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THE SCATTERING OF PARTICLES AND WAVES ON NUCLEON NODES OF THE ATOM

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ABSTRACT

Experiments on scattering of particles and waves in matter carried out from Rutherford's time did not give the sound proof that every atom has only one scattering site. In the light of the Dynamic Model of Elementary Particles (DM) and Shell-Nodal Atomic Model (SNM), the scattering theory of particles and waves in matter has obtained a new resolution that is considered in this paper. According to the DM, the center of mass of the nucleon performs radial oscillations with the amplitude of the order $1.4 \cdot 10^{-13}$ *cm* and frequency of $1.8 \cdot 10^{18}\ s^{-1}$ resulted in the dynamic spherical volume of a radius equal to the amplitude of the oscillations. The dynamic volume is a scattering core of the nucleon. The latter, as a center of scattering, was identified by Rutherford with the smallest solid nucleus, where practically a whole mass of the atom, excluding electrons, is concentrated. As a result, the density of such a hypothetical formation must be of an unbelievable high value (about $10^{15}\ g/cm^3$). A new theory of scattering, based on the DM and SNM, shows that the centers of scattering of α- and β-particles and waves in matter are individual nucleons, constituents of the atom, located in nodal points of nucleon shells of the atom. Results presented and numerous other data already published lead to the conclusion that the modern nuclear model of the atom is doubtful and must be re-examined.

1. INTRODUCTION

Experiments of Geiger, Marsden and Rutherford began a quantitative theory of the scattering of α-particles. Resting upon his own results and experimental data obtained by Geiger and Marsden [1] on this subject and also upon the results carried out by Crowther on scattering of β-particles [2], Rutherford has suggested [3] that a very small area of an atom,

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which was called an atomic nucleus, is responsible for the deflection of incident α- and β-particles.

Thus, on the basis of an analysis of all data accumulated to that time related to the scattering in matter and the resulting supposition on the existence of a minute atomic nucleus, Rutherford put forward both a theory of scattering of incident particles in matter and a nuclear model of the atom, which were fully developed further and being accepted exist till now. A principal assumption of Rutherford‘s theory was that both the positive charge and the mass of the atom were more or less “uniformly distributed” over the size of about 10^{-12} *cm* across or a little more.

One should note in this regard, first, that all experiments on the scattering, including those performed latter on, did not give the sound proof that every atom has only one scattering site. These experiments only state that atoms do have scattering sites of α- and β-particles. Second, there is not univalent understanding, what does it mean a deflection (or scattering) on an atom of particles, which at the same time behave themselves as waves. Third, the nature of mass and electric charge was a great puzzle of that time. So it makes no sense to speak about the “uniformly distributed” charge, unknowing what the charge is.

At the end of the 20th century, marked by an appearance in 1996 the book, “Alternative Picture of the World” by L. Kreidik and G. Shpenkov [4], the aforementioned puzzle was solved in the framework of the Dynamic Model of Elementary Particles (DM) [5]. Moreover a thorough analysis of particular solutions of the wave equation, carried out by the authors, has shown that the atom has the shell-nodal structure, resembling the molecule, and the atomic nucleus, in its modern understanding, does not exist.

Basing on the discovery of the nature of mass and electric charge (and other effects originated from the DM), and the resulting solutions concerning the structure of the atom, fully developed in the framework of the Shell-Nodal Atomic Model (SNM) [4-6], we can take a look at pioneer works on the scattering (which were resulted in the nuclear atomic model) from a new point of view that is the goal of this paper.

At the beginning let us to analyze the Rutherford’s work [3], which led him to the conclusion on the nuclear structure of the atom. It makes sense because this work was first and principal which began the foundation of modern nuclear physics.

The scattering of α-particles at large angles in the same conditions in thick layers of different metals, obtained experimentally by Geiger and Marsden (Rutherford had relied upon these results), is presented in Table 1.

Table 2.1 [1]

Metal	Atomic weight, *A*	*N*	$N / A^{3/2}$
Lead	207	62	208
Gold	197	67	242
Platinum	195	63	232
Tin	119	34	226
Silver	108	27	241
Copper	64	14.5	225
Iron	56	10.2	250
Aluminum	27	3.4	243
			Mean value: 233

The relative number of diffusely scattered α-particles, N, was obtained by the registration of the number of scintillations per minute on a zinc sulphide screen.

According to the theory of single scattering, the part of the total number of α-particles, scattered under some angle during passing through the thickness t, is proportional to the value nA^2t (where n is the concentration of atoms). It is valid if one supposes that the central charge is proportional to the atomic weight A. In this case, the thickness of substance from which scattered α-particles can fly out and act upon screen of zinc sulfide depends on the kind of the metal. Since Brag has shown that the braking ability ("stopping power") of an atom for an α-particle is proportional to the square root of its atomic weight, the value of nt for different elements is proportional to $1/\sqrt{A}$. Therefore, t corresponds to the greatest depth from which the scattered α-particles can leave the metal. Thus, the value N of α-particles scattered back from a thick metal plate is respectively proportional to $A^{3/2}$, *i.e.*, the ratio $N/A^{3/2}$ has to be the constant value.

Taking into consideration difficulties with experiments, conformity of the theory with the experiment (as one can see from Table 1) is sufficient.

Another results discussed in Rutherford's paper concern the scattering of β-rays in substance carried out by J. Crowther [2]. We find there: if t_m is the thickness at which a half of all particles is deflected under the angle φ then, as J. Crowther showed, $\varphi/\sqrt{t_m}$ is the constant value for the substance at the fixed φ…. On the basis of Crowther's data on values $\varphi/\sqrt{t_m}$, for different elements and for β-rays with the speed of $2.68\cdot 10^{10}$ *cm/s*, the value of the central charge Z_ne can be computed in accordance with a theory of the single dispersion… The values Z_n, calculated on the basis of Crowther's results, are presented in Table 2.

Table 2. The experimental data on scattering of β-particles [2].

Element	Atomic weight, A	$\varphi/\sqrt{t_m}$	Z_n
Aluminum	27	4.25	22
Copper	63.2	10.0	42
Silver	108	15.4	78
Platinum	194	29.0	138

The relative values of the "*charge of nucleus*" Z_n presented in Table 2 is difficult to reduce in correspondence with the order numbers of elements Z approximately equal to $\frac{1}{2}A$ ($_{13}$Al, $_{29}$Cu, $_{47}$Ag, $_{78}$Pt).

Nevertheless, on the basis of the scattering data for β- and α-rays, presented in Tables 1 and 2, Rutherford concluded, "*the central charge in an atom is approximately proportional to its atomic weight*". He decided that the scattering observed was from a positively charged small single nucleus. He stated that, in accordance with his theory of scattering, the number of deflecting α-particles was proportional to the squared charge of the nucleus equal, approximately, to a half of the atomic weight [7].

Rutherford's formula for α-particles scattering has the form

$$dN = nN\left(\frac{Ze^2}{M\upsilon^2}\right)^2 \frac{d\Omega}{\sin^4\frac{\vartheta}{2}}, \qquad (1)$$

where N is the number of α-particles incident per a second on the surface of scattered leaf, dN is a mean number of α-particles scattered at the angle ϑ within a solid angle dΩ, n is the number of scattering nuclei in 1 cm^3, M is the mass of an α-particle and υ is its speed at the large distance from a nucleus.

The experimental data shows that deflection of α-particles does not obey completely to this formula. Rutherford notes [2] in this regard during his analysis resulted in the supposition of the existence of the nucleus, "*The large and small angle scattering could not then be explained by the assumption of a central charge of the same value*".

But further, he wrote: "*Considering the evidence as a whole, it seems simplest to suppose that the atom contains a central charge distributed through a very small volume, and that the large single deflections are due to the central charge as a whole, and not to its constituents. At the same time, the experimental evidence is not precise enough to negative the possibility that a small fraction of the positive charge may be carried by satellites extending some distance from the center. Evidence on this point could be obtained by examining whether the same central charge is required to explain the large single deflections of α- and β-particles; for the α-particle must approach much closer to the center of the atom than the β-particle of average speed to suffer the same large deflexion".*

The expression "*a central charge distributed…"* calls the principal question, what is the electric charge? Whether it is a kind of matter, if it can be distributed "*through a ... volume*". What is the nature of the electric charge?

Thus, all the data presented shows that it is unconvincing to speak about the confluence of all nucleons in an atom in the one drop-nucleus. On the contrary, the above-considered examples, taken from Rutherford's paper, testify that centers of the α- and β-particles scattering are H-elements (nucleons) of the atom, constituting the atom, which are in substance a part of its united physical space [8]. Collisions of microparticles with matter are the interaction, not only, with an individual H-element, but also, with all atomic space-matter. We will show this in this paper.

Let us continue the discussion on this subject relaying on the alternative model of scattering [8] consistent with the above data and with the shell-nodal (multicenter) atomic model [9]. We relay also on the uncovered nature of the electric charge [5, 6].

2. THE THEORY OF SCATTERING ON NUCLEONS OF SHELL-NODAL ATOMIC MODEL

Recall at the beginning, according to the theory of scattering, the probability of scattering is

$$dw = -\frac{dN}{N}, \tag{2}$$

where *N* is the number of particles impinging on a thin foil sheet, and *dN* is the number of scattered particles; the sign "-" indicates that *dN* is the loss of particles from the total flow [8]. The probability (2) is proportional to the thickness of the material layer *dx* passed by the beam of particles:

$$-\frac{dN}{N} = \alpha dx, \tag{3}$$

where $\alpha = dw/dx$ is the density of probability of scattering. Hence, the scattering law has the form

$$N = N_0 e^{-\alpha x}. \tag{4}$$

In accordance with the shell-nodal atomic model [5, 9, 10], α-particles scatter on nucleon nodes, the number of which is approximately equal to a half of the atomic weight. An incident α-particle interacts with all nucleons of a nucleon node, but it scatters mainly on one nucleon of the node to which the α-particle approaches.

A nucleon of every node has the relative freedom of motion within its potential volume. The center of mass of a nucleon oscillates within the spherical volume with the amplitude

$$\Psi = \frac{A_m}{z_{m,n}} = \frac{r_0}{z_{m,n}}\sqrt{\frac{2hR}{m_0 c}} \tag{5}$$

where $h = 2\pi m_e \upsilon_0 r_0 = 6.6260693(11)\cdot 10^{-27}\, erg\cdot s$ is the Planck constant,

$R = \frac{R_\infty}{(1 + m_e/m_0)} = 109677.5833\, cm^{-1}$ is the Rydberg constant,

$r_0 = 0.5291772108(18)\cdot 10^{-8}\ cm$ is the Bohr radius,

$c = 2.99792458\cdot 10^{10}\ cm\cdot s^{-1}$, and $z_{m,n}$ are roots of Bessel functions [11].

The first maximum of the kinetic component of the zero-order spherical function ($z_{m,n} = b'_{0,1} = 2.79838605$) defines the displacement of the value

$$\Psi = 3.219483546\cdot 10^{-13}\, cm. \tag{6}$$

According to (5), the particular sphere of scattering correspond to every root $z_{m,n}$. For example, if $z_{m,n} = a'_{0.1} = 4.49340945$, that corresponds to the maximum of the potential component of the zero-order spherical function, we have $\Psi = 2.005016\cdot 10^{-13}\, cm$.

Zeros of potential and kinetic components of the zero-order Bessel spherical functions are, respectively,

$$z_{0,n} = \pi n \text{ and } z_{0,n} = \frac{\pi}{2}(2n-1) \tag{7}$$

In view of a very high frequency of pulsations of the nucleon spherical shell, $\omega_e = 1.869162505 \cdot 10^{18}\, s^{-1}$ [6], the displacement (5) determines the spherical volume of oscillations of the center of mass of a nucleon [12]. A sphere, confining this volume, is the sphere of the center of mass of the nucleon. It is the core (nucleus) of nucleon scattering.

The cross-section of the scattering sphere,

$$\sigma_n = \pi \Psi^2 \tag{8}$$

is the measure of scattering of particles and waves.

Let the effective area of the center of scattering is equal to σ_n, then the total scattering area of microparticles by atoms of the metal foil is

$$S_{tot} = A_{ef} \sigma_n n S d\,, \tag{9}$$

where A_{ef} is the number of nucleons in an atom participating in scattering of particles or waves, n is the concentration of atoms, S is the area of the foil, and d is its thickness.

The density of probability of scattering is determined as

$$\alpha = -\frac{\Delta N}{Nd} = \frac{S_{tot}}{Sd} = A_{ef} \sigma_n n\,, \tag{10}$$

hence, the specific density of scattering is

$$\alpha_s = \frac{\alpha}{\varepsilon_0 \varepsilon} = \frac{A_{ef} \sigma_n n}{A_r m_0 n} = \frac{A_{ef}}{A_r} \frac{\sigma_n}{m_0}\,, \tag{11}$$

where A_r is the relative atomic mass, $\varepsilon_0 = 1 g/cm^3$ is the unit density, ε is the relative density.

If one introduces an element of the scattering mass $\Delta m = \varepsilon_0 \varepsilon s x$ in terms of the specific thickness of scattering,

$$x_s = \frac{\Delta m}{s} = \varepsilon_0 \varepsilon x\,, \tag{12}$$

the law of scattering (4) takes the form

$$N = N_0 e^{-\alpha_s x_s} . \qquad (13)$$

The effective number of nucleons, scattering incident particles or waves, is determined by the extent of their mutual overlapping in matter of a foil and by the character of their collective interaction with incident particles and waves. Ignoring the overlapping, we have $A_{ef} = A_r$.

In the case when the scattering object is an atomic volume, the density of probability must be proportional to the relative atomic mass, $\alpha \sim A_r$.

If scattering takes place on an atomic area, $\alpha \sim A_r^{2/3}$; if it is realized on an atomic line, $\alpha \sim A_r^{1/3}$. Such an approximate estimation allows writing a series of possible values of the effective number of nucleons participating in the scattering of incident particles or waves:

$$A_{ef} = A_r , \quad A_r^{2/3} , \quad A_r^{1/3} . \qquad (14)$$

With due account of (5) and (8), the effective section of scattering per atom will be defined by the formula

$$\sigma_{ef} = A_{ef} \sigma_n = \pi A_{ef} \left(\frac{A_m}{z_{m,n}} \right)^2 . \qquad (15)$$

In the case of *scattering of waves* of a relatively short length (with respect to the size of a nucleon), the volume scattering will prevail, so that we should accept $A_{ef} = A_r$. Then, the specific density of scattering (11) takes the form

$$\alpha_s = \frac{\sigma_n}{m_0} = \frac{\pi}{m_0} \left(\frac{A_m}{z_{m,n}} \right)^2 . \qquad (16)$$

Hence, for the maximum of the first kinetic shell, $z_{m,n} = b'_{0,1}$ (see (6)), we have

$$\alpha_s = 0.1955 \ g^{-1} \cdot cm^2 . \qquad (17)$$

The value obtained precisely coincides with the experimental magnitude of $\alpha_s = 0.2 \ g^{-1} \cdot cm^2$ holding practically for all targets in the case of short X-rays [13]. The good agreement of (17) with the experimental data indicates on the validity of the theoretical approach presented.

For the case of *scattering of particles*, the atomic plane of scattering manifests itself. Accordingly, the effective section of scattering per atom is equal to

$$\sigma_{ef} = \pi A_r^{2/3} \left(\frac{A_m}{z_{m,n}} \right)^2 . \qquad (18)$$

Effective roots $z_{m,n}$ depend on the structure of nucleonic shells and on the energy of falling particles or intensity of waves directed to the space of the being investigated matter. In spite of this uncertainty, it is reasonable to compare theoretical cross-sections calculated by the formula (18) with the experimental data.

Table 3 presents the experimental data on scattering cross-sections, taken from [14] (in barn, $1 barn\,(b) = 10^{-24}\, cm^2$), in comparison with the data calculated by the above formula for the roots of Bessel functions lying within the central part of the experimental values. Since scattering is a mass process, experiment determines an effective value of the scattering cross-section corresponding to the mean value of a series of roots of Bessel functions.

Table 3. A comparative list of the scattering cross-sections data

Experiment [14]		Theoretical data, Eq. (18)		
Element	σ_{tot}, b	σ_{ef}, b	$Z_{m,n}$ [11]	$Z_{m,n}$ value
1	2	3	4	5
He	1.0 ± 0.7	1.11	$j_{0,1}$	2.40482556
Li	1.4 ± 0.3	1.604	$j_{0,1}$	2.40482556
Be	7 ± 1	8.129	$j'_{1/2,1}$	1.16556119
C	4.8 ± 0.2	5.420	$y_{1/2,1}$	1.57079633
N	10 ± 1	10.90	$j'_{1/2,1}$	1.16556119
O	4.2 ± 0.3	4.776	$j'_{1,1}$	1.84118378
F	3.9 ± 0.2	3.761	$y'_{0,1}$	2.19714133
Ne	2.4 ± 0.3	2.135	$y'_{1/2,1}$	2.97508632
Na	4.0 ± 0.5	4.271	$y'_{0,1}$	2.19714133
Mg	3.6 ± 0.4	3.699	$j_{0,1}$	2.40482556
Al.	1.4 ± 0.1	1.287	$b'_{1,1}$	4.22227640
Si	1.7 ± 0.3	1.737	$y'_{1,1}$	3.68302286
P	5 ± 1	5.100	$y'_{0,1}$	2.19714133
S	1.1 ± 0.2	1.159	$y_{1/2,2}$	4.71238898
Cl	16 ± 3	20.257	$j'_{1/2,1}$	1.16556119
Ar	1.5 ± 0.5	1.476	$a'_{0,2}$	4.49340946
K	1.5 ± 0.3	1.455	$a'_{0,2}$	4.49340946
Sc	24 ± 2	23.73	$j'_{1/2,1}$	1.16556119
Ti	4 ± 1	3.799	$y'_{1/2,1}$	2.97508632
V	4 ± 1	4.475	$b'_{0,1}$	2.79838605
Cr	3.0 ± 0.5	3.18	$a'_{2,1}$	3.34209366
Mn	2.3 ± 0.3	2.353	$y_{0,2}$	3.95767842
Fe	11 ± 1	10.99	$j'_{1,1}$	1.84118378
Co	7 ± 1	6.677	$j_{0,1}$	2.40482556
Ni	17.5 ± 1	15.6	$y_{1/2,1}$	1.57079633
Cu	7.2 ± 0.7	8.41	$y'_{0,1}$	2.19714133
Zn	3.6 ± 0.4	3.54	$y_{2,1}$	3.38424177

Ga	4 ± 1	3.868	$a'_{2,1}$	3.34209366
Ge	3 ± 1	3.023	$j_{1,1}$	3.83170597
As	6 ± 1	5.787	$b'_{0,1}$	2.79838605
Se	11 ± 2	10.83	$a'_{1,1}$	2.08157598
Br	6 ± 1	5.344	$y'_{1/2,1}$	2.97508632
Kr	7.2 ± 0.7	8.066	$j'_{3/2,1}$	2.46053557
Rb	12 ± 2	11.42	$a'_{1,1}$	2.08157598
Sr	10 ± 1	10.42	$y_{1,1}$	2.19714133
Y	3 ± 2	3.24	$y_{5/2,1}$	3.95952792
Zr	8 ± 1	8.535	$j'_{3/2,1}$	2.46053557
Nb	5 ± 1	4.683	$a'_{2,1}$	3.34209366
Mo	7 ± 1	6.824	$b'_{0,1}$	2.79838605
Ru	6 ± 1	5.93	$j'_{2,1}$	3.05423693
Rh	5 ± 1	5.007	$a'_{2,1}$	3.34209366
Pd	3.6 ± 0.6	3.656	$y_{0,2}$	3.95767842
Ag	6 ± 1	5.855	$j_{1/2,1}$	3.14159265
Cd	7 ± 1	6.829	$y'_{1/2,1}$	2.97508632
In	2.2 ± 0.5	2.284	$j_{2,1}$	5.13562230
Sn	4.9 ± 0.5	4.667	$j'_{5/2,1}$	3.63279732
Sb	4.3 ± 0.5	4.266	$j_{1,1}$	3.83170597
Te	5 ± 1	4.897	$j'_{5/2,1}$	3.63279732
J	3.6 ± 0.5	3.648	$j'_{3,1}$	4.20118894
Xe	4.3 ± 0.4	4.205	$y_{0,2}$	3.95767842
Cs	20 ± 10	19.59	$j'_{1,1}$	1.84118378
Ba	8 ± 1	7.668	$y'_{1/2,1}$	2.97508632
La	15 ± 5	14.17	$y'_{0,1}$	2.19714133
Ce	9 ± 6	8.784	$b'_{0,1}$	2.79838605
Eu	8 ± 1	7.784	$j'_{2,1}$	3.05423693
Er	15 ± 4	16.04	$y'_{0,1}$	2.19714133
Tm	7 ± 3	6.977	$a'_{2,1}$	3.34209366
Yb	12 ± 5	13.08	$j'_{3/2,1}$	2.46053557
Hf	8 ± 2	8.173	$j_{1/2,1}$	3.14159265
Ta	5 ± 1	5.208	$y_{0,2}$	3.95767842
W	5 ± 1	5.264	$y_{0,2}$	3.95767842
Re	14 ± 4	13.73	$j'_{3/2,1}$	2.46053557
Os	11 ± 1	10.77	$y_{3/2,1}$	2.79838605
Pt	10 ± 1	9.69	$y'_{1/2,1}$	2.97508632
Au	9.3 ± 1	9.25	$j'_{2,1}$	3.05423693
Hg	20 ± 5	20.17	$a'_{1,1}$	2.08157598
Tl	14 ± 2	14.61	$j'_{3/2,1}$	2.46053557
Pb	11 ± 1	11.4	$y_{3/2,1}$	2.79838605
Bi	9 ± 1	9.099	$j_{1/2,1}$	3.14159265

As follows from (18), the effective parameter of scattering is

$$L = \sqrt{\frac{\sigma_{ef}}{\pi}} = A_r^{1/3}\,\frac{A_m}{z_{m,n}}\,. \tag{19}$$

In the modern atomic theory, the latter parameter is called the effective radius of an atomic nucleus. But in the shell-nodal atomic model [9] (based on the Dynamic Model of elementary particles, DM [5]), L is the parameter of scattering bound up with the *number of nucleons in an atom* and the *scattering sphere of the nucleon*. The scattering sphere (volume) of the nucleon is defined by the amplitude (5) of pulsations of its center of mass, which has an associated character. Recall, the rest mass of the nucleon does not exist (as of all microparticles in the DM). Accordingly, it does no sense the notion of a solid atomic nucleus (of the unbelievable gigantic density herein) in the theory in question; like there is no sense to speak, as was mentioned above, about "*a central charge distributed through a volume…*" unknowing, what does it mean, the charge [15, 16]?

Experimentally, the atomic cross-section of scattering is determined by the formula,

$$\sigma_{tot} = \frac{1}{nd}\ln\left(\frac{I_0}{I}\right), \tag{20}$$

where I_0 and I are intensities of flows of incident and passed particles or waves, d is the thickness of a target.

On the basis of (18) and (20), we find the experimental radius of the *nucleon* sphere of scattering,

$$\Psi = A_r^{-1/3}\left(\frac{\sigma_{tot}}{\pi}\right)^{1/2}, \tag{21}$$

which well agrees with the theory of scattering presented here.

In the case of a neutron flux, experiments confirm, with a certain degree of approximation, the following equality:

$$\sigma_{tot} = A_r^{2/3}\sigma_n\,. \tag{22}$$

The latter is also consistent with the scattering theory based on the DM.

3. CONCLUSION

Experiments on scattering carried out from Rutherford's time state that atoms do have scattering sites of α- and β-particles, but they do not give the sound proof that every atom has only one scattering site. Accordingly, Rutherford's supposition that the scattering observed was from a positively charged small single atomic nucleus is not convincing.

The principal questions arise herein. One of them is, what is the electric charge? Whether it is a kind of matter, if it can be "uniformly distributed" (following Rutherford, and used to regard in modern physics) through a volume of a nucleus. Another question is, what is the nature of mass of matter at the level of "elementary" particles and of the atom as a whole?

In the light of the Dynamic Model of Elementary Particles (DM), uncovered the nature of mass and electric charge, and Shell-Nodal Atomic Model (SNM), the scattering theory of particles and waves in matter has obtained a new resolution that has been considered in this paper.

According to the DM, the center of mass of the nucleon, as a pulsing spherical wave microformation of space, performs radial oscillations with the amplitude of the order $1.4\cdot10^{-13}$ *cm* and frequency of $1.8\cdot10^{18}$ s^{-1} resulted in the dynamic spherical volume of a radius equal to the amplitude of the oscillations. This dynamic volume is a scattering core of the nucleon whose mass has the associated character; and hence, it is the scattering core of the atom as a whole, because all nucleons in the atom (of the molecular like structure, according to the SNM) are bound between themselves by strong interactions.

The dynamic volume caused by natural pulsations of the nucleon was identified by Rutherford with the smallest solid nucleus, where practically a whole mass of the atom, excluding electrons, is concentrated. Accordingly, the density ascribed to such a hypothetical formation, accepted finally in physics, has an unbelievable high value (about 10^{15} g/cm^3).

A new theory of scattering, based on the DM, shows that the centers of scattering of α- and β-particles and waves in matter are individual nucleons (pulsing spherical microformations of space of the zero rest mass), constituents of the atom, located in nodal points of its nucleon wave shells, in accordance with the SNM.

A new view on the structure of atoms will essentially influence on foundations of chemistry. Actually, the first analysis based on SNM showed that the role of electrons in the chemical bonds formation is not principal [17]. As turned out the main role in the formation of geometrical (spatial) structure of the bonds in molecules belongs to nucleons. Electrons are responsible only for the strength of these bonds. Moreover, it was convincingly shown the conceptual unfoundedness of the notion of hybridization of atomic orbitals [18, 19].

Thus, the results presented and numerous other data already published (referred above, see also [20, 21]) lead to the conclusion that the modern nuclear model of the atom is doubtful and must be reconsidered.

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