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PHYSICS

CLASSICAL POINT OF VIEW ON THE PHOTON

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Abstract

The article considers a classical model of photon propagation in space. Based on this model it is possible to estimate the current and the voltage corresponding to a single photon of any wavelength, but it is impossible yet to understand a real structure of photons or space. We can predict only that there are movements of couples of charges associated with a photon

Keywords: photon, electro-magnetic wave, electrical oscillations, dipole

Introduction

As we know, a photon is one of the basic particles in quantum mechanics and relativistic physics. But it still does not have an acceptable explanation for a number of its inherent properties, or a single model, or correct ideas about its structure. In this article we'll try to propose a next approach for the calculations of some photon's parameters.

Let's begin from a number of contradictions and paradoxes, which really exist, but do not attract enough attention. In quantum mechanics, the energy E of the photon e is equal to the energy of a strictly monochromatic wave with a frequency ω :

$$E = \hbar \omega \quad (1)$$

where $\hbar$ is the Planck constant.

It follows from the relation (1) that a photon is an infinite wave in space and time, but that contradicts to the Heisenberg's uncertainty principle and to the experimental fact that photons always have a finite life time.

The next problem arises with the wave's nature of a photon, like an electromagnetic wave (a solution of Maxwell's equations). Hence for a standing electromagnetic wave there are moments in times when due to the electro-magnetic nature both electric and magnetic fields are simultaneously equal to zero. Therein the volume density of the wave energy is also zero, so the photon energy at these moments disappears, and after some time suddenly appears out from nowhere!

And there are not all known paradoxes for the photons.

Photon

We know many different ways for description of the photon motion in space today. For example, in radio engineering it is possible to consider the movement of electromagnetic waves movement in the cable, as the process of recharging of a system of inductances and capacitors distributed in space, as it shown on Fig. 1.

Fig.1. Scheme for electromagnetic wave propagation through the cable

Using this approach as a model for the motion of a photon in space, it is sufficient to assume that the physical space has similar parameters, namely: distributed inductance L and capacitance C . That means that the physical space is not "empty"!

By the way, this assumption removes the paradox with the disappearance of the energy in standing electromagnetic wave, because the disappeared energy is transferred to the space and then again comes back from it.

This concept of space as some physical environment ("ether") has been proposed since ancient times,

but only since R. Descartes [1] the concept of ether is considered as a scientific hypothesis and it has some background. Modern ideas about the properties of physical space have changed greatly [2].

In this work, we will pay attention to the process of photon propagation only and try to estimate (calculate) some macroscopic parameters of the photons. For presented on Fig.1 circuit we can record the wave resistance Z of the "cable" (space), and remember that the oscillation period T for this system is:

$$Z = \sqrt{\frac{L}{C}} \quad (2)$$

$$T = 2\pi \sqrt{LC} \quad (3)$$

And here we have the first surprise: the concept of the wave resistance of vacuum there is not exists in some systems of physical units. If in SI system this resistance is approximately equal to 376.730 Ohms [3], in the CGS system a similar expression (with the dimension of resistance) is absent at all!

Of course, it is absurd that the concept of a specific physical quantity (wave resistance) depends on selecting the system of units!

But let us continue. Next, we can write that the energy of the wave running along the cable is a serial transition of energy stored from the inductance L to the energy of the capacitor C and so on. The one step for transformation was described as:

$$E = C \frac{U^2}{2} = L \frac{I^2}{2} = \hbar \omega \quad (4)$$

where in addition to the previous notation of symbols, U is the capacitor's voltage, I – is the current in inductance, q is the charge, Φ – is magnetic flux ($\Phi = LI$) and T – the period of oscillations.

Taking into account the quantization of the magnetic flux Φ :

$$\Phi = h/2e \quad (5)$$

where h is the Planck constant ($2\pi \hbar$) and e is the charge of electron.

Also it is easy to draw a conclusion, that:

$$L = \frac{\lambda Z}{2\pi V} \quad (6)$$

$$C = \frac{2\pi V Z}{\lambda} \quad (7)$$

where λ – is a wavelength and V – is a speed of light.

Let us suppose that $q=e$ and we'll obtain a complete match of the formulas (1), (4), (5).

It may be assumed that the photon carries a connected couple of charges in space (dipole) and this movement generates magnetic and electric fields. Such idea we have known before [4], but this is again only

some iteration that cannot explain all properties of photons. For example, in such model we cannot explain diffraction on several slots or the influence of an observer on the result of an experiment (next paradox).

In addition, it can not be argued that $q=e$, and the change in the value of the dipole charge corresponds to renormalization of a number of coefficients and the value of the flux quantum, which is still experimental tested only in a superconductor. So, the question of the magnitude of the charge q remains open yet and only an estimate was given here.

We can draw a conclusion, that with a high probability, that a dipole (or quadrupole) moves in space, because the photon is not deflected in an electric field. Possible replacement of the electron charge to the charges of quark [2], will lead to a slight change in the numerical coefficients in the above formulas.

Let us carry out numerical estimates for the magnitude of currents and voltages in space, associated with the motion of a photon with a wavelength near 600 nm.

So, period $T = \lambda/V \sim 2 \cdot 10^{-15}$ s, current $I = e/T \sim 10^{-4}$ A, $U \sim IZ \sim 37 \cdot 10^{-3}$ V

Conclusion

In addition, within the framework of the proposed model, it is possible to assume that the stimulated emission is a process of summering of magnetic fluxes several photons etc.

Of course, a very rough photon's model was proposed, but it has the right to exist, but it cannot explain the diffraction of a single photon on several slots, the phenomenon of entangled photons, etc. But we need to start with something ...

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