The Myth about the Quantum Electron Spin of $\hbar/2$ and Reality of Wave Processes

1. *Introduction*

In a theory of Einstein and de Haas's experiment, the magnetic moment of a closed electric circuit (an electron orbit) was accepted to be equal to

$$\mu_e = \frac{1}{c} IS, \tag{1.1}$$

where c is the speed of wave motion of the space surrounding the H-atom, I is the average value of an orbital current, and S is the area of the orbit.

Only one half-wave of the fundamental tone with one node, in which an electron is localized, is placed on any electron orbit of the radius r. A wavelength of the fundamental tone, its period and the circular frequency are equal, respectively, to

$$\lambda = 4\pi r, \qquad T = \lambda / \upsilon, \qquad \omega = \frac{2\pi}{T} = \frac{2\pi}{\frac{4\pi r}{\upsilon}} = \frac{\upsilon}{2r}, \tag{1.2}$$

where υ is the wave speed on an orbit.

The average value of the electron wave current I on an orbit, as any harmonic value, is defined by the formula

$$I = \frac{2}{\pi} I_m, \qquad \text{where} \qquad I_m = \left(\frac{dq}{dt}\right)_m = \omega e \tag{1.3}$$

is the amplitude of the electron current. Thus, the *average current of an electron orbit* is

$$I = \frac{2}{\pi} I_m = \frac{2}{\pi}\frac{\upsilon e}{2r} = \frac{1}{\pi}\frac{\upsilon e}{r} = \frac{4e}{T} = \frac{2e}{T_e}, \tag{1.4}$$

where T_e is the period of electron's revolution along an orbit.

Taking into account the equality (1.4), the magnetic moment of an electron orbit, i.e., the magnetic moment of a harmonic wave of the fundamental tone, is

$$\mu_e = \frac{1}{\pi}\frac{\upsilon e}{cr}\pi r^2 = \frac{\upsilon}{c} er. \tag{1.5}$$

At the stationary orbits (see the paper *"Wave Quanta"*), $\upsilon = \frac{\upsilon_0}{n}$ and $r = r_0 n$; therefore, the magnetic moment of any electron orbit is the same and constant:

$$\mu_e = \frac{\upsilon}{c} er = \frac{\upsilon_0}{c} er_0 = const. \tag{1.5a}$$

The ratio of the orbital magnetic moment of the electron μ_e to its orbital moment of momentum $\hbar = m\upsilon r = m\upsilon_0 r_0$ is

$$\frac{\mu_e}{\hbar} = \frac{e}{mc}. \tag{1.6}$$

This relation, confirmed experimentally and obtained theoretically by the authors on the basis of different approaches, including the wave one, is beyond any doubts. From this relation, it uniquely follows that an electron does not have the spin of one half of its orbital moment of momentum, as well as not having the corresponding magnetic moment of one half of the orbital magnetic moment of electron.

Physics of the 20th century built the orbital magnetic moment on the basis of the mechanical model of uniform motion of the electron regarded, in the classical spirit of the definition of a current, as a flow of electric charge, "electron liquid (or gas)", in a substance. According to such a model the average value of current was accepted to be equal to the ratio

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$$I = e / T_e . \tag{1.7}$$

From this formula, the magnetic orbital moment, half as much than the real value, followed:

$$\mu_e = \frac{v_0}{2c} e r_0 . \tag{1.8}$$

Accordingly, the ratio of the orbital magnetic moment to the orbital moment of momentum of the electron turned out to be half as much than the real ratio (1.6) confirmed experimentally:

$$\frac{\mu_e}{\hbar} = \frac{e}{2mc} . \tag{1.9}$$

At that time, instead of seeking the error, which led to this ratio, the hypothesis-fitting was accepted. According to this hypothesis, the proper magnetic moment μ_s equal to the orbital magnetic moment μ_e was attributed to the electron. Then, naturally, in order to reduce in the correspondence with the proper magnetic moment, the "proper moment of momentum", "spin" with the measure $\hbar / 2$ was also attributed to the electron.

An appearance of the correspondence of the theory to the experiment was created as a result of such a mathematical adjustment:

$$\frac{\mu_e + \mu_s}{\hbar} = \frac{e}{mc} . \tag{1.10}$$

The spin myth gave birth to the theoretical spinomania. Of course, an electron has its own magnetic field and magnetic moment and moment of momentum. But, as the calculations show, the last is insignificantly small in comparison with the orbital moment. Let us imagine that the proper moment of momentum of Earth is equal to one half of its orbital moment of momentum. The Earth cannot endure such a huge moment and will be destroyed. The same situation meets an electron with the "spin" equal to $(1/2)\hbar$. The azimuth speeds of the electron space must have values approximately in 100 times exceeding the speed of light. The absurdity is absolute.

The Dirac equation, created for the proof of the correctness of an introduction of the spin, "proved" its "existence". Thus, the formal correspondence of the "theory" with the experiment was realized due to the gross fitting. However, the correspondence of a theory with the experiment does not quite mean that this theory is true, because under the word a theory is hidden very often a primitive eclecticism.

For this reason, the Dirac equation is false and has significance only from the point of view of history of the philosophical and logical errors of the past.

We will consider this problem (and relevant ones) in detail, following dialectical physics, on the basis of the wave calculations of the orbiting electron.

2. *Basic notions*

The notions, which approximately reflect the real objects and phenomena of nature, are in the basis of physical theories.

Let us agree to call the notions, which quite exactly describe the properties of an object of thought, *objective notions* (*Yes*-notions). In opposite case, the notions will be called *subjective notions* (*No*-notions). In a general case, a clear boundary between objective and subjective notions does not exist.

Therefore, if an objective notion contains elements of subjectivism, we call it the *objective-subjective notion* (*Yes-No*-notion). If a subjective notion contains elements of objectivity, we call it the *subjective-objective notion* (*No-Yes*-notion).

Such a classification of notions more completely corresponds to basic judgements of dialectical logic: *Yes-Yes*, *Yes-No*, *No-Yes*, and *No-No*, which reflect the real picture of intellectual thought. In conformity with these judgements, the absolutely objective *Yes*-notions, strictly speaking, should be called the *objective-objective notions* (the notions *Yes-Yes*) or briefly *Yes*-notions. Analogously, the absolutely non-objective notions should be called the *subjective-subjective notions* (the notions *No-No*) or briefly *No*-notions.

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The philosophy of physics of the 19th century has regarded, and continues regarding, notions as only subjective constructions. And many scientists assume that notions have a conditional character of definite covenants. This is a point of view of the philosophy of subjectivism, machism, and pragmatism.

On the contrary, in dialectical philosophy, a notion of the high scientific level must, first of all, be the logical construction, which more exactly adequately reflects the contents and form of an object of nature with this notion. Only then, notions could be regarded as scientific agreements.

Subjective elements of notions lead to misunderstanding of objective properties of objects and phenomena of nature. In order to make theories formally consistent, with experiments, subjective notions generate additional hypotheses and interpretations. The lasts introduce in science nonexistent "physical properties", which are formal mathematical constructions far from reality.

As a rule, at the macrolevel, notions are objective ones on the whole, because their originals (we mean objects to which these notions are ascribed) are visible with the naked eye. Therefore, the objectivity of such notions is verified easily.

At the microlevel, everything is more complicated, because the objectivity of notions is very difficult to verify. By virtue of this, in modern physics, the fully developed practice of the creation of formal hypotheses and interpretations exists. Such formal hypotheses and interpretations only do harm to science, creating an illusion of resolving of a problem.

We will consider the dialectics of objectivity of notions with an example of periodical processes.

Let us assume that a wave of a frequency ν is propagated along a circular trajectory of a radius r. If p waves are placed on the circular orbit, then the linear, λ, and radian (relative), λ_φ, measures of wavelength will be defined by the relations:

$$\lambda = \frac{2\pi r}{p}\ , \qquad \lambda_\varphi = \frac{\lambda}{r} = \frac{2\pi}{p}\,. \tag{2.1}$$

Between the linear velocity υ of the wave front on the circumference and the circular frequency (the angular velocity) of revolution ω_{orb} (or ω_e), the following relations take place:

$$\upsilon = \omega_{orb} r\,, \tag{2.2}$$

$$\omega_{orb} = \frac{2\pi}{T_{orb}} = 2\pi\nu_{orb}\,, \tag{2.3}$$

where T_{orb} and ν_{orb} are the period and frequency of revolution of the wave front.

In the circular motion, the length of a circumference, $C=2\pi r$, is the period-quantum of extension (length); and the period T_{orb} is the time circumference or the period-quantum of time extension (duration).

Obviously, the wave period T is related with the wave-circumference T_e (or T_{orb}) as

$$T = T_e / p\,. \tag{2.4}$$

The relation between the wave frequency ν and the frequency of revolution ν_e takes the form

$$\nu = \frac{1}{T} = \frac{p}{T_e} = p\nu_e\,. \tag{2.5}$$

The equality (2.5) defines the analogous relation between the circular frequency ω and the circular velocity of rotation ω_e of the wave:

$$\omega = \frac{2\pi}{T} = \frac{2\pi p}{T_e} = p\omega_e\,. \tag{2.6}$$

In the case, when $p = 1$, i.e., $\lambda = 2\pi r$, the wave will be called the *unit wave* and its length will be denoted as λ_e. For the unit wave, the wave frequency and the frequency of its rotation are equal: $\omega = \omega_e$.

If $p = 1/2$, we deal with the circular frequency of the wave of the fundamental tone

$$\omega = (1/2)\omega_e\,. \tag{2.7}$$

It is convenient to express arbitrary circular frequencies ω_p through the circular frequency of the fundamental tone as

$$\omega_p = p\omega = \frac{p}{2}\omega_e\,, \tag{2.8}$$

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where p is the number of half-waves placed on the circumference. Then, elementary potential-kinetic waves of an arbitrary frequency take the form

$$\hat{\Psi} = \hat{a} e^{i\frac{p}{2}(\omega_e t - k_e s)} . \tag{2.9}$$

3. *The symmetrical definition of a current I*

Classical physics defines the value of a current flowing in a conductor as the "quantity of electricity being conveyed by the motion of electrons or ions through the cross-section area of the conductor per unit time". However, a current is not the flow of an "electric liquid", it is the complicated wave process. It takes place both on the left and on the right from the cross-section. And the value of current represents by itself the rate of change of this process (Fig. 3.1).

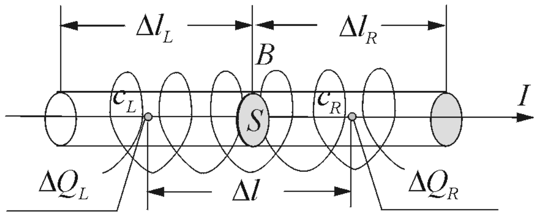

Fig. 3.1. On the definition of the notion a *value of current*; the spiral trajectory B, enveloping a conductor, symbolizes a magnetic field; c_R and c_L are centers of masses of elements of the field, belonging to the intervals Δl_L and Δl_R.

By this reason, one can state that the common definition of the value of current I is related to the objective-subjective notion.

Moreover, the definition of the average value of current takes into account only the "quantity of electricity" displaced on the right side from the cross-section S, $\Delta Q_R = \langle \rho_q \rangle S \Delta l_R$, localized at the part $\Delta l_R = \upsilon \Delta t$:

$$I = \frac{\Delta Q}{\Delta t} = \frac{\Delta Q_R}{\Delta t} = \langle \rho_q \rangle S \upsilon , \tag{3.1}$$

where $\langle \rho_q \rangle$ is the average "density of electricity" and $\Delta Q = \Delta Q_R$.

If we regard the formula (3.1) as the formal convention, there are no problems from the point of view of pragmatism.

In dialectics, this definition has evident subjective features, because it does not take into account the "quantity of electricity" approaching from the left (directly to the cross-section S), $\Delta Q_L = \langle \rho_q \rangle S \Delta l_L$, where $\Delta l_L = \Delta l_R = \Delta l = \upsilon \Delta t$.

This second component of the "quantity of electricity", unconditionally, takes part in the formation of the wave process in an arbitrary cross-section S. It influences the objective measure, called the "value of electric current", which is defined by means of physical apparatuses independently of our understanding of its nature. Moreover, as we will show further, the subjectivism of the formula (3.1) gave birth to the spin hypothesis, which does not reflect reality.

In nature, the binary symmetry dominates. And in any cross-section of a conductor, we deal with the symmetry of the process of motion at the microlevel.

Accordingly, the definition (3.1) cannot be recognized as correct, because, in the domain of a cross-section S, the current and the ambient magnetic field, as the wave process, are formed by both the incoming and issuing "quantity of electricity". Their sum defines the "passing quantity of electricity ΔQ"

$$\Delta Q = \Delta Q_L + \Delta Q_R . \tag{3.2}$$

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The following average current (in a conductor, in the domain of a cross-section *S*) corresponds to the quantity (3.2):

$$I = \frac{\Delta Q}{\Delta t} = \frac{\Delta Q_R + \Delta Q_L}{\Delta t} = 2\langle \rho_q \rangle S\upsilon = 2\langle n \rangle eS\upsilon\,, \tag{3.3}$$

where $\Delta t = \Delta l / \upsilon$ is the time of the "passing quantity of electricity ΔQ"; e is the quantum of the "quantity of electricity", which expresses the measure of some wave electric property *E*; $\langle \rho \rangle = \langle n \rangle e$ is the density of the electric property *E*; and $\langle n \rangle$ is the average concentration of carries of the electric property *E*.

The symmetrical definition (3.3) reflects the objective symmetrical structure of the field of a current in the domain of a cross-section. Practically, we are interested only in the value of a current, which does not rest evidently on the real measuring of the "quantity of electricity" ΔQ.

Therefore, the one-sided character of the definition of the average value of current (3.1) in no way influences measurements, which are normal in engineering and scientific practice.

However, as soon as a theory analyzes the unit phenomena, the difference of the two formulae, (3.1) and (3.3), influences the objective understanding of a physical process and can lead to the erroneous theoretical conclusions.

The formula of the average value of current (3.3) has a general character and relates to currents of different wave properties, if ΔQ is the measure of some wave property.

Let us consider the average value of the current of an orbiting electron, relying on the formula (3.3). The average density of "electricity" $\langle \rho_q \rangle$ of the electron orbit is

$$\langle \rho_q \rangle = \frac{e}{2\pi r S_e} = ne\,, \tag{3.4}$$

where

$$n = \frac{1}{2\pi r S_e} \tag{3.5}$$

is the electron concentration and S_e is the cross-section of the electron *physical* orbit (which differs from the *mathematical* orbit with the zero cross-section).

From this, we obtain the average current of the orbiting electron:

$$I = 2neS_e\upsilon = \frac{2e}{2\pi r S_e} S_e \upsilon = \frac{2e}{T_{orb}}\,, \tag{3.6}$$

where $T_{orb} = \dfrac{2\pi r}{\upsilon}$ is the period of electron's revolution.

The formula (3.6) can be also obtained in the other way. Let us consider the average rate of motion along a circumference within the interval from the cross-section S_+ to the polar opposite cross-section S_-, as is shown in Fig. 3.2.

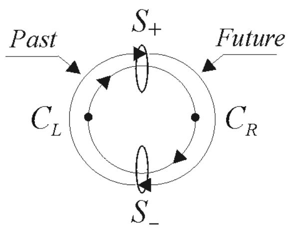

Fig. 3.2. The closed circuit; *Past* and *Future* are, respectively, the limiting past and the limiting future, during the period of revolution T_{orb}; C_R and C_L are, respectively, the right and left "half-circumferences" of the future and the past.

The right and left half-circumferences, C_R and C_L, define maximal displacements from the right and left sides of the cross-section S_+.

The half-space of an orbit, $\Omega_R = C_R \cdot S_e = \pi r S_e$ (where S_e is an arbitrary cross-section), is the half-space of the motion from the section S_+, whereas the half-space $\Omega_L = C_L \cdot S_e = \pi r S_e$ is the half-space of the motion to the section S_+.

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The half-spaces, Ω_R and Ω_L, are the spaces of the past and future motions with respect to the cross-section S_+, which in the cross-section S_- are closed on to each other. Both time fields define the time field of passing of the electron through the cross-section S_+.

The half-circumference C_R, as the wave-beam, is circumscribed by the electron, as the wave front, during the half-period of electron's revolution along the orbit. In the half-space of motion from the cross-section S_+, the following relation expresses the average velocity of moving off:

$$I = \upsilon = \frac{e}{\frac{1}{2} T_{orb}} = \frac{2e}{T_{orb}} = \frac{2\pi r}{T_{orb}}, \tag{3.7}$$

where $e = C_R = \pi r$. During the following half-period, the average velocity of approaching to the cross-section S_+ will be the same in value.

The average velocity of moving off and approaching to the section S_+ is, simultaneously, the average velocity of passing through the cross-section S_+.

Since the sections, S_+ and S_-, are arbitrary, the formula (3.7) is valid for any cross-section.

If $e = m$ is the electron's mass, then the average current of mass exchange I_M through the cross-section S_+ will take the form

$$I_M = \frac{m}{\frac{1}{2} T_{orb}} \tag{3.8}$$

or

$$I_M = \frac{2m}{T_{orb}}. \tag{3.9}$$

This is the average current of mass exchange from the section S_+ to the section S_-. During the second half-period, the mass exchange from the section S_- to the section S_+ will take place with the same velocity. The sections, S_+ and S_-, are arbitrary polar opposite sections, therefore, the formulae (3.8) and (3.9) are valid for any cross-sections.

The rate of motion of an electron's electric property e from the cross-section S_+ will be defined by the formula, analogous to (3.7):

$$I = \frac{e}{\frac{1}{2} T_{orb}} = \frac{2e}{T_{orb}}. \tag{3.10}$$

The same will be the rate of motion of an electron's electric property e to the cross-section S_+. Accordingly, this value will be the average velocity of passing of an electron's electric property e through any cross-section. In essence, the current (3.10) represents by itself the "electric" orbital current of the electric exchange and self-exchange.

The average value of current (3.10) is consistent with the other calculations of the average current in wave processes. The asymmetrical formula (3.1) results in the average value of current, which is half as much, i.e.,

$$I = neS_e\upsilon = \frac{e}{2\pi r S_e} S_e \upsilon = \frac{e}{T_{orb}}. \tag{3.11}$$

This value is not in conformity with Einstein's–de Haas's experiments.

4. *The circular wave motion and a current*

Any particle E, as the wave structure moving along a circumference, represents by itself only one wave node on a circular orbit. Accordingly, only one half-wave of the fundamental tone is placed on an orbit and the wavelength of the fundamental tone is equal to the two circular trajectories–half-waves:

$$\lambda = 4\pi r. \tag{4.1}$$

This conclusion is confirmed by the elementary solution of the wave equation, which is described by the Bessel wave function of the order $\frac{1}{2}$.

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Within one ***particular*** *wave* λ, an arbitrary object E twice passes every point of an orbit. The ***particular*** *wave half-period* T_{orb} represents by itself the ***particular*** *period of revolution* of an object E along an orbit. At the same time, during any *period of rotation*, the object turns out to be twice in any point of the circular trajectory.

The motion in inner space of a circular trajectory, along two successive half-circumferences, occurs in one direction (clockwise or anticlockwise). In this sense, they affirm each other. This can be expressed briefly by the logical judgement *Yes*, which affirms the absent of a contradiction (*Yes* = "no contradiction").

In the outer space, these motions are mutually opposite in direction. In this sense, they negate each other. This can be expressed by the brief logical judgement *No* (*No* = "a contradiction exists").

Thus, as inner absolute motions, the motions along two successive half-circumference are one-directed. Simultaneously, the same motions in outer space, as mutually relative ones, are opposite-directed. This also shows the contradictoriness of the circular motion.

If S_p is an arbitrary potential point of a wave of the fundamental tone (i.e., its node), then, the conjugated diametrically opposite point S_k will be the kinetic point of the wave (its loop) (Fig. 4.1). In the longitudinal wave of the fundamental tone, the rectilinear amplitude of displacement is equal to the diameter of a circumference,

$$a_m = 2r . \tag{4.2}$$

The amplitude of the curvilinear displacement along a circumference is equal to half-circumference, i.e., quarter-wave:

$$A_m = \pi r . \tag{4.3}$$

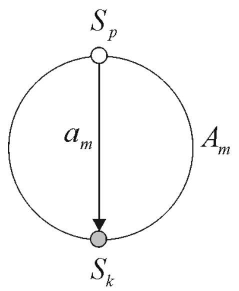

Fig. 4.1. The amplitudes of displacement, a_m and A_m, in a wave of the fundamental tone on a circumference; S_p and S_k are the potential and kinetic points (nodes) of the wave; the kinetic node represents the center of a loop of the wave.

If T_{orb} is the half-period of the wave of the fundamental tone, then, the following expressions are valid: for the wave period

$$T = 2T_{orb} , \tag{4.4}$$

the frequency of the fundamental tone

$$\nu = 1/T , \tag{4.5}$$

the velocity of wave motion

$$\upsilon = \frac{\lambda}{T} = \lambda\nu = \frac{2\pi R}{T_{orb}} , \tag{4.6}$$

and for wavelengths of the fundamental tone and the unit wave

$$\lambda = \upsilon T , \qquad \lambda_e = \frac{1}{2}\lambda = \upsilon T_{orb} . \tag{4.7}$$

In the wave of the fundamental tone, the half-period T_{orb} is the time of the wave revolution of an object along a circumference, which defines the frequency of revolution (frequency of half-wave):

$$\nu_{orb} = \frac{1}{T_{orb}} = \frac{2}{T} = 2\nu . \tag{4.8}$$

The center of the wave front of the electron half-wave of the fundamental tone circumscribes one circle. Such motion represent by itself the superposition of two mutually perpendicular potential-kinetic displacements with respect to the center of an orbit (Fig. 4.2):

$$\Psi_x = r \cdot \exp(i\omega_{orb} t) , \qquad \Psi_y = ir \cdot \exp(i\omega_{orb} t) , \tag{4.9}$$

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where $\omega_{orb} = 2\pi\nu_{orb}$ is the circular frequency. These displacements are the unit potential-kinetic oscillations, describing the electron's motion as the center of the wave front of the *orbital* wave. They form the *frontal waves*, when the orbit moves along the *Z*-axis with the velocity υ_z:

$$\Psi_x = r \cdot \exp(i\omega_{orb}t - k_z z + \alpha), \quad \Psi_y = ir \cdot \exp(i\omega_{orb}t - k_z z + \alpha), \tag{4.10}$$

where $k_z = \omega_{orb} / \upsilon_z$ is the wave number.

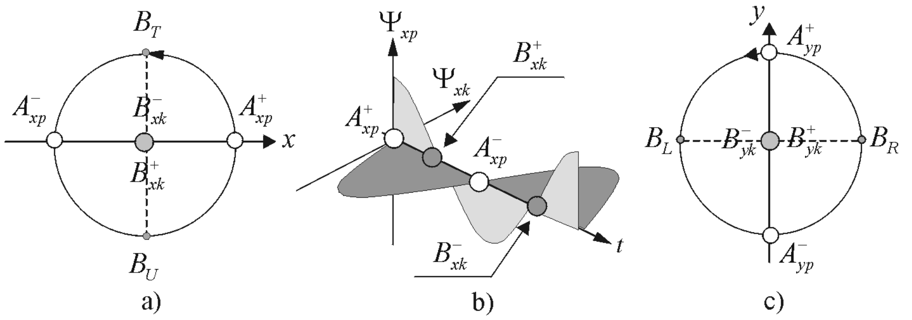

Fig. 4.2. The frontal Ψ_x-oscillation (wave), $A^{\pm}_{xp}$ and $B^{\pm}_{xk}$ are its potential and kinetic nodes (a); a graph of the Ψ_x-wave, Ψ_{xp} and $\Psi_{xk} = i\Psi_{xp}$ are its potential and kinetic components (b); the frontal $\Psi_y = i\Psi_x$-oscillation (wave) with the potential and kinetic nodes (c).

The frontal and orbital waves, as the waves of superstructure over the basis (subatomic) space are related to different levels of the motion on an orbit. The orbital waves are the inner waves of the orbit, whereas the frontal waves are the waves of the front of the orbit. The frontal and orbital waves of superstructure can induce, if a system is open, in the outer space of the basis, the corresponding basis waves. The lasts are propagated with the velocity *c*, i.e., the wave velocity of basis space.

In each of the frontal waves, the average rate of displacement along the axes, *x* and *y*, is defined by the ratio of four amplitudes of displacements a_m to the period of the wave of the fundamental tone:

$$\langle\upsilon\rangle = \frac{4a_m}{T} = \frac{8r}{T} = \frac{4r}{T_{orb}}. \tag{4.11}$$

In such a case, the amplitude frontal rate of displacement is

$$\upsilon = \frac{\pi}{2}\langle\upsilon\rangle = \frac{4\pi r}{T} = \frac{2\pi r}{T_{orb}} \tag{4.12}$$

and

$$\lambda = \upsilon T = 4\pi r. \tag{4.13}$$

If we divide the wave (4.13) by the wave velocity *c* in the field-space outside the circuit, we will obtain the time wave

$$T = 4\pi T_r, \tag{4.14}$$

where

$$T_r = r / c \tag{4.15}$$

is the time radius-period or the radial period.

The time wave of the fundamental tone is defined, in absolute units, by the measure

$$\lambda_T = \frac{T}{T_R} = 4\pi. \tag{4.16}$$

The kinetic points $B^{\pm}_{xk}$ of the Ψ_x-wave are defined by the electron's motion in the points B_T and B_U. The time density *I* of any kinetic wave property *e*, related with the kinetic points, is equal to the product of the number of points and some wave property *e* divided by the corresponding period:

$$I = \frac{2e}{T_{orb}} = \frac{4e}{T}. \tag{4.17}$$

This also concerns such a wave property as the "electric charge".

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5. *A current in potential-kinetic fields of a circular pendulum and of a string*

Let us turn to the motion of the circular mathematical pendulum. The circular pendulum of mass m is connected with an elastic spring, fixed in a point A inside of an absolutely smooth horizontal transparent hollow ring of radius r (Fig. 5.1). The spring is shown, conditionally, in the form of a thin thread. The point A is a point of the unstable states of rest: A_+ and A_- (potential points). The point B is a point of the equilibrium state, represented by the two states of motion: B_+ and B_- (kinetic points).

Two circular motions represent the complete swing of the pendulum. The swing starts in the point A in the state A_+. In this state, the spring is completely compressed and the displacement from the equilibrium state B is equal to the kinetic amplitude of displacement with the positive sign: $+a = +\pi r$. The pendulum passes the point B with the positive maximal velocity in the kinetic state B_+. Then, it reaches the point A in the potential state A_-. In this state, the displacement is equal to the kinetic amplitude of displacement with the minus sign: $-a = -\pi r$. The half-period of the swing is completed in the state A_-. Along with this, one circular motion is completed. The second half-period begins from the state A_-.. Then, the pendulum passes the point B in the kinetic state B_- with the negative maximal velocity and returns in the initial state A_+. The period of the swing is T and the half-period $T_e = \frac{1}{2}T$ is the time of revolution along a circle.

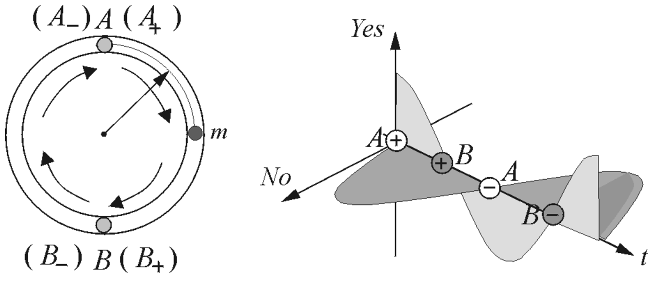

Fig. 5.1. The circular mathematical pendulum (a) and a graph of the potential-kinetic field of its motion (b).

The potential-kinetic displacement of pendulum along a circle is

$$\hat{a} = a_p + ia_k = ae^{i\omega t} = a\cos\omega t + ia\sin\omega t\,, \qquad (5.1)$$

where a_p and ia_k are the potential and kinetic displacements, $a = \pi r$ is the amplitude of displacement from the equilibrium state B up to the point of rest A.

The field of potential-kinetic velocity

$$\hat{\upsilon} = \frac{d\hat{a}}{dt} = i\omega a e^{i\omega t} \qquad (5.2)$$

is characterized by the average value of velocity

$$\upsilon = \frac{2}{T}\int_{-T/2}^{0} \hat{\upsilon}dt = \frac{2}{T} a e^{i\omega t}\Big|_{-T/2}^{0} = \frac{2C}{T} = \frac{4}{T}a = \frac{4\pi r}{T} = \frac{2\pi r}{T_e}\,, \qquad (5.3)$$

where $C = 2\pi r$ is one half-oscillation and T_e is the half-period of oscillation (the time of revolution along a circle).

If the circular motion is periodic, the form of the function of velocity does not matter, because the average velocity in all cases will be equal to the ratio of the circumference length by the period of revolution. In particular, if the motion is uniform, we have

$$\upsilon = \frac{2}{T}\int_{-T/2}^{0} \upsilon dt = \frac{2C}{T} = \frac{4}{T}a = \frac{4\pi r}{T} = \frac{2\pi r}{T_e}\,. \qquad (5.3a)$$

One can say that the uniform motion along a circle is the amplitude wave motion with the two periods, every of which represents by itself one circular motion. Each circular motion represents by

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itself the synthesis of the two plane polarized unit oscillations-waves along the mutually perpendicular directions.

The potential-kinetic mass of the pendulum, $\hat{m} = me^{i\omega t} = m_p + im_k$, as the mass of superstructure, describes its potential-kinetic state. It represents the mass potential-kinetic wave. And the potential-kinetic field of change of state of the mass is the wave field of the potential-kinetic charge: $\hat{q} = \dfrac{d\hat{m}}{dt} = i\omega\hat{m}$. In turn, the field of change of the potential-kinetic charge,

$$\hat{I} = \frac{d\hat{q}}{dt} = \frac{d^2\hat{m}}{dt^2} = i\omega\hat{q} = -\omega^2\hat{m}\,, \tag{5.4}$$

is the field of potential-kinetic (kinematic) current (the field of superstructure).

In the discrete potential points, A_+ and A_-, characteristic wave states of mass and charge are equal, respectively, to

$$A_+:\quad \hat{m}(0) = me^{i\omega t}\Big|_{t=0} = m\,, \qquad\qquad \hat{q} = i\omega\hat{m}(0) = i\omega m\,. \tag{5.5}$$

$$A_-:\quad \hat{m}(0) = me^{i\omega t}\Big|_{t=T/2} = -m\,, \qquad\qquad \hat{q} = i\omega\hat{m}(0) = -i\omega m\,. \tag{5.5a}$$

Analogously, in the kinetic points, B_+ and B_-, we have

$$B_+:\quad \hat{m}(\tfrac{1}{4}T) = me^{i\omega t}\Big|_{t=T/4} = im\,, \qquad\qquad \hat{q} = i\omega\hat{m}(\tfrac{1}{4}T) = -\omega m\,. \tag{5.6}$$

$$B_-:\quad \hat{m}(\tfrac{3}{4}T) = me^{i\omega t}\Big|_{t=3T/4} = -im\,, \qquad\qquad \hat{q} = i\omega\hat{m}(\tfrac{3}{4}T) = +\omega m\,. \tag{5.6a}$$

Thus, in the potential points, the charges are potential; in the kinetic points, the charges are kinetic.

The average value of the potential current, in any cross-section, is defined by the formula:

$$iI = \frac{2}{T}\int_{-T/2}^{0}\hat{I}dt = -\frac{2}{T}\omega^2\int_{-T/2}^{0}\hat{m}dt = \frac{2}{T}mi\omega e^{i\omega t}\Big|_{-T/2}^{0} = \frac{4qi}{T} = \frac{2qi}{T_e}\,, \tag{5.7}$$

where $q = m\omega$ is the amplitude of the kinematic charge. Analogously, the average value of the kinematic current, in any cross-section, is

$$I = \frac{4q}{T} = \frac{2q}{T_e}\,. \tag{5.7a}$$

In the uniform motion along a circumference, as an amplitude wave, the value of current in a cross-section of any point B (Fig. 5.2) has the same value:

$$I = \frac{2}{T}\int_{T/4}^{3T/4} Idt = \frac{2}{T}\int_{T/4}^{3T/4} dq = \frac{2}{T}q\Big|_{T/4}^{3T/4} = \frac{2}{T}\big((\omega m) - (-\omega m)\big) = \frac{4}{T}m\omega = \frac{4q}{T} = \frac{2q}{T_e}\,. \tag{5.8}$$

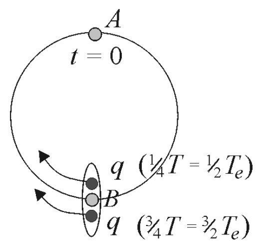

Fig. 5.2. On the calculation of the average current, flowing through a cross-section B, if only one charge q circulates.

Let us now consider a string in the form of a circle with two ends fixed in one point A. In such a string, one can excite the circular polarized transversal wave. Such a string represents by itself an elementary pattern of the wave beam, in which the transversal potential-kinetic wave oscillations take place. An equation of the potential-kinetic beam-wave has the form:

$$\hat{a} = ae^{i(\omega t \pm ks + \varphi_0)} = aie^{\pm iks + \varphi_0}e^{i\omega t}\,, \tag{5.9}$$

where

$$\hat{a}_s = ae^{\pm iks} \tag{5.9a}$$

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is the potential-kinetic amplitude of transversal displacements. This amplitude is equivalent to the circular motion with the radius $r_s = a|\cos ks|$, where s is the length along the beam, reading off the point A, and φ_0 is the initial phase of oscillations. The time component of the wave field of a string is

$$\hat{a}_t = e^{i\omega t}. \tag{5.10}$$

In such a field, the longitudinal mass wave-beam is

$$\hat{m} = me^{i(\omega t \pm ks)} = me^{\pm iks}e^{i\omega t}. \tag{5.11}$$

The mass potential-kinetic wave defines the potential-kinetic longitudinal current

$$\hat{I} = \frac{d\hat{q}}{dt} = -\omega^2 \hat{m} = -\omega^2 me^{\pm iks}e^{i\omega t}. \tag{5.12}$$

Its average value, in time and space, is defined by the integral

$$I = \frac{2}{2\pi i}\int \hat{I} d\varphi = \frac{1}{\pi}\omega e e^{i\varphi}\Big|_{-\pi/2}^{\pi/2} = \frac{2}{\pi}\omega e = \frac{4e}{T} = \frac{2e}{T_e}, \tag{5.13}$$

where $\varphi = \omega t \pm ks + \varphi_0$ is the phase of the wave, $k = \omega / \upsilon_0$ is the wave number corresponding to the wave velocity υ_0, s is the curvilinear length along the beam of current I and of charge $e = \omega M_A$, M_A is the mass of one atom of a string and I is the elementary kinematic current related with one atomic chain along a string.

If the string consists of N atomic chains, the current increases N times, however, the form of the formula does not change. In this case, the charge also will be N times as much: $e = \omega M_A N$. The wave perturbation is transmitted along a string in the form of motion from one to another atom with the average rate υ_0. With that, the integral mass transfer does not take place. The last happens at the level of individual local perturbations along a string.

Since the transversal oscillations also take place, the transversal circular current of individual charges $e = \omega M_A$, flowing along a circle of the radius $r_s = a|\cos ks|$ with the velocity $\upsilon_s = \omega r_s$, takes place as well.

As in the case of the *transversal current*, the same period and charge define the average *longitudinal current*; therefore, *both currents are always equal*.

6. *Some parameters of the wave field of gravitation related with the time wave of the fundamental tone*

Let us consider the Earth's motion, which we assume, for simplicity, is circular. The gravitation constant defines the circular frequency

$$\omega_g = \sqrt{4\pi\varepsilon_0 G} = 9.156956336 \cdot 10^{-4} s^{-1}. \tag{6.1}$$

Here, we accept $\quad G = 6,672590000 \cdot 10^{-8} g^{-1} \cdot cm^3 \cdot s^{-2}$. (6.1a)

Using the formula of the time wave of the fundamental tone (4.16), we arrive at the gravitational radial period

$$T_g = \frac{\lambda_T}{\omega_g} = \frac{4\pi}{\omega_g} = 1.372330516 \cdot 10^4 s, \tag{6.2}$$

which expresses the central exchange (central interaction) and defines the azimuth time wave

$$T = 4\pi T_g = 2 \cdot 86226.06935s = 2 \cdot 23.95168593h = 2 \cdot 23^h 57^m 06^s.069. \tag{6.3}$$

This wave is equal to two Earth's days, which form two circular cycles-half-waves. Each of the cycles-half-waves is equal to one day.

On the basis of (6.3), we find the period of revolution T_e

$$T_e = 2\pi T_g = 86226.06935s = 23.95168593h \approx 23^h 57^m 06^s, \tag{6.4}$$

It is equal to the Earth's day. The corresponding angular velocity of the Earth's rotation is $\omega_e = 7.29211501 \cdot 10^{-5} s^{-1}$ and the time day radius is

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$$T_R = \frac{1}{\omega_e} = \frac{T_e}{2\pi} = 1.37134425 \cdot 10^4 s\,. \qquad (6.5)$$

The last is equal, practically, to the gravitational radial period that points out the resonance state of Earth's motion in the gravitational field of the Universe.

The period of Earth's revolution around the Sun defines the half-wave of Earth's orbit. In such a case, the time wavelength is equal to two years:

$$\lambda_T = 3.149458919 \cdot 10^7 s\,. \qquad (6.6)$$

Two potential states-winters and two kinetic states-summers represent the Earth's wave. Let us compare the Earth's period with the period of mathematical pendulum. There (see Fig. 5.1), winters are represented by the potential domains with the centers A_+ and A_-; summers are represented by the kinetic domains with the centers B_+ and B_-.

The domains of Earth's wave (A_+, B_+, A_-, and B_-) are devided by four transitional climate states – two springs and two falls. The beginning of every year in many countries coincides with the potential center that is quite logical. Thus, the 2000-year is the 1000th wave cycle in the gravitational field.

If we take, as the reference value, the Earth's day in the 2000-year, equal approximately to $23^h 56^m 04^s$, we should accept the gravitational constant in that year equal to

$$G = \omega_g^2 / 4\pi\varepsilon_0 = 6.682160218 \cdot 10^{-8} g^{-1} \cdot cm^3 \cdot s^{-2}\,. \qquad (6.7)$$

This value is at the level of the fundamental measure:

$$G = \frac{\omega_g^2}{4\pi\varepsilon_0} \approx (6 + 0.682188177) \cdot 10^{-8} g^{-1} \cdot cm^3 \cdot s^{-2} =$$

$$= (6 + \frac{\pi}{2} \lg e) \cdot 10^{-8} g^{-1} \cdot cm^3 \cdot s^{-2}.$$

If we accept this value as the "independent (absolute)" standard, we obtain

$$\omega_g = \sqrt{4\pi\varepsilon_0 \left(6 + \frac{\pi}{2}\lg e\right) \cdot 10^{-8} g^{-1} \cdot cm^3 \cdot s^{-2}} = \sqrt{4\pi \left(6 + \frac{\pi}{2}\lg e\right) \cdot 10^{-8}}\, s^{-1} \qquad (6.8)$$

and

$$\omega_g = 9.163561161 \cdot 10^{-4} s^{-1}. \qquad (6.8a)$$

Further, we have

$$T_g = \frac{\lambda_T}{\omega_g} = \frac{4\pi}{\omega_g} = 1.371341381 \cdot 10^4 s \qquad (6.9)$$

and

$$T_e = 2\pi T_g = 86163.92016 s = 23^h 56^m 03^s.92\,, \qquad (6.10)$$

$$T = 4\pi T_g = 172327.8403 s = 2 \cdot 23^h 56^m 03^s.92\,. \qquad (6.11)$$

As we see, everywhere, the fundamental measures of the quantitative spectrum on the basis of the fundamental period $\Delta = 2\pi \lg e$ show their worth. With that, the number π is the absolute amplitude of the circular wave, if one expresses the amplitude through radii of orbits:

$$a_m = A_m / r = \pi\,. \qquad (6.12)$$

7. *The parameters of a circular electron orbit and Einstein's and de Haas's experiments*

Returning to the electron's circular motion, let us assume that the electron orbits with the frequency ω_e. Then, its circular (rotatory) transversal "magnetic" charge q_e, which defines the kinetic ("magnetic") cylindrical field of the electron orbit, is

$$q_e = m\omega_e\,. \qquad (7.1)$$

The corresponding average transversal ("magnetic") current is

$$I_B = \frac{4q_e}{T} = \frac{2q_e}{T_e}\,. \qquad (7.2)$$

The average current (7.2) defines the orbital transversal kinetic ("magnetic") electron's moment

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$$\mu_{orb} = \frac{1}{c} I_B S = \frac{\upsilon_0}{c} q_e r_0 . \tag{7.3}$$

The ratio of the moment (7.3) and the orbital moment of electron's momentum on the Bohr first orbit, $\hbar_{orb} = m\upsilon_0 r_0$, defines the wave number of the subatomic wave field of matter-space (Fig. 7.1):

$$\frac{\mu_{orb}}{\hbar_{orb}} = \frac{\upsilon_0 q_e r_0}{cm\upsilon_0 r_0} = \frac{q_e}{mc} = \frac{\omega_e}{c} = k_e . \tag{7.4}$$

The formula (7.4) is in conformity with the experiment, if we will transform the fictitious "electric" and "magnetic" units into the objective units of nature.

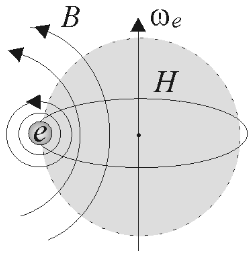

Fig. 7.1. The orbiting electron in the space of the *H*-atom and its transversal kinetic cylindrical *B*-field.

We can now clarify the nature of the electron charge *e*, which enters in the expression for the total energy of the orbiting electron (where it is regarded as the charge of the central field):

$$E = \frac{m\upsilon^2}{2} - \frac{e^2}{4\pi\varepsilon_0 r} = \frac{m\upsilon_0^2}{2} - \frac{e^2}{4\pi\varepsilon_0 r_0} . \tag{7.5}$$

Because $\frac{e^2}{4\pi\varepsilon_0 r_0^2} = \frac{m\upsilon_0^2}{r_0}$ and electron mass is $m = 4\pi\varepsilon_0 r_e^3$, we obtain

$$e^2 = 4\pi\varepsilon_0 m\upsilon_0^2 r_0 = \frac{4\pi\varepsilon_0 r_e^3 m\upsilon_0^2 r_0}{r_e^3} = \frac{m^2\omega_e^2\upsilon_0^2 r_0}{\omega_e^2 r_e^3} = \frac{q_e^2\upsilon_0^2 r_0}{\upsilon_e^2 r_e} .$$

Taking into account that in the cylindrical field $\upsilon_0^2 r_0 = \upsilon_e^2 r_e$, we arrive at

$$e = q_e = m\omega_e . \tag{7.6}$$

Thus, the central "potential" ("electric") charge *e* and the transversal "kinetic" ("magnetic") charge q_e are equal in value. One can come to the same conclusion on the basis of the following consideration. The orbiting electron forms the cylindrical wave field, which is limited from below by the electron radius r_e,. Along the axis of the trajectory, each electron state corresponds to a part of the orbit, equal to the electron's diameter with the area of the cylindrical surface

$$S = 2\pi r_e d_e = 4\pi r_e^2 . \tag{7.7}$$

On this surface, the transversal electron flow is defined by the transversal (cylindrical) charge

$$q_e = S\upsilon_e\varepsilon_0 = 4\pi r_e^2\upsilon_e\varepsilon_0 . \tag{7.8}$$

On the other hand, the central electron flow is defined by the longitudinal (spherical) charge

$$e = 4\pi r_e^2\upsilon_e\varepsilon_0 . \tag{7.9}$$

Accordingly, we again arrive at the conclusion that $e = q_e$.

In addition, some remarks on the magnetic moment. The electron's magnetic moment and electron's moment of momentum at the orbital motion are the different measures of the same wave process. Indeed, any system, for example, a metallic rod suspended by a thin elastic thread, can be regarded as a closed system (of course, under a definite approximation). Let its initial moment of momentum be equal to zero. This means that its moment of macromomentum, as a solid, and the total moment of micromomenta of all orbital electrons form the total moment of momentum of the system equal to zero:

$$L_S = L_{macro} + L_{micro} = 0 . \tag{7.10}$$

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Under the action of external fields, the ordering of moments of momentum of individual orbital electrons can take place. As a result, the general change of the moments of micromomentum arises. This phenomenon is accompanied with an appearance of the moment of macromomentum of the rod, so that

$$\Delta L_S = \Delta L_{macro} + \Delta L_{micro} = 0 . \tag{7.11}$$

Let us further introduce the kinetic "magnetic" moment of the orbital electron, as the product of its orbital moment of momentum $\hbar$ by the wave number $k_e = \omega_e / c$ of the field of the subatomic ("electrostatic") level of matter:

$$\mu_{orb} = k_e \hbar = \frac{\omega_e}{c} m \upsilon r = \frac{\upsilon}{c} er . \tag{7.12}$$

In such a case, the equality (7.11) can be presented as

$$k_e \Delta L_{macro} + (-\sum_n k_e \hbar_n) = 0 \quad \text{or} \quad k_e \Delta L_{macro} - \sum_n \mu_{orbn} = 0 . \tag{7.13}$$

If N is the number of ordered orbits, participating in given process, we arrive at

$$\frac{\sum_n \mu_{orbn}}{k_e \Delta L_{macro}} = \frac{\sum_n \mu_{orbn}}{k_e \sum_n \hbar_{orbn}} = 1 \quad \text{or} \quad \frac{\sum_n \mu_{orbn}}{\sum_n \hbar_{orbn}} = \frac{N\mu_{orbn}}{N\hbar_{orbn}} = \frac{\mu_{orbn}}{\hbar_{orbn}} = k_e . \tag{7.14}$$

Hence, we have

$$\frac{\mu_{orbn}}{\hbar_{orbn}} = k_e . \tag{7.5}$$

Thus, the "orbital magnetic moment" is, in essence, the other expression of the orbital moment of momentum, which is one of the measures of the orbital motion.

8. *An electron in the space of a conductor*

In a general case, an electron in the space of a conductor circumscribes an elementary amplitude wave-beam of the electron current I. This wave-beam represents the superposition of two transversal x- and y-beams of currents:

$$I_x = \omega e \cdot e^{i(\omega t - k_z z + \alpha)} , \qquad I_y = i\omega e \cdot e^{i(\omega t - k_z z + \alpha)} , \tag{8.1}$$

where

$$\omega e = I_{em} \tag{8.1a}$$

is the elementary quantum-amplitude of the electron current, k_z is the wave number, z is the displacement along the axis of a conductor and α is the initial phase. In the interatomic space of a conductor (the space of basis), the wave number is defined as

$$k_z = \omega / c . \tag{8.2}$$

If the axial speed of the wave motion is equal to zero, then $k_z = 0$.

The equations (8.1) can be also obtained at the consideration of the transversal plane x- and y-waves-beams of the "electric" charge:

$$Q_x = e \cdot e^{i(\omega t - k_z z + \alpha)} , \qquad Q_y = ie \cdot e^{i(\omega t - k_z z + \alpha)} , \tag{8.3}$$

where e is the amplitude of the electron's charge (Fig. 8.1a).

The plane waves-beams, Q_x and Q_y, are related with the electron's wave motion, which is presented by the superposition of two transversal potential-kinetic x- and y-waves-beams, shifted in phase by quarter of a period:

$$\Psi_x = re^{i(\omega t - k_z z + \delta)}, \qquad \Psi_y = ire^{i(\omega t - k_z z + \delta)} , \tag{8.4}$$

where δ is the initial phase of the wave of potential-kinetic displacements.

The waves-beams Ψ_x , Ψ_y , Q_x , and Q_y define the transversal plane waves-beams of current I:

$$I_x = \frac{dQ_x}{dt} = i\omega e \cdot e^{i(\omega t - k_z z + \alpha)}, \qquad I_y = \frac{dQ_y}{dt} = i\omega ie \cdot e^{i(\omega t - k_z z + \alpha)} , \tag{8.5}$$

or

$$I_x = \frac{dQ_x}{dt} = \omega e \cdot e^{i(\omega t - k_z z + \alpha + \pi/2)} , \quad I_y = \frac{dQ_y}{dt} = \omega e \cdot e^{i(\omega t - k_z z + \alpha + \pi)} . \tag{8.6}$$

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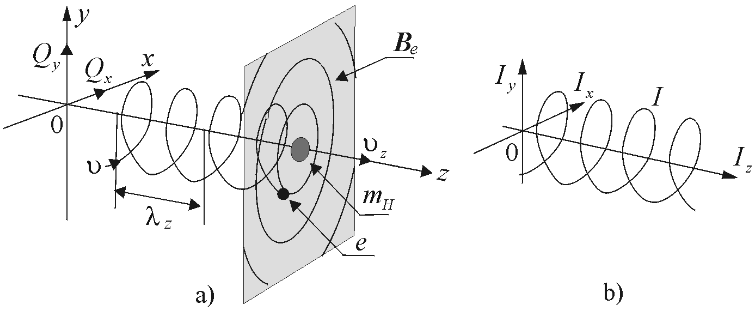

Fig. 8.1. The electron charge waves-beams, Q_x and Q_y, and the *H*-atom of mass m_H in the cylindrical space of a conductor; υ is the azimuth velocity of electron's motion; λ_z is the axial wavelength; υ_z is the axial velocity of the electron along the *z*-axis of a conductor; B_e is the wave front (a). A graph of the longitudinal-transversal current-beam: I_x and I_y are the transversal wave beams-currents, I_z is the axial current, and *I* is the amplitude spiral wave-beam of current (b).

The plane-polarized waves-beams of current form the amplitude electron wave-beam (Fig. 8.1b). The waves-beams I_x and I_y describe the transversal current, which represents by itself the amplitude spiral wave-beam of electron current. The transversal current is inseparable of the axial current I_z (Fig. 8.1b).

The average current (axial, transversal) is defined by the integral

$$I = \frac{2}{2\pi i}\int \hat{I} d\varphi = \frac{1}{\pi}\omega e e^{i\varphi}\Big|_{-\pi/2}^{\pi/2} = \frac{2}{\pi}\omega e = \frac{4e}{T} = \frac{2e}{T_e}. \qquad (8.7)$$

The cylindrical field-space of the longitudinal-transversal wave beam-current is the field of its ***transversal component***, which at the macrolevel is known under the name the "*magnetic*" *field*. ***This is the transversal current***. ***The longitudinal*** (axial) ***component of the current*** is called the "*electric*" *current*.

In a case, when $\upsilon = \upsilon_z$, the angle of a spiral trajectory of the current-beam is equal to $\varphi = 45^\circ$. And the elementary average current of the wave-beam will be presented by the expression

$$I = \frac{2e}{T_e} = \frac{4e}{T} = 4e\nu = \frac{4e\upsilon}{\lambda_\upsilon}, \qquad (8.8)$$

where $\lambda_\upsilon = 2T_e\upsilon = 4\pi r$ is the azimuth wavelength of the fundamental tone. The electron current induces, in the ambient space, the basis waves of the same frequency $\nu = c/\lambda$, where λ is the wavelength in the space of basis. Therefore, the formula of current (8.8) can be also presented as

$$I = 4e\nu = 4ec/\lambda. \qquad (8.8a)$$

The limiting quantum of the amplitude of current is equal to the fundamental measure

$$I_{e\max} = \omega_e e = e^2/m, \qquad (8.9)$$

where *m* is the electron mass. From here, we obtain the limiting value of the quantum of average current, taking into account the objective measure of the ampere, $1A = 1.062736593\cdot 10^{10}\, g/s^2$:

$$I_{\max} = \frac{2}{\pi}\omega_e e = \frac{2e^2}{\pi m} = 2.026111200\cdot 10^9\, g/s^2 = 0.190650366A. \qquad (8.9a)$$

The total cylindrical field, formed by all elementary electron fields B_e, is presented around a conductor by the cylindrical "magnetic" field.

During the half-period T_e, an electron accomplishes one revolution in the plane of the wave front, forming the transversal half-wave. Simultaneously, it passes half of the axial wave. Therefore, the transversal and longitudinal (axial) currents turn out to be equal.

At the complete ordering of orbits of atomic *H*-units of average mass m_u (a.m.u.), the specific orbital magnetic moment σ, i.e., the magnetic moment of the unit mass, will be defined by the ratio

$$\sigma = \mu_{orb}/m_u. \qquad (8.10)$$

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If $\mu_0 = \frac{\upsilon_0}{c} e r_0$ is the magnetic moment of the Bohr first orbit, the relative specific moment of the atomic *H*-unit, expressed in the units μ_0, takes the form:

$$n_{theor} = \frac{m_u \sigma}{\mu_0} = \frac{\mu_{orb}}{\mu_0} = \frac{r\upsilon}{r_0 \upsilon_0}. \tag{8.10a}$$

This relation concerns the total ordering of orbits. Therefore, the measure n_{theor} is the specific moment of magnetic saturation. Under the condition $r\upsilon = r_0\upsilon_0$, the specific moment is equal to $n_{theor} = 1$ (Table. 8.1).

Table. 8.1. The specific atomic moments of saturation of binary alloys of iron.

Addition	Atomic %	n*	$n_{theor} = n/2$
Al	7.1	2.05	1.025
	19.7	1.74	0.87
Au	6.2	2.08	1.04
	10.5	2.02	1.01
Si	8.3	2.00	1.00
	15.9	1.67	0.835
V	5.9	2.09	1.045
	10.6	1.91	0.955
Co	20	2.42	1.21
	80	1.95	0.975
Pd	5.5	2.19	1.095
	40	1.89	0.945
		----	----
		$\langle n \rangle = 2$	$\langle n_{theor} \rangle = 1$

In contemporary physics, the magnetic orbital moment μ_0 is presented by the subjective measure of the Bohr magneton $\mu_B = \frac{1}{2}\mu_{orb}$, which does not have an analogue in nature. Therefore, the specific atomic moment is presented by the erroneous measure *n*, twice exceeding the objective theoretical measure n_{theor}:

$$n = 2n_{theor} = \frac{\mu_{orb}}{\mu_B} = \frac{2r\upsilon}{r_0\upsilon_0}. \tag{8.11}$$

9. The symmetrical formula of current and the Lorentz transversal interaction

On the basis of Ampère’s transversal interaction,

$$\Delta F = B\Gamma\Delta l = B\frac{I}{c}\Delta l, \tag{9.1}$$

and using the symmetrical formula of current, we arrive at the elementary quantum of the Lorentz interaction, which is a variable quantity:

$$F_L = \frac{\Delta F}{2N} = B\frac{2ne\upsilon S}{2cN}\Delta l = \frac{\upsilon}{c}e\frac{2N}{2N}B = \frac{\upsilon}{c}eB, \tag{9.2}$$

where $2N$ is the total number of electrons in an element Δl of a conductor (Fig. 9.1).

Thus, we have
$$F_L = \frac{\upsilon}{c}eB = g_h B, \tag{9.3}$$

where
$$g_h = \frac{\upsilon}{c}e \tag{9.4}$$

* *American Institute of Physics Handbook*, Ed. by D.E. Gray, N.Y., McGraw-Hill, 1963, p. 5-172.

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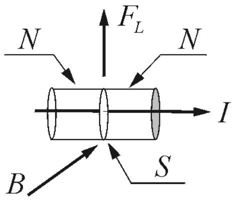

Fig. 9.1. An element Δl of a conductor: N is the number of elementary particles, participating in the formation of current I and localized in its symmetrical parts; S is the central cross-section, dividing the conductor into two symmetrical parts; and B is the magnetic field vector.

is the quantum-charge of the transversal magnetic field. Owing to the transversal magnetic charge, the formula of interaction in the magnetic field (9.3) turns out the similar to the formula of interaction in the central (longitudinal) electric field.

10. *The symmetrical formula of current and electrolyze*

In conclusion, let us consider (at the elementary level) the process of precipitation of atoms on a cathode under the action of a current (Fig. 10.1).

If we deal with the equilibrium process, then, on average, each half-circuit in Fig. 9.1 corresponds to the half-period $\frac{1}{2}T_K$ of an elementary cycle T_k. The mass of a precipitated substance M is defined through the average value of current I as

$$M = \frac{Am_u}{ne} Q = \frac{Am_u}{ne} I\Delta t\,. \tag{10.1}$$

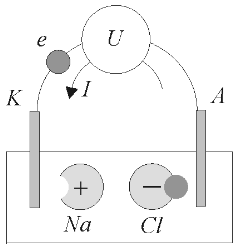

Fig. 10.1. An elementary circuit with two unclosed half-circuits, related with the points of anode A and cathode K.

In a case of the elementary act of precipitation of N_k natrium atoms, Na, on the cathode, the average quantum of current is equal to the ratio of the charge $Q_K = n_V e N_K$ ($n_V = 1$ is the valency of Na), flowing in the outer circuit, to the half-period $\frac{1}{2}T_K$:

$$I = \frac{Q_K}{\frac{1}{2}T_K} = \frac{2n_V e N_K}{T_K}\,. \tag{10.2}$$

The time of precipitation of N_k atoms of natrium on the cathode corresponds to half-period. As a result, we have

$$M = \frac{Am_u}{n_V e} I\Delta t = \frac{Am_u}{n_V e}\frac{2n_V e N_K}{T_K}\cdot\frac{1}{2}T_K = N_K A m_u\,. \tag{10.3}$$

If $\Delta t = \frac{1}{2}T_K N_T$, where N_T is the number of half-periods $\frac{1}{2}T_K$ in the time interval Δt, we obtain

$$M = \frac{Am_u}{n_V e}\frac{2n_V e N_K}{T}\cdot\frac{1}{2}T_K N_T = N_K N_T A m_u = N A m_u\,, \tag{10.4}$$

where $N = N_K N_T$ is the number of precipitated Na-atoms.

At the level of an elementary quantum of precipitation, the equality $N_K = N_T = 1$ is valid. In this case, we have $M = Am_u$. If one uses the classical formula of current

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$$I = e / T_k \tag{10.5}$$

(which does not correspond to the real process), during the time quantum of precipitation of atoms on the cathode $\Delta t = \frac{1}{2}T_K$, the precipitated mass will be equal to $\frac{1}{2}Am_u$. This value is the physical absurdity. In such a situation, one should be invented the lost "spin of mass" of $\frac{1}{2}Am_u$ in order to obtain the whole mass for one *Na*-atom (repeating the sad history of introduction of the electron spin). Of course, the equations obtained approximately describe the process of precipitation of atoms on a cathode, which actually has the wave character (this circumstance was not taken here into account). In spite of this, the above consideration confirms conclusions presented in this section.

11. *Conclusion*

Let us enumerate the principal theoretical (in the framework of dialectical physics) parameters of the electron.

1. The *electron mass* has the associated character, its formula is

$$m_e = \frac{4\pi r_e^3 \varepsilon_0}{1 + k_e^2 r_e^2}; \qquad \text{at} \qquad k_e r_e << 1, \quad m_e = 4\pi r_e^3 \varepsilon_0,$$

where $\varepsilon_0 = 1\, g \cdot cm^{-3}$ is the unit mass density.

2. The *radius of the electron sphere* (following from the above formula) is

$$r_e = \sqrt[3]{m_e / 4\pi\varepsilon_0} = 4.169587953 \cdot 10^{-10}\ cm.$$

3. In the cylindrical field, the speed-strength is defined by the expression $\upsilon = \dfrac{\omega a}{\sqrt{kr}}$. The correlation between speeds and radii of two shells of the same field-space, originated from this expression, defines the *speed-strength at the surface of the electron sphere*:

$$\upsilon_e = \upsilon_0 \sqrt{r_0 / r_e} = 7.793635223 \cdot 10^8\ cm \cdot s^{-1},$$

where $r_0 = 5.29177249 \cdot 10^{-9} cm$ and $\upsilon_0 = 2.187691415 \cdot 10^8 cm \cdot s^{-1}$ are the Bohr radius and speed.

4. The *electron charge* is

$$e = m_e \omega_e = 4\pi r_e^2 \upsilon_e \varepsilon_0 = 1.70269248 \cdot 10^{-9}\, g \cdot s^{-1} \quad \text{or} \quad e = 1.60217733 \cdot 10^{-19}\, C.$$

Hence, the *fundamental frequency of exchange* of the "electrostatic" field and the *wave radius*, corresponding to this frequency, are equal to

$$\omega_e = e / m_e = 1.869161968 \cdot 10^{18}\ s^{-1},$$

$$\lambda\!\!\!^{-}_e = c / \omega_e = 1.603886999 \cdot 10^{-8}\ cm.$$

The *fundamental wave diameter* $D = 2\lambda\!\!\!^{-}_e = 0.32\ nm$ defines the mean interatomic distance in the ordered spaces of matter-space-time (crystals).

The fundamental frequency of the wave "electrostatic" field ω_e (quantum mechanics deals just with these waves, unknowing about it, under the name the waves of "probability") defines also the *quantum of the specific resistance* of space of the subatomic level

$$\rho_{\omega e} = 1 / \varepsilon_0 \omega_e = 6.042328513 \cdot 10^{-6}\ \Omega \cdot cm,$$

which is equal to the mean specific resistance of elements of the periodic table at 273 *K*; etc.

5. The orbital magnetic moment of electron is

$$\mu_e = \frac{\upsilon_0}{c} e r_0 = \frac{e}{mc}\hbar = 6.575105736 \cdot 10^{-20}\ g \cdot cm \cdot s^{-1} \text{ or } \mu_e = 1.854803085 \cdot 10^{-23}\ J \cdot T^{-1}.$$

6. A ratio of the orbital magnetic moment to the moment of momentum of the electron corresponds to Einstein's-de Haas's experiment:

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$$\frac{\mu_e}{\hbar} = \frac{e}{mc} = k_e = \frac{\omega_e}{c}.$$

This magnitude, in accordance with the objective theory of electromagnetic processes, is equal to the wave number of the fundamental frequency.

The possible limiting values of electron's *proper* magnetic moment and spin are not so difficult to calculate relying on the parameters μ_e and $\hbar$. The maximal proper (spin) *electron magnetic moment* can be estimated by the formula

$$\mu_{s,\max} = \frac{\upsilon_e}{c} e r_e. \tag{11.1}$$

Taking into account that $\upsilon_e = (r_0 / r_e)^{1/2} \upsilon_0$, we have

$$\mu_{s,\max} = \left(\frac{r_e}{r_0}\right)^{1/2} \frac{\upsilon_0}{c} e r_0 = \left(\frac{r_e}{r_0}\right)^{1/2} \mu_e = 0.280702311 \cdot \mu_e, \tag{11.2}$$

The following *proper moment of momentum* (spin) of the electron, at most, could be:

$$\hbar_{s,\max} = m\upsilon_e r_e = \frac{mc}{e} \mu_{s,\max} = \frac{mc}{e}\left(\frac{r_e}{r_0}\right)^{1/2} \mu_e = \left(\frac{r_e}{r_0}\right)^{1/2} \hbar, \tag{11.3}$$

where $\hbar = h/2\pi = m\upsilon_0 r_0$ is the electron's *orbital moment of momentum* and h is the electron's *orbital action* called the Planck constant. (The electron's orbital action quite often is attributed also to those particles, whose motion has no relation to the electron, and then, on such speculative principles, new concepts are developed).

Again, the same standard relation (as for the orbital motion-rest), in this case for the electron's proper motion-rest, takes place between the possible magnetic moment (11.2) and the moment of momentum (11.3):

$$\frac{\mu_{s,\max}}{\hbar_{s,\max}} = \frac{e}{mc}. \tag{11.4}$$

These results provide justification to assume that the electron spin of the value $\hbar/2$ is the theoretical myth. All relativistic equations, including Schrödinger's equation, were built on the basis of negation of *contains* and *causes*. The description of nature was made on the basis of *forms* and *effects*, which only were recognized as the "scientific reality". Following the fully developed approach, the researcher must deal with sensations and their interpretation is the matter of creative fantasy of the free game of notions. Accordingly, a physical theory must not answer the question "*why*", but must answer only the question "*how*". In such situation, a talent of the mathematical matching of calculations to the experiment is especially appreciated. By this way, the great successes were obtained, but an understanding of the nature of phenomena was not achieved. The mathematical constructions, farther and father from reality, astonishingly complicated its understanding and are, in essence, physically senseless.

Thus, however hard we may try to approach from different points, we arrive at the conclusion that the initial conceptions of the Dirac equation are false. Therefore, this equation cannot give us the objective picture of atomic processes. Concerning different concepts of quantum mechanics, they continue the traditions of the thirtieths. Contemporary physics and chemistry still continue to set forth doctrines on the basis of completely exhausted themselves ideas. The further development of the aforementioned concepts proceeds via the complication of mathematical constructions, where already no physical sense can be found; and their logic is in the highest degree confused and speculative.

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