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Қ. И. Сәтпаев атындағы Қазақ ұлттық техникалық зерттеу университеті

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НАН РК сообщает, что научный журнал «Известия НАН РК. Серия геологии и технических наук» был принят для индексирования в Emerging Sources Citation Index, обновленной версии Web of Science. Содержание в этом индексировании находится в стадии рассмотрения компанией Clarivate Analytics для дальнейшего принятия журнала в the Science Citation Index Expanded, the Social Sciences Citation Index и the Arts & Humanities Citation Index. Web of Science предлагает качество и глубину контента для исследователей, авторов, издателей и учреждений. Включение Известия НАН РК. Серия геологии и технических наук в Emerging Sources Citation Index демонстрирует нашу приверженность к наиболее актуальному и влиятельному контенту по геологии и техническим наукам для нашего сообщества.

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CHARACTERISTICS AND PROPERTIES OF PHYSICAL AND QUANTUM FIELDS OF NANOCARBON AND THEIR APPLICATIONS

Abstract. It is theoretically justified, characteristics have been determined for physical (electric, magnetic) and quantum (wave corpuscle) fields of surface nanocarbon electrons.Validity and preserving have been specified for their numerical values of field characteristics for nanopowders of solid bodies. It has been proved that quantum-dimensional effect of nanopowders is the surface activity of a substance, the essence of field actions. Actions of physical and quantum fields and the proposed model of electron can influence considerably on the development of nanotechnology and nanophase materials science.

Key words: nanopowder, electric and magnetic fields, wave-corpuscle characteristics, quantum-dimensional effect, Compton effect, wave length.

Introduction. A large number of qualitatively new indicators and properties of substance nanoparticles uncharacteristic of the macrostates of the latter have been experimentally discovered [1]. Nanoparticles of many solids significantly change their optical, electrical, magnetic and electromagnetic properties, acquire high thermal and radiation stability, become ultra-light and super-strong, extremely hard and wear-resistant, stand incredible impact forces and show flexibility to large loads without loss of continuity. Nanoparticles made from nanoparticles significantly change Young's modulus, Poisson's ratio, shear modulus, compressibility, and other properties.

The experimenters [1] note the unusually high “free valency” of nanoparticles, allowing them to form new nanomaterials with unimaginable qualities for macro substances. For example, silicon and tantalum nanoparticles form tantalum silicide (practically non-oxidizing in the open air) with a melting point of + 5500 °C, a record low electrical resistance. Nanopowders of aluminosilicate, iron or cobalt, magnesium or manganese form an alloy with an anomalously high magnetocaloric effect, which made it possible to create new cryogenic devices and revise the fundamentals of magnetic material science.Free-valence surface electrons occupy high energy levels with a large reserve of absorbed energy during crushing and abrasion of a substance to a nanopowder, unattainable in ordinary ion-radical reactions and characteristic only of extreme effects. As an example, let us note our experiments [2-4] of modifying road bitumen with the addition of nanocarbon up to 200 nanometers in the amount of up to 2% of mass, where a new phenomenon of low-energy transformation of bitumen resins into asphaltenes and oils, providing it with high strength and growth, has been discovered low temperature stability. In nanocarbon a catalyst property was observed that promoted the mutual transformations of the structural elements of bitumen and increased their reaction rate up to phase transitions of solid nanoparticles into ***liquid hydrocarbon molecules***.

The main reason for nanoparticles to acquire the properties of surface active substances (SAS), a catalyst, and a promoter is the quantum-dimensional effect (QDE), i.e. commensurability of nanoparticle size and de Broglie wavelength λe of an electron [5]:

$$\lambda_e \approx h / \sqrt{m_{эф} E_{ф}} \,, \quad (1)$$

where $m_{эф}$ – effective mass, $E_{ф}$ – Fermi electron energy,$h = 6,625 \cdot 10^{-34} J{\cdot}sec$ – Planck constant. Known that $m_{эф}$ may turn out to be by an order, sometimes two orders of magnitude, less than its real mass [6]. The Fermi electron energy also differs from its total energy by one or two orders of magnitude [6,7]. Consequently, the length calculated by (1) is a random variable, and the QDE is a doubtful factor in the acquisition of the properties of SAS, catalyst, and promoter by nanoparticles. In the theory of nanomaterials and physical nanochemistry, the energy and wave parameters of a nanoparticle are calculated using de Broglie relations[1-5]:

$$\lambda = h / mu, \quad (2)$$

where m – mass, u – nanoparticle velocity. Formulas (1) and (2) are widely used in determining the energy and wave parameters of a nanoparticle, the energy costs of producing nanomaterials, and the economic benefits of their industrial application. Using (1) and (2), the experimental values of the de Broglie wavelength from 0.1 to 10 nm for metals and from 10 to 100 nm for semiconductors, semimetals, and alloys of refractory metals are substantiated [5,7]. In our opinion, the real physical meaning and the physicochemical mechanism of the special qualities of nanoparticles and nanomaterials lie behind CDE.The purpose of this article is to build an adequate theoretical understanding and justification of the physical (field) and quantum-mechanical mechanisms of the quantum-dimensional effect. Considering the vastness of the nanoparticles class, we focus on nanocarbon of coal rocks [2-5], and summarize the results of its study on nanoparticles of solids and their alloys.

Characteristics of the physical fields of surface electrons of nanocarbon. Each nanocarbon particle is bounded by a surface in the form of a sphere of radius R of the order of 100 nm (10^{-7} m). It is inhabited by electrons of carbon molecules C_2 with a surface density ρ_e in the amount of 10^{15} units per cm^2 of the area: $\rho_e \sim 10^{15} e/cm^2$ [2-4]. Sphere with the area $S \sim 4\pi \cdot 10^{-14} cm^2$, is inhabited by about 10^6 electron units $\rho_e' \sim 10^6 e/S$[2-4]. The intensity $E\ (C2)$ and the density $U\ (C2)$ of the electric field, the induction $B_e$and the strength of the H_e magnetic field are defined in [2-4]:

$$E(C_2) = 1{,}04 \cdot 10^9\ В/м \approx 10^7\ В/см, \quad (3)$$

$$E_e = 1{,}442(10^7 \div 10^{10})\ В / см, \quad (4)$$

$$U_e = (10^3 \div 10^5)\ В, \quad (5)$$

$$B_e = (0{,}3 \div 3 \cdot 10^3)\ T_e, \quad (6)$$

$$H_e = (1{,}6 \cdot 10^6 \div 1{,}6 \cdot 10^9)\ a / м. \quad (7)$$

The kinematic energy T_e and the electron velocity V_e are also determined [2-4]:

$$T_e = (10^3 \div 10^5)\ эВ, \quad (8)$$

$$V_e = (0{,}593 \div 1{,}875)\ 10^8\ м / с. \quad (9)$$

Characteristics (3) - (9) of the electric and magnetic fields of the surface electron of nanocarbon have experimental confirmation in the materials of the scientific discovery of the corresponding member of the USSR Academy of Sciences B.V.Deryagin [8]. The tension (3) of an individual molecule C2 and the tension (4) of a nanocarbon are sufficient for emission of surface electrons [2-4, 8]. Let us consider the motion of the emission electron in the electric field with strength (5) and the magnetic field with the induction (6). As its average speed in the interval (9) with average energy (8) we take the velocity $V_e = 0{,}712 \cdot 10^8 m/sec$. The trajectory will be a helical orbit with a Larmor radius rL. Electron experiences precession with angular velocityω_L(cyclotron frequency) or Larmor frequencyν_L [9]with the values

$$r_L = 2 \cdot 10^{-7}; \quad \omega_L = 3,52 \cdot 10^{14}\, Гц; \quad \nu_L = 0,56 \cdot 10^{14}\, Гц, \tag{10}$$

where Гц = (1/c) – Hertz. The precession of a material point does not make sense. Academician of the USSR Academy of Sciences M.A. Markov [10] said: ***"... the fundamental difficulty of the theory ... is due to the fact that all particles in modern physics are regarded as point particles."***

Values (10) have no experimental evidence. Their reliability follows from the formulas for the relationship between the characteristics of the magnetic field and reliable values of the electric field. In addition, the academician of the USSR Academy of Sciences, Nobel Laureate V. L. Ginzburg, considering the problem of creating super-powerful quantum generators, wrote [6]: "... ***the creation of x-ray and gamma-ray analogs is one of the important fundamental physical problems ... All the proposals we know regarding the sizes and grasers belong to the field of energies not exceeding 10 keV (10^4 eV)*** ... "X-ray and γ-ray laser systems are called Raser and Graser respectively. The values of the electric field strength (5) and the coincidence of the Larmor radius (10) with the focusing radius of the field of existing high-power lasers indicate the reliability of the characteristics of the physical fields of nanocarbon. We determine the pressure *Qe* of the magnetic field with intensity *H**e*** [9]:

$$Q_e = \frac{\mu_0 H_e^2}{2} = 3,217 \cdot 10^{12} \frac{H}{м^2}, \tag{11}$$

where *H* – Newton(power unit). Pressure (11) exerts a inhibitory effect on the motion and the electron experiences magnetic bremsstrahlung with a length λ_L:

$$\lambda_L = V_e / \nu_L = (0,712 \cdot 10^8) : (0,56 \cdot 10^{14}) = 1,271 \cdot 10^{-6} \ м. \tag{12}$$

Comparing (12) with the de Brogliewaveleng the mitted by world-famous power full asersystems [6, 7], we have their completecoincidence. This fact proves the reliability of the characteristics of the magnetic field of nanocarbon and indicates that our device for the nanopowder production in a rotating magnetoelectric field works as the powerfull asersystem. Its magnetoelectric field wave generator has a power of 4 kW and deserves much attention from the point of view of quantum generators. We consider the quantum field characteristics of nanocarbon.

Quantum field characteristics of surface electrons of nanocarbon. For a nonrelativistic electron, we write down [9, 11] the law of equivalence of the total energy ε_e and Einstein mass m_e and de Broglie relation:

$$E_e = m_e c^2; \quad c = 2,998 \cdot 10^8 \ м / c, \tag{13}$$

$$\varepsilon_e = h\nu_e; \quad P_e = m_e \nu_e = h / \lambda_e; \quad \lambda_e \nu_e = c. \tag{14}$$

In the 2nd case, the common mass of electron is used. Takingitintoaccountusing (13) and (14) we determine the electron frequency ν_e

$$\nu_e = m_e c^2 / h = 1,236 \cdot 10^{20} \ Гц. \tag{15}$$

With the help of (15), we calculate electron wave length λ_e

$$\lambda_e = c / \nu_e = 2,426 \cdot 10^{-12} \ м. \tag{16}$$

The coincidence of the value (16) with the Compton wavelength of the electron expresses the essence of the Compton effect [9, 11]. Value (15) coincides with a theoretically determined electron frequency [12]. However, the method of calculating λ_e by the author [12] is very different from ours, which proves the possibility of calculating ν_e and λ_e in the classical way. In view of (16), we turn to the second formula from (14) and calculate the electron velocity V_e

$$V_e = c. \tag{17}$$

An equality (17) contradicts the Special Theory of Relativity (STR) and all modern physics based on it. This means that the meaning of the pulse in (14) differs from that implied in quantum physics (QPh). Therefore, abandoning the point model of the electron, we take its spatial model, where its arbitrary point A has an absolute velocity $\overrightarrow{u_A}$ from the sum of the translational velocity $\overrightarrow{u_0}$ of the center of massOand rotation of the electron around this center with the angular velocity $\overrightarrow{\omega_e}$ [13]:

$$\overrightarrow{u_A} = \overrightarrow{u_0} + \overrightarrow{\omega_e} \times \overrightarrow{r_A}, \tag{18}$$

where $\overrightarrow{r_A} = \overrightarrow{OA}$. Integrally the (18) gives the absolute velocity $\overrightarrow{u_A}$:

$$\overrightarrow{u_a} = \overrightarrow{u_e} + \overrightarrow{\omega_e} \times \overrightarrow{r_e}, \overrightarrow{u_e} = \overrightarrow{u_0} \tag{19}$$

With the free motion of the electron $\overrightarrow{u_e}, \overrightarrow{\omega_e}$ are constant in space and time, $\vec{r_e}$is rigidly connected with the electron and constant in module.It is orthogonal to $\overrightarrow{\omega_e}$ and changes a position in space according to the law of rotation. The impulse $P_e = m_e V_e$, included in (14), differs from the impulse $\overrightarrow{Q_a} = m_e \overrightarrow{u_a}$, i.e. $m_e V_e \neq m_e u_a$ ***This is the main difference between the point model of the electron of modern physics and its real spatial model.***

The values $\overrightarrow{u_e}$, $\overrightarrow{\omega_e}$, $\vec{r_e}$, in (19) are subject to determination. Referring to the QDE and the last equality (14), we take

$$r_e = \lambda_e / 2\pi; \quad \omega_e = 2\pi \nu_e; \quad r_e \omega_e = c, \tag{20}$$

where r_e – a radius of a minimal sphere centered at a point O, completely covering the electron. The unknown form of the electron remains to be determined. A rotating electron has a kinematic momentum $J_e \overrightarrow{\omega_e}$, where J_e - the main moment of inertia of the electron relative to the axis of its rotation, coinciding with one of the dynamic axes. Let the electron spin express its kinematic momentum [9, 11]:

$$k_e = \hbar / 2 \quad или \quad J_e \omega_e = \hbar / 2. \tag{21}$$

The kinetic energy of the electron rotation $T_{евр}$ is equal to [9,11]

$$T_{евр} = J_e \omega \frac{2}{e} / 2 = (J_e \omega_e) / 2 = \hbar \omega_e / 4. \tag{22}$$

According to (20) $\hbar\omega_e = \varepsilon_e$ and according to (13) the right side of (22) is equal to

$$T_{евр} = m_e c^2 / 4. \tag{23}$$

The kinetic energy of translational (figurative) movement $T_{епр}$ of the electronis equal to

$$T_{епр} = m_e u \frac{2}{e} / 2 = m_e c^2 / 2 - T_{евр} = m_e c^2 / 4. \tag{24}$$

Theequalities (23) and (24) allow to determine the effective velocities$u_{эф}$rotational (relative) and u_e translational (figurative) movements of the electron

$$u_{эф} = c / \sqrt{2}; \quad u_e = v_e = c / \sqrt{2} \tag{25}$$

From the equalities (22) and (23), taking into account the last relation (20), we get

$$J_e = m_e r_e / 2. \tag{26}$$

The equality (26) indicates the cylindrical shape (disk) of the electron with a base radius r_e and a relatively small height, much smaller than r_e. We accept the vectors $\overrightarrow{u_e}$, $\overrightarrow{\omega_e}$ as collinear, we fix an arbitrary point A on the rim of the disk and follow its movement. If $\overrightarrow{u_e}$, $\overrightarrow{\omega_e}$ are codirectional, then with the translational-rotational movement of the electron, point A will move along a helical line winding around a cylindrical surface with a radius r_e and an axis directed along the vectors $\overrightarrow{u_e}, \overrightarrow{\omega_e}$. In this case, they speak of the right helicity of the electron [9-12]. If $\overrightarrow{u_e}$, $\overrightarrow{\omega_e}$ have opposite directions, then the trajectory of point A will be a left-handed helix and speak of the left helicity of the electron. In both cases, starting from (25), we have

$$u_a = \left(u_{эф}^2 + u_в^2\right)^{1/2} = c. \tag{27}$$

Theelectron can be polarized $\overrightarrow{u_e}$, $\overrightarrow{\omega_e}$ mutually orthogonal, point A describe a cycloid with concavity up or down and for a right- or left-polarized electron with conservation (27). For polarization, efforts are needed and the most probable path will be a spiral with parameter a and pitch d:

$$a = 2\pi r_e = \lambda_e; \quad d = 2\pi r_e = \lambda_e. \tag{28}$$

The surface point A of the electron, describing the helix with the parameter and pitch (28), passes a distance of a length $l_e = c \cdot сек$ during translational movement with a velocity of (25) for $v_e$rotations. The pitch of the screw will be the de Broglie wavelength of the electron, and the number of rotations v_e, for which the electron travels a path of length l_e, – frequency of this wave. These are the geometric and physical meanings of the wave characteristics of the electron.

Such an electron model satisfies (13) the first and last expressions (14). The second of the de Broglie relations (14) contradicted SRT and CF, regardless of the indicated electron model. Taking $P_e= m_e u_a$ as the impulse, where u_a - the absolute velocity of the spatial electron model, we will have

$$P_e = m_e u_e. \quad P_e = m_e c. \quad P_e = \hbar\omega_e / c. \quad P_e = 2\pi\hbar / \lambda_e. \quad P_e = m_e u_a = h / \lambda_e. \tag{29}$$

The equality (29) is the second relation from (4), refined and consistent with SRT and CF, expressing the relationship of the total electron momentum with the characteristics of its de Broglie wave. This is logical from the point of view of Einstein's law (13), the wave form (14) of this law. This implies the law of conservation of the momentum of the total momentum

$$P_e\lambda_e = m_e u_a \lambda_e = m_e c \lambda_e = h. \tag{30}$$

From (30), there are consequences, which are important for the process of radiation and energy absorption by the electron. Radiating the energy, the electron lengthens and vice versa, absorbs energy, shortens the wavelength. According to (30), when the energy is emitted, the electron must lose a mass, and when it absorbs energy, increase it. Therefore, particles with masses should act as energy carriers, i.e. energy is inherent only in bodily and mass essence.Since the electron emits (absorbs) photons, x-ray and γ - ray, that they have mass. This contradicts SRT and CF, is not perceived by modern physics. However, it is experimentally proved the presence of mass in the photon [14].

Note that $\overrightarrow{u_a}$ - this is the group velocity of the electron. It is different from the velocity of the center of mass, $u_e<u_a$, shows the presence of electron rotation near the center of mass with a constant kinematic momentum. A number of corollaries can be drawn from the law (21) established experimentally. When the energy is radiated, the electron wavelength increases; therefore, the radiation frequency decreases according to (14). In accordance with the choice of (20), the angular velocity of rotation of the electron decreases. Then the moment of inertia J_e of the electron should increase. Turning to the expression (26), we see that

$$J_e = m_e r_e^2 / 2 = (m_e r_e) r_e / 2 = (m_e \lambda_e / 2\pi)(\lambda_e / 2\pi) / 2 = (h / c)(\lambda_e / 2\pi) / 2 = const \cdot \lambda_e. \tag{31}$$

From (31) the increase of J_e with λ_e follows.

In such a way, the electron model satisfies the basic postulate of STR and CF, experimentally established conservation laws and gives consistent results with the theory and experiments of radiation (absorption) of energy. The electron along with the form must have a structure and all that it emits is contained in its bowels. However, this is forbidden by modern physics and considers the electron to be the only mass particle without an internal structure [14]. Based on the act of electron production during the decay of a neutron that does not have an electron in the internal structure [14], we conclude that the electron is assembled from elements erupted from the bowels of the neutron during decay, has these elements in its internal structure, emits (absorbs) these same elements - photons, x-rays andγ - rays. Such a vision does not contradict anything, with the exception of the statement of modern physics about the absence of the internal structure of the electron. It should also be noted its electric charge and electron magnetism, expressed by Bohr magneton $\mu = 9,274 \cdot 10^{-24}$ *Дж / тл* [11]. In view of (26), we consider the expression (21) multiplied by the charge and transformed to the form:

$$\frac{er_e^2\omega_e}{2} = \frac{\hbar e}{2m_e} = \mu_e. \tag{32}$$

The left side of (32) can be called the electric kinematic momentum

$$\vec{q} = i_e\overrightarrow{\omega_e}, \quad i_e = er_e^2 / 2. \tag{33}$$

Accordingto (21) and (33) the kinematic momentum $\overrightarrow{k_e}$ and the electric kinematic momentum $\overrightarrow{g_e}$ are connected through the moment of inertia J_e and the electric moment of inertia i_e:

$$\overrightarrow{q_e} = \frac{e\overrightarrow{k_e}}{m_e}; \quad i_e = \frac{ej_e}{m_e}. \tag{34}$$

The Expression (34) shows that the electric kinematic momentum and the electric moment of inertia are very large quantities that differ from the mass of the kinematic momentum and the moment of inertia by a constant value e/m_e:

$$\frac{e}{m_e} = 1,759 \cdot 10^{11} \quad кл / кг \tag{35}$$

The equality (35) indicates that the charge mass is dispersed along the periphery of the electron, the ordinary mass is concentrated in its center of mass like an atom.

We hypothesize: *a Newtonian mass with a kg unit of measure is represented by a bipolar magnetic mass with the property of a magnet and orientational attraction.*

Combined field and quantum actions of nanocarbon on emission electrons. Each emission electron is accelerated by the voltage (5) of the electric field of the nanocarbon and, according to (10), makes a helical motion near the nanocarbon in its magnetic field with induction (6). We draw a plane through the center of mass of the nanocarbon, the hole from where the electron is torn, and the center line of the cylindrical surface (toroid) on which the helical trajectory of the center of mass of the electron is wound. The electron and the hole for man **exciton** [6, 12]. The electron makes three kinds of motions in space: helical motion with a portable velocity V_e, main rotation with an angular velocity ω_e, and precession. The precession is regular and is ensured by the moment of magnetic forces acting on the electron. orders of magnitude of angular velocities ω_L (1014 Hz) and ω_e (1020 Hz) indicate the applicability of the Zhukovsky rule [13] to them and the order of the moment of magnetic forces ensuring regularity of the precession, from 10^{-20} J to 10^{-18} J.The motion along a helical path differs from the motion in a circular orbit in that the interaction force of the electron and its hole, the centrifugal force of motion along a helical path will be equally oriented and directed into the hole at least once on each turn. As a result of the combined actions of these two forces, the electron falls on a nanocarbon and makes an exciton impact, causing a further collapse of the nanocarbon into smaller particles of a smaller nanoscale.

This is a real mechanism for the development of nanoprocesses; it is unnoticed and unexplored by anyone. Being an internal mechanism, it does not require large external energy forces and can explain the phase transition of solid nanocarbon particles added to the liquid state in bitumen. This fact is confirmed by experiments conducted in the laboratory of Kazakhstan Highway Research Institute JSC [2-4].

Conclusions about the accepted electron model. Nanotechnology and processes for the production of nanomaterials, like all other technological operations, are the result of electromagnetic interactions of atoms, an atom and a molecule, a molecule with a molecule in a substance. The rupture of chemical and physical bonds between the indicated structural elements of a substance, the formation of the necessary bonds are chemical reactions. Connections form electrons, thanks to them, the material world exists.The surface electrons of a nanocarbon form its physical fields and determine their characteristics. Emission electrons, interacting with the physical fields of nanocarbon, decide its fate. These circumstances are associated with the spatial model of the electron. In formulating the electron model, Einstein's law (13) was substantially used, with an important clarification that the mass is constant and does not obey the Einstein-Lorentz law, and de Broglie relation (14) with the refinement of the meaning of the pulse.The Compton wavelength and spin of the electron, the laws of conservation of the kinematic momentum and angular momentum of the electron, and the value of Bohr magneton were used. It is shown that the Bohr magneton follows from the law of conservation of the kinematic momentum of the electron, as a derivative, does not make much sense. Its reason lies in Maxwell's classical electrodynamics, which reduces magnetism to electricity and excludes the independent essence of the electron and the entire material world.

The model revealed the essence of the wave properties of an electron, the propagation of which required a carrier medium. It was established that it is not the wave that propagates, but the electron itself moves and what is called the wavelength and frequency are the parameters of this movement. The model explains the precession of the electron in the magnetic field under the action of a moment of magnetic forces and establishes that due to the high angular velocity of rotation, the electron having a large gyroscopic moment obeys the Zhukovsky rule and uniquely determines the momentum of external forces ensuring the regularity of the precession. The kinematic momentum of rotation of the electron, the spin, is preserved.

It is proved that the surface activity of matter and nanocarbon is a consequence of the manifestation of the properties of surface electrons with free valency in nanomaterials and their special characteristics. These facts can serve the development of nanotechnology, nanoscience and nanomaterial science, which are the basis of the cyclical economy and its digitalization using additive 3D printing. The role and place of physical and quantum fields of nanocarbon and its surface electrons are shown, the basis of the theory of electron in nanotechnology and nanomaterial science, developed in the direction of structural elements and electron structure, is laid.

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НАНОКӨМІРТЕКТІҢ ФИЗИКАЛЫҚ ЖӘНЕ КВАНТТЫҚ ӨРІСТЕРІНІҢ СИПАТТАМАЛАРЫМЕН ҚАСИЕТТЕРІ ЖӘНЕ ОЛАРДЫ ҚОЛДАНУ

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Аннотация. Нанокөміртектің беттік электрондарының физикалық (электрлік, магниттік) және кванттық (корпускулярлық-толқындық) өрістерінің сипаттамалары теориялық тұрғыдан негізделді және анықталды. Қатты денелердің наноұнтақтары үшін өрістердің сипаттамаларының сандық мәндерінің ақиқаттығы және сақталуы анықталды. Наноұнтақтардың кванттық мөлшерлік эффекті заттың беттік белсенділігі, яғни электрон өрістерінің әсері екені дәлелденді.Физикалық және кванттық өрістердің әсерлері мен электронның ұсынылған моделі нанотехнологиялар мен наноматериалтанудыңдамуына елеулі әсер етуі мүмкін.

Түйін сөздер: наноұнтақ, электр және магнитөрістері, корпускулярлық-толқындық сипаттамалар, кванттық өлшеу әсері, комптон әсері, толқын ұзындығы.

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ХАРАКТЕРИСТИКИ И СВОЙСТВА ФИЗИЧЕСКИХ И КВАНТОВЫХ ПОЛЕЙ НАНОУГЛЕРОДА И ИХ ПРИЛОЖЕНИЯ

Аннотация. Теоретически обосновано, определены характеристики физических (электрического, магнитного) и квантового (корпускулярно-волнового) полей поверхностных электронов наноуглерода. Установленысправедливость и сохранение числовых значений характеристик полей для нанопорошков твердых тел. Доказано что квантоворазмерный эффект нанопорошковесть поверхностная активность вещества, суть действия полей электрона. Действия физических и квантовых полей и предложеннаямодель электрона могут существенно влиять на развитие нанотехнологии и наноматериаловедения.

Ключевые слова: нанопорошок, электрическое и магнитное поля, корпускулярно-волновые характеристики, квантоворазмерный эффект, эффект Комптона, длина волны.

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