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Nature of Elementary Energy Carriers

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Abstract

The property of matter is characterized by mass expressing its measure of inertia, and energy-the measure of motion and structural-energy c correspondence in the system are in equilibrium with the environment. Violation of this stationary state of the system by external influence causes the occurrence of physical and chemical processes in it, which are accompanied by energy manifestations in the form of release (absorption) of heat, light, electricity, magnetism, etc. These phenomena characterize the movements of material substances. Clarification of their nature is interest for a deep understanding of the mechanism of energy transfer between material objects. According to the universal law of conservation of matter and the conversion of energy, we can unequivocally conclude that the material nature of energy carriers must remain unchanged. That is, as a result of the process in the system, elementary particles provide the manifestation of thermal, light, electric, magnetic and other forms of energy transfer. The presence of an elementary "electromagnetic particle" in the atomic-molecular structure of substances characterizes "energy".

Keywords: ***Matter; Energy; Electron, Light; Magnetism***

Introduction

For the rational use of energy resources, it is necessary to clarify the mechanism of energy transfer and the nature of their carriers. In this regard, in the scientific literature, there are quite different opinions, where energy is considered apart from matter. However, the definition of energy is formulated in the form: "energy is a scalar physical quantity, which is a single measure of various forms of motion and interaction of matter, a measure of the transition of matter from one form to another" [1]. According to this definition and the universal law of conservation of matter and conversion of energy, the material nature of the energy carrier must remain unchanged, and its form of movement can be changed. A vivid example is the energy carriers of sunlight, which during photosynthesis changes the initial velocity of the movement ~ 3·108 m/s, and transforms into the motion of the components that make up the atomic-molecular structure of the cell [2]. Moreover, the interaction of the elementary carriers of heat and light with the elements of the atomic-molecular structure of substances leads to change in their movement, so that the absorbed heat and light are not detected explicitly and are in the form of a component of the internal energy of the system.

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Under certain conditions, the accumulated energy carriers that change the form of movement, but retain the material nature can be extracted back. Evidence of this: the release of heat, light, etc., the components of the energy of the sunbeam during the combustion of wood, coal, oil, etc.

One form of energy transfer is alternating electric current. However, until now the nature of the carriers of electric energy and the speed of electron movement during the transfer of electric current is debatable. It is generally accepted that the ordered movement of electric charges forms an electric current, where the current carriers in most cases are electrons. Modern scientific achievements in the field of the atomic-molecular structure of substances have revealed the mysterious of micro-phenomena with unusual properties of micro-objects [3-9]. When considering substances, it is necessary to pay attention to the interconnectedness of micro-macroscopic structures that affect the properties of material objects.

This article discusses elementary particles of the nuclear-electronic structure of substances, which characterize the concept of "energy" with their movements and participate in energy manifestations in the form of heat, light, electricity, etc.

Discussion

The conservation of heat and light of sunlight during photo-biosynthesis in plants, animals, etc. in the composition of substances clearly demonstrates the interaction of constituent components in the form of the internal energy of these systems. It is generally accepted that light is transported by photons with an energy quantum $h\nu$ [10]. However, in the scientific literature, there is no specific definition of the heat carrier. According to the molecular-kinetic theory, heat is the movement of system components or transfer by infrared radiation. We suppose a hypothesis in [11-13], according to which the elementary carriers of heat are "*theplotrons*", which can be considered as an "*electromagnetic particle*" [14-19]. For these particles, based on thermodynamics and quantum-mechanical data we calculated the mass, the relationship with temperature, and the internal pressure created by them. In [20], they propose heat transfer in a particle less form of matter having mass, where: "The thermal energy Q is characterized by the ether mass "*m*", moreover, there is a relationship $Q=mc^2$ (c is the speed of light in the ethereal medium of near-Earth vacuum), which favor the presence of "theplotrons". With the transition of the boundary-Planck's constant *h*-the quantum characteristics of matter prevail, although a single integral object consists of these micro and macro components and it is difficult to talk about any form of an elementary particle when absent measuring instruments. However, the wave characteristics of the electron have been experimentally proved, but its exact shape cannot be imagined and the authors' expression [20], "the particleless form of matter," states reality. In addition, $Q=mc^2$ duplicating Einstein's equation $E=mc^2$ which describing the magnitude of the motion of matter with mass "m" and velocity "*c*" is a conceptual expression. Heat as a form of energy transfer by equation $Q=mc^2$ expresses the kinetic energy of "particleless forms of matter" with mass «*m*» and speed «***c***» (this speed is "*c*" is dependent on the thermal conductivity of the body). It characterizes the change of internal energy and the change in temperature of the system respectively. But, in the thermal theory of the authors, there is no correlation of temperature with heat and directly with their carriers, no matter what form they have.

It follows from the universal law of conservation of matter and energy conversion that the material nature of energy carriers remains unchanged and only their nature of movement changes. Given this position, M. Faraday in [21], argues that regardless of the thermal, light, chemical, physiological, magnetic or mechanical energy source, they can all manifest in the form of the same electricity. This conclusion means the identity of the nature of elementary energy carriers and serves in favor of the conclusion that photons, "theplotrons" and other elementary energy carriers are varieties of the same "electromagnetic particles" [14-19], which differ in the form of their movement depending on process conditions. For example, based on electromagnetic induction, when the magnetic field interacts with a moving conductor an alternating electric current appears. At the same time, the Lorentz's force act on the nuclear-electronic system and have a separating effect on charges (electron and proton; dipoles of the "electromagnetic particle"). As a result of the displacement of charges from a stationary position, a potential difference arises in the nuclear-electronic structure, which is the driving force behind various processes including electric current. And the notion that the conductors of electric current are "free electrons" is accepted. In this case, according to the reference literature, "free electrons" of a conductor under-voltage move at a speed of ~ $1 \cdot 10^{-5}$ m/s, and an electric current propagates at a speed close to the speed of light. For clarity, we present the data obtained in [22], wherein a conventional lighting network, for a copper conductor under voltage, the electron velocity (v) was calculated by the formula:

$$v = \frac{I\mu}{qdN_A S}$$

Where ***I*** is the current strength, ***μ*** is the molar mass of the conductor, ***q*** is the electron charge, ***d*** is the density of the conductor, ***N***A is the Avogadro's number, and ***S*** is the cross-section of the conductor. The numerical values of physical quantities were taken from the reference book characteristic for copper:

$$I = 1A,\ \mu\left(Cu\right) = 0.0064 kg/mol, \mathrm{q} = 1.6 \cdot 10^{-19}\, C,\ d = 8 \cdot 10^{3}\, kg/m^{3},\ N_{A} = 6.02 \cdot 1023 mol^{-1},\ S = 1.5 mm^{2}$$

Substitution of numerical values and calculation gives the following value:

$$v = \frac{1 \cdot 0.064}{1.6 \cdot 10^{-19}} \cdot 8.94 \cdot 103 \cdot 6.02 \cdot 1023 \cdot 1.5 \cdot 10^{-6} \approx 5 \cdot 10^{-5}\, m/s$$

As follows from the calculation, the electron drift velocity of 5·10-5 m/s is insignificant. To calculate the electron velocity at constant current, we used the data of galvanizing iron with an area of 1000 cm^2 at a current strength of 2.5 A and a zinc density of 7.15 g/cm^3 given in [23]. Our calculation according to the above formula gives the following value for the electron velocity:

$$v = \frac{2.5 \cdot 0.0327}{1.6 \cdot 10^{-19}} \cdot 7.15 \cdot 103 \cdot 6.02 \cdot 1023 \cdot 1 \cdot 10^{-1} \approx 1.1 \cdot 10^{-9}\, m/s$$

The observed electron velocity of $1.1 \cdot 10^{-9}$ m/s during electrolysis, that is, during electrochemical work is associated with direct inhibitions of the heterogeneous heterophase chemical reaction, phase transitions and rearrangement in the structure of metal crystal lattices, and corresponds to the electrochemical kinetics of the process. Here, the electron's movement along the conductor has a "relay" character, leading to a change in the nature of the "chemical individual". With alternating current, the structure of the "chemical individual" is preserved, that is, the electron makes a movement within the cell of the metal lattice ("chemical individual"). In this case, for alternating current with a frequency of 50 Hz, and the mean free path of an electron in a metal lattice with 2.10^{-10} m, the electron velocity should approximately be:

$$v = 2.10^{-10} \cdot 50 = 1 \cdot 10^{-8} m / s .$$

The calculated values of the electron velocity of constant and alternating electric currents are about $1.1 \cdot 10^{-9}$ m/s and $1 \cdot 10^{-5}$-1.10^{-8} m/s, respectively, and its insignificant value in comparison with the propagation speed of the electric current means that the transfer of electrical energy is carried out through other substances.

Unambiguously, the transmission of electricity is carried out by means of a conductor, which consists of chemical elements of the "chemical individual" and elementary particles. Therefore, under the influence of an external driving force, the direct participants in the transfer of electric current, in addition to the electron, should be other elementary particles. In this case, the appearance of a magnetic field in the conductor during the passage of electricity means that the electric current carriers must have an electromagnetic nature. The manifestation of electrical and magnetic energy means the presence of their material carrier, which should contain electrical and magnetic components. That is, for the proposed "electromagnetic particles" in [13-19], the constituent elements should be electric dipole-having electrical properties (charges "+" and "-") and a magnetic dipole (north and south poles of the magnet) characterizing magnetic properties. The charges of the "electric dipole" according to Coulomb's law are attracted and make a movement, creating a microcurrent. The lines of force of the magnetic component-magnetic dipoles-react to moving charges rendering them a repulsive effect. As a result, the "electromagnetic particle" rotates along its axis, making a rotationally pulsating motion. In [24], it is noted that the phenomenon of "self-pulsation" (self-movement) is the most important concept for representing the essence of body motion, but there is still no exact information in science about the self-pulsation of elementary particles. It is possible that the electric and magnetic fields of the earth, which are in dynamic equilibrium, influence the lines of force of "electromagnetic particles". From this, we can conclude about the complexity of the composition of the "electromagnetic particle", which we accept as an elementary energy carrier. And in favor of the presence of electrical and magnetic components of the "electromagnetic particle" is the classical theory of electromagnetic phenomena, where a closed current is considered an elementary source of magnetism [25]. The magnetic action of a closed current (circuit with current) is determined by the product of the current strength "i" and the area of the circuit "σ" representing the magnetic moment *M*:

$$M = \frac{i\sigma}{c} \text{(in the GHSsystem of units)}$$

Where c is the speed of light. Hence, the vector *M* is taken as a magnetic moment and is written in the form: $M=m^{-l}$, where m is the equivalent magnetic charge of the circuit, and l is the distance between the "charges" of opposite signs (+ and -). In our opinion, since there is no "magnetic charge", these charges are related to the "electric dipole" of the "electromagnetic particle". In addition, the material nature of the contour, which is the source of "magnetic dipoles" is neglected. The existence of the microcurrent and the reasons for the magnetic properties of substances were also expressed in the Ampère's hypothesis [26], where the property of permanent magnets was explained by the existence of "molecular" currents, although at that time there was no information about the nuclear-electronic structure of atoms. It follows from Ampère's hypothesis that the magnetic phenomenon manifests itself as a result of a "molecular" electric current. But, the effect of magnetic lines of force on a moving conductor generates an electric current, which means the presence of a separately existing magnetic component, which induces an Electrical Moving Force (EMF) M. Faraday's electromagnetic induction. However, the magnetic component does not turn into an electrical component and vice versa, which coexists separately in the composition of the "electromagnetic particle". For example, in the work of a closed oscillatory circuit, where the conversion of electric energy into magnetic energy and vice versa is accepted, the expression used is not true. In the process of discharging the capacitor, under the action of its voltage, the "electromagnetic particles" of the conductor are guided by directionally creating an electric current and performs electrical work by moving the electrons of the inductive coil. That is the nuclear-electronic system of the inductive coil is polarized due to this current and a potential difference arises in it. In each "electromagnetic particle", the "magnetic component" creates a magnetic field (Lorentz's force) pushing apart the charges of the nuclear-electronic system, which enhances the potential difference. In the inductive coil an Electrical Moving Force (EMF) occurs, opposite to the EMF of the initial state of the capacitor, and the discharged capacitor is recharged due to the EMF of the inductive coil. This process is repeated, however, the conversion of electrical energy into magnetic energy and vice versa is absent, but only there is interaction.

It can be concluded that the dialectical structure of the matter based on the law of the unity of the struggle of opposites and the universal law of conservation of matter and energy conversion, the unity of electrical and magnetic phenomena allows us to suppose the presence "electromagnetic particles" consisting of dipole components with electrical and magnetic characteristics in the atomic-molecular structure. The supposed probably imaginary structure of the dipoles of "electromagnetic particles" in the middle part has a "magnetic component" that divides the electric dipole into two parts. The polar parts of the electric dipole and the pole of the "magnetic component" have field lines of force that interact with each other, as well as with the magnetic and electric fields of the earth's surface. Then we can agree that a field is also a form of matter and recognize the presence of "sub-elementary particles" (possibly a particle less form of matter) [20].

Naturally, a lot of questions arise regarding the ratio of the charges of the polar parts of the electric dipole, the nature of the magnetic dipoles of the "magnetic component" of the "electromagnetic particle". Despite this, the structure and principle of operation of the "electromagnetic particle" have a certain analogy with the work of open oscillatory circuits used in the experimental works of Heinrich Hertz [27], which proved the existence of "electromagnetic waves". Consider an open oscillatory circuit used in G. Hertz's experiments to detect electromagnetic waves. In order to reduce the capacitance of the capacitor "C" in an open electric oscillatory circuit, it is necessary to increase the distance between the plates by expanding them while reducing the area of the plates of the closed oscillatory circuit **(FIG. 1)** [28].

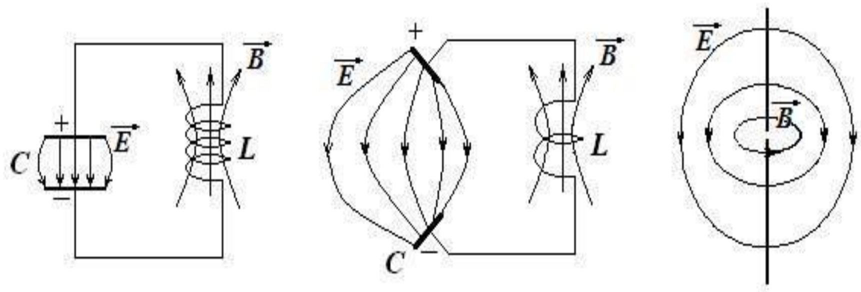

FIG. 1. **Transformation of a closed electrical oscillatory circuit into the open.**

To reduce coil inductance (*L*), the number of turns should be reduced. The result is a piece of wire or an open oscillatory circuit shown in **FIG. 1**. Vectors *E* and *B* characterize the direction of the lines of force of electric and magnetic fields, respectively. It turned out that if oscillations occurred in this oscillatory circuit, then they enveloped this open oscillatory circuit from all sides. As a result of this, a changing electric field created an alternating magnetic field, and an alternating magnetic field created an electric field and so on **(FIG. 2)**. This process began to be called an electromagnetic wave.

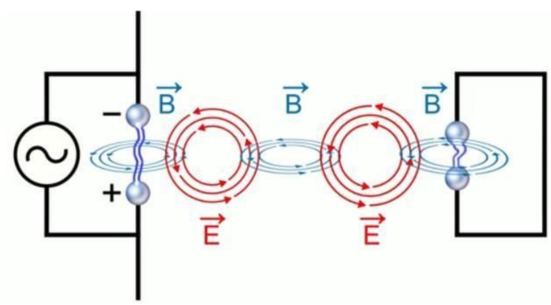

FIG. 2. **The emergence of an electromagnetic wave.**

We believe that the poles of the dipoles of "electromagnetic particles" represent two plates of the "capacitor" as in the open oscillatory circuit, connected through an "inductive coil" representing the "magnetic component". The moving charges synchronously exert the effect of the Lorentz’s force, the earth’s magnetic field, increasing the repulsion of the magnetic forces of the “magnetic component”. When exposed to the electrical voltage from outside, the nuclear-electronic structure of the conductor undergoes polarization. Upon reaching a certain value of the electric potential in the nuclear-electronic structure equal to the breakdown voltage, as in an open oscillatory circuit, "electromagnetic particles" are emitted from the system into the environment.

Since the nature of the "electromagnetic particle" consists of an electric and magnetic component, which appears simultaneously with the corresponding lines of force, it is difficult to assert any form to give it a pulsating and rotational motion. Perhaps, in this regard, in [29], it is believed that an electron with its electromagnetic field constitutes a single, organically connected material system. It is natural that the mass of motion of the electron's electromagnetic field can be directly attributed to the electron itself. However, this statement does not correspond to reality, since "electromagnetic particles" are present separately in the atomic structure in combination with an electron. An interesting proposal is also a physical model of the electric current, where its carriers are electrons bound into single complexes with the magnetic field of the conductor, that is, the presence simultaneously with the electron and magnetic substance [30]. During its propagation, the electric field interacts with conduction electrons already in the conductor, which are paired with the magnetic field of the conductor, but the nature of the electric field propagating through the conductor remains unknown. In our opinion, the idea proposed by the author is a modified version of Maxwell's electromagnetic theory [31].

Thus, under the influence of external voltage, the "electromagnetic particle" instantly orientates along the entire length of the conductor, creating a directed oriented movement, that is, it creates an electric current. In this case, the electron in the nuclear-electronic structure is shifted from its stationary position until the change in the chemical potential of the conductor is not compensated by the external EMF.

Consequently, an electric current is the oriented movement of "electromagnetic particles" consisting of an electric and magnetic component, causing electrons to move along the wire, and not the speed of the electrons themselves.

Then the question arises about the role of electrons in the transmission of electrical energy. In this regard, according to thermodynamics, work and heat are the forms of energy transfer realized by directed and chaotic movements of particles, respectively. And for the work to be done, the directed influence of energy carriers on the "working medium" is necessary. For example, in internal combustion engines, for directional movement of energy carriers-"theplotrons" with combustion products, it is necessary to have cylinders with a piston with appropriate devices where mechanical work is performed. Similarly, to perform electrical work, the directed movement of "electromagnetic particles" is also required, where for this the conductor serves as a cylinder under the influence of an external EMF, and the "working medium" is an electron. "Electromagnetic particles" directionally move the "working body"-an electron in the cell of the "chemical individual" of the conductor, which performs electrical work, like a piston in internal combustion engines. In the case of direct current, electrochemical work proceeds at the electrode-substrate interface with a change in "chemical individuals" and the movement of an electron along an external circuit represents the relay pattern of movement between lattice cells. It should be noted that in order to carry out chemical, biochemical, and electrochemical works, the conditions of the directed motion of "electrochemical particles" and electrons are also required. As we noted in [18,19], for this it is necessary to create the difference of the "electrochemical potential" in the system, which is the driving force of the process in the structure of "chemical individuals". That is, the corresponding types of work are carried out on the redistribution of charges and "electromagnetic particles" in each link of the "chemical individual" of the substance, accompanied by the release of "electromagnetic particles" in the form of heat, light, and other manifestations.

Conclusion

The dialectical structure of the matter based on the law of the unity of the struggle of opposites, the unity of electrical and magnetic phenomena allows us to suppose the presence "electromagnetic particles" consisting of dipole components with electrical and magnetic characteristics in the atomic-molecular structure.

The transmission of electrical, chemical, thermal and other types of energy is carried out by a set of motion of "electromagnetic particles" in accordance with the law of conservation of matter and energy conversion, and work is performed with their directed movements under appropriate conditions using auxiliary devices and "working bodies".

Chemical, biochemical work is carried out by the redistribution of electrons in chemical bonds with a change in the nature of "chemical individuals". During electrical work, the electron as “working body” moves within the cell lattice of the conductor and in the process, the nature of the “chemical individual” of the consductor does not change. In the case of electrochemical work, the process proceeds at the electrode-substrate interface with a change in “chemical individuals”, and the electron’s movement along the external circuit represents the relay mode between the lattice cells.

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