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L I G H T - M O V E M E N T OF PHOTONS OR O S C I L L A T I O N S OF ETHER ?

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In wave theory, the speed of light is determined by the properties of the medium and does not depend on the movement of the source, and the Doppler effect determines the frequency changes when the source moves and when the receiver moves by two different formulas $\nu = \frac{\nu_0}{1 - \frac{V}{C}}$ *and* $\nu = \nu_0(1 + \frac{V}{C})$.

The article shows that the ethereal Doppler effect in optics is used erroneously, because it is assumed that light propagates in a medium in the same way as sound propagates in air or water. An effect extended to the ballistic hypothesis is proposed, according to which, when the light source moves, the frequency is determined by the same formula $\nu = \nu_0(1 + \frac{V}{C})$ *as when the receiver moves.*

The extension of the effect to the ballistic hypothesis makes it possible to consistently explain all known optical phenomena and prove that the cosmological redshift occurs without the recession of galaxies and the myth of the Big Bang.

In **1842**, Doppler proposed formulas for determining the frequency of oscillations:

$\nu = \frac{\nu_0}{1 - \frac{V}{C}}$ - in the case when the **source** moves relative to the medium at a speed **V,** and

$\nu = \nu_0(1 + \frac{V}{C})$ - in the case when the **receiver** moves relative to the medium at a speed V.

The changes of frequency when the the source moves and when the the receiver moves are **different** only because the oscillations propagate in the medium and this speed does not depend on the movement of the source. In **1850**, the Doppler effect was experimentally confirmed for **sound**, and since it was assumed that **light** propagated through the ether in the same way that **sound** propagates in air, the Doppler formulas were applied to the propagation of light. Since then, it has been generally accepted that the movement of the **light source** and the movement of the **receiver** lead to a **different** change in frequency.

Developed on the basis of the theory of ether, the Doppler effect is still used in determining frequencies in all situations with movements of the light source and receiver.

It is shown below that the use of the ethereal Doppler effect in the analysis of light propagation is erroneous and instead of it, the effect extended to the ballistic hypothesis should be used, according to which, both when the light source moves and when the receiver moves, the frequency changes in the same way, that is, when the source moves, the frequency is determined the same formula $\nu = \nu_0(1 + \frac{V}{C})$ as when moving the receiver.

Doppler effect in wave theory

In **the wave theory**, **light** is the oscillations of the **ether**. A stationary source creates oscillations of frequency ν_0 in the **ether**, which, with an oscillation period T_0 and a wavelength λ_0, propagate in the ether at a speed **C**. A stationary receiver sees the oscillation period T_0 and frequency ν_0.

When the receiver is moving:

When a **receiver moves** towards a stationary source at a **speed V**, oscillations relative it go at speed (**C** + **V**) > **C** and with a wavelength λ_0 and the receiver sees an increased frequency $\nu = \nu_0(1+\frac{V}{C})$. **(1)**

When the source is moving:

When a **source moves** towards a stationary receiver at a **speed V**, it seems to catch up with the oscillations and for each period of oscillations T_0 the wavelength decreases by VT_0. The oscillations come to a stationary receiver at a speed **C** and a wavelength CT_0-VT_0 and the receiver sees the frequency $\nu = \frac{\nu_0}{1-\frac{V}{C}}$. **(2)**

It can be seen from a comparison of expressions (1) and (2) that when the source moves, the frequency changes somewhat more than when the receiver moves.

Example:

A source with a speed of **V**=**20** m/s (**72** km/h) approaches a fixed receiver and emits light at a frequency of ν_0 = **600** THz (**600,000,000,000,000** Hz).

According to the formula $\nu = \nu_0(1+\frac{V}{C})$, the frequency increases to **600 000 040 027 691.423** Hz

according to the formula $\nu = \frac{\nu_0}{1-\frac{V}{C}}$, the frequency increases to **600,000,040,027,694.094** Hz,

that is, in the second case, the change in frequency is greater by only **2.67** Hz,

At the speed of the source V=**200** m/s, the difference in frequencies is equal to **267** Hz.

When moving at the same speed:

More importantly, **in the case when the source and receiver are moving at the same speed V**, in accordance with formulas (1) and (2), the **frequency** should **not change** at all. That is, the ethereal Dopder effect states that in the case when the relative speed between the source and the receiver is zero, the frequency does not change and the receiver sees the frequency ν_0. Changes in frequencies when moving at the same speed **V** are shown in Fig.1.

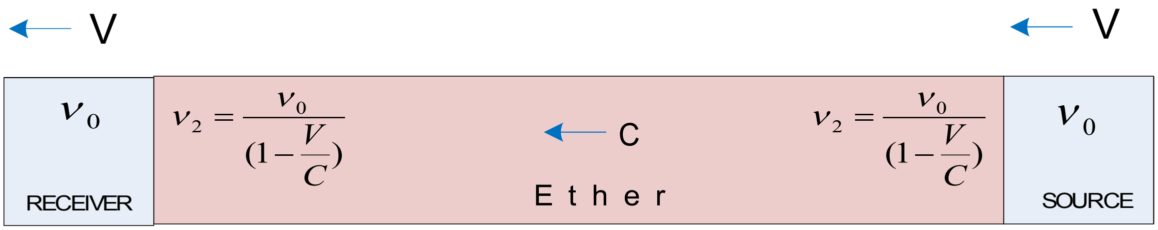

Fig.1

When t**he source and receiver are moving** relative to the ether with the same speed **V**, and the **receiver moves ahead**, oscillations in the ether go at a speed of **C** and with a reduced wavelength. Meeting with the receiver, the oscillations lower the frequency to ν_0,

If the **source is moving ahead** (Fig. 2), the vibrations in the ether go with an increased wavelength and increase the frequency to ν_0 when they meet with the moving receiver.

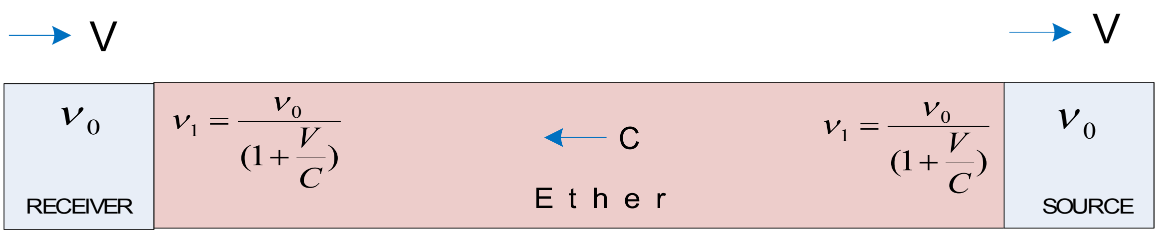

Fig.2

The so-called formula **for the general case** is always given $\nu = \nu_0 \frac{(1+\frac{V_1}{C})}{(1-\frac{V_2}{C})}$, **(3)**

when the sourceand receiver simultaneously move at **different** speeds V_1 and V_2 .

In practice, the most interesting case is when the source and receiver move in **the same direction** with the same speed **V**. If instead of different velocities V_1 and V_2 in the formula [3] we substitute one value V and - taking into account that the source and receiver are moving in the same direction - to change the sign in the numerator or denominator, the frequency is equal to the frequency ν_0/

Since oscillations can only propagate in a medium, the motions of a light source and receiver in a vacuum are not considered in the wave theory.

The conclusion of the ethereal wave theory that the frequency of light does not change at the same speed of the source and receiver **is erroneous** and can be verified experimentally.

It is shown below that the replacement of the ethereal Doppler effect by the effect extended to the ballistic hypothesis, i.e. the replacement of the ethereal formula $\nu = \frac{\nu_0}{1-\frac{V}{C}}$ by the formula

$\nu = \nu_0 (1 + \frac{V}{C})$, makes it possible to explain the Doppler nature of the cosmological redshift without the myths of the theory of relativity.

Our understanding of the nature of light

Before considering situations with the movements of a light source and a receiver, let's try to imagine **what light is**.

When we look at a sunbeam, at the light of a lamp, or even at a laser beam, we cannot imagine what is moving in the beam and at what speed. What and how do we see? Something flies out of illuminated objects and enters our eyes? Is light the "outflow of atoms" from objects, as Pythagoras supposed? Or do we see light because something flies out of our eyes, as it was argued after Aristotle for a thousand and a half years?

How to imagine that something is moving in the beam with a speed of 299 792 458 m/s? But already in the **19**th century, when it was believed that light was vibrations of the ether, Fizeau and Foucault were able to measure this speed quite accurately.

So what moves in the beam? Does laser force ether to oscillate and works like microphone? Of course not, since it is already known that light does not need any medium to propagate and it can propagate in absolute vacuum.

Everything was simplified when the **laser** was invented in **1960** and pulsed lasers appeared almost immediately. If the laser is turned on, for example, for one nanosecond, the leading edge of the light pulse will start to emerge from it at a speed **C**. By the time the trailing edge of the pulse comes out, the leading edge will have traveled a distance of one feet, that is, the laser will create a pulse of light - a beam 1 feet long. The impulse is moving too fast to be seen, but it can be photographed. And already in **1971**, Michel Dugua photographed a laser pulse in water using a high-speed camera. I photographed the «light on the fly».

Physicists create and use pulses whose length does not exceed how many wavelengths of light. A short laser pulse makes it **possible to measure the speed of light** in the laboratory - by the time passed by the pulse of the specified distance, it is possible to accurately determine the speed of its movement.

It is now known that no luminiferous medium is required for light, and the light can move in the void. At the same time, light exhibits wave properties. In quantum physics, instead of the ethereal wave theory, corpuscular-wave dualism is adopted, according to which photons, depending on the conditions of observation, exhibit the properties of classical waves or the properties of classical particles.

In all situations, we consider **light as a stream of photons** - fundamental particles **emitted from a light source** at a speed **C** relative to the source.

Unlike Newtonian corpuscles, each photon is characterized by its own frequency, spin, is polarized and exhibits "wave properties". But since photons are neutral particles and do not interact with each other, these "wave" properties - interference and diffraction - appear only when photons are absorbed by atoms of an opaque screen.

It is generally accepted that a photon is a massless particle (the theoretical value of the mass is less than

10 -20 eV/s2). But since the photon has momentum, we believe that in fact its mass is not zero and will be measured in the future. In a vacuum, photons move in a straight line with a speed C relative to the source until they meet the reradiating atoms of the medium

Photons **in vacuum** always move at a speed C relative to the source. Why? We do not know, but we consider it as a **property of atoms** to radiate (shoot) each photon only at a speed of C. But in nature, there is practically nowhere absolute emptiness. With speed C, the emitted photon moves only until it meets the atoms of the re-emitting medium, and in the air it is immediately **re-emitted** and relative to the air it travels with the speed **C / n**.

By **reemission of photons** by the medium we mean the following. A photon exits a **stationary laser** at a speed **C** and moves with this speed by inertia in a vacuum until it meets the **first air atom**. Meeting with an atom of air at a speed of **C,** the photon is absorbed by the atom and gives its momentum to the electron of the atom. After some delay, the electron emits a new photon at the same speed C, with the same momentum and in the same direction. The photon moves at speed C until it meets the next re-emitting atom, is absorbed by it, lingers for the time of re-emission, and is again radiated at speed **C** in the same direction. Such a **mechanism of reemission** simply explains the motion in the medium with the speed **C**/n and the **fac**t that a photon always leaves glass or water with the speed **C** and **with this speed C** moves in the vacuum until it meets the new medium. The fact that the photon leaves the medium not with the speed **C/n,** but with the speed **C**, unequivocally proves that the photon always moves between the atoms of the medium with the speed **C**.

The movement of the light source and the extended Doppler effect

A **stationary** laser emits, "shoots" photons of frequency ν_0 at a speed of **C**. A monochromatic beam comes out of the laser - a stream of photons of frequency ν_0. Does anything change when a laser with a speed **V** moves relative to a given inertial frame?

When the laser moves relative to a given inertial frame, exactly such photons of frequency ν_0 are emitted from it. The moving laser "shoots" the same photons of frequency ν_0 and these photons move **relative to the laser** with the same speed **C** as they do relative to the stationary laser. At the **moment of emission** by a moving laser, the **frequency and wavelength** of photons **do not change,** as happens when a sound source moves in wave theory.

The fact that relative to a moving laser photons move with the same speed **C** means that relative to a given inertial frame and medium, photons at the moment of radiation move at a speed of **C+ V,** and not **C**, as in the ethereal wave theory.

It is obviously **absurd to assert** that the photons emitted by a moving laser do not move with a speed of **C + V**, but with a speed of **C,** since one would have to admit that in this case the laser emits photons not with a speed of **C**, but with a speed of **C-V**. What, **do the atoms feel that the laser is moving** (even if it is moving very slowly), and therefore "shoot" photons at a lower speed?

In all cases, **at the moment of emission**, photons do not change their frequency and move relative

to the source at a speed of **C**, and not at a speed of **C-V**, as in the ethereal wave theory.
Photons have a frequency ν_0 , relative to a stationary medium, they travel at a speed of C+V. When photons meet the atoms of the medium, they change the frequency from ν_0 to $\nu = \nu_0(1+\frac{V}{C})$ and with such a frequency go to a stationary receiver. That is, when the source moves, the frequency changes in the same way as when the receiver moves.

In vacuum, frequency changes occur only with the relative motion of the light source and the receiver. If the source and the receiver are moving with the same speed V relative to the given inertial

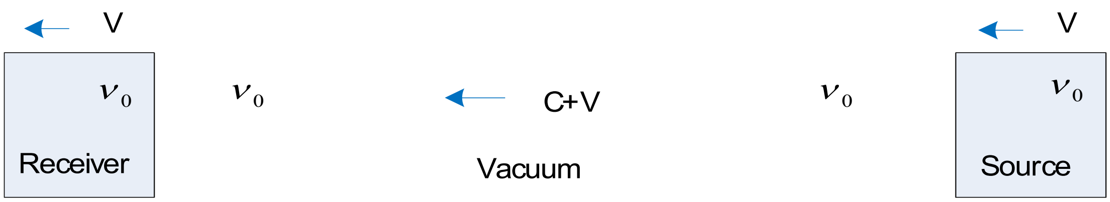

Fig. 3

frame, photons of frequency ν_0 go to the receiver with the speed **C+V** relative to the frame and the receiver sees unchanged frequency (Fig.3).

The change in frequencies when the light source and receiver move at the same speed V in the air is shown in Fig.4.

At the moment of emission by a moving laser, photons of frequency before meeting with air atoms move in a vacuum with a speed of **C relative to the lase**r and with a speed of **C + V relative to air**.

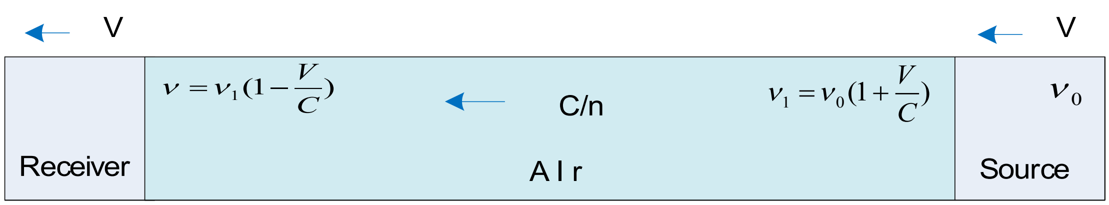

Fig. 4

Meeting with the first atoms of the medium at a speed of **C + V,** photons are re-emitted and their frequency rises from ν_0 to $\nu_1 = \nu_0(1-\frac{V}{C})$. After re-emission by air atoms, the speed of photons changes from **C + V** to the average value of the speed equal to **C / n**. With the speed **C/n**, the photons arrive at the receiver moving with the speed **V** and reduce the frequency from $\nu_1 = \nu_0(1-\frac{V}{C})$ to

$$\nu = \nu_1\left(1-\frac{V}{C}\right) = \nu_0\left(1+\frac{V}{C}\right)\left(1-\frac{V}{C}\right) = \nu_0\left(1-\frac{V^2}{C^2}\right).$$

If the laser and receiver move in the opposite direction, the laser is in front (Fig.5), photons exit the laser at a speed of **C** relative to the laser and relative to the air at a speed of **C-V,** then they are re-emitted by air atoms and reduce the frequency to $\nu_2 = \nu_0\left(1-\frac{V}{C}\right)$.

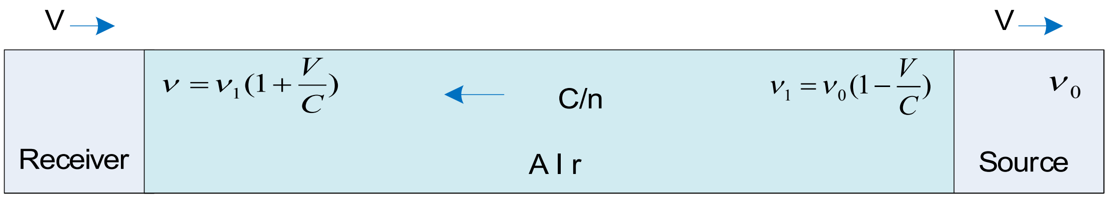

Рис.5

With this frequency $\nu_2 = \nu_0\left(1-\frac{V}{C}\right)$, photons go to the receiver and, meeting with it, increase the frequency to $\nu = \nu_2\left(1+\frac{V}{C}\right) = \nu_0\left(1-\frac{V}{C}\right)\left(1+\frac{V}{C}\right) = \nu_0\left(1-\frac{V^2}{C^2}\right)$.

Thus, **in both cases**, after a double re-emission, the **photon frequency** changes by a factor $\left(1-\frac{V^2}{C^2}\right)$ and **turns out to be less than** ν_0.

The situation when the source and receiver move with the same speed **V** relative to a stationary medium is obviously **similar** to the situation when the light source and receiver are stationary and the **re-emitting medium moves relative to them** at a speed **V**.

The mechanism of photon re-emission by a moving re-emitter described above made it possible to explain the **cosmological redshift** without Lemaitre's fantasies about the recession of galaxies and the Big Bang [2, 3]. Briefly, this explanation boils down to the following.

Each time a star's light passes through a moving mass of gas or atmosphere of a moving planet or star on its way to Earth, its frequency changes by a factor of $\left(1-\frac{V^2}{C^2}\right)$.

If photons encounter a gas cluster moving towards them, they are re-emitted, increase in frequency from ν_0 to $\nu_1 = \nu_0\left(1+\frac{V}{C}\right)$, and pass through the cluster at an increased frequency.

Leaving a moving gas cloud, photons meet with atoms of a stationary interstellar medium at a speed of **C-V**, are re-emitted by them and lower the frequency to the value

$$\nu = \nu_1\left(1-\frac{V}{C}\right) = \nu_0\left(1+\frac{V}{C}\right)\left(1-\frac{V}{C}\right) = \nu_0\left(1-\frac{V^2}{C^2}\right)$$

, that is, photons come to the Earth with a reduced frequency - a redshift occurs (Fig. 6).

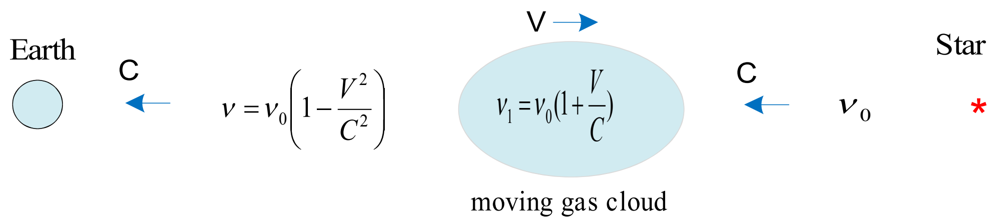

Fig.6

If photons meet with a gas accumulation moving towards the Earth (Fig. 7), they reduce the frequency from ν_0 to the value $\nu_2 = \nu_0\left(1-\frac{V}{C}\right)$, leave the moving accumulation with such a frequency and, entering the stationary interstellar medium, are re-emitted by the atoms of the medium and increase the frequency to the value ,
that is, in this case, the frequency decreases and a redshift occurs.

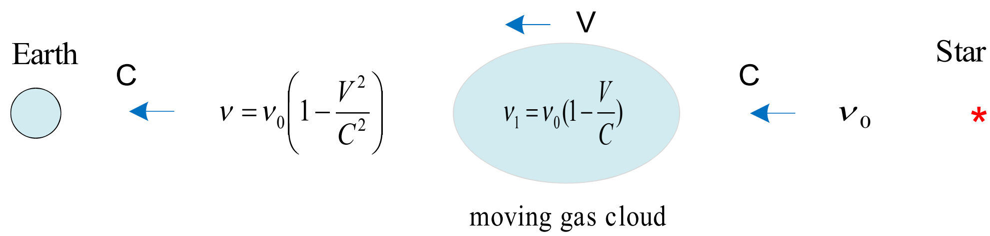

Fig.7

Thus, irrespective of the direction of movement of the gaseous cluster, with each reemission, the frequency of photons - in accordance with the extended Doppler effect - decreases, changing by a factor $\left(1-\frac{V^2}{C^2}\right)$.

Obviously, with each re-emission, the frequency of light decreases very slightly, but on a long journey from galaxies, photons are re-emitted by moving clusters many times. The magnitude of the shift turns out to be the greater, the further the galaxy is from the Earth, and the cosmological redshift turns out to be the way astronomers see it.

The cosmological redshift has a Doppler explanation, but it arises not because of the mythical recession of galaxies, but because of the re-emission of light by moving accumulations of intergalactic gas.

Conclusion

The effect proposed by Doppler 180 years ago makes it possible to determine the frequency of oscillations if the oscillations propagate in a medium and their speed does not depend on the movement of the source. In accordance with the wave theory, the change in frequency during the movement of the source is determined by a formula different from the formula for the case with the movement of the receiver, and therefore the frequency can change **only** in the case of relative movement of the source and receiver.

The Doppler effect is still erroneously applied in optics and should be replaced by the extended Doppler effect based on the ballistic hypothesis, which perfectly describes all optical phenomena with the movement of the light source and the receiver and allows you to explain the phenomenon of cosmological redshift without myths about the recession of galaxies and the Big Bang.

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