ON ELECTRON'S DYNAMICS.

J. G. Klyushin, Ph. D.
Academy of Civil Aviation, chair of applied mathematics;
e-mail: klyushin@shaping.org;
mail: International Club of Scientists,
Kazanskay St., 36, 190031, St. Peterburg, Russia.

A model of electron's movement in aether is proposed. It explains some "relativistic effects" and results of many experiments which now are explained ad hoc or aren't explained at all.

1. Main equation.

The second Newton's law is valid for a neutral body: force **F** is equal to mass m multiplied it's acceleration **a**, i.e.

$$\mathbf{F} = m\mathbf{a} \tag{1.1}$$

If one does not understands what force is then this correlation may be understood as force definition. On the other hand there is a lot of different concepts of force in to-day physics: force as potential gradient, electrodynamic forces etc. Therefore it is often convenient to believe us to know what force means, i.e. to believe that this concept is given to us by nature as a relatization of a certain external action on the subject under consideration. If so then (1.1) may be considered as a reaction of an electrically neutral mass m on external action **F**: the mass gains acceleration **a**.

Correlation (1.1) is generalized in modern physics in the following way

$$\mathbf{F} = \frac{d}{dt}(m\mathbf{V}) = m\mathbf{a} + \frac{dm}{dt}\mathbf{V} \tag{1.2}$$

here **V** is velocity. Derivative dm/dt posses different physical meaning in different problems. In accordance with gravity concept proposed by the author [1] dm/dt in electrodynamical problems means electron's charge. One can find details of this concept in chapter 10 of paper [1]. So equality (1.2) in electrodynamics looks as follows:

$$\mathbf{F} = m\mathbf{a} + q\mathbf{V}, \tag{1.3}$$

where q is electron's charge and **V** is its velocity. The first item in (1.3) describes neutral mass reaction and the second one describes charged body reaction, its electric pliability. This item is defined by viscosity of the medium in which movement takes place. Let us call this medium aether. But external action can not be exhausted by these items. Medium inertical forces should also be displayed as it takes place in habitual media.

Term aether is "red rag" for many physicists. But whatever other terms like "physical vacuum" be used the fact is and even the most orthodox physicists are compelled to submit that the space is filled with a certain medium. And I hope all my readers are agreed that this medium possesses omic resistance. We precisely know it, it is vacuum impedance $1/\varepsilon_0 c$ where ε_0 is electric constant and c is light velocity.

The very idea that aether should resist charge a bodies (and light) movement was asserted by many authors, among which perhaps the most consistent (known to the author) are Russian scientists P. D. Prussov, and G. A. Shlenov. But here we shrive for not qualitative but rather quantitative assertions. Meanwhile we try to find here the quantitative formula describing this resistance.

Let us suppose that medium inertial forces are proportional to aether impedance $1/\varepsilon_0 c$, to constant ε_0 which means aether density in accordance to [1] and [2]. It should also be proportional to velocity square V^2 if one takes into account the parameters dimensions. Let us take proportion coefficient equal to $1/2$ in order to be in concordance with the experiments results.

One finally gets

$$\mathbf{F} = m\mathbf{a} + q\mathbf{V} - \frac{qV^2}{2c}\mathbf{e} \tag{1.4}$$

where **e** is velocity unit vector.

The following assertions will be formulated in scalar form for a projection of vector correlation (1.4) in order to avoid complex designations. Equations for other projections can be received in analogues way. One gets past evident transformations:

$$\frac{dV}{dt} = \frac{F}{m} - \frac{qV}{m} + \frac{qV^2}{2mc} \quad (1.5)$$

(1.5) is the first order equation with respect to V. To shorten writing let us introduce designations $\frac{F}{q} = a, -1 = b, \frac{1}{2c} = p$.

(1.5) comes to the form

$$\frac{dV}{dt} = \frac{q}{m}\left[a + bV + pV^2\right] \quad (1.6)$$

It is well known that this equation has a solution [3]. If $a + bV_0 + pV_0^2 \neq 0$ then integral curve passing through (t_0, V_0) point is received as a solution with respect to V of the equation

$$\int_{V_0}^{V} \frac{dV}{\left(a + bV + pV^2\right)} = \frac{q}{m}\int_{t_0}^{t} dt \quad (1.7)$$

If

$$a + bV_0 + pV_0^2 = 0 \quad (1.8)$$

then straight line

$$V = V_0 \quad (1.9)$$

is solution.

Let us begin our analyses with solution (1.9). (1.8) solution is

$$V_0 = \frac{-b \pm \sqrt{b^2 - 4ap}}{2p},$$

or taking into account our designations

$$V_0 = c\left(1 \pm \sqrt{1 - 2F/qc}\right) \quad (1.10)$$

This equation real solutions exist if

$$1 - 2F/qc \geq 0, \quad (1.11)$$

i.e. if force F is big enough. (1.10) has evident physical essence: F is the force conserving V_0.

If this force acts on electron already moving with velocity V_0 it will go on moving with this stable velocity. This means that electron movement does not imply the first Newton's law. Its movement is closer to that of a car on the surface or airplane in the air. If external force F=0 then velocity

$$V = \frac{cV_0}{\left[V_0 - \exp\{q/m\,(t - t_0)\}(c - V_0)\right]} \quad (1.12)$$

i.e. velocity V exponentially descrieases when there is no external force. In particular this means that electron is at rest with respect to aether when no external force acts on it.

2. Case $1 - 2F/qc > 0$.

Let us come back to (1.6) equation and its solution (1.7). If inequality (1.11) holds strictly then solution is

$$V = \frac{\exp\left\{\frac{q\sqrt{b^2-4ap}}{m}(t-t_0)\right\}\left[\frac{2pV_0 + b - \sqrt{b^2-4ap}}{2pV_0 + b + \sqrt{b^2-4ap}}\right]\left[b + \sqrt{b^2-4ap}\right] + \sqrt{b^2-4ap} - b}{2p\left[1 - \exp\left\{\frac{q\sqrt{b^2-4ap}}{m}(t-t_0)\right\}\left[\frac{2pV_0 + b - \sqrt{b^2-4ap}}{2pV_0 + b + \sqrt{b^2-4ap}}\right]\right]} \quad (2.1)$$

If $V_0 = 0$, $t_0 = 0$ then equality (2.1) becomes a little more simple

$$V=\frac{\left(b-\sqrt{b^2-4ap}\right)\left(\exp\left\{\frac{q\sqrt{b^2-4ap}}{m}t\right\}-1\right)\left(b+\sqrt{b^2-4ap}\right)}{2p\left[\left(b+\sqrt{b^2-4ap}\right)-\exp\left\{\frac{q\sqrt{b^2-4ap}}{m}t\right\}\left(b-\sqrt{b^2-4ap}\right)\right]} \tag{2.2}$$

or in the initial designations

$$V=\frac{\left[c\exp\left\{\frac{q\sqrt{1-2F/qc}}{m}(t-t_0)\right\}\left(V_0-c-c\sqrt{1-2F/qc}\right)\left(\sqrt{1-2F/qc}-1\right)\right]}{\left[V_0-c+c\sqrt{1-2F/qc}-\exp\left\{\frac{q\sqrt{1-2F/qc}}{m}(t-t_0)\right\}\left(V_0-c-c\sqrt{1-2F/qc}\right)\right]}+$$
$$+\frac{c\left(\sqrt{1-2F/qc}+1\right)\left(V_0-c+c\sqrt{1-2F/qc}\right)}{\left[V_0-c+c\sqrt{1-2F/qc}-\exp\left\{\frac{q\sqrt{1-2F/qc}}{m}(t-t_0)\right\}\left(V_0-c-c\sqrt{1-2F/qc}\right)\right]} \tag{2.1a}$$

If $V_0=0$, $t_0=0$ then (2.1a) becomes a little more simple

$$V=\frac{2F\left[\exp\left\{\frac{q\sqrt{1-2F/qc}}{m}t\right\}-1\right]}{q\left[\left(-1+\sqrt{1-2F/qc}\right)+\exp\left\{\frac{q\sqrt{1-2F/qc}}{m}t\right\}\left(1+\sqrt{1-2F/qc}\right)\right]} \tag{2.2a}$$

F is voluntary here, it depends on our will but we consider it constant during integration process when F is picked up a velocity $U=2F/q$ is also picked up. (2.2a) implies velocity V gained by charge q is proportional to the velocity U which is defined by the force acting on q.

It was assumed earlier that

$$1-2F/qc>0 \tag{2.3}$$

or this is the same that

$$U=2F/q<c \tag{2.4}$$

(the problem of dimensions is considered in the author's paper [2]).

But one can see that correlation (2.2) is also reasonable when inequality (2.3) becomes quality, i.e. when

$$2F/q=U=c \tag{2.5}$$

Light velocity is apparently achieved in this case

$$V=c \tag{2.6}$$

This fact is coordinated to (1.10). It is necessary to emphasize that just force is essential in order to active a certain velocity and not force impulse for example. Multiplier depending on t in (2.2) grows quickly with t growing and aims for a certain constant depending on U. Therefore long action with constant force rather quickly leads (2.2) solution to expression (1.10). The velocity becomes constant. Therefor big impulse enlarges the covered track but does not guarantee velocity enlargement. This is also true with respect to energy spared for electron's acceleration: its gradient is essential but not produced work.

Let us investigate some examples which explain the result we received. Previously adduce some author's evaluations in his paper [1]: electron's charge $q=7{,}3\cdot10^{-10}$ кг/с which implies $q/m=\omega=8{,}1\cdot10^{20}$ Hz, i.e. q/m is angular velocity of mass creating electron.

Example 1

Let $1-2F/qc=1/4$, i.e. $F=3/8\,qc=0{,}082$ Newton per electron. Then

$$V = \frac{4\cdot 0{,}041\cdot 10^{10}\left[e^{\omega t}-1\right]}{7{,}3\left[3e^{\omega t-1}\right]} \approx 1{,}5\cdot 10^{8}\ \text{m/s}.$$

Example 2

Let $1-2F/qc = 0{,}0137$, i.e. $F = 0{,}108$ Newton per electron. Then

$V \approx 2{,}06\cdot 10^{8}\ \text{m/s}$.

Example 3

Let $1-2F/qc = 10^{-6}$ i.e. $V = 0{,}10948$ Newton per electron. Then

$V = 2{,}99\cdot 10^{8}\ \text{m/s}$.

When $F = 0{,}1095$ Newton per electron it actives light velocity.

Force root in the proposed theory is in a certain sense analogous to relativistic root. But it differs at least in one essential aspects: its equality to zero does not lead to physically absurd infinities. And design change in it just change character of its movement as we see below.

3. Case $1-2F/qc < 0$

In this case (1.10) equality does not posses real solutions, i.e. there is not exist conserving force for any initial velocity V_0. Nevertheless (1.7) equation has a solution. Its left hand part

$$\int_{V_0}^{V}\frac{dV}{a+bV+pV^2} = \frac{2}{\sqrt{4ap-b^2}}\operatorname{arctg}\frac{2pV+b}{\sqrt{4ap-b^2}}\Bigg|_{V_0}^{V} \tag{3.1}$$

One gets after corresponding transformations

$$\frac{c\sqrt{2F/qc-1}\,(V-V_0)}{c^2(2F/qc-1)+(V-c)\cdot(V_0-c)} = \operatorname{tg}\left(\frac{q\sqrt{2F/qc-1}}{2m}(t-t_0)\right) \tag{3.2}$$

Hence

$$V = \frac{\left[2Fc/q - cV_0\right]\operatorname{tg}\left(\frac{q\sqrt{2F/qc-1}}{2m}(t-t_0)\right) + cV_0\sqrt{2F/qc-1}}{\left[c\sqrt{2F/qc-1} - (V_0-c)\operatorname{tg}\left(\frac{q\sqrt{2F/qc-1}}{2m}(t-t_0)\right)\right]} \tag{3.3}$$

If $V_0 = 0$, $t_0 = 0$, then

$$V = \frac{2F\operatorname{tg}\left(\frac{q\sqrt{2F/qc-1}}{2m}t\right)}{q\left[\sqrt{2F/qc-1} + \operatorname{tg}\left(\frac{q\sqrt{2F/qc-1}}{2m}t\right)\right]} \tag{3.4}$$

Superlight velocity V oscillate around medium velocity

$$U = 2F/q.$$

If $V_0 = c$, $t_0 = 0$ then

$$V = c + c\sqrt{2F/qc-1}\,\operatorname{tg}\left(\frac{q\sqrt{2F/qc-1}}{2m}t\right) \tag{3.5}$$

Velocity oscillate around light velocity. Discontinuity points corresponds the moments of radiation, i.e. superlight electron radiates in velocity direction. This fact explains widely known Cherenkov's effect.

If force root is equal to zero, i.e. $u = c$ then (3.3) implies $V = c$.

This means that sublight and superlight velocities are coordinated when light barrier is overcome.

4. Example. Kaufman experiment.

One of the first experiments which later became experimental cornerstone for relativity theory (RT) was Kaufman experiment on electrons deviation in perpendicular electric and magnetic fields. Nonparabolic character of such deviation was unexplainable because theory predicted just such deviation. The way out was found in supposition that electron's mass was enlarging with its velocity growing. Later on Einstein spread this supposition also on electrically neutral bodies movement.

It is shown below that its genune reason is inaccuracy of to-day electrodynamics and theory of electrons' movement (details of generalized electrodynamical theory may be found in the author's papers [4] and [5]).

Let us remind the problem. To-day electrodynamics predicts only Coulomb force acting on a charge moving in a capacitor parallel to its plates. If so then it can be shown that a charge moving along x_2 axis is deviated along x_1 axis

$$x_1 = \alpha \frac{q}{mV^2} \tag{4.1}$$

If a solenoid magnetic field is directed parallel to electric one then the charge is simultaneously deviated along x_3 axis:

$$x_3 = \beta \frac{q}{mV} \tag{4.2}$$

α and β here are the device constants.

Hence

$$\frac{x_3^2}{x_1} = \frac{\alpha^2 q}{\beta m} \tag{4.3}$$

If $q/m = \mathrm{const}$ then (4.3) defines a parabola and is independent with respect to charge velocity. But Kaufman's experiment shows that this fraction is not constant and decreases with the charge velocity increase. The way out was found in special relativity theory (SRT) framework. It was supposed that the charge mass (and later on it was supposed that any mass) depends on velocity in the following way

$$m = \frac{m_0}{\sqrt{1 - V^2/c^2}} \tag{4.4}$$

(4.3) and (4.4) together imply:

$$\frac{x_3^2}{x_1} = \frac{\alpha^2 q \sqrt{1 - V^2/c^2}}{\beta m_0} \tag{4.5}$$

This is a steadily decreasing function with respect to V. It achieves its maximum when V=0 and its minimum is equal to 0 when V=c. This fact looks strange because V is a multiplier in solenoid magnetic force formula. Therefore this fraction numerator can be done litlle if velocity V is picked up small enough. Meanwhile its denominator is constant. In other terms physical reasoning leads us to the conclusion that this fraction should be zero when V is zero. But this contradicts (4.5).

This paper author proposed generalized dynamics equations in paper [4]. One can find its digest in paper [5]. It is shown there that an additional force depending on velocity acts on a charge moving in a capacitor. One gets using generalized dynamics equations and the results of previous section insted of (4.3):

$$\frac{x_3}{x_1} = \frac{1 - \sqrt{1 - \alpha_1 V_2 V/c^2}}{1 - \sqrt{1 - \alpha_1 \left(1 + 2V^2/3c^2\right)}} \tag{4.6}$$

Here α_1 is a constant constructed of the device and universe constants, V_2 is electron's velocity in solenoid. This fraction is equal to zero when V=0. It increases at the interval $[0, V_2)$, achives its maximum when $V=V_2$ and decreases at the interval $(V_2, c]$ up to nonzero value

$$\frac{1 - \sqrt{1 - \alpha_1 V_2/c}}{1 - \sqrt{1 - \alpha_1 (1 + 2/3)}} \tag{4.7}$$

Conclusion. Let us summarize our argue.

Electron movement in a medium a model of is proposed. This medium is assumed to fill the space. A priory no quality is prescribed to it. We find out this qualities by its action on a moving object. Aether do not act on a massive body moving in it steadily (the first Newton law). This means for us that this medium acts on a mass as a tough liquid (Euler paradox). Only accelerated movement needs force.

But electron experiences certain drag already when moving steadily. In accordance to the author concept (paper [1]) this is because electron is a thoroid made of a rotating mass. Mathematically this means that electron is a derivative of this mass with respect to time. Or in the other way: steadily moving electron is an accelerated mass. And ether resists such acceleration.

The received differential equation has solution which describes not only subluminal but also superluminal movement.

Cherenkov's effect and Kaufman's experiment explanation is proposed as examples. The number of such examples could be enlarged.

References.

[1] J. G. Klyushin. On the Maxwell approach to gravity. St. Peterburg, Russia, 1995.

[2] J. G. Klyushin. Mechanical dimensions for electrodynamical quantities. Galilean electrodynamics. V.11, №5, 2000, is to appear.

[3] E. Kamke. Differentialyleichungen Sosungsmethoden und Sosungen, Seipzig, 1959.

[4] J. G. Klyushin. A field generalization for Lorentz force formula. Galilean Electrodynamics, V11, №3, 2000.

[5] J. G. Klyushin. Generalized dynamics aboutforces acting on a charge moving in capacitor and solenoid. The international Congress-2000.
Fundamental problems of Natural Sciences and Engineering. Proceedings, St. Peterburg, 2000.