On mass of a photon

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Abstract
In the article is shown, as the photons will be formed and the physical sense of a ratio between mass and energy is uncovered.

Problem of availability of mass for a photon the orthodoxies have complicated so, that can not in it's be disassembled, of what the reader can be convinced from this article. That also to me to not confuse the reader, we shall consider in the beginning arguments demonstrating absence of mass for a photon, and then we shall produce proofs that the photon all the same has mass. Here I shall quote the Physical encyclopedia under edition A.M. Prohorov, M., 1988 - desktop book of orthodoxies.

The photon has not mass. Here it is necessary to agree upon distinction so-called, rest-mass and relativistic mass, bound with motion of a particle with light speed. Apparently, that about a rest-mass of a photon it is impossible to reason, since if it to stop, the photon disappears, by transmitting the energy and angular momentum to ambient particles.

ФОТÓН (γ) (от греч. phōs, род. падеж phōtós — свет) — элементарная частица, квант эл.-магн. поля. Масса покоя Ф. m_γ равна нулю (эксперим. ограничение $m_\gamma < 5 \cdot 10^{-60}$ г), и поэтому его скорость равна скорости света. Спин Ф. равен 1 (в единицах $\hbar$), и, следовательно, Ф. относится

PHOTON (γ) - elementary particle, quantum of an electromagnetic field. A rest-mass P. m_γ is peer to zero point (experimental limitation $m_\gamma < 5 \cdot 10^{-60}$ g), and consequently its speed is peer to speed of light. A spin P. Is peer 1 (in terms of $\hbar$), … (v.5, page 354)

The availability of mass for a photon completely is disclaimed by followers of a relativity theory, since under this theory any mass can move only with up to light speed. If will appear, that the photon has mass, it is necessary to revise all relativity theory, though it is easier than it, in this case to reject. The followers of the exchange mechanism of interplay also disclaim availability of mass for a photon. On their notions of interplay of particles fulfils by exchange of virtual (unobservable) particles. For example, two electrical charges interchange virtual photons to realize a repulsion or attraction of miscellaneous electric charges. As it concretely occurs, the orthodoxies do not know, but consider, that the mechanism of exchange interaction acts apart of Compton wavelength of a particle:

$$\lambdabar_0 = \frac{\hbar}{mc} \tag{1},$$

where: m - particle mass, c - speed of light, $\hbar$ angular momentum of a particle.

It is necessary how to explain to audience, that gravitational and electrostatic interplay act on indefinitely large spacing interval, and, for example, nuclear interaction - on very small. Therefore mass of a photon and «graviton» needs to be accepted zero, that fraction in a right member has become indefinitely large. Here term «graviton» is taken in inverted commas, I do not believe in this fabrication of orthodoxies. The nuclear forces too «are easily explained» if to consider, that they are conditioned by exchange of mesons having mass eligible for sizes a nucleus.

Now we shall see what fraud hides behind it outwardly by logical explanation of a long-range action gravitational and electrostatic field and small radius of action of nuclear forces. The formula de Broglie and the experiments on its check demonstrate that for all particles the angular momentum is identical and is peer:

$$\hbar = mvr = m\alpha \tag{2},$$

where: v - speed of a particle, r - radius of its screw trajectory (as was found out in new physics). By substituting (7.3.1.2) in (7.3.1.1) we shall be convinced, that «the Compton wavelength of a particle» does not depend on its mass, but only from product vr for the given particle, which one in no relativistic area remains to a constant (for an electron α = 1.1576 cm^2/sec). It is ground of these facts of gambles of orthodoxies about the exchange

mechanism of interplays it is necessary to recognize false. Therefore only arguments of a relativity theory we can esteem seriously so long as this theory is represented to us valid.

The photon has mass. For the benefit of availability of weight for a photon speak some fixed experimental facts: 1. Pressure of light, 2. Effect of a Compton, 3. A frequency drift of photons in a gravitational field. Let's consider them in that order.

1. Pressure of light. It is clear, that the pressure of light is connected to its corpuscular nature. The explanation of pressure of light from the point of view of the electromagnetic theory is not logical: "Pressure of light according to the electromagnetic theory. If on a body surface normally to her the electromagnetic wave drops, the availability of an electric vector E results in displacement of charged particles of material. The driving charges on the part of a magnetic vector H of a coming surge are affected by (with) forces of Lorentz... This force determines a light face pressure of bodies". Н.И. Карякин etc., Brief reference book on physics, "Higher School", M., 1962, page 297. From this explanation it is visible, that the pressure of light depends as well on an electron concentration in material that contradicts experiment. The quantitative calculation of pressure of light on new physics is given in [1] (chapter 23, the formula (23.11)), where is simultaneously shown an error of orthodoxies in adjustment of the notions under experiment.

2. Effect of a Compton.

КОМПТОНА ЭФФЕКТ (комптон-эффект, комптонов-ское рассеяние) — рассеяние эл.-магн. волны на сво-бодном электроне, сопровождающееся уменьшением частоты. Эффект наблюдается для больших частот рассеиваемого эл.-магн. излучения (в рентг. области и выше). Он проявлялся уже в первых опытах по рассеянию рентг. лучей на свободных электронах, но впервые с требуемой тщательностью был изучен А. Комп-тоном (A. Compton) в 1922—23. Исторически К. э. явился одним из гл. свидетельств в пользу корпуску-лярной природы эл.-магн. излучения (в частности, света). С точки зрения классич. электродинамики рас-сеяние с изменением частоты невозможно. *(Compton effect, Compton scattering) - dissipation of an electromagnetic wave on a mobile electron accompanied by reduction of frequency. The effect is watched for large frequencies of disseminated electromagnetic radiation (in x-ray area and above). He showed already in the first experiments on dissipation of X-rays on mobile electrons, but for the first time with demanded carefulness was studied by A. Compton in 1922-23. Historically C.e. was by one of the main testimonies for the benefit of the corpuscular nature of electromagnetic radiation (in particular, light). From the point of view of a classic electrodynamics the dissipation with a frequency drift is impossible.* (т.2, page 431). Even in this quotation the absence the logic in orthodox notions is visible. If from the point of view of a classic electrodynamics (Maxwell) the dissipation with a frequency drift is impossible, there is no sense to speak about dissipation of an electromagnetic wave on a mobile electron and in general about these waves, and it is necessary conduct speech about dissipation of a photon on an electron.

В опытах А. Комптона (A. Compton) по рассеянию рентг. лучей было установлено, что кванты излучения подчиня-ются тем же кинематич. законам, что и частицы вещества, в частности квант излучения с частотой ω обладает также и импульсом $h\omega/c$ (см. *Комптона эффект*). *In experiments of A. Compton on dissipation of X-rays was established, that the quanta of radiation are subject to those to the kinematics laws, as particles of matter, in particular quantum of radiation with frequency ω has as well an impulse $h\omega/c$.* (т.5, page 354). And from this quotation it is visible, that the photon has mass, since only at its availability it is possible to speak about an impulse. The statement, that the rest-mass of a photon is peer to zero point, practically anywhere it is impossible to apply, since the reposing photons do not exist, therefore gambles around of the formula (1) have not physical sense.

3. Frequency drifts of photons in a gravitational field. This effect directly indicates availability of mass for a photon, i.e. its gravitational interaction with gravitating bodies. Red displacement of a spectrum of massive stars, deviation of light beams near to the Sun, reddening of photons moved up in a field of gravitation of the Earth, and turn blue them at motion downwards uniquely indicate availability of mass of a photon. New physics does not

distinguish «rest-mass» and «relativistic mass», since considers, that, and the rest-mass is relativistic, since is conditioned by circular movement of components of elementary particles with speed of light *c*. Thus, because of operation of law of preservation of an angular momentum *L* the ratio is executed:

$$mr = \frac{L}{c} \qquad (3),$$

where: *m* - particle mass, *r* - its radius.

Interconversion of mass and energy. This problem is more friend than all to consider on an example of an electron. An electron - the light charged particle, can receive at interplays large acceleration, therefore interconversion of mass and energy will realize easily. The modern physics can not answer a problem, whence and how there are photons at absorption and radiation of energy by atom. To find the answer to this problem, we shall take into consideration that the electron represents two rotated around of common center of gravidynamic interplay a neutrino. The steadiest configuration of this system will correspond to a bottom of a potential well at equaling of centrifugal effort of repulsion and of gravidynamic attractive force. At obtaining or radiation of any portion of energy the electron will pass in disequilibrium, from which one a neutrinos again will return on a stable orbit. This situation is shown on a figure 1.

Fig. 1
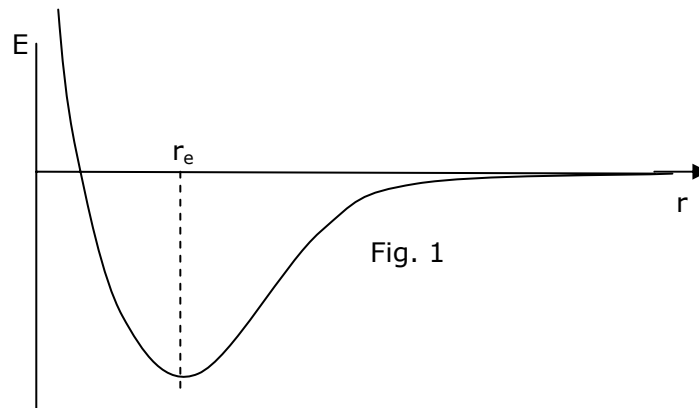
Spacing interval re between a neutrino corresponds to their stable orbit $r_{e^\pm} = 2.81785$ fm. On this spacing interval bond energy a neutrino (well depth) corresponds 0.511 MeV. Though for a mobile electron the well depth of gravidynamic interplay remains 0.511 MeV, but if there is potential energy for an electron, it can be increased, for example, up to 0.511 MeV + 13.6 eV on orbit of Bohr. Thus radius of an electron decreases pursuant to (3), though and it is insignificant.

If an electron beams to accelerate in a potent electrostatic field, radius of electrons decreases of the proportionally obtained kinetic energy. If now electron needs be to be braked and to be stopped at bombardment of a target cathode, radius of an electron is augmented up to classic radius sharply. Thus the photons with energy of the equal obtained kinetic energy are beamed. Precisely that occurs at an electron jump in atom from a high-altitude orbit on low. Thus, the formula (3) always provides a precise interconversion of mass and energy. For example, if we from each nucleon of a nucleus shall take away energy 7 MeV on energy of gravidynamic connection, radius of nucleons will be increased, and the nuclear mass will be diminished by the conforming value.

Let's find a total energy of a photon on a screw trajectory. Translational and tangential velocities on coils of such trajectory are peer, therefore:

$$h\nu = \frac{mc^2}{2} + \frac{mc^2}{2} = mc^2 \qquad (4),$$

whence mass of a photon:

$$m = \frac{h\nu}{c^2} \qquad (5).$$

As the transfer and reception of energy in a micro cosmos realizes, basically, photons, (4) confirms the famous formula of connection of mass and energy: $E = mc^2$. Now we know also physical sense of this formula.

References:
1 http://www.new-physics.narod.ru