the general science journal

PHOTON

Feliks F. GORBATSEVICH

Geological Institute of the Kola Science Centre RAS, 184209, Apatity, Murmansk region. St. Fersmana 14, Russia
E- mail: gorich2608@yandex.ru

Annotation. The photon is the most important structural unit of the universe energy. Thanks to the streams of photons, astronomers know the structure and limits of the universe. It has been established that photons propagate in vacuum at a speed of *C* = 299792458 m/s and have no rest mass. It is shown that similar properties of a photon are explained by the presence of an ethereal medium and its wave excitation. A visual interpretation of the dual corpuscular-wave nature of photons is given. The availability of an ethereal medium makes it possible to explain all the essential properties of a photon.

Key words: photon, impulse, electromagnetic and shear waves, ethereal medium.

The term "photon" was coined by Gilbert Lewis in 1926, although the concept of light in the form of discrete particles has been around for centuries and was formalized in Newton's construction of the optics science. However, in the 19th century, the wave properties of light (which generally means electromagnetic radiation) became clearly evident [1]. In modern literature, the concept of "photon" is most likely referred to particles of light in the optical range. The concept of "quantum" is applied to high-energy pulses of the electromagnetic waves spectrum.

Photons bring light and life-giving energy from the Sun to our planet. Thanks to the streams of photons, we know the limits of the universe. The photon is the most important structural unit of the universe energy. In fundamental works [2-4] a photon is presented as a discrete pulse (quantum) of electromagnetic energy propagating in the interstellar space of the vacuum.

The sources [2, 3, 5] state that photons manifest themselves as a particle and a wave at the same time. They move at a constant speed *C* = 299792458 m/s in empty space. A photon overcomes vast astronomical spaces of millions of light years without noticeable changes in its structure. It has zero mass and rest energy. The photon is electrically neutral. It can be emitted by the electron shells of atoms. It can also be absorbed by them [3].

The photon carries energy, which is related to the frequency f and the constant $\hbar$:

$$E = \hbar f, \tag{1}$$

where $\hbar = 6.62 \cdot 10^{-34}$ j/s, Planck's constant.

A photon exhibits particle-like interactions when colliding with electrons and other particles. For example, it demonstrates this quality in the Compton effect, in which light quanta collide with atoms, causing the release of electrons [3].

It is generally accepted [2, 3, 5] that a photon is an elementary particle, despite the fact that it has no mass. By itself, it cannot decay, although the energy of a photon can be transferred (or created) by interacting with other particles. In the referred works it is mentioned that it has not yet been possible to give a clear interpretation of the dual corpuscular-wave nature of photons.

By analogy with the laws of mechanics, in order to explain such properties of a photon, it is necessary to recognize the existence of a material medium in which a wave can propagate with a certain and constant speed. According to [5], "A wave considered in classical physics is a process that is always associated with some material medium that carries the wave: sound waves in air, elastic waves in a liquid, etc. Waves, therefore, can be defined as the state of the material medium that carries them".

The propagation of electromagnetic waves, photons of light, X-rays, etc. is most logically explained by the presence of an ethereal medium [6]. In this medium electromagnetic waves of any frequency propagate with the same precisely set speed. They have zero mass and rest energy, at the same time, having the ability to carry significant power in a wave. This is indicated by the strength of the manifestation of atomic and nuclear explosions. Observations of the diffraction and interference of light, carried out by A. Fresnel and subsequent researchers, convincingly showed the presence of wave properties of photons [1]. The behavior of a photon as a particle can be explained by the fact that a photon has the form of an impulse limited in space. Based on the foregoing, a photon is a short pulse with harmonic filling with electromagnetic oscillations of frequency f.

It is known that the displacement vectors **E** and **H** in an electromagnetic wave are mutually perpendicular and are always directed along the normal to the direction of its propagation. In the ethereal medium, various types of shear deformations are realized, but there are no compression-tension deformations [6].

Shear acoustic waves have relatively many properties in common with those of electromagnetic oscillations [7–11]. Just as in an electromagnetic wave, displacements in an acoustic wave occur in a direction perpendicular to the orientation of their propagation. Acoustic shear waves propagate only in a solid body.

The results of the analysis of a large number of observations of the shear oscillations propagation in solid media and the known recorded optical phenomena [7–15] allow us to make a primary classification of common and different phenomena that accompany of these types of oscillations. Common features, the description of which in many cases is mathematically adequate for two types of radiation propagating in anisotropic media, are:

- the phenomenon of birefringence for electromagnetic and a similar phenomenon for acoustic [11, 15];
- the phenomenon of pleochroism (dichroism) for electromagnetic and the effect of linear acoustic anisotropy of absorption (acoustic pleochroism) for acoustic [10, 13];
- optical activity (electromagnetic oscillations) and rotation of the polarization vector (acoustic oscillations) [9, 12];
- an increase in the ellipticity degree of polarized two types of oscillations as they propagate in a randomly inhomogeneous medium [12, 16].

However, each of these manifestations has the following characteristics:

- electromagnetic oscillations have dispersion (waves of different lengths propagate in material media at different speeds), and during the propagation of acoustic oscillations, dispersion manifests itself to a lesser extent [2, 10, 17];
- properties, for example, dielectric permittivity, which determine the wave surface of electromagnetic oscillations for the most low-symmetry medium, are described by a tensor of the second rank (6 components), however, the elasticity properties, which determine the surface of acoustic oscillations of the lowest-symmetry medium, are described by a tensor of the fourth rank (21 constants) [2, 11];
- the number and spatial position of the symmetry elements of the medium during sounding by vibrations of both types often do not coincide, the number of elastic symmetry elements, as a rule, is greater [18, 19];

- there is a class of heterogeneous media (minerals, rocks, textured materials), where the effect of linear acoustic anisotropy of absorption is recorded very often [10], optical pleochroism (dichroism) in natural media is less common [12, 13];

- there is a class of media where optical activity is strongly manifested [2], with the propagation of acoustic oscillations, the effect of rotation of polarization vector has so far been recorded only at high oscillation frequency [9];

- some liquid media at ordinary temperatures and pressures are good conductors of shear oscillations at high frequencies (0.5-1.0 MHz and higher) [10].

Thus, during the propagation of light, electromagnetic and elastic shear waves, many similar, close phenomena are observed, showing the existence of common elements in the structure of both a solid body and ether. The above list of common and different phenomena and signs of interaction with the environment of electromagnetic and acoustic vibrations is not complete.

Figure 1 shows a shear wave pulse recorded on the screen of an ultrasonic flaw detector. Just like photons, shear acoustic waves have zero mass and rest energy, but they can carry a certain amount of energy. Their propagation velocity is determined by the characteristics of the solid [10, 11].

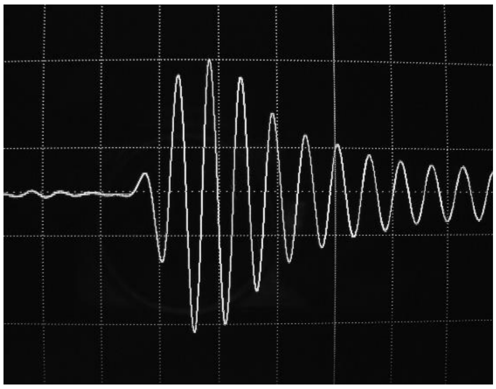

Fig. 1. Acoustic plane polarized pulse of a shear wave propagating in a solid.

Close and similar phenomena observed during the propagation of light (electromagnetic) and elastic shear waves (pulses) allow us to represent a photon as a pulse with harmonic filling by an electromagnetic wave. Figure 2 shows the shape of the phases of oscillations of a plane polarized photon. In the case of linear polarization, the particles of the ethereal medium are sequentially displaced in one plane in the orientation perpendicular to the direction of propagation. Ether particle displacements occur in a straight line in one direction, and then in the opposite direction. This happens with the component of the intensity vector **E** and the magnetic induction vector **H**. The number of harmonic periods filling of the pulse, its length, depending on the photon energy, can be different. The shape of the pulse envelope is determined by the conditions of its radiation. According to Bohr's model of atomic structure, the energy of a photon and its frequency emitted by the outer shells of electrons (formula (1)) will be less than the inner ones [3].

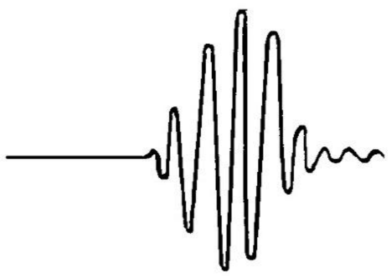

Fig. 2. General view of a plane polarized photon with harmonic filling by an electromagnetic wave.

Acoustic shear pulses also can acquire elliptical and circular polarization. Moreover, the latter can be both left and right circular [10]. Numerous experiments [12, 15, 20] have established that photons, like shear acoustic pulses, can exhibit linear, elliptical and circular polarization. Moreover, this happens with the **E** component, as well as with the **H** component. With the types of polarization, elliptical and circular, the particles of the medium make displacements in the form of an ellipse and a circle. In Figure 3 successively shows the types of photon polarization, in which the particles of the ethereal medium make different types of displacements from the initial position.

Figure 3a schematically shows the cross section of a linearly polarized photon. The vibrations carried by a photon occupy a certain volume as shown in its cross section. The passage of the wave is accompanied by the deviation of the ether particles from the equilibrium position, first in one direction, then in the opposite direction along a straight (conditionally vertical) line. The largest displacements occur in the central part of the section, which is reflected by the thickness of the arrows. Figure 3b shows the elliptical polarization of a photon. In this case, the displacement vector of particles sequentially rotates clockwise. When rotated by 90^0, the magnitude of the vector is only a fraction of the vertical. This explains the ellipticity of the photon cross section.

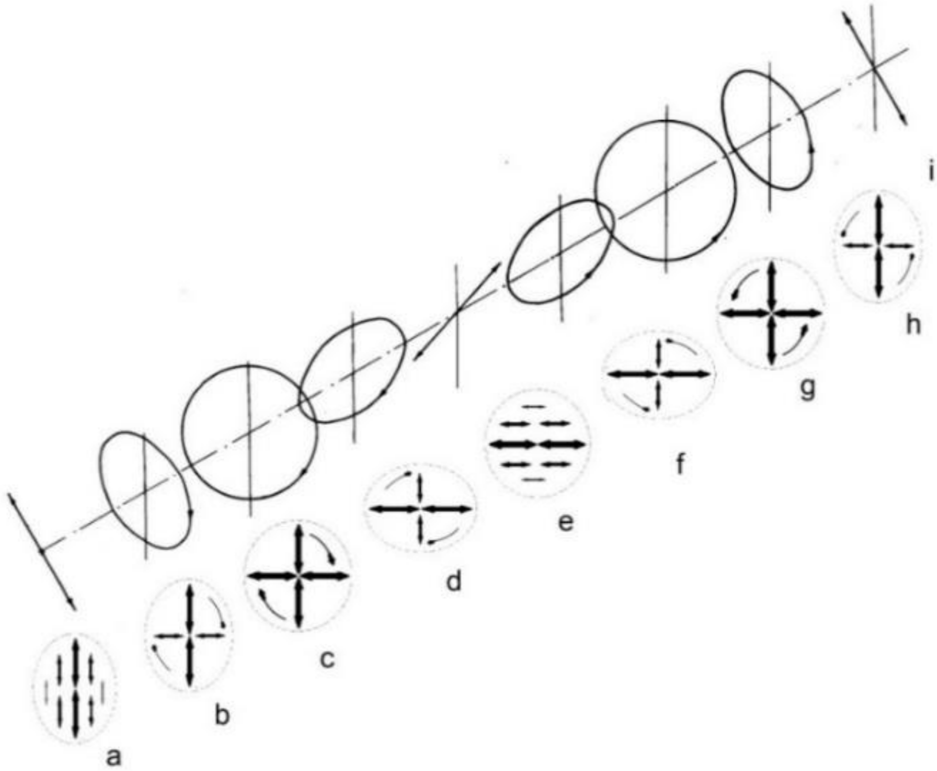

Fig. 3. Types of photon polarization: linear, elliptical, circular.

The next diagram, Fig. 3c shows the cross section of a photon in circular polarization. In this case, the particle displacement vector of the medium does not change its value when it is rotated clockwise within 360^0. Thus, with circular polarization, the contours of a photon are a helical figure. A conditional reconstruction of the contour of a circularly polarized photon is shown in Fig. 4. When a photon arrives at a point in space, the initial value of the displacement vector is small, then its value reaches a maximum and then decreases, as in the case of linear polarization (Fig. 2).

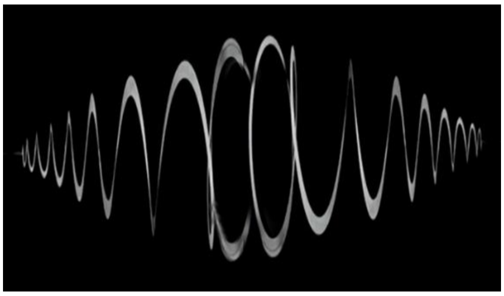

Fig. 4. Reconstruction of a circularly polarized photon.

Further in Figs 3d-3h the cross sections of all possible types of photon polarization are shown. For example, Fig. 3d is a cross section of a photon with its longest axis directed horizontally. The next Fig. 3f depicts the cross section of a linearly polarized photon with conventionally horizontal displacements of the medium particles. Scheme Fig. 3f is a cross section of a photon with the largest diameter of the ellipse oriented in the horizontal direction; but with particles shifted counterclockwise. The following Figs 3g and 3h show the cross sections of photons of circular polarization and vertically oriented elliptical. In this case, the displacement of ether particles occurs counterclockwise.

White light, such as that propagating from the sun, contains all kinds of photon polarizations. With special devices, polarizers of various types, from the total flow of white light, photons of a certain polarization can be allocated, that is shown in Fig. 3 [12, 14, 15, 20].

Conclusion

The representation of a photon as a discrete pulse (quantum) of electromagnetic energy propagating in the vacuum of interstellar space outside the material environment does not correspond to the observed facts. Such pulses would have different propagation speeds and would not have wave properties. Similar processes from acoustics show that the propagation of acoustic shear oscillations of different frequencies with the same speed is possible in solid media with certain elastic-inertial properties [8]. Similar optical polarization phenomena clearly indicate the presence of a medium that also exhibits the elastic-inertial properties of a quasi-solid body. The ether is such a medium [6]. The ether contains the amount of energy carried by a photon during its propagation. In the absence of such a medium, there are no ground for explaining the known properties of photons.

Proposed concept of a photon (quantum) of electromagnetic energy corresponds to its basic properties. A photon is a limited impulse with harmonic filling by an electromagnetic wave. Therefore, it simultaneously exhibits the properties of both waves and particles. Photons of different frequencies propagate in the ethereal medium at a constant speed *C*. It can exist only in motion or otherwise have zero mass. This confirms the fact that the photon is a local perturbation of the ethereal medium. The displacement vector of ether particles is always directed along the normal to the direction of photon propagation. The frequency of its wave is fixed in a wide range. The energy transferred in the disturbed ethereal medium increases in proportion to its frequency. Accordingly, the pulse length also increases in proportion to the frequency. It can exhibit all types of polarization that can be detected by optical devices. The presence of an ethereal medium makes it possible to explain all the essential properties of a photon. Photons are emitted and absorbed by the orbital electrons of atoms. The mechanism of their emission and absorption is of particular interest and is not considered here.

References

1. Whittaker, E. A history of the theories of aether and electricity. Thomas Nelson and Sons Ltd. London, Edinburg, Paris, New York, 1910.
2. Born, M. and Wolf, E. Principles of optics. Pergamon Press, Oxford, London, New York, Paris, 1964.
3. Sivukhin, D.V. General course of physics. Vol. IV. Optics. Moscow. FIZMATLIT, 2005 (In Russian).
4. Putilov, K.A., Fabrikant, V.A. Physics course. Vol. 3. Moscow. FIZMATLIT, 1963 (In Russian).
5. Zisman, G.A., Todes, O.M. Course of general physics. Vol. 3. Moscow. FIZMATLIT, 1970 (In Russian).
6. Gorbatsevich, F. The Ether and Universe. VDM Verlag, Saarbrucken, 2010. http://www.amazon.com/s/ref=nb_sb_noss?url=search-alias%3Dus-stripbooks-tree&field-keywords=Gorbatsevich&x=10&y=20
7. Sommerfeld, A. Mechanik der deformierbaren medien. 6 Auflage. Leipzig, Geest & Portig K.G., 1970.
8. Babakov, I.M. Theory of vibrations. Moscow. Nauka, 1968 (In Russian).
9. Ermilin, K.K., Lyamov, V.E. and Prokhorov, V.M. Polarized effects in linear and non-linear acoustic crystallography. Akusticheskiy Zhurnal, Vol. 25, 2, 1979, pp. 161-179 (In Russian).
10. Gorbatsevich F. Acoustopolariscopy of Minerals and Rocks. VDM Verlag, Saabrucken, 2009. http://www.amazon.com/Acoustopolariscopy-Minerals-Rocks-Feliks-Gorbatsevich/dp/3639136373/ref=sr_1_10?s=gateway&ie=UTF8&qid=1285747327&sr=8-1011.
11. Nye, Y.F. Physical properties of crystals. Oxford. Claredon Press, 1964.
12. Shurkliff, W.A. Polarized Light. Harvard University Press, 1962.
13. Smith, G.F.H. Gemstones. London, Chapman and Hall, 1972.

14. Zhevandrov, N.D. Application of polarized light. Moscov. Nauka, 1978 (In Russian).
15. Frocht, M.M. Photoelasticity. Moscow-Leningrad. Vol. I. Izdatel’stvo OGIZ, 1948 (In Russian).
16. Gorbatsevich, F.F. The phenomenon of shear wave depolarization in anisotropic heterogeneous media. Physics of the Earth, No. 6, 1998, pp. 83-90 (In Russian).
17. Korsunsky, L.N. Propagation of radio waves by satellite communications. Moscow. Izdatel'stvo Sov. Radio, 1971 (In Russian).
18. Farnel, G.W. Elastic waves in trigonal crystals. Can. J. Phys. Vol. 39, 1961, pp. 65-80.
19. Tröger, W.E. Optische bestimmung der gesteinbildenden minerale. Stuttgart, 1959.
20. Peisakhson, I.V. Optics of spectral devices. Ltningrad. Mashinostroenie, 1975 (In Russian).