Series: **PHYSICS and ASTRONOMY**

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Experimental Clarification of Maxwell-similar Gravitation Equations

Annotation

Maxwell-similar gravitation equations and the experiments of Samokhvalov are considered. It is noted that the observed effects are so significant, that in order to explain them within the said Maxwell-similar gravitation equations these equations should be supplemented by a certain empirical coefficient that may be named gravitational permeability of the medium. Then it is shown that with such supplement the results of experiments are in good agreement with so modified gravitation equations. A crude estimate of this coefficient is given. Some corollaries of these equations are considered, in particular, the gravitational excitation of electric current, the impact of gravito-magnetic induction on the electric current. Some phenomena that can be explained with the aid of these equations are indicated. This paper is a translation of paper [14].

Contents

1. Introduction

There are known Maxwell equations for electromagnetic field of the form (1), proposed by Heaviside [1] (the formulas are given in Appendix 1). Heaviside is also the author the gravitation theory [2], where the gravitation field is described by equations (3) of similar form. Later it was shown [3], that in a weak gravitation field at low speeds from basic equations of general relativity he gravitational analogs of electromagnetic field may be derived, and they have the similar form (3).

Thus, in weak gravitation field of the Earth the Maxwell-similar equations may be used for the description of gravitational interactions. It means that there exist gravitational waves possessing gravito-electric component with intensity E_g and gravito-magnetic component with induction B_g. Mass m, moving in a magnetic field with speed v, is subject to Lorentz gravito-magnetic force (analog of the known Lorentz force) of the form (in the CGS system))

$$F = \varsigma \frac{m}{c}\left[v \times B_g\right], \tag{1}$$

where ς is a coefficient equal to 1 according to Heaviside, and equal to 2 in general relativity theory.

Samokhvalov [4-11] had conceived and carried out a series of unexpected and surprising experiments, which presumably can be explained by interaction of irregular mass currents. Irregular mass currents J_g create variable gravito-electrical intensity E_g and gravito-magnetic induction B_g. At the interaction of this induction with the masses m, moving with speed v there arises gravito-magnetic Lorentz force. It is important to note that the effect are so significant, that in order to explain them within the said Maxwell-similar equations these equations should be supplemented by a certain empirical coefficient ξ. Further it is shown that with such modification the results of experiments are in good agreement with the modified gravitation equations.

Thus, based on the Samokhvalov's experiments the Maxwell-similar equations should be rewritten in the form

$$\mathrm{div} E_g = 4\pi G m, \tag{2}$$

$$\mathrm{div} B_g = 0, \tag{3}$$

$$\mathrm{rot} E_g = -\frac{\xi}{c}\frac{\partial B_g}{\partial t}, \tag{4}$$

$$\mathrm{rot} B_g = \frac{4\pi G}{c} J_g + \frac{\xi}{c}\frac{\partial E_g}{\partial t}, \tag{5}$$

Where the value of coefficient ξ will be determined below from the said experiments. This coefficient can be called <u>the gravitational permeability of the medium</u>.

2. Certain Analogies and Consequences

Here we shall consider certain analogies between electrodynamics and gravito-electrodynamics, and some consequences of the above examined equations. A qualitative analogy of such kind was indicated by Samkhvalov in [4-11]. One of the consequences has been described in [12].

2.1. The Induction of Circular Mass Current

Magnetic flow Φ, passing through the area S of the coil with the length L, carrying alternated current J, in CGS system

$$\Phi = \frac{4\pi}{c}\cdot\frac{SJ}{L}. \tag{1}$$

The induction average for the area S is

$$B = \frac{4\pi J}{cL}. \tag{2}$$

If the coil is a ring of diameter R, then

$$B = \frac{2J}{cR}. \tag{3}$$

Let us assume now that the ring is carrying alternated mass current J_g. Then, without considering the technical realization, by analogy with (1.5) we shall get

$$B_g = \frac{2GJ_g}{cR}. \tag{4}$$

2.2. Gravitational Excitation of Electric Current

From (1.4) follows that gravitational moving force created by gravito-magnetic flow in the circuit of mass current is

$$\varepsilon_g = \frac{\xi}{c} \cdot \frac{d\Phi_g}{dt}, \tag{5}$$

which differs by coefficient ξ from the similar formula of electrodynamics.

The force of induced electric current in a closed-loop (in the CGS system) is:

$$J = \frac{1}{cR_e} \cdot \frac{d\Phi}{dt}, \tag{5a}$$

where R_e - the resistance to these electrons motion. This current in the metal is created by free electrons with the charge e_o. By analogy, taking into account (5), we find that variable gravito-magnetic flow Φ_g also creates vortex induced mass current

$$J_g = \frac{\xi}{cR_m} \cdot \frac{d\Phi_g}{dt}, \tag{6}$$

where R_m is the resistance to mass particles motion This current in the metal is created by free electrons of the mass m_e. Then $R_m = R_e$ - resistance to the electrons motion. In this case mass current J_g corresponds to electric current

$$J_{ge} = J_g \frac{e_o}{m_e}. \tag{7}$$

It is known that

$$m_e \approx 9.1 \cdot 10^{-34}\,\text{г}, \quad e_o \approx 1.6 \cdot 10^{-19}\,\text{Кл},$$

$$\eta = \frac{e_o}{m_e} \approx 1.8 \cdot 10^{14}\,\frac{\text{Кл}}{\text{г}}. \tag{8}$$

Thus, the strength of the induced current created by variable gravito-magnetic flow Φ_g is

$$J_{ge} = \frac{\xi\eta}{cR_e} \cdot \frac{d\Phi_g}{dt}. \tag{9}$$

Similarly to (7), the electric current J corresponds to mass current

$$J_{gm} = J\frac{m_e}{e_o}. \tag{9a}$$

Thus, the strength of mass current created by variable magnetic flow Φ is

$$J_{gm} = \frac{1}{cR_e\eta} \cdot \frac{d\Phi}{dt}. \tag{9b}$$

2.3. Rotation of a Porous Ring

Let us consider a ring of average radius R, made of porous metal and charged electrically. Evidently the charges are located on the pores surfaces. Approximately we may assume that the charges distribution density along the ring's circle is described by the function:

$$\rho(\varphi) \approx \rho_o \cdot (1 + \sin(\lambda\varphi)), \tag{10}$$

where

ρ_o - is a constant

φ - angular coordinate,

λ - the length of a "wave" depending on the average distance between the pores.

If we cause rotation of the ring with a certain angular speed ω, then the charges distribution density along the circle of the ring becomes a functions of time t

$$\rho(t) \approx \rho_o \cdot (1 + \sin(\lambda\omega t)), \tag{11}$$

The current flowing in the ring is

$$J(t) = \frac{d\rho(t)}{dt} \approx \rho_o \cdot \lambda\omega \cdot \cos(\lambda\omega t), \tag{12}$$

where m_o is a constant. This current creates a magnetic flow that is perpendicular to the ring's plane. The magnetic induction of this flow average by the ring's area is determined in the CGS system by the formula (3). Consequently, the magnetic induction of a rotating charged porous ring, average by the ring's area, is

$$B \approx 2\rho_o \omega\lambda \cdot \cos(\lambda\omega t)/(cR). \tag{13}$$

By analogy we can state that the rotating porous ring creates mass current

$$J_g(t) = \frac{dm(t)}{dt} \approx m_o \cdot \lambda\omega \cdot \cos(\lambda\omega t). \tag{14}$$

Then from (4) we find that this current creates variable gravito-magnetic induction

$$B_g \approx 2m_o G\omega\lambda \cdot \cos(\lambda\omega t)/(cR). \tag{15}$$

2.4. Induction of a Moving Body

It is known that the induction of field created by a charge q, moving with speed $\bar{v}$, in a certain point, is

$$\bar{B} = q(\bar{v} \times \bar{r})/cr^3 . \tag{16}$$

The vector $\bar{r}$ is directed from the point, where the moving charge q_1 is located, to the referred point. Similarly, the gravito-magnetic induction of the field created by the mass m, moving with a speed $\bar{v}$, in a certain point, is

$$\overline{B_g} = Gm(\bar{v} \times \bar{r})/cr^3 , \tag{17}$$

Because, as shown in the Section 2.2, the electronic current is at the same time also the mass current, the gravito-magnetic induction can create the Lorentz force, affecting the electric current.

2.5. Gravito-magnetic Lorentz Force

In the definition of gravito-magnetic Lorentz force we have used a certain gravito-electric intensity $E'_g = E_g + \frac{\varsigma}{c}\left[v \times B_g\right]$ - see (10) in Appendix 1. By analogy with (4) this expression must be supplemented by a coefficient ξ. The full gravito-magnetic force will get the following definition:

$$F = m\xi\left(E_g + \frac{\varsigma}{c}\left[v \times B_g\right]\right), \tag{18}$$

which also differs from the similar formula in electrodynamics by the coefficient ξ .

2.6. Gravito-magnetic Ampere Force

It is known that a conductor carrying electric current $\overline{J}$ in a magnetic field with induction $\overline{B}$ is affected by Ampere force (per a length unit

$$\overline{F_a} = \frac{1}{c}\left(\overline{J} \times \overline{B}\right) \tag{19}$$

Similarly, a conductor carrying mass current $\overline{J_g}$ in a gravito-magnetic field with induction $\overline{B_g}$ is affected by Ampere force

$$F_{ag} = \frac{\varsigma\xi}{c}\left[J_g \times B_g\right], \tag{20}$$

Let us consider the case when mass current is a consequence of electric current, i.e. the particles carrying the charge form the mass current. Then

$$J_g = J\eta_2, \tag{21}$$

$$\eta_2 = m/q, \tag{22}$$

where m, q – mass and charge of the particle. Then a conductor carrying electric current $\overline{J}$ in a gravito-magnetic field with induction $\overline{B_g}$ is affected by Ampere force

$$F_{age} = \frac{\varsigma\xi\eta_2}{c}\left[\overline{J} \times \overline{B_g}\right]. \tag{23}$$

For example, if the charged particle is an electron, then

$$m_e \approx 9.1 \cdot 10^{-34}\text{г}, \quad e_o \approx 1.6 \cdot 10^{-19}\text{K}l,$$

$$\eta_2 = \frac{m_e}{e_o} \approx 0.6 \cdot 10^{-14}\,\frac{\text{g}}{\text{Kl}}. \tag{24}$$

But if the charged particle is an ion with mass $m = h \cdot m_e$, then

$$\eta_2 = \frac{h \cdot m_e}{e_o} \approx 0.6h \cdot 10^{-14}\,\frac{\text{g}}{\text{Kl}}. \tag{25}$$

and for complex molecules $\eta_2 \Rightarrow 1$. So, at the interaction of gravito-magnetic induction with electrical current significant Ampere forces are likely to act.

2.7. Density of Magnetic Wave Energy

It is known that the density of electromagnetic wave energy [13], is

$$W = \frac{B^2}{8\pi}\left[\frac{\text{g}}{sm \cdot sec^2}\right] \qquad (26)$$

By applying the derivation shown there for the equations (1.2-1.5) of gravito-electromagnetic wave, we find

$$W_g = \frac{\xi^2 B_g^2}{8\pi G}. \qquad (27)$$

2.8. Induction of Current-carrying Conductor

It is known that the magnetic induction of infinite conductor carrying electric current is:

$$B = 2J/(cd), \qquad (28)$$

where d - is the distance from the conductor to the point of measurement. Similarly, the gravito-magnetic induction of infinite conductor with mass current is

$$B_g = 2GJ_g/(cd). \qquad (29)$$

3. Certain Experimental Estimates

The analysis of Samokhvalov's experiments [4-11], performed in Appendix 2, permits to obtain a crude estimate of the coefficient ξ of gravitational permeability. There it was shown that for vacuum

$$\xi \approx 10^{12}. \qquad (1)$$

For the air medium this coefficient depends on the pressure. For atmospheric pressure $\xi \Rightarrow 0$, which explains the absence of visible effects of gravitational interaction of moving masses.

There exist several phenomena which can be explained with the aid of the equations (1.2-1.5), considered above, with the existence of coefficient of gravitational permeability ξ – see [12, 15-19].

Appendix 1. The Equations of Electromagnetism and Gravito-magnetism

Further we shall use the following notations:

- q - electric charge $\left[\sqrt{\mathrm{g}\cdot \mathrm{s}m}\right]$;
- ρ - electric charge density $\left[\sqrt{\mathrm{g}\cdot \mathrm{s}m}\big/ sm^3\right]$;
- J - electric current density $\left[\dfrac{1}{sm\cdot sec}\sqrt{\dfrac{\mathrm{g}}{\mathrm{sm}}}\right]$;
- c - speed of light in vacuum $c \approx 3\cdot 10^{10}[\mathrm{sm}/\mathrm{sec}]$;
- E - electric field intensity $\left[\sqrt{\mathrm{g}\cdot \mathrm{s}m}\big/ sec^2 = 3\cdot 10^4\ \mathrm{V}/\mathrm{m}\right]$;
- B - magnetic induction $\left[\dfrac{1}{\mathrm{sec}}\sqrt{\dfrac{\mathrm{g}}{\mathrm{sm}}} = \mathrm{G}s\right]$;
- v - speed $[\mathrm{sm}/\mathrm{sec}]$;
- F - force $\left[\mathrm{d}yn = \mathrm{g}\cdot \mathrm{s}m\big/ sec^2\right]$;
- m - mass $[\mathrm{g}]$;
- ρ_g - mass density $\left[\mathrm{g}\big/ sm^3\right]$;
- J_g - mass current density $\left[\mathrm{g}\big/ sm^2 sec\right]$;
- G - gravitational constant,
$$G \approx 7\cdot 10^{-8}\left[\frac{\mathrm{d}yn\cdot \mathrm{s}m^2}{\mathrm{g}^2} = \frac{sm^3}{\mathrm{g}\cdot sec^2}\right];$$
- E_g - gravito-electric field intensity $\left[\mathrm{sm}\big/ sec^2\right]$;
- B_g - gravito-magnetic induction $\left[\mathrm{sm}\big/ sec^2\right]$.

The Maxwell equations for electromagnetism in CGS system are as follows:

$$\mathrm{div}E = 4\pi\rho, \tag{1}$$

$$\mathrm{div}B = 0, \tag{2}$$

$$\mathrm{rot}E = -\frac{1}{c}\frac{\partial B}{\partial t}, \tag{3}$$

$$\mathrm{rot}B = \frac{4\pi}{c}J + \frac{1}{c}\frac{\partial E}{\partial t}. \tag{4}$$

The Lorentz force for the electric charge is

$$F = qE + \frac{q}{c}\left[v \times B\right]. \tag{5}$$

The Maxwell equations for gravito-electromagnetism in Gauss CGS system are as follows:

$$\mathrm{div}E_g = 4\pi G\rho_g, \tag{6}$$

$$\mathrm{div}B_g = 0, \tag{7}$$

$$\mathrm{rot}E_g = -\frac{1}{c}\frac{\partial B_g}{\partial t}, \tag{8}$$

$$\mathrm{rot}B_g = \frac{4\pi G}{c}J_g + \frac{1}{c}\frac{\partial E_g}{\partial t}. \tag{9}$$

The Lorentz force for the mass is

$$F = mE_g + \varsigma\frac{m}{c}\left[v \times B_g\right], \tag{10}$$

where ς - is a coefficient equal to 1 by Heaviside and equal to 2 in general relativity theory.

Appendix 2. The Experiments of Samokhvalov

1. Experiment 1

We shall consider the experiment of Samokhvalov described in [4]. Two disks are placed into a vacuum chamber; they are misbalanced (by skewed axes) and are rotating in one direction. Both disks are overheated. Technical parameters of the setup are as follows:

- Material of the disks aluminum
- Pressure in the chamber $1\mathrm{P}a$
- Density of aluminum $\rho \approx 2.7\mathrm{g/sm}^3$
- Thickness of the disks $h \approx 0.09\mathrm{s}m$
- Diameter of the disks $2R = 16.5\mathrm{s}m$
- Gap between the disks $d \approx 0.3\mathrm{s}m$
- Beating on the sides $0.05\mathrm{s}m$

- Number of revolutions $f \approx 50/sec$
- Temperature of overheating (in [4] is written that the temperature rise measured after some minutes was $50\mathrm{K}$).

Let us consider the disk's rotation as mass current. We can assume that this current is formed by the mass's motion in the circle of the upper band of the disk of radius $R \approx 7sm$ and the cross-section

$$S \approx 0.3 \cdot 2.5 sm^2 \approx 7.5 sm^2 . \qquad (1)$$

The speed of this mass is

$$v = 2\pi R \cdot f \approx 2\pi \cdot 7 \cdot 50 \approx 2200 sm/\sec . \qquad (2)$$

So, the mass current is

$$J_g = S\rho v \approx 7.5 \cdot 2.7 \cdot 2200 = 4400 g/\sec . \qquad (3)$$

This current is variable because the beating of the disks. In accordance with (2.4) this current causes a variable axial induction (along the ox axis of the disk) average on the circle area of radius R,

$$B_g = \frac{2GJ_g}{cR} \qquad (4)$$

or

$$B_g = \frac{2 \cdot 7 \cdot 10^{-8} \cdot 4400}{3 \cdot 10^{10} \cdot 7} \approx 3 \cdot 10^{-15}. \qquad (5)$$

This induction is variable in time because of he disks We shall assume that the circular frequency of this induction is

$$\omega \approx 2\pi f = 314 . \qquad (6)$$

In accordance with (2.9), the strength of vortex electric current created by variable gravito-magnetic flow, is

$$J_{ge} = \frac{\eta\xi}{cR_e} \cdot \frac{d\Phi_g}{dt}. \qquad (7)$$

or

$$J_{ge} = \frac{\eta\xi\omega}{cR_e} \cdot \Phi_g . \qquad (8)$$

In our case

$$\Phi_g = \beta\pi R^2 B_g = \beta\pi R^2 \cdot 3 \cdot 10^{-15}, \qquad (9)$$

where β – is the coefficient of induction weakening on the level of the driven disk (because of the gap). So,

$$J_{ge} = \frac{\eta\omega\xi}{cR_e} \cdot \beta\pi R^2 B_g \tag{10}$$

or

$$J_{ge} = \frac{1.8 \cdot 10^{14} \xi \cdot 314}{3 \cdot 10^{10} R_e} \cdot \beta\pi 8.25^2 \cdot 3 \cdot 10^{-15} = \frac{\xi\beta}{R_e} 10^{-6}. \tag{10a}$$

This electric current raises the disk temperature. In the experiment it was shown that the disk's temperature has increased by $\Delta T \approx 100$ grades Let us consider the equivalent voltage

$$E_e = J_{ge} R_e \tag{11}$$

And assume that such increase of the disk temperature may be due to the voltage E_e. From (10a, 11) we find

$$E_e = \xi\beta 10^{-6}. \tag{12}$$

Let us assume that such equivalent voltage is $E_e = 200$. Then we find

$$\xi\beta \approx 2 \cdot 10^8. \tag{13}$$

Here ξ depends on the pressure, and β depends on the gap. Assuming that $\beta \approx 1/d^2$ and knowing that $d \approx 0.3sm$, we find $\beta \approx 0.01$. Thus, based on Samokhvalov's experiment we can now assume that for the indicated conditions the gravitational permeability coefficient with the pressure of 0.1 atm is equal to

$$\xi_p(0.1) \approx 2 \cdot 10^{10}. \tag{14}$$

2. Experiment 2

Let us now consider the experiments of Samokhvalov described in [5]. Two disks are placed into a vacuum chamber, misbalanced by skewed axes. The first of them rotates forcibly, and the second disk begins rotation due to the impact of the first one. The speed f_2 of the second disk's rotation (if the rotation speed of the first one is constant) depends on the gap between the disks d and on the pressure in vacuum chamber p . We may assume that the rotation speed of the driven disk is

$$f_2(p,d) = f_{2p}(p) \cdot f_{2d}(d). \tag{1}$$

This experiment explores these two dependences.

The dependence of rotation speed on the pressure

$$f_2(p, d=0.2) = f_{2p}(p) \cdot f_{2d}(0.2) \tag{2}$$

is given in [5] on Fig 2, from which we find

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p=[0.1 ,0.3 ,0.5 ,0.7,0.9,1] (atm),
f=[24, 17, 8, 2, 0.2, ε],
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where ε is a small value that it is impossible to find from the experiment results. Fig. 1 shows this experimental dependence (by circles) and (by full line) – the approximating function in the form of 5th degree polynomial. In particular, we have

$$f_2(0.1, 0.2) = 25, \quad f_2(0, 0.2) \approx 37. \tag{2a}$$

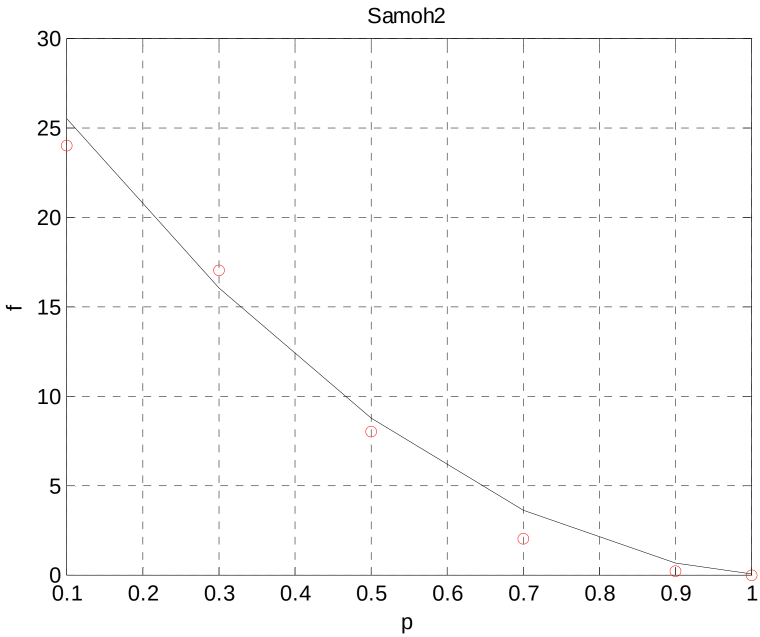

Fig. 1.

The dependence of rotation speed on the distance

is given in [5, Fig. 3], from which we find:

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d=[0.15, 0.2, 0.25, 0.3] (sm),
f1=[24, 17, 6, 5] при p=1atm ,
f102=[30, 25, 12, 10] при p=1.02atm .
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Fig. 2 shows this experimental dependence (by circles) and the approximating function (by full line) – in the form of $a + b/d^2$, and the function

$$f_{2d}(d) = 1/d^2 . \quad (3)$$

To a first approximation further we shall use the function (2). In particular, for $d = 0.3$ (cm) we have $f_{2d}(0.2) \approx 25$.

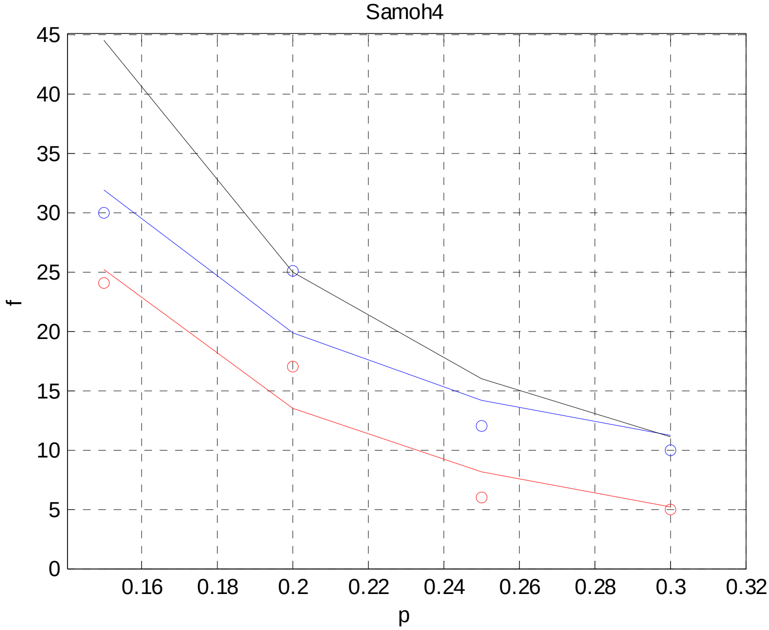

Fig. 2.

Analysis of the functions $f_{2p}(p)$ and $f_{2d}(d)$

Taking into account (2, 3), we find:

$$f_{2p}(p) = f_2(p,0.2)/f_{2d}(0.2) = 0.04 f_2(p,0.2). \quad (4)$$

In particular from (2a) we find:

$$f_{2p}(0.1) = 0.04 f_2(0.1,0.2) = 0.04 \cdot 25 = 1, \quad (5)$$

$$f_{2p}(0) = 37 \cdot 25 \approx 1000. \quad (6)$$

From (1, 3, 4) we get:

$$f_2(p,d) = 25 f_2(p, d = 0.2)/d^2 . \quad (7)$$

Below in (3.7) it will be shown that

$$f_{2p}(p) = \vartheta \cdot \xi_p^2(p). \quad (8)$$

Thus,

$$\xi_p(p) \approx \sqrt{\frac{f_{2p}(p)}{\theta}}, \tag{9}$$

From (9) it follows that

$$\frac{\xi_p(0)}{\xi_p(p)} \approx \sqrt{\frac{f_{2p}(0)}{f_{2p}(p)}}, \tag{10}$$

In experiment 1 it was shown, that

$$\xi_p(0.1) \approx 2 \cdot 10^{10}. \tag{11}$$

Combining (5, 10, 11), we get

$$\xi_p(0) \approx \xi_p(0.1)\sqrt{\frac{f_{2p}(0)}{f_{2p}(0.1)}} \approx 2 \cdot 10^{10}\sqrt{\frac{1000}{1}} \approx 6 \cdot 10^{11}$$

From this we can find a crude estimate of the gravitational permeability of vacuum:

$$\xi \approx 10^{12}. \tag{13}$$

3. The Role of Gravito-magnetic Lorentz Forces

In Samokhvalov's experiments the driving disk drags the driven disk. Now we shall present the explanation of this phenomenon. Samokhvalov notes that first there occurs the vibration of the driving disk, and then begins the rotation of the driven disk – then see Fig. 3.

The disks' vibration is explained in the following way. Above, analyzing the Experiment 1, it was shown that the driving disk is a variable mass current (1.3) with circular frequency (1.6). The "pulsing" mass m_1 creates a variable electro-gravitational intensity

$$E_g = \frac{Gm_1}{d^2}, \tag{0}$$

where d - is the gap between the disks. This intensity is perpendicular to the plane of the disc and on the level of the driven disk affects its mass m_2 by the force (2.18):

$$F_1 = m_2 \xi E_g. \tag{1}$$

Above, when analyzing the experiment 1, we have showed that the masses m_1, m_2 are the mass of a circle of higher band of the disk with radius $R \approx 7 cм$ and cross-section (1.1). This mass is equal to

$$m_1 = m_2 = 2\pi RS\rho. \tag{2}$$

The force F_1 is directed perpendicularly to the disk plane (as and intensity E_g) and varies with the frequency $f \approx 50/sec$, causing the vibration of the driven disk. Evidently, the speed v_2 of this vibration is proportional to the force F_1, i.e.

$$v_2 = \alpha F_1, \tag{3}$$

where α is a certain constant.

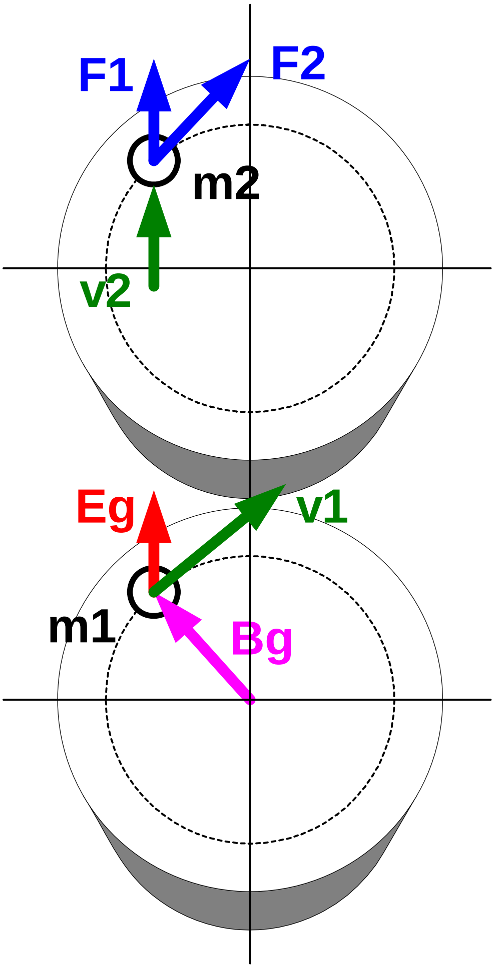

Fig. 3.

This force may explain the "oscillatory" character of the process of repulsion of the screen with the increase of the oscillations amplitude (angle of the frame's deviation) after steadying of the disk rotation speed", which is reflected in the Samokhvalov's experiments described in [8].

Rotating force acting on the driven disk is explained as follows. Gravito-magnetic induction B_g (1.4), created by the driving disk is directed perpendicularly to the mass current of the driving disk, i.e. along the disk's radius and parallel to its plane. This induction acts on the vertically vibrating mass m_2 of the driven disk by gravito-magnetic Lorentz force (2.18):

$$F_2 = m_2 \xi v_2 B_g \frac{\varsigma}{c}. \tag{4}$$

This force is tangential to the circumference of the disc, because perpendicular to the direction of induction (which is directed along the radius of the disk) and the speed (which is perpendicular to the plane of the disk). Due to the fact, that the speed of vibration v_2 and the induction B_g are changing synchronously, the vector of this force doesn't change direction. Apparently, the rotation speed of the driven disk is proportional to the force F_2, i.e. the number of its revolutions is

$$f_2 = \gamma F_2, \tag{5}$$

where γ – a certain constant. Combining (1-5) we get

$$\begin{aligned} f_2 &= \gamma m_2 \xi v_2 B_g \frac{\varsigma}{c} = \gamma m_2 \xi B_g \frac{\varsigma}{c} \alpha F_1 = \\ &= \gamma m_2 \xi B_g \frac{\varsigma}{c} \alpha m_2 \xi E_g = \alpha\gamma (m_2 \xi)^2 \frac{\varsigma}{c} B_g E_g \end{aligned}. \tag{6}$$

So, the number of revolutions is

$$f_2 = \vartheta \cdot \xi^2. \tag{7}$$

Which is proportional to ξ^2 with a certain proportionality factor

$$\vartheta = \alpha\gamma m_2^2 \frac{\varsigma}{c} B_g E_g. \tag{8}$$

This ratio is used in the above analysis of the Experiment 2.

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