International Conference «Process Management and Scientific Developments»
Birmingham, United Kingdom, June 9, 2020, pp. 173-182,
DOI:10.34660/INF.2020.54.74.001

Analysis of the electric field of a plane lattice of sign-alternating axes

Professor Vladimir Leonov
e-mail: leonquanton#gmail.com

Abstract. The electric field of a plane lattice of sign-alternating axes can be represented by a complex potential. Separating the real and imaginary parts of the complex potential, we find the electric field strength function and its modulus. Analysis of the electric field of a plane lattice of sign-alternating axes shows us that this field is short-range. When moving away from the lattice, its electric field strength decreases very quickly. We see that at a distance equal to the lattice step 1.0a, the field strength decreases by an order of magnitude, and at a distance of two steps 2.0a from lattice its electric field can be neglected in practical calculations. Our analysis shows us that the electric field of the lattice of sign-alternating axes is a very inhomogeneous field and this is a short-range field at a distance of one step of the lattice. Sign-alternating fields are widely used in my fundamental theory of Superunification: sign-alternating superstrings, sign-alternating shells of nucleons and others [1-5].

Keywords: sign-alternating fields, short-range fields and forces, theory of Superunification, sign-alternating superstrings, bifilar winding, quantum engines, Universe.

1. Calculation of the lattice field of sign-alternating axes. Fig. 1 shows a plane lattice of sign-alternating electric axes. The signs of polarity of the electric charge of such axes are alternating when the plus (+) sign changes to a minus (-) sign on the adjacent axis. Such a plane lattice is accepted by us as infinite. The origin of the Y coordinate is the axis with a positive charge (+), and the X axis is lying in the plane of the lattice.

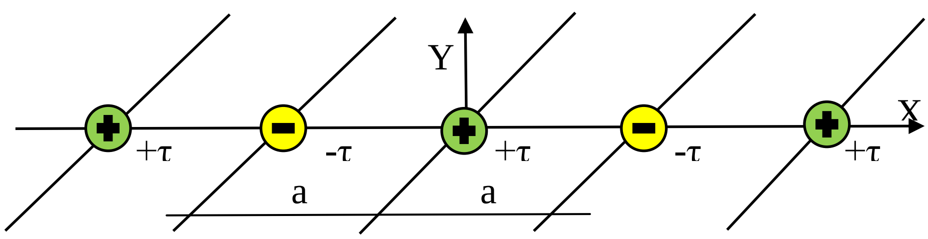

Fig. 1. This is a plane lattice of sign-alternating electric axes.

The electric potential U of sign-alternating electric axes of a similar bifilar winding (Fig. 4) is described by a function of a complex variable [1]:

$$U = \frac{\tau}{4\pi\varepsilon_0\varepsilon_1} iLn(tg\frac{a}{\pi}z) \qquad (1)$$

where τ is the linear density of electric charges of the axis, C/m;
$\varepsilon_0 = 8.85 \cdot 10^{-12}$ F/m is electric constant;
ε_1 is the relative dielectric constant of the medium;
a is the distance between the centers of the axes, m;
z = x + iy is a complex number ($i^2 = -1$).

We separate the real part of the complex potential (1) from its imaginary part and we obtain the function of the electric potential φ (x, y) in a rectangular coordinate system [5]:

$$\varphi = \frac{\tau}{4\pi\varepsilon_0\varepsilon_1} \ln \frac{ch\frac{\pi}{a}y + \cos\frac{\pi}{a}x}{ch\frac{\pi}{a}y - \cos\frac{\pi}{a}x} \qquad (2)$$

Next, we find the function of the electric field intensity vector E as the gradient from the scalar field of the potential φ (x, y) of the lattice of sign-alternating electric axes [6]:

$$E = grad\varphi = \frac{\partial\varphi}{\partial x}\mathbf{i} + \frac{\partial\varphi}{\partial y}\mathbf{j} =$$

$$= \frac{\tau}{2\pi\varepsilon_0\varepsilon_1 a}\left(\frac{ch\frac{\pi}{a}y \cdot \sin\frac{\pi}{a}x}{ch^2\frac{\pi}{a}y - \cos^2\frac{\pi}{a}x}\mathbf{i} + \frac{sh\frac{\pi}{a}y \cdot \cos\frac{\pi}{a}x}{ch^2\frac{\pi}{a}y - \cos^2\frac{\pi}{a}x}\mathbf{j} \right) \qquad (3)$$

where **i** and **j** are unit vectors in the x and y axes, respectively.

As we see from (2) and (3), the electric field of the lattice of alternating electric axes is represented by special functions [7, 8]. So that we can make a graphical representation of the electric field in equipotential and electric lines of force, we must write the equations for equipotentials and electric lines of force, provided that equipotential lines are always perpendicular to the electric lines of force. The line perpendicularity condition is satisfied by equation (1) and its solutions (2) and (3).

We assume that the electric potential of an axis with a small radius r_0 has a maximum value ½ φ_{max}. The potential difference along the axes (+) and (-) is equal to ½ φ_{max} - (-½ φ_{max}) = φ_{max}. By this we set the boundary conditions for solving our equations. Further, from (2) we find the linear density τ of electric charges of the axis under the boundary conditions ½ φ_{max}, x = r_0, y = 0:

$$\tau = \frac{2\pi\varepsilon_0\varepsilon_1\varphi_{max}}{\ln\dfrac{1+\cos\frac{\pi}{a}r_0}{1-\cos\frac{\pi}{a}r_0}} \qquad (4)$$

2. Equations equipotential and electric field lines of the lattice of sign-alternating fields. Next, we separate the variables with respect to y and x in equation (2) and obtain the equipotential equation in implicit form through hyperbolic functions:

$$\mathrm{ch}\frac{\pi}{a}y = \mathrm{cth}\frac{2\pi\varepsilon_0\varepsilon_1}{\tau}\cdot\cos\frac{\pi}{a}x \qquad (5)$$

After substituting (4) in (5) we obtain the equation of equipotentials of a lattice of sign-alternating electric axes:

$$y = \pm\frac{a}{\pi}\ln(k_1\cos\frac{\pi}{a}x + \sqrt{k_1^2\cos^2\frac{\pi}{a}x - 1}) \qquad (6)$$

where k_1 is the equipotential coefficient which has its own formula:

$$k_1 = \left|\mathrm{cth}\left(\frac{\varphi}{\varphi_{max}}\ln\frac{1+\cos\frac{\pi}{a}r_0}{1-\cos\frac{\pi}{a}r_0}\right)\right| \qquad (7)$$

The lines of equipotentials intersect the X axis at the point x at y = 0:

$$x = \pm\frac{a}{\pi}\arccos\frac{1}{k_1} \qquad (8)$$

Equations (6), (7) and (8) allow us to graphically represent the lattice field of sign-alternating electric axes in the form of equipotential surfaces having the potential φ/φ_{max} expressed in relative units (Fig. 1).

To build a picture of the field in electric lines of force we use the stream function Ψ of intensity **E** (3) which penetrates the lattice of alternating electric axes (Fig. 1) [7]:

$$\Psi = \frac{\tau}{2\pi\varepsilon_0\varepsilon_1}\mathrm{arctg}\frac{\mathrm{sh}\frac{\pi}{a}x}{\sin\frac{\pi}{a}x} \qquad (9)$$

Next, we find the total flux Φ of the electric field emerging from the charged axis using the Gauss theorem for surface S around an axis:

$$\Phi = \oint_S E dS = \frac{\tau}{\varepsilon_0\varepsilon_1} \qquad (10)$$

From (10) we find:

$$\tau = \varepsilon_0 \varepsilon_1 \Phi \tag{11}$$

Substituting (11) in (9) we get:

$$\Psi = \frac{\Phi}{2\pi} \operatorname{arctg} \frac{\operatorname{sh} \frac{\pi}{a} x}{\sin \frac{\pi}{a} x} \tag{12}$$

From (12) we obtain the equation of the electric lines of force:

$$y = \pm \frac{a}{\pi} \ln \left(\operatorname{tg} 2\pi \frac{\Psi}{\Phi} \cdot \sin \frac{\pi}{a} x + \sqrt{\operatorname{tg}^2 2\pi \frac{\Psi}{\Phi} \cdot \sin^2 \frac{\pi}{a} x + 1} \right) \tag{13}$$

The total flux Φ and its parts in the form of the ratio Ψ/Φ are included in (13). The magnitude of the flux penetrating the first quadrant of the coordinate system between the X and Y axes is one quarter: Ψ/Φ = ¼. The beginning of the coordinate is the X axis, and we will do the counting direction of the flux counterclockwise. Then along the X axis at y = 0 the flux is equal to zero Ψ = 0, and along the Y axis as y → ∞ the flux is equal to one quarter (12):

$$\Psi = \frac{\Phi}{2\pi} \operatorname{arctg} \infty = \frac{1}{4} \Phi \tag{14}$$

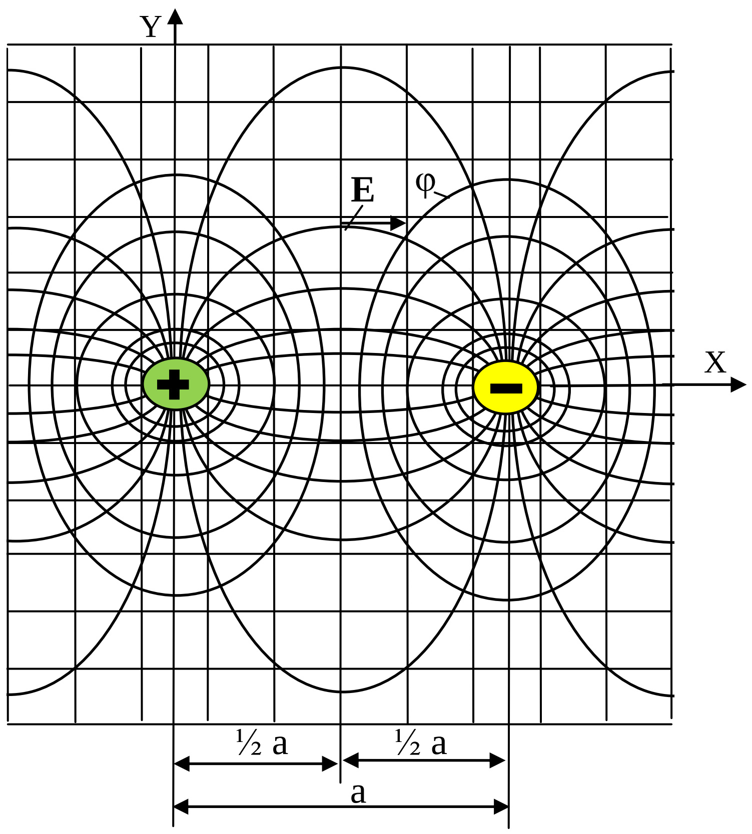

Fig. 2. The picture of the electric field of the lattice of sign-alternating electric axes is represented by the equipotentials φ = const and electric lines of force **E**.

Equation (14) allows us to determine the coordinates of the electric lines of force for the relative flux Ψ/Φ from 0 to ¼ inside the first quadrant with any interval. Due to the symmetry of the field, we can always construct its complete picture for four quadrants of the coordinate system from the calculated data for the first quadrant.

Based on equations (2), (3), (6) and (13), we constructed a graphic picture of the electric field of the lattice of sign-alternating electric axes in the form of equipotentials φ = const and electric lines of force **E** (Fig. 2). Analysis of the electric field of the lattice of sign-alternating electric axes shows us that this field is very inhomogeneous and is mainly concentrated in the lattice itself at distances of no more than the step of the lattice a. This is a short-range electric field.

3. Analysis of a short-range field of a lattice of sign-alternating fields. Next, we find from (3) the modulus of the electric field strength E of sign-alternating electric axes:

$$E=\sqrt{\left(\frac{\partial E}{\partial x}\right)^2+\left(\frac{\partial E}{\partial y}\right)^2}=\frac{\tau}{4\pi\varepsilon_0\varepsilon_1 a}\left(ch^2\frac{\pi}{a}y-\cos^2\frac{\pi}{a}x\right)^{-\frac{1}{2}} \qquad (15)$$

On the Y axis at x = 0, the modulus of the electric field strength E_{1y} (15) will have the form:

$$E_{1y}=\frac{\tau}{2\pi\varepsilon_0\varepsilon_1 a(sh\frac{\pi}{a}y)}; \qquad f_1=\frac{1}{sh\frac{\pi}{a}y} \qquad (16)$$

As we see from (16), the field strength E_{1y} changes according to the inverse hyperbolic sinus law (f_1, Fig 3), which is characterized by a very rapid decline when we move away from the lattice of sign-alternating electric axes.

On the Y axis at x = 0.5a, the modulus of the electric field strength E_{2y} (15) will have the form:

$$E_{2y}=\frac{\tau}{2\pi\varepsilon_0\varepsilon_1 a(ch\frac{\pi}{a}y)}; \qquad f_2=\frac{1}{ch\frac{\pi}{a}y} \qquad (17)$$

As we see from (17), the field strength E_{2y} changes according to the inverse hyperbolic cosine law (f_2, Fig 3), which is characterized by a very rapid decline when we move away from the lattice of sign-alternating electric axes.

Figure 3 shows graphs of a rapid decrease in field strength when we move along the Y axis moving away from the lattice plane of sign-alternating axes (Fig. 1). We see that at a distance equal to the lattice step 1.0a, the field strength decreases by an order of magnitude, and at a distance of two steps 2.0a from lattice its electric field can be neglected in practical calculations. Our analysis shows us that the electric field of the lattice of sign-alternating axes is a very inhomogeneous field and this is a short-range field at a distance of one step of the lattice.

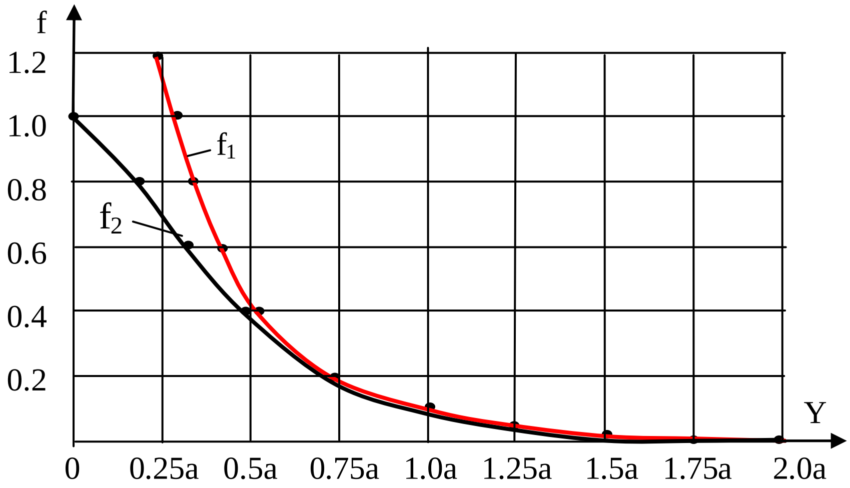

Fig. 3. We see a rapid decrease in the field strength E_{1y} (16) and E_{2y} (17) as a function of f_1 (16) and f_2 (17) when we move along the Y axis moving away from the lattice plane of sign-alternating axes (Fig. 1).

The electric force $\mathbf{F_e}$ acting on the electric charge q_e in a sign-alternating field (Fig. 1) is proportional to the field strength **E** (3), (15), (16), (17). These are short-range forces:

$$\mathbf{F_e} = q_e\mathbf{E} \qquad (18)$$

4. Practical application of sign-alternating fields in science and technology:

4.1. "Antigravity" dielectric separators of finely dispersed particles. The separator includes: bifilar winding 1, drum 2, brush 3, hopper 4, fraction receiver 5, particles 6 (Fig. 4).

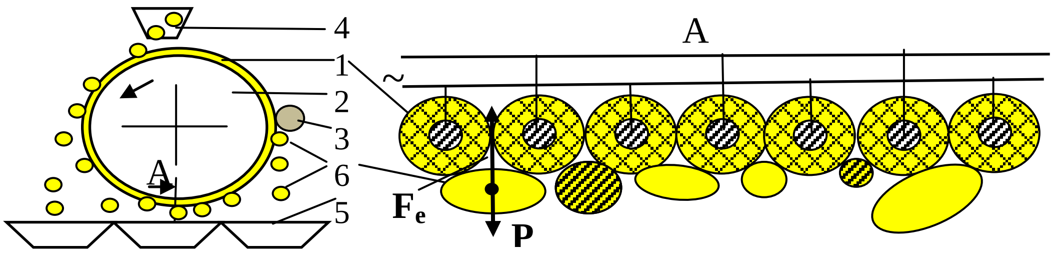

Fig. 4. This is a scheme of an "antigravity" dielectric separator with a bifilar winding in section A (increase).

Bifilar winding was used by Nikola Tesla in electric devices. We wrapped the bifilar winding 1 on the drum 2 in two wires with insulation. Power winding 1 is AC, frequency 50... 3000 Hz, voltage 1... 10 kV. Bifilar winding has a unique property, it attracts both non-magnetic (dielectric and conductive) and magnetic materials. Earth gravity also manifests itself in a similar way. The force Fe attraction of the particles by the bifilar winding is due to their polarization p, where p is the electric dipole moment of the particle [9]:

$$\mathbf{F_e} = p \cdot \mathrm{grad}\mathbf{E} \qquad (19)$$

The separator works as follows [10]. Particles 6 (seeds, dust and crushed rock) from the hopper 4 are fed to the surface of the bifilar winding 1 which attracts them with force $\mathbf{F_e}$. The drum 2 has a rotation and under the action of the force **P** of gravity, various particles are divided into fractions in the receiver 5. For this work, I was awarded the Russian Government Prize in Science and Technology in 1995.

The name “antigravity” separator is taken by me in quotation marks, since fully antigravity is created due to the combined influence of the gradients of electric (19) and magnetic fields as a gradient of electromagnetic energy gradW.

4.2. The creation of artificial gravity and antigravity quantum engines. My studies of the behavior of particles in the field of a bifilar winding allowed me to recognize the electromagnetic nature of quantum gravity. To create gravity force **F**, we must, like formula (19), create an energy gradient W which quantized space-time is filled with [11, 1]:

$$\mathbf{F} = \mathrm{grad}W \qquad (20)$$

Formula (20) is the main one when describing the fundamental forces of nature: gravity, electromagnetism, nuclear and electroweak forces. From (20) it follows Newton's gravitation law and the momentum conservation law, which are special cases of the formula (20) by the enormous energy quantized space-time. In astrophysics, the energy W (20) is dark energy and it is able to move the galaxies with acceleration by force **F** (20). The Universe has tremendous elasticity and tension, which are set by sign-alternating superstrings.

4.3. The Universe has sign-alternating superstrings. Our Universe is pierced by electric and magnetic superstrings which are an endless chain of sign-alternating electric (±e) and magnetic (±g) charges-quarks. These are point charges. Fig. 5 shows a scheme for calculating the electric force F_e acting on elementary quark-charges (± e) inside a superstring.

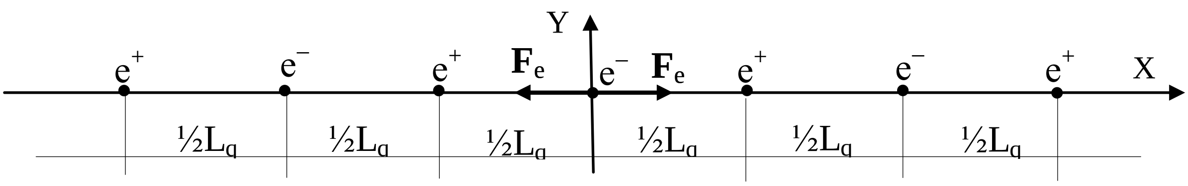

Fig. 5. Calculation of the tensioning of sign-alternating electrical superstring.

For a = $\frac{1}{2}L_{q0}$ = $0.37.10^{-25}$ m, we obtain the superstring tension force using the field superposition principle, where e = $1{,}6\cdot10^{-19}$ C is an elementary electric quark-charges [1, 12]:

$$\mathbf{F}_e = \frac{\mathbf{1}_x}{4\pi\varepsilon_o}\frac{e}{(0{,}5L_{qo})^2}\left(1-\frac{1}{2^2}+\frac{1}{3^2}-\frac{1}{4^2}+\cdot\cdot\right)=\frac{\mathbf{1}_x}{\pi\varepsilon_o}\frac{e}{L_{qo}^2}\left(\frac{\pi^2}{12}\right)=\frac{\pi}{12\varepsilon_o}\frac{e}{L_{qo}^2}\mathbf{1}_x=\pm 1.4\cdot 10^{23}\,\mathrm{N} \qquad (21)$$

The magnetic superstring has a similar tension force: $F_g=\pm 1.4 \cdot 10^{23}$N, confirming the colossal elasticity of quantized space-time (dark matter). For the first time I was able to calculate these forces based on the methodology for the analysis of sign-alternating fields.

4.4. A nucleon has an alternating shell as the basis of nuclear forces. The theory of Superunification has made significant adjustments to our understanding of the nature of nuclear forces. We left the quark structure of nucleons. But we replaced fractional quarks with entire quarks (±1e). In addition, we placed quarks in the sign-alternating nucleon shell. The nucleon shell can be compressed and by this action it itself forms the nucleon mass as a result of spherical deformation (Einstein's curvature) of quantized space-time (dark matter). But most importantly, we got the effect of the attraction of the alternating shells of nucleons to each other, regardless of the presence of an unbalanced charge on the nucleon (Fig. 6) [1, 13, 14].

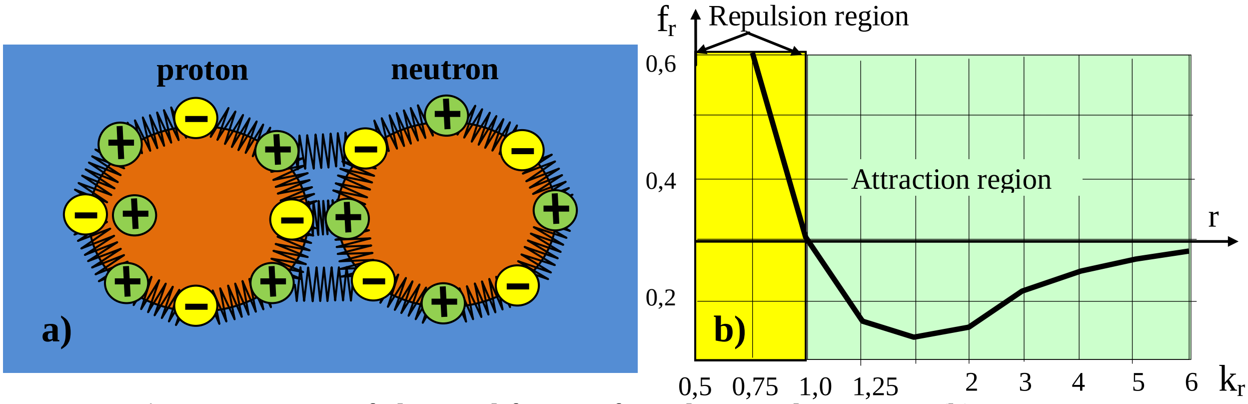

Fig. 6. Variation of electrical forces of repulsion and attraction (b) in interaction of the sign-alternating nucleons shells (a) [1].

The attraction of sign-alternating shells of nucleons implements the principle of short-range contact forces at distances r ~ 10^{-15} m. The nature of these short-range forces, as shown by the calculations (see the graph in Fig. 6b), fully corresponds to the nuclear forces between nucleons in the nuclei of atoms [1].

References:

[1] V. S. Leonov. Quantum Energetics. Volume 1. Theory of Superunification. Cambridge International Science Publishing, 2010, 745 pgs.

[2] V.S. Leonov. Quantum Energetics: Theory of Superunification. Viva Books, India, 2011, 732 pages.

[3] Download free. Leonov V. S. Quantum Energetics. Volume 1. Theory of Superunification, 2010. http://leonov-leonovstheories.blogspot.com/2018/04/download-free-leonov-v-s-quantum.html *[Date accessed April 30, 2018].*
[4] Vladimir Leonov ORCID https://orcid.org/0000-0001-5270-0824
[5] Vladimir Leonov – blogger. https://www.blogger.com/profile/03427189015718990157. *[Date accessed April, 2011].*
[6] William R. Smythe. Ctatic and Dynamic Electricity. McGraw-Hill Book Company Inc. New York – Toronto – London, 1950, 637 p.
[7] Leonov V.S. Calculation and analysis of ponderomotive forces in sign-alternating electric fields. Moscow: Collection of scientific works of the MIISP, vol. 16, issue 5, 1979, p. 36-42.
[8] Janke E., Emde F., Lesh F., Special functions, formulae, diagrams, tables. Moscow, Nauka, 1977, 344 p.
[9] Leonov V.S. Application of the theory of the function of a complex variable for calculating the field of a bifilar winding. Moscow: Collection of scientific works of the MIISP, vol. 15, issue 5, 1978, p. 25-27.
[10] Author's Certificate USSR No 680762 /Leonov V.S., Tarushkin V.I. Dielectric separator. - Bulletin of Inventions, 1979, No. 31, priority 1976.
[11] Vladimir S. Leonov and etc. Non-rocket, non-reactive quantum engine: idea, technology, results, prospects. Published: // Aerospace Sphere Journal (ASJ) 2019, №1, pp. 68-75. DOI: 10.30981/2587-7992-2019-98-1-68-75
[12] Vladimir Leonov. Tensioning of the Electromagnetic Superstring. viXra:1910.0506 *submitted on 2019-10-25.*
[13] Vladimir Leonov. Quantized Structure of Nucleons. The Nature of Nuclear Forces. viXra:1910.0290 *submitted on 2019-10-17.*
[14] Leonov V.S., Electrical nature of nuclear forces, Agrokonsalt, Moscow, 2001.

For citation:
Leonov V.S. Analysis of the electric field of a plane lattice of sign-alternating axes. International Conference «Process Management and Scientific Developments» Birmingham, United Kingdom, June 9, 2020, pp. 173-182, DOI:10.34660/INF.2020.54.74.001
Download PDF:
https://drive.google.com/file/d/1vwWkIF_M16nsA_z9zhR34E91xcP13uqa/view?usp=sharing