On the Electromagnetic Waves

September 30, 2014.

José Francisco García Juliá

jfgj1@hotmail.es

The electromagnetic waves are folds that propagate in a polarized vacuum.

Key words: polarization of the vacuum, electromagnetic waves.

An electric charge would induce an electric polarization in the vacuum [1]:

$$(-, +) \ldots (-, +) \text{ or } (+, -) \ldots (+, -) \tag{1}$$

depending on whether the electric charge is $+q$ or $-q$, respectively, and where (-, +) and (+, -) represent the induced electric dipoles in the vacuum space.

From (1), we see, by construction, that the electric charges of the same (different) sign repel (attract) each other.

The induced dipoles, (1), form the electric lines of force, then, we define the electric vector field, $\vec{E}$, for an electric charge, q, as proportional, k_e, to the number of lines of force per unit area, N/S, per solid angle, S/r^2:

$$\vec{E} = k_e \frac{N}{S}\frac{S}{r^2}\vec{u}_r = k_e \frac{N}{r^2}\vec{u}_r = \frac{1}{4\pi\varepsilon_0}\frac{q}{r^2}\vec{u}_r \tag{2}$$

ε_0 being the electric permittivity of the vacuum and r the radial distance, with

$$k_e N = \frac{1}{4\pi\varepsilon_0} q \tag{3}$$

The electric lines of force are anchored to the electric charges, and are radial. If the charge is at rest the lines are straight. If the charge is moving at constant speed, uniform motion, the lines are still straight but their density decreases in the direction of the motion. However, if the charge in some way is shaken [2] (p. 37), each individual line is distorted for forming a fold that travels along it. Each fold of induced electric dipoles is a transversal electric field that varies with the time generating around it a magnetic field (Ampere-Maxwell law), which varies also generating around it an electric field (Faraday law), and so on. The electric and magnetic field are perpendicular between themselves, and the energy passes from one to another. They form an electromagnetic pulse that propagates along each individual line. All these pulses form together a spherical wave front. This is compatible with the Huygens principle. At large distances the electromagnetic wave is a plane wave.

From a classical point of view, we may calculate the energy of an individual pulse with the aid of the Poynting vector, $\vec{S} = \vec{E} \times \vec{H}$, which represents the flux of energy per unit time per unit area, where $\vec{H} = \vec{B}/\mu_0$ is the intensity of the magnetic vector field, and $\vec{B}$ the magnetic vector field and μ_0 the magnetic permeability of the vacuum. The speed of the pulse would be, $c = (\varepsilon_0\mu_0)^{-1/2}$.

From a quantum point of view, the energy of an individual pulse would be simply, *hf*, where *h* is the Planck's constant and *f* the frequency. The speed of the pulse would be expressed as, $c = \lambda f$, where λ is the wavelength. For all the pulses, that is, for the electromagnetic wave radiated by the electric charge, the total energy would be, *Nhf*.

It is considered, for us erroneously, that a quantum of energy, *hf*, is a particle, a photon. Then, the pulses would be particles or photons, and the wave would be a great number of grouped photons that statistically (on average) function as a wave. For the photons there are no restrictions because they are bosons. This cannot be applied to the fermions since they cannot group to form waves because of the Pauli exclusion principle. And consider a fermion, which is a particle, also as a pulse (a wave) is only a conjecture [3].

But the pulses are not particles. A pulse is a quantum of energy, *hf*, called photon. But the photon cannot be a free particle, because it is a pulse that travels along a line of force. Remember the formation of the pulse from a fold in a line. The photon is not free, it follows the line.

When an electron emits or absorbs energy, this energy is emitted or absorbed through its lines of force. The photoelectric effect is an absorption process. In the Compton effect, the photon and the electron interact through the lines of force. In general, the electromagnetic interactions are produced via the electromagnetic lines of force, which are lines of induced electric (or magnetic) dipoles in the vacuum space [1].

The dispersion of the white light by a prism of glass in its constituent colors proves that the light is a wave and not particles [4].

In summary, the electromagnetic waves are folds that propagate in a polarized vacuum.

[1] José Francisco García Juliá, On the Electric and Magnetic Forces, viXra: 1409.0116 [Classical Physics].
http://vixra.org/abs/1409.0116

[2] Eugene Hecht and Alfred Zajac, Óptica, Fondo Educativo Interamericano, 1977. Original edition, Optics, Addison-Wesley, Reading, Massachusetts, 1974.

[3] José Francisco García Juliá, A Criticism to the Quantum Mechanics, viXra: 1308.0001 [Quantum Physics].
http://vixra.org/abs/1308.0001

[4] José Francisco García Juliá, The Dispersion of the Light by a Prism of Glass, viXra: 1307.0003 [Quantum Physics].
http://vixra.org/abs/1307.0003