Photon is an Electromagnetic wave

A. Einstein, postulating independence of speed of light of velocity of a source or the receiver, has avoided the answer to a question: what is light (an electromagnetic wave) and why its speed in space is limited. It is appear to us, that the answer to this question has fundamental significance and will mention many parties of modern physics. Attempt to find the answer to the put question is below given on the basis of returning concept of Ether in structure of the Universe on the modern basis.

Till now remains not clear, what is the electromagnetic excitation of vacuum as it is formed and propagated. Fig.1 help to imagine that process. The big black circle designates electron, making vertical fluctuations in a source along a vertical axis with arrows. The positive charge of a dipole nearest to it follows it in this movement. The negative charge (a black circle) next dipole is involved in this movement with the speed determined by frequency of electron fluctuations. . Process is propagated in vacuum with speed of light and for one second of electron fluctuation a deformation will be transferred in vacuum to distance 3.10^8 m as an electromagnetic wave. It will be shown below, that the length of a wave of " red border " radiation for photon vacuum coincides with $\lambda_{rb} = 2\pi r \cdot \alpha^{-1} = 1.204302 \cdot 10^{-12}$ m. It is visible, that the dipole distance of photon vacuum [Rykov, 2000] by all means enters as quantum of length of an electromagnetic wave. On fig. 1 into length of a wave enters 861 dipole distances. From here it is possible to imagine, as far as our drawing is approximate. From the given sizes it is possible to receive time of transfer of action from electron to the first charge of a dipole which repeats its fluctuations. The period of a wave is expressed by equality $\lambda/c=4{,}017119 \cdot 10^{-21}$ sec. Having divided the period on 861 dipole distances, we shall receive time of polarization of one dipole $T/861 = 4.665643.10^{-24}$ sec. We shall check up calculations by definition of speed of transfer of interaction: $c=2.997846.10^8$ m/s. That speed of light is received, anything surprising is not present. The result confirms that the given approach to the phenomenon of radiation and propagation of electromagnetic wave is true.

It is important to emphasize that the electromagnetic wave is not formed by a charge of one sign, and made of alternating elementary charges of opposite signs and their displacement (deformations). If it to not take into account, there can be a false notion, that the wave of excitation is formed by gradual growth or reduction of displacement of a charge of one sign. On the contrary, each dipole on a way of propagation passes process from minimal to the maximal displacement set by energy or frequency of an electromagnetic wave. The electromagnetic phenomenon is connected to alternation of charges of a different sign while gravitation is transferred by in phase fronts of charges of one sign [*Rykov*, 2000].

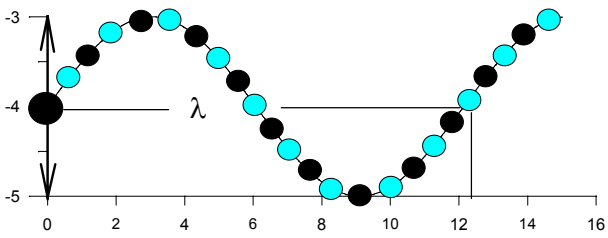

Fig.1. The drawing of formation of an electromagnetic wave in structure of vacuum.

From the point of view of physics of the beginning of XX century - amplitudes of waves should superposed. The photoeffect contradicted such notion. In A. Einstein's paper (1905) has explained the fact of dependence of a photoeffect from frequency of radiation and its independence of radiation brightness. The amplitude of deformation of dipoles of vacuum has to increase, it is necessary to increase speed of electron oscillations, represented in the beginning of coordinate "o", i.e. frequency of its fluctuations or to increase a charge of electron having presented that in one place can be simultaneously two and more electrons. The last one is impossible. Thus, all quantum phenomena are completely determined by a discrete structure of a matter and vacuum. Definitely, the discrete device of the world and presence of speed of light forbids simple addition of deformation of one dipole of vacuum under action of an electromagnetic field of any intensity.

The spectrum of electromagnetic radiation [*Physical encyclopedia*, 1998] is submitted in the table:

Frequency, Hz	Length of a wave, m	The name of a range	Sources
10^3	3.10^5	Radiowaves	Alternating currents in conductors and in electronic streams (generators of radio frequencies and the MICROWAVE)
10^{12}	3.10^{-3}	Infra-red radiation	Molecules and atoms at thermal and electric influences
$3{,}75.10^{14}$	8.10^{-7}	Seen light	
$7{,}5.10^{14}$	4.10^{-7}	Ultra-violet radiation, soft roentgen	Atoms under influence accelerated electrons
3.10^{17}	10^{-9}	roentgen and gamma - radiation	Processes in atoms under influence of the accelerated charged particles
3.10^{20} - 10^{23}	10^{-12} - 3.10^{-15}	gamma - radiation	Nuclear processes, radioactive disintegration, space processes

The table looks enough full. The structure of photon vacuum practically has constant lattice $2*1.4\cdot10^{-15}$ m. Here it is covered either a riddle, or the direct contradiction to idea of charged structure of vacuum. It is known, that " the red border " vacuum corresponds to length of a wave 1, 204367.10^{-12} m, that in 430,5 times more a constant lattice and any problems does not arise at interpretation. By the way, the ratio of well known magnetic induction quantum to the elementary charge magnetic induction is exactly the same! The matter is that in usual crystals with reduction of length of a wave of elastic waves up to a constant lattice speed of their propagation by virtue of clearing deformations of ionic units of a lattice should decrease up to zero. The problem arises at a question on how can exist and 3.10^{-15} m in the structure of vacuum accepted by us will be propagated a flat electromagnetic wave with such a length of a wave.

Besides it appears that in the same encyclopedia there are other data on gamma-quanta radiation with the big frequencies (smaller lengths of waves). These data are those (tables):

Frequency, Hz	Wave Length	Source
2.48935e+020	1.2043e-012	Soft radiation The excited nucleus, nuclear reactions
2.48935e+021	1.2043e-013	Annihilation, space beams and substance.
2.48935e+025	1.2043e-017	Rigid Brake, magnate-brake, electrons dispersion on photons and on relic radiation, disintegration of particles (peonies), annihilation.
2.48935e+028	1.2043e-020	Ultrahigh Energy
2.48935e+031	1.2043e-023	

First of all, there are questions on sources of rigid and more vigorous waves. It is accepted to speak any more about waves, and about photons. Their electromagnetic nature is established only at an alpha and beta decay of nucleus on absence of deviations in strong magnetic fields. In the first line of the table we have full concurrence to " red border " vacuum. The second line gives still chance of generation and propagation in charging structure of vacuum, and last three lines leave far for frameworks of possible "recognition" by photons vacuum as space of propagation. The further work on the given problem is necessary. A possible way - opening of a new nature of electromagnetic radiation as magnetoelectric, i.e. a wave movements of charges raise not, and generation electromagnetic wave in **a magnetic continuum** and formation, according to Maxwell formula, an electric voltage. The "local" stream of a magnetic induction is created, which proceeds from the small area of the vacuum limited to a closed surface "s". For such model of formation of an ultra short-wave magnetoelectric wave there is no necessity to consider quantum structure of vacuum. It is necessary to know properties of a "magnetic" continuum. For a scalar $E = cB$ ([Feynman, 1964]) or $\xi\eta = (\frac{E}{B})^2$, $B = \frac{1}{\eta}H$. Then it is received, that $\frac{\xi}{\eta} = (\frac{E}{H})^2$, where the connection of electric and magnetic constants of vacuum with a square of the relation of electric and magnetic strength is reflected. On the other hand electric intensity "E" is not equal to zero a case when an electric charge is inside a cavity $div\overline{E} = \xi q_k$ from which there is a stream "E". The conclusion follows, that the source of a magnetic induction creates a certain charge in a magnetic continuum, the size and which nature of it is not clear on this moment. It is probable, gamma – quantum of ultrahigh energy are formed in vacuum. However, the formula for the Plank

constant testifies, that it is determined both electric $\xi = 8.98755179 \cdot 10^9$, and magnetic $\eta = 10^7$ vacuum constants $h = 2\pi e_o^2 \alpha^{-1} \sqrt{\xi / \eta}$. It is necessary to expect that energy of photon also is defined, as well as in case of an electromagnetic wave as $w = h\nu$. Curious transformation of the given formula $h = 2\pi\alpha^{-1} \frac{E}{H} q_i^2$, i.e. the Plank constant is defined by the relation of anaphase amplitudes electric and magnetic strength's in an electromagnetic wave. In this case it looks like the characteristic of radiation. Actually, M. Plank has entered it namely for definition of intensity of radiation.

The electromagnetic wave can be excited by change of magnetic intensity or a magnetic induction, as it is well known. There are magnetic aerials of radiation and reception. But at lengths of the waves surpassing in tens, hundreds times a constant of the crystal lattice equal double dipole distance, problems are not present. They arise, when the length of a wave is comparable to size of that constant. Excitation of a magnetoelectric wave by formation of a vortex of intensity of a magnetic continuum of vacuum can give the decision of a problem.

As the first approach the decision of a task in view we will address to formulas Maxwell.

$\oint H_\ell d\ell = i_{con} + i_{disp}$ - Circulation of intensity of a magnetic field is equal to the sum of a current of conductivity and a current of displacement. That fact here is expressed that the magnetic field is distinct from zero both at moving electric charges, and at change of an electric field in time, i.e. $\oint H_\ell d\ell = i_{con} + \frac{\partial}{\partial t} \int_S D_n dS$.

$\oint E_\ell d\ell = -\frac{\partial}{\partial t} \int_S B_n dS$ - The fact of occurrence of an electric field at change in time of a magnetic field. From an induction of a magnetic field it is possible to replace integral by a full stream of a magnetic induction $\Phi = \int_S B_n dS$ from a source inside the closed surface. Also it is possible to rewrite the second equation this way: $\oint E_\ell d\ell = -\frac{\partial \Phi}{\partial t}$.

$\oint_S D_n dS = q$ - The stream of an electric induction through the closed surface is equal to a full charge inside this surface. The equation describes an electric field around of charges.

$\oint_S B_n dS = 0$ - A stream of a magnetic induction ($\Phi = 0$) through any closed surface which is not containing moving charges (absence of displacement currents!).

In the differential form of Maxwell equation will be to rewrite:

$rot\, \overline{H} = \overline{i_{np}} + \frac{\partial \overline{D}}{\partial t}$.

$rot\, \overline{E} = -\frac{\partial \overline{B}}{\partial t}$.

$div\, \overline{E} = \frac{\rho}{\varepsilon_o}$.

$div\, \overline{B} = 0$.

R. Feynman [1964] states this equations in the following form:

$div\, \overline{E} = \frac{\rho}{\varepsilon_o}$ - The stream of vector "H" through inside of the closed surface is equal to a charge.

$rot\,\overline{E} = -\frac{\partial \overline{B}}{\partial t}$ - The integral from a vector "E" on the closed contour is equal to change in time to a stream of an induction of a vector "B" through a contour.

$div\,\overline{B} = 0$ - The stream of a vector "B" through the closed surface is equal to zero (in case inside the closed cavity there are no sources of a magnetic field - монополи or variables a current - a comment of the author).

$rot\,\overline{B} = \frac{1}{c^2}(\frac{\overline{j}}{\varepsilon_o} + \frac{\partial \overline{E}}{\partial t})$ - The integral of a vector In on a contour is defined by a current in a contour and change in time of vector "E". Dimension is carried out then when the stream of a magnetic induction is entered $rot\,\overline{\Phi} = \frac{1}{c^2}(\frac{\overline{j}}{\varepsilon_o} + \frac{\partial \overline{E}}{\partial t})$, equal $\Phi = B \cdot S$.

The law of preservation of charge after Faraday occurs from 1. and 4.: $div\,\overline{j} = -\frac{\partial \rho}{\partial t}$ - The stream of the charge forming a vector of a current, through the closed surface is equal to speed of change of a charge inside it. But the most remarkable follows further. On R. Feyman (his treatment!) there is a calibration procedure by introduction of certain potentials $rot\,\overline{E} = -\frac{\partial}{\partial t} rot\,\overline{A} \rightarrow rot(\overline{E} + \frac{\partial \overline{A}}{\partial t}) = 0$ and $div\,\overline{A} = -\frac{1}{c^2}\frac{\partial \varphi}{\partial t}$ (Lorenz calibration). Change of "A" potential is entered due to addition of $grad\,\varphi$. The given operation is named by " calibration transformation ". At such calibration there is no infringement of Maxwell laws - the form of their representations only varies. In result it is received two wave equations for the description of an electromagnetic wave:

$\frac{\partial^2 A}{\partial x^2} - \frac{1}{c^2}\frac{\partial^2 A}{\partial t^2} = -\frac{j}{\varepsilon_o c^2}$ and $\frac{\partial^2 \varphi}{\partial x^2} - \frac{1}{c^2}\frac{\partial^2 \varphi}{\partial t^2} = -\frac{\rho}{\varepsilon_o}$ - For one coordinate. In three-dimensional space the equation enters derivatives on all three coordinates.

In the right parts currents and charges of environment are kept. We shall note the important circumstance - transition the right parts are equated for emptiness (vacuum) to zero. **So transition from ether to emptiness against Maxwell "will" was made.** It is accepted that electromagnetic waves are propagating in emptiness, instead of in the environment in which there can be charges and currents of displacement.

The wave equation can be received and without operation of calibration. We take 4 equation on R. Feyman's record with our specification:

$$rot\,\overline{\Phi} - \frac{1}{c^2}\frac{\partial \overline{E}}{\partial t} = \frac{1}{c^2 \varepsilon_o}\overline{j} = \frac{1}{\eta}\overline{j}.$$

The second equation gives us $rot\,\overline{E} = -\frac{1}{S}\frac{\partial \Phi}{\partial t}$. We shall make operation rot to a stream of an induction of a magnetic field - $rot(rot\,\overline{\Phi}) - \frac{1}{c^2}\frac{\partial}{\partial t}(rot\,\overline{E}) = \frac{1}{\eta} rot\,\overline{j} \rightarrow \frac{\partial^2}{\partial x^2}\overline{\Phi} + \frac{1}{c^2 S}\frac{\partial^2}{\partial t^2}\overline{\Phi} = \frac{1}{\eta} rot\,\overline{j}$. Have received the wave equation with a stream of a magnetic induction, not resorting to change of the form of record of Maxwell equations.

There is a problem of writing of the wave equation for a stream of electric intensity with the right part of a rotor of volumetric density of an electric charge. We shall have in this case all set of the mathematical description of an electromagnetic wave. It is possible to suspect, that in this case there is no volumetric density of an electric charge, and there is the vortex current determined by movement of some charge $j = \frac{dq_x}{dt}$ on a circle. For radiation with small frequencies in the decision of the wave equation the spherical wave is formed. However with growth of frequency the spherical or flat wave front can not be formed by virtue of restriction of speed of transfer electric and magnetic strengths on a surface of front by speed of light. So, for example, for frequency $2{,}4.10^{20}$ Hz the period of fluctuation will be about 4.10^{-21} sec. If the

surface of front is formed not faster, than with speed of light, the radius of a surface for the specified period will make only $4.10^{-21}*3.10^{8} = 1{,}2.10^{-12}$ meters that is comparable to the sizes of atoms. At high energy the front of a wave is so small, that it is easy for accepting as any particle. For the size of the front, equal double dipole of the vacuum structure there will correspond to frequency of radiation 10^{25} Hz. The specified estimations correspond to length of a wave of radiation, i.e. the formula is used $\lambda = r = c / f$. Thus, the length of a wave actually still testifies and restricts the sizes of wave front.

As magnetic strength are strongly connected to electric strength in electromagnetic radiation we shall receive the second wave equation concerning electric intensity $\frac{\partial^2}{\partial x^2}\overline{E} + \frac{1}{c^2 s}\frac{\partial^2}{\partial t^2}\overline{E} = \frac{1}{se_o}\Phi_o rot\frac{\overline{de_o}}{dt}$. Ratio between "E" and "Φ" is used and definition of an elementary stream of a magnetic induction here will be as $\Phi_o = e_o\sqrt{\frac{\xi}{\eta}} = 4{,}80320404\cdot 10^{-18}$ Weber. Some incorrectness was used at a choice of value of a charge $q_x = e_o$. We do not know existence of the elementary charge that is distinct from a electron charge (except for fractional charges of quarks which hardly are in a free condition in vacuum). As the closed surface the area "s" accepts a surface of sphere with radius of length of the wave, determining spherical front of a wave $s = \pi\lambda^2$.

Volumetric energy of an electromagnetic wave is $w = \frac{1}{2}(\frac{E^2}{\xi} + \frac{H^2}{\eta})\cdot V = \frac{E^2}{\xi}V = \frac{H^2}{\eta}V$.

More logically as volume to accept the cylinder directed along distribution of a wave. We'll have $V_{rb} = \pi(\lambda_{rb}\alpha)^2 d_{rb}$. Electric intensity for "red border» of vacuum is $E_{rb} = b\Delta r_{rb} / e_o = 7{,}329367465\cdot 10^{20}$ V/m [Rykov, 2000]. Energy of birth of pair electron and a positron is determined there as $w_{rb} = \frac{1}{\xi}E_{rb}^2 V_{rb} = 1{,}63742243\cdot 10^{-13} = 2m_e c^2$. From here we find the volume of deformation caused by a photon - a wave and we make an estimation of deformation as lengths of the cylinder $d_{rb} = \frac{V_{rb}}{\pi(\lambda_{rb}\alpha)^2} = 1{,}11975547\cdot 10^{-17}$ m, that slightly exceeds maximum possible deformation of structure of photon ether. The estimation is within the framework of our theory. So, we shall receive an end result of an estimation of energy of gamma - quantum $w = h\nu = \frac{\pi d}{\xi}(\alpha\lambda E)^2 = \pi\eta d(\alpha E/\nu)^2$. That, finally, speaks a magnetic constant of vacuum that gamma - quantum and its propagation is connected to a magnetic continuum of vacuum and restriction of propagation of an electromagnetic wave in size of a constant lattice of photon ether disappears. The pulse of an electromagnetic wave will be $p = \frac{w}{c} = \sqrt{\frac{\eta}{\xi}}\pi d(\alpha E/\nu)^2$. It coincides with a pulse of a photon $p = h\nu$ on value. **This remarkable coincidence proves our eventual result is physically correct.**

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Reference

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