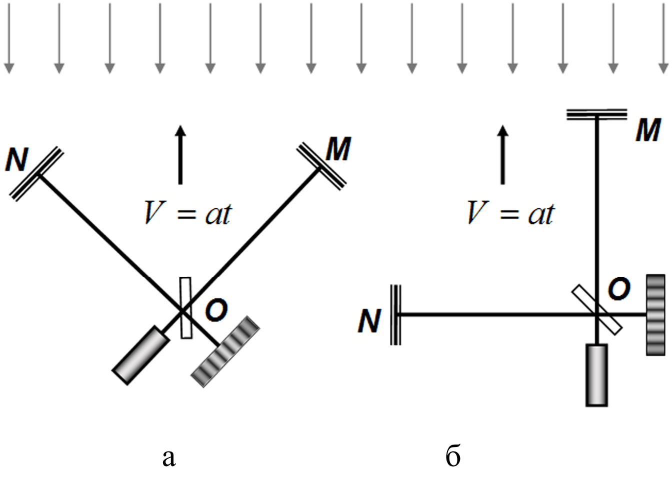

Fig.8 Scheme of the experiment: a) orientation of the interferometer when frequency difference is zero; b) orientation of the interferometer when maximum frequency difference is registered

While the interferometer's orientation as shown in Fig.8b, causes phase advance between the beams, coming to the beam-splitter and causing the shift of interference fringes on the screen. If the system stops accelerating and the velocity is stabilized (*V=const*), then the new position is fixed and no extra fringe shift occurs.

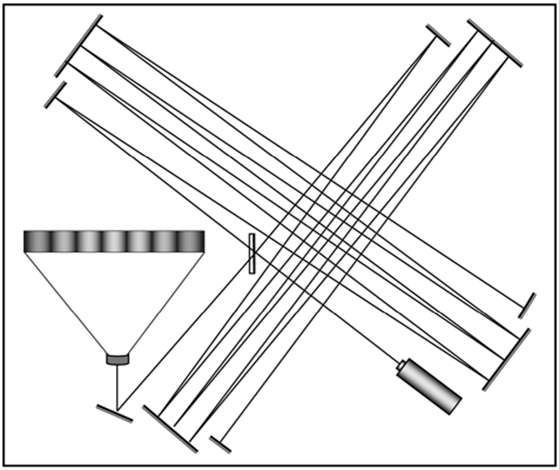

Fig.9 The layout the interferometer

Conclusions

A new method of determination of the absolute velocity of a system in the *ether* by organization of an accelerated motion of the system is suggested. Acceleration causes changes in the parameters of all internal wave processes in the system and their dependence on the absolute velocity of the system.

Preliminary experiments allowed to register the frequency shift, due to the Doppler effect, in the system, moving with acceleration. The frequency shift of the received signals was estimated by the movement of interference fringes.

It follows from formulas 2.8, 2.9 and 2.10 that the values of the Doppler effect and Radar effect are functions of not only the acceleration but also of the initial velocity of the system V_0. The greater V_0 the greater the values of the Doppler effect and Radar effect (Fig.5). Then it is possible to determine the absolute velocity of the system in the *ether* by getting the value of the Doppler effect or Radar effect and comparing it to the values, calculated for $V_0=0$. Actually, it gives a chance to verify the postulates of special relativity about the invariance of the speed of light.

Shifts of interference fringes can be observed on the screen when the velocities of the used devices are being changed. When the system stops accelerating and starts to move with a new constant velocity ($V>0$) the shifted interference fringes do not return to their initial positions. The interference fringes return to their initial positions only when the system is slowing down. Such interference behavior indicates that before acceleration (V=0) and after acceleration (V>0) the system, by its internal state, proved not invariant to itself. The fact which questions the invariance principle: interference fringes must always take the same position on the screen in case of any constant velocity. While this doesn't take place, one can estimate the velocity of the system by observing the interference fringes.

Whenever the physical bodies move with acceleration all their internal wave processes are affected by the Radar effect and the Doppler effect. This causes desynchronization of the established wave ties and makes the bodies react with a manifest resistance to the change of velocity, i.e. *inertia*. In this sense, *inertia* is the result of the Doppler effect in bodies, impossible without a wave medium, the *ether*.

Summary

The examined method for measuring the absolute velocity in the *ether* is not the only one in existence, but it's the first one in which the real results were obtained. Further study in this direction is the absolute necessity which will result not only in creation of the qualitatively new types of devices and mechanisms, but also in our better understanding of the world around us. This will definitely bring physics, technologies and engineering up to a totally new level.

The paper contains just preliminary information, but even this modest amount is sufficient for scientists, interested in solving the "*ether*" problem and returning it into the science. Now every interested party can verify our calculations, repeat our experiments so as to confirm or refute the results we obtained, and possibly suggest better technical solutions.

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P.S. The video report about the conducted experiments and the program for calculation of the direct Doppler effect and the Radar effect are provided on the website of the Institute of Rhythmodynamics (http://rhythmodynamics.com).

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