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Basic Electromagnetism
(Unified Field Theory)

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This booklet is dedicated to information interpretation of electromagnetism, according to which only electric field is real and the rest is artefacts, distortion of field information caused by the motion of interacting charges.

This approach allowed to correct and amend the field equation system, correct calculation of kinetic energy density and quantity of the motion of a charge, interaction force of the charges in motion, show the electric nature of gravitation and describe longitudinal electrostrictive waves, i.e. to set up a basic unified field theory as well as to define the mass of neutrino.

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Introduction

According to a historical physical tradition, gravitation and electromagnetism are considered to be separate phenomena, which do not have anything in common. And it is not surprising! In fact the source of electromagnetism are electrical charges and the source of gravitation are masses, which at least at first sight are totally different things from the physical point of view. However, two facts make us doubt the validity of this tradition.

Firstly, any matter possessing mass is consisted of charged elementary particles and any charged particle possesses mass, so that in any case they are connected with each other.

On the other hand, the equivalence proportion of mass and energy contains a totally electromagnetic constant equal to vacuum velocity of light, which makes us suspect electromagnetic nature of mass.

However, attempts of many years to solve this problem as well as the efforts of the whole life of Albert Einstein, the author of the theory of relativity, turned out to be ineffective.

And this should have happened as Einstein deduced Lorentz's transformations, which later became the basis of his theory of gravitation, from Maxwell's equations for electromagnetic field. These equations were so perfect in describing electromagnetic phenomena that it could not occur to anybody (including Einstein) that they did not take into account something in those phenomena.

In the same reverent manner the author of this booklet considered Maxwell's equations until he faced imperfection of the theory of relativity, closely connected with these equations [1] through Lorentz's transformations, and this made him doubt their fullness. These doubts were growing but only in 10 years they became affirmative [2] that allowed not only to update the system of electromagnetism equations but also to show the equivalence of charges and masses, i.e. to show electromagnetic origin of the mass of bodies.

However, it was not done on the basis of fundamental physical laws, common for electromagnetism and gravitation, and the latter were just compared with each other, and thus there arose a necessity to state systematically the theory of electromagnetism where all the innovations would be an integral part of Maxwell's equations. Thus this makes the idea of this booklet.

It is based on the principle of inseparable unity of matter and information, where matter is a traditional substance affecting our sense organs and their additional measuring instruments, and information is the structure of this substance and its motion.

Thus metal is just a substance (matter) of a machine and the machine in a certain manner is a structured matter in motion, i.e. with a certain mechanism, which is information itself.

It is important that the machine mechanism being objective reality is information "in itself", i.e. structure and motion outside of us and not depending on us, and our understanding of this mechanism is information "for us", distorted to a certain degree compared to the information "in itself".

But since we as well as all other "perceiving" subjects (including inanimate ones) deal only with the information "for us", our reaction to this distorted information is unwillingly inadequate. And this fact is not only the law of nature but also the most important physical law.

Thus electrical charges interacting with each other through material medium, dividing them, receive information, distorted by the medium, about the charge size of each other and as a consequence their interaction is less by ε_k times compared to the vacuum interaction where it is considered to be $\varepsilon_k = 1$, where ε_k is relative dielectric medium permeability. Even the name ε_k itself indicates a limited ability of medium to let the information pass from one charge to another.

Relative magnetic μ_k medium permeability performs similar function featuring the limited ability of the medium to transfer information about the charges motion.

Accordingly the finitude of the velocity of light brings delay of electromagnetic information, i.e. brings again its distortion.

It is obvious that electromagnetic field is not a "special form of matter" but just information about the size of the charge, i.e. actually it is an information field [3] bearing not only information "in itself" about the initial object but also information about the medium surrounding the object, i.e. about the medium structure, formed by the size and motion of the initial charge.

Altogether these pieces of information make space information "for us", i.e. what is called the field.

Therefore if we do not consider in details the essence of the charge as such, then the whole electromagnetism comes in fact to the study of distorted information about a charge on its way from its source to a recipient. And this booklet is dedicated to this topic although the author addressed it for the first time 24 years ago [4].

And before we turn to the study of these distortions, we would like to note that unlike Einstein we do not consider Galileo's fundamental principle of relativity as well as the principle of the constancy of the velocity of light in any reference system as God-given, i.e. not as information "in itself" but as information "for us". And we will show that the principle of relativity formulated by Galileo himself in a pure information manner: "It is impossible to discover (measure) absolute motion" means that although at straight-line uniform motion the charges interaction changes, the same changes occur in the measuring instruments moving together with them, which does not violate their indications at any uniform motion.

In the same manner the velocity of light measurements do not depend on the motion of the measuring instruments relative to the light sources not due to some mythical length reduction and time delay but due to real distortions of the measurements of the sizes and velocities of moving bodies in general but in case with the light exactly compensating the motion effect.

This booklet does not state all the cases of electromagnetism nor all the possible applications but it tells only the essence of these phenomena from the modern point of view.

I. Electrostatics. Environmental Reflection of Charge

Let us take as an axiom the postulate on the adequacy of environmental reflection of a charge in relation to the dependence of a medium induced charge on the size of the initial charge and on nothing else.

As it is possible to receive all the information about the charge q only if we go around it from all the sides and reflect it in a "mirror" closed around it, then

$$q / \varepsilon_k = \oint_S \boldsymbol{D} d\boldsymbol{S}, \qquad (1)$$

where $\boldsymbol{D}$ is a vector of the density of information "for us", i.e. the charge induced in the unit of area of the surface S closed around the charge; q is information about the initial charge "in itself"; ε_k is the mentioned above relative dielectric medium permeability performing the function of the factor of proportionality of the information "for us" in the form of an integral (1) to the information "in itself" q.

If we differentiate (1) spaces inside the surface S in all its volume, we shall receive a local form (1) as follows

$$div\boldsymbol{D} = \rho / \varepsilon_k, \qquad (1a)$$

where ρ is the charge space density in each point inside *S*.

The vector field with density $\boldsymbol{D}$ of the information "for us" is the electrostatic field, although instead of $\boldsymbol{D}$ the vector $\boldsymbol{D}_0 = \boldsymbol{D}\varepsilon_k$, is very often used, which is called a shift vector. This allows to simplify (1) and (1*a*) as follows

$$q = \oint_S \boldsymbol{D}_0 d\boldsymbol{S}, \tag{1b}$$

and $$div\boldsymbol{D}_0 = \rho. \tag{1c}$$

If we accept as a second axiom that the force *F*, affecting the trial charge q_0, acting as a measuring instrument for the electrostatic field, is proportional to $\boldsymbol{D}$ and q_0, then

$$\boldsymbol{F}_k = q_0 \boldsymbol{D}_0 / \varepsilon_0 \varepsilon_k = q_0 \boldsymbol{E}, \tag{2}$$

where ε_0 is an absolute dielectric vacuum permeability; $\boldsymbol{E} = \boldsymbol{D}_0 / \varepsilon$ is electric field intensity and $\varepsilon = \varepsilon_0 \varepsilon_k$ is dielectric medium permeability.

If the charge *q* possesses spherical symmetry, and if we embrace it with the spherical surface *S* with the radius *r*, we shall receive from (1)

$$E = q / 4\pi\varepsilon r^2, \tag{3}$$

which gives well-known Coulomb's law if we place it into (2)

$$\boldsymbol{F}_k = qq_0 / 4\pi\varepsilon r^2. \tag{3a}$$

Introducing the notion of scalar potential *U* of the field

$$E = -grad\ U, \tag{4}$$

we can re-write (3) as follows

$$\boldsymbol{F}_k = qq_0 / 4\pi\varepsilon r^2. \tag{5}$$

and (3a) as follows

$$W = q_0 U = qq_0 / 4\pi\varepsilon r, \qquad (6)$$

where W is the energy of the trial charge q_0 in the field of the charge q or, vice versa.

It results from (3a) and (6) that, firstly, like charges repel one another and opposite charges attract one another and, secondly, that in the first case the energy of their interaction is positive and in the second case it is negative.

Expression (6) allows to define "classical" radius r_0 of electron and positron, if we suppose that the whole internal energy mc^2 of these particles has a pure electric origin. Then $m_0 c^2 = e^2 / 4\pi\varepsilon r_0$, where m_0 and e are the mass and charge of electron (positron). Hence

$$r_0 = e^2 / 4\pi\varepsilon c^2 m_0 \cong 10^{-15} m. \qquad (7)$$

Traditionally it has been considered that this proportion is not quite true because from the momentum of electron results, as it were, a little bit different proportion, which differs from (7) by half. But in Chapter II we shall deduce another proportion for the momentum compared to the traditional one, which gives a result for the electron radius that agrees with (7).

If differentiate (6) in volume V, when $dV = dS{\cdot}dr$, we shall have for the density w of the field energy either

$$w = Udq_0 / dV = U\rho, \qquad (8a)$$

or

$$w = (dq_n /dS)\,(dU/dr) = D_0\, E/2, \qquad (8b)$$

if instead of ρ_0 we consider 2 medium induced charges $\pm q_n$ of opposite signs, so that $du/dr = -E$ and $2dq_n /dS = D_0$.

It results from (3) and (8b) that although the intensity of the field of the sum of two charges $q_1 + q_2 = q$ equals the sum of the field intensities of each charge $\boldsymbol{E} = \boldsymbol{E}_1 + \boldsymbol{E}_2$, the energy density of the field of the sum of two charges is $W = W_1 + W_2 + \boldsymbol{D}_1\boldsymbol{E}_2/2 + \boldsymbol{D}_2\boldsymbol{E}_1/2$, i.e. it is either bigger than the sum of the energy densities of the field of each charge if they are like charges, or it is smaller if they are opposite charges. This means that the system of opposite charges is always stable and the system of like charges is unstable.

From (1*a*) and (4) with acknowledgement of (2) results so-called Poisson equation

$$\Delta U = \mathrm{div} qradU = -\rho / \varepsilon, \qquad (1d)$$

which will be necessary further on.

Now we shall also consider the field of a cylinder uniformly charged and infinite in length as we shall need this in the next Chapter.

As in this case we deal with cylindrical symmetry, it is enough to consider the field of an element *dl* of the cylinder length, at which falls the charge *dq*. Then embracing this element with optional cylindrical surface with radius *r* and length *dl*, we shall have according to (1) and (2)

$$\oint_S \boldsymbol{E} d\boldsymbol{S} = E2\pi r dl = dq, \quad \text{hence}$$

$$E = dl / 2\pi r dl = \eta / 2\pi r, \qquad (9)$$

where $\eta = dq / dl$ is line density of the cylinder charge.

To sum up, we would like to state that the shift vector $\boldsymbol{D}$ in its substance equals the induced charge dq_n, falling at the unit dS of the surface, normal field, i.e.

$$D = dq_n / dS = dq_n / (dl)^2, \qquad (10)$$

where *dl* is the length of the ground side *dS*.

II. Kinematics.
Reflection of Charges and Currents In Motion.

In Chapter I it was shown how a stationary charge is reflected in the medium around it and up to what degree the medium reduces the information about it. And it is stated that in statics medium can reduce information "for us" compared to information "in itself" by ε_k times, not distorting it anyhow, if, of course, the medium is isotropic. We have not considered the cases of medium anisotropy as in statics they do not have any essential meaning.

Now we shall study how the charge information "in itself" is distorted if the charge moves.

For this purpose, first of all we shall turn to the measuring distortions of length and velocity of moving bodies in general.

II-1. Distortion of Information on Lengths, Velocities and Charges.

For this purpose let us consider an attempt to measure the length and velocity of a rod flying by us with the velocity of v_0 along a ruler, which we have in our possession. Let us also pretend that we have a stopwatch and that before the experiment, the length of a still rod was l_0.

It is obvious for everybody that when in the process of the experiment the beginning of the moving rod will be in line with the beginning of the scale of the still ruler, the experimentalist standing beside the beginning of the scale will see the other end of the rod not opposite the l_0 division of the ruler but opposite the division $l_1 > l_0$, whose image was brought by a light beam with the velocity of c in the moment when the beginning of the rod came in line with the beginning of the ruler scale, i.e. with delay of l_1/c.

However, during this time the far end of the rod will come the way from l_1 to l_0, so that $l_1 - l_0 = v_0 l_1/c$, hence

$$l_1 = l_0/(1 - v_0/c). \qquad (11a)$$

When finally the end of the rod will be in line with the beginning of the ruler scale, the experimentalist due to the same reason will see it not opposite $|l_0|$ but opposite $|l_2| < |l_0|$, i.e.

$$l_2 = l_0/(1 + v_0/c). \qquad (11b)$$

If the experimentalist records the period $\Delta\tau$ of time when the rod moved by the beginning of the scale from the beginning to the end, then dividing by $\Delta\tau$ (11*a*) and (11*b*), he/she will get

$$v_1 = v_0/(1 - v_0/c) \qquad (12a)$$

$$v_2 = v_0/(1 + v_0/c). \qquad (12b)$$

Thus the experimentalist has to state that the approaching rod *looks* longer and faster than the retreating rod of the same length.

In the same manner when attempting to measure the length of the still rod by the means of the moving ruler, the experimentalist approaching the rod will get (11*b*) and (12*b*) and retreating from the rod – (11*a*) and (12*a*).

Now let us imagine that in the measuring process both of them are moving towards each other, i.e. the rod with the velocity of v_{01} as well as the experimentalist with the velocity of v_{02} in relation to the still ruler.

In the moment when the beginning of the rod from one side and the approaching experimentalist with the still ruler from the other side will be in line with the beginning of the scale of the still ruler, the experimentalist, obviously, will see on the still ruler the same picture (11*a*). However, on his/her moving ruler he/she will see $l'_1 = l_1/(1 - v_{02}/c)$, i.e.

$$l'_1 = l_0/(1 - v_{01}/c)(1 - v_{02}/c), \qquad (13a)$$

because for him/her section l_1 of the still ruler is moving, as it were, towards him/her being still with the velocity of v_{02}.

Also if in the same conditions the experimentalist will watch the beginning of the rod that has already passed when its end will be in line with the beginning of the scale of the still ruler and the experimentalist, the latter will see

$$l'_2 = l_0/(1 + v_{01}/c)(1 + v_{02}/c). \qquad (13b)$$

If the rod and the experimentalist are moving along the still ruler in the same direction although with different velocities v_{01} and v_{02}, then in order to bring closer or to take away the rod we shall have

$$l''_1 = l_0/(1 - v_{01}/c)(1 + v_{02}/c) \qquad (13c)$$

and $$l''_2 = l_0/(1 + v_{01}/c)(1 - v_{02}/c).$$

Facing such anisotropy of measurements in front of and behind himself, which has obviously been caused by the delay of information (if it were $c = \infty$ all these effects would disappear), an observer has to develop a hypothesis regarding the features of symmetry, which is characteristic of the measuring instruments used by him/her.

Thus it is natural to assume harmonic symmetry of the measurements anisotropy for electromagnetic as well as optical nature of the phenomena as the harmonic average l_1 and l_2 from (11*a*) and (11*b*) allows to receive l_0 without any distortions. Really

$$l_{harm..} = (2l_1l_2)/(l_1 + l_2) = l_0\,, \qquad (14a)$$

where harmonic average $l_{harm.}$, as it is well-known, is an inverse value of arithmetic mean (in this case – half-sum) of reverse average values:
$l_{harm.} = 1/[(1/l_1 + 1/l_2)/2]$, i.e. (14*a*). In the same way for the velocity from (12*a*) and (12*b*)

$$v_{harm.} = (2v_1v_2)/(v_1 + v_2) = v_0 \qquad (14b)$$

Then the harmonic average for the measurements anisotropy at mutual opposing motion (13*a*) and (13*b*) will be for the lengths

$$l^{\Sigma}_{harm.} = (2l'_1 l'_2)/(l'_1 + l'_2) = l_0/(1 + v_{01}v_{02}/c^2), \qquad (15a)$$

and for the velocities

$$v^{\Sigma}_{harm.} = (v_{01} + v_{02})/(1 + v_{01}v_{02}/c^2), \qquad (15b)$$

where $v_{01} + v_{02} = l/\Delta\tau$ if $\Delta\tau$ is the time when the rod is passing by the experimentalist at their mutual opposing motion.

We would like to draw our attention to two fundamental facts. Firstly, (15*b*) totally agrees with the well-known velocity addition formula according to Einstein. However, if according to Einstein it was as a consequence of transcendentalism with length reduction, time delay and other nonsense, here it clearly results from determinative measuring mistakes due to information delay as well as from harmonic averaging method of measurements anisotropy

Therefore when one of the velocities v_{01} or v_{02} equals the velocity of light *c*, it results from (15*b*) that $v^{\Sigma}_{harm.} = c$, but this constancy of the velocity of light for a still and moving observer does not mean anything but a phenomenon, which *seems* to the experimentalist that is connected with the choice of the measuring instruments type as well as with the method of results processing.

Secondly, since (15*b*) is connected with harmonic averaging of the velocities measurements anisotropy, this formula and, consequently, Einstein's formula is not a universal one because at different averaging method other results would be received.

Anyway, the side of the ground dS in (10), which is parallel to the velocity vector of the charge motion, according to (11a) and (11b) looks different when approaching the trial charge (measuring instrument) and when retreating from it. The ground itself looks either bigger, or smaller accordingly.

And then according to (10) and (2) the whole charge field seems to the observer (trial charge) to be anisotropic, i.e. when approaching and retreating

$$\boldsymbol{E} = \boldsymbol{E}_0(1 \pm \boldsymbol{v}/c). \qquad (16)$$

But the trial charge cannot be in a doubt about which of the two fields (16) it should react to. Therefore, first of all, it should react to an arithmetically average field, which results from harmonic averaging of lengths (and squares), i.e. at

$$\boldsymbol{E} = (\boldsymbol{E}_1 + \boldsymbol{E}_2)/2 = \boldsymbol{E}_0(1 + v/c + 1 - v/c)/2 = \boldsymbol{E}_0, \qquad (16a)$$

finally receiving adequate information about the size of the charge.

However, secondly, unlike in statics the trial charge is also affected by a turning couple of forces

$$(\boldsymbol{E}_2 - \boldsymbol{E}_1)/2 = (\boldsymbol{v} \times \boldsymbol{E}_0)/c = \boldsymbol{B}c, \qquad (17)$$

where $\boldsymbol{B} = (\boldsymbol{v} \times \boldsymbol{E}_0)/c^2$ is magnetic induction caused in the medium by the charge motion.

All this means that magnetic field is just a consequence of inadequate medium reflection of electric field $\boldsymbol{E}_0$ of the charge in motion. As a result false additional information (17) appears, which interferes with the measurements carried out by the trial charge, and which is deemed by it (and by us) as a separate magnetic field.

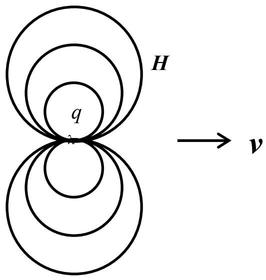
However, the energy density of this field is a real thing and makes

$$w_m = B^2 / 2\mu, \qquad (18)$$

if we put (16) into (8*b*).

In case of a single point charge in motion, its electric field $\boldsymbol{E}_0$ has spherical symmetry, and magnetic field $\boldsymbol{B} = (\boldsymbol{v} \times \boldsymbol{E}_0) / c^2$, is proportional to angle sine between $\boldsymbol{v}$ and $\boldsymbol{E}_0$, so that on the motion line it equals zero.

If we look at this picture from aside as well as from above or from downside, the change of $\boldsymbol{H}$ depending on angle φ between $\boldsymbol{E}$ and $\boldsymbol{v}$ appears as follows (Picture1), where $H = Ev \sin\varphi$.



Picture 1

The whole combined set of lines of constant intensity is the set of toroidal surfaces.

It results from the above-said that electric field $\boldsymbol{E}_0$ from the sides of a flying electron with relativistic velocities does not become infinite and, moreover, does not change at all (16*a*) despite what relativism theorists have said about this issue [5] and despite what was stated in [1].

Now we shall turn to information distortions of width (height) of bodies moving with constant velocity.

Let us consider a body having width l_0, approaching the observer with velocity v along an axis x. In the moment when the body near end reaches the observer, it will seem to him/her that the far end due to information delay has not yet reached an axis y by the amount of vl/c, where l is the distance from the body far end to the observer l/c ago.

Then $l^2 = l_0^2 + v^2 l^2 / c^2$, hence $l = l_0 / \sqrt{1 - v^2 / c^2}$, or in symbols $l = l_0 / (1 - jv/c)$ hus taking into account (10) we have for shift and intensity vector longitudinal to the field motion at the observer's different sides

$$\boldsymbol{D}'_{1,2} = \boldsymbol{D}_0 (1 \pm jv/c) \text{ и } \boldsymbol{E}'_{1,2} = \boldsymbol{E}_0 (1 \pm jv/c). \qquad (19)$$

Inducing arithmetic mean out of (19), the observer will have, first of all, $\boldsymbol{E} = \boldsymbol{E}_0$, i.e. that the longitudinal field of the charge in motion does not change at any velocity although relativists affirm [5] that it equals zero at the velocity of light.

However, secondly, the trial charge in motion will be compressed from the sides under the forces $(\boldsymbol{E}_1 - \boldsymbol{E}_2)/2 = j\boldsymbol{E}_0 v/c$.

If the information source as well as its recipient (trial charge) are both moving with velocities v_1 and v_2, the information, as it was already mentioned, is distorted twice, i.e. first by the source motion and then by the recipient motion.

$$\boldsymbol{E}''_{1,2} = \boldsymbol{E}'_{1,2} (1 \pm jv_2/c) = \boldsymbol{E}_0 (1 \pm jv_1/c)(1 \pm jv_2/c). \qquad (20)$$

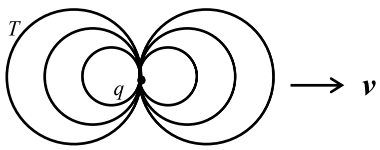
On the average this gives, firstly, $\boldsymbol{E}''_{1,2} = \boldsymbol{E}_0 (1 - v_1 v_2 /c^2)$. And, secondly, half-difference (20) indicates that the observer undergoes side compression by force $E_0 (v_1 - v_2)/c$, which does not influence its mechanical trajectory and in case when the velocities are equal it equals zero and cannot be used as an absolute movement indicator.

Thus the charge motion is reflected in medium not only in the form of vector field $\boldsymbol{B}$ but also in the form of scalar field.

$$T = \boldsymbol{vE} /c^2 \qquad (21)$$

which we shall call striction field.

According to (21) striction field of a point charge in motion should have a form shown on Picture 2, where change T depending on angle φ between $\boldsymbol{E}$ and $\boldsymbol{v}$ is depicted: $T = Ev\cos\varphi$, and the highest field is along the velocity line.



Picture 2

And lines T in front of and behind the charge make pairs of spherical surfaces.

If we put (19) into (8*b*), energy density of the striction field will be

$$w_T = T^2 / 2\mu, \qquad (22)$$

which together with (18) gives density of the total kinetic energy of the motion field.

$$w = E^2 v^2 (\sin^2 \varphi + \cos^2 \varphi) / 2\mu c^4 = \varepsilon E^2 v^2 / 2c^2. \qquad (23)$$

Integrating (23) on the whole field space volume, we shall receive kinetic energy of the electron in motion

$$W_e = v^2 e^2 \int_{r_0}^{\infty} dr / 8\pi\varepsilon c^2 r^2 = v^2 e^2 / 8\pi\varepsilon c^2 r_0, \qquad (24)$$

hence electron momentum is

$m_0 v = ve^2 / 4\pi\varepsilon c^2 r_0$, i.e. $r_0 = e^2 / 4\pi\varepsilon c^2 m_0$, that unlike the classic theories agrees with (7).

First of all this means that electron mass has a pure electrical origin and, secondly, that striction field dots all the i's in electrodynamics.

And really on the basis of striction forces it is not difficult to demonstrate electrical origin of gravitation [2].

Thus for two charges strictionally interacting and moving in the same direction at a distance *r* according to (20)

$F_D = -q_1 q_2 v_1 v_2 / 4\pi\varepsilon c^2 r^2$, while their interaction according to Newton $F_N = - Gm_1m_2/r^2$, where *G* is gravitation constant. Comparing these forces it is easy to summarize that F_D and F_N is the same thing, if only

$$m = qv / 2c\sqrt{\pi\varepsilon G} = qv\sqrt{\mu} / 2\sqrt{\pi G}. \qquad (25)$$

According to (20), if like charges with the same velocity move in one direction, F_D is negative. If charges are opposite, for (25) their velocities should be opposing as well. Otherwise (25) is not fulfilled.

However, it is highly probable that making some slow movements (vibrations), like elementary particles move in one direction and opposite particles move towards each other so that (25) always applies to them. Another thing is that the nature of these movements is not quite clear. Maybe it is resonance precession or something like this.

Certainly, (25) is true for neutral bodies as well if we use as q total charge of all the like particles of each body.

Now if we compare (25) and (7) it is possible to express G in terms of electron mechanical parameters.

$$G = r_0 v_0^2 / m_0,$$

and v in terms of quantum-mechanical parameters.

$$v^2 = 2\pi\alpha c G m^2 / h,$$

where $h = 2\pi\alpha c m_0 r_0$ is Planck's constant, $\alpha = 137$ is fine structure constant.

II-2. Interaction of Moving Charges and Currents.

Relativity principle implies reciprocity principle, according to which, if one of interacting charges is under force $\boldsymbol{F}_L$, the other one is under the same force but from the opposite side. Hence the mathematical expressions of these forces should contain the same components. And this is true if we take into consideration that the information going from one charge to another is distorted twice: first during its source motion and then during its recipient motion. In the first case initial field $\boldsymbol{E}_0$ is turned into
$\boldsymbol{E}' = \boldsymbol{E}_0(1 \pm \boldsymbol{v}_1 / c)$ according to (1b), and in the second case it is turned into

$\boldsymbol{E}'' = \boldsymbol{E}'(1 \mp \boldsymbol{v}_2 / c) = \boldsymbol{E}_0 + \boldsymbol{E}_0 \times \boldsymbol{v}_1 \times \boldsymbol{v}_2 / c^2 = \boldsymbol{E}_0 - \boldsymbol{B}_1 \times \boldsymbol{v}_2$, so that the force is

$$\boldsymbol{F}_L = q_2 \boldsymbol{E}'' = q_2(\boldsymbol{E}_0 - \boldsymbol{B}_1 \times \boldsymbol{v}_2). \tag{26}$$

(26) implies that when moving the charges undergo, firstly, general Coulomb interaction (2) and, secondly, magnetic force effect
$\boldsymbol{F}_M = -q_2 \boldsymbol{B}_1 \times \boldsymbol{v}_2 = -q_1 \boldsymbol{B}_2 \times \boldsymbol{v}_1$, representing information addition (disturbance) in relation to the initial Coulomb force $\boldsymbol{F}_C$.

Then the whole Maxwell magnetism is artifact, which none-theless controls charges behavior as they “do not know” about it.

As a result like charges are also attracted by magnetic field besides Coulomb repulsion if they move in one direction but are additionally pushed apart if they move towards each other. With opposite charges everything is vice versa.

But if the charges move across each other, magnetic force turns the like charges in the same direction and opposite charges – in opposing directions.

Everything occurs in the same manner with neutral current conductors, however, there is no Coulomb interaction.

This Lorentz force fully describes interaction between the charges in motion as well as with an external magnetic field, however, it totally contradicts Galileo’s relativity principle.

Really, according to (26), if the charges are moving one after another with equal velocities, their interaction force does not differ from electrostatic force because
$\boldsymbol{B}_1 = \boldsymbol{v}_1 \times \boldsymbol{E}_0 / c^2 = 0$ as the angle between $\boldsymbol{v}_1$ and $\boldsymbol{E}_0$ equals zero. However, if the charges are moving parallel to each other, their interaction force is reduced by $(1 - v^2/c^2)$ times as the angles be-tween $\boldsymbol{v}_1$ and $\boldsymbol{E}_0$ and between $\boldsymbol{B}$ and $\boldsymbol{v}_2$ are $\pi / 2$, where
$\boldsymbol{v} = \boldsymbol{v}_1 = \boldsymbol{v}_2$.

Then the observer moving together with the charges can define their and his/her own absolute movement simply by turning the charges system along or across the velocity vector, which is denied by the relativity principle. But as Lorentz force fully describes electromagnetic interaction of charges, we are to suppose that besides this force there exists some other force compensating for the electromagnetic force change at turns and making the system to be invariant to them.

Formally this force should be

$$\boldsymbol{F}_D = -q_2(\boldsymbol{v}_1\boldsymbol{E}_0)\boldsymbol{v}_2/c^2 = -q_2 T_1 \boldsymbol{v}_2, \qquad (27)$$

where scalar T is kinetic potential of the field of the charge in motion that agrees with (21).

Really the modulus of sum of $\boldsymbol{F}_M$ and $\boldsymbol{F}_D$ at the same charges velocities $\boldsymbol{v}$ always equals $q_2 E_0 v^2/c^2$ in spite of the relative position of the charges because

$$\boldsymbol{F}_M^2 + \boldsymbol{F}_D^2 = q_2^2 \boldsymbol{E}_0^2 v^2 (\sin^2\varphi + \cos^2\varphi)/c^4 = q_2^2 \boldsymbol{E}_0^2 v^2/c^4,$$

where φ is an angle between $\boldsymbol{E}_0$ and $\boldsymbol{v}$.

Instead of Lorentz force (26) we should use the following force

$$\boldsymbol{F} = \boldsymbol{F}_L + \boldsymbol{F}_D = q_2(\boldsymbol{E}_0 - \boldsymbol{B}_1 \times \boldsymbol{v}_2 - T\boldsymbol{v}_2), \qquad (28)$$

which is indifferent to the relative position of the charges (to angle φ) in relation to their velocity vector.

Nonetheless $\boldsymbol{F}$ depends on the velocity value that also contradicts the relativity principle. However, we should acknowledge that when measuring with an instrument moving with the same velocity, its counteracting (balancing) system has either gravitation or electromagnetic nature (including springs). But in both cases [2] such counteraction itself changes by v^2/c^2 times, which does not alter the instruments indications.

And we should find out why traditional electromagnetism ignores striction field formally as well as meaningfully.

Meanwhile the both motion fields formally arise if we multiply the both parts (1c) by $\boldsymbol{v}$ and take into consideration that at the constant charge velocity $\boldsymbol{v}\, div\, \boldsymbol{E} = rot(\boldsymbol{v}\times\boldsymbol{E}) + grad(\boldsymbol{v}\times\boldsymbol{E})$.

Then taking into account (17) and (21)

$$rot\boldsymbol{B} + qradT = \mu\boldsymbol{\partial}, \qquad (29)$$

where $\boldsymbol{\partial} = \rho\boldsymbol{v}$ is current density and $\mu = \varepsilon / c^2$.

Thus velocity c of light in medium is determined by dielectric and magnetic permeability of the medium $c^2 = 1/\varepsilon\mu$, and in "hollow", for which $\varepsilon = \varepsilon_0$; $\mu = \mu_0$,

$$c^2 = 1/\varepsilon_0\mu_0.$$

As one would expect, (29) differs from the traditional proportion by the value of *grad T*, the absence of which in the traditional theory could, probably, be explained simply by a mistake that was made by one of the founders and has been reproduced by his/her adherents.

This is even more highly probable that the line currents fields do not contain a longitudinal component ***E*** generating *T* due to cylindrical symmetry of the electric field ***E*** of electrons not including external EMF, so that their motion field is almost pure magnetic. It is almost pure because external voltage *U* attached to line conductor nevertheless generates *T* but not in connection with its own charges field.

In this case integrating (29) with respect to the surface closed around a current element of unit length *dl*, we shall receive

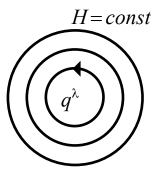
$$\oint_S rot\boldsymbol{B}d\boldsymbol{S} = \oint_l \boldsymbol{B}dl = I\mu, \qquad (30)$$

where $I = \int_S \boldsymbol{\partial}d\boldsymbol{S}$ is electric current creating a magnetic field around itself. Besides,

$$T = (\boldsymbol{E}_{ext.}\boldsymbol{v})/c^2 = Uv/lc^2,$$

where *l* is the length of the conductor part, to which external voltage *U* is applied.

Due to cylindrical symmetry at distance r from the conductor everywhere B = const, and $l = 2\pi r$, then it results from (30) that $B = \mu I / 2\pi r$, which is the current magnetic field.



Picture 3

In section perpendicular to the current line flowing towards us, the field drawing will appear to be as follows (Picture 3).

It is obvious that in case with the current conductor, electrostatic fields of protons and electrons are mutually balanced and only the magnetic field of electrons in motion remains.

On the contrary, in case of the uniform motion with infinite velocity $\boldsymbol{v}$ and with density ρ of a charged plate with thickness l along its homogeneous field $\boldsymbol{E}$ there is no magnetic field but there is a striction field $T = \boldsymbol{E}\boldsymbol{v}/c^2$, and from (29) only $qradT = \mu\boldsymbol{\partial}$, is left, where $E = \rho l / 2\varepsilon$, $\mu = 1/\varepsilon c^2$, $\boldsymbol{\partial} = \boldsymbol{v}\rho$, $qrad\ T = 2T/l$.

Introducing symbols $-T = \mathrm{div}\,\boldsymbol{A}$ and $\boldsymbol{B} = \mathrm{rot}\,\boldsymbol{A}$, we shall have from (29)

$$\mathrm{rot\,rot}\,\boldsymbol{A} - qrad\,\mathrm{div}A = \mu\boldsymbol{\partial}, = -\Delta A. \qquad (31)$$

This means that instead of the set of magnetic and striction fields, it is possible to consider one field of vector potential A, whose rotation equals B, and divergence equals $-T$, so that

$$\left.\begin{array}{l}\mathrm{div}\boldsymbol{A} = -T \\ \mathrm{rot}\boldsymbol{A} = \boldsymbol{B}\end{array}\right\}. \qquad (32)$$

Then magnetic field $\boldsymbol{B}$ causes rotation of specific impulse $\boldsymbol{A}$, whose source is electrostriction represented by kinetic potential T.

Taking into account (17) and (21) it also results from (32)

$$\boldsymbol{A} = U\boldsymbol{v}/c^2. \tag{33}$$

III. Dynamics. Information Distortion at Interacting Charges Evolution.

In order to describe processes changing in space and time, we shall need to refer to the charge, momentum and energy conservation laws.

Charge conservation law implies that a charge cannot appear from nothing, it can only flow from one place into another in the form of electric current. Therefore if in a certain closed space a charge, for example, increases in time, i.e. $\partial q / \partial \tau > 0$, this means that through a closed surface bounding this space conduction or transfer current is flowing inside this space, exactly equaling this change, so that

$$I_n = \oint_S \boldsymbol{\partial}_n d\boldsymbol{S} = -\partial q / \partial \tau, \tag{34}$$

where $\boldsymbol{\partial} < 0,$ as it is directed towards $d\boldsymbol{S}$.

In local form, i.e. calculating for space volume unit, (34) gives

$$div\boldsymbol{\partial}_n = -\partial \rho / \partial \tau, \tag{35}$$

Hence taking into account (1) we shall also receive

$$\boldsymbol{\partial}_n = -\varepsilon \partial \boldsymbol{E} / \partial \tau, \tag{36}$$

where in the right part it is so-called transfer current

$$\boldsymbol{\partial}_c = \varepsilon \partial \boldsymbol{E} / \partial \tau, \tag{37}$$

so that as a result we have

$$\boldsymbol{\partial} = \boldsymbol{\partial}_n + \boldsymbol{\partial}_c. \tag{38}$$

Thus taking into account (38), (31) appears as follows

$$\Delta \boldsymbol{A} = -\mu \boldsymbol{\partial} = -\mu \rho \boldsymbol{v} - \partial \boldsymbol{E} / \partial \tau c^2, \tag{39}$$

describing the changes of momentum field (vector potential ***A***) at the change of charges motion velocities and electric field voltage.

On the other hand, the momentum conservation law, according to which when changing momentum ***A*** of the charge, force ***E*** arises preventing this change, implies

$$\boldsymbol{E} = -\partial \boldsymbol{A} / \partial \tau, \tag{40}$$

taking this into consideration (39) appears as follows

$$\partial^2 \boldsymbol{A} / \partial \tau^2 c^2 + \Delta \boldsymbol{A} = -\mu \boldsymbol{\partial}_n, \tag{41}$$

From (41), in "hollow" space, i.e. without transfer and conduct currents $\boldsymbol{\partial}_n = 0,$ we receive equation of the field wave of momentum ***A***

$$\Delta \boldsymbol{A} = -\partial^2 \boldsymbol{A} / \partial \tau^2 c^2. \tag{42}$$

However, momentum field consists of two fields: electromagnetic ***B*** and electrostriction *T*. Therefore having equation (42), we can put it into (32), which will give separate descriptions of the magnetic field waves in the form of wave rotation ***A*** and of the striction field in the form of divergence of the same wave ***A***.

In the same above-mentioned cases, when there is either electromagnetic field or electrostriction field, (42) degenerates accordingly either into the system

$$\left.\begin{aligned} rot\boldsymbol{E} &= -\partial \boldsymbol{B} / \partial \tau \\ rot\boldsymbol{B} &= \partial \boldsymbol{E} / \partial \tau c^2 \end{aligned}\right\}, \tag{43}$$

or into the system

$$\left.\begin{aligned} div\boldsymbol{E} &= \partial T / \partial \tau \\ gradT &= -\partial \boldsymbol{E} / \partial \tau c^2 \end{aligned}\right\}. \qquad (44)$$

Electromagnetic wave is a cross one as it represents a set of mutually conditioned rotations of electric and magnetic fields placed on perpendicular planes; and electrostriction wave is a longitudinal one as induced striction charge $\rho_c = \varepsilon \mathrm{div}\boldsymbol{E}$ and kinetic potential difference T in it sequentially substitute each other in the direction of the wave propagation.

According to the energy conservation and conversion law, any system potential energy reduction in time should be followed by the corresponding increase of its kinetic energy, which calculating for a charge unit gives

$$\boldsymbol{Ev} = -\partial U / \partial \tau = Tc^2. \qquad (45)$$

Then considering (1*a*) and (45) we receive from (44)

$$div\boldsymbol{E} = \rho / \varepsilon - \partial^2 U / \partial \tau^2 c^2,$$

hence taking into account (1*d*) finally

$$\partial^2 U / \partial \tau^2 c^2 - \Delta U = \rho / \varepsilon. \qquad (46)$$

In spite of the fact that T appears in the summary (46), this equation rather traditionally describes delayed potential

$$U(\tau) = \int_V \rho(\tau - r / c) dV / 4\pi\varepsilon r. \qquad (47)$$

The above-stated implies that the electromagnetism theory needs to be improved by adding a section dedicated to the striction field theory, which will allow to describe in the right way the charge energy and momentum (24), interaction of the charges in motion (28), gravitation (25), longitudinal waves and a number of applied problems.

Pursuant to our version, the system of equations of electric, magnetic and striction fields should be as follows

$$
\begin{aligned}
&div\boldsymbol{E} = \rho / \varepsilon + \partial T / \partial \tau, \quad rot\boldsymbol{B} + gradT = \mu \boldsymbol{\vartheta}_n - \partial \boldsymbol{E} / \partial \tau c^2, \\
&rot\boldsymbol{E} = -\partial \boldsymbol{B} / \partial \tau, \qquad div\boldsymbol{B} = 0,
\end{aligned}
\tag{48}
$$

differing from the traditional one in the second component of the right part of the first equation and in the second component of the left part of the second equation containing kinetic potential T of the striction field, which like the magnetic field $\boldsymbol{B}$ shows itself only in kinematics and dynamics.

Attachment.
Mass of Neutrino and Graviton.

The material of this booklet together with the results of [2] allows to see from another point of view the problem of proportion of elementary particles size and mass as well as the problem of neutrino mass defining, which has preoccupied astrophysicists for the last decades of this century.

First of all let us remember the definition method of classical radius of electron.

The traditional explanation justly results from a presumption about electromagnetic nature of electron's internal energy, i.e. from the following equality

$$m_0 c^2 = e / 4\pi\varepsilon r_0, \tag{49}$$

where m_0 and r_0 are electron's mass and radius accordingly, and e is its charge.

Formally it seems to be explaining everything, however, there arise two inaccuracies.

First of all, the electron's charge is subject to electrical dispersal (repulsion), i.e. its energy is positive. At the same time the electron's mass is subject to gravitation contraction to a point, i.e. this energy is negative.

Thus (49) can be accepted only as the equality of *moduli* of the electrical and gravitation energies but not of the energies themselves.

Secondly, in correspondence with the formula (28) in [2] gravitation energy in this case is

$$W_m = - Gm_0^2 c^2 / (r_0 c^2 - Gm_0),$$

so even if we equate modulus W_m to electrical energy modulus $W_e = e^2 / 4\pi\varepsilon r_0$, we would not receive (49) in any case.

And the thing here is that expressions for gravitation interactions do not take into consideration quantum effects, i.e. the structure of elementary particles, which differs from point representations.

In order to correct this, it is necessary to correct gravitation formulae that will turn W_m into $m_0 c^2$ at $r = r_0$.

For this it is necessary to re-write it in the following form

$$W_m = Gm_0^2c^2/[(r_0 c^2 + Gm_0) - rc^2], \quad (50)$$

which at $r >> r_0$ is turned into classical forms.

Then at $r = r_0$ it will be $W_m = m_0 c^2$, which corresponds to (49).

Thus at the above conditions the procedure of defining of the electron's classical radius seems to be perfectly reasoned.

However, in this case electrical as well as gravitation forces according to Coulomb's law and (50) should extend the electron's shell up to radius $r_0 + Gm_0/c^2$, when it is prevented by switching (50) into infinite compression. And if the electron radius is r_0, then it is only meaning the average radius of its shell, which also should be as wide as $2Gm_0/c^2$, as only in this case its outer layer is on the edge of infinite gravitation contraction and its inner layers are subject to a powerful gravitation and electrical extension that in average leads to stable balance in the area of r_0.

Any deviation from r_0 towards increase sharply increases the shell contraction, and any deviation towards decrease of r_0 causes sharp increase of the shell electrical extension that provides the electron's stability.

But according to (50) close to (49) the equality of moduli of gravitation and electrical energies is also established on the other side of the boundary of the transition of gravitation attraction into repulsion, i.e. at $r_n = r_0 + 2Gm_n/c^2$, where m_n is presumably the positron mass:

$$m_n c^2 = e^2/4\pi\varepsilon(r_0 + 2Gm_n/c^2) \cong m_0c^2 - 2Gm_0^2/r_0,$$

hence $$m_n \cong m_0 - 2Gm_0^2/r_0c^2. \qquad (51)$$

Thus radius r_n of the positron shell is slightly bigger than the electron radius r_0, and the positron mass m_n is also slightly smaller than m_0.

But what concerns the positron stability, its conditions substantially differ from the conditions of the electron stability, as the electrical repulsion and gravitation attraction influence the positron shell in opposite directions. And in case of spontaneous increase of r_n the electrical repulsion more and more dominates the gravitation attraction and the positron shell bursts as a soap bubble.

Perhaps the instability of the positron shell equality explains relative rarity of positrons compared to electrons.

At such proportion of size, the electron is just inserted into the positron shell so that their boundary goes along the line of transition of the gravitation attraction into repulsion, i.e. along $r_n = r_0 + Gm_0/c^2$. This structure, probably being a neutrino, makes a rather stable connection as now the electrical repulsion of the positron shell is turned into the electrical attraction to the electron shell.

Within this structure the electron energy according to (50) is positive and makes m_0c^2, and the positron energy is negative and makes $-m_pc^2$, so that together they make the neutrino energy, i.e. taking into account (51) $m_n c^2 = m_0 c^2 - m_p c^2 = 2Gm_0^2/r_0$, hence the neutrino mass is

$$m_n = 2Gm_0^2/r_0 c^2 \sim 10^{-72} \text{ kg}. \qquad (52)$$

We can receive the same result if we consider $m_n c^2$ as full energy of the electrical interaction of unlikely charged concentric spheres with radius r_0 and $r_p = r_0 + 2Gm_0/c^2$. Then

$$m_nc^2 = \frac{e^2}{4\pi\varepsilon r_0} + \frac{e^2}{4\pi\varepsilon(r_0 + 2Gm_0/c^2)} - \frac{2e^2}{4\pi\varepsilon(r_0 + 2Gm_0/c^2)} =$$

$$m_0c^2\left(1-\frac{r_0}{r_0+2Gm_0/c^2}\right)\cong\frac{m_0c^2\,2Gm_0}{r_0c^2}, \quad \text{i.e. (52)}$$

where the first two components represent self-energy of electron and positron, and the third component represents their mutual energy (energy of their interaction).

If we exchange the shells of electron and positron, we shall receive antineutrino.

Despite the fact that the neutrino mass is extremely small, density of these particles in the Universe allows to replace the model of a flying apart Universe with the model of a pulsating Universe, which much better corresponds to the state of restless minds.

To sum up, we would like to mention that although in the model representation "electrical" radius of neutrino and antineutrino is r_0+Gm_0/c^2, this does not make much sense in reality as neutrino practically does not have either electrical charge, or outer electrical field.

Only "gravitation" radius of neutrino can have real value $r_g = Gm_0/c^2 \sim 10^{-57}$ m, where gravitation interaction of the shells of electron and positron in neutrino according to (50) makes $m_nc^2 = 2Gm_0^2/r_0$, which according to (52) corresponds to the neutrino mass.

But a particle with a minimum possible size $r_g \sim 10^{-57}$ m and with a minimum mass $m_g = m_n \sim 10^{-72}$ kg can quite claim for a role of a hypothetical graviton. So neutrino is a graviton, whose inappreciable size and mass allow to build models of physical vacuum (ether). And double "electrical" radius $2(r_0 + Gm_0/c^2)$ of neutrino should be treated as a distance between gravitons in vacuum. Then the vacuum density should make $\sim 10^{-27}$ kg/m^3.

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C o n t e n t s

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