Nature of Atomic Orbits

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Using the hypothesis of the electron with the exploding corona, the physical nature of the atomic orbit in the hydrogen atom is shown.

Keywords: electron, Bohr's model of the hydrogen atom, the orbit stability nature.

1. Introduction

Bohr had postulated, in his model of the hydrogen atom, the existence of the stable orbits for the electron. According to Bohr's model the frequency of the photon, ν_{cl}, that appears, when the electron jumps from the stable orbit with more high energy, E_{init} (with the initial quantum number n_{init}) to lower one, E_{fin} (with the final quantum number n_{fin}), equal to (in the book [1] it is formula (6.11))

$$\nu_{cl} = \frac{\left(E_{init} - E_{fin}\right)}{h} = \left(\frac{m_e e^4}{8\varepsilon_0^2 h^3}\right)\left(\frac{1}{n_{fin}^2} - \frac{1}{n_{init}^2}\right), \qquad (1)$$

where h is Planck's constant, m_e is the electron mass, e is the electron charge, ε_0 is the electrical constant. It follows from this that the orbital electron oscillates with the frequency

$$\nu_{cl} = \frac{m_e e^4}{8\varepsilon_0^2 h^3} \times \frac{1}{n^2} \tag{2}$$

in the principal (n=1) and excited (n=2,3,4…) states of the hydrogen atom.

Results of calculations on the formula (1) are in good agreement with experimental data. But a nature of the stability of the electron on the orbits *did not be explained*. Bohr only postulated the existence of such a stability. Recently Simulik, basing on his "slightly generalized Maxwell equations" has derived Bohr's postulates [2]. He stated: "Now we can show on the basis of this model that the assertions known as *Bohr's postulates are consequences of equations (1)* (equations (1) from the paper [2]) *and of their classical interpretation*: *i.e.,* these assertions can be derived from the model, and there is no need to postulate them from beyond the framework of classical physics, as is done in Bohr's theory."

The purpose of this work is to show that the nature of the stability of the electron on the orbits can be visually explained using the hypothesis of the electron with the exploding corona [3, 4]. I shall first give here a short description of the explosions for readers not familiar with the works [3, 4].

The electron in the proposed hypothesis has small ($r<10^{-46}$ m) negatively charged core, which remains in stable state by pressure of a hypothetical fation* gas. This gas fills the Space and causes the

*The term "fation" is introduced, in [4], in honour of Nicolas Fatio de Duillier, who, in 1690, had offered the idea of the mechanical gravitation and had assumed the existence of these sub-particles. This hypothesis, for the historical reasons, is far-famed as Lesage's theory.

shadow-gravity. About the shadow gravity, except [3,4], there exists a voluminous literature, part of which is [5, 6].

Fations assumed to be neutral sub-particles. Some part of bombarding the core fations is disintegrated on negatively and positively charged components at the core surface. This phenomenon seems to be similar to well-known process of disintegrations of gamma quanta on electrons and positrons at the strong electric field of the atomic nucleus. In this process some asymmetry take place: some excess of negatively charged components as against positive ones are created with very small probability at the E-core. Analogously, respective excess of positive charged components is created at the positron core, *P-core*. Undoubtedly, this is associated with differences in properties of the electron and positron cores: they are oppositely charged. Of course, such a process of creating charged components, without the concomitant creation of oppositely charged ones, contradicts the law of conservation of charge, which is considered as exact for ordinary particles, but some analogies can be used to support our assumption. It is well known that, in result of CP violation, K^0 mesons (neutral mesons) decay on particles and antiparticles with asymmetry in experiments on the level of ordinary matter. All this can be some basis for the conjecture of the existence of a violation of the charge conservation law on the sub-electron level.

During a time T the negatively charged excess is accumulated on the core surface. It is retained on the surface basically by pressure of the fation gas. At the end of the period T the accumulated layer explode. In the work [4] this process is described in more detail.

The explosion has two stages. At the first stage, the exploding corona expands similarly to a compressed matter, in the sense that its components are bound to each other, and the corona is impenetrable for an external electrical field. Hereafter the first stage of the explosion will be referred (for short) as the E-corona. Respectively,

positron has P-corona. At the instant when the radius of the E-corona is increased to some value R_m it disintegrates into separate sub-particles. This is the beginning of the second stage. One after another flows of these new sub-particles produce spherical λ layers (Fig. 1) radiated with velocity of light c (like the classical electric field). The thickness of each moving λ layer is constant and is given by

$$\lambda = cT \tag{3}$$

where T is the period of explosions, c is the speed of light.

In work [3] flows of these new sub-particles have been identified with the electrostatic field and named as *electrical field sub-particles* (EFS). We took on $R_m \cong \lambda$, inasmuch as the core radius $r_c << \lambda$ (in [7] was found $\lambda = 3.86159 \times 10^{-13}$ m and, as above mentioned, $r_c < 10^{-46}$ m).

E-corona and EFS carry the negative charges; respectively P-corona and the field created by the positron carry the positive charge. I already have pointed out in previous works that this concept radically differs from the modern theory, according to which electrostatic field is a flow of *neutral* virtual photons. In this connection it is not clear how the neutral photon distinguishes positive and negative charges to produce an attraction or repulsion. In the work [7] was shown that the process of an electrostatic interaction takes on the clear and natural physical meaning on the conception of *two-component* of the electrostatic field (EFS).

We consider that the E-corona front and λ layers expand with the velocity of light in vacuum, **c**, inasmuch as EFS have extremely small masses or their inertial masses are equal to zero.

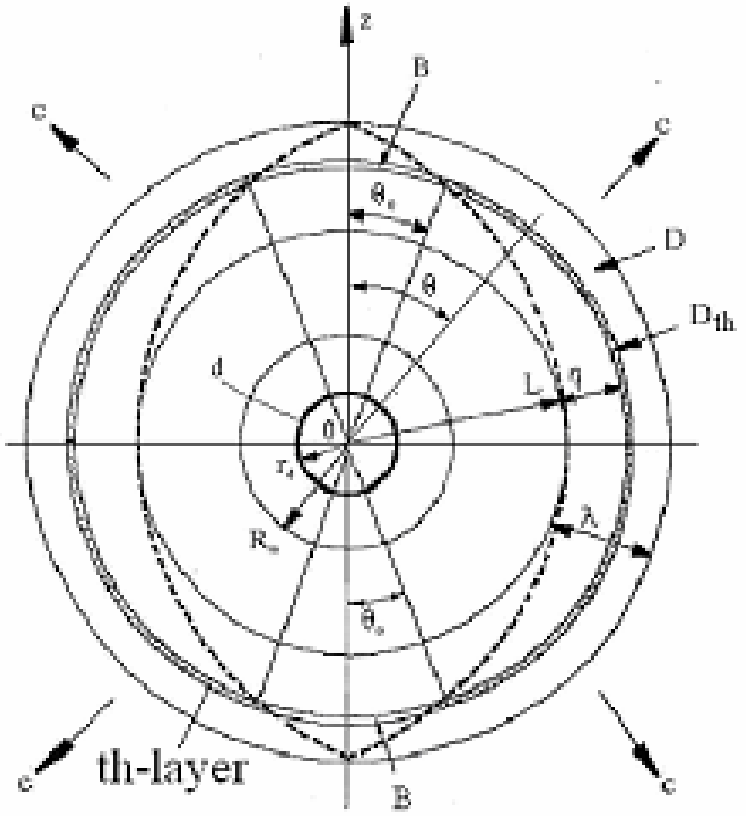

Figure 1. A cross section of the corona explosion (at its disintegration instant $t = 0$) and periodical flows of EFS, radiated by the source-electron or positron located at the point O. Only two λ layers of these flows are shown. Each λ layer has width equal to λ. $R_m \approx \lambda$ is the corona radius; d is the mono-layer (a layer one sub-particle thick). All the EFS placed in the spherical mono-layer d with radius r_d are found, during time t, in the region D of the thin layer (th-layer) with radius $L + \eta$, and, thus, all EFS from the corona appear in the region D of the λ layer. The energy of EFS has uniform distribution density in the region D; the other two regions, B, are empty. Dashed lines denote the cross section of the boundary surfaces separating D and B regions. θ is the angle of a random direction of the axis z in space relative to the chosen direction.

In the work [3] was found that components of the E-corona, before its disintegration, are moving in the manner obeying the following equations

$$v_r = c r_d / \lambda; \quad v_\tau = \left(c^2 - v_r^2\right)^{1/2} = c\left[1 - (r_d/\lambda)^2\right]^{1/2}; \quad v_{\tau z} = 0, \tag{4}$$

where v_r and v_τ are radial and tangential velocities respectively, $v_{\tau z}$ is the projection of $\mathbf{v}_\tau$ on the symmetry axis z. In consequence of

these relationships all the EFS placed in a spherical mono-layer d with radius r_d (Fig. 1) are found, during time t, in the region D_{th} of the thin layer (th-layer) with radius $L_k + \eta_k$, and, thus, all EFS from the E-corona appear in the region D of the λ layer. Here and further k=1,2,3… is number of the λ layer beginning with the corona explosion. It was found that the energy density of the EFS, in the region D, is equal to (in [3] it is the formula (9))

$$\varepsilon_D = \frac{\varepsilon_c \lambda^2}{(2L_k + \lambda)(L_k + \lambda)}, \qquad L \geq 0, \tag{5}$$

where $\varepsilon_c = 3m_e c^2 / 4\pi\lambda^2$ is the energy density of the E-corona mater.

As is seen, the energy of EFS has a uniform distribution density in the region D (it does not depend on the η_k); the other two regions, B, are empty. Dashed lines denote the cross section of the boundary surfaces separating D and B regions.

2. Derivation of the formula for frequencies of electron oscillations basing on the hypothesis of the exploding electron corona

Let us assume that the charge of the nucleon of the hydrogen atom (proton) create the same electrostatic field as the electron being differed from it only by sign of charge. In this case we may use all results of previous work [3]. It is possible that the proton includes the core of the positron, corona of which explodes in the same way as the electron one and emits periodical flows of positive charged EFS. By some grounds for such an assumption can be the fact that an action of the electron and the proton on other charges exactly equals, differing only by directions.

Inasmuch as, in consequence of the space isotropy, the axes z of the E-corona symmetry (Fig. 1) is bound to be oriented in space at random at each explosion, the λ layer is formed of the th-layers with axes z, that are also oriented in space at random. In doing so, the orbital electron finds oneself either in the region D with the energy density of the EFS ε_D or in the empty regions B randomly.

In the work [3] was found that the probability ingress of a point, the spherical coordinate θ and φ of which are random, but the radial coordinate r_k, as well as the distance η_k are determinate, is equal to (in [3] it is the formula (11))

$$P_\eta = \cos\theta_0 = \left[\frac{\eta_k(2L_k+\eta_k)}{\lambda(2L_k+\lambda)}\right]^{1/2}\frac{L_k+\lambda}{L_k+\eta_k}, \qquad (6)$$

where $L_k \geq 0$ is the distance from the point 0 to the lower boundary of the λ layer.

The probability ingress of a point in the whole non-empty D region of the λ layer (all coordinates, r, θ, φ are random) is equal to

$$P_D = \frac{(2L_k+\lambda)(L_k+\lambda)}{3(L_k+\lambda)L_k+\lambda^2} \qquad (7)$$

(in [3] it is the formula (14)).

In the work [7] has been shown that short periodical impulses act on the electron, which is in one of the λ layer. For hydrogen atom the relative pulse duration is $\tau/T = \lambda^2/3r_B^2 \sim 10^{-5}$, where $\tau = \lambda^3/3cr_B^2$ is absolute pulse duration, $\lambda = \lambda_C/2\pi$, and $r_B \sim 10^{-11}$ m (Bohr radius). Therefore boundaries of the λ layer practically do not change their positions in space for the time τ. The boundaries shift on the distance λ in the radial direction, when the next explosion occurs. Thus, since

the pulse duration τ is considerably shortest than the explosion period $T=\lambda/c$, and as the electron finds oneself in the nonempty region D_{th} of the th-layer randomly, it is a random pulse process, in which short impulses alternate with random pauses, t_p (Fig. 2). We can easily show that density of the probability distribution of intervals between impulses, $t_p=jT$, satisfies the equation

$$p(t_p) = P_\eta (1-P_\eta)^{j-1}, \tag{8}$$

where j=1,2,3…..is the number of periods T in the interval between impulses; the probability P_η corresponds to (6).

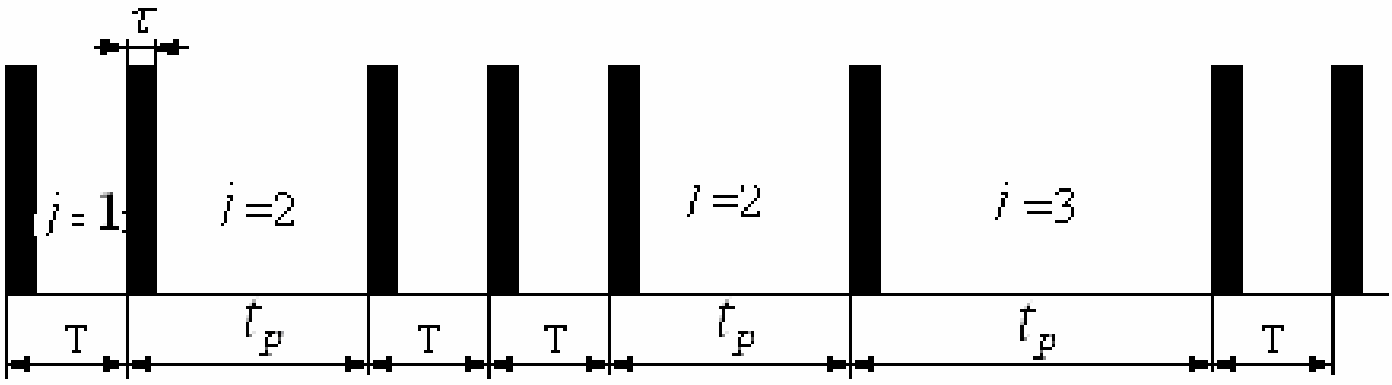

Figure 2. Diagram of the stochastic process of the electron interaction with EFS (not in scale). $T_p=kT$ is random interval between impulses; τ is width of the impulse.

The mathematical expectation is equal to

$$M(t_p) = \sum_{j=1}^{\infty} P_\eta T j (1-P_\eta)^{j-1} = \frac{T}{P_\eta} = \frac{\lambda}{cP_\eta} \tag{9}$$

and the variance

$$D(t_p) = \sum_{j=1}^{\infty} \left[jT - M(t_p)\right]^2 p(t_p) = \frac{T^2(1-P_\eta)}{P_\eta^2} = \frac{\lambda^2(1-P_\eta)}{c^2 P_\eta^2}. \tag{10}$$

Owing to such a *stroboscopic effect* we may consider dynamics of the electron *only as function of* $\eta = \eta_k + x$, *considering* L_k and η_k to be constants. In the same manner as in Bohr's model we shall consider the simplified variant, in which orbits have circular forms and a movement of the nucleus is not taken into account.

We shall see below that the electron is oscillated relative to the equilibrium orbit, as the attractive radial force, F_η, randomly varies depending on whether the orbital electron appears in the area *D* or in the empty area *B* of the th-layer. Classical (Coulomb's) force, in fact, is the average value for usual macroscopic conditions when all spherical coordinates of a target-electron, r, θ, φ, are random variables. Therefore, using (6), (7) and the expression for Coulomb's force, we obtain the averaged value of the force F_η as

$$\overline{F_\eta} = \frac{F_{cl} P_\eta}{P_D} = \frac{e^2\left[3(L_k+\lambda)L_k+\lambda^2\right]}{4\pi\varepsilon_0 r_k^2 (2L_k+\lambda)^{3/2}\,\lambda^{1/2}} \times \frac{(2L_k+\eta_k+x)^{1/2}(\eta_k+x)^{1/2}}{(r_k+x)}, \qquad (11)$$

where *x* is the displacement of the electron from the equilibrium orbit with radius r_k; spherical coordinates θ and φ are random variables but the radial distance from lower boundary of the λ layer, η_k, is determinate one, $L_k = r_k - \eta_k$.

As is seen, the force $\overline{F_\eta}$, as distinguished from classical one, depends from two parameters L_k and η_k (Fig 3), and it do *not adheres to the inverse square law* until orbital electron is within the limits of the λ layer and L_k is constant (given the above mentioned *stroboscopic effect*). When the electron moves away from the proton the returning attractive force, $\overline{F_\eta}$, (contrary to the inverse square law) increases and the converse. *Thus the electron is in an equilibrium*

state until it is within the limits of the λ layer and $L_k = const$ *. This is the basic cause of existence of stable orbits in the atoms.* I do not lose sight the fact that, durations of these stabilities can be different.

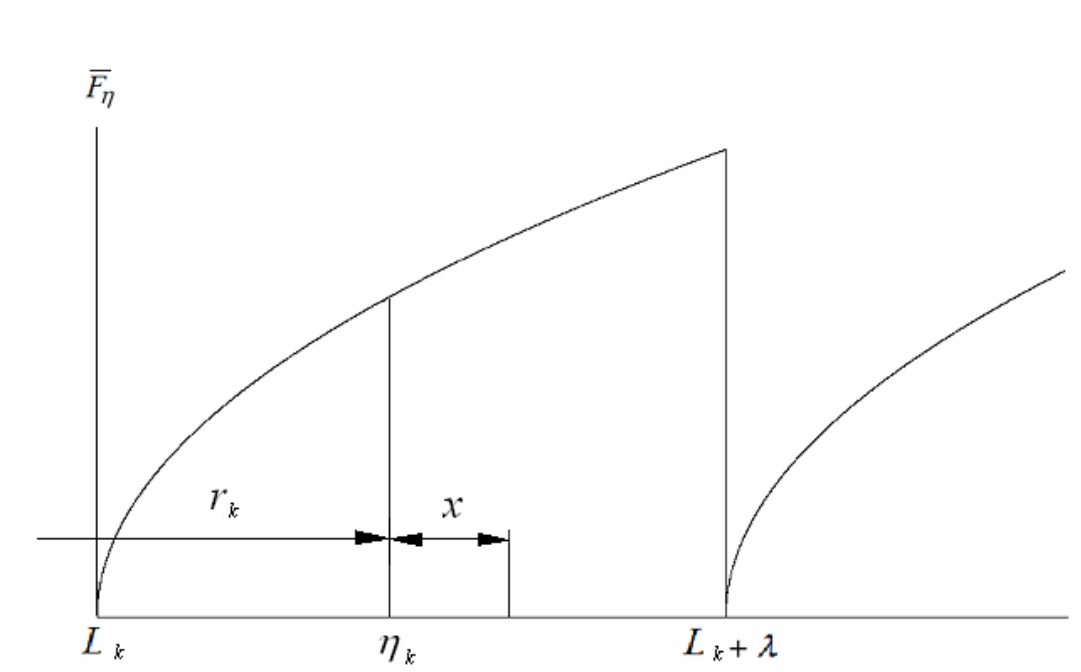

Figure 3. Dependence of the attractive force $\overline{F_\eta}$ from radial coordinates: the distance L_k from the nucleon to the lower boundary of λ layer and the distance η_k from the boundary; r_k is distance from the nucleon to the equilibrium orbit, x is displacement from the equilibrium position. Until the electron is within the limits of the λ layer, the force does not adhere to the inverse square law. When the electron passes to another λ layer (for example in the positive direction), L_k becomes $L_{k+1}=L_k+\lambda$, the force is abruptly changed from maximum to zero, and electron finds a new orbit with a coordinate η_{k+1} conformable to the equilibrium state.

However, in consequence of the force F_η is a random variable, the equilibrium is observed only in the mean: electron performs oscillations in the radial direction.

In order to obtain a natural stochastic picture of oscillations I have performed a simulation using Monte-Carlo method and Visual Basic program (see the Appendix). On the Fig. 5 it is shown one short

realization of the simulation. We shall consider character of these oscillations below.

First we shall find the expression for frequencies of the oscillations analytically.

Using usual methods and, taking into account (11), we can write the following equation of motion of the electron in the hydrogen atom in the radial direction as

$$\frac{d^2x}{dt^2} + A\frac{\left(2L_k+\eta_k+x\right)^{1/2}\left(\eta_k+x\right)^{1/2}}{r_k^2\left(r_k+x\right)} - \frac{r_k^2 \mathrm{v}_k^2}{\left(r_k+x\right)^3} = 0\,, \qquad (12)$$

where x is a displacement of the electron from its equilibrium position, $\mathrm{v_k}$ is orbital velocity and

$$A = \frac{e^2\left|3\left(L_k+\lambda\right)L_k+\lambda^2\right|}{4\pi\varepsilon_0 m_e (2L_k+\lambda)^{3/2}\,\lambda^{1/2}}\,. \qquad (13)$$

The second term in the square brackets of (12) is the centrifugal acceleration.

As is seen, equation (12) non-linearly depends from the radial coordinate x. After its linearization, by usual method (see Fig.4), we obtain the oscillation equation of the electron in radial direction in limits of the λ layer as

$$d^2x/dt^2 + \left(dB/dx\right)_{x=0}\cdot x = 0\,, \qquad (14)$$

where

$$B = \left[A\frac{\left(2L_k+\eta_k+x\right)^{1/2}\left(\eta_k+x\right)^{1/2}}{r_k^2\left(r_k+x\right)} - \frac{r_k^2 \mathrm{v}_k^2}{\left(r_k+x\right)^3}\right]. \qquad (15)$$

Proceeding from the equilibrium condition, $d^2x/dt^2 = 0$ for x=0, we obtain for the orbital velocity the relationship as

$$v_k^2 = \frac{A(2L_k+\eta_k)^{1/2}(\eta_k)^{1/2}}{r_k^2} \quad . \tag{16}$$

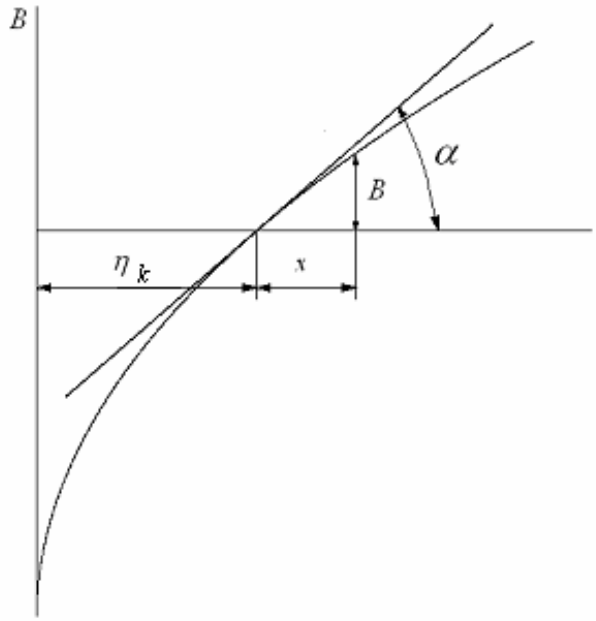

Figure 4. Diagram illustrated the linearization method of the function *B* (15); $\tan\alpha = dB/dx$ for $x = 0$.

The solution of the equation for the harmonic oscillator (12) has the view

$$x = a\cos(2\pi\nu_k nt) \text{ , } n=1,2,3\ldots \tag{17}$$

where ν_k is the natural oscillation frequency of the electron in the radial direction, until it is within the limit of the λ layer; a is the amplitude of the oscillation, which, as it is seen in Fig. 5, is a random variable. This frequency is equal to

$$\nu_k = \frac{1}{2\pi}\left(\frac{dB}{dx}\right)_{x=0}^{1/2} = \frac{1}{2\pi r_k^2}\left[\frac{A\left(L_k^2+6L_k\eta_k+3\eta_k^2\right)}{\left(2L_k+\eta_k\right)^{1/2}\eta_k^{1/2}}\right]^{1/2}, \tag{18}$$

where $r_k = \lambda k$ is the radius of *k-th* λ layer and k= 1,2,3….

Schrödinger also pointed out on existence such as high-frequency oscillations in his work [8], in which he, for the first time, had

suggested his famous equation. Ibid he considered the equation for the natural frequencies $\nu = C'\sqrt{C+E}$ and had expressed the idea that the frequencies of a light emission is equal to the difference of two such as natural oscillation frequencies. Some afterwards Max Born had suggested the probability interpretation of Schrödinger's equation, however the idea of the mechanical natural oscillation of the electron also was not wrong. Analogous point of view has Volodimir Simulik [2]. He wrote on the page 125: "But the main point is that a classical interpretation (without probabilities) is now possible." Mine conclusion is that some *combination of classical mechanism and probabilities* exists in the atom nature. The orbital electron executes mechanical oscillations but their amplitude executes random modulations owing to the stochastic impulsive character of the attractive force F_η (Fig. 5).

I also suppose that the hydrogen atom radiates the light when its electron jumps from more distant λ layer to the λ layer, which is placed nearer to the nucleus. The electron is on the orbit until then while the amplitude of its oscillations do not transcend the boundary of the λ layer, otherwise it jumps to the next more stable λ layer.

3. Some numerical analysis

As is seen, new formula (18) differs from the classical one (2) by the addition degree of freedom η_k. Owing to this feature, for each $k \geq k_{bn}$, exists one value $0 \leq \eta_k \leq \lambda$ such that $\nu_k = \nu_{cl}$ *exactly*. In order to find boundary numbers, k_{bn}, of λ layers, let us equate (2) and (18) as follows

$$\frac{m_e e^4}{8h^3\varepsilon_0^2 n^2}=\frac{1}{2\pi r_k^2}\left[\frac{e^2\left[3(L_k+\lambda)L_k+\lambda^2\right]\left(L_k^2+6L_k\eta_k+3\eta_k^2\right)}{4\pi\varepsilon_0 m_e(2L_k+\lambda)^{3/2}\,\lambda^{1/2}(2L_k+\eta_k)^{1/2}\eta_k^{1/2}}\right]^{1/2}, \qquad (19)$$

whence, after substituting, $\eta_k=\lambda$, $L_k=r_k-\eta_k=(k_{bn}-1)\lambda$ and $r_k=k_{bn}\lambda$, we obtain equating for numbers k_{bn} as

$$k_{bn}=\sqrt{2}n\left(\frac{h}{e}\right)^{3/2}\left\{\left[\frac{\varepsilon_0}{\pi m_e\lambda}\right]^3\frac{\left[3(k_{bn}-1)k_{bn}+1\right]\left[(k_{bn}-1)^2+6(k_{bn}-1)+3\right]}{(2k_{bn}-1)^2}\right\}^{1/4}. \qquad (20)$$

Next, using the method of successive approximations, we obtain numerical data conformable to *n* states as

Table 1.

n	1	2	3	4	5	…
k_{bn}	2781	11117	25009	44459	69465	…
ν_n,10^{15} c^{-1}	3.2898	0.8225	0.3655	0.2056	0.1316	…

Numerical analysis shows that k_{bn} are lowest boundaries of infinite series conformable to classical natural frequencies ν_n. As an example, in the below table, it is shown a little part of the dependence η_k from the λ layer number k for series $k\geq k_{b1}=2781$ corresponding to $\nu_{nat}=3.2898\times10^{15}$ c^{-1}. Thus, the number $k=k_{b1}=2781$ is the number of the lowest λ layer in which, and in all $k>k_{b1}$ ones, electron is in a relative stable state and has the frequency of oscillations $\nu_{nat}^1=3.2898\times10^{15}$ c^{-1}.

Table 2

k	2781	2782	2783	2784	2785	..
η_k,10^{-13} m	3.8588	3.8533	3.8478	3.8422	3.8367	..

Here, and above, we used for calculations: m_e=9.1093829×10^{-31} kg; e=1.602176565×10^{-19} C; h=6.62606957×10^{-34} J·s;

ε_0=8.854187817×10^{-12} F/m; c=2.99792458×10^8 m/s; $r_k = k\lambda$; $L_k = r_k - \eta_k$. Here we also took $\lambda = \lambda_C / 2\pi = h/(2\pi m_e c)$= 3.86159268 m, which was found in the work [7]; λ_C is Compton wavelength. Analogous tables can be shown for k_{b2}=11117 and so forth.

Thus, the orbital electron has infinite variants to jump from an initial λ_{init} layer of $k \geq k_{bn}$, for example n=3 series, to any final λ_{fin} layer of $k \geq k_{b1}$, for example n=1 series. In doing so, it emits the correspondent photon, for example,

$$\nu_{31} = 3.2898\times10^{15} - 0.3655\times10^{15} = 2.9243\times10^{15} \text{ c}^{-1}, \qquad (21)$$

which is equal to one term of Layman bands.

Above we did not use an additional constraint in the formula (18) except an assignation of observed values of the natural frequencies of oscillations (2). Below we shall consider a variant in which constraint of the radial coordinate of the orbital electron is introduced by Bohr's condition as

$$r_n = \frac{n^2 h^2 \varepsilon_0}{\pi m_e e^2}. \qquad (22)$$

After substituting this constraint the formula (18) takes the form

$$\nu_n = \frac{m_e e^4}{8\varepsilon_0^2 h^3} \times \frac{b_n}{n^2}, \; n=5,10,15\ldots \qquad (23)$$

which differs from the Bohr's form (2) by the additional multiplier

$$b_n = \left\{ \frac{4\left[3(L_n+\lambda)L_n + \lambda^2\right]\left(L_n^2 + 6L_n\eta_n + 3\eta_n^2\right)}{n^2 r_n (2L_n+\lambda)^{3/2}\sqrt{(2r_n-\eta_n)\lambda\eta_n}} \right\}^{1/2}, \qquad (24)$$

which is exactly equal to 25 for observed ν_n and correspondent η_n.

As is easily seen from the below table, in this case the electron also has a possibilities to choose the coordinates η_n such that the natural frequencies are exactly equal to the observed meanings. In doing so, radiuses of orbits r_n are 25 times as greater than Bohr's ones.

Table 3.

n	k_n	r_n 10^{-9} m	η_n 10^{-13} m	ν_n 10^{15} c^{-1}
5	3426	1.3229817	1.6727025	3.289842
10	13704	5.2919266	1.6713305	0.8224605
15	30873	11.9064487	1.6709683	0.365538
20	54814	21.1669341	1.670866	0.2056151
25	85647	33.0733828	1.67083	0.1315937
30	123332	47.6257948	1.6708161	0.091385

Thus Bohr's constraint (22) singles out discrete terms out of infinite series such that $k_n > k_{bn}$. I consider that formula (18) is closer to quantum theory, according to which electron can be randomly appear at any distance from the nucleus. But according to (18) electron, as distinguished from the quantum theory, cannot be placed to nucleus closer then $k_{bn}\lambda$ for each observed natural frequency.

I do not consider here the links of the oscillation stability with the considered hypothetical model parameters. This is item of subsequent works. It may be noted only that the stability directly depends from the impulse variance (10), which turn out depends from P_η, and therefore from $r_k = k\lambda$ and η_k. Indeed, taking into account the relation P_η from η (6), we can see from (10) that the variance $D(t_p) \to \infty$ when $\eta \to 0$, whence the stability of the orbital electron

near the lower boundary of the λ layer is decreased and vice-versa, when $\eta \to \lambda$ the invariance $D(t_p) \to 0$ and the stability is increased.

4. Some Results of the Simulation of Stochastic Oscillations of the Orbital Electron

On fig. 5 it is shown a diagram of electron oscillations in radial direction obtained by the simulation (see the appendix).

In spite of an accumulation of calculation errors, the obtained numerical values of frequency have values close to those were obtained by analytic method. For example, for n=5 we obtained by simulating $\nu_{sim} = 3.305 \times 10^{15}$ c^{-1}, whereas by analytic method it was obtained $\nu_{analit} = 3.2898 \times 10^{15}$ c^{-1}. It is interesting to observe that amplitude of the oscillations performs periodical beating. But this picture has only illustrative importance, because character of the amplitude variations, to a large extent, depends from the base of the random number generator. Generated by Visual Basic numbers is only pseudorandom. For this reason I as yet could not study stability of the electron oscillations at various orbits and at various λ layers by simulation. It is possible that the beating is a result of composition of the *mechanical oscillations and some probability waves* that is in line with quantum theory.

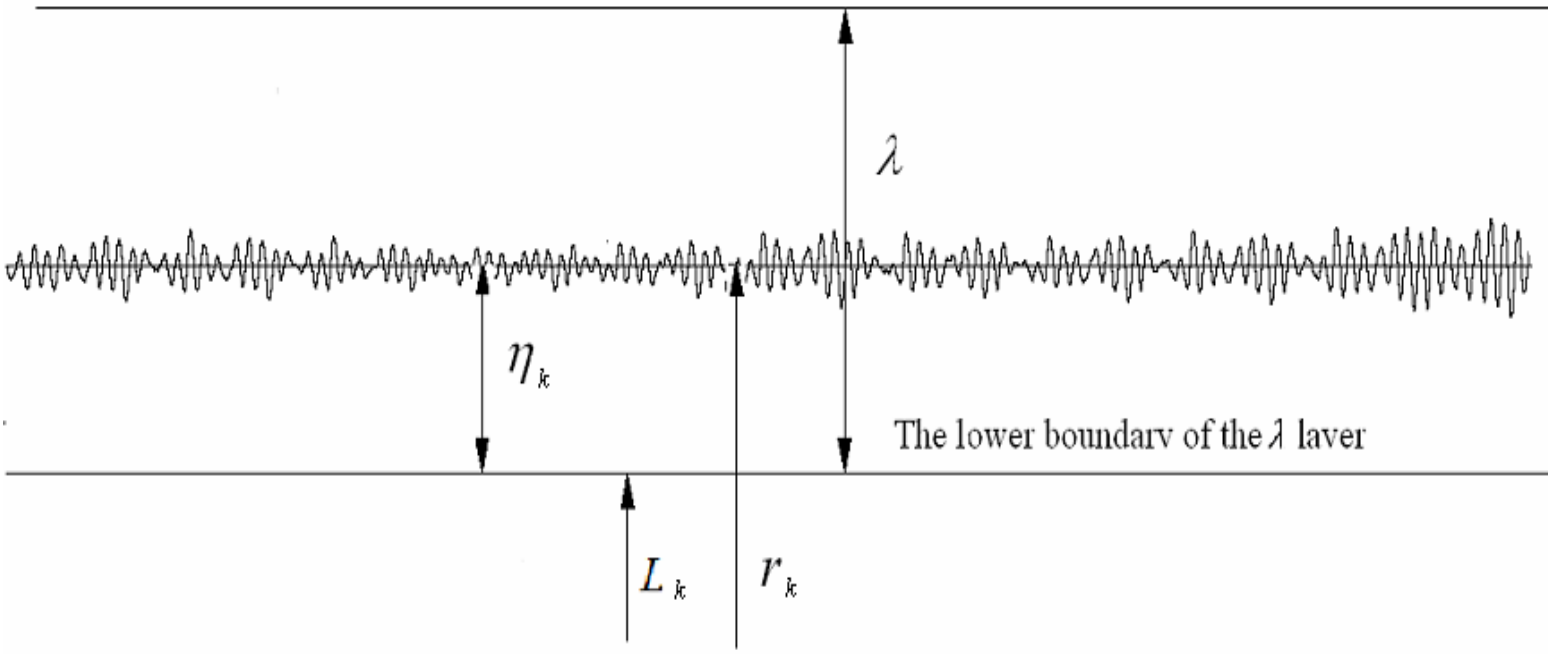

Figure 5. Diagram of electron oscillations in radial direction obtained by the simulation (see the appendix).

Observe also that, as is seen from below data, the results of the simulation good verify the analytical law of probability distribution of intervals between impulses, $t_p=jT$ (8), mathematical expectations (9) and variances (10).

Table 4.

J	1	2	3	4	5
For-la (8)	0,658233	0,22496	0.076885	0.026277	0.0089804
Simulation	0,658246	0,22495	0.076885	0.026276	0.0089797

Mathematical expectations are equal to: from the simulation $M\left(t_p\right)_{sim}=1.95686\times10^{-21}$ s and in accordance with (9) $M\left(t_p\right)_{analit}=1.95689\times10^{-21}$ s. The variances are: from the simulation $D\left(t_p\right)_{sim}=1.30867\times10^{-42}$ s^2 and in accordance with (10) $D\left(t_p\right)_{analit}=1.30876\times10^{-42}$ s^2.

All calculations and simulations were performed without regard to oscillations of η, from which the probability, P_η, also depends, see (6).

5. Conclusion

Thus, using the idea of the electron corona explosions, we have obtained a visual picture of the hydrogen atom. The electron, in this picture, performs radial natural oscillations with high frequencies, depending from radii of its orbits, i.e. from the numbers k of the λ layers. Owing to the additional degree of freedom η_k there exists infinite numbers of λ layers where electron has states with observed oscillation frequencies, probably with different durations of stabilities.

I show (using Monte-Carlo method and Visual Basic program) that high-frequencies oscillations have a stochastic character and amplitude modulation. Although, in doing so, I failed to avoid accumulations of errors of calculations in simulation, and cannot test an oscillatory stability, I have obtained the pictorial view on character of oscillations of the electron in the hydrogen atom and on nature of stability of the orbital electron.

Actually, it is possible that the scenario is considerably complicate. For example, it is required analysis in the best possible manner the problems of phases of explosions of the orbital electron corona and the positron binding in the proton. It is possible, that it is necessary to take into account a retardation of the field propagation from proton to the electron and some other features of the hypothesis. I intuitively supposed that radii of the E-coronas of the orbital electron and bound in the proton positron are equal to each other, although the radius of the proton, $\sim 10^{-15}$ m, is considerably lesser than the radius of the E-corona explosions, $\sim 10^{-13}$ m.

Appendix

Algorithm of the Simulation of Stochastic Oscillations of the Orbital Electron

As has been specified in the main text, the electron goes on an orbit by discrete steps with the period of explosions $T = \lambda / c$. At each i-th step it is displaced on the distance S_i, which is the resultant vector of the previous displacement S_{i-1} and displacement ΔS_i by action of the attractive force F_η to the proton. This force is random value. It is equal to

$$F_D = \frac{F_{Cl}}{P_D} = \frac{e^2 \left| 3(L_k + \lambda) L_k + \lambda^2 \right|}{4\pi\varepsilon_0 (L_k + \eta_k)^2 (2L_k + \lambda)\,(L + \lambda)}\,, \qquad (1A)$$

if the electron randomly finds oneself in the region *D*, and equal to zero if it appears in the empty region *B* (see Fig. 1 in the main text). On the other side, this force can be expressed via the acceleration $w_D = \Delta S_D / T^2$, as

$$F_D = m_e w_D = \frac{m_e \Delta S_D c^2}{\lambda^2} \qquad (2A)$$

Equating (1A) and (2A), we obtain

$$\Delta S_D = \frac{e^2 \left| 3(L_k + \lambda) L_k + \lambda^2 \right|}{4\pi\varepsilon_0 m_e c^2 (L_k + \eta_k)^2 (2L_k + \lambda)\,(L_k + \lambda)}\,, \qquad (3A)$$

where all denotations is the same as the ones given in the main text. From figure 1A it is clear that coordinate η_i relative to the lower border of the λ layer is equal to

$$\eta_i = \eta_{i-1} + f + b \cdot \tan\left(\Delta\alpha_i / 2\right), \tag{4A}$$

where

$$f = S_{i-1}\cos\beta_{i-1} - \Delta S_i\,; \tag{5A}$$

$$b = S_{i-1}\sin\beta_{i-1}\,. \tag{6A}$$

Here the variable coordinate $\eta_i = \eta_k + x$, where x is a displacement in relation to the mean value η_k (see the main text).

Next

$$\tan\Delta\alpha_i = \frac{b}{L_k + \eta_{i-1} + f}\,; \tag{7A}$$

$$\beta_i = \pi/2 - \Delta\alpha_i - \gamma\,, \tag{8A}$$

were

$$\gamma = \arctan(f/b)\,. \tag{9A}$$

Next

$$S_i = b/\sin\gamma\,. \tag{10A}$$

Starting conditions are as follows: The angle of radius-vector rotation

$$\Delta\alpha_0 = 2\arcsin\left(\frac{S_0}{2\left(L_k + \eta_k\right)}\right); \tag{11A}$$

$$S_0 = \mathrm{v}_k T = \frac{\sqrt{A}\left(2L_k + \eta_k\right)^{1/4}\left(\eta_k\right)^{1/4}}{r_k}\,, \tag{12A}$$

where $\mathrm{v_k}$ is found from (16), see the main text.

$$\beta_0 = ar\cos\left(\frac{S_0}{2(L_k + \eta_k)}\right). \qquad (13A)$$

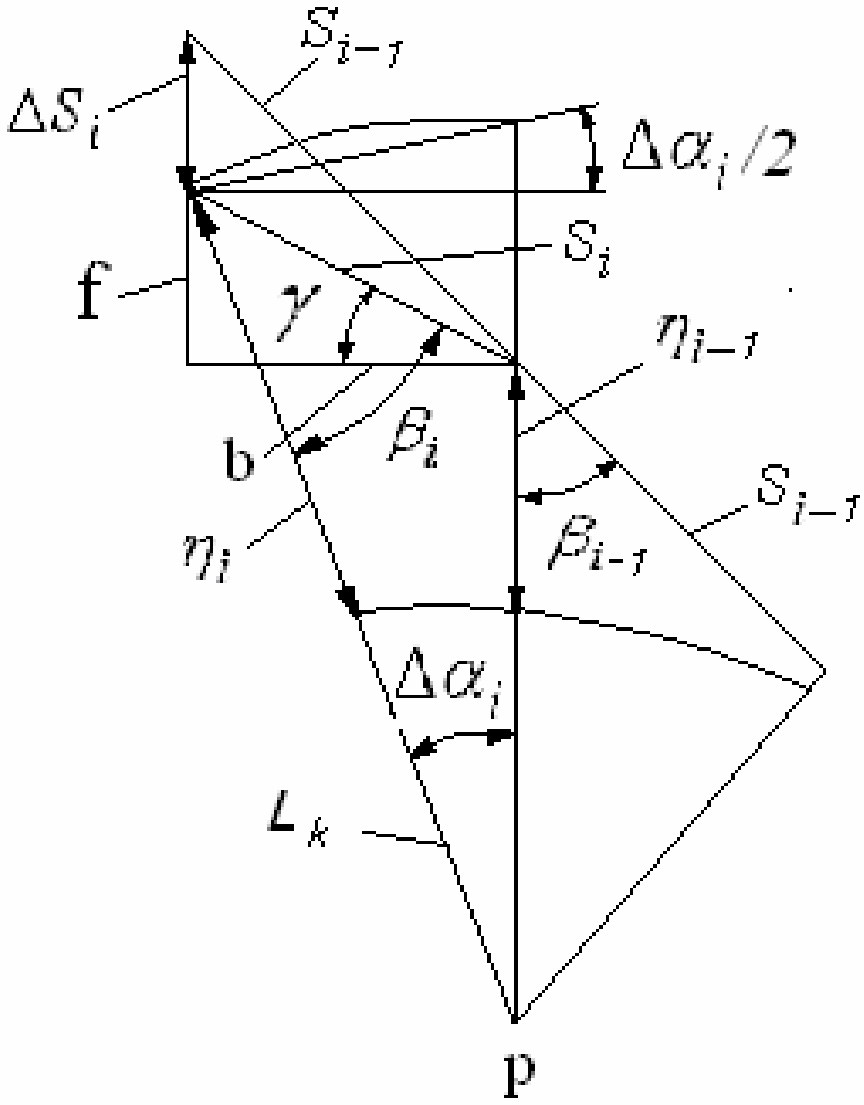

Figure 1A. Schema of simulations of the orbital electron motion: S_i and S_{i-1} are the current and previous, respectively, shifts of the electron during time T of the explosion; $\Delta\alpha_i$ is the angle of radius-vector rotation corresponding to i-th explosion.

Let us to use the Monte-Carlo method for modeling of the random process. The symmetry axe z of the field created by the proton (Fig 1 in the main text) occupy, in general, equiprobable positions in space, therefore, as it was mentioned above, the orbital electron finds oneself

in the region D or in he empty region B randomly. This means that all positions of the end of a unit vector on the sphere possesses the equally probability density, whence the joint probability distribution of coordinates θ, φ is equal to

$$f(\theta,\varphi)=\frac{1}{4\pi}\sin(\theta), \tag{14A}$$

and the probability-distribution function is equal to

$$F(\theta,\varphi)=\frac{1}{4\pi}\int_0^{2\pi} d\varphi\int_0^{\theta}\sin(\theta)d\theta=\frac{1}{2}[1-\cos(\theta)]. \tag{15A}$$

On Fig 2A it is shown diagram of this function; in doing so, the function $F(\theta,\varphi)$ equiprobable distributed in the limits $0\le F(\theta,\varphi)\le 1$. It is seen that the orbital electron finds oneself in the nonempty region D if $\theta_0<\theta<\pi-\theta_0$ (see also Fig 1 in the main text). In the program of the simulation this condition has the form: if $\cos(\theta_0)>abs[1-2\cdot F(\theta,\varphi)]$, then $\Delta S_i=\Delta S_D$, otherwise $\Delta S_i=0$.

The program of the simulation was made for Visual Basic. Some results and analysis are given in the main text.

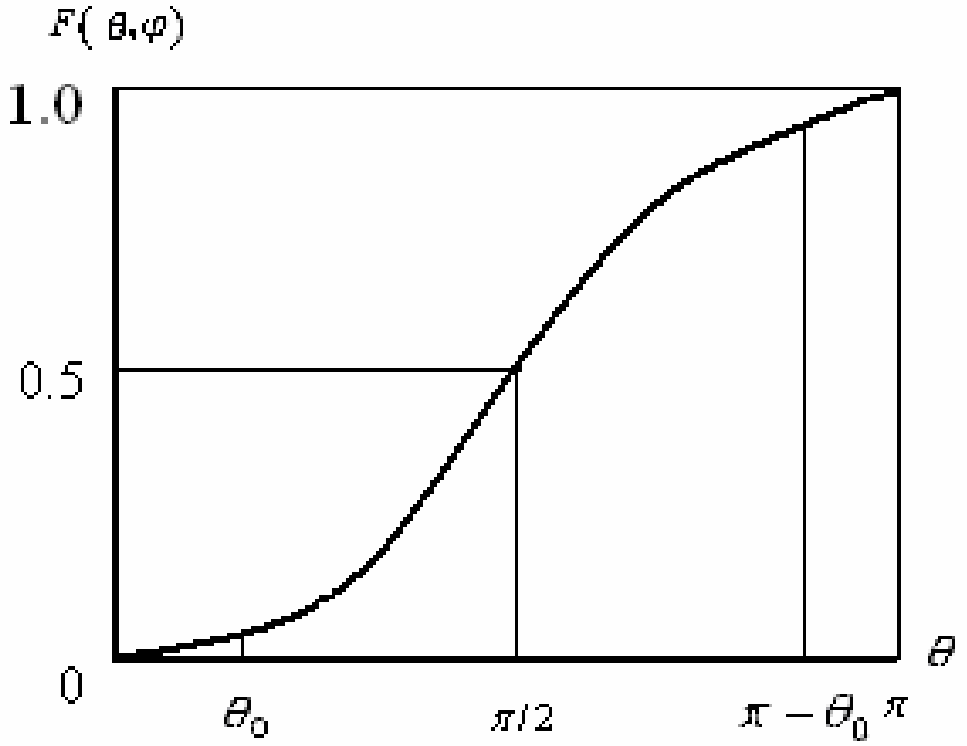

Figure 2A. Diagram of the function (15A). If $\theta_0 < \theta < \pi - \theta_0$, the orbital electron randomly find oneself in the nonempty region *D*. In this case $\Delta S_i = \Delta S_D$, otherwise $\Delta S_i = 0$.

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