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REVIEW AND APPLICATIONS OF SOLAR MODULES DEVELOPED AND PRODUCED BY VIESH

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The article presents review of the applications of solar modules and the solar modules themselves that are currently developed, researched and produced by VIESH.

It considers planar solar modules manufactured by the technology of lamination of photovoltaic cells, as well as of their filling with encapsulant in the form of two-component polysiloxane organosilicon gel which increases light-blocking, thermal and electro insulating resistance of a solar module; improves output electrical parameters and the term of nominal power twice (from 20 to 40-50 years). While using gel, one should consider its high adhesion to photovoltaic cells, glass and most other materials; reduced optical loss in encapsulating layers; zero corrosive effect on photovoltaic cells; the possibility of modules application in systems with solar concentrators and their ecological safety. The article also considers folding solar modules made at the Institute, and presents their characteristics. Under the contract with a company from the Krasnodar region VIESH is also developing tiles with solar cells and improved design. It considers matrix solar modules with over 1 000 V voltage and longer term of nominal power that are able to work with solar concentrators of various design, thus raising efficiency of matrix solar photovoltaic cells. Comparison of various characteristics of planar solar modules with matrix modules is given. Various concentrator modules in combination with matrix solar cells making it possible to produce warm working body at the output of a solar module (thermal photovoltaic module) are considered. Alongside with concentrator solar modules the article presents review of thermal photovoltaic cells without concentrators (hybrid solar collectors) that are actively developed at the Institute. Conventional solar collectors with cheaper, simplified and lighter design, which could of interest, first and foremost, to cottagers, gardeners and farmers from spring to autumn. On the basis of all the above-said it may be concluded that each type of solar modules developed and produced by VIESH can find application in various branches of energetics, architecture, transport, etc. Considering permanent growth of energy supply tariffs and decreasing prices for solar modules and collectors, transition to the use of solar energy converters and collectors is inevitable from economic considerations.

Keywords: Solar modules, electric transport, stand-alone power supply, matrix solar cells, organosilicon compound, encapsulating, lamination, solar tiles, thermal photovoltaic modules, hybrid solar collectors, solar concentrators.

In contemporary world, alongside with deterioration of environmental situation, you can't fail to notice continuous growth of prices for heat and electric energy. There are branches where independent electric power supply sources are in high demand, and in some cases they play a decisive role

for normal functioning. Of utmost importance are such branches of solar energy application as:

1. Facilities without permanent heat supply or having difficulties with heat supply and prices (small industrial enterprises, remote independent energy consumers, etc.) (Fig. 1).



Fig. 1. Small-scale power plants supplying electric energy to self-contained facilities



Fig. 2. Means of transport where solar cells are used



Fig. 3. Battery chargers for various devices

2. Architectural and energy-saving solutions in construction (the use of solar modules at buildings facades and roofs, various sheds and slates are solving not only architectural problems but also financial ones reducing the amount of bought electric energy).

3. Land, water and air transport (velomobiles, motorbikes, automobiles, boats, sailboats, cutters, gliders, airplanes, spaceships, satellites) (Fig. 2).

4. Tourism and defense industries where compact and light chargers for various electronic devices in the field are required (folding chargers of varied capacity and sizes meet requirements of different consumers) (Fig. 3).

5. Ecological settlements currently becoming more and more popular, where special attention is given to the use of renewable energy sources and non-renewable fossil fuels and coal, gas and oil

products are rejected from an environmental, ethical and economical considerations (Kitezha (the Kaluga region), Grishino (the Podporozh'ye region), Nevoecovill (the Sortaval region), Tiberkul (the Kuragino region), Kovcheg (the Kaluga region), the Schetin school (the Krasnodar region), Bolshoi Kamen (9- km to the North of Vologda), the Muravyevsky park of sustainable natural management (the Tambove region), Tiberkul (the Krasnoyarsk region) and many others [1].

The All-Russian Research Institute for Electrification of Agriculture (VIESH) has for decades been developing, making and researching solar photovoltaic modules of moderate capacity (up to 100 W) (Fig. 4, 6, 7), and modules of higher capacity (over 100 W) using one-sided and double-sided solar cells (Fig. 5).

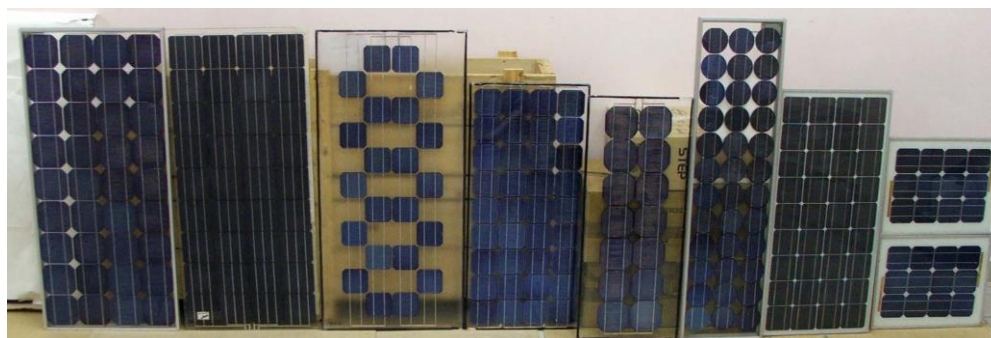


Fig. 4. Samples of moderate capacity solar cells developed and fabricated at VIESH

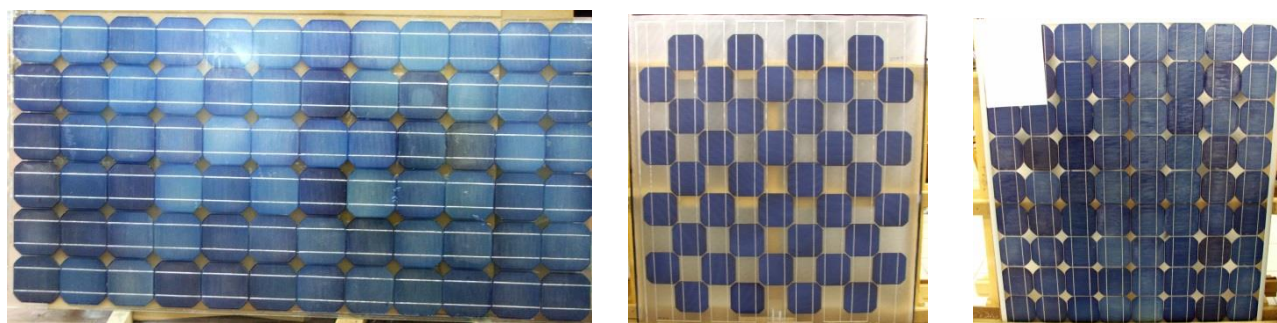


Fig. 5. Samples of solar modules with increased capacity

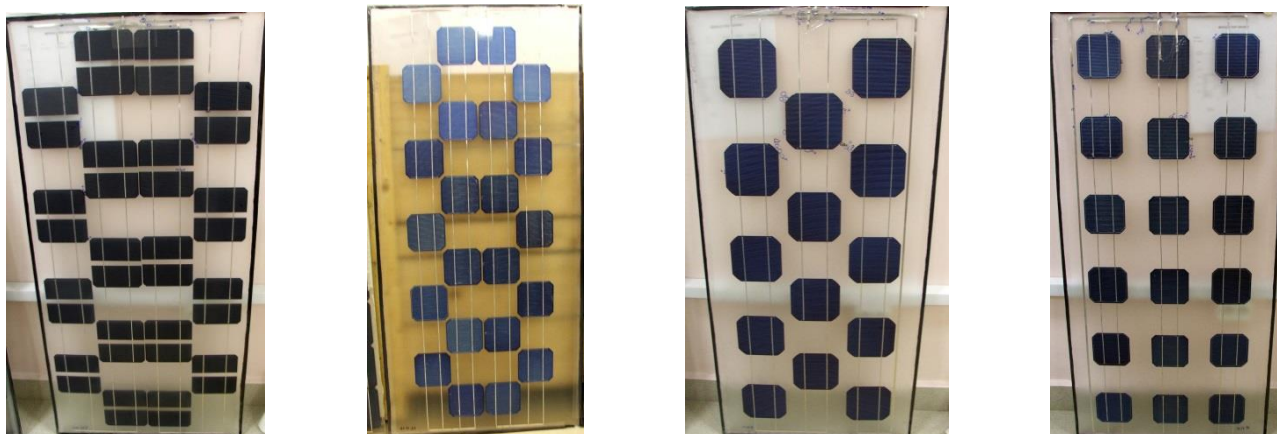


Fig. 6. Solar modules for various architectural solutions and design

As Fig. 4 demonstrates, modules are made of solar cells of varied form (pseudosquare, square and circle) and sizes ((100 mm and 125 mm). Both one-sided and two-sided cells are used, the latter for illuminating both sides and increasing output electrical capacity. Unusual configuration of solar cells makes it possible to create various ornaments (Fig. 6) that can attach individuality to architectural solutions (roofing, sheds, etc.). Alongside with tempered glass with low iron content (Fig. 5 to the left) special tempered glass with reduced reflection coefficient (matt-surfaced) are used, thus increasing output capacity through reduction of optical losses (Fig 5 at the center and Fig. 6 to the right).

In modules design instead of conventional low-molecular siloxane rubber filler or film on the basis of ethylene with vinyl acetate, low modulus polysiloxane two-component compound is used [2, 3]. Due to the use of filler, light-, thermal and electroinsulating resistance of a solar module is increased and its output electrical parameters and term of nominal capacity are raised twice (from 20 to 40-50 years). It is also important to note high adhesion of polysiloxane compound to photovoltaic cells, glass and other materials, reduced optical losses in encapsulating layers; zero corrosive effect

on photovoltaic cells; the possibility to apply modules in systems with solar concentrators, as well as their ecological safety [4].

VIESH has developed the technology and the device for filling two-component polysiloxane compound into glass units with photovoltaic cells that makes possible serial production of solar modules. Modules for architectural solutions are also fabricated with the use of this compound (Fig. 6). Alongside with protection from direct solar radiation, such modules allow to generate electric energy as well, thus reducing costs for electricity supply or providing operation independence. In comparison with standard solar modules, such solutions allow to diversify buildings exterior due to pattern, color and transparency.

Table 1 presents characteristics of encapsulated and laminated solar modules.

While fabricating solar modules in GNU VIESH, the process of laminating photocells is used (Fig. 4 to the left and Fig. 7, 8). On the basis of laminated modules, folding compact solar modules for electricity supply to electric equipment and charging batteries in the field, are fabricated (Fig. 7). Modules are assembled of sections whose number varies from one to six and more, depending on

Table 1

Characteristics of encapsulated and laminated solar modules

Length, m; Width, m; Thickness, mm	0.8 – 1.6; 0.3 – 1.1; 7 – 38
Off-load voltage, V	8 – 36
SC current, A	3.2 – 5.1
Capacity, W	19 – 165
Efficiency of photo transformation, %	10 – 14
Guarantee term of nominal capacity, years	15 – 40
Material of the module front side	Tempered glass optiwhite (3 – 4 mm)
Material of the module back side	Glass; film material
Manufacturing method	Lamination; pouring of filler
Filler	Polysiloxane compound; polymer film
Cost of 1W of nominal capacity, c.u.	1.75 – 2.75
	Electric power supply, electric transport, architecture

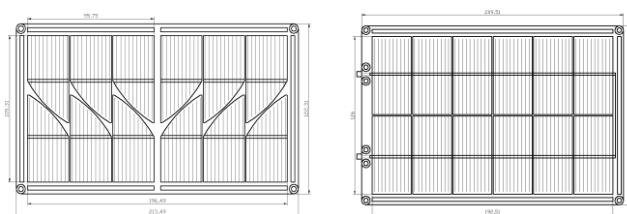


Fig. 7. Compact folding solar modules made with the use of lamination technology
(in the middle there is a folding module with USB interface (5 V, 0.5 A) and a sectional module to the right)

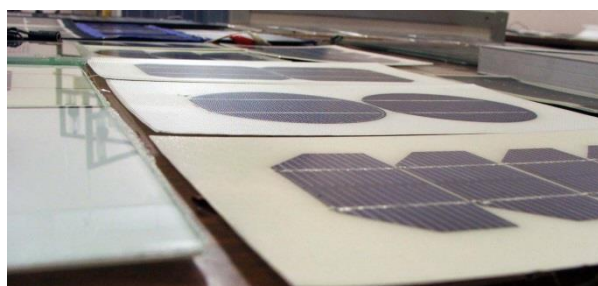


Fig. 8. Flexible solar modules with light design

required voltage and capacity [5, 6]. For electricity supply to electric equipment with USB standard (5 V; 0.5 A) a compact two-fold module with 10x10 cm size and an increasing voltage stabilizer allowing to charge devices even in cloudy weather are used (Fig. 7, the center). Fig. 7 presents various solar modules designed for charging electric devices with supply voltage from 6 to 12 V and

more. For unification and standardization of chargers a sectional solar module with output parameters equal to output parameters of the USB interface (Fig. 7, to the right) has been developed, thus providing connection of a required number of such modules, that increases voltage, current or the both parameters up to the adequate level of consumer electricity supply.



Fig. 9. Architectural solutions with the use of planar solar cells

Table 2

Characteristics of laminated folding solar modules

Length, m; Width, m; Thickness, mm	0. – 0.9; 0.1 – 0.4; 0.5 – 20
Off-load voltage, V	0.5 – 18
SC current, A	0.4 – 5.1
Capacity, W	0.15 – 75
Efficiency of photo transformation, %	9 – 14
Guarantee term of nominal capacity, years	5 – 15
Material of the module front side	Optically transparent film
Material of the module back side	Film coating
Manufacturing method	Lamination
Filler	Polymer film
Cost of 1W of nominal capacity, c.u.	2.5 – 3.75
Areas of application	Electrical transport, Stand-alone electric power supply

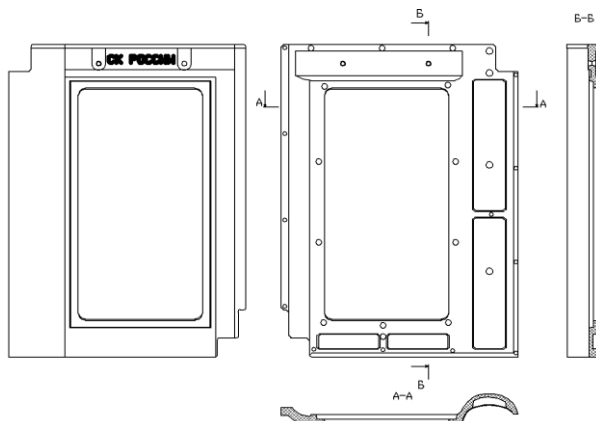


Fig. 10. Design of the solar tile base

Folding modules for complicated field conditions made of monocrystalline silicon, are equipped with rigid frame or a case in order to prevent cells failures. However, in less severe conditions laminated modules provide flexibility, simplicity and compactness required for electrical transport vehicles (water transport, velo- and electric vehicles, air drones). Such parameters are characteristic of solar modules made with the use of the lamination technology but without strengthening frames and cases (Fig. 7 to the right and Fig. 8).

Alongside with conventional planar modules (Fig. 9 to the left) in architectural solutions solar modules embedded into roof covering (solar tiles) are also used [7] (Fig. 9 in the center and to the right).

In order to save silicon, we suggested the solar tiles design with cylindrical parabolic concentrators (Fig. 10). We have prepared two patents for new design, and are planning to sell the developed tiles in the Krasnodar region under a contract with the Inovatiks company [8].

VIESH is also developing solutions to raise efficiency of high-voltage matrix solar modules that have been researched by the Institute specialists for decades [9]. The two-sided matrix solar module (Fig. 11) is designed for developing DC high-voltage solar power plants (over 1 000 V). Such high voltage allows to use modules with transformerless inverters and to connect them to high-voltage DC lines with 110-500 kW voltage without converter substations.

This approach efficiency is evident while using matrix modules with concentrators [10], especially in comparison with planar modules (with similar capacity). The 0.7 m matrix solar module has 900 V operating voltage. The converter

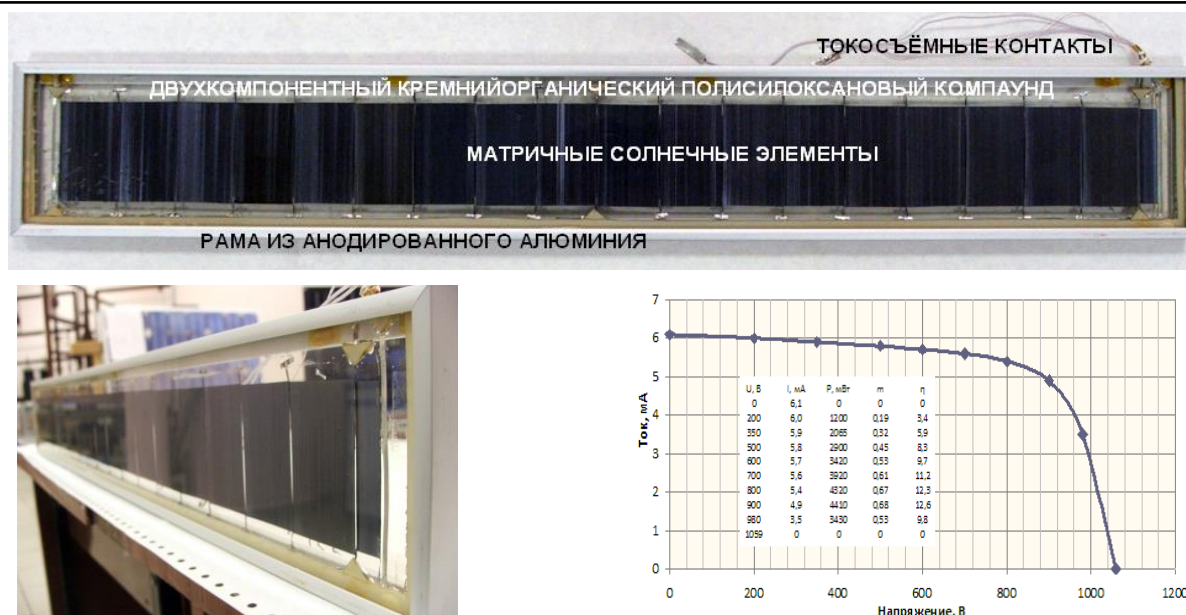


Fig. 11. High-voltage matrix solar module and its volt-ampere characteristics

Table 3

Comparison of characteristics of planar and high-voltage solar modules [9]

Parameter	High-voltage solar module	Planar solar module
Voltage, V	750	12 – 24
Guarantee term of nominal capacity, years	40 – 50	20 – 25
Average efficiency at 1 kW/m ² , solar radiation, 1.5 AM spectrum and temperature 25 °C, %	12 – 14	15,1
Efficiency at concentrated solar radiation of 100 kW/m ² , spectrum AM 1.5 and temperature 25 °C, %	18 – 20	1

substations cost amounts to 30% of solar power plants. To obtain 900 V operating voltage with the use of conventional planar solar modules it would be necessary to connect in series over 1 500 planar solar cells with 150x150 mm size [9].

Comparison of characteristics of conventional foreign planar and high-voltage matrix solar modules made of monocrystalline silicon, is given in the Table 3.

Matrix solar modules have two-side working surface. Due to solar radiation reflection to the back surface, electric capacity and efficiency are increased and this fact should be considered while comparing planar and high-voltage solar modules.

Matrix modules have twice the service life (40-50 years) (in comparison with foreign planar solar modules), 18-20% efficiency at 50-200-fold concentration and such efficiency remains constant as temperature increases up to 60° C, which makes the system of cooling modules simpler, and the module current grows in proportion to concentration [9].

For photoreceivers on the basis of matrix modules we have developed original solar concentrators of cylindrical parabolic and paraboloid types [11, 12], whose surface profile provides uniform illumination of the photoreceiver surface (Fig. 12).

Due to uniform 8-fold concentration obtained with the use of a paraboloid concentrator with a special profile, installed at the side of a cylindrical photoreceiver with matrix photovoltaic converter (Fig. 12, to the right), the use of solar tracing systems and systems for cooling photocells by transfer fluid, electric power generation was increased in comparison with stationary planar photovoltaic modules fabricated in an industrial scale. In addition, when heating the upper part of the cylindrical photoreceiver of the second concentrator, transfer fluid temperature at the output amounts to 42 – 25 °C while its consumption is 0.5 – 1.5 kg/hour [13, 14].

When using solar power plants with concentrators, we should notice such positive aspects, as saving of solar-grade silicon; consumer can get both electric and heat energy, so the total cost of installed

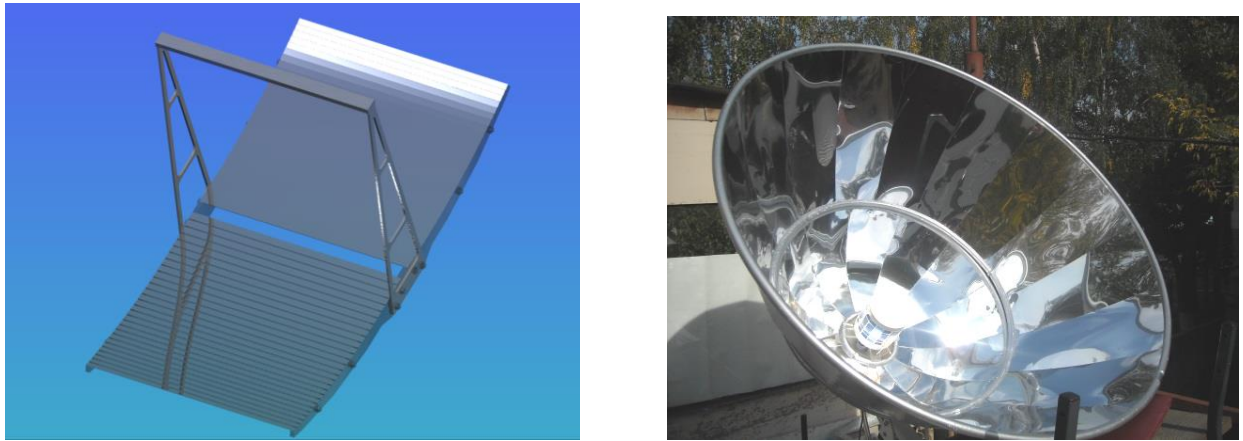


Fig. 12. Solar modules with concentrators of cylindrical parabolic (to the left) and paraboloid (to the right) types with uniform illumination of the photoreceiver on the basis of the high-voltage matrix module

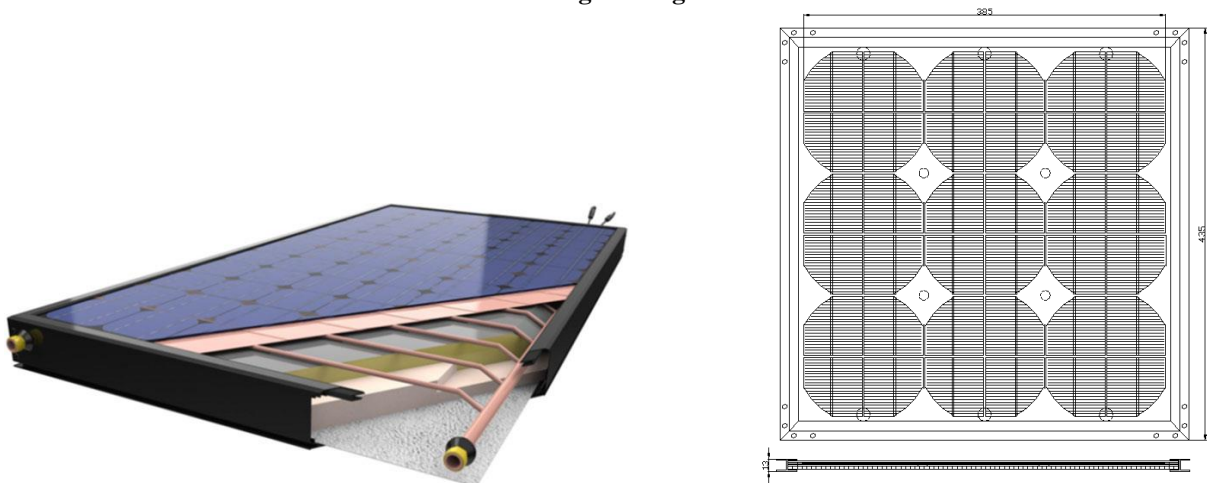


Fig. 13. Thermal photovoltaic module VOLTHER [16] (a hybrid solar collector) (to the left), and the one developed by GNU VIESH (to the right)

capacity is reduced due to summation of these factors; the cosine effect is considered, which is characteristic of solar plants not equipped with solar tracking systems. All this increases generated energy by 25-30% in comparison with stationary modules without sun tracking systems [9].

In addition to electric power generation, planar solar modules can heat coolant or passing air. Due to such solution, solar cells efficiency is raised, while their temperature remains consistently low (20 - 30 °C) even on hot sunny days. In addition to electric power, consumers receive hot water and other technical fuels or air, that can be used for domestic needs or other thermal processes. Cogeneration of electricity and heat will make it possible to increase annual electric power generation and at the same time receive hot working body at the output (Fig. 13) [15, 16]. In snowy season pumped hot working body will cause melting of snow accumulating on the solar cells surface (depending on the modules tilt angle). Temperature optimization of solar cells and heat car-

rier in a required range is possible through modifying heat carrier consumption.

The laboratory is developing thermal photovoltaic module without a concentrator (a hybrid collector) on the basis of planar solar cells (Fig. 13, to the right). Its design is specified by calculating thermal modes of solar cells and heat carrier (heat carrier amount and consumption) with the use of the Ansys software for finite element analysis [17].

Alongside with hybrid collectors, the Institute develops solar collectors with the use of components of home manufacture, simplified design and improved technical and economical parameters to be applied at cottages, gardens and farms from spring to autumn. These modules are characterized by a minimal number of components, low weight, simplicity of design and use, as well as low cost of the module, which is extremely important for final consumers (cottagers, gardeners and farmers).

Each type of solar modules depicted above finds its application in various branches of energet-

ics, architecture, transport, etc., though its most promising application seems to be energy supply to independent energy consumers and complexes. Permanent growth of tariffs for energy supply and decrease of prices for solar modules and collectors entails gradual transition to converters of renewable energy, particularly, solar energy, is inevitable due to economical considerations.

References

1. Analitichesky obzor jekologicheskikh poseleniy Rossii. Issledovatel'skaja gruppa TSIRKON. [State-of-the-art review of the ecological settlements of Russia. Research ZIRCON group]. – Moscow: Zircon, 2012. C. 20 – 26. (In Russian).
2. Patent Russian Federation No. 2284075. MPK H01L31/042. Solar photo-electric module and way of its production / Persits I.S., Potapov V.N., Strebkov D.S., Chekhunina G.S. Demand: 2005117015/28, 03.06.2005, it is published: 20.09.2006.
3. Patent Russian Federation No. 2431786. MPK F24J2/00 F24J2/05 F24J2/46. Solar photo-electric module and way of its production / Persits I.S., Strebkov D.S., Chekhunina G.S., Teals A.V., Poulek V. Demand: 2010108966/06, 11.03.2010, it is published: 20.10.2011.
4. Effective technologies of power supply with use of renewable power. Perspective energy saving technologies of agricultural production. Catalog of investment projects. Moscow: VIESH, 2012. Page 12 – 13.
5. Patent Russian Federation for useful model No. 45561. MPK H01L31/00. I.S. folding photo-electric module / Persits I.S., Potapov V.N., Strebkov D.S., Chekhunina G.C. Demand: 2004131986/22, 05.11.2004, it is published: 10.05.2005.
6. The certificate of the Russian Federation on useful model No. 37433. MPK H01L31/00. Module photo-electric / Persits I.S., Potapov V.N., Strebkov D.S. Заяв: 2003134483/20, 28.11.2003, it is published: 20.04.2004.
7. Krovel'noe pokrytie krysh – solnechnaya cherepitsa. [A roofing covering of roofs – a solar tile. Zhejiang Heda Solar Technology. <http://www.hdszj.com>
8. Jenergosberegienie i jenergoeffektivnost na osnove primenenija innovacionnykh stroitel'nykh materialov i novykh tehnologij – OOO Innovatiks. [Energy saving and energy efficiency on the basis of use of innovative construction materials and new technologies – OOO Innovatiks] <http://www.innovatiks.ru/>
9. Strebkov D.S., Polyakov V.I., Panchenko V.A. Issledovanie vysokovol'tnykh solnechnykh kremnievych modulej [Research of high-voltage solar silicon modules] // ISJAE, 2013, No. 6/2.
10. Strebkov D.S., Majorov V.A., Panchenko V.A., Osmakov M.I., Bad S.A. Solnechnaja ustanovka s matrichnumi fotoelementami i koncentratorom [Solar installation with matrix photo cells and the concentrator] // Electro, 2013, No. 2, S. 50-52
11. Panchenko V.A., Majorov V.A. Izgotovlenie i issledovanie sostavnogo parabolotoricheskogo koncentratora solnechnogo izluchenija dlja razlichnykh preobrazovatelej solnechnoj jenerгии [Production and research of the compound parabolotoroid concentrator of sunlight for various converters of solar energy] // Proceedings of the 8th International scientific and technical conference, on May 17-18, 2012, Moscow, VIESH, 2012, Part 4, S. 89-94.
12. Majorov V.A., Panchenko V.A. Issledovanie parabolotoricheskogo koncentratora v ustanovke s solnechnymi jelementami [Research of the parabolotoricheskij concentrator in installation with solar elements] // Materials of the eighth All-Russian scientific youth school with the international participation (20-23.11.2012, Moscow, MSU). Renewables, 2012. Page 284-289.
13. Strebkov D.S., Majorov V.A., Panchenko V.A. Solnechnyj teplo-fotoelektricheskij modul s parabolotoricheskim koncentratorom [The solar warm and photo-electric module with the parabolotoroid concentrator] // Alternative power engineering and ecology, 2013, No. 1/2, S. 35-39.
14. Patent Russian Federation for useful model No. 132258. The Teplo-fotoelektricheskij module with a parabolotoricheskij concentrate of sunlight / Majorov V.A., Panchenko V.A., Trushevsky S.N., Demand: 2012154821/06, 18.12.2012. It is published: 10.09.2013.
15. Hybrid solar collector. Pavel Sevela, Byorn Olesen – <http://www.zvt.abok.ru/articles/106/> Gibriddnii_solnechnii_kollektor
16. Heatphoto-electric solar modules (hybrid solar collectors) Solimpeks. Volther Hybrid PV-T Panels. <http://www.solimpeks.com>
17. Program complex of the final and element analysis Ansys – www.ansys.com

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EFFECT OF MAGNETIC FIELD ON ION TRANSPORT IN PLANT CELLS

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It is currently believed that transport of nutrients into the cell involves two autonomous mechanisms – passive movement of substances along electrochemical gradient and their active transport against electrochemical gradient. Since ions are electrically charged, their distribution between the cell and its environment is defined both by potential difference and concentration difference. These two values are commonly designated as electrochemical gradient.

If a membrane is placed between solutions with different ions concentration, diffusion potential emerges, whose value is determined by the Henderson equation. Under the effect of diffusion potential, ions start ordered motion generating electric current.

Under the effect of magnetic field on plant cells, direction of speed vector is changed while membrane pores area and degree of electrolytic dissociation are increased. This increases the current flowing through the cell membrane. The current strength depends on diffusion potential, and the magnitude of the gradient of magnetic induction and velocity of the seeds in magnetic field.

This leads to change of concentration of mineral elements that enter plant cells. An analytical expression that correlates the change in concentration of mineral elements with magnetic field parameters, was established

It has been found that change in concentration of mineral elements depends on diffusion potential gradient and the magnitude of magnetic induction, as well as speed of seeds in magnetic field.

This implies that increasing the concentration of mineral substances involved in chemical reactions, thus increasing their speed.

Keywords: magnetic field, magnetic induction, magnetic field gradient, ion velocity, ion concentration.

Pre-sowing treatment of seeds makes it possible to raise agricultural crops yield, to reduce plant disease incidence and increase agricultural products quality.

To implement the technology of magnetic treatment of seeds it is necessary to reveal the mechanism of magnetic field effect on seeds, which will allow to determine optimal modes of processing. For this purpose it is necessary to research effect of magnetic field on ions transport in plant cells.

It is currently believed that transport of nutrients into the cell involves two autonomous mechanisms – passive movement of substances along electrochemical gradient and their active transport against electrochemical gradient. Since ions are electrically charged, their distribution between the cell and its environment is defined both by potential difference and concentration difference. These two values are commonly designated as electrochemical gradient.

If a membrane is placed between solutions with different ions concentration, diffusion potential emerges, whose value is determined by the Henderson equation [1]:

$$\varphi = \frac{RT}{F} \frac{(U_1 - V_1) - (U_2 - V_2)}{(U'_1 - V'_1) - (U'_2 - V'_2)} \ln \frac{U'_1 + V'_1}{U'_2 + V'_2}, \quad (1)$$

where R is universal gas constant, J/mole·K; T – solution temperature, K; F – the Faraday number, C/mole;

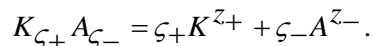
$$U_{1(2)} = \Sigma(C_+ v_+)_{1(2)}; V_{1(2)} = \Sigma(C_- v_-)_{1(2)};$$

$$U'_{1(2)} = \Sigma(C_+ z_+ v_+)_{1(2)}; V'_{1(2)} = \Sigma(C_- z_- v_-)_{1(2)};$$

where C_+ , C_- – concentrations of cations and anions correspondingly, mole/m³; v_+ , v_- – velocity of cations and anions movement, m/sec; z_+ , z_- – valence of cations and anions; index 1 refers to ions in solution 1, index 2 – in solution 2.

Diffusion potential is responsible for ion movement through phospholipid membranes in plant cells.

Ions are formed in the process of salts and acids dissociation due to chemical reaction:



In the process of dissociation one molecule produces ζ_+ cations with valence z_+ and ζ_- with va-

lence z_- . Let us denote the product of these values by β :

$$\beta = \zeta_+ z_+ = \xi_- z_- \quad (2)$$

Part of molecules that have been broken down to ions, is determined by the degree of electrolytic dissociation [2, 3]:

$$\alpha = \frac{n}{N_a C} \quad (3)$$

where n – number of molecules having broken into ions; N_a – Avogadro's number, molecules/mole; C – molar concentration of substance, mole/l.

Under the effect of diffusion potential, ions start ordered motion generating electric current I . Current intensity is equal to the total charge of positive and negative ions passing through the membrane pores per unit time.

It is the ions that are at the distance not exceeding their motion speed, notably in the volume $v_i a^2$, that will pass through the membrane per unit time. Then current intensity will amount to:

$$I = \sum_{i=1}^k (n_{i+} a^2 v_{i+} z_{i+} e + n_{i-} a^2 v_{i-} z_{i-} e), \quad (4)$$

where e – elementary charge, C.

When in motion, ions are affected by forces of electric field F_e , friction F_m and interaction between ions and solvent molecules F_{θ} [2]. In accordance with the Newton's second law we get:

$$m_i \frac{dv_i}{dt} = F_{ei} - F_{mi} - F_{\theta i}, \quad (5)$$

where m_i – ion mass, kg.

Electric field strength is determined by the formula [2]:

$$F_{ei} = z_i e E = z_i e \text{grad} \varphi. \quad (6)$$

Forces of friction and interaction among ions are directly proportional to speed [2]:

$$F_{mi} = k_{mi} v_i; \quad (7)$$

$$F_{\theta i} = k_{\theta i} v_i, \quad (8)$$

where k_m и k_{θ} – coefficients of friction and ions interaction, N·c/m, correspondingly.

Inserting (6), (7), (8) into the equation (5), we get:

$$m_i \frac{dv_i}{dt} = z_i e \text{grad} \varphi - k_{mi} v_i - k_{\theta i} v_i. \quad (9)$$

Having solved (9), we obtain the equation of ion motion:

$$v_i = \frac{z_i e \text{grad} \varphi}{k_{mi} + k_{\theta i}} \left(1 - e^{-\frac{k_{mi} + k_{\theta i}}{m_i} t} \right). \quad (10)$$

As coefficients of friction and ions interaction by far exceed ion mass, we can neglect the value

$e^{-\frac{k_{mi} + k_{\theta i}}{m_i} t}$ [2] and consider that ion is moving with uniform speed

$$v_i = \frac{z_i e \text{grad} \varphi}{k_{mi} + k_{\theta i}}. \quad (11)$$

At $\text{grad} \varphi = 1$ V/m and $k_{\theta i} = 0$, ion is moving with absolute speed [2]:

$$v_i^0 = \frac{z_i e}{k_{mi}}. \quad (12)$$

Interaction between ions and molecules can be considered with the use of electric conductivity coefficient:

$$f_i = \frac{k_{mi}}{k_{mi} + k_{\theta i}}. \quad (13)$$

Then speed of ion movement will be defined by the expression:

$$v_i = v_i^0 f_i \text{grad} \varphi. \quad (14)$$

Substituting the expression for speed of ion motion (14) in the equation (4), we shall obtain:

$$I = \sum_{i=1}^k (n_{i+} a^2 v_{i+}^0 f_{i+} z_{i+} e \text{grad} \varphi + n_{i-} a^2 v_{i-}^0 f_{i-} z_{i-} e \text{grad} \varphi). \quad (15)$$

As the Faraday number is determined by the expression

$$F = e N_a, \quad (16)$$

the formula (15) can be written in the following form:

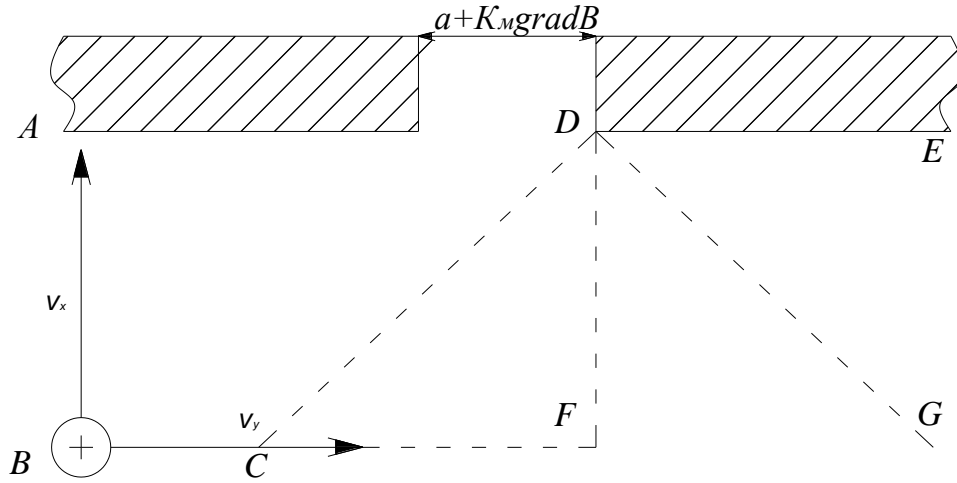


Fig. 1. The diagram of ions motion through the membrane

$$I = \frac{a^2 F \text{grad} \varphi}{N_a} \times \sum_{i=1}^k (n_{i+} v_{i+}^0 f_{i+} z_{i+} + n_{i-} v_{i-}^0 f_{i-} z_{i-}). \quad (17)$$

In the process of dissociation one molecule produces ζ_+ cations and ζ_- anions, therefore

$$n_{i+} = \zeta_+ n_i; \quad n_{i-} = \zeta_- n_i. \quad (18)$$

Substituting the expression (18) into the membrane pores area and degree of electrolytic dissociation are increased.

When in motion, ions are affected by forces of electric field F_e , friction F_m , interaction between ions and solvent molecules F_{π} and Lorentz force $F_{\mathcal{L}}$. In accordance with the Newton's second law of thermodynamics for normal velocity component we get:

$$m_i \frac{dv_{xi}}{dt} = F_{ei} - F_{mi} - F_{\mathcal{L}i}, \quad (21)$$

or

$$m_i \frac{dv_{xi}}{dt} = z_i e \text{grad} \varphi - k_{mi} v_i - k_{\mathcal{L}i} v_i. \quad (22)$$

If we neglect coefficients of friction and ions interaction [2], the solution of the equation (22) will be:

$$v_{xi} = v_i^0 f_i \text{grad} \varphi. \quad (23)$$

Correspondingly, for tangential component we get:

$$m_i \frac{dv_{yi}}{dt} = F_{\pi i} - F_{mi} - F_{\mathcal{L}i}, \quad (24)$$

or

$$m_i \frac{dv_{yi}}{dt} = z_i e B v - k_{mi} v_i - k_{\mathcal{L}i} v_i. \quad (25)$$

Having solved the equation (25), we get:

$$v_{yi} = v_i^0 f_i B v. \quad (26)$$

Per unit time through membranes pores whose area will increase under magnetic field effect and will amount to $(a + K_M \text{grad} B)^2$, those ions will pass that are in the volume (Fig. 1)

$$V_1 = a S_{ABCD} = v_{xi} \cdot (a + K_M \text{grad} B)^2 + \frac{1}{2} K_{\mathcal{L}} v_{yi} (a + K_M \text{grad} B) \text{grad} \varphi, \quad (27)$$

where $K_{\mathcal{L}}$ – coefficient of proportionality between distance that ions pass and the gradient of diffusion potential, m^2/T .

Under the effect of Lorentz force, ions that are in the *CDF area* (Fig. 1), will move to the *DEG area* where concentration will increase. Therefore, it is advisable to change the direction of magnetic field action for these ions to pass the membrane. In this case ions that are in the following volume, will pass through the membrane:

$$V_2 = v_{xi} \cdot (a + K_M \text{grad} B)^2 + K_{\mathcal{L}} K_{\mathcal{L}} v_{yi} (a + K_M \text{grad} B) \text{grad} \varphi, \quad (28)$$

where $K_{\mathcal{L}}$ – coefficient considering the number of ions remaining in the *DEG area*, of their total number that have moved from the *CDF area*. In the general case coefficient $K_{\mathcal{L}}$ is in the range from 0.5 to 1.0.

Intensity of current passing through cell membrane under the effect of magnetic field will amount to:

$$I = \sum_{i=1}^k (n_{i+} v_{x_{i+}} (a + K_M \text{grad} B) \times \\ \times (a + K_M \text{grad} B + K_K K_\theta v_{y_{i+}} \text{grad} \varphi) z_{i+} e + \\ + n_{i-} v_{x_{i-}} (a + K_M \text{grad} B) \times \\ \times (a + K_M \text{grad} B + K_K K_\theta v_{y_{i-}} \text{grad} \varphi) z_{i-} e). \quad (29)$$

Substituting the expressions for component of ions motion speed (23) and (26) in the equation (29), we get:

$$I = \sum_{i=1}^k (n_{i+} v_{i+}^0 f_{i+} (a + K_M \text{grad} B) \times \\ \times (a + K_M \text{grad} B + K_K K_\theta B v) z_{i+} e \text{grad} \varphi + \\ + n_{i-} v_{i-}^0 f_{i-} (a + K_M \text{grad} B) \times \\ \times (a + K_M \text{grad} B + K_K K_\theta B v) z_{i-} e \text{grad} \varphi). \quad (30)$$

Under the effect of magnetic field concentration of mineral elements that enter plant cells, is changed. The speed of changing ions concentration will be defined by dependence following from the expression (30):

$$\frac{dn_{i2}}{dt} = n_{i1} v_{i1}^0 f_{i1} (a + K_M \text{grad} B) \times \\ \times (a + K_M \text{grad} B + K_K K_\theta B v) \text{grad} \varphi, \quad (31)$$

where n_{i2} – number of ions that have moved from the solution 1 to the solution 2.

In this case the change of ions number in the solution 2 will be:

$$\Delta n_{i2} = \int_0^{t_{o\delta p}} n_{i1} v_{i1}^0 f_{i1} (a + K_M \text{grad} B) \times \\ \times (a + K_M \text{grad} B + K_K K_\theta B v) \text{grad} \varphi dt. \quad (32)$$

If magnetic induction is changed along seeds motion trajectory, for periodic magnetic field [4]

$$\text{grad} B = \frac{2B}{\tau}, \quad (33)$$

where τ – pole pitch, m.

In this case the number of ions in plant cells will increase by the value

$$\Delta n_{i2} = n_{i1} v_{i1}^0 f_{i1} (a + \frac{2K_M B}{\tau}) \times \\ \times ((a + \frac{2K_M B}{\tau}) t_{o\delta p} + \frac{1}{2} K_K K_\theta B N_n \tau) \text{grad} \varphi, \quad (34)$$

where $t_{o\delta p}$ – time of seeds processing in magnetic field, c; N_n – number of magnetic reversals.

Considering (3) and (18) the expression (34) can be written in the following form:

$$\Delta n_{i2} = \alpha_i N_a C_{i1} v_{i1}^0 f_{i1} (a + \frac{2K_M B}{\tau}) \times \\ \times ((a + \frac{2K_M B}{\tau}) t_{o\delta p} + \frac{1}{2} K_K K_\theta B N_n \tau) \text{grad} \varphi. \quad (35)$$

Change of ions concentration in the solution 2 will be defined by the dependence:

$$\Delta C_{i2} = C_{i1} v_{i1}^0 f_{i1} (a + K_M \text{grad} B) (a + \frac{2K_M B}{\tau}) \times \\ \times ((a + \frac{2K_M B}{\tau}) t_{o\delta p} + \frac{1}{2} K_K K_\theta B N_n \tau) \text{grad} \varphi. \quad (36)$$

As the time of seeds in magnetic field is

$$t_{o\delta p} = \frac{l}{v} = \frac{N_n \tau}{v}, \quad (37)$$

where l – the path that seeds pass in magnetic field, m, the expression (36) will have the following form:

$$\Delta C_{i2} = C_{i1} v_{i1}^0 f_{i1} N_n \tau (a + \frac{2K_M B}{\tau}) \times \\ \times (\frac{a}{v} + \frac{2K_M B}{v\tau} + \frac{1}{2} K_K K_\theta B) \text{grad} \varphi. \quad (38)$$

Conclusions

Under the effect of magnetic field current passing through plant cells membranes, intensifies. Current intensity depends on diffusion potential, gradient and value of magnetic induction, as well as the speed of seeds motion in magnetic field.

This leads to increased concentration of mineral substances involved in chemical reactions, thus increasing their speed.

References

1. *Nikolsky B.P., Smirnova N.A., Panov M.Yu., etc.* Fizicheskaja khimija. Teoreticheskoe i prakticheskoe rukovodstvo [Physical chemistry. Theoretical and practical guidance] / under the editorship of Akad. B.P. Nikolskogo. – L.: Chemistry, 1987. – 880 pp.
2. *Antropov L.I.* Teoreticheskaya elektrohimiya [Theoretical electrochemistry]. – 2nd prod., reslave. and additional – M.: Vyssh. school, 1969. – 512 pp.
3. *Khmelnitsky R.V.* Fizicheskaja i kolloidnaja khimija [Physical and colloidal chemistry]. – M.: Vyssh. school, 1988. – 400 pp.
4. *Savchenko V.V.* Ustanovka dlja magnitnoy obrabotki semjan sel'skohozjajstvennyh kultur [Installation for magnetic processing of seeds of crops] // Vestnik VIESH. – 2013. – No.4(13). – P. 12 – 14.

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SUMMARY OF THE UNIFIED PHYSICAL THEORY OF SPACE-TIME, MATTER AND FIELD*

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The article presents summary of a revised and enlarged edition of the author's monograph. The concept of space-time, matter and field developed therein can be considered as natural generalization of classical works. With the use of averaging procedure, Newton's and Einstein's gravitation theory, field theory and quantum mechanics equations - the Schrödinger and Klein - Gordon-Fock equations follow from this concept. With the aid of variational methods in equations of matter motion a new class of forces proportional to gradients of electric charge density and mass have been obtained, that evidently form strong and weak interactions in atomic nuclei. As the concept of matter we use the concept of relativistic structureless liquid whose drops, as may be supposed, are elementary particles, nuclei and atoms. This approach affords an opportunity to make an attempt of constructing the unified physical theory of space-time, matter and field on the basis of classical variance analysis. The latter admits numerical solution of obtained equations with the use of supercomputers for elementary particles, nuclei, atoms and quarks.

Keywords: gravitation, unified field theory, quantum mechanics, variance analysis, equations of matter motion, theory of space-time and matter, quarks.

1. Introduction

The article represents a summary of the revised and enlarged edition of the author's monograph [1]. The concept of space-time, matter and field developed therein, can be considered as natural generalization of classical works [2–12]. With the use of averaging procedure, Newton's and Einstein's gravitation theory, field theory and quantum mechanics equations - the Schrödinger and Klein-Gordon-Fock equations follow from this concept. With the aid of variational methods in equations of matter motion a new class of forces proportional to gradients of electric charge density and mass have been obtained, that evidently form strong and weak interactions in atomic nuclei. At some points of matter gradient forces can assume infinite values and, consequently, accelerating it to superlight velocities, transfer it to space with complex coordinates where quantum phenomena occur.

As the concept of matter, as opposed to the notion of a material point, the concept of relativistic structureless liquid is used whose droplets are believed to be elementary particles, nuclei and atoms. This approach made it possible to carry out an attempt of axiomatic construction of a unified physical theory of space - time, matter and field based on the classical variance analysis. The latter admits numerical solution of obtained equations with the use

of supercomputers for elementary particles, nuclei, atoms and quarks. Carrying out such calculations it would be possible to see in detail, for example, nuclear explosion or generation and nature of superconductivity and superfluidity on a screen display.

It is possible that an essential part of galaxies and the whole Universe consists of such distributed, uncharged and, consequently, invisible, nonluminous elementary matter forming hidden mass of the Universe.

The same is true of space around stars. This additional mass surrounding the Sun, can account for anomalies of the spacecraft "Pioneer" motion. It would be interesting to consider the dynamics of such formations and the possibility of their interaction with quanta of electromagnetic radiation of stars, which can change the scenario of the development of our Universe. It is now that, using impressive scientific and technological potential accumulated by our civilization, we can make unprecedented leap into the future in research from the quarks level to the Universe, including the holy of the holies – the human genetic code in its dynamics.

The new approach has been developed in the result of correction of mathematical inaccuracies in the standard conventional classical field theory. It has accumulated essential features of the previous stage of development of deterministic line of research and does not require "struggle" with infinities.

* In order for discussion.

The Chapter I develops a four-dimensional version of the theory (time plus three space coordinates) with a related fifth coordinate playing the role of the universe time and with an accuracy to constant multiplier being an interval of Riemannian space-time. In this case interval is always a real number and all coordinates and corresponding equation solutions should be considered in the field of complex numbers. Complex numbers are vital to quantum mechanics: our Universe is indeed complex!

In the Chapter II, with the use of a drop model the simplest system of equations for quarks is described in zero approximation and its computer solution is given. It is concluded that in this model there is a possibility of existence of particles – drops with electric charges 2, 1, 2/3 and 1/3, under the condition that particles with electric charge equal to 2, 2/3 и 1/3 cannot exist in a free state – otherwise they will explode. These preliminary results require further intensive work in that direction.

The chapter III presents the diagram of one of various types of advanced electric thrusters able to generate more energy than they receive from outside. In manuals on electrodynamics, when proving the law of conservation of energy it is presumed that considered volume with a device is rigidly fixed. It turns out that when a volume with a device is not fixed, it can initiate motion, in some cases not consuming external energy. There is a good probability that a major part of energy of the sun and stars is generated in collisional processes not obeying the law of conservation of energy that are considered in this chapter. The last assumption is related to the fact that electromagnetic forces are not potential and depend in particular on velocities of matter motion. The same can be said about einstein gravitation phenomena. Moreover, if at great distances like electric charges repel from each other, in particle-like states of matter they can be attracted to each other, in particular, in direct proportion to a distance between them!

In the present work the energy law is formulated in a generally covariant version in the following way: generalized density of energy of physical vacuum is equal to zero. In the general case it is not possible to divide generalized density of energy into kinetic and potential, as they, notably, are not generally covariant. In 1994 in the former moscow experimental design bureau “gorizont” for the first

time in the world they fabricated and tested the superconductor thruster of the № 3 type [13] with 398 kg weight, where a new gradient force with 2 kgf magnitude was registered, which could not be explained with the use of standard physical theories. In such a device thrust depends on magnitude of direct current once introduced into superconducting coils stationary to each other.

So far the author has developed the diagrams of more advanced, ecologically friendly high-performance electric motors and thrusters with large-tonnage thrust. A version of the theory has been formulated where motion occurs not only in space but also in time. Therefore, the concept of god and the biblical prophecies up to 2033 are discussed.

Considering these prophecies and meteorological data, in order to save our civilization it is necessary with the use of advanced ecologically safe technologies in the shortest time possible to reduce the amount of combusted organic fuel approximately to the level of 1990 after which the earth average temperature started to increase, and thus purify the earth atmosphere from greenhouse gases and cool it. With the use of these technologies it is necessary to shift the asteroid apophis with over 50 mln t weight to an orbit safe for the earth. For the first time this theory was published at the web-sites limanmobile.ru in 2011 and valentin777.ru in 2014. You can get information on the progress in the development of this theory, for example, in the works [2–21] where additional references are given.

2. Basic Concepts and Axioms

Our Universe will be characterized by the following attributes – time, space, scalar field, electromagnetic field, fundamental interaction of space-time, matter and field.

In variational principle we shall characterize space-time with the five independent variables s, x^μ ($\mu = 0, 1, 2, 3$) considering them as general coordinates in five-dimensional space-time. Three space coordinates x^1, x^2, x^3 can represent any values defining coordinates of events in three-dimensional space, $x^0 = ct$, c – light velocity in vacuum, t – coordinate time can be defined by coordinate clock keeping random time. The value

$$\tau = s / c, \quad (2.1)$$

will be termed universal (proper) time of events.

After we get the equations of the coordinates motion in physical space with the use of variation method, the interval meeting the requirement $ds^2 = g_{\mu\nu} dx^\mu dx^\nu$ will be assigned.

Matter will be described by the following values: m – rest density, p – pressure, q – entropy and \mathbf{v}^μ – speed of matter motion ($\mathbf{v}^\mu = d\mathbf{x}^\mu/ds$). Scalar field will be characterized with potential ϕ , electromagnetic field – with the four functions \mathbf{A}^μ ($\mu = 0, 1, 2, 3$) playing the role of potentials of electromagnetic fields, gravitational field – with the sixteen values $g^{\mu\nu}$, playing the role of potentials of gravitational field.

In the search for equations of motion with the use of variational method, we shall rely on the following three axioms:

Axiom 1. There exist four functions L, L_0, L_1, L_2 , depending on the arguments $\rho, m, p, q, v^\mu, \phi, A^\mu, g^{\mu\nu}$ and possibly their first and second partial derivatives x^μ and s , such as that equations of matter motion, as well as equations for potentials of scalar, electromagnetic and gravitational fields are obtained from the condition of extreme integrals, correspondingly

$$S = \int L ds \quad (2.2)$$

on possible trajectories of matter motion,

$$S_0 = \int L_0 ds d\Omega \quad (2.3)$$

at possible configurations of scalar field,

$$S_1 = \int L_1 ds d\Omega \quad (2.4)$$

at possible configurations of electromagnetic field,

$$S_2 = \int L_2 ds d\Omega \quad (2.5)$$

at possible configurations of gravitational field where

$$d\Omega = dx^0 dx^1 dx^2 dx^3. \quad (2.6)$$

Non-variable variables are considered preset and are not to be varied. All the functions L, L_0, L_1 , and L_2 does not explicitly depend on s .

Axiom 2. In our Universe model equations of matter motion and equations for potentials of scalar, electromagnetic and gravitational fields must be generally covariant, or shape-invariant at permanently differentiated transformations of coordinates.

Axiom 3. As matter we shall use the concept of relativistic structureless liquid.

It is evident that Axiom 1 makes the wording of variational principle in the field of fundamental physics more precise, Axiom 2 generaliz-

es the Einstein principle of general relativity [6] and Gilbert's axiom 2 in his original field theory [7], and Axiom 3 is a counterbalance to the concept of material point. In theoretical terms, variables $\rho, m, p, q, v^\mu, \phi, A^\mu, g^{\mu\nu}, L, L_0, L_1, L_2$ can depend not only on x^μ , but also on s . Therefore, in expressions for actions (2.2) – (2.5) integration is carried out in five-dimensional volume. However, if functions $\rho, m, p, q, \phi, v^\mu, A^\mu, g^{\mu\nu}, L, L_0, L_1, L_2$ do not explicitly depend on s (it is precisely these functions that will be considered in this work), integration in the fifth coordinate s in integrals (2.3) – (2.5) can be neglected, as this will not affect field equations.

As in the partial version of the theory considered here, in physical space interval associated with the condition $ds^2 = g_{\mu\nu} dx^\mu dx^\nu$ (2.7), will be assigned to coordinate s , lack of explicit dependence on s in the expressions L, L_0, L_1, L_2 is natural.

It should be stressed that consideration of integrals for actions in five-dimensional mathematical space is caused by our desire to obtain equations of motion for matter and fields in tensor form.

As we shall see, variables $s, \rho, m, p, q, v^\mu, \phi, A^\mu, g^{\mu\nu}$ are quite sufficient to describe multiple characteristics of our Universe unwrapping in four-dimensional space $\{x^\mu\}$ ($\mu = 0, 1, 2, 3$) with geometric land- interval s corresponding to the relation (2.7).

In this case the values ρ, m, p, q, ϕ will be scalars, v^μ, A^μ – vectors, and sixteen functions $g^{\mu\nu}$ – symmetric tensors of second order. These values will depend only on the coordinates x^μ ($\mu = 0, 1, 2, 3$), which, in their turn, will be functions of either the interval s , or, actually, the complex coordinate x^0 (at your convenience).

It appears that equations obtained in this Chapter, describe motion of space-time, matter and field at microscopic level, in particular, motion inside elementary particles, nuclei and atoms (drops of relativistic structureless liquid). When averaged, gradient forces are transferred into the known Einstein – Gilbert, Maxwell – Lorentz and Schrödinger equations.

The theoretical and experimental research demonstrates that in our Universe the following relations take place:

$$\mathbf{L} = -mc \sqrt{v_\alpha v^\alpha} - \frac{\rho}{c} \mathbf{A}_\alpha \mathbf{v}^\alpha, \quad (2.7)$$

$$\mathbf{L}_0 = \frac{1}{2} \partial_a \varphi \partial^a \varphi + \mathbf{k}_0 \mathbf{q} \varphi, \quad (2.8)$$

$$\mathbf{L}_1 = -\frac{F_{\alpha\beta} F^{\alpha\beta}}{16\pi c} - \frac{\rho}{c} \mathbf{A}_a \mathbf{v}^a + \frac{\varepsilon}{c} \mathbf{A}_a \mathbf{A}^a, \quad (2.9)$$

where ε – a certain extremely small number,

$$\mathbf{F}_{a\beta} = \mathbf{A}_{\beta;a} - \mathbf{A}_{a;\beta}. \quad (2.10)$$

$$\mathbf{L}_2 = -\frac{c^3}{16\pi k} \mathbf{R} + \frac{1}{c} \mathbf{W}, \quad (2.11)$$

$$\begin{aligned} \mathbf{W} = & (\mathbf{m}c^2 + \mathbf{p}) \sqrt{v_\alpha v^\alpha} - \\ & - \mathbf{m}c^2 + \mathbf{f}(\rho) - \frac{1}{16\pi} \mathbf{F}_{a\beta} \mathbf{F}^{a\beta} + \\ & + \frac{1}{2} \left(\frac{\partial \varphi}{\partial x_\alpha} \frac{\partial \varphi}{\partial x^\alpha} + \varphi \right) + \frac{1}{2} \mathbf{q}_{;a} \mathbf{q}^{;a}, \end{aligned} \quad (2.12)$$

where Ω – a certain area of space of four dimensions where integration occurs, \mathbf{g} – determinant composed of $\mathbf{g}^{\mu\nu}$. Integrals will be varied under the condition of independence of functions $\rho, \mathbf{m}, \mathbf{p}, \mathbf{q}, \varphi, \mathbf{A}^\mu, \mathbf{g}^{\mu\nu}$ explicitly from the coordinate s and lack of connection (2.7) in variation principle.

3. The V – System of Equations

Summing up these results, we can write the following system of equations which under some initial and boundary conditions completely defines motion of space-time, matter, as well as scalar, electromagnetic and gravitational fields:

$$\mathbf{ds}^2 = \mathbf{g}_{\mu\nu} \mathbf{dx}^\mu \mathbf{dx}^\nu, \quad (3.1)$$

$$\frac{dm v^\lambda}{ds} - \frac{\rho}{c^2} \mathbf{F}^\lambda_{\nu} \mathbf{v}^\nu - \frac{1}{c^2} \mathbf{f}^\lambda_{\nu} \mathbf{v}^\nu - \frac{\partial m}{\partial x_\lambda} +$$

$$+ \mathbf{m} \Gamma^\lambda_{\sigma,\mu\nu} \mathbf{v}^\mu \mathbf{v}^\nu = 0 \quad (\lambda = 1, 2, 3), \quad (3.2)$$

$$\mathbf{v}_a \mathbf{v}^a = 1, \quad (3.3)$$

$$\nabla_\nu (\rho \mathbf{v}^\nu) = \varepsilon \nabla_\mu \mathbf{A}^\mu \quad (3.4)$$

$$\nabla_\alpha \nabla^\alpha \varphi = \mathbf{k}_0 \mathbf{q}, \quad (3.5)$$

$$\nabla_\nu \mathbf{F}^{\mu\nu} = -4\pi(\rho \mathbf{v}^\mu - \varepsilon \mathbf{A}^\mu), \quad (3.6)$$

$$\mathbf{R}^{\mu\nu} - \frac{1}{2} \mathbf{g}^{\mu\nu} \mathbf{R} = \frac{8\pi k}{c^4} \mathbf{T}^{\mu\nu}, \quad (3.7)$$

$$\mathbf{m}c^2 \mathbf{v}^\mu \nabla_\nu (\mathbf{P} \mathbf{v}^\nu) + \mathbf{q}^{;\mu} \mathbf{q}^{;\nu}_{;\nu} +$$

$$\begin{aligned} & + [\mathbf{P} \mathbf{A}_a \mathbf{v}^a - \mathbf{f}'(\rho)] \rho^{;\mu} + c^2 \mathbf{P} \mathbf{m}^{;\mu} - \mathbf{p}^{;\mu} + \\ & + (\mathbf{P} - 1) \rho \mathbf{F}^{\mu\nu} \mathbf{v}_\nu + \varepsilon \mathbf{F}^{\mu a} \mathbf{A}_a - \rho_{;a} \mathbf{v}^a \mathbf{P} \mathbf{A}^\mu + \mathbf{q}^{;\mu}_{;\nu} \mathbf{q}^{;\nu} - \\ & - \nabla^\mu \left[\left(\frac{\partial \varphi}{\partial x_\alpha} \frac{\partial \varphi}{\partial x^\alpha} + \varphi \right) + \frac{1}{2} \mathbf{q}_{;a} \mathbf{q}^{;a} \right] = 0. \end{aligned} \quad (3.8)$$

$$\partial_\nu (\sqrt{-g} \mathbf{g}) = 0, \quad (3.9)$$

where $\mu, \nu, \alpha = 0, 1, 2, 3$,

$$\begin{aligned} \mathbf{T}^{\mu\nu} = & \mathbf{m}c^2 \mathbf{P} \mathbf{v}^\mu \mathbf{v}^\nu + \mathbf{q}^{;\mu} \mathbf{q}^{;\nu} + \frac{\partial \varphi}{\partial x_\mu} \frac{\partial \varphi}{\partial x_\nu} - \\ & - \frac{1}{4\pi} \mathbf{F}^\mu_{\beta} \mathbf{F}^{\nu\beta} - \mathbf{g}^{\mu\nu} [\mathbf{p} + \mathbf{f}(\rho) + \\ & + \frac{1}{2} \mathbf{q}_{;a} \mathbf{q}^{;a} + \frac{1}{2} \left(\frac{\partial \varphi}{\partial x_\alpha} \frac{\partial \varphi}{\partial x^\alpha} + \varphi \right) - \\ & - \frac{1}{16\pi} \mathbf{F}_{a\beta} \mathbf{F}^{a\beta}], \end{aligned} \quad (3.10)$$

$$\begin{aligned} \mathbf{F}_{\sigma\nu} = & \frac{\partial \mathbf{A}_\nu}{\partial x^\sigma} - \frac{\partial \mathbf{A}_\sigma}{\partial x^\nu}, \\ \mathbf{f}_{\sigma\nu} = & \mathbf{A}_\nu \frac{\partial \rho}{\partial x^\sigma} - \mathbf{A}_\sigma \frac{\partial \rho}{\partial x^\nu}, \end{aligned} \quad (3.11)$$

$$\Gamma_{\sigma,\mu\nu} = \frac{1}{2} \left(\frac{\partial g_{\sigma\mu}}{\partial x^\nu} + \frac{\partial g_{\sigma\nu}}{\partial x^\mu} - \frac{\partial g_{\mu\nu}}{\partial x^\sigma} \right). \quad (3.12)$$

The system (3.1) - (3.12) will be termed **V**-system of equations.

We should point out some peculiarities on the **V**-system of equations.

As mentioned above, the function $\mathbf{f}(\rho)$, exactly as the functions $\mathbf{L}, \mathbf{L}_0, \mathbf{L}_1$ и \mathbf{L}_2 , cannot be uniquely defined within the framework of the formal technique developed here. Therefore, when describing phenomena of our Universe we used the method of selection of these functions relying on experimental data.

Having approximated with the use of polynomial, for preliminary calculations as function $\mathbf{f}'(\rho)$ we shall use the following expression:

$$\begin{aligned} \mathbf{f}'(\rho) = & \mathbf{f}_0 \text{sign } \rho + \rho^n (\mathbf{f}_1 + \mathbf{f}_2 \rho^2 + \\ & + \mathbf{f}_3 \rho^4 + \mathbf{f}_4 \rho^6 + \dots), \end{aligned} \quad (3.13)$$

which apparently reveals the lepton-quark structure of matter where \mathbf{n} is a certain natural number, derivative is designated by line mark. Certainly, in more precise calculations we could try to introduce other scalars - $\mathbf{m}, \mathbf{p}, \mathbf{q}$ into this formula. Looking ahead, it should be mentioned that conceptually, in dependence on charge density the function $\mathbf{f}'(\rho)$

forms some characteristic electromagnetic potential in charge media forming these media themselves, for example, elementary particles.

The equations (3.2) differ from conventional equations in that they are characterized by non-classical gradient forces proportional to partial derivatives from charge density and matter mass. As gradients of charge density and mass can naturally assume infinite values, force becoming infinite at these points can accelerate matter up to light and superlight velocities, transferring the values of variables, particularly four-velocity and potentials of electromagnetic fields, to complex plane, which brings about quantum phenomena. In case when normal speed passes light barrier, four-velocity becomes unbounded in absolute value – in fact, infinite. However, this peculiarity in equations can be removed.

To find such class of solutions it is convenient to use one Hamilton function S and one equation with which it complies, instead of four-velocity where any of its four components can assume infinite value. Then, knowing the Hamilton function, we can determine four-velocity.

As now only one function S assumes infinite value, it is convenient to replace a variable, for example:

$$S = F\left(\frac{1}{\psi}\right), \quad (3.14)$$

where $F(z)$ – is a certain function meeting the following conditions:

$$F(\text{const}) = 0, F(\infty) = \infty, \quad (3.15)$$

where **const** – a certain value. It is exactly in this way that this is done in the theory of differential equations when they are trying to find unbounded solutions within the considered region of space. Further on, we shall use the following replacement of a variable:

$$S = -i\mathbf{d} \ln \psi, \quad (3.16)$$

where i = imaginary number, \mathbf{d} – some number. Such research concept is also convenient in numeric computation. Therefore, alongside with the V -system, we can write first S -system, and then ψ – system of equations. In the first system the function S is used, in the second – function ψ .

In the present version of the theory matter gives birth to field (scalar, electromagnetic, gravi-

tational), and field – to matter. Therefore, not only matter is accompanied by fields but also field is accompanied by matter. It is evident that when electromagnetic field expands, matter in a fixed point is born by field virtually, for a short period of time, and executes lateral oscillations, giving birth to field once again. In such scenario, we can come to quantum states of matter and field – to quanta which are observed in practice in the process of electromagnetic field expansion. Apparently, processes in quanta are brought about by oscillation character of matter and fields motion. It is extremely interesting to consider the dynamics of such formations. It is clear that that in the absence of electromagnetic field and gradient forces, matter moves along geodesic arcs of four-dimensional space-time.

4. The Thruster of a New Type

We shall use the term “thruster of a new type” to mean a device generating more energy than it gets from outside. In estimating such equipment, all kinds of energy should be considered. In practice such characteristic of equipment as efficiency is used, which is numerically equal to the ratio of generated useful energy to energy obtained from outside. All the types of equipment known to the author as of 2014, have efficiency strictly less than unity. This equipment is not classified as thrusters of a new type. The electrical machine suggested in this Section, is based on the effect of perpendicularity of magnetic force to the direction of movement of electric charge and may be defined as a thruster of a new type. Subject to quality requirements, its efficiency can be greater than unity.

This machine can be within a short time implemented, for example, as a standard thruster with ten tons thrust for both ground and space purposes. In the simplest low-capacity (though we can also offer a high-capacity version), but easy to operate device we use two charged bodies (electric charges) moving back and forth with mutually perpendicular velocities in one phase, where return points in charges moving back and forth, are concurrent. Under this electric charge another electric charge \mathbf{e}_2 is located, that moves horizontally back and forth with velocity, for example, $\mathbf{v}_2 = \mathbf{b} \cos(\omega t)$, where \mathbf{b} is

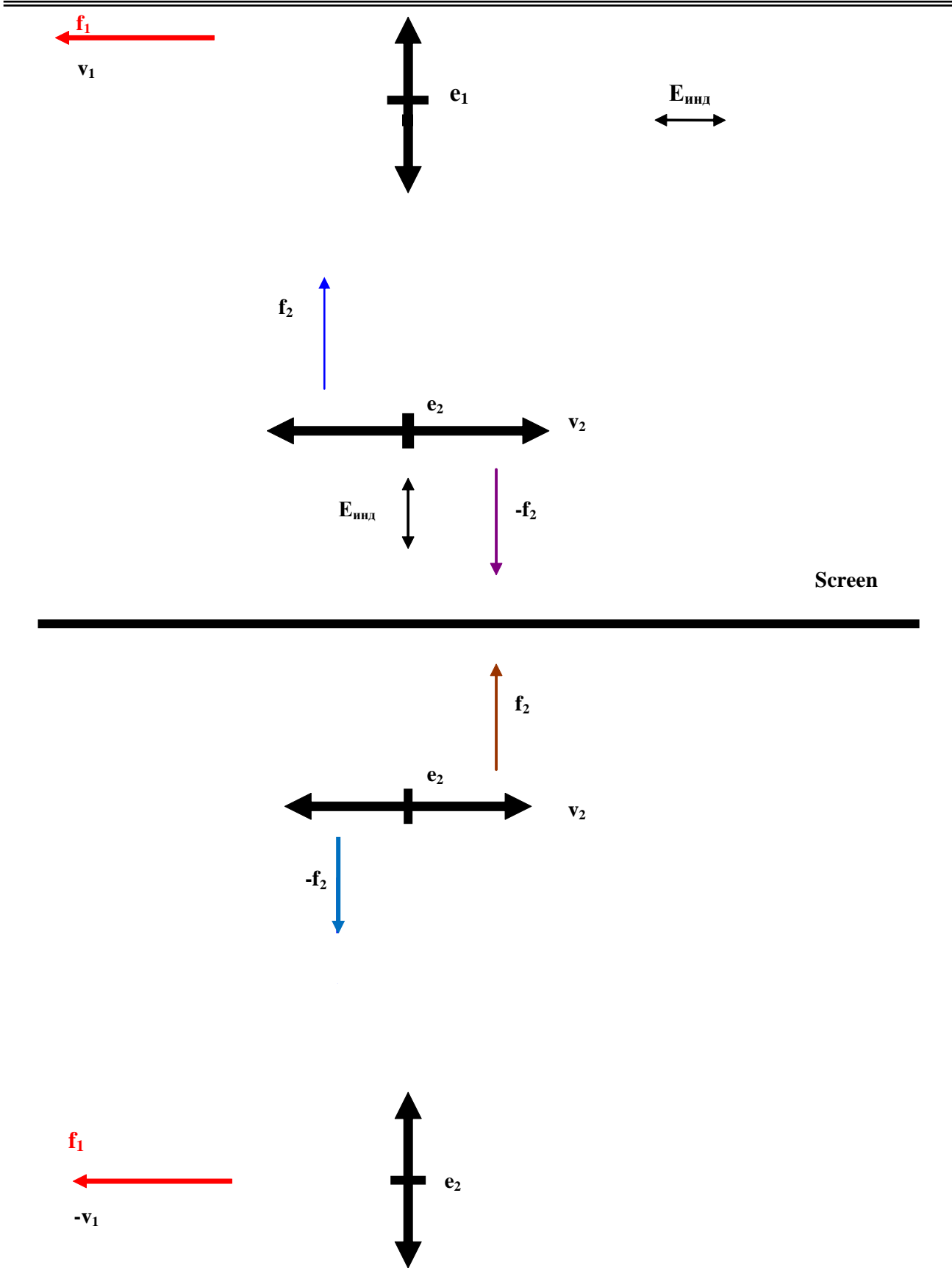


Fig. 1

a certain number. For the sake of simplicity let us assume that these charges are related to a device transforming rotational motion into translational (for example, as in a locomotive). A second device placed under the screen, is a mirror reflection of the first one.

Hence all electric charges carry out periodic motion, each of them creates varying magnetic field. Therefore, charge \mathbf{e}_1 is in magnetic field of charge \mathbf{e}_2 and vice versa. Force action of magnetic field on moving charge can be determined in accordance with the left hand rule. Direction of magnetic fields (vector of magnetic induction) is determined in accordance with the right-hand screw rule. Let us assume that we have determined (not without difficulty) the direction of all the forces in action (it should be noted that the velocities of all the charges are changing sign simultaneously, just as the vectors of magnetic induction). Being variables, the force \mathbf{f}_1 , just as the force \mathbf{f}_2 , are always directed one-way. All forces in the both devices directed perpendicularly to the velocity of charge movement, do not change kinetic energy of these charges. Therefore, once set in motion (on magnetic bearings, in the absence of air, etc.) they will maintain motion for an indefinitely long time. .

The force \mathbf{f}_2 of the first device and the force \mathbf{f}_2 of the second device, directed in opposite directions, do now affect the machine motion in general. Magnetic force \mathbf{f}_1 – the Lorentz force acting on the upper charge \mathbf{e}_1 is of extreme interest to us. Let us stress again that being variable, it is always directed in one direction, notably, perpendicular to both the velocity \mathbf{v}_1 of the motion of the charge \mathbf{e}_1 and to the direction of magnetic field, \mathbf{f}_1 , created by the moving charge \mathbf{e}_2 . The same can be stated about the device located below the screen. Thus, the force \mathbf{f}_1 of the first device and the force \mathbf{f}_1 of the second device will act in the same direction while all charges of the machine execute their periodic motion, that is, indefinitely long. As here magnetic fields are variable, there emerge induction forces, as in electric transformers, which, firstly, are alternating in signs, and, secondly, directed perpendicularly to the corresponding velocities of charges motion. To Coulomb (potential) interactions the law of conservation of energy applies. Energy related to electromagnetic fields radiation is proportional $1/c^3$ and, consequently, insignificant [19, § 67].

Therefore, these factors do not have great influence on the device operation. Our goal is to rapidly find practical use of these forces – which can bring our civilization wealth and prosperity! For the first time unusual phenomena in force interaction of two electric charges moving at mutually perpendicular velocities was noted in [21].

5. On the Advanced Electric Machines

We have developed the diagrams of seven brand new, energy-efficient, ecologically friendly electric machines that can be used for further exploration of the Earth and Space, in particular, of Near Space, including the Moon and Mars. It would be possible to build manned and unmanned facilities on the Earth, the Moon and Mars orbits in the coming years. With the use of these machines it would be possible to remove hazardous waste from the Earth, transporting it to the Sun where they will be completely burned. New technologies would allow to obtain electric power directly in cities with the use of an extensive super-reliable network of units (electric motors – generators), as well as in settlements and stand-alone enterprises, farms, buildings, etc. Effective “flying saucers” will provide the people of the Earth with high-speed, reliable and inexpensive transport communication all over the planet and in Near Space. These transport means will accelerate intermixing of population and establishment of long-expected peace on the Earth.

Therefore, the advanced, ecologically friendly energy and transport technologies will allow to save non-renewable resources of oil, gas, coal, etc, for future generations, to fundamentally explore the Earth and Solar system, and, if they rapidly implemented, in the coming years they will save us from final overheating of the atmosphere because of combustion of huge amount of organic fuel, catastrophic greenhouse effect and cold attacks, long-term harvest failures caused by destruction of soil microorganisms, food riots, wars, horrifying insani-tary conditions in cities and total unmanageability of states. A set of such units does not require fuel for its operation.

Conclusions

1. The three axiomatic statements (in the form of the axioms 1-3) offer the opportunity to formulate more general unified physical theory, including

equations of Newton, Einstein, quantum mechanics, electrodynamics, and in zero approximation explaining quart structure of common matter.

2. From this theory a new interpretation of the law of preservation of energy for a certain class of phenomena follows, enabling to develop fuel-free ecologically friendly electric machines of a new level.

3. The formulated theory allows to considerably expand the framework of further scientific research.

References

1. *Limansky V.G.* O prostranstve – vremeni, materii i pole [About space – time, matter and field]. Depp. VINITI. 1990, No. 3815. B90.
2. *Newton I.* Matematicheskie nachala naturalnoy filosofii [Mathematical beginnings of natural philosophy] // In book: A.N. Krylov, *Sobr. tr.*, M. – L.: GITL, 1936.
3. *Faraday M.* Experimentalnye issledovaniya po elektrichestvu [Pilot studies on electricity]. T. 1 – 3. M.: GITL, 1947 – 1959.
4. *Maxwell D.K.* Izbrannye sochineniya po teorii elektromagnitnogo polja [The chosen compositions according to the theory of an electromagnetic field]. M.: GITL, 1959.
5. *Lorentts G.A.* Teorija elektronov i ejo primenenie k javlenijam sveta i teplovogo izlucheniya [The theory of electrons and its application to the phenomena of light and thermal radiation]. M.: GITL, 1953.
6. *Einstein A.* Izbrannye nauchnye trudy [Chosen scientific works]. M.: Science, 1970 (1), 1971 (2).
7. *Gilbert D.* Osnovaniya fiziki [Physics bases] // In book *Variation principles of mechanics / Under the editorship of Polak L.S.* - E.: GIFML, 1959. Pp. 589 – 598.
8. *Bor N.* Izbrannye trudy [Chosen works]. M.: Science, 1970 (1), 1971 (2).
9. *Schrödinger E.* Izbrannye trudy po kvantovoj mehanike [The chosen works on quantum mechanics]. M.: Science, 1976.
10. *Dirac P.A.M.* Printsipy kvantovoj mehaniki [Principles of quantum mechanics]. M.: G.I.F.M.L., 1960.11.
11. *Gell – Mann M.* Phys. Lett, 8.214, 1964.
12. *Zweig G.* CEPN Report No. 8182 / Th 401, 1964 .
13. Patent Russian Federation No. 2085016. Propeller – Generator / Limansky V.G., priority on May 29, 1995.
14. *Matveev V.A., Rubakov V.A., Tavkhelidze A.N., Shaposhnikov M.E.* Nesokhranenie barionnogo chisla v ekstremalnykh usloviyakh [Not preservation of barionny number in extreme conditions] // UFN, M.: Science, t.156, page 253.
15. *Fok V.A.* Teorija prostranstva – vremeni i tjagotenija [Theory of space – time and inclination]. M.: GITTL, 1955.
16. *Bogolyubov N.N., Shirkov D.V.* Kvantovye polja [Quantum fields]. M.: Science, 1980.
17. *Vladimirov Yu.S.* Sistemy otscheta v teorii gravitacii [Reference systems in the gravitation theory]. M.: Energoizdat, 1982.
18. *Buchholz N.N.* Osnovnoj kurs teoreticheskoy mehaniki [Basic course of theoretical mechanics]. M.: Science, GRF. – ML, h. 2, 1966.
19. *Landau L.D. and Lifshits E.M.* Teorija polja [Field theory]. M.: Science, G.R.F.– T.L. 1967.
20. *Tamm I.E.* Osnovy teorii elektrichestva [Bases of the theory of electricity]. M.: Science, GRF. – ML, 1976. *Feynman R.F. Leyton P.* Feynmanovskie lekci po fizike [Sends of M. Feynman lectures on physics]. M.: World, 1977. Pp. 269 – 270.
21. Bible. Initial. M.: Russian Bibl. General, 1994.

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ATMOSPHERIC WATER EVAPORATING ENGINES. CURRENT STATE, POSSIBLE IMPROVEMENTS AND APPLICATIONS FOR IRRIGATION

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Production of energy from water evaporation in unsaturated air is considered. Three types of atmospheric water evaporating engines (AWEE) are described. All of them use the mentioned energy source. Carrying out the heat-and-mass transfer process on wet surfaces of solid bodies (WSSB) is proposed for improved performance. Application of the AWEE as an irrigation water pump drive is proposed. Aeroirrigation, i.e. supplying large quantities of cold humid air to improve plants living conditions in fields is proposed.

Keywords: renewable energy, atmospheric water evaporation engine, downdraft energy tower, vapor pressure deficit, aeroirrigation.

Introduction

Water vapor in the atmosphere is usually not saturated. Hence, when some amount of water is put in contact with an excessive amount of air, the water evaporates endothermically. This is a non-equilibrium process. So, a device may be built which takes atmospheric air and water as its input and produces mechanical work and humid, cool air as its output. We will call this device an *atmospheric water evaporating engine (AWEE)*. Let us review several methods of implementing the AWEE and consider some possible improvements.

Wet bulb method

Hygrometer is an instrument used for measuring the moisture content in the atmosphere. It contains two thermometers. One is dry, and the other one is wet. Water evaporation process lowers the temperature of the wet thermometer. One can replace thermometers with the heat exchangers of thermoelectric generator, steam engine, or other heat engine and thus get an AWEE. This kind of AWEE is being mass produced as a "drinking bird" toy [1].

Negative buoyancy method or Downdraft energy tower

A pipe is placed between two locations of different heights above sea level. The pipe is open from both ends. A mass m of water is sprayed inside the pipe near its upper end. As the water evaporates, air cools down, its density increases, and the Archimedes force occurs. When the portion of the cooled air moves down the pipe to the lower end, the Archimedes force does a work which is extracted with an air turbine. Amount of the work depends on the state of the atmosphere. It is shown in [2] that in a typical sunny day the Archimedes force

work is ≈ 8 times greater than the work required to lift the mass m of liquid water to the upper end of the pipe. According to [2], the ratio between the Archimedes force work and the pumping work does not depend on the initial air or water temperature, initial or final air humidity. It follows that if the incoming air is far from saturation, then there is a linear dependency between useful work per kg of the evaporated water and the tower height.

This method was suggested by Carlson in 1974 [2]. Several inventions in this area were patented since then, including downdraft towers combined with wind power station [3-7]. According to [8], downdraft energy towers can achieve electricity production cost of about 4¢/kWh in Australia, which is cheaper than energy from coal or gas produced in this country. To reach that cost, the tower must be about ≈ 1200 m tall and ≈ 400 m in diameter. As the height of the tower decreases, useful work per m^3 of air volume decreases while relative losses grow. Thus with decreasing height the power station first becomes unprofitable and then unable to produce sufficient energy for pumping up the necessary amount of water to sustain its operation. As the time of writing there is no known working downdraft energy tower prototype.

Positive displacement AWEE

The theory of one possible reciprocating AWEE cycle was presented by Barton in 2008 [9]. Also, a prototype engine was built [10] where the air was preheated to increase power. [9] gives several sample results of cycle calculation. E.g., if air temperature is 35°C , relative humidity is 35.5%, atmospheric pressure is normal, expansion ratio is ≈ 1.16 , and water temperature is 20°C , then the cycle work is 346 J/(kg dry air), water consumption is ≈ 5 g/(kg dry air), exhaust air is saturated, and its

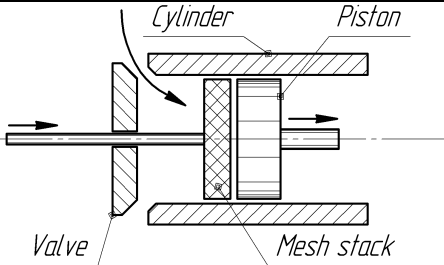
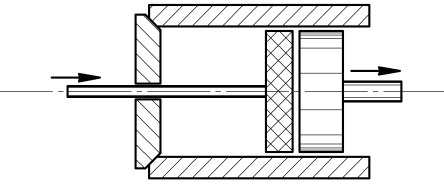
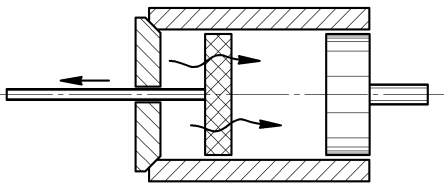
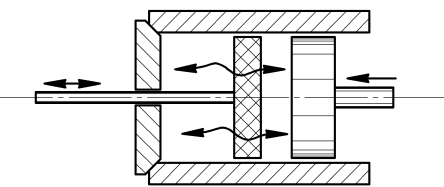
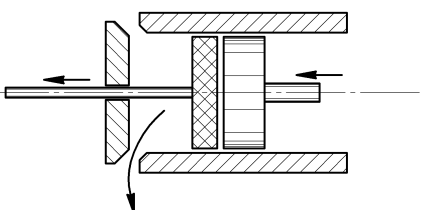
temperature is 22.8°C. One can see from this result that, in contrast to the downdraft energy tower, the cycle power per kg of water consumed does not depend on the engine geometry. Hence, the positive displacement AWEE can be effective even when implemented in small scales.

Use of wet surfaces of solid bodies (WSSB) for efficient evaporation in AWEE

An AWEE operation is based upon the well-known process of evaporative cooling. All schemes of the AWEE referenced here except "drinking bird" imply that the evaporation occurs at the surfaces of the droplets created by the atomizers. But this is not the only method known. Evaporation can also take place at the *wet surfaces of solid bodies* (WSSB). WSSB are used in cooling towers, several types of air humidifiers, desert coolers, etc.

We propose using WSSB for carrying out evaporation in downdraft energy towers and positive displacement AWEEs. Any materials and body forms used in the known heat-and-mass transfer devices can be appropriate, e.g. plates, gauzes, films, lattices, foams, rotating discs, wood chips, pultruded FRP, etc. In many cases, the evaporative air cooling devices with WSSB are more efficient than those with atomizers. E.g. [11], p.212, compares two such devices. One uses atomizers while the other uses stacks of wet meshes made from flat nylon threads with the cell size of 2x2 mm. Under equal conditions, the heat transfer power per m³ of device working volume is 13.6 times greater for the second device, while the total energy consumption is 1.3 times greater.

Table 1. An example of positive displacement AWEE cycle

Cycle phase	Drawing <i>Cylinder</i> <i>Piston</i> <i>Valve</i> <i>Mesh stack</i>	In 4-stroke ICE
Intake. Hot, dry air enters cylinder		Intake. Cold, oxygen-rich air enters cylinder
Expansion – flywheel energy is used. $V \uparrow$ at several %. $P, T \downarrow$. Water does not evaporate as air does not move through mesh stack		Compression – fly-wheel energy is used. $V \downarrow$ in several times. $P, T \uparrow$. Fuel does not burn
Cooling. $V \approx \text{const}$. Air is blown through moving mesh stack, air evaporates, $P, T \downarrow$ at several %.		Ignition $V \approx \text{const}$, $P, T \uparrow$
Working stroke. $V \downarrow$. $P, T \uparrow$. Mesh stack can pass from piston to valve and back several times to approach ideal evaporative cooling.		Working stroke. Fuel burns and at the same time expansion occurs
Exhaust – no evaporation as air does not move through mesh stack		Exhaust – no burning

For the engine presented in [9, 10], atomization energy demand constitutes insignificant share of engine's power, therefore the increase of this demand by a factor of 1.3 would not be critical for the engine performance.

The power to blow air through wet body can be obtained from different sources. A special fan located inside the engine can be used. A moveable displacer similar to that of Stirling engine can be used, with wet material fixed or located inside the moveable displacer. Kinetic energy obtained by air entering the cylinder at intake phase can be spent to move air through wet material. Negative buoyancy of previously cooled air can be used. It is useful to consider the AWEE cycle in parallel with 4-stroke IC engine cycle. The two are very similar, but changes in pressure and temperature are taken with opposite sign for the AWEE. One possible scheme of the reciprocating AWEE is shown in table 1.

For a downdraft energy towers, the evaporation at the WSSB can be useful, at least in demonstration prototypes of minimal height. There are two reasons for that. First, as mentioned before, useful energy production per mass of water depends linearly on the tower height H . Atomization of water requires some pumping head which is independent on the H and is usually more than 20m [3,11]. It must be added to H when pumping power is calculated. Hence the ratio (pumping power)/(useful power) per kg of water grows as H decreases, and, consequently, the overall engine efficiency can fall to negative values at the some sufficiently low H . Second, heat-and-mass transfer between a single droplet and air in the tower is not instant. As the droplet moves down together with the downdraft, it also falls down through the downdraft because of the droplet's own weight. Hence, the droplet's residence time in the tower is limited by $H/(\text{terminal velocity})$. As H decreases, this limitation begins to reduce the effectiveness ratio of the cooling process. When WSSB are used, water distribution losses can be reduced to essentially zero together with the velocity of downward surface water flow. Thus, these two kinds of loss may be kept insignificant.

To prove the concept of WSSB we have built a working model of a downdraft energy tower that is ≈ 1.5 m tall [12]. We used one layer of cotton gauze as an evaporation surface. Air entering the tower was blown through the gauze by the Archimedes force. Despite a small temperature difference

of $\approx 5^\circ\text{C}$, calculated pressure difference $\approx 0.25\text{Pa}$ and power of air stream in the order of 1mW, the model demonstrated creation of a downdraft and rotation of an impeller installed at the outlet. No attempt was made to use the tower's output for pumping water as calculated radiation losses turned to be too high. Our preliminary estimates show that $H=10\text{m}$ is sufficient to make the model capable to pump water by itself.

AWEE application in agriculture. Aeroirrigation

We propose considering a possible use of an AWEE for driving irrigation pumps. Irrigation process usually implies hot and dry climate, i.e. good air conditions for using an AWEE technology. At the location where the irrigation takes place in the certain season, pumping is required at the same time when the AWEE can produce energy. Hence there is no need to store energy. In contrast to power station proposals, e.g. [8], an AWEE driving a water pump doesn't require a special water supply channel – the engine can be fed from the same water source as the pump itself. Finally, irrigation systems are spread over large areas, so it is profitable to keep them off-grid to save costs of the power supply lines.

The AWEE exhausts large amounts of cool and humid air. E.g., if shaft power is 10kW and the thermal efficiency is 0.3% then about 1.2kg/s of water gets evaporated and the cooling power is around 3MW. It is natural to expect that the cool and dense exhaust air will flow around and stay near ground until it gets warm again. It is likely that the network of multiple AWEEs is capable of cooling down and humidifying air in large fields without the need for any additional irrigation ditches. There will be dew in the evening when the soil begins to cool down as the air humidity will still stay high. We propose to study and use this set of phenomenon as a method of improving living conditions of crops in fields. We propose calling this method the *aeroirrigation* as the water comes to the crops from air.

Conclusion

We reviewed several types of the AWEEs which utilize a little-known renewable energy resource. We formulated and attempted to justify some proposals regarding the further study, improvement and application of the AWEEs.

References

1. Perelman Ja.I. Zanimatel'naja fizika [Entertaining physics]. M., «Nauka», 1965, Book 2.
2. Patent – US3894393, IPC F03G7/04, F03D9/00. Power generation through controlled convection (aeroelectric power generation) / Phillip R. Carlson; Lockheed Aircraft Corp – 05/466,178; Filed 5.2.1974; Publ. 7.15.1975.
3. Patent – US6510687, IPC F03G7/00, F03D1/00, F03G7/04. Renewable resource hydro/aero-power generation plant and method of generating hydro/aero-power / Dan Zaslavsky, Rami Guetta, Rony Hitron и др; Sharav Sluices Ltd. - 08/854,085; Filed 5.9.1997; Publ. 1.28.2003.
4. Patent – US6057606, IPC A01G15/00, F03D9/00. Method and system for power generation from humid air / Itzhak Porat; Armament Development Authority, Ministry Of Defence, The State Of Israel; Filed 10.6.1998; Publ. 5.2.2000.
5. Patent – US5477684, IPC B01D53/77, B01D53/34, F03G6/04, F03G7/04, B01D47/06, B01D53/14. Convection towers / Melvin L. Prueitt; The Regents Of The University Of California; Filed 11.4.1994; Publ. 12.26.1995.
6. Patent – US4801811, IPC F03D1/04, F03G6/04, F03G7/04. Method of and means for generating electricity in an arid environment using elongated open or enclosed ducts / Gad Assaf, Lucien Bronicki; Geophysical Engineering Co.; Filed 5.14.1980; Publ. 1.31.1989.
7. Patent – US8517662, IPC F03D9/00. Atmospheric energy extraction devices and methods / Hanback John; Solar Wind Energy Tower, Inc.; Filed 5.1.2011, Publ. 8.27.2013.
8. Altman T., Carmel Y., Gueta R., Zaslavsky D., and Doytsher Y. 2005. Assessment of an "Energy Tower" Potentials in Australia Using a Mathematical Model and GIS // Solar Energy, 78:799-808.
9. Barton N.G. An evaporation heat engine and condensation heat pump // ANZIAM J. 49(2008), 503-524, doi:10.1017/S1446181108000035
10. Sunoba Pty Ltd. Previous Work (evaporation heat engine; condensation heat pump) – <http://www.sunoba.com.au/previous.htm> (retrieved Jan 10 2014)
11. Stefanov Eu.V., Ventiljacija i kondicioniranje vazduha [Ventilation and air conditioning]. SPb: "Avok Severo-Zapad", 2005.
12. Budyak D. Aqua powered engine – <http://ecovillage.narod.ru/energy/meteo/water-powered-engine.mov> (retrieved Feb 16 2014).

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VELOCITY OF PROPAGATION OF ELECTRIC CURRENT*

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In existing theoretical physics it is accepted that electric current represents the directed movement of "conductivity electrons" in the conductor, thus round the conductor a certain magnetic field is by all means formed.

Within the Uniform Theory of Physics (UTP) it is shown that electrons aren't carriers of electric current, and the so-called magnetic field round the conductor with current and is electric current. Thus the carrier of current is new, truly elementary particle, the electrino, removed by the author from Planck's constant.

Keywords: *electron, electrino, charge and mass of an electrino, sectorial speed of an electrino, address frequency, step of an electrino, speed of an electrino step, speed orbital.*

Introduction

Fundamentals of Unified Physics Theory was issued by J. Kh. Baziev in 1994 [1] and it was succeeded in the book for the first time the discovering the nature of Plank constant h :

$$h = \frac{m_e \cdot \mu \cdot \sqrt[3]{4\pi/3}}{2} = 6.6262681 \cdot 10^{-34} \frac{kg \cdot m^2}{s} = const \quad (1)$$

where $m_e = 6,85575729963 \cdot 10^{-36} kg = const$ mass of a new truly elemental particle called by the author «electrino», and its charge turned out to be positive and equal to e :

$$\begin{aligned} e &= 1.98766431671 \cdot 10^{-27} C = const \\ \mu &= 119,916984 m^2/s = const \end{aligned} \quad (2)$$

is Milliken constant name dafter the wonderful American experimenter Robert Milliken who determined the charge of the first truly elemental particle, electron $e = -1,6021892 \cdot 10^{-19} C$.

Before *The Fundamentals*[1] was issued it had been believed in the whole world that the electrical current is directed movement of conductivity electrons within a conductor and besides there is a certain magnetic field formed without fail around the conductor, and nobody knew the nature of this field.

It was shown in the fourth chapter of [1] describing the new non-Maxwell electrodynamics that there are no conductivity electrons in the conductors at all, and that electrons are not in the least carrying

agents of the electrical current, and that the so called magnetic field around the conductor is the true electrical current, and the electrino is its material carrying agent. It was also established that electrino is the carrying agent of the magnetic field, it acts as a photon in all kinds of radiation and it acts as a neutrino while it is moving in a straight line from the Sun and stars, it has neither mass, no charge by opinion of its author W. Pauli and this brings down this particle to the fictitious level. It was shown convincingly in the seventh chapter [1] that the velocity of neutrinos generated by the Sun is 10^{20} to 10^{23} m/s. Electrino takes 50% of charge in the atom's structure and 99.83% of its mass. It means that the theoretical physics completed by 1927 was created at the time when the science did not know about 99.83% of matter and therefore that this theory could not be complete and objective in spite of all the talent and even genius of its creators, besides the electrodynamics of James Maxwell had also got out of date by now to such an extent that we could not call it the theory of electricity. While analyzing the phenomenon of electromagnetic induction Maxwell went to the conclusion that the induction of electromotive force arises because of the electric field while the conductors are minors and serve only as some kind of device displaying this field. We will show further that Maxwell was mistaken.

This article is devoted to investigation of electric current within the frame of the new electro-

* In order for discussion.

dynamics based on the results of the experiment carried out properly.

Experimental technique and the test conditions

The following measurement instrumentation was used while carrying out this experiment.

1. Ericsson storage battery as a source of direct current with voltage of 12.3 V and the current of $i = 8.24 \text{ mA}$, measured values.

2. Double-trace oscilloscope with frequency of $f = 150 \text{ Hz}$. The sampling number is $n = 25 \cdot 10^9 \text{ s}^{-1}$.

3. Impulse generator U1-18 with quality factor of $Q = 100$, with internal abatement of noise equal to 10 dB and attenuation of 20 dB and frequency of $f = 100 \text{ kHz}$. The number of the generator is 32250.

4. Micrometer gauge MK 0-25 mm, Russian State Standard GOST 6507, number 7533.

5. Test conductors made of copper and aluminium with insulation and without it of different diameters.

6. The place of the experiment is Scientific and Production Complex Etalon-test, Zelenograd, Moscow District.

7. The conditions in the laboratory are $t = 25^\circ$ and pressure $P = 747 \text{ mm Hg}$.

To measure the velocity of the current propagation along the conductor two pieces of the same conductor of different lengths were taken l_1 and l_2 and the length l_1 is four to six times as long as the length l_2 (reference sample). Nano-second impulses of the current start moving from the generator simultaneously along the both conductors and get to the double-trace oscilloscope at different moments of time and that allows to define the impulse delay time $\Delta\tau$ along the long specimen (l_1) and to calculate the velocity of the propagation of current along the conductor under the investigation V_i :

$$V_i = (l_1 - l_2) / \Delta\tau_i, \text{ m/s.} \quad (3)$$

The delay time $\Delta\tau$ is measured with the error of $\Delta_1 = \pm 1 \cdot 10^{-10} \text{ s}$, and the length of the conductor pieces and the conductor diameter are measured with the error of $\Delta_2 = \pm 1 \cdot 10^{-4} \text{ m}$ and with the error $\Delta_3 = \pm 1 \cdot 10^{-5} \text{ m}$ respectively.

Theoretical foundation of the experiment

We will bring (without deduction) some basic equations of the new electrodynamics because without them it would be impossible to analyze objectively the results obtained in the experiment. The physical values with the index zero, for example σ_0 , mean the status of fundamental constants of the Fundamentals of Unified Theory of Physics.

$$\begin{aligned} \sigma_0 &= \frac{m_s \cdot V_0 \cdot v_{unit}}{\varepsilon} = \frac{1.98766431671 \cdot 10^{-27} \text{ N}}{1.98766431671 \cdot 10^{-27} \text{ C}} = \\ &= 1 \frac{\text{N}}{\text{C}} = 1 \frac{\text{N} \cdot \text{m}}{\text{C} \cdot \text{m}} = 1 \frac{\text{V}}{\text{m}}, \end{aligned} \quad (4)$$

where $V_0 = 2,89926295497 \cdot 10^8 \text{ m/s} = \text{const}$ – is the velocity of the propagation of the radio beam and laser beam; $v_{ed} = 1 \text{ s}^{-1}$ is an act of interaction according to the first Newton law; $m_{\varepsilon} u \varepsilon$ – are mass and charge of the electrino respectively; σ_0 – is unit intensity of the electric field of one electrino within vortex flow.

$$\begin{aligned} h_0 &= \frac{\alpha \cdot \varepsilon^2}{m_s \cdot V_0 \cdot v_{unit}} = \\ &= \frac{4.11060869206 \cdot 10^{-34} \text{ N} \cdot \text{m}}{1.98766431671 \cdot 10^{-27} \text{ N}} = \\ &= 2.06805981145 \cdot 10^{-7} \text{ m} = \text{const}, \end{aligned} \quad (5)$$

where h_0 is the step of electrino along the conductor in a single revolution around it in the vortex flow; it is equal to the distance between vortex packets;

$\alpha = 1,04044721942 \cdot 10^{20} \text{ J/C}^2 = \text{const}$ – is an electrodynamic constant of the Fundamentals of Unified Theory of Physics;

$$V_{si} = 2\pi \cdot r_i^2 \cdot \omega_i, \text{ m}^2/\text{s} \quad (6)$$

is sector velocity of the electrino in the electrostatic field of the conductor, where r_i is the conductor radius, and ω_i is circular frequency of electrino revolution around the conductor, s^{-1} .

$$U_i^2 = V_{si} \cdot \omega_i = 2\pi \cdot r_i^2 \cdot \omega_i^2, \text{ m}^2/\text{s}^2 \quad (7)$$

is the square of orbital velocity of the electrino around the conductor.

$$U_i^2 = \frac{\varepsilon \cdot n_i \cdot E_i^0}{m_s}, m^2/s^2, \quad (8)$$

where E_i^0 - is electrode potential of atoms of the i -th conductor, V ; n_i - is the number of electric fields of the conductor atoms interacting simultaneously with the electrino of the vortex flow.

$$V_i = h_0 \cdot \omega_i, m/s \quad (9)$$

is the velocity of the current propagation along the conductor.

$$\omega_i = \frac{V_i}{h_0}, s^{-1} \quad (10)$$

is the circular frequency of the revolution of the electrino around the conductor.

Equations (9) and (10) allow to calculate easily the circular frequency of revolution ω_i and all the other values describing the interaction of the vortex flow of electrinos with the conductor while defining the experimental value of velocity of the current propagation V_i . Equalling the right parts of the equations ((7) and (8) we can get orbital velocity of the electrino as a function of E_i^0 and n_i :

$$V_{si} \cdot \omega_i = \frac{\varepsilon \cdot n_i \cdot E_i^0}{m_\varepsilon}, \quad (11)$$

$$n_i = \frac{m_\varepsilon \cdot V_{si} \cdot \omega_i}{\varepsilon \cdot E_i^0} = \frac{m_\varepsilon \cdot U_i^2}{\varepsilon \cdot E_i^0} \quad (12)$$

$$U_i = \sqrt{\varepsilon \cdot E_i^0 \cdot n_i / m_\varepsilon}, m/s \quad (13)$$

is the orbital velocity of electrino as a function of E_i^0 and n_i .

Results of measurements

Velocity of the current along copper conductor

$r_1 = 1,115 \cdot 10^{-3} m$ is radius of the conductor without insulation;

$l_1 = 1,270 m$ is the basic conductor;

$l_2 = 0,325 m$ is the reference conductor;

$\Delta\tau_1 = 3,9 \cdot 10^{-9} s$ is impulse delay time;

$V = 12,3V$; $i = 8,24 \cdot 10^{-3} mA$ are values measured with milliamperimeter.

Result analysis

$V_1 = (l_1 - l_2)/\Delta\tau_1 = 2,42307692307 \cdot 10^8 m/s$ is propagation velocity of the electrino along the conductor and the velocity of the current at the same time;

$\omega_1 = V_1/h_0 = 1,1716667524 \cdot 10^{15} s^{-1}$ is revolution frequency of the electrino in the lower orbit around the conductor;

$U_1 = 2\pi r_1 \cdot \omega_1 = 8,20840624582 \cdot 10^{12} m/s$ is orbital (U_{max}) velocity of the electrino in the first (the lowest) orbit of the vortex package;

$$E_{Cu}^0 = -0,05 V$$

is copper electrodepotential;

$$\begin{aligned} V_{SCu} &= U_1 \cdot r_1 = 2\pi r_1 \cdot \omega_1 \cdot r_1 = \\ &= 9,15237296408 \cdot 10^9 m^2/s \end{aligned}$$

is sector velocity of the electrino in the electrostatic field of the copper conductor with the radius r_1 ;

$$\begin{aligned} n_i &= \frac{m_\varepsilon \cdot U_1^2}{\varepsilon \cdot E_{Cu}^0} = \frac{-46,1926756659 \cdot 10^{-11} J}{-9,93832158355 \cdot 10^{-29} J} = \\ &= 4,64793529546 \cdot 10^{18} \end{aligned}$$

is the number of the conductor electronegative fields interacting simultaneously with every electrino of the vortex flow;

$$L_1 = V_1 \cdot \Delta\tau_1 = 0,945 m$$

is extent of electric impulse along the conductor;

$$n_{\pi 1} = L_1/h_0 = 4,5695003344 \cdot 10^6$$

is the number of vortex packages in the nanosecond impulse;

$$\begin{aligned} N_\varepsilon &= V \cdot \frac{\Delta\tau_1}{\Phi_0} = \frac{47,97 \cdot 10^{-9} V \cdot s}{7,7429542 \cdot 10^{-25} V \cdot s} = \\ &= 6,19530979532 \cdot 10^{16} \end{aligned}$$

is the total number of the electrinos in the impulse;

$$\Delta i_1 = N_\varepsilon \cdot \varepsilon / \Delta\tau_1 = 31,574862 \cdot 10^{-3} A$$

is the value of the current in the impulse, theoretical value according to the new electrodynamic law, where

$$\Phi_0 = 7,7429542 \cdot 10^{-25} V \cdot s = const$$

is magnetic flow constant;

$$v_1 = \Delta\tau_1/\varepsilon = 1,588540973 \cdot 10^{25} s^{-1};$$

$$v_1 = V/\Phi_0 = 1,588540973 \cdot 10^{25} s^{-1}$$

is passage frequency of the electrino along the conductor with the current Δi_1 ;

$$n_{\varepsilon\pi} = N_{\varepsilon}/n_{\pi 1} = 1,35579589495 \cdot 10^{10}$$

is the number of electrinos in one vortex package;

$$\begin{aligned} k_1 &= \sqrt{n_{\varepsilon\pi}/2\pi} = \sqrt{N_{\varepsilon}/2\pi \cdot n_{\pi 1}} = \\ &= \sqrt{21,5781618504 \cdot 10^8} = \\ &= 4,64523001050 \cdot 10^4 \end{aligned}$$

is electrino population of one orbit in the package; the value averaged over orbits;

$$n_1 = n_{\varepsilon\pi}/k_1 = 2,91868409505 \cdot 10^5$$

is the number of orbits in the vortex package;

$$V = \Phi_0 \cdot n_1 \cdot k_1 \cdot \omega_1 = 12,3 V$$

is voltage, generated by the Ericsson accumulator applied in the experiment; is the physical essence of the voltage of the current being generated by Ericsson storage battery used in the experiment.

The distance between the orbits within one package is assumed to be equal to the distance between the neighbouring packages, so the thickness of the vortex package between the conductor surface and the outer edge of the flow is Δl_1 :

$$\Delta l_1 = n_1 \cdot h_0/2\pi = 9,6066134997 \cdot 10^{-3} m.$$

The real value of the distance between the orbits ought to be essentially less and the exact value of Δl can be determined with the help of a diminutive magnetic needle, unfortunately our laboratory did not possess it.

However if we assume that

$$U_1 = \frac{V_s}{r_1} = 8,20840624582 \cdot 10^{12} m/s$$

is U_{max} of the electrino of the first lowest orbit of the vortex package then the average orbital velocity of the electrino will be $\overline{U_{\varepsilon}}$:

$$\overline{U_{\varepsilon}} = \frac{U_1}{2} = 4,104203125 \cdot 10^{12} m/s,$$

and the electrinos which are in the middle among the total number n_1 of the orbits and therefore they are $\bar{r} = V_s/\overline{U} = 2,23 \cdot 10^{-3} m = 2r_1$ distant from the conductor axis.

It is obviously that the external orbit of the vortex package is r_2 distant from the conductor axis and it is equal to:

$$r_2 = \bar{r} + r_1 = 3r_1 = 3,345 \cdot 10^{-3} m,$$

and the thickness of electrinos' vortex package which is equal to the thickness Δl_1 of nanosecond impulse amounts to:

$$\Delta l_1 = r_2 - r_1 = 2,23 \cdot 10^{-3} m.$$

Velocity of the current propagation along thin copper conductor

$r_2 = 2,5 \cdot 10^{-4} m$ is the radius of the bare copper conductor;

$l_1 = 3,876 m$ is the length of the basic conductor;

$l_2 = 0,372 m$ is the length of the reference conductor;

$\Delta\tau_2 = 9 \cdot 10^{-9} s$ is delay time of an impulse;

$V = 12,3 V$ is impulse voltage.

Result analysis

$V_2 = (l_1 - l_2)/\Delta\tau_2 = 3,893333333 \cdot 10^8 m/s$ is the velocity of the current propagation along the conductor;

$$\omega_2 = V_2/h_0 = 1,88260190144 \cdot 10^{15} s^{-1}$$

is revolution frequency of an electrino belonging to the lower orbit around the conductor;

$$U_2 = 2\pi r_2 \cdot \omega_2 = 2,9571841516 \cdot 10^{12} m/s$$

is orbital velocity of the electrino of the first orbit of the vortex package;

$$V_{s2} = U_2 \cdot r_2 = 7,392960379 \cdot 10^8 m^2/s$$

is sectorial velocity of the electrino in the electrostatic field of the thin copper conductor;

$$\begin{aligned} n_2 &= \frac{m_{\varepsilon} \cdot U_1^2}{\varepsilon \cdot E_{Cu}^0} = \frac{-59,9531732582 \cdot 10^{-12} \text{ Дж}}{-9,93832158355 \cdot 10^{-29} \text{ Дж}} = \\ &= 6,03252498464 \cdot 10^{17} \end{aligned}$$

is the number of electronegative fields of the conductor atoms interacting simultaneously with every electrino of the vortex flow;

$$L_2 = V_2 \cdot \Delta\tau_2 = 3,504 m$$

is the extension of the electric impulse along the conductor;

$$n_{\pi 2} = L_2/h_0 = 1,69434171129 \cdot 10^7$$

is the number of the vortex packages in a nanosecond impulse;

$$N_{\varepsilon} = V \cdot \Delta\tau_2/\Phi_0 = 1,42968687584 \cdot 10^{17}$$

is the total number of electrinos in the impulse;

$$\Delta i_2 = V \cdot \varepsilon/\Phi_0 = 3,15748620797 \cdot 10^{-2} A$$

is the amount of current in the impulse;

$$v_2 = V/\Phi_0 = 1,588540973 \cdot 10^{25} s^{-1}$$

is the frequency of passing of an electrino through the conductor; it is equal to v_1 ;

$$n_{\varepsilon\pi} = N_{\varepsilon}/n_{\pi2} = 8,43800790781 \cdot 10^9$$

is the number of electrinis in one vortex package;

$$k_1 = \sqrt{n_{\varepsilon\pi}/2\pi} = 3,66462913317 \cdot 10^4$$

is the number of electrinis populating one trajectory in the vortex package;

$$n_2 = n_{\varepsilon\pi}/k_2 = 2,30255439259 \cdot 10^5$$

is the number of orbits in the vortex package;

$$V = \Phi_0 \cdot n_2 \cdot k_2 \cdot \omega_2 = 12,3 \text{ V}.$$

Velocity of the current along aluminium conductor

$r_3 = 0,85 \cdot 10^{-3} \text{ m}$ is the radius of the bare conductor;

$l_1 = 1,307 \text{ m}$ is the basic conductor;

$l_2 = 0,324 \text{ m}$ is the reference conductor;

$\Delta\tau_2 = 3,9 \cdot 10^{-9} \text{ s}$ is the impulse delay time;

$V = 12,3 \text{ V}$ is impulse voltage.

Analysis of the measurement results

$$V_3 = (l_1 - l_2)/\Delta\tau_3 = 2,52051282051 \cdot 10^8 \text{ m/s}$$

is the velocity of the current propagation along the conductor;

$$\omega_3 = V_3/h_0 = 1,2187813943 \cdot 10^{15} \text{ s}^{-1}$$

is the circular frequency of an electrino of the lower orbit around the conductor;

$$U_3 = 2\pi r_3 \cdot \omega_3 = 6,5091549469 \cdot 10^{12} \text{ m/s}$$

is the orbital velocity of the electrinis of the first orbit;

$$E_{Al}^0 = -1,55 \text{ V}$$

is aluminium electrode potential, it is also electrostatic potential of aluminium atoms;

$$V_{SAI} = U_3 \cdot r_3 = 5,53278170486 \cdot 10^9 \text{ m}^2/\text{s}$$

is the sectorial velocity of the electrino in the electrostatic field of the conductor;

$$n_3 = \frac{m_{\varepsilon} \cdot U_3^2}{\varepsilon \cdot E_{Al}^0} = \frac{-29,0472253733 \cdot 10^{-11} \text{ J}}{-3,0808796909 \cdot 10^{-27} \text{ J}} = 9,42822449675 \cdot 10^{16}$$

is the number of electronegative fields of the conductor interacting simultaneously with every electrino of the vortex flow;

$$L_3 = V_3 \cdot \Delta\tau_3 = 0,983 \text{ m}$$

is the extension of the electric impulse along the conductor;

$$n_{\pi3} = L_3/h_0 = 4,7532474378 \cdot 10^6$$

is the number of vortex packages in the nanosecond impulse;

$$N_{\varepsilon} = V \cdot \Delta\tau_3/\Phi_0 = 6,19530979532 \cdot 10^{16}$$

is the total number of the electrinis in the impulse;

$$\Delta i_3 = N_{\varepsilon} \cdot \varepsilon/\Delta\tau_3 = 3,15748620797 \cdot 10^{-2} \text{ A}$$

is the amount of current in the impulse;

$$\nu_3 = V/\Phi_0 = 1,58854097315 \cdot 10^{25} \text{ s}^{-1}$$

is the frequency of electrino passing through the conductor;

$$n_{\varepsilon\pi} = N_{\varepsilon}/n_{\pi3} = 1,30338465993 \cdot 10^{10}$$

is the number of electrinis in one vortex package;

$$k_3 = \sqrt{n_{\varepsilon\pi}/2\pi} = 4,55455937909 \cdot 10^4$$

is average population of one orbit of the vortex package;

$$n_3 = n_{\varepsilon\pi}/k_3 = 2,86171405715 \cdot 10^5$$

is the number of orbits in one vortex package;

$$V = \Phi_0 \cdot n_3 \cdot k_3 \cdot \omega_3 = 12,3 \text{ V}$$

is impulse voltage.

If we compare now the results of analysis for two copper conductors of different diameters, it will not be difficult for a reader to understand some very important theoretical propositions of the new electrodynamics.

1. Neither electric current, nor electrical machine, and nor electrical engineering, nor radioengineering in general can exist without negative static potential E_i^0 .

2. Electric current is generated with the electrino vortex flow around the conductor and along it.

3. The velocity of the current propagation along the conductor is not equal to the light velocity and it is not a constant value. Besides the velocity of electrino propagation along the thin conductor V_i is 29.867% more than the light velocity $c_0 = 2,99792458 \cdot 10^8 \text{ m/s}$.

4. Orbital velocity of the electrino around the conductor is $n = U_i/C_0 = 27380.29$ times as much as the light velocity!

5. Theory of relativity formulated in 1905 has never been a theory, it has been a hypothesis created in isolation from physical reality and on-based on postulates:

velocity of light and all other kinds of radiation is:

$$c_0 = 2,99792458 \cdot 10^8 \text{ m/s} = \text{const.}$$

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