**THE_MOST_MYSTERIOUS_FIELD**

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*The summary.* The new mathematical model of the magnetic field of the Earth in the form of the decisions of Maxwell's equations for quasistationary electromagnetic fields is offered.

The question of an origin of a magnetic field of the Earth remains till now a subject of sharp interest of researchers. Now as the working hypothesis, the hypothesis about generation of a magnetic field of the Earth (and other planets) due to convective movements of electro-conductive substance in a liquid kernel of a planet is accepted. This hypothesis has received the name – the theory of a hydromagnetic dynamo. However concrete mathematical model of a hydromagnetic dynamo for the Earth it is not constructed yet. Difficulties are connected as with a lack of data on the energy sources raising convection movement in a kernel of the Earth, and with mathematical difficulties of the decision of full system of the equations of magnetic hydrodynamics. Among earlier defective hypotheses, such as: a hypothesis about the ferromagnetic nature of terrestrial magnetism, a hypothesis about division of electric charges in a body of the Earth, a hypothesis about electric currents caused termo-EMF, etc., we have not met a hypothesis about quasistationary electromagnetic field of the Earth. Therefore, we have decided to pass all way which has been earlier passed by coryphaeuses of electromagnetism.
But before to start an object of research, we would like to ask one question to experimenters.
Look, please, at fig.1 and fig.2. In fig.1 the direction of rotation of the Earth and a direction of its magnetic field (compasses in the centre of sphere and outside) is shown. In fig.2 the direction of rotation of negative electric charges round a compass arrow is shown.

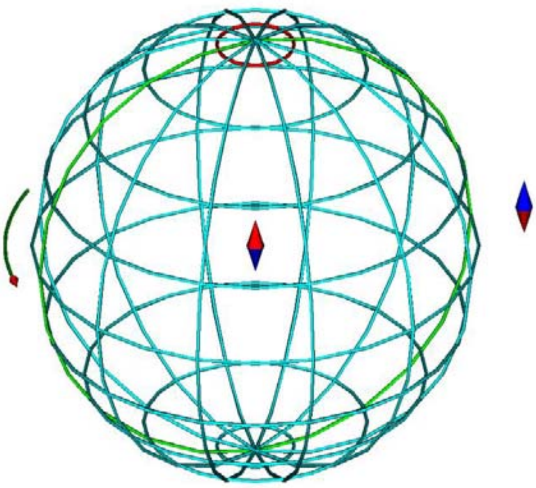

Fig.1
Direction of rotation of the Earth and direction of its magnetic field

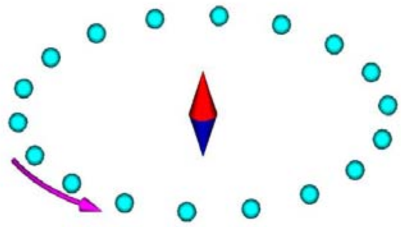

Fig.2
Prospective direction of a magnetic field of electrons that moving on a ring orbit

As you can see, in both cases magnetic fields have an identical direction.
Question: – Misters experimenters, somebody of you has carry out „pure experiment" to confirm what is shown in fig.2 ?
Unfortunately, we should afflict those experimenters who will want to execute such experiment, – we on the Earth cannot create a condition for performance such „pure experiment".
Now let's repeat a course of reasoning of H.A. Lorentz which have led to its explanation of behaviour electric and magnetic fields by way of consideration of problem in various inertial frame of reference.
In fig.3 two parallel ranks of negative charges $q_e$ (electrons) are represented. We will consider, that ranks are infinite, and the distance between the next charges *"a"* in each rank is not enough, that allows us to consider each rank as the electrically charged line.

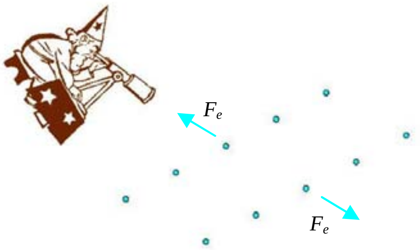


Fig.3
Electrostatic forces of pushing away between two ranks of the motionless like charges

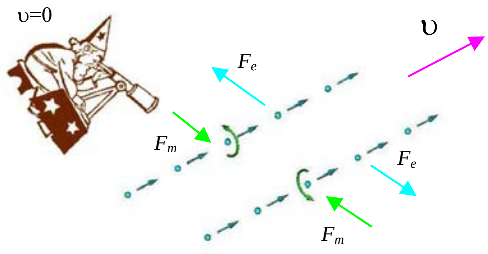


Fig.4
Electrostatic and magnetic interaction between moving like charges charges

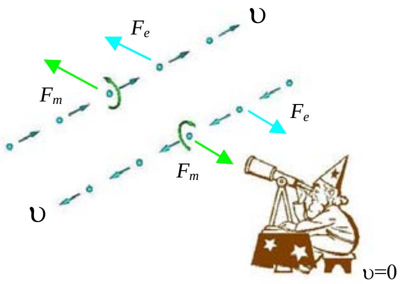


Fig.5
Electrostatic and magnetic interaction between moving like charges

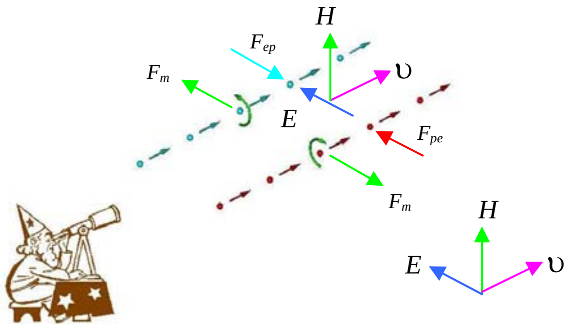


Fig.6
Electrostatic and magnetic interaction between moving unlike charges

The observer and charges are motionless rather each other. The observer "sees" only electrostatic pushing away. Magnetic forces in any way do not show themselves. Linear density of charges in ranks are $\tau = q_e/a$.
Intensity of the electrostatic field created in vacuum by each line, on distance $x=2R_e$ is calculated under the formula

$$E(x) = \frac{\tau}{2 \cdot \pi \cdot \varepsilon_0 \cdot x} = \frac{q_e}{4 \cdot \pi \cdot \varepsilon_0 \cdot a \cdot R_e} \qquad |\mathrm{V/m}| \rightarrow |\mathrm{N}^{1/2}|/|\mathrm{s}| \qquad (1)$$

Substituting in the formula (1) value of the electric constant of vacuum, we will receive

$$E(x) = \frac{q_e \cdot c^2}{10^7 \cdot a \cdot R_e} \qquad |\mathrm{V/m}| \rightarrow |\mathrm{N}^{1/2}|/|\mathrm{s}| \qquad (2)$$

Linear electrostatic pressure between lines

$$p_e = \tau \cdot E(x) = \frac{q_e{}^2 \cdot c^2}{10^7 \cdot a^2 \cdot R_e} = \frac{\Phi_e^2}{10^7 \cdot a^2 \cdot R_e} \qquad |\mathrm{C{\times}V}|/|\mathrm{m}^2| \rightarrow |\mathrm{N/m}| \qquad (3)$$

where: $\Phi_e = q_e \cdot c = 4.8032042{\times}10^{-11}$ $|\mathrm{N}^{1/2}|{\times}|\mathrm{m}| \rightarrow |\mathrm{Wb}|$ –elementary charging impulse.
So, the mathematics shows, that the magnetic field participates in purely electrostatic interaction. The observer simply does not have experimental, and theoretical techniques for detection of this interaction.
<u>We pass to following drawing.</u> In fig.4 the same two ranks of electrons are shown, but here they move with a speed υ about observer. The observer knows, that electric unidirectional currents are drawn to each other. The induction of magnetic field of an infinite rectilinear conductor with current $J = \tau \cdot \upsilon$ being in vacuum, in points on distance $x=2R_e$ from a conductor, is calculated under the formula

$$B(x)=\frac{\mu_0\cdot J}{2\cdot\pi\cdot x}=\frac{\mu_0\cdot q_e\cdot\upsilon}{4\cdot\pi\cdot a\cdot R_e} \qquad |T| \to |N^{1/2}|/|m| \qquad (4)$$

Substituting in the formula (4) value of a magnetic constant of vacuum, we will receive

$$B(x)=\frac{q_e\cdot\upsilon}{10^7\cdot a\cdot R_e} \qquad |T| \to |N^{1/2}|/|m| \qquad (5)$$

Linear magnetic pressure between lines

$$p_m = J\cdot B(x)=\frac{q_e^{\ 2}\cdot\upsilon^2}{10^7\cdot a^2\cdot R_e} \qquad |A|\times|T| \to |N/m| \qquad (6)$$

Resultant linear pressure between moving in one direction ranks of the like electric charges

$$p_e - p_m = \frac{q_e^{\ 2}\cdot c^2}{10^7\cdot a^2\cdot R_e}-\frac{q_e^{\ 2}\cdot\upsilon^2}{10^7\cdot a^2\cdot R_e}=\frac{q_e^{\ 2}\cdot\left(c^2-\upsilon^2\right)}{10^7\cdot a^2\cdot R_e} \qquad |N/m| \qquad (7)$$

From the formula (7) follows, that if electric charges could reach a velocity of light then they could fly, as photons, not deviating from an initial direction and not dissipating. Besides, the formula (7) prompts to us, that electric charges and photons have a related origin.
We pass to a following drawing. In fig.5 two ranks of electrons are shown which fly in opposite directions with a speed υ relative the motionless observer. The observer knows, that opposite direction electric currents make a start from each other. We can simply combine two linear pressure (electrostatic and magnetic) and to receive result

$$p_e + p_m = \frac{q_e^{\ 2}\cdot c^2}{10^7\cdot a^2\cdot R_e}+\frac{q_e^{\ 2}\cdot\upsilon^2}{10^7\cdot a^2\cdot R_e}=\frac{q_e^{\ 2}\cdot\left(c^2+\upsilon^2\right)}{10^7\cdot a^2\cdot R_e} \qquad |N/m| \qquad (8)$$

But the formula (8) does not give a full explanation to this complex interaction. Movement of electric charges in opposite directions should create electric field turbulences between ranks, therefore this variant is necessary for studying for a case of movement of charges on a ring orbit. References to works in which interaction of ring currents is considered are lower given.
http://vlamir43.narod.ru/dipole_of_speed_e.pdf
http://vlamir43.narod.ru/FORMULA_FOR_SUPERCONDUCTIVITY_e.pdf
http://vlamir43.narod.ru/GSM_e.pdf
http://vlamir43.narod.ru/THE_ELECTRICAL_WIND_e.pdf
http://vlamir43.narod.ru/THE_MOST_IMPORTANT_QUANTUM_NUMBER_e.pdf

We pass to last drawing in this series. With fig.6 in one rank electrons are replaced by positrons $q_p$ and all charges move in one direction with a speed υ relative the motionless observer. The observer already knows that in this case electrostatic forces work on rapprochement of ranks whereas magnetic forces work on pushing away of ranks from each other.
Resultant linear pressure between moving ranks in one direction of opposite electric charges will be same, as well as in the formula (7), but with an opposite sign

$$p_m - p_e = \frac{-q_e^{\ 2}\cdot\left(c^2-\upsilon^2\right)}{10^7\cdot a^2\cdot R_e} \qquad |N/m| \qquad (9)$$

In fig.6 the relative positioning of vectors of intensity of electric field $E$, to intensity of magnetic field $H$ and speed of movement $\upsilon$ of charges is shown also, which completely coincides with Maxwell's right-handed arrangement of these vectors in an electromagnetic wave.
Further it is necessary for us to calculate the linear pressure arising at movement of elementary charges on a ring orbit (fig.7 see). In this case we should find and set in the equations number of charges $N_e$ which is simultaneously being in a ring orbit and linear density of positive charges in a ring orbit $\tau_e = N_e \cdot q_p / 2 \cdot \pi \cdot R_e$, using results of the experiment executed by us on measurement of a magnetic induction of a ring current by force $J_c = 10$ |A |.

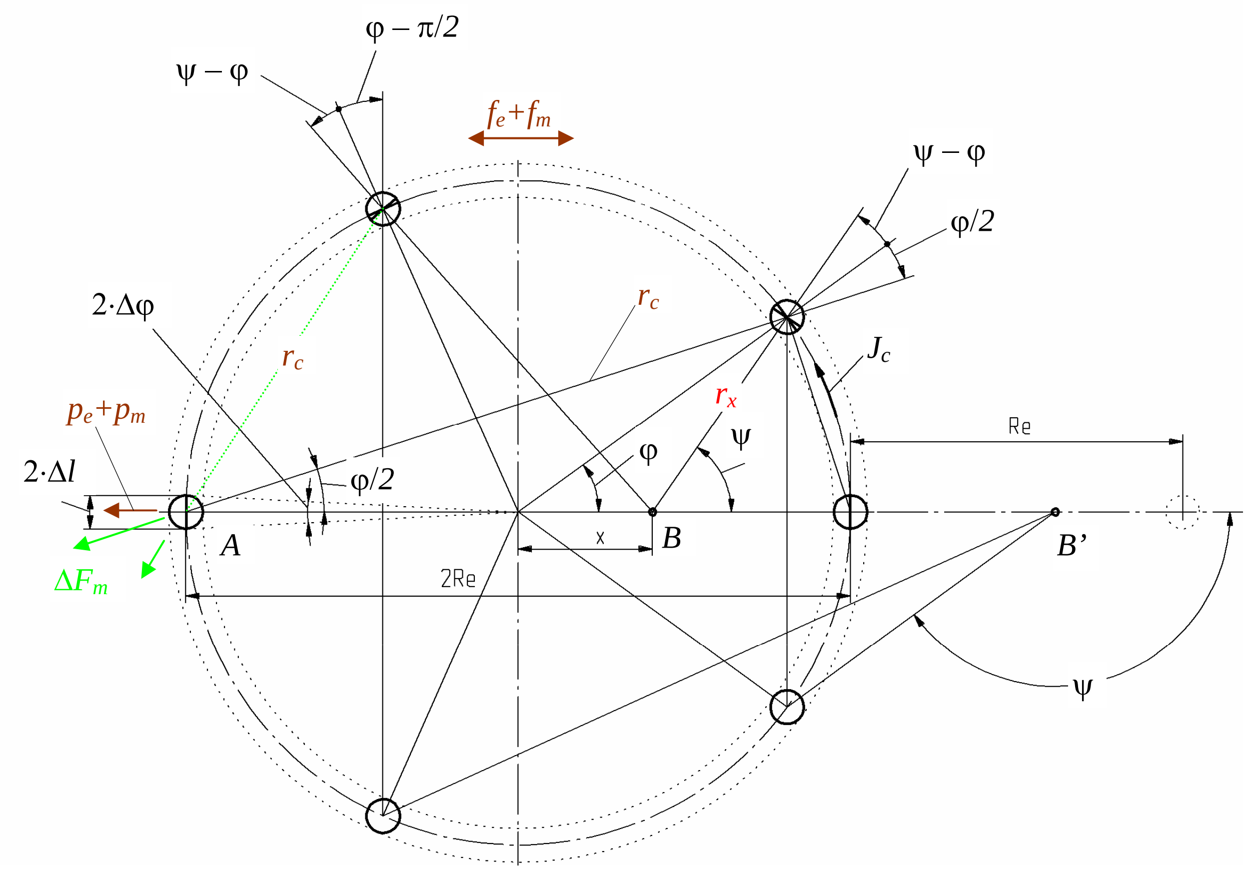


Fig.7. *To calculation of linear electrostatic and magnetic pressure in a ring current*

Moving charges on a ring orbit create on an orbit line own magnetic field which we can compare with the external magnetic field operating on the same charges with force of Lorentz, but in an opposite direction. For a case when speed of a charge is perpendicular to a direction of external magnetic field $B_L$, Lorentz's force $F_L$ and radius of orbit $R_L$ are calculated under formulas

$$F_L = q_e \cdot \upsilon \cdot B_L = J_e \cdot B_L \qquad |N| \qquad (10)$$

$$R_L = \frac{M_e \cdot \upsilon}{q_e \cdot B_L} = \frac{M_e \cdot J_e}{q_e^2 \cdot B_L} \qquad |m| \qquad (11)$$

where: $J_e = q_e \cdot \upsilon$ – force of a current of one charge, |A|
$M_e$ – mass of electron, |kg |

For the subsequent comparative analysis of calculations spent by us we will write down also the formula of the law of Ampere for force of interaction of two elementary currents and formula by Biot–Savart-Laplace for an induction of the magnetic field created by an elementary current.

$$dF_{ij} = \left(\frac{\mu_0}{4 \cdot \pi}\right) \cdot \left(\frac{J_i \cdot J_j}{r_{ji}^3}\right) \cdot \left(d\vec{l}_i \times \left(d\vec{l}_j \times \vec{r}_{ji}\right)\right) \qquad |N| \qquad (12)$$

$$dB_x = \left(\frac{\mu_0}{4 \cdot \pi}\right) \cdot \left(\frac{J}{r_x^3}\right) \cdot \left(d\vec{l} \times \vec{r}_x\right) \qquad |T| \qquad (13)$$

For calculation of force of magnetic interaction between elementary pieces of a ring $2\cdot\Delta l=2\cdot R_e\cdot\Delta\varphi$ (fig.7 see) we will take advantage of formulas (4) and (6) at condition that co-operating „elementary pieces“ parallel currents are located opposite each other. Under such condition $r_c=2\cdot R_e\cdot\cos(\varphi/2)$, thus everyone is necessary for turning „an elementary current“ on a angle $(\varphi/2)$ – one of them clockwise, the second counter-clockwise. Thus speed of charges will change and, accordingly, the current will be equal $J_c'=J_c\cdot\cos(\varphi/2)$. Besides, we should provide turn of each elementary site of a ring $2\cdot\Delta l'=2\cdot\Delta l\cdot\cos(\varphi/2)$, i.e. change of running length.
Using the formula (6) after the specified transformations we will receive expression for calculation of elementary force $\Delta F_m$ of magnetic pushing away between two chosen identical pieces in length $2\cdot\Delta l$

$$\Delta F_m=\left(\frac{\mu_0}{4\cdot\pi}\right)\cdot\left[\frac{(J_c')^2}{r_c}\right]\cdot(2\cdot\Delta l') \qquad |N| \qquad (14)$$

At summation of all elementary forces $\Delta F_m$ operating on an elementary piece $2\cdot\Delta l=2\cdot R_e\cdot\Delta\varphi$ in the point *"A"*, it is necessary for us to calculate only normal component of these forces. Therefore, everyone $\Delta F_m$ should be multiplied by the module $|\cos(\varphi/2)|$.

$$\Delta_\perp F_m=\left(\frac{\mu_0}{4\cdot\pi}\right)\cdot\left[\frac{J_c^2\cdot\cos^2(\varphi/2)}{2\cdot R_e\cdot\cos(\varphi/2)}\right]\cdot 2\cdot R_e\cdot\Delta\varphi\cdot\cos(\varphi/2)\cdot|\cos(\varphi/2)| \qquad |N| \qquad (15)$$

After summation of all normal a component of forces $\Delta_\perp F_m$ and the subsequent division of the received sum on length of a piece $\Delta l=R_e\cdot\Delta\varphi$, we will receive required magnetic pressure

$$p_{mc}=\frac{\sum\Delta_\perp F_m}{\Delta l}=\left(\frac{\mu_0}{4\cdot\pi}\right)\cdot\left(\frac{4\cdot J_c^2}{3\cdot R_e}\right)=2.667\times10^{-4} \qquad |N/m| \qquad (16)$$

Magnetic pressure $p_{mc}$ represents product of a magnetic induction by value of current $J_c$ in a ring, but with essential difference from the magnetic induction calculated under formula (13). This difference consists that at integration under formula (13) the sum elementary magnetic inductions $\Delta B_i$ without turn of a vector of a current is calculated. Therefore, integration operation in the formula (13) «conducts in infinity», i.e. the integral has no decision.
Moreover, «the effect of zero resistance and a zero magnetic induction in superconductors», found out Meisner and Oxenfeld in 1933, should force theorists and experimenters to continue researches of Biot, Savart and Laplace to find the new decision for the formula (13).
Value of a magnetic induction on a line of current $J_c$ is defined under the formula

$$B_c=\left(\frac{\mu_0}{4\cdot\pi}\right)\cdot\left(\frac{J_c}{2\cdot R_e}\right)\cdot 2\cdot\int_0^\pi\cos^2\left(\frac{\varphi}{2}\right)\cdot d\varphi=\frac{B_o}{4} \qquad |T| \qquad (17)$$

where: $B_o$ – magnetic induction in the ring centre.

$$B_o=\left(\frac{\mu_0}{4\cdot\pi}\right)\cdot\left(\frac{2\cdot\pi\cdot J_c}{R_e}\right)=\frac{\mu_0\cdot J_c}{2\cdot R_e} \qquad |T|$$

I.e., the magnetic induction on a current line cannot be infinitely big as it turns out under the formula (13), but cannot be and zero, as result of pushing out of a magnetic field from a current-

carrying superconductor. Hence, it is impossible to consider existing theoretical interpretation of a magnetic induction satisfactory. Further, in order to avoid mess, we will name the magnetic induction calculated under formulas (17) and (19) vector magnetic induction, and the induction of a magnetic field calculated under the formula (13) – Laplace's magnetic induction.
For a derivation of the general formula of a vector magnetic induction in any point on axes *X*, on distance *"x"* from the ring centre, we will apply the previous technique. Under the same conditions it is necessary for turning everyone „an elementary current" on a angle $(\psi-\varphi)$ counter-clockwise. Thus speed of electrons will change and, accordingly, the current magnitude will be equal $J_c{}' = J_c \cdot \cos(\psi-\varphi)$. Besides, we should take into account change of each elementary site of a ring $\Delta l' = \Delta l \cdot \cos(\psi-\varphi) = R_e \cdot \cos(\psi-\varphi) \cdot \Delta\varphi$.
Using the formula (16) after the specified transformations we will receive expression for calculation of vector elementary magnetic induction $\Delta B_r$ in a point *"B"*.

$$\Delta B_r = \left(\frac{\mu_0}{4\cdot\pi}\right)\cdot\left(\frac{J_c'}{r_x^2}\right)\cdot\Delta l' = \left(\frac{\mu_0}{4\cdot\pi}\right)\cdot\left(\frac{J_c\cdot R_e\cdot\cos^2(\psi-\varphi)}{\left[R_e^2-2\cdot R_e\cdot x\cdot\cos(\varphi)+x^2\right]^2}\right)\cdot\Delta\varphi \quad |\mathrm{T}| \qquad (18)$$

Having executed all necessary substitutions of parametres *"φ"* and *"x"*,

$$r_x = \sqrt{R_e^2-2\cdot R_e\cdot x\cdot\cos(\varphi)+x^2}$$

$$\cos(\psi) = \frac{R_e\cdot\cos(\varphi)-x}{\sqrt{R_e^2-2\cdot R_e\cdot x\cdot\cos(\varphi)+x^2}}$$

$$\cos(\psi-\varphi) = \frac{R_e-x\cdot\cos(\varphi)}{\sqrt{R_e^2-2\cdot R_e\cdot x\cdot\cos(\varphi)+x^2}}$$

we will come to integrated expression for the further research of a phenomenon of a magnetic induction

$$B_r = \left(\frac{\mu_0}{4\cdot\pi}\right)\cdot\left(\frac{J_c}{R_e}\right)\cdot 2\cdot\int_0^{\pi}\frac{\left[1-\frac{x}{R_e}\cdot\cos(\varphi)\right]^2}{\left[1-2\cdot\frac{x}{R_e}\cdot\cos(\varphi)+\left(\frac{x}{R_e}\right)^2\right]^2}\cdot d\varphi \quad |\mathrm{T}| \qquad (19)$$

Having executed calculations for a ring in diameter 100mm = 0.1m ($R_e$ = 0.05m), from a copper wire in diameter 1.5 mm, at force of current $J_c$ = 10A, we will receive following results:
– vector magnetic induction in the centre of ring $B_r$ ($x$ = 0) = 0.126 |mT|;
– vector magnetic induction on a line of ring $B_r$ ($x = R_e$) = 0.031 |mT|;
– magnetic induction on a ring line under the formula (17) $B_c$ = 0.031 |mT|.
In the centre of a ring of value of Laplace's induction (the formula (13)), of vector induction $B_r$ (the formula (19)) and experimentally measured induction coincide.
Value of a vector magnetic induction on a current line exactly four times is less, than its value in the centre of ring $B_r$ ($x = R_e$) = $0.25\cdot B_r$ ($x$ = 0) = $0.25\cdot B_o$. In fig.8 schedules for all four magnetic inductions, which have been considered above, are shown.

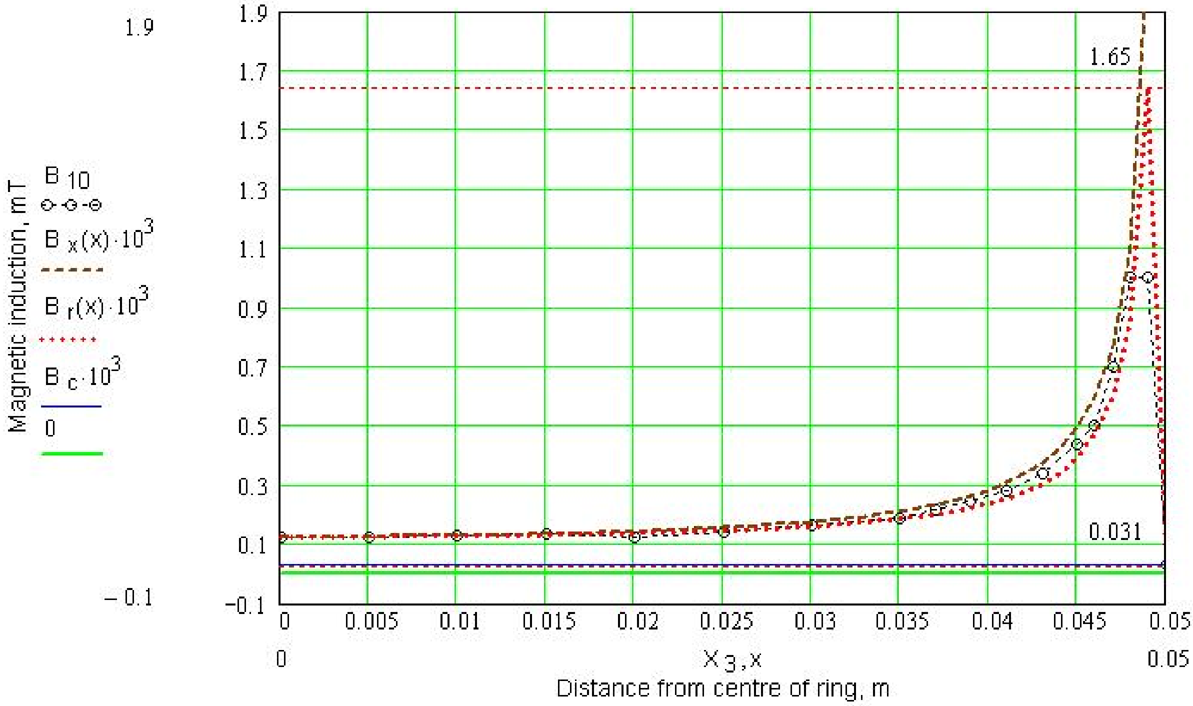


Fig. 8

B$_{10}$ –*Experiment data (a dashed line with black circles);* B$_x$ – *Laplace's induction (a dashed brown line);* B$_r$ – *Vector magnetic induction (the schedule of red points)*; B$_c$ – *Induction on a line of a ring current (a horizontal dark blue line).*

Coming back to fig.7 we will define stretching force $f_m$, operating on a ring in a tangential direction

$$f_m = \int_0^{\pi/2} p_{mc} \cdot R_e \cdot \cos\varphi \cdot d\varphi = \frac{4 \cdot J_c^2}{3 \cdot 10^7} = 1.133 \times 10^{-5} \qquad |N| \qquad (20)$$

The formula (20) speaks what even on rectilinear wires with a current the stretching forces created by a magnetic field of own current operate.

For the description of behaviour of a magnetic field outside of a ring current we will write down formulas for Laplace's induction and a vector induction using as argument relative distance from the ring centre $a = x/R_e$ .

The formula for Laplace's induction

$$B_x(a) = \left(\frac{\mu_0}{4 \cdot \pi}\right) \cdot \left(\frac{J_c}{R_e}\right) \cdot 2 \cdot \int_0^{\pi} \frac{1 - a \cdot \cos(\varphi)}{\left[1 - 2 \cdot a \cdot \cos(\varphi) + a^2\right]^{3/2}} \cdot d\varphi \qquad |T| \qquad (21)$$

The formula for a vector induction

$$B_r(a) = \left(\frac{\mu_0}{4 \cdot \pi}\right) \cdot \left(\frac{J_c}{R_e}\right) \cdot 2 \cdot \int_0^{\pi} \frac{(1 - a \cdot \cos(\varphi)) \cdot |1 - a \cdot \cos(\varphi)|}{\left[1 - 2 \cdot a \cdot \cos(\varphi) + a^2\right]^2} \cdot d\varphi \qquad |T| \qquad (22)$$

In fig.9 continuation of schedules about fig.8 on a ring outer side is shown.

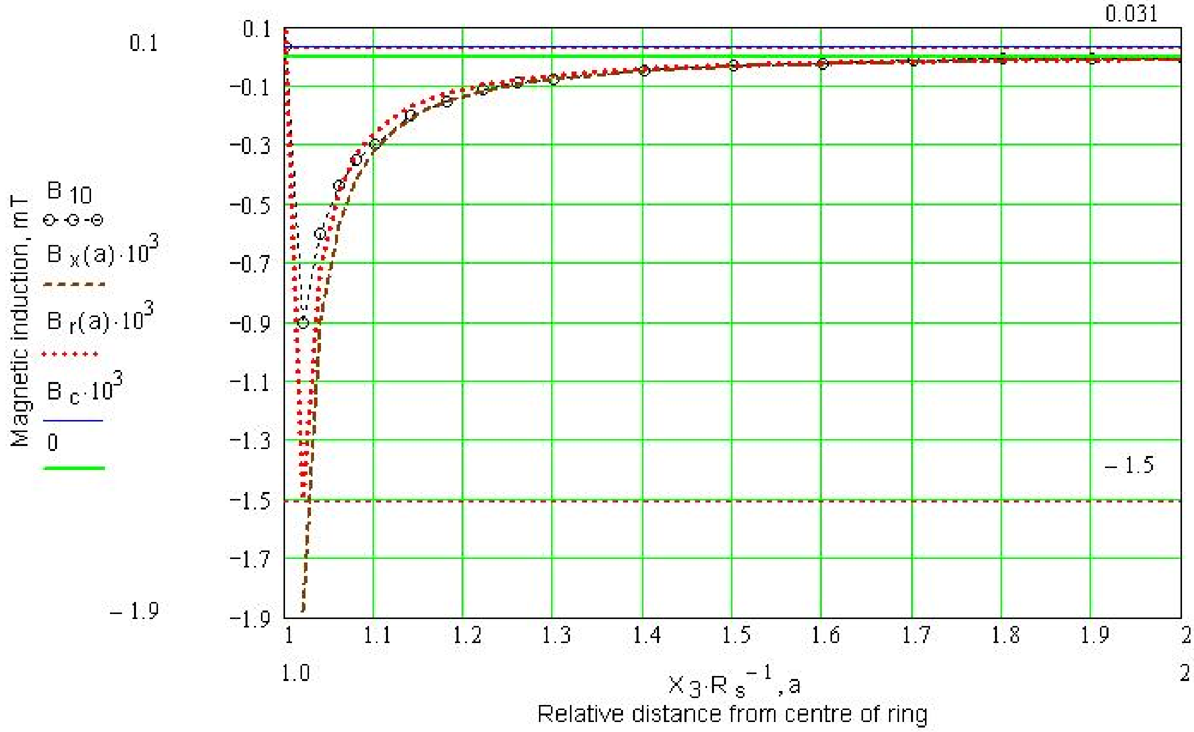


Fig. 9

$B_{10}$ *–Experiment data (a dashed line with black circles);* $B_x$ – *Laplace's induction (a dashed brown line);* $B_r$ – *Vector magnetic induction (the schedule of red points)*; $B_c$ – *Induction on a line of a ring current (a horizontal dark blue line).*

As well as in the previous case, a vector induction on a line of the ring current, calculated under the formula (22), $B_r$ ($a$ = 1) = $B_r$ ($x$ = $R_e$) = 0.031 |mT |. But at transition through a line of a current the induction sharply changes a sign on opposite, and, formulas available in our disposal, do not allow to calculate the sizes of area of transition.

Using the formula (19) it is possible to calculate the magnetic flow covered by a concrete ring current, but the conclusion of the general formula for a magnetic flow also remains while an unresolved problem. Probably, that attempts to give a logic explanation of a magnetic induction by means of movement only of like charges, basically cannot give the positive answer.

Under the formula (11) we will calculate speed of electron, moving in a magnetic field with induction $B_c$ = 0.031 |mT | =31×10$^{-6}$ |T | on a circular orbit in radius $R_e$ = 0.05m.

$$\upsilon_e = \frac{q_e \cdot B_o \cdot R_e}{4 \cdot M_e} = \frac{\pi \cdot q_e \cdot J_c}{2 \cdot 10^7 \cdot M_e} = 2.763 \times 10^5 \quad |\mathrm{m/s}| \qquad (23)$$

Thus, to be kept in a ring orbit electron should move in a direction of current $J_c$ = 10A which is a current of positive charges. Thus, we come back to a variant shown in fig.6.

In this case, the electric pressure enclosed to a conductor causes in metal drift of elementary electric dipoles $\Delta E$ with a speed $\upsilon_e$, and occurrence of the forces focusing electric dipoles in any one direction. The choice of directions for a vector of intensity of a magnetic field and for a vector of intensity of electric field in this case is purely formal problem. It is possible to take, for example, as reference points, – directions of magnetic and electric pressure upon a line of a ring current. For comparison we will result the well-known and experimentally verified formulas for magnetic pressure $P_H = \mu_0 \cdot H^2$ in a narrow backlash between poles of a permanent magnet and electrostatic pressure $P_E = \varepsilon_0 \cdot E^2$ in a narrow backlash between facings of the flat condenser.

In both cases a direction of forces (pressure) coincide with a direction of fields and operate on rapprochement of surfaces. It is possible to present, as the magnetic field, and electric field push out any substance from space between poles of a magnet or condenser facings. In result, in a backlash there is lowered, in comparison with surrounding space, a pressure of this substance.

The formula (23) allows to define some constant, which on dimension represents linear density of electric charges in conductors.

$$\tau_e = \frac{J_c}{\upsilon_e} = \frac{2 \cdot 10^7 \cdot M_e}{\pi \cdot q_e} = 3.62 \times 10^{-5} \qquad |\mathrm{N}^{1/2}| \times |\mathrm{s}| \times |\mathrm{m}^{-1}| \qquad (24)$$

Having multiplied value $\tau_e = 3.62 \times 10^{-5}$ by length of a circle of a ring and, having divided into magnitude of an elementary charge, we will receive number of dipoles $N_e$ circulating in a ring.

$$N_e = \frac{\tau_e \cdot 2 \cdot \pi \cdot R_e}{q_p} = \frac{4 \cdot 10^7 \cdot R_e \cdot M_e}{q_p \cdot q_e} = 7.097 \times 10^{13} \qquad (25)$$

Thus, using the formula for a magnetic induction in the ring centre, we have received number of elementary electric dipoles $\Delta E$ in a ring without dependence from force of an electric current in it. Hence, elementary electric dipoles are the fundamental portions of electric field filling space. Moreover, the linear density of electric dipoles $\tau_e$ represents a constant peculiar, at least, for our planet. In the theoretical physics it is accepted to define an electric dipole of two unlike elementary charges $q_e$ and $q_p$, as product of magnitude of one charge by distance $\Delta l$ between charges. It is necessary to recognize, that such definition of an electric dipole is absolutely unsatisfactory. Electric power lines the same as also magnetic, always are closed. The assumption that exists certain, intangible us follows from existing concept of an electric dipole, subspace through which electric power lines between unlike charges become isolated. Even artificial introduction of dot dipole electric moment ($\Delta l \to 0$) does not improve mathematical calculations. Such uncertainty cannot occur with magnetic power lines, as attempts to find out magnetic monopoles, and remain in the field of a fantasy. But step-type behaviour at level of elementary electric charges really exists, therefore the magnetic field can be unique "channel" for continuous link between unlike electric charges only. This link is well traced at a conclusion of the formula for length of an elementary piece of the ring falling to one elementary charge, in the form of magnetic permeability of vacuum, i.e. that substance through which link between magnetic and electric fields is carried out.

$$\Delta l_e = \frac{2 \cdot \pi \cdot R_e}{N_e} = \frac{\mu_0}{4 \cdot \pi} \cdot \left( \frac{\pi \cdot q_e^2}{2 \cdot M_e} \right) = 4.426 \times 10^{-15} \qquad |\mathrm{m}| \qquad (26)$$

Value $\Delta l_e = 4.426 \times 10^{-15}$ |m| by $\pi/2$ times more classical radius of electron.
By analogy to a magnetic field we will write down a normal component for electric elementary forces

$$\Delta_\perp F_e = \left( \frac{\tau_e^2}{4 \cdot \pi \cdot \varepsilon_0} \right) \cdot \left[ \cos^2(\varphi/2) \right] \cdot \left| \cos(\varphi/2) \right| \cdot \Delta\varphi \qquad |\mathrm{N}| \qquad (27)$$

Instead of summation of normal component of forces $\Delta_\perp F_e$ it is possible to apply operation of integration and directly to receive required electrostatic pressure

$$p_{ec} = \left( \frac{1}{4 \cdot \pi \cdot \varepsilon_0} \right) \cdot \left( \frac{\tau_e^2}{2 \cdot R_e} \right) \cdot 2 \cdot \int_0^\pi \left[ \cos^2(\varphi/2) \right] \cdot \left| \cos(\varphi/2) \right| = 313.998 \qquad |\mathrm{N/m}| \qquad (28)$$

The magnitude of intensity of electric field on a line of current $J_c$ is defined as quotient of dividing electrostatic pressure $p_{ec}$ by a charge of ring $N_e \cdot q_e$

$$E_c = \frac{4 \cdot \tau_e^2 \cdot c^2}{3 \cdot 10^7 \cdot R_e \cdot N_e \cdot q_e} = 2.761 \times 10^7 \qquad |\text{V/m}| \qquad (29)$$

The huge magnitude of the electrostatic field almost is completely localised in a conductor with a current. This field is the main power source, stretching a ring since magnetic stretching force $f_m = 1.133 \times 10^{-5}$ |N| disappearing is small in comparison with electric $f_e$

$$f_e = \int_0^{\pi/2} p_{ec} \cdot R_e \cdot \cos\varphi \cdot d\varphi = 15.7 \qquad |\text{N}| \qquad (30)$$

The tangential component of intensity of electric field in a ring current of the ideal form completely is absent, since opposite sites of a ring create counter tangential components of intensity of electric field on a ring line. Therefore, the ring current in a usual conductor cannot arise without participation of foreign forces, and the raised ring current in a superconductor cannot exist infinitely long.

The caliber factor between constants electric and magnetic fields we will choose from a condition of equality of electrostatic pressure $P_E$ in a narrow backlash between facings of the flat condenser and magnetic pressure $P_H$ in a narrow backlash between poles of a permanent magnet, i.e. this wave resistance of vacuum.

$$\frac{E}{H} = \sqrt{\frac{\mu_0}{\varepsilon_0}} = \mu_0 \cdot c = 376.73 = \rho_0 \quad |\Omega| \rightarrow |\text{m/s}| \qquad (31)$$

In developed by us before Galactic System of Measures (GSM) the wave resistance of vacuum is equall unit. In the formula (31) it is shown, that the unit of measure of wave resistance $|\Omega|$ is recalculated in usual linear speed of movement. But this transformation turns out in system of units SI. Actually wave resistance of vacuum represents a root square of the relation of linear speed to angular speed, or a root square of the relation of the passed piece of a way to the "passed" angle of turn for the same time interval. Here this above-stated formulation of wave resistance just also is a stumbling-block in construction of logically clear model of interaction electric and magnetic fields. Probably, that other expression of wave resistance of the vacuum, presented as product of a magnetic constant $\mu_0$ by speed of light in vacuum $c$, will help with construction of such model.

Let's return to research of intensity of electric field.

The calculated value of intensity of electric field in a current-carrying ring by all means can cause mistrust in those readers who are informed on an atmospheric electricity and data about the measured value of intensity of electric field in atmosphere of the Earth met in reference books. These data we repeat in mentioned below table 1.

**The table 1**

| Height from a surface, km | 0 | 0.5 | 1.5 | 3 | 6 | 12 | 100 |
|---|---|---|---|---|---|---|---|
| Intensity of an *E*-field, V/m (Over ocean, Arctic regions) | 130 | 50 | 30 | 20 | 10 | 2.5 | ~0 |
| Intensity of an *E*-field, V/m (Over continents) | 75 | 130 | 70 | 40 | 25 | 20 | – |

The potential difference between a surface of the Earth and an ionosphere which conditional border is at height 100 km, fluctuates within 100÷250 kV. Herewith the surface of the Earth is charged by a negative electricity.
But, what such 100÷250 kV, in comparison with designed tens millions volt on the meter, received by us on a small ring with a current?
Let's address to the processes occurring in atmosphere of the Earth. Linear lightnings observed in atmosphere have extent from several kilometers to several tens kilometers and currents in hundred thousand amperes, at diameter of the channel 10÷25 centimeters. The current density in the storm electric discharge makes not so big magnitude – an order 10÷20 A/mm$^2$.
That is, it is quite comparable even to our simple experiment.
Penetrative intensity of electric field for dry air is equal 3000 kV/m, i.e. that «to overpunch the current channel» in the length 1 |km |, the voltage of 3 billion volt is necessary.
Therefore, there is a question – how in atmosphere the mechanism of accumulation and the discharge of electric charges in storm clouds is arranged?
As the official paradigm asserts, that like charges must push away from each other, it (the official paradigm) should agree and that, the storm clouds of only negative or only positive charges cannot be formed. But we after all observe, that lightnings "beat" not only between clouds, but also in negatively charged surface of the Earth. The dipole model, assuming ability of elementary dipoles of molecules of water to be built in long chains from one edge of a cloud to another, does not maintain criticism. For example, above the negative pole of a cloud turned to "zero" of an ionosphere, and below the positive pole turned to "minus" on a surface of the Earth. But also in this case the official paradigm cannot explain, why lightnings "do not beat" on shorter way from a negative pole of a cloud to positive, and storm clouds always choose longer way for discharge (the length of lightnings between powerful storm clouds can reach 150 km., – 10 times the size of a cloud).
Thus, we with necessity come to conclusion, that there is quite certain electric structure of space which defines behaviour of electric charges and dipoles. Accordingly, there should be a connection of electric structure of space with a magnetic field, and not only in the form of Maxwell's equations for an electromagnetic wave in which except of the space in obligatory parameter the time is. In the equations for stationary fields time is absent, and we can observe fields separately though the formula (3) says, that neither that, nor other field anywhere cannot disappear.
The formula (29) allows to estimate the magnitude of, perpendicular to a surface of the Earth, components of intensity of electric field. However in this case we deal with medium which is dielectric, therefore the intensity $E_g(Y)$ of electric field of the Earth we should calculate concerning an individual elementary charge.

$$E_g(Y) = \frac{4 \cdot \tau_e^2 \cdot c^2}{3 \cdot 10^7 \cdot (R_g + Y) \cdot q_e} \qquad |\mathrm{V/m}| \qquad (32)$$

where: $Y$ – distance from a surface of the Earth to an investigated point, |m|
$R_g$ = 6371000 |m| – average radius of the Earth.

Calculation gives value of intensity of electric field on a surface of the Earth $E_g(0) = 1.538\times10^{13}$ |V/m|. The average distance from a terrestrial surface to the bottom border of storm stratocumulus clouds makes ~500 meters. A difference intensities of electric field between these two surfaces $E_g(0) - E_g(500) = 1.207\times10^9$|V|, that is quite comparable to penetrative potential for a half-kilometer spark interval of air of the raised humidity.
As to Table1, the values of intensity specified in it are functions of very many local and global factors (atmospheric temperature, atmospheric pressure, time of days, a season etc.). The atmospheric currents flowing from an upper atmosphere on a surface of the Earth have density

$(2\div3)\times10^{-12}$ A/m$^2$. At average электропроводности pure air $(2\div3)\times10^{-14}$ $|\Omega\times m|^{-1}$, the power failure on each vertical meter just also will make nearby 100 Volt.
According to the formula (32) over a surface of the Earth on each vertical meter the difference intensities of global electric field is equal $2.414\times10^6$ |V|, but we do not have reasons to be afraid of it as the field is directed to one party including in a body of the person. To more annoying is non-uniform electrization of bodies with various conductance under the influence of global intensity of electric field.
Product of intensity of electric field on a dielectric constant of vacuum $\varepsilon_0$ gives an induction of electric field which represents density of electric charges, and allows to calculate a full electric charge of the Earth $Q_g$.

$$D_g = \varepsilon_0 \cdot E_g(0) = \frac{\tau_e^2}{3\cdot\pi\cdot q_e\cdot R_g} = 136.184 \qquad |\mathrm{C/m^2}| \qquad (33)$$

$$Q_g = D_g\cdot 2\cdot\pi\cdot R_g^2\cdot 2\cdot\int_0^{\pi/2}\cos(\theta)\cdot d\theta = \frac{4\cdot\tau_e^2\cdot R_g}{3\cdot q_e} = 6.946\times10^{16} \qquad |\mathrm{C}| \qquad (34)$$

It, of course, fantastic magnitude in comparison with a full charge of the Earth, from 3 to 5.7 Coulomb about which inform various textbooks and directories.
Rotation of the Earth round own axis with angular speed $\omega_g = 7.292115\times10^{-5}$ |rad/s| creates electric currents which on intensity decrease from equator to geodetic poles on a surface of the Earth. The integrated ring electric current of the Earth is calculated under the formula

$$J_g = \tau_e\cdot 4\cdot\pi\cdot R_g^2\cdot\omega_g\cdot\int_0^{\pi/2}\cos(\theta)\cdot d\theta = \tau_e\cdot 4\cdot\pi\cdot R_g^2\cdot\omega_g = 1.346\times10^6 \qquad |\mathrm{A}| \qquad (35)$$

Hence, on the axis of rotation of the Earth, stimulating the magnetic field which intensity smoothly decreases from $0.134\times10^{-3}$ |A/m| in the centre of the Earth to $0.553\times10^{-4}$ |A/m| on geodetic poles. In a zone of geodetic poles ring currents are minimum, therefore, magnetic poles, for lack of a ferromagnetic kernel of the Earth, will look in the form of dim circles round geodetic poles. To the value of integrated superficial ring current calculated by the formula (35) it is necessary to add the ring current existing in space between a surface of the Earth and an ionosphere. Using the formula (32) we will write down the equation of an induction of electric field in atmosphere of Earth $D_g(Y)$, for the subsequent calculation of the additional electric charge that is distributed in 100-kilometre height of atmosphere of the Earth.

$$D_g(Y) = \varepsilon_0\cdot E_g(Y) = \frac{\tau_e^2}{3\cdot\pi\cdot q_e\cdot(R_g+Y)} \qquad |\mathrm{C/m}| \qquad (36)$$

Using the formula (34) and integration on height over surface of the Earth we will calculate the additional electric charge $Q_a$ that is localized in atmosphere of the Earth.

$$Q_a = \frac{4\cdot\tau_e^2}{3\cdot q_e}\cdot\int_{R_g}^{R_g+10^5}(R_g+Y)\cdot dY - Q_g = 1.395\times10^{22} \quad |\mathrm{C}| \qquad (37)$$

Comparing results of calculations under formulas (34) and (37) it is possible to estimate approximately, that actual intensity of magnetic field on a geodetic axis of the Earth should be, at least, by six the order of magnitude above, i.e. from 134 |A/m| in the centre of the Earth till 55.3

|A/m| in poles. In the modern representations the solid internal kernel of the Earth consists of iron-nickel alloy. Relative magnetic permeability of iron-nickel alloys in the field of weak magnetic intensity is estimated by sizes $10^3 \div 10^4$. It is necessary to tell that to operate with these values rather risky since the internal kernel of the Earth is under huge pressure, an order 360 |GPa | on a kernel surface. At pressure 100 |GPa| the iron and nickel density increases approximately by 25%; at pressure 1000 |GPa| – increases twice. How changes relative magnetic permeability of an alloy – the experimental science thus while could not find out.
Therefore, we stop on a hypothesis, that the magnetic field of the Earth is generated with integrated superficial and atmospheric ring currents created by rotation of the Earth round own axis. Thus, magnetic poles as it has been told above, cannot be combined with geographical, and move near to them under the influence of various atmospheric factors and the dynamic processes occurring in the Earth mantle. By means of this hypothesis it is simple to explain occurring in the past the polarity reversal of magnetic field of the Earth.
As the geomagnetic field of the Earth almost completely is generated with thin and very much facile of atmosphere film the continental atmospheric disturbances and change of a parity of density of carriers of a negative and positive electricity, could cause a critical deviation of magnetic axis from an axis of rotation of the Earth. Further action was entered by the dynamic processes occurring in the Earth mantle and in the liquid external kernel of a planet which led to time polarity reversal of geomagnetic field.
Therefore, one of conditions (for example, at present) should be the basic and more long, than opposite. This assumption demands continuation of works and search of the new facts.

## THE CONCLUSION

Mass of atmosphere $M_a = 5.15\times10^{18}$ |kg|.
Atmospheric composition: Nitrogen ($N_2$) – 78.08 %, Oxygen ($O_2$) – 20.95 %, Argon (Ar) – 0.93 %, other gases ($CO_2$, Ne, He, $CH_4$, Kr, $H_2$) – 0.04 %.
Number of molecules and atoms of first three gases in atmosphere of Earth $N_{ma} = 1.043\times10^{44}$ pieces. The relation of number of elementary charges (or dipoles) to number of molecules and atoms in terrestrial atmosphere is equal

$$\eta_g = \frac{Q_a}{q_e \cdot N_{ma}} = 8.346\times10^{-4} \qquad (38)$$

For check of a parity of mathematical calculations (38) and resulted in article it is necessary to spend measurement of forces $f_m + f_e$ (see fig.7 and formulas (20) and (30)).

<u>The list of the used literature</u>

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