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Levitation of rotating discs

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I. Introduction

Next, we consider a mathematical model of fast-rotating disks, which makes it possible to explain such features of these disks as levitation, acceleration without increasing engine power, the appearance of radiation (halo), disappearance from view at the end of acceleration.

In [1-3], Etkin describes numerous experiments that indicate the existence of levitation of rapidly rotating disks (RRD). The most striking examples of the effects of RRD are the experiments of Searl [5], Roschin and Godin [6, 7], Azanov [8]. In particular, Etkin describes the relevant experiments with gyroscopes. Earlier, diverse and spectacular experiments with gyroscopes, which Laithwaite conceived and performed, are also known [9]. Modern performance of these experiments is demonstrated by Beletsky in [10]. Laithwaite argued that his experiments prove that Newton's laws of motion are limited to moving along straight lines, where there is no rate of change of acceleration, and that circular motion creates some "gyroscopic force." Considering the experiments in [9, 10], it is difficult to present another explanation. In 1974, Laithwaite decided to demonstrate his observations on the gyroscopic force. However, his contemporaries decided that he led a series of false conclusions about gyroscopic motion. As a result, the materials of his lectures were never published. For him was contrasted ofmathematical proof, in which it was shown that the state of the gyroscope in any of its experiments can be described using the formula derived from Newton's second law [4]. Thus, it was shown that the gyroscopic effect is also observed in those fanciful configurations that Laithwaite invented. But not more! We see in experiments [9, 10] that Laithwaite's gyroscopes **come** to this stable state **without extraneous forces** and, therefore, there is an unknown force that performs the work of this transition. It can be said that a force is generated in the gyroscope acting along the axis of rotation. If the axis is vertical, then the gyroscope tends to levitate.

In addition to levitation, there are other features of RRD:

1) RRD accelerate without increasing engine power;
2) RRD begin to radiate - a halo - pink [5] or blue [8] appears;
3) after the appearance of the halo, the RRD disappears from the view, which (most likely) indicates a sharp increase in the vertical speed [5, 7].

Therefore, the RRD theory of levitation should explain in addition to the **levitation mechanism** itself of the RRD also **overclocking** of the RRD, the **vertical acceleration** of the RRD, the occurrence of a **halo** and, most importantly, the **source of energy** for levitation, overclocking, acceleration, and halo.

II. Maxwell's equations for gravitomagnetism

In [12], the author proposes a new solution to Maxwell's equations for gravitomagnetism, which is used to build mathematical models of various natural phenomena - sand vortex, sea currents, whirlpool, crater, water soliton, water and sand tsunami, turbulent flows, additional (non-Newtonian) interaction forces celestial bodies. At the same time, it is proved that they can be explained by **the existence of significant gravity-magnetic forces**. On the same basis, it is proved that **the energy of the source of gravitational forces can be used to perform work**, and this does not contradict the law of conservation of energy.

In [12, Chapter 2] it is shown that the stationary gravitomagnetic field is described by a system of equations:

$\mathrm{div} J = 0,$ (1)

$\mathrm{div} H = 0,$ (2)

$\mathrm{rot} H = J.$ (3)

These equations relate gravitomagnetic intensities*H*and densities of mass currents*J*. The existence of mass currents in a rotating disk is explained by the heterogeneity of the solid.

Expanding expressions for div and rot, we rewrite equations (1-3) for a cylindrical coordinate system in the following form:

$\frac{H_r}{r} + \frac{\partial H_r}{\partial r} + \frac{1}{r} \cdot \frac{\partial H_\phi}{\partial \phi} + \frac{\partial H_z}{\partial z} = 0,$ (4)

$\frac{1}{r} \cdot \frac{\partial H_z}{\partial \phi} - \frac{\partial H_\phi}{\partial z} = J_r,$ (5)

$\frac{\partial H_r}{\partial z} - \frac{\partial H_z}{\partial r} = J_\phi$, (6)

$\frac{H_\phi}{r} + \frac{\partial H_\phi}{\partial r} - \frac{1}{r} \cdot \frac{\partial H_r}{\partial \phi} = J_z$, (7)

$\frac{J_r}{r} + \frac{\partial J_r}{\partial r} + \frac{1}{r} \cdot \frac{\partial J_\phi}{\partial \phi} + \frac{\partial J_z}{\partial z} = 0$ (8)

In [12, Chapter 2] it is shown that the solution of this system of equations (4-8) can be obtained in the form of functions that are separable to coordinates. These functions are as follows:

$H_r = h_r(r) \cdot \cos(\eta z)$, (9)

$H_\varphi = h_\varphi(r) \cdot \sin(\eta z)$, (10)

$H_z = h_z(r) \cdot \sin(\eta z)$, (11)

$J_r = j_r(r) \cdot \cos(\eta z)$, (12)

$J_\varphi = j_\varphi(r) \cdot \sin(\eta z)$, (13)

$J_z = j_z(r) \cdot \sin(\eta z)$, (14)

where η is some constant, and $h_r(r)$, $h_\phi(r)$, $h_z(r)$, $j_r(r)$, $j_\phi(r)$, $j_z(r)$ are functions of the coordinater; the derivatives of these functions will be denoted by top point.

These functions are determined by a system of 4 differential equations of the following form:

$\mathbf{h_z} = -\frac{1}{\eta}\left(\frac{h_r}{r} + \dot{h}_r\right)$, (15)

$\mathbf{j_z} = \frac{h_\varphi}{r} + \dot{h}_\varphi$, (16)

$\mathbf{j_r} = -\eta h_\varphi$, (17)

$\mathbf{j_\varphi} = -\eta h_r - \dot{h}_z$. (18)

In this system of 4 differential equations with 6 unknown functions, you can arbitrarily define two functions. We will assume that

$j_\varphi = Q\omega r$, (19)

where ω is the angular velocity of rotation of the disk, r is the distance from this point to the center of rotation of the disk, Q is a constant that determines the quality of a rotating disk as a carrier of mass charges. Appendix 1 gives a solution to equations (15-18). It shows that the function $\mathbf{h_z(r)}$ and its derivatives are determined by a numerical solution of the differential equation. We denote this solution:

$h_z = h_z(r)$. (20)

From (18-20) we find

$h_r = -\frac{1}{\eta}\left(\dot{h}_z + Q\omega r\right)$, (21)

To determine the three functions j_z, j_r, h_φ by the two equations (16, 17), various assumptions can be made. Unfortunately, the author is not aware of any experiment that would allow giving justification to this or that assumption.

2.1. Let's pretend that

$j_z = 0$. (22)

Then from (16, 17, 22), we find:

$h_\varphi = \frac{C}{r}$, (23)

$j_r = -\frac{C\eta}{r}$, (24)

where C is some constant. The choice of the values of the constants C, η, ω determines the value of the functions $h_r(r)$, $h_\varphi(r)$, $h_z(r)$, $j_r(r)$, $j_\varphi(r)$, $j_z(r)$by (19-23).

2.2. Let's pretend that

$h_\varphi = C \cdot j_\varphi$. (25)

Then from (19, 25, 17), we find:

$h_\varphi = CQ\omega r$, (26)

$\boldsymbol{j_z = 2CQ\omega}$, (27)

$\boldsymbol{j_r = -\eta CQ\omega r}$. (28)

The choice of the values of the constants C, η, ω determines the value of the functions $h_r(r)$, $h_\varphi(r)$, $h_z(r)$, $j_r(r)$, $j_\varphi(r)$, $j_z(r)$by(19-21, 26-28).

Thus, the solution of the system of equations (1-3) for a rotating solid is obtained.

III. Flows of energy and momentum

In chapter 2.5 it is shown that along with mass currents and in the same physical volume, there are internalflows of gravitomagnetic energy. In the cylindrical coordinate system, these internal flows are directed

- on a radius - $\overline{S_r}$;
- on a circle - $\overline{S_\varphi}$;
- vertically - $\overline{S_z}$.

The densities of these flows are described by the formula

$$\begin{bmatrix} S_{ro}(r,\varphi,z) \\ S_{\varphi o}(r,\varphi,z) \\ S_{zo}(r,\varphi,z) \end{bmatrix} = \begin{bmatrix} (j_\varphi h_z - j_z h_\varphi)\cdot sin^2(\eta z) \\ (j_z h_r - j_r h_z)\cdot sin(\eta z)\cdot cos(\eta z) \\ (j_r h_\phi - j_\phi h_r)\cdot sin(\eta z)\cdot cos(\eta z) \end{bmatrix}. \qquad (1)$$

Total fluxes are equal to the integrals of these densities:

$$\bar{S} = \begin{bmatrix} \overline{S_r} \\ \overline{S_\varphi} \\ \overline{S_z} \end{bmatrix} = \iiint_{r,\varphi,z} \begin{bmatrix} S_{ro}(r,\varphi,z) \\ S_{\varphi o}(r,\varphi,z) \\ S_{zo}(r,\varphi,z) \end{bmatrix} dr\cdot d\phi\cdot dz. \qquad (2)$$

or

$$\bar{S} = \begin{bmatrix} \overline{S_r} \\ \overline{S_\varphi} \\ \overline{S_z} \end{bmatrix} = \left(2\pi\int_r r\cdot \begin{bmatrix} S_r(r) \\ S_\varphi(r) \\ S_z(r) \end{bmatrix} dr\right)\cdot \begin{bmatrix} D_3 \\ D_2 \\ D_2 \end{bmatrix}, \qquad (3)$$

where are the densities of these flows

$$\begin{bmatrix} S_r(r) \\ S_\phi(r) \\ S_z(r) \end{bmatrix} = \begin{bmatrix} (j_\phi h_z - j_z h_\phi) \\ (j_z h_r - j_r h_z) \\ (j_r h_\phi - j_\phi h_r) \end{bmatrix}, \qquad (4)$$

and values

$$\begin{bmatrix} D_3 \\ D_2 \\ D_2 \end{bmatrix} = \int_z \begin{bmatrix} sin^2(\eta z) \\ 0.5\, sin(2\eta z) \\ 0.5\, sin(2\eta z) \end{bmatrix} dz \qquad (5)$$

are constants for the disk as a whole. It is seen that the listed energy flows depend on the speed of rotation of the disk and are absent outside the disk. The choice of the values of the constants C, η, ωdetermines the value of the functions $h_r(r)$, $h_\phi(r)$, $h_z(r)$, $j_r(r)$, $j_\phi(r)$, $j_z(r)$, and, therefore, and flow values as functions of the radius.

To determine the value of η, we note that the density of the vertical energy flow should be taken to be zero on the surfaces of the disk (indeed, the flow does not come from anywhere, forms in the disk and does not come out of the disk). Consequently, $sin(2\eta z) = 0$ at $z = 0$ and at $z = d$, where d is the thickness of the disk. Moreover, $2\eta d = \pi$. So,

$$\eta = \frac{\pi}{2d}. \qquad (6)$$

$$D_2 = \int_0^d sin(\frac{\pi}{d}z)dz = |_0^d\left(-\frac{d}{2\pi}cos(\frac{\pi}{d}z)\right) = -\frac{d}{2\pi}(cos(\pi) - cos(0))$$

or

$$D_2 = \frac{d}{\pi} \qquad (7)$$

From (3-7) we find the energy fluxes along the circumference and along the axis of the rotating disk:

$$\bar{S} = \begin{bmatrix} \overline{S_\phi} \\ \overline{S_z} \end{bmatrix} = 2\pi D_2 \int_0^R \left(r\cdot \begin{bmatrix} (j_z h_r - j_r h_z) \\ (j_r h_\phi - j_\phi h_r) \end{bmatrix} dr\right), \qquad (8)$$

where R is the radius of the disk.

Consider another radial flow of energy emerging from the outer circumference of the disk:

$$\bar{S} = \begin{bmatrix} \overline{S_\phi} \\ \overline{S_z} \end{bmatrix} = 2\pi R d D_3\left(j_r(R)\cdot h_\phi(R) - j_\phi(R)\cdot h_r(R)\right), \qquad (9)$$

where taking into account (6)

$$D_3 = \int_0^d sin^2(\frac{\pi}{2d}z)dz = |_0^d\left(\frac{z}{2} - \frac{2d}{4\pi}sin(\frac{\pi}{d}z)\right) = \left(\frac{d}{2} - \frac{2d}{4\pi}sin(\frac{\pi}{d}d)\right)$$

or

$D_3 = \frac{d}{2}\left(1 - \frac{d}{\pi} sin(\frac{\pi}{d} d)\right).$ (10)

Umov [11] introduced into physics the idea of the movement of energy, the flow of energy and the speed of movement of energy. At the same time, the energy flux densityS, energy densityW, and energy speed $v$are related by the formula

$S = W \cdot v.$ (11)

A gravitomagnetic momentum circulates in the disk along with the energy flow. The density of the pulse, as is known, is determined by the formula

$p = W/v.$ (12)

From (11, 12) we find:

$p = W^2/S.$ (13)

In our case, the flow of energy is the flow of gravitomagnetic energy, and the energy is the kinetic energy of a rotating disk. Consequently, along with the flows of energy in the disk of flows of gravitomagnetic momentum are circulating.

We find the density of flows of momentum. Essentially, the tasks we need to consider are the gravity-magnetic flux density at a given radius and the kinetic energy density of the disk at a given radius

$W = \pi \rho d r^3 \omega^2,$ (14)

where ρ is the density of the disk material. d is disc thickness.

The density of the gravitomagnetic momentum in accordance with (13, 14) is determined by the formula of the form

$p = \begin{bmatrix} p_\varphi \\ p_z \end{bmatrix} = W_r^2 / \begin{bmatrix} S_{\varphi o}(r, \varphi, z) \\ S_{zo}(r, \varphi, z) \end{bmatrix}$ (15)

So, along with the energy fluxes, gravitomagnetic momentums with density (5) circulates in the disk. They are the cause of the above phenomena.

We find full gravitomagnetic momentum by formula

$\bar{p} = \begin{bmatrix} \overline{p_\phi} \\ \overline{p_z} \end{bmatrix} = \frac{1}{2\pi D_2} \int_0^R \left(W_r^2 / \begin{bmatrix} r(j_z h_r - j_r h_z) \\ r(j_r h_\phi - j_\phi h_r) \end{bmatrix} \right) dr.$ (16)

<u>The vertical flow of gravitomagnetic energy</u> is proportional to the gravitomagnetic momentum (as in electrodynamics). This impulse is the driving impulse for levitation.

<u>The circumferential flow of gravitomagnetic energy</u> is also proportional to the gravitomagnetic momentum. This momentum accelerates the rotation of the disk.

<u>The radial flow of gravitomagnetic energy emerging from the outer circumference of the disk</u> (9) is the radiation of gravitomagnetic energy, i.e. gravity magnetic wave. Experiments with RRD show that this radiation creates a halo. This fact shows that

• gravitational magnetic radiation may be **visible**,

• RRD that do not have the ability to take off can serve as a <u>**source of gravitomagnetic radiation to study this radiation.**</u>

Since all energy flows depend on the speed of rotation of the disk, all energy flows increase in magnitude and RRD

• accelerates

• begins to radiate,

• increases vertical speed and disappears ...

IV. Source of energy

Let us now consider the source of energy for moving a disk under the action of a levitating force. It could be assumed that the source of energy is a disk motor that generates a mass current (just as the source of energy of a DC motor is a current source). But the disc spinning by inertia also levitates. Consequently, the source of energy is the gravitational field of the Earth.

Thus, the <u>source of energy for levitation, acceleration, vertical acceleration and halo is the gravitational field of the Earth</u>.

Appendix 1.

Consider equations (2.15-2.20). From (2.18, 2.20) we find:

$h_r = -\frac{1}{\eta}\left(\dot{h}_z + Q\omega r\right).$ (1)

From (2.15, 1) we find:

$$h_z = -\frac{1}{\eta}\left(\frac{h_r}{r} + \dot{h}_r\right) = -\frac{1}{\eta}\left(-\frac{1}{\eta}\left(\frac{\dot{h}_z}{r} + Q\omega\right) - \frac{1}{\eta}\left(\ddot{h}_z + Q\omega\right)\right)$$

or

$$h_z = \frac{1}{\eta^2}\left(\ddot{h}_z + \frac{\dot{h}_z}{r} + 2Q\omega\right)$$

or

$\ddot{h}_z + \frac{\dot{h}_z}{r} - \eta^2 h_z + 2Q\omega = 0.$ (2)

Appendix 2 shows that the solution of equation (2) can be found by numerical differentiation. At the same time, from (1), the function $h_r(r)$can be found. (6).

From (2.16, 2.19) we find:

$\frac{h_\varphi}{r} + \dot{h}_\varphi = 0.$ (3)

The solution of equation (3) is:

$h_\varphi = \frac{C}{r},$ (4)

where C is some constant.

Appendix 2.

Consider equation (2) from Appendix 1:

$\ddot{h}_z + \frac{\dot{h}_z}{r} - \eta^2 h_z + 2Q\omega = 0.$ (1)

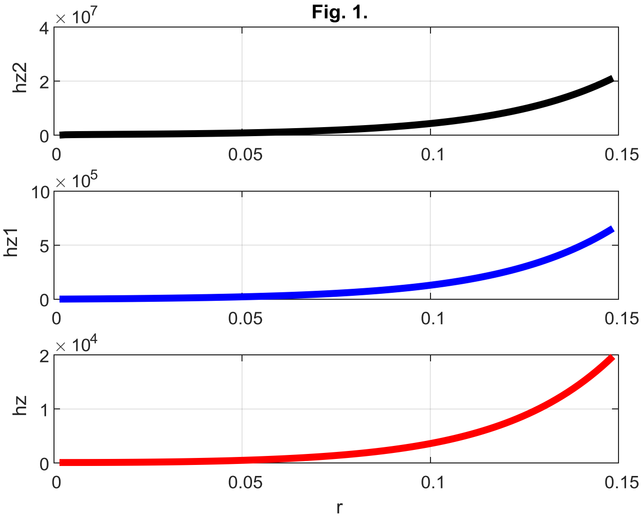
Suppose known

$h_z(0) = 0,$ (2)

$\ddot{h}_z(0) = 0.$ (3)

Then the function $h_z(r)$ and its derivatives can be found by numerical differentiation. For an example in fig. 1 shows the graphs of these functions at $R = 0.15,\ \eta = 30,\ \omega = 100.$

Fig. 1.



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