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B. T. UTELBAYEB[1], E. N. SULEIMENOV[2], A. B. UTELBAYEBA[3]

[1]Bekturov Institute of Chemical Sciences. Almaty, Republic of Kazakhstan,
[2]Kazakhstan-British Technical University, Almaty, Republic of Kazakhstan,
[3]South-Kazakhstan State University named after M. Auezov, Shymkent, Republic of Kazakhstan

"ELECTROMAGNETIC MATTER" IN ATOMIC MOLECULAR STRUCTURE OF SUBSTANCES

Abstract. The magnitude of the charge potential characterizes by electric field strength (E), and they interact through the "magnetic matter" characterized by intensity of magnetic field (H). The magnetic phenomenon of substances are not derived or converted of electricity into magnet, it is manifested from the composition of the charges as its component in the form of a "magnetic matter" at the energetic process, i.e. at the interaction of charges and their movements.

In turn, the electroneutrality of atomic-molecular structures implies that the physical quantities that characterize charges are manifested in the presence of another charge or when their stationary state is violated. The appearance of the electromagnetic field of the conductor during the flow of electric current, current displacement, electromagnetic radiation, etc. allow us to believe that in the atomic and molecular structure of substances there is a certain "material substance" that creates an electric field under the action of EMF, which is called "electromagnetic matter". The identity of the nature of elementary energy carriers manifested in the form of heat, light, electricity, etc., the mass of "electromagnetic matter"is calculated.

Keywords. substance, atom, electron, nucleus, magnet, charge, field, "electromagnetic matter".

Introduction. According to the modern concepts of the matter consisting of chemical elements, i.e., interconnected atoms - electroneutral particles include a positively charged nucleus and negatively charged electrons [1-6]. And by the interaction of charged particles, we know the theory of short-range action - which is carried out through some intermediate link, and the theory of long-range action where the interaction can be transmitted instantly over arbitrarily long distances. Later, James Maxwell [7] established that any interaction between charged bodies does not occur instantly, but over a certain period of time. This was confirmed by Faraday's experiments [8], where charges are surrounded by an electric field through which the interaction is carried out. In other words, the works of Faraday and Maxwell indicated that there are still some carriers of interaction and charges interact with each other through their fields. In other words, each charged particle creates an electric field in the surrounding space, which is abstractly described by the lines of attraction and repulsion. Thus, an electrostatic field occurs around any stationary charge, which does not change its properties over time. This field will act on any other electric charge, and the field of the other charge will also act on the first charge. At the same time, an electric current is an ordered movement of electric charges that create a magnetic field around themselves. These fields are

described using force lines that can graphically represent not only the direction, but also the strength of the electric and magnetic fields at a given point. However, the nature of the lines of force of electric and magnetic fields, their density still remains undiscovered. And this article is devoted to elucidating these problems based on the energy manifestations of electric current, where charged particles participate in real processes.

DISCUSSION

It is known that scientific achievements in the field of atomic and molecular structure of substances revealed the phenomena with unusual properties of micro objects, which are reflected in the properties of macroscopic formations of substances[1-6]. And any substance consists of alternating opposite charged nuclei and electrons, which are generally electroneutral. In an electric current, electrons are taken by moving charges, and the core remains stationary preserving the structure of this conductor. According to scientific terminology, electric charge is a characteristic of particles and bodies that determines their interaction with the electromagnetic field. It is known, that J. Maxwell proposed the theory of the electromagnetic field, according to which the electric and magnetic fields exist as interconnected components of a single whole – the electromagnetic field. It followed that any changes in the electromagnetic field must generate electromagnetic waves propagating at a finite speed that depends on the dielectric and magnetic permeability of the medium. For a vacuum, the theoretical value of this velocity was close to the experimental measurements of the speed of light obtained at that time, which allowed Maxwell to suggest (later confirmed) that light is one of the manifestations of electromagnetic waves. In 1887, the German physicist G. Hertz [9] set up an experiment that fully confirmed Maxwell's theoretical conclusions. However, abstractly accepting the electromagnetic field, the change of which generates an electromagnetic wave, where the wave is the trajectory of "some matter" and thus the nature of the electromagnetic field itself remains open. According to the definition of scientific literature, an electromagnetic field is a force field formed around an electric current, equivalent to electric and magnetic fields. At the same time, the issue of the flow of electric current through the conductor is still debatable. According to generally accepted concepts, the movement of electrons causes the flow of electric current and the carriers of electricity in metals are electrons under the influence of an electric field [10]. However, recently it has become clear that the speed of the electron during the flow of an electric current is very different from the speed of the electric field. Hence, if the carrier of electricity is electrons (metals), then what is their role in creating an electric field. In practice, an electric field propagating at the speed of light appears along the entire length of the conductor. In turn, the speed of propagation of the electric field in a conductor depends on its dielectric(ε) and magnetic (μ) permeability, and in (ε μ) 1/2 is less than in a vacuum. For example, for a copper conductor, the

permittivity ( ) is 978, and the magnetic permeability (μ) is 0.999 and the propagation speed of the electric field (v) is equal to:

$$v = C/(\varepsilon\mu)^{1/2} = 3 \cdot 108/(978 \cdot 0{,}999)^{1/2} = 3 \cdot 108/31{,}26 = 0{,}959 \cdot 10^7 \text{ m/s.}$$

The calculated speed is about $0.959 \cdot 10^7$ m/s compared to the speed of the electron in the interval $1 \cdot 10^{-4}$ - $1 \cdot 10^{-5}$ m/s differs by 11 – 12 orders of magnitude, and, therefore, electrons at this speed cannot create an electric field[11]. In [12], the process of passing an electric current is explained by the formation of a magnetic field and the formation of a rigid complex with an electron. It is considered that when a voltage is applied, the electric field propagates at the speed of light and interacts with conduction electrons, where the movement of electrons excites the magnetic field. An electron and a magnetic field form a single rigid complex that carries an electric current at the speed of light. However, the electron moves at a speed of less than 0.1 mm per second and it follows that this assumption is not real.

In [13], it is stated that the electric current is carried along the wire by electromagnetic waves, and not by the movement of electrons. As we noted above, waves are the trajectory of a material substance, and the material nature of the wave components of the electromagnetic field components remain undiscovered. The authors also neglect the role of electrons as one of the main participants in the transmission of electrical energy.

Unambiguously, the transmission of electricity is carried out through a conductor, which consists of a nucleus of electrons and elementary particles. Therefore, under the influence of an external driving force, the direct participants in the creation of an electromagnetic field and the flow of an electric current, in addition to the electron, must be other participants in the atomic structure. This means that in the atomic-molecular structure of the conductor there is a certain "material substance" that creates an electric field under the action of the EMF source. At the same time, the appearance of a magnetic field in the conductor during the passage of electricity means that the "material substance" must have an electromagnetic nature.

In this regard, the nature of this elementary matter was of interest, and based on the analysis of scientific literature on the atomic and molecular structure of substances, it was found out:

– the presence of magnetic moments in the electrons and nuclei, the main components of the atomic structure;

– formation of magnetic and electric fields of the conductor during the flow of an electric current (moving charge);

– substances are characterized by dielectric (ε) and magnetic (μ) permeability describing their electrical and magnetic properties ;

– attraction (repulsion) of metal objects to a magnet;

– attraction and formation of associations of electron-neutral atoms with each other;

– coexistence of opposite charges without annihilation, etc.

According to these data, it can be concluded that the basic structure of substances consists of electrons and nucleons, so the presence of magnetic matter in these particles must be an axiom, i.e., each elementary charge includes electric and magnetic components. In addition to the charge, the particles have a moment of momentum, which is called spin [13]. According to these authors spin is not caused by the rotation of the particle around the axis, because such an explanation would have to assume the presence of a linear rotation speed greater than the speed of light, which is impossible. Therefore, spin is considered as an internal property of the particle and it is associated with the presence of magnetic properties of the particle namely the presence of a magnetic moment, which also cannot be explained by the movement of the charge and is considered as the original property of the particle [13]. Note that in classical electrodynamics, the magnetic moment can only be the result of the movement of charges along closed trajectories.

According to the Ampere's hypothesis [14] elementary electric currents responsible for magnetic properties circulate inside the molecules composing the substance. At the same time, if these currents are located chaotically in relation to each other, their action is mutually compensated, and no magnetic properties are detected. In the magnetized state, the elementary currents in the body are oriented in a strictly defined way, so that their actions add up. And according to modern scientific literature the magnetic interaction is not caused by special magnetic charges, similar to electric charges, but by the movement of electric charges - a current. Based on the basic property of matter, which is characterized by mass, expressing the measure of inertia and energy – the measure of its movement. It is well known that an electrostatic field occurs around any stationary charge, which does not change its properties over time. This "field" will act on any other electric charge, which will also act on the first charge. According to Coulomb's law, opposite charges interact with "electric lines of force", but the nature of these forces is not revealed. In addition, the "force lines" of opposite charges must be annihilated when they come into contact, which in reality does not happen. We believe that the interaction of charges refers to energy processes where there is an energy manifestation. So the interaction of charges is carried out by "some matter" such as "magnetic components" of charges, which implements attraction (repulsion). Hence, the force fields between the charges represent "magnetic matter".

Thus, charges represent a form of matter consisting of electric and magnetic components, where the magnitude of the charges characterizes the electric field intensity (E), and their interaction through "magnetic matter" is characterized by the intensity of the magnetic field (H Magnetic phenomena of substances are not derivatives or transformation of electricity into magnetic, but represent the "magnetic matter" of charges manifested in energy processes, i.e., when charges interact and their movements.

The named physical quantities characteristic of charges are shown in the presence of another charge. The electronutrality of atoms, the appearance of the electromagnetic field of the conductor when an electric current flows, the current displacement allow us to believe that a certain "material substance" that creates an

electric field under the action of an EMF source is "electromagnetic matter". We believe that it is formed as a result of the interaction between elementary positive and negative charges and represents an "electric dipole"(the charges of the poles "+" and "–") with "magnetic matter" (the North and South poles of the magnet) performing the interaction. These "electromagnetic matter" under the influence of external voltage creates an electromagnetic field and moves free electrons along the conductor creating an electric current [15]. Therefore, the electromagnetic field is created not by the movement of electrons, but by "electromagnetic matter".

For "electromagnetic matter" taking into account the dipole structure, the value of the charge of the poles is assumed to be equal to the charge of the electron (4.8×10^{-10} CGS of charging units or 1.6×10^{-19} culon). The interaction of charges is carried out by means of "magnetic matter". For micro-objects near the boundary of the Planck value, their characteristics are complicated by the lack of direct instrumental measurements and it is difficult to determine the structure and shape of the elementary "material substance". And in the scientific literature, this concept is presented in different ways: in the form of "particle-free form" [16], "particle-field dualism of Matter" [17], "particle-wave dualism" [18], "electromagnetic particle" [19-22], "electromagnetic wave" [8], etc. According to the work of M. Faraday in [7], it is stated that regardless of the thermal, light, chemical, physiological, magnetic or mechanical energy source, all of them can manifest as the same electricity. This thesis means that the nature of elementary energy carriers is identical. For example, in the case of alternating current, a change in voltage causes the shape of "electromagnetic matter" to change and make ripples. In turn, when the electron moves in relation to the nucleus, the interaction changes, which is manifested in the form of the release of the "magnetic component" of charges. The released "magnetic component" pushes out the pulsating "electromagnetic matter", which, depending on their nature of movement, are released in the form of heat, light, electromagnetic waves, and other energy manifestations. And the place of isolated "electromagnetic matter" is filled by an external source of "electromagnetic matter" according to the relay mechanism. At the same time, practice shows that the structure of the" chemical individual " of the conductor does not change at alternating current, and the value of the self-induction EMF (ind) is expressed by a known equality [12]:

$$\varepsilon_{ind} = -L\, dI/dt$$

where, L is the inductance of the circuit or the self-induction coefficient, the value of which depends on the geometric properties of the circuit and on the nature of the system's magnetic components; dI/dt is an infinitesimal change in the current strength over time. The movement of charges takes the work defined by the product of IU per unit of time and the Ohm's law at each moment of time has a value:

$$R = \varepsilon_{out} + \varepsilon_{ind} = \varepsilon_{out} - L\, dI/dt.$$

Therefore, the participants of the electric current are elementary "electromagnetic matter" in the atomic-molecular structure of the "chemical individual", which

creates an electromagnetic field under the influence of an EMF source and induces the movement of electrons along the conductor.

The electron is shifted from a stationary position until the external potential difference created by "electromagnetic matter" is reached by performing electrical work creating an alternating current in the system. The relationship between the work of external forces, Joule heat and inductance of the circuit in the conductor is reflected in accordance with the law of conservation of energy in the form [12]:

$$P - Q = d/dt\ [^1/_2 LI^2]$$

where P is the work of external forces, Q is the Joule heat, L is the inductance of the circuit or the self-induction coefficient, the value of which depends on the geometric properties of the circuit and the nature of the system's magnetic components, I is the current strength. The integral of $d/dt\ [^1/_2 LI^2]$ equal to $^1/_2 LI^2$ expresses the magnetic energy of the system, which is inextricably linked to the existence of a magnetic field in it. According to this view, the change in the magnetic energy of the current system is associated not only with the work of external forces and the release of Joule heat, but also with the work of the field spent when moving the conductors under the action of an ampere force. The law of conservation of energy requires the following equality:

$$dW_m = -A - (Q - P).$$

Here dW_m is an infinitesimal change in the magnetic energy of the system, and is a mechanical work.

Electromagnetic energy is distributed in space with a density of

$$W = {}^1/_{8\pi}\ (\varepsilon E^2 + \mu H^2).$$

It is also noted here that in fast-changing fields, the question of converting magnetic energy into electrical energy and Vice versa loses its physical meaning. At the same time, it is necessary to consider any energy transformations that occur in the electromagnetic field, attracting the amount of electromagnetic energy as a whole to the energy balance. At the same time, the Poynting vector characterizes the flow of electromagnetic energy, which takes into account the following fundamental circumstance in the equations: the change in electromagnetic energy inside a volume is accompanied by the outflow or flow into this volume of an equivalent amount of energy carried by "electromagnetic matter". Similarly, when performing work (chemical, biological, electrochemical, etc.), it is characteristic to move (redistribute) electrons and elementary particles with the same energy manifestations. In all these changes, the number of electrons involved in the process before and after remains constant and only redistributes them between the structural elements of "chemical individuals" [23], and the elementary particles representing their energy movements are scattered in the environment forming combinations with their components. For example, ordinary light rays received by "electromagnetic waves" and thermal energy are a stream of "electromagnetic matter". The elementary particle - heat carrier "theplotron" proved by us in [15,19-22,24-27], is a type

of "electromagnetic matter". In [24,25] based on the thermodynamic and quantum – mechanical representations we have proposed the hypothesis about carriers of heat – " theplotrons". The elementary heat carrier is called by us - "theplotron" - due to the lack of strict conclusions and terms in the scientific literature that characterize the process of heat transfer at the level of "elementary particles". For the combustion of hydrogen using thermodynamic data and using the formulas of quantum physics, the mass of the heatron was calculated ($2{,}435 \cdot 10^{-36}$-$5{,}280 \cdot 10^{-36}$ kg). Similarly, using the pressure of light as a type of electromagnetic radiation, experimentally detected and measured by the Russian physicist P. N. Lebedev, the mass of the photon was calculated. The pressure of a photon, like any material object that characterizes the energy ε and moves at the speed of light, has a momentum $\boldsymbol{p = \varepsilon / c}$. This formula allows us to determine the mass of a photon as a kind of "electromagnetic matter", where, according to spectroscopic optical data for visible light, the value of its frequency varies from $\mathbf{3.31 \cdot 10^{14}}$ to $\mathbf{7.81 \cdot 10^{14}}$Hz. It is known from the Planck equation that $\boldsymbol{\varepsilon = h\nu}$, and the momentum of a material particle is equal to the product of its mass (m) and velocity ($\boldsymbol{v}$):

$$\boldsymbol{p = mv}$$

When the particle speed is equal to the speed of light, the photon momentum formula is written as (Compton effect):

$$\boldsymbol{p = mc}$$

In these cases equality is true:

$$\boldsymbol{mc = h\nu / c} \text{ (i.e. } \boldsymbol{mc^2 = h\nu)}$$

From here:

$$\boldsymbol{m = h\nu / c^2}$$

Substituting numeric values into the formula gives the mass of the photon at the corresponding frequencies:

$$\mathbf{m = 6.62 \cdot 10^{-34} \cdot 3.31 \cdot 10^{14} / (3 \cdot 10^{8})^2 = 2.43 \cdot 10^{-36}\ kg}$$
$$\mathbf{m = 6.62 \cdot 10^{-34} \cdot 7.81 \cdot 10^{14} / (3 \cdot 10^{8})^2 = 5.43 \cdot 10^{-36}\ kg}$$

These numbers $2.43 \cdot 10^{-36}$ kg and $5.43 \cdot 10^{-36}$ kg are close to the mass of "theplotron" $5.28 \cdot 10^{-36}$ kg, which was calculated by us in the thermodynamic data for the combustion of hydrogen and exactly matches the calculations.

Conclusion. Based on the nuclear – electronic structure of atoms consisting of charged particles, it is proposed that ***the charges represent a form of matter including electric and magnetic components.*** The charge values characterize the potential energy expressed by the ***electric strength (E)***, and their interaction is carried out by means of "***magnetic matter***" characterized by the ***magnetic field strength*** (***H***) (*Maxwell's equation*).

Magnetic phenomena of substances ***are not derivatives or transformation of electricity into magnetic,*** but components of charges that appear in energy pro-

cesses in the form of ***"magnetic matter***", i.e., when charges interact and their movement. The interaction of elementary positive and negative charges formed by "***electromagnetic matter***" representing the "electric dipole" (polar charges "+" and "–") with the "***magnetic matter***" engaged in the interaction of charges in the atomic structure of substances.

The force fields between the charges represent "magnetic matter", and the electromagnetic field is formed by "electromagnetic matter" under the action of an external force. Depending on the nature of the process, "***electromagnetic matter***" is released from the system in the form of heat (a set of "theplotrons"), light (a stream of photons), electromagnetic waves ("electromagnetic matter"), and other energy manifestations.

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Резюме

Б. Т. Утелбаев, Э. Н. Сулейменов, А. Б. Утелбаева

ЗАТТАРДЫҢ АТОМДЫ МОЛЕКУЛАЛЫҚ ҚҰРЫЛЫМЫНДАҒЫ «ЭЛЕКТРОМАГНИТТІ МАТЕРИЯ»

Табиғаттағы орын алатын үдерістер мен ғылыми тұрғыдағы мәліметтерге сүйене отырылып, микро макроскопиялық бірліктегі материялық дүниеліктер арасындағы энергетикалық құбылыстар негізінде заттардың атомды молекулалық құрылымында элементар құраушы дүниеліктердің бар екендігі талданылады. Атомдардың оң зарядты ядродан және теріс зарядты электрондардан тұратыны негізінде зарядтардың электрлік және магниттік компоненттерден құралатын материя түрі екендігі ұсынылады. Заряд шамалары олардың электрлік кернеулігі (***E),*** ал олардың өзара әрекеттесуі магниттік материя арқылы жүзеге асатын магнит өрісінің кернеулігі ***(H*****)** арқылы сипатталынады. Магниттік құбылыс электр тогының туындысы немесе оның магнитке айналуы нәтижесінде емес, ол сол зарядттардың бойында болатын табиғи материалды дүниелік және зарядтар қозғалысы немесе өзге үдеріс нәтижесінде көрініс береді. Зарядтарды сипаттайтын физикалық шамалар олардың стационарлы күйінен ауытқуынан орын алады. Сыртқы электр қозғаушы күш әсерінен электр тогының өтуінен өткізгіштерде электромагниттік өрістің туындауы олардың атомды молекелалық деңгейінде нақты бір элементар«электромагнитті материяның» бар екендігін тұжырымдалынды. Жылу, жарық және өзге түрдегі энергия тасымалдаушы элементар бөлшектердің табиғатының бір екендігі ескеріле отырылып «электромагнитті материя»массасы есептелінді.

Түйін сөздер: зат, атом, электрон, ядро, магнит, заряд, өріс, «электромагнитті материя».

Резюме

Б. Т. Утелбаев, Э. Н. Сулейменов, А. Б. Утелбаева

«ЭЛЕКТРОМАГНИТНАЯ МАТЕРИЯ» В АТОМАРНО-МОЛЕКУЛЯРНОЙ СТРУКТУРЕ ВЕЩЕСТВ

В статье на основе реальных процессов и энергетических проявлений, происходящих между материальными объектами, учитывая микро-макроскопического единства веществ и по имеющимися данным, обсужденЫ некоторые элементарные составляющие атомно – молекулярного строения веществ. Основываясь на ядерно-электронной структуре атомов, состоящих из заряженных частиц, предложено, что **заряды представляют форму материи, включающей электрическую и магнитную компоненты**. Величины зарядов характеризуют потенциальную электрическую энергию, выражаемую **напряженностью (*E*)**, а их взаимодействие осуществляется посредством ***«магнитной материи»*** характеризуемой **напряженностью магнитного поля *(H*)**. Магнитные явления веществ не являются производными, а составляющими зарядов, проявляющихся при энергетических процессах в виде **«магнитной материи»**, т.е. при взаимодействии зарядов и их движения. В свою очередь, из электронейтральности атомно-молекулярных структур вытекает, что ф*изические величины, характеризующие заряды, проявляются при наличии другого заряда или при нарушении их стационарного состояния.* Появление электромагнитного поля проводника при протекании электрического тока, ток смещение, электромагнитное излучение и др. позволяют полагать, что в атомарно-молекулярной структуре веществ имеется некая «материальная субстанция», создающая электрическое поле под действием ЭДС источника, которое названо «электромагнитной материей». На основе идентичности природы элементарных переносчиков энергии, проявляющихся в виде теплоты, света, электричества и др. ,рассчитана масса «электромагнитной материи».

Ключевые слова: вещество, атом, электрон, ядро, магнит, заряд, поле, «электромагнитная материя».