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THE INHABITANTS OF THE MICROWORLD

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Announcement. The new theory of microworld allows us to present the structures of the main inhabitants of the microworld: the photons, the electrons, the protons, the neutrons, the nuclei, the atoms, the molecules and the clusters. The experimenters have already obtained the images of some clusters; from these images, the authenticity of the implemented theoretical principles of the formation of the models of the electrons, the protons, the neutrons, the atomic nuclei and the atoms themselves results. A theoretical model of the photon results from the aggregate of the existing models, which describe its features and the processes of an interaction with the rest of the inhabitants of the microworld [2], [3].

THE STRUCTURES OF THE INHABITANTS OF THE MICROWORLD

All inhabitants of the microworld are the localized (limited in space) formations; that's why the size of an inhabitant of the microworld is the first parameter, which forms the correct notions concerning it. The sizes of the inhabitants of the microworld are changeable. They are changed within the certain limits. There are the names of the ranges, in which the sizes of the inhabitants of the macroworld and microworld are changed (Table 1) [1].

Table 1. Ranges of the change of the factors for specification of the sizes of the inhabitants of microworld

Range of change	Name	Designation Russian/international
10^{15} - 10^{18}	Exa	Э/E
10^{12} - 10^{15}	peta	П/P
10^{9} - 10^{12}	tera	Т/T
10^{6} - 10^{9}	giga	Г/G
10^{3} - 10^{6}	mega	М/M
10^{2} - 10^{3}	kilo	к/k
10^{1} - 10^{2}	hecto	г/h
0,0-10^{1}	deca	Да/da
0.0	**beginning**	**Н/B**
0,0 - 10^{-1}	deci	д/d
10^{-1} - 10^{-2}	centi	с/c
10^{-2} - 10^{-3}	milli	м/m
10^{-3} - 10^{-6}	**micro**	мк/μ
10^{-6} - 10^{-9}	nano	н/n
10^{-9} - 10^{-12}	pico	п/p
10^{-12} - 10^{-15}	femto	ф/f
10^{-15} - 10^{-18}	atto	а/a

1. THE PHOTON

The photon consists of six ring magnetic fields, which are closed with each other along the circled contour (Fig. 1). Radius is the main geometrical parameter of the photons. It is changed, but the structure of the photons (Fig. 1) remains unchanged [2], [3].

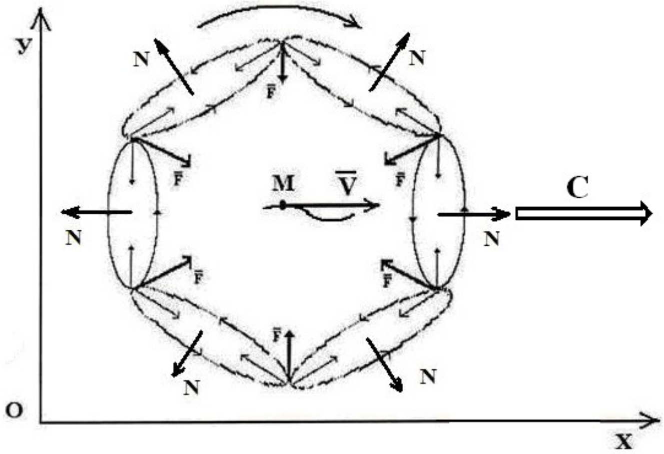


Fig. 1. Diagram of the model of the photon

A radius of the largest photons is nearly $r = 0.052m = 5.2 \cdot 10^{-2} m$. It is a MILLI band (Table 1). An aggregate of such photons forms the lowest temperature, which is nearly 0.056 K. The size of the smallest gamma photons is nearly $3.0 \cdot 10^{-18} m$. It is an ATTO band (Table 1). Thus, the radius of the photons is changed within the limits of sixteen orders of magnitude (10^{16}) (Table 2) [1].

Table 2. Bands of changes of radii r (wavelengths λ) and masses m of the photons

Bands	Radii (wavelengths), $r = \lambda$, m	Masses m, kg
1. Low-frequency band	$3 \cdot 10^{6} ... 3 \cdot 10^{4}$	$0.7 \cdot 10^{-48} ... 0.7 \cdot 10^{-46}$
2. Broadcast band	$3 \cdot 10^{4} ... 3 \cdot 10^{-1}$	$0.7 \cdot 10^{-46} ... 0.7 \cdot 10^{-41}$
3. Microwave band	$3 \cdot 10^{-1} ... 3 \cdot 10^{-4}$	$0.7 \cdot 10^{-41} ... 0.7 \cdot 10^{-38}$
4. Relic band	$r = \lambda \approx 1 \cdot 10^{-3}$	$2.2 \cdot 10^{-39}$
5. Infrared band	$3 \cdot 10^{-4} ... 7{,}7 \cdot 10^{-7}$	$0.7 \cdot 10^{-38} ... 0.3 \cdot 10^{-35}$
6. Light band	$7.7 \cdot 10^{-7} ... 3.8 \cdot 10^{-7}$	$0.3 \cdot 10^{-35} ... 0.6 \cdot 10^{-35}$
7. Ultraviolet band	$3.8 \cdot 10^{-7} ... 3 \cdot 10^{-9}$	$0.6 \cdot 10^{-35} ... 0.7 \cdot 10^{-33}$
8. Roentgen band	$3 \cdot 10^{-9} ... 3 \cdot 10^{-12}$	$0.7 \cdot 10^{-33} ... 0.7 \cdot 10^{-30}$
9. Gamma band	$3 \cdot 10^{-12} ... 3 \cdot 10^{-18}$	$0.7 \cdot 10^{-30} ... 0.7 \cdot 10^{-24}$

Note: In the first band, the second band and the third band of Table 2, the parameters of the aggregate of the photons are given (Fig. 2); in the rest bands, the parameters of the single photons are given (Fig. 1).

The equations, which describe a motion of the centre of masses M of the photons (Fig. 1) [2], [3]:

$$x = Ct + 0.067 r \sin 6\omega_0 t; \qquad (1)$$

$$y = 0.067 r \cos 6\omega_0 t, \qquad (2)$$

operate within the limits of the axiom of unity of space, matter and time. The rest mathematical models, which describe the corpuscle features of the photon, are derived analytically from the analysis of the process of its motion; from the equation (2) the wave equation of Louis de Broglie and Schrodinger equation, which operate outside the axiom of unity, are derived [2]. Certainly, the above-mentioned derivations of the mathematical models, which describe behaviour of the photons, serve as a strong proof that its model is close to reality (Fig. 1). The results of an interpretation of the optical experiments, which prove the corpuscle features of the photons, are even stronger evidences [2], [3].

An amplitude and colour variety of visual information, which is brought by the light photons to our eyes, amaze us, because their radius is changed within the limits of only a half of order of magnitude $(3.0.....7.0)\cdot 10^{-7} m$ (Table 2). The pulses of the photons are given in Fig. 2. The parameters of these pulses are given in the first band, the second band and the third band of Table 2 [2], [3].

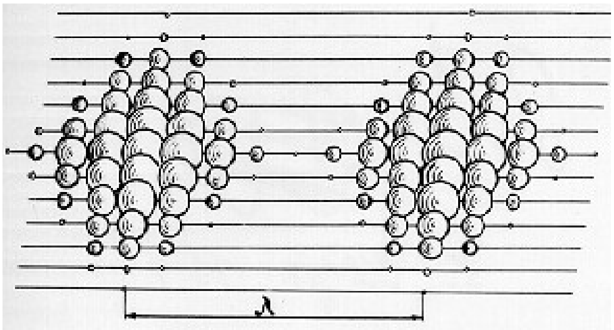


Fig. 2. Diagram of the photons wave with the length of λ

3. THE ELECTRON

A theoretical value of the radius of a free electron (Fig. 3) is constant and is $r_e(theor) = 2.4263016\cdot 10^{-12} m$. It differs from its experimental value in the sixth sign after point $r_e(exper) = 2.4263089\cdot 10^{-12} m$ [2]. The size of the electron is in a FEMTO band (Table 1).

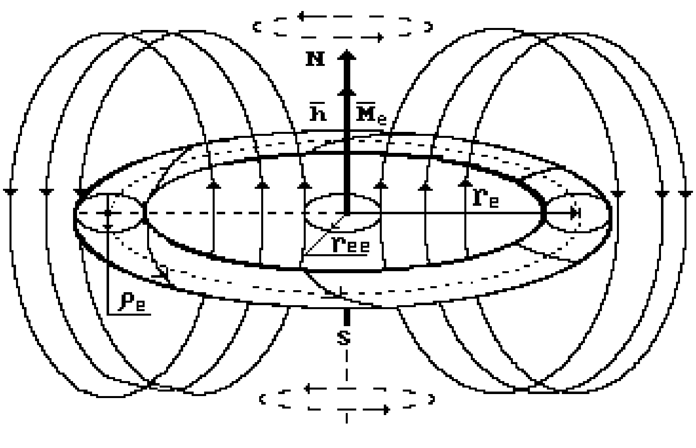


Fig. 3. a) diagram of the theoretical model of the electron (only a part of the magnetic lines of force is shown)

A formation of the toroidal structure of the electron is described by 50 mathematical models, which have 23 constants. The radius of the centerline of the torus is the main of them. It is calculated according to several mathematical models, which give one and the same result. Here is one of such models [2], [3]

$$r_e(theor) = \frac{C \cdot h}{4\pi \cdot \mu_B \cdot H_e} = \frac{2.998 \cdot 10^8 \cdot 6.626 \cdot 10^{-34}}{4 \cdot 3.142 \cdot 9.274 \cdot 10^{-24} \cdot 7.025 \cdot 10^8} = 2.426 \cdot 10^{-12} m. \quad (3)$$

4. THE PROTON

A model of the proton in the form of a solid torus (Fig. 4) is proved by the calculation of its parameters, the aggregate of which gives some values, which correspond to their experimental values. The radius of the centreline of the torus is one of such parameters (Fig. 4). Its value (4) is close to an interval of the change of the sizes of the atomic nuclei $(1.2\ldots1.5)\cdot10^{-15}$ *m*, where the protons is a part [2]. It is an ATTO band (Table 1).

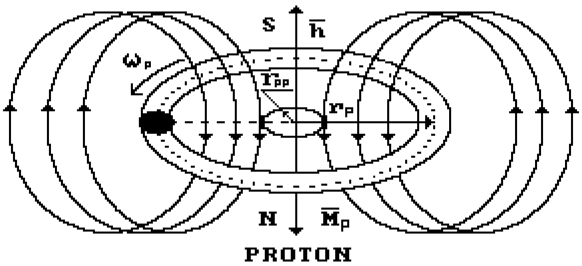


Fig. 4. Model of the proton

$$r_P = \frac{C \cdot h}{4\pi \cdot M_P \cdot H_P} = \frac{2.997925 \cdot 10^8 \cdot 6.626176 \cdot 10^{-34}}{4 \cdot 3.141593 \cdot 1.406171 \cdot 10^{-26} \cdot 8.5074256 \cdot 10^{14}} = 1.3214098 \cdot 10^{-15} m. \quad (4)$$

5. THE NEUTRON

Availability of six mutually perpendicular magnetic poles (three north poles and three south poles) is the main feature of the magnetic field of the neutron being postulated by us (Fig. 5) [2].

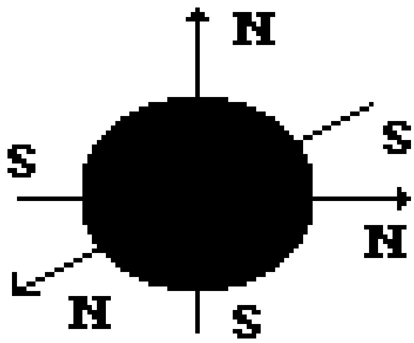


Fig. 5. Diagram of the models of the neutron

A theoretical value of the radius of the neutron is [2], [3]

$$r_N = \frac{k_0}{m_N} = \frac{2.2102541 \cdot 10^{-34}}{1.6749543 \cdot 10^{-27}} = 1.3195907 \cdot 10^{-15} m. \quad (5)$$

The above-mentioned elementary particles (Figs 1, 2, 3, 4 and 5) are united by a constant of their localization. It is [2], [3]

$$k_0 = k_e = k_P = k_N = \frac{h}{C} = \frac{mr^2\nu}{r\nu} = m \cdot r = 2.210 \cdot 10^{-42}\, kg \cdot m = const. \qquad (6)$$

Thus, there are the main elementary particles, from which the atomic nuclei and the atoms themselves are formed (Figs 1, 2, 3, 4 and 5). A formation of the atomic nuclei and the atoms themselves is the next stage. We acted exactly nearly 10 years ago as we had no experimental information concerning the structures of the atoms, the molecules and the clusters. Now we possess it, and we shall make a reverse process: we shall form the atomic nuclei, which should result from the images of the clusters. As a result, we shall see a correspondence of authenticity of the principles of the formation of the atomic nuclei, by which Nature is guided and which we have found before the images of the clusters have been obtained [2], [3].

6. THE CLUSTERS

The European investigators are the leaders of an acquisition of the images of the inhabitants of the microworld, which have the largest resolution. An image of the benzene $Ñ_6Í_6$ cluster being captured by them is given in Fig. 6, a; the result of processing of this image is given in Fig. 6, b.

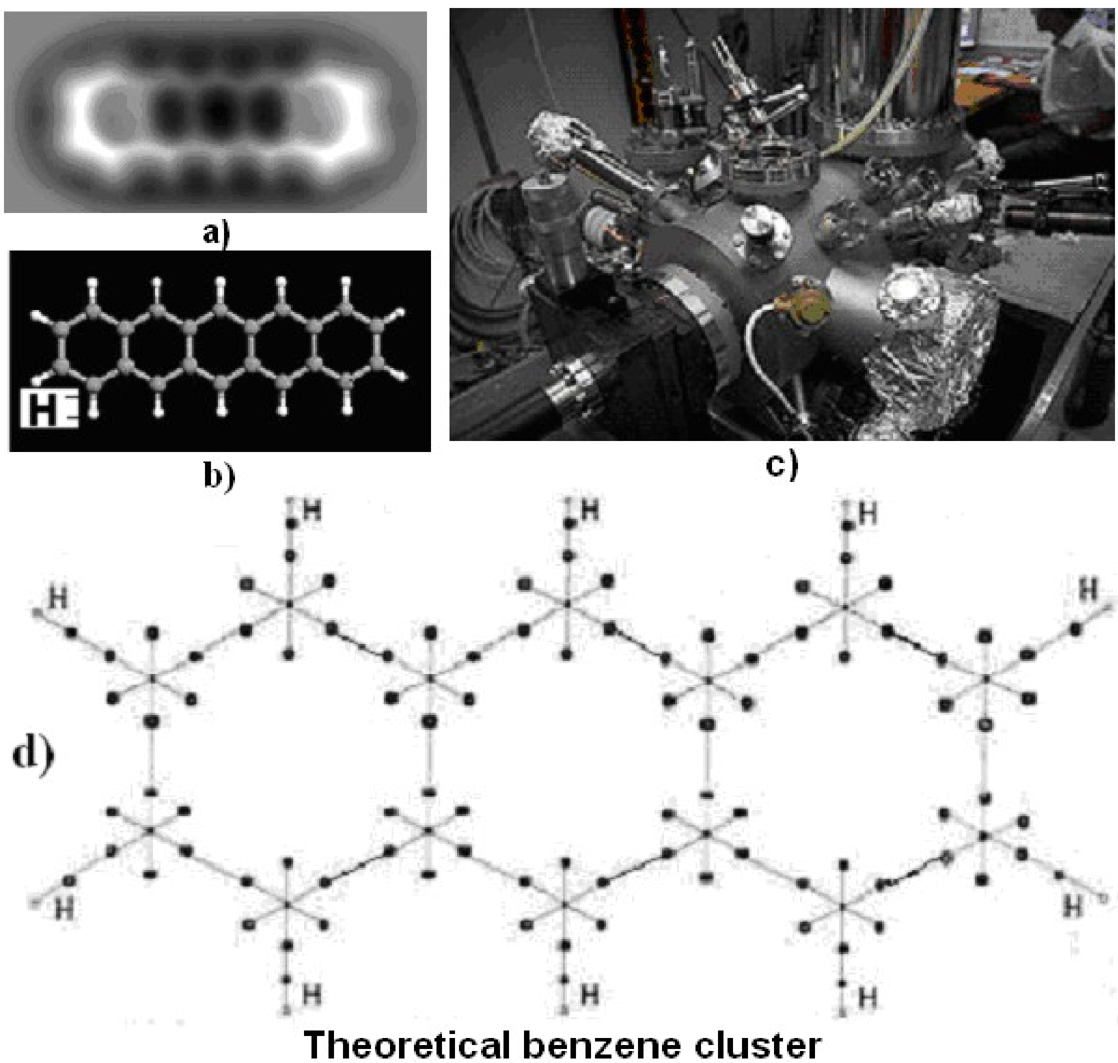
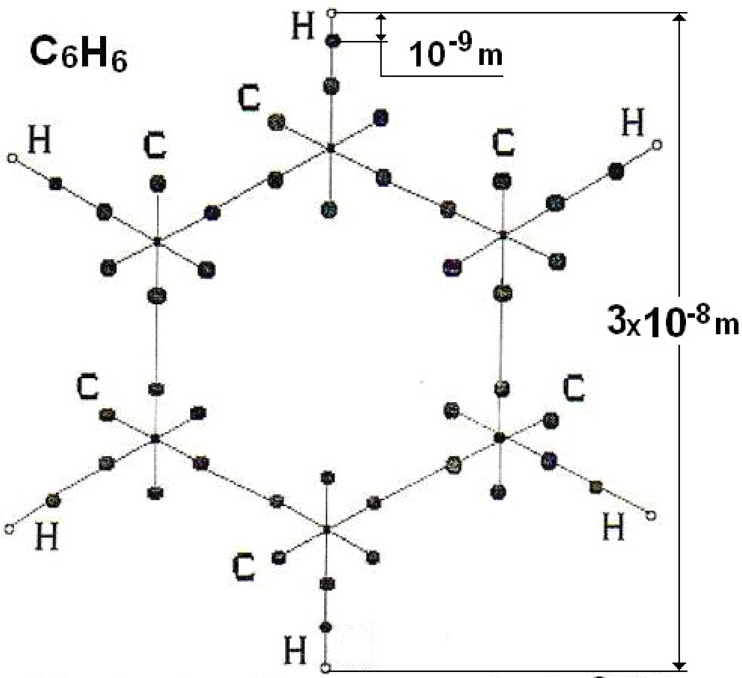


Fig. 6. Achievements of the European experimenters in photography of the benzene cluster

Thus, the experimenters have taken a photo of the benzene cluster and have obtained its misty image first (Fig. 6, a); then they have represented it more legibly (Fig. 6, b). But there are only balls, which are connected by the direct rods with each other, in this legibility. The external rods have the balls as well, but their sizes are less. Let us help the experimenters to decipher the structures of these balls and the rods. The theoretical benzene cluster, which results from the new theory of microworld, is given in Fig. 5, d. The theory discovers the structures of the balls. They are the carbon atoms. The theory discovers the structure of the misty protrusions in Fig. 6, a, as well as the structure of the external rods with smaller balls in Fig. 6, b. They are the hydrogen atoms, and the external smaller balls are the protons (Fig. 4) of the hydrogen atoms.

It is known that the benzene clusters $\tilde{N}_6\acute{I}_6$ are formed from the benzene molecules, which consist of six carbon atoms and 6 hydrogen atoms. The new theory of microworld gives a clear representation of the structure of the benzene molecule (Fig. 7), and the image of the benzene cluster (Fig. 6, a, b) proves authenticity of this structure [2], [3].



The structure of the benzene molecule C_6H_6

Fig. 7. The theoretical structure of the benzene molecule

As it is clear (Fig. 7), the electrons of the hydrogen atoms interact with the nuclei linearly. The electrons of the hydrogen atoms interact with the electrons of the carbon atoms linearly as well. The sharp protrusions at the external contour of the benzene cluster (Fig. 6, a) prove that the electron microscope has failed to see the hydrogen atoms, and it is natural, because the dimensions of the protons, the nuclei of the hydrogen atoms (Fig. 4), are very small $1.32\cdot10^{-15}$ *m*. The theory makes it possible to see not only the electrons (Fig. 3), but the protons (Fig. 4) of the hydrogen atom and the atom as well (Fig. 8) [2].

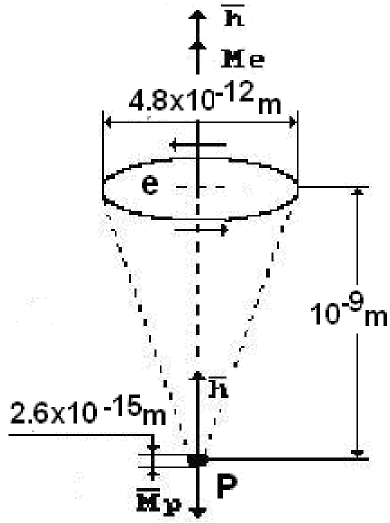


Fig. 8. The theoretical model of the hydrogen atom and its dimensions in the unexcited state

The theoretical model of the hydrogen atom (Fig. 8) results from the mathematical model (7) of the law of formation of the spectra of the atoms and the ions, which was discovered by us in the year of 1995 [4]. There is no energy of orbital motion of the electrons in this law, but there is energy E_b of the linear interaction of the electrons with the protons of the atomic nuclei (8) [2], [3], [4]

$$E_f = E_i - \frac{E_1}{n^2}, \tag{7}$$

where E_f is energy of the photon being emitted by the electron; E_i is energy of ionization of the hydrogen atom; E_1 is binding energy of the hydrogen atom with its proton, which corresponds to the first (unexcited) energy level of the hydrogen atom; n=1, 2, 3,… is the main quantum number.

Binding energy of the electron with the proton, which corresponds to any energy level of any atom, is determined according to the formula [2], [3], [4].

$$E_b = \frac{E_1}{n^2} = \frac{h\nu_1}{n^2}. \tag{8}$$

Energies of the photons being emitted by the electron of the hydrogen atom and other atoms when the electrons transit between the energy levels are calculated according to the formula [2], [3], [4]

$$\Delta E_f = E_f = E_1 \cdot \left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]. \tag{9}$$

According to Coulomb’s law, if an electron of the hydrogen atom resides at the first energy level (in an unexcited state), a distance between the proton and the electron is [2], [3], [4]

$$R_1 = \frac{e^2}{4\pi \cdot \varepsilon_o \cdot E_1} = \frac{(1.602 \cdot 10^{-19})^2}{4 \cdot 3.142 \cdot 8.854 \cdot 10^{-12} \cdot 13.598 \cdot 1.602 \cdot 10^{-19}} = 1.059 \cdot 10^{-10} m. \tag{10}$$

The calculation results according to these formulas are given in Table 3. A hydrogen atom model results from these formulas and the calculation results according to these formulas (Fig. 8).

Table 3. The hydrogen atom spectrum, the binding energies E_b between the proton and the electron and the distances R_i between them [2], [4]

Values	n	2	3	4	5
E_f (exp)	eV	10.20	12.09	12.75	13.05
E_f (theor)	eV	10.198	12.087	12.748	13.054
E_b (theor)	eV	3.40	1.51	0.85	0.54
R_i (theor)	$\cdot 10^{-10} m$	4.23	9.54	16.94	26.67

As it is clear (Fig. 8), the electron of the hydrogen atom interacts with its proton linearly, not orbitally. It is a consequence of an absence of energy of an orbital motion of the electrons in the atoms resulting from the laws of formation of the spectra of the atoms and ions expressed by the mathematical models (7), (8), (9).

The distance between the proton and the electron in the hydrogen atom depends on temperature. An analysis shows that at the usual temperature the electron establishes the bond with another atom and happens to be between the second and the third energy levels of the atomic state (Table 3). It means that in the molecules the distance between the protons and the electron in the hydrogen atom is increased approximately by an order of magnitude and the factor $10^{-10} m$ in Table 3 adopts a value of $\cdot 10^{-9} m$ (Fig. 8) [2], [3].

The theoretical model of the carbon atom, which forms the benzene clusters (Fig. 6, a, b, d) is given in Fig. 9, c, and the model of the nucleus of this atom is given in Fig. 9 a. From this, the differences of the properties of black lead and diamond, which consist of one and the same chemical element, carbon, result. They are hidden in the structures of the nuclei and the atoms of these chemical elements (Fig. 9) [2], [3].

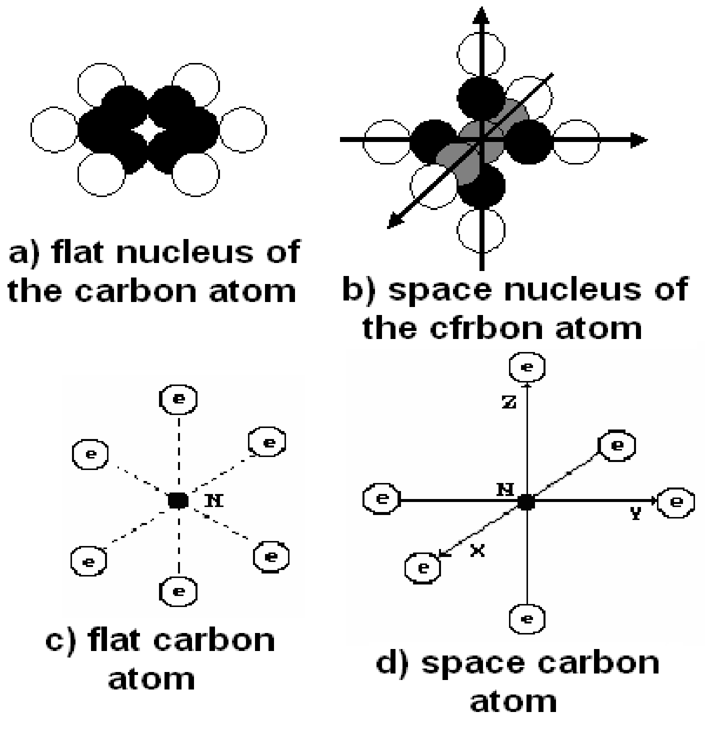


Fig. 9. Structures of the carbon nuclei and the carbon atoms

A question arises: the nucleus of which chemical element proves the linear interaction of the protons and the neutrons in the atomic nuclei? This function is vividly expressed in the structures the carbon nuclei (Fig. 9, a and b) and even more vividly in the structure of the nucleus of beryllium atom. The results of the nuclear experimental spectroscope show that 100% of natural beryllium atoms have the nuclei with four protons and five neutrons (Fig. 10, b).

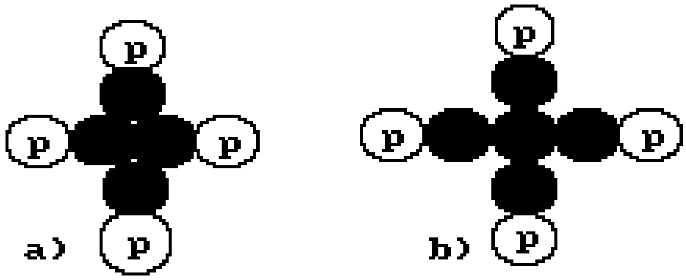


Fig. 10. Diagrams of a possible arrangement of the nucleus of the beryllium atom

It is stipulated by the fact that the particle linear interaction in case of nucleus formation takes place only when the number of these particles is such. If the nucleus of the beryllium atom had four protons and four neutrons (Fig. 10, a), it would be impossible to unite them linearly [2].

Are there the experimental proofs of the linear interaction of the protons of the nucleus of the beryllium atom (Fig. 11) with its electrons? They result from the experimental spectra of this atom being given in Table 4.

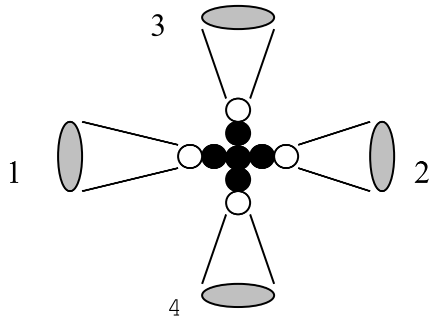


Fig. 11. Diagram of the structure of the beryllium nucleus and the beryllium atom: 1, 2, 3 and 4 are numbers of the electrons

Table 4. Binding energies E_b of the electron of the hydrogen atom e_H and the electrons (1, 2, 3, 4) of the beryllium atom Be with the nucleus at the time when all of them are in the atoms [2]

n	1	2	3	4	5	6	7	8	9
e_H	13.6	3.40	1.51	0.85	0.54	0.38	0.28	0.21	0.17
1	16.17	4.04	1.80	1.01	0.65	0.45	0.33	0.25	0.20
2	16.17	4.04	1.80	1.01	0.65	0.45	0.33	0.25	0.20
3	16.17	4.04	1.80	1.01	0.65	0.45	0.33	0.25	0.20
4	16.17	4.04	1.80	1.01	0.65	0.45	0.33	0.25	0.20
n	10	11	12	13	14	15	16	17	18
e_H	0.14	0.11	0.09	0.08	0.07	0.06	0.05	0.05	0.04
1	0.16	0.12	0.10	0.08	0.07	0.06	0.05	0.05	0.04
2	0.16	0.12	0.10	0.08	0.07	0.06	0.05	0.05	0.04
3	0.16	0.12	0.10	0.08	0.07	0.06	0.05	0.05	0.04
4	0.16	0.12	0.10	0.08	0.07	0.06	0.05	0.05	0.04

The data of Table 4 show that beginning from the 13th energy level (n=13) the binding energies of all electrons of the beryllium atom with the nucleus are the same as the binding energies of the electron e_H of the hydrogen atom (Table 3). It means that when the electrons move away from the atomic nucleus, their mutual influence disappears almost completely, and they begin to behave in the same way as the electron of the hydrogen atom (Fig. 8) [2], [3].

Thus, when all electrons of any atom are in the atom, they interact each with its own protons in the nucleus and form the spectra, which are similar to the spectrum of the hydrogen atom. It is impossible to prove it with the help of a direct experiment. But there is an indirect proof. The dependencies of black-body radiation do not depend on material of the black-body, i.e. on an atom of the chemical element.

The structure of the existing nucleus of the beryllium atom is shown in Fig. 10, b, and in Fig. 11; it gives additional proofs of a connection of the neutrons and the protons by means of unlike magnetic poles of these particles. This diagram of the nucleus (Fig. 10, b) proves an importance of the screening functions of the neutron and complexity of its magnetic field (Fig. 5) [2], [3].

The electrons of the beryllium atom (Fig. 11) do not make an orbital motion in the atom. Each of them interacts with its proton in the nucleus precessing on it at the time of an absorption or emission of the photons [2], [3].

From the linear interaction of the protons with the neutrons in the atomic nuclei, there results another consequence: an excess of the number of the neutrons over the number of the protons when the structures of the nuclei become complicated. It is stipulated by the necessity of preservation of symmetry of the structure of the nucleus when it becomes complicated. For example the nucleus of the copper atoms has 29 protons and 35 neutrons (Fig. 12) [2].

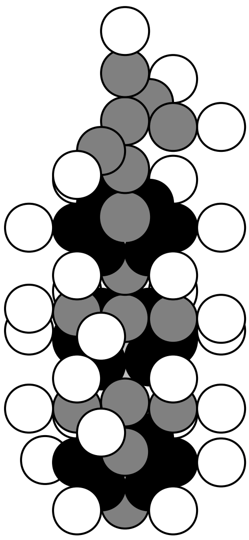


Fig. 12. It is easy to see that the copper atom will have only one axis electron. Two atoms are united with the axis electron and form a structure without magnetic poles at its ends. It is the reason why copper has no magnetic properties.

Let us describe the regularities of a connection of the atomic electrons with the protons of the nuclei. For this purpose, let us pay attention to the fact that the vectors of the moments of magnet M_e of the electrons and the protons M_P are directed conversely (Fig. 8). It means that the electron with the proton bring closer the unlike electric charges of these particles, and the like magnetic poles limit their approach. The vectors of the spins $\bar{h}$ of these particles coincide as far as the direction is concerned. This regularity is manifested vividly in the diagrams of the hydrogen molecules (Fig. 13) [2], [3].

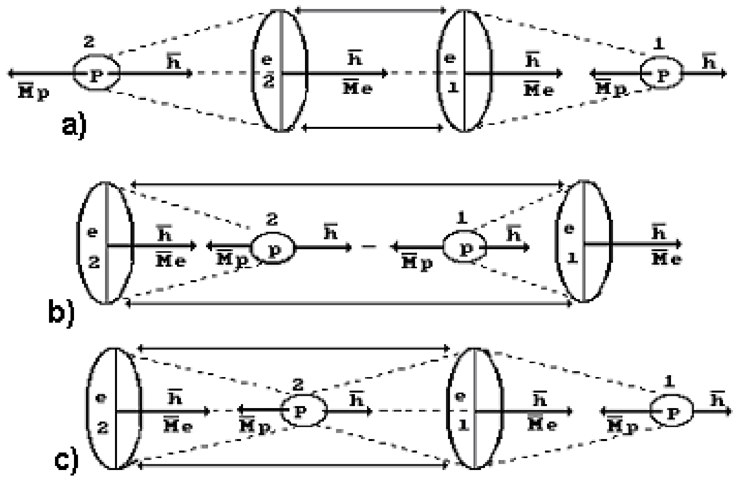


Fig. 13. Diagrams of the hydrogen molecule: a), b) - orthohydrogen; c) - parahydrogen

Let us pay attention to the logic actions of Nature when the structure of the hydrogen molecule, which is given in Fig. 13, a, is formed. Electrostatic forces of interaction attraction of the first electron and the first proton are counterpoised by the conversely directed magnetic forces of these particles. That's why vectors $\overline{M}_e$ and $\overline{M}_p$ of their moments of magnet are directed conversely. Electrostatic forces of repulsive forces, which act between the first electron and the second electron, are counterpoised by the magnetic forces, which bring them closer to each other; that's why the directions of vectors $\overline{M}_e$ of both electrons coincide [2].

In order to compensate electrostatic forces of interaction attraction of the second electron and the second proton, it is necessary to make magnetic forces of these particles conversely directed. This operation is reflected in the conversely directed vectors $\overline{M}_p$ and $\overline{M}_e$ of the moments of magnet of the second proton and the second electron (Fig. 13, a, to the left).

One more variant of an arrangement of the orthohydrogen molecule is shown in Fig. 13, b. A principle of the formation of this molecule is the same. The vectors of the moments of magnet of the electrons and the protons are directed in such a way that if electric forces bring closer the particles, magnetic forces should move away them from each other. As a result, equilibrium is established between these forces. Stability of the structure being formed depends on binding energies between its elements. As the moments of magnet of the electrons exceed the moments of magnet of the protons by two orders of magnitude, electromagnetic forces of the first structure (Fig. 13, a) keep its elements together stronger than in the structure, which is shown in Fig. 13, b; that's why there is every reason to think that the first structure of orthohydrogen is more stable than the second structure [2], [3], [4].

When the parahydrogen molecule is formed (Fig. 13, c), logic of bond formation between the first electron and the first (to the right) proton remain the same. The, force of interaction attraction of the first electron and the second proton as well as of the second electron and the second proton are counterpoised by their conversely directed magnetic forces.

As the vectors of the moments of magnet of the electron and the proton, which are situated at the edges of this structure, are directed conversely, the total moment of magnet of such structure is close to zero (Fig. 13, c). That's why one has considered that the vectors of the moments of magnet of the protons in such structure are directed conversely, and it has been called parahydrogen.

It is interesting to note that there are 3/4 of orthohydrogen in the mixture of the hydrogen molecules. When the temperature of gas is decreased, all orthohydrogen molecules (Fig. 13, a) transform into the parahydrogen molecules (Fig. 13, c). It is caused by an increase of repulsive forces between the orthohydrogen electrons. When the temperature is decreased, the distance between these electrons is decreased, electrostatic repulsive forces are increased, and the ortho-hydrogen molecule (Fig. 13, a) is destroyed and transforms into the parahydrogen molecule (Fig. 13, c) [2].

CONCLUSION

Thus, the Russian theory of the microworld demonstrates its ability to help the experimenters get a more profound understanding of the results of their experimental achievements; the nanotechnologists get the possibility to work out nanotechnologies perceptively.

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