the general science journal

Photons and electromagnetic Waves

e.falkner@online.de

The theory of Maxwell presupposes an electromagnetic medium, which must be easily polarizable but however outward altogether electrically neutral. The polarizability of this medium is linear and isotropic contrary to the ordinary matter, as the form of the Maxwell equations for the light ether shows. That means, the dielectric constant (electrical field constant) of the ether is not a tensor, but a simple numerical value. In the literature for the ether polarization the notation electric displacement field is used in order to deny ethers clear material characteristics, as it, without justification, is demanded in the theory of Einstein, although the expression "displacement" means that "something" is geometrically moved.

The material equations for the ether can be written as follows

$$\vec{D} = \varepsilon_o \vec{E} = \vec{P}_e \text{ and } \vec{B} = \mu_o \vec{H} = \vec{M}_e ,$$

whereby $\vec{P}_e$ polarization and $\vec{M}_e$ magnetization of the ether is. If also in the regarded area, ordinary matter is placed, the above equations can simply be extended:

$$\vec{D} = \vec{P}_e + \vec{P}_m = \varepsilon_o \vec{E} + \varepsilon_o \chi_e \vec{E} = \varepsilon_o (1 + \chi_e) \vec{E} = \varepsilon_o \varepsilon_r \vec{E} = \varepsilon \vec{E} ,$$

$$\vec{B} = \vec{M}_e + \vec{M}_m = \mu_o \vec{H} + \mu_o \chi_m \vec{H} = \mu_o (1 + \chi_m) \vec{H} = \mu_o \mu_r \vec{H} = \mu \vec{H} .$$

Thus electric displacement field and magnetic field can be understood as sum of the polarizations and magnetizations of the ether and of matter. Since the polarization and the magnetization are defined as dipole moment per volume, the ether can be thought of like matter, composed of positive and negative pairs of particles, which are converted into dynamic electric and magnetic dipoles through an electrical field (shift polarization). A simple consideration shows that the particles of the light ether must be electrons and positrons or virtual electron positron pairs (those everywhere are present), as it is demanded likewise by Dirac's theory. That means, with a sufficiently strong electric field, the ether would disintegrate into electrons and positrons (Fig. 2). In this case the outside electrical field must be stronger than the internal field of the electron and positron pair. This view shows that the ether can be understood as a quasi paramagnetic and dielectric matter, whereby paramagnetism is only produced by shifting of electrons and positrons against each other. As long as this particle shifting does not exceed a certain value, after switching off the outside field, pairs again pull the electron and positron together and pass on this freed energy to the next neighbors.

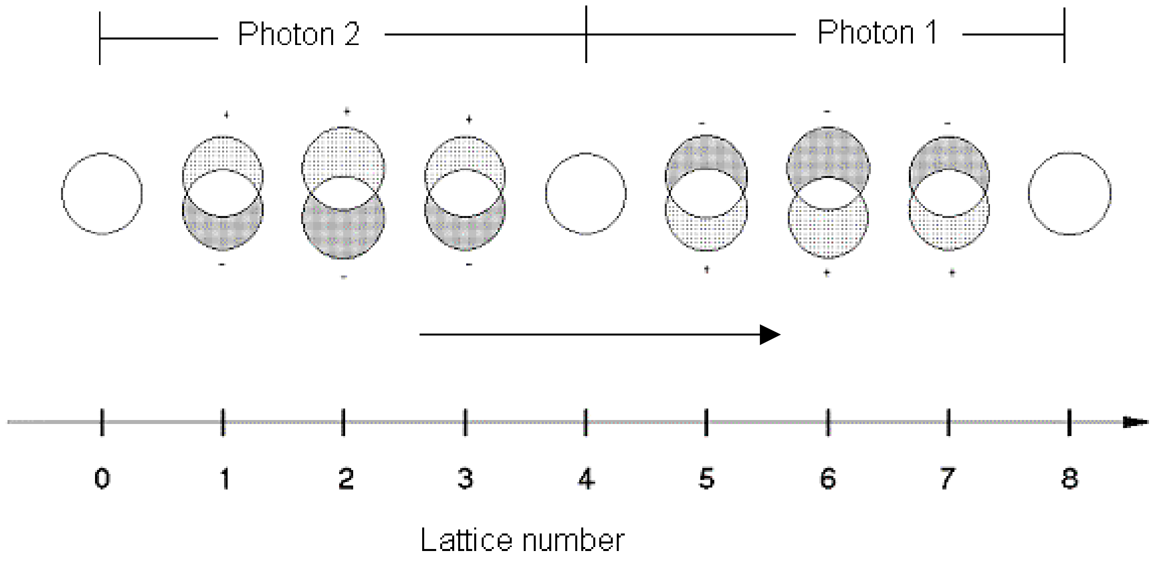

Figure 1: Electromagnetic wave in a luminiferous ether lattice of "virtual" electron-positron pairs. The electromagnetic wave propagates completely analog to a optical phonon in a ordinary crystal lattice.

In this way an electromagnetic wave develops in ether, which spread as an electromagnetic disturbance over the virtual electron positron pairs, in complete analogy to the propagation of optical phonons in a crystal lattice (Fig. 1). The widespread opinion of photons as flying "magic" particles can be regarded hereby as unfounded and outdated, since the virtual pairs almost do not move through the sea of virtual pairs, but simply pass on the electromagnetic disturbance from pair to pair. Therefore electromagnetic waves can be understood as electromagnetic disturbances, which propagate as electromagnetic oscillations over the chains of electron positron pairs, whereby the pairs oscillate only around their rest positions. Similarly, electrons in a conductor move in the electric alternating current with a very low speed around their rest positions, whereby the effect transmission likewise takes place with speed of light.

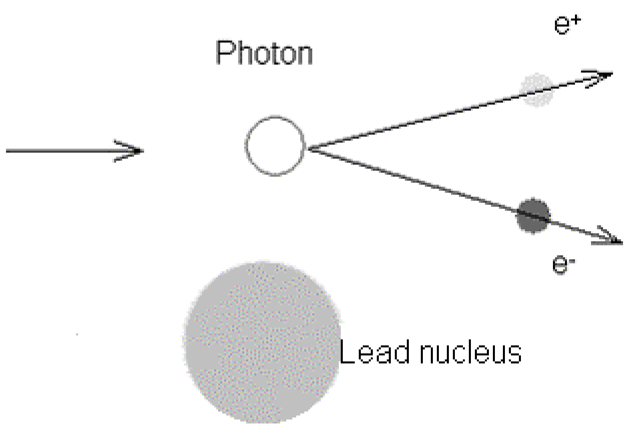

Figure 2: In the vicinity of a heavily charged atomic nucleus the luminiferous ether becomes strongly polarized. So it is sufficient to add a low energy disturbance (a Photon) to cause a disintegration of a virtual electron positron pair.

Under otherwise same conditions the total energy per unit length of a wave train is in reverse proportional to the square of the wavelength according to the old light theory (F. Hasenöhrl) [1]. A wave thus carries an energy quantity, which is in reverse proportional to their length, as one could also confirm experimentally (photoelectric effect) and quantum-theoretically (Planck's law). Since the electric field of the wave changes sign after a half wavelength, the electron must be pushed away, in the Compton and photoelectric effect, with half of the energy of a whole wave, i.e. as long as the virtual electrons of the wave and the free electron act directly on another. In these experiments, the half wave can be called photon, whereby the energy $E = hf$ is the total energy of this half wave, thus it is the maximum energy of individual photon which could be transferred to an electron.

The photons which are emitted of a free atom, lose a part of their energy, which is transferred to the atom as recoil energy. That means, the virtual electron-positron pairs are pushed like atoms of an absolutely cold solid body (hard balls), whereby the momentum is passed over a chain of virtual pairs with the speed of light. At the same time the virtual pairs oscillate around their center of mass, likewise with an average speed, which is equal to the speed of light. From it, result two equally large portions of total kinetic energy of the photon, which are purely of mechanical origin: the energy of translation of the center of mass

$$E_1 = \frac{1}{2}mc^2 = \frac{1}{2}hf$$

and the oscillation energy with respect to the center of mass

$$E_2 = \frac{1}{2}mc^2 = \frac{1}{2}hf\ .$$

That this picture also represents a rule within the macroscopic range, it shows simple examples with the elastic collision of two equally large coupled masses. Two equal masses, of which one rests before the collision, collide elastically and remain elastically coupled after the collision. The total momentum before and after collision remains the same, while the kinetic energy of translation is halved. If kinetic energy and momentum before the collision are:

$$E_{kin} = \frac{1}{2}mv^2;\ p = mv$$

one receives after collision, the same momentum but only half of the kinetic energy if the internal energy of oscillation is not considered:

$$E_{kin} = \frac{1}{2}2m\left(\frac{v}{2}\right)^2 = \frac{1}{4}mv^2,\ p = 2m\frac{v}{2} = mv\,.$$

If we put $2m=M$ and $v/2=V$ and if internal energy is taken into account, then total energy and momentum after collision can also be written:

$$E = \frac{1}{2}MV^2 + \frac{1}{2}MV^2 = MV^2 = \frac{1}{2}mv^2,\ p = MV = mv\,.$$

As one can see, the formula is formally identical to the formula of energy of radiation:

$$E = MV^2 .$$

In a macroscopic system the oscillation energy would be after short time converted into heat energy, which is also nothing else but the kinetic energy (vibrations) of individual particles of the bodies.

Based on L. de Broglie, a certain wave can be associated to each particle, which can be expressed as $\lambda = \frac{h}{p} = \frac{h}{mv}$. As one can see this formula is for photons with $v=c$ fulfilled and one receives the Compton wavelength of the particle $\lambda_o = \frac{h}{mc}$. Based on Einstein, for each mass $m = \frac{hf}{c^2}$ can be written and with $c = \lambda_o f$ it follows $\lambda = \frac{c^2}{fv}$, $\lambda = \frac{\lambda_o c}{v}$ and $\frac{\lambda_o}{\lambda} = \frac{v}{c}$. I.e. if the mass m is a pure standing electromagnetic wave with the wavelength λ_o, the de Broglie formula and Compton wavelength formula are limitedly applicable. The meaning is, a half wavelength of an electromagnetic wave would have the same mass as a particle, for which the relation $\lambda_o = \frac{h}{mc}$ is valid. For an electrically neutral mass, the de Broglie formula cannot be correct, because in this case no standing electromagnetic wave can be produced. Thus the Einstein energy mass equivalence is valid only for electromagnetic radiation, as could be observed in different nuclear reactions, whereby only electromagnetic radiation is produced but a number of elementary particles remains unchanged after all unstable particles have returned to the ground state. Remark: In the standard model one assumes that each energy can be converted into mass, why in certain cases, in order to adjust missing mass, invisible particles (neutrinos) are postulated.

These consequences of the Maxwell theory clearly contradict the etherless relativity theory of Einstein, which is based on non-physical assumptions of an absolutely empty space with some unjustified physical properties and a quasi "material" (influenceable) time.

References

1. F. Hasenöhrl: "Zur Theorie der Strahlung in bewegten Körpern", Annalen der Physik 15, 344-370, (1904)