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Deceasing of Gravitational Mass of the Magnesium subjected to an
Alternating Magnetic Field of Extremely Low Frequency.

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Here we propose an experiment in order to check the decreasing of Gravitational Mass of the Magnesium subjected to an alternating magnetic field of Extremely Low Frequency. In addition, we show how the Inertial Properties, of a Spacecraft with Magnesium core, can be strongly reduced. Gravity Multipliers made of Mg are presented, and then it is show its use in several devices.

Key words: Gravitational Mass, Magnetic Field of Extremely Low Frequency, Magnesium.

INTRODUCTION

In this paper it is suggest an experiment in order to check the decreasing of Gravitational Mass of the light metal Magnesium subjected to an alternating magnetic field of Extremely Low Frequency. Also we show how the Inertial Properties, of a Spacecraft with Magnesium core, can be strongly reduced. In addition, Gravity Multipliers of Mg are presented. It is then shown its use in Gravitational Motors, Gravitational Thruster of Fluids, production of Microgravity environments, and a Cooling and Heating Gravitational System.

THEORY

In a previous paper [1] we shown that there is a correlation between the gravitational mass, $m_g$, and the rest inertial mass $m_0$, which is given by

$$\chi = \frac{m_g}{m_0} = 1 - 2 \left[ 1 + \left( \frac{\Delta p}{m_0 c^2} \right)^2 \right]^{-\frac{1}{2}}$$

where $\Delta p$ is the variation in the particle’s kinetic momentum; $U$ is the electromagnetic energy absorbed or emitted by the particle; $n_r$ is the index of refraction of the particle; $W$ is the density of energy on the particle ($J/kg$); $\rho$ is the matter density ($kg/m^3$) and $c$ is the speed of light.

The instantaneous values of the density of electromagnetic energy in an electromagnetic field can be deduced from Maxwell’s equations and has the following expression

$$W = \frac{1}{2} E^2 + \frac{1}{2} \mu H^2$$

where $E = E_m \sin \omega t$ and $H = H_m \sin \omega t$ are the instantaneous values of the electric field and the magnetic field respectively.

It is known that $B = \mu H$, $E/B = \omega/k_r$ [2] and

$$v = \frac{dz}{dt} = \frac{\omega}{\kappa_r} = \frac{c}{\sqrt{1 + \left( \frac{\sigma}{\omega \epsilon} \right)^2}}$$

where $k_r$ is the real part of the propagation vector $k$ (also called phase constant); $k = |k| = k_r + ik_i$ ; $\epsilon$, $\mu$ and $\sigma$ are the electromagnetic characteristics of the medium in which the incident (or emitted) radiation is propagating ($\epsilon = \epsilon_0$; $\epsilon_0 = 8.854 \times 10^{-12} F/m$; $\mu = \mu_0$, $\mu_0$ where $\mu_0 = 4 \pi \times 10^7 H/m$; $\sigma$ is the electrical conductivity in S/m). From Eq. (3), we see that the index of refraction $n_r = c/v$ is given by

$$n_r = \frac{c}{v} = \frac{\epsilon_r \mu_r}{\sqrt{1 + \left( \frac{(\sigma/\omega \epsilon)^2}{1 + (\sigma/\omega \epsilon)^2 + 1) \right)}}^2$$

Equation (3) shows that $\omega/k_r = v$. Thus, $E/B = \omega/k_r = v$, i.e.,

$$E = vB = v\mu H$$

Then, Eq. (2) can be rewritten as follows

$$W = \frac{1}{2} E^2 + \frac{1}{2} \mu H^2 = \frac{1}{2} \mu H^2 - \frac{1}{2} \mu H^2 = \mu H^2$$

For $\sigma >> \omega \epsilon$, Eq. (3) gives

$$n_r^2 = \frac{c^2}{v^2} = \frac{\mu \sigma}{2 \omega \epsilon}$$

Substitution of Eqs. (6) and (5) into Eq. (1) gives
\[
\chi = \frac{m_g}{m_{i0}} = \left\{1 - 2 \left[1 + \left(\frac{\mu^2 \sigma}{4\pi \rho^2 c^2}\right) H^4 - 1\right]\right\}
\]  
(8)

Note that if \( H = H_m \sin \omega t \). Then, the average value for \( H^2 \) is equal to \( \frac{1}{2} H_m^2 \) because \( H \) varies sinusoidally (\( H_m \) is the maximum value for \( H \)). On the other hand, we have \( H_{rms}=H_m/\sqrt{2} \). Consequently, we can change \( H^4 \) by \( H_{rms}^4 \), and the Eq. (8) can be rewritten as follows

\[
\chi = \frac{m_g}{m_{i0}} = \left\{1 - 2 \left[1 + \left(\frac{\mu^2 \sigma}{4\pi \rho^2 c^2}\right) H_{rms}^4 - 1\right]\right\}
\]  
(9)

SUGGESTED EXPERIMENT

Let us now consider an experiment where the light metal Magnesium (Mg), whose characteristics are given by: \( \sigma = 2.2 \times 10^7 \text{ S/m} \); \( \rho = 1738 \text{ kg/m}^3 \), is subjected to an alternating magnetic field \( B_{rms} \) of Extra-low frequency, \( f^* \). According to Eq. (10), the gravitational mass of the Magnesium core, \( m_{gc} \), is expressed by the following equation:

\[
m_{gc} = \left\{1 - 2 \left[1 \times 10^{12} B_{rms}^4 \right] f \right\} m_{i0c}
\]  
(14)

In the equation (14), \( m_{i0c} \) is the rest inertial mass of the Magnesium Core.

**INERTIAL PROPERTIES**

Now, we will show how the Inertial Properties of a Spacecraft can be strongly reduced.

Consider the schematic diagram of a spacecraft shown in Fig. 1. At the center of the spacecraft there is a Magnesium Core, subjected to an alternating magnetic field \( B_{rms} \) with Extra-low frequency, \( f^* \). According to Eq. (10), the gravitational mass of the Magnesium core, \( m_{gc} \), is expressed by the following equation:

\[
m_{gc} = \left\{1 - 2 \left[1 \times 10^{12} B_{rms}^4 \right] f \right\} m_{i0c}
\]  
(14)

For \( f = 0.1 \text{Hz} \) Eq. (10) gives

\[
\chi = \frac{m_g}{m_{i0}} = \left\{1 - 2 \left[\sqrt{1 + 5.1 \times 10^{-11} B_{rms}^4} - 1\right]\right\}
\]  
(10)

For \( B_{rms} = 500 \text{T} \) Eq. (11) gives

\[
\chi = -1.1
\]  
(12)

Thus, we get

\[
P_{(Mg)} = m_{g(Mg)} g = \chi m_{i0(Mg)} g = -1.1 m_{i0(Mg)} g
\]  
(13)

In 2018, physicists from the Institute for Solid State Physics at the University of Tokyo, Japan, have recorded the largest magnetic field ever generated indoors — a whopping \( 1,200 \text{T} \) [3]. This means that the experiment suggested in this work will can be carried out in the very near future.

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\[ M_{gs\text{total}} \simeq M_{gs} + m_{gc} = M_{gs} + \left(1 - 2 \left[ \frac{5.1 \times 10^{-12} B_{rms}^2}{f} \right] \right) m_{gc} \]  

(16)

Therefore, for \( 5.1 \times 10^{-12} B_{rms}^2 / f > 1 \), we get

\[ M_{gs\text{total}} \simeq M_{gs} - \left[ \frac{5.1 \times 10^{-12} B_{rms}^2}{f} \right] m_{gc} \]  

(17)

For example, if \( M_{gs} \simeq M_{gs} = 10,000 \text{kg} \); \( m_{gc} = 5,000 \text{kg} \); \( f = 0.1 \text{Hz} \); and, \( B_{rms} \simeq 529 \text{T} \), then Eq. (17) yields

\[ M_{gs\text{total}} < 8 \text{kg} \]

This means that the weight of the spacecraft becomes less than 80N.

Mach’s principle predicts that inertial forces acting on a particle are the result from the gravitational interaction between the particle and the other particles of the Universe. Thus, the inertial forces \( F_i \) acting on a particle are proportional to gravitational mass, \( m_g \), of the particle, i.e., \( F_i = m_g a_i \) [1].

This fact shows that the inertial effects upon a spacecraft can be strongly reduced because, as we have seen, the gravitational mass of the spacecraft \( M_{gs\text{total}} \) can be strongly reduced \( (F_i = M_{gs\text{total}} a_i) \). In practice, it means that will be possible to become quasi-null the inertial properties of the spacecraft.

Under these circumstances, the spacecraft can describe incredible trajectories, and to make super accelerations and super decelerations in a very short time interval (<1s), without being destructed (See The Gravitational Spacecraft [4]).

GRAVITY MULTIPLIER

In a previous paper [5] it was shown that, when the gravitational mass, \( m_g \), of a plate (very thin plate) is reduced by the factor \( \chi_1 = m_g / m_{g_{01}} \), then the gravity acceleration after the plate, \( g_1 \), is reduced at the same proportion, i.e., \( g_1 = \chi_1 g \) where \( g \) is the gravity acceleration before the plate (See Fig. 2).

Fig. 2 - The gravity acceleration after the plate is \( g_1 = \chi_1 g \) where \( g \) is the gravity acceleration before the plate. The perpendicular axis of the plate can be in any direction.

Consequently, after a second plate, with gravitational mass, \( m_g \), the gravity becomes:

\[ g_2 = \chi_2 g_1 = \chi_1 \chi_2 g \]

where \( \chi_2 = m_g / m_{g_{02}} \). In a generalized way, we can write that after the \( n \)th plate the gravity, \( g_n \), will be given by:

\[ g_n = \chi_1 \chi_2 \cdots \chi_n g \]  

(18)

If \( \chi_1 = \chi_2 = \cdots = \chi_n = \chi < -1 \), and \( n \) is odd then, the gravitational forces, \( F \), between a body \( B \) before the first plate and another body \( A \) after the second plate are repulsive (See Fig. 3), and given by

\[ F = m_B g_B = m_A g_A = m_B (\chi^2 g) = m_A (\chi^2 g) = -G \frac{M_{gs}}{r^2} = -G \frac{m_B m_A}{r^2} = -G \frac{m_B m_A}{r^2} \]  

(19)

Fig. 3 – The gravity after a battery of plates

In this case, the plates have the same dimensions (with the same inertial mass \( m_{i0p} \)), and they are made of Magnesium, subjected to an alternating magnetic field, \( B_{rms} \), with Extra-low frequency, \( f \). If the gravitational masses of the plates are, \( m_g \), then, according to Eq. (10), we can write that

\[ \chi = \frac{m_g}{m_{g_{0p}}} = \left(1 - 2 \left[ \frac{5.1 \times 10^{-12} B_{rms}^2}{f} \right] \right) \]  

(20)

If \( f = 0.1 \text{Hz} \) and \( B_{rms} = 600 \text{T} \), Eq. (20) gives

\[ \chi = m_g / m_{g_{0p}} \simeq -2.5 \]

(21)

Then, the gravity after the \( n = 5 \) plate is

\[ \chi^n = (-2.5)^5 = -97.6 \]

Therefore, we get

\[ g_n = \chi^n g = -97.6 g \]  

(22)
Thus, this system multiply the gravity, $g$, by 97.6 times.

We can use the Gravity Multipliers to convert gravitational energy into rotational kinetic energy by means of a Gravitational Motor, which design can be similar to the Internal Combustion Engine. In that Gravitational Motor, the pistons can be designed as shown in Fig. 4.

Then, the gravitational force, $F$, acting on one piston (See Fig.4) is

$$F = m_g g_n$$

and the average power is $P = F v$, where

$$v = \frac{1}{2} \sqrt{2aH} = \sqrt{\chi_n g_n H/2}$$

where $H$ is the stroke length of the piston. Thus, we can write that

$$P = F v = m_{gP} \sqrt{\chi_n g_n H/2}$$

For $\chi = -2.5; \quad n = 5; \quad g = 9.81 m/s^2; \quad g_n = -97.6g = -956.4$ (See Eq. (22)); $m_{gP} = 5kg$ and $H = 0.15m$, then Eq. (25) gives

$$P = 4 \times 10^4 W = 40kW \cong 53HP$$

For 4 pistons the total power is

$$P \cong 212 HP$$

ANOTHER GRAVITATIONAL MOTOR

In Fig.5, we show a schematic diagram of another type of Gravitational Motor, with different characteristics to the type previously proposed. Now the Gravitational Motor has 4 Gravity Multipliers (GM), which can be made with plates of Magnesium, subjected to an alternating magnetic field, $B_{rms}$, with Extra-low frequency, $f$.

The Gravity Multipliers, GM1, GM2 and the GM3 are placed below the rotor (See Fig.5); GM1 and GM2 on the right and GM3 on the left. Above the GM1 the local gravity, $\tilde{g}$, is intensified for $\chi_1 g = +Ng$, where $\chi_1 = -N$ and $\chi_2 = 1$ are the correlation factors for GM1 and GM2, respectively. Above the GM3 the local gravity becomes $\tilde{g} = -Ng$, where $\chi_3 = -N$. The function of GM4 and GM5 (See Fig.5), is only to revert the gravity down to values very close to $g$.

As the gravity acceleration on the left half of the rotor becomes $\tilde{g} = -Ng$ while the gravity acceleration on the right half of the rotor becomes $\tilde{g} = +Ng$, the torque on the rotor is

$$T = \left( \tilde{F} - \tilde{F} \right) \times \tilde{r} = \left( \frac{1}{2} m_g g_n g_n + \frac{1}{2} m_g g_n g_n \right) \tilde{r}$$

where $m_g$ is the mass of the rotor, and the rotor spins with angular velocity $\omega$.

Then, the average power, $P$, of the gravitational motor is given by

$$P = T \omega = Nm_{gP} \omega r$$

On the other hand, we have that

$$\omega = \sqrt{2Ng/r}$$

Therefore the angular speed of the rotor is

$$\omega = \sqrt{2Ng/r}$$

By substituting (30) into (28) we obtain the expression of the average power of the gravitational motor, i.e.,

$$P = Nm_{gP} \sqrt{\frac{2Ng}{r}} = m_{gP} 2Ng/r$$

Now consider an electric generator coupling to the gravitational motor in order to produce electric energy. Since $\omega = 2\pi f$ then for $f = 60Hz$ we have

$$\omega = 120\pi rad/s = 3600pm$$

Therefore for $\omega = 120\pi rad/s$ and

$$\chi_1 = \chi_2 = -N = \chi_n = (-2)^n = -128$$

the Eq. (30) tells us that we must have

$$r = 2Ng/\omega^2 = 0.0176 m$$

Since $r = R/3$ and $m_{gP} = \rho \pi R^2 h$ where $\rho, R$ and $h$ are respectively the mass density, the
radius and the height of the rotor then for 
\[ h = 0.25m \text{ and } \rho = 7800\text{Kg.m}^{-3} \text{ (Iron)}, \]
we get 
\[ m_{0} = 17.1\text{kg} \] 
(34)
Thus, Eq. (31) gives 
\[ P \approx 1.4 \times 10^{5} W \approx 140\text{ kW} \approx 187\text{ HP} \]

Note that this electrical energy is produced without the use of any type of fuel, because the energy, which moves the Gravitational Motor comes from Earth’s gravitational field, i.e., the Gravitational Motor converts directly energy from the Earth’s gravitational field into rotational mechanical energy.

Thus, the Gravitational Motors are similar to the turbines of the hydroelectric plants. While the turbines convert energy from the Earth’s gravitational field into rotational mechanical energy, by means of water of the rivers, this type of Gravitational Motors convert energy from the Earth’s gravitational field directly into rotational mechanical energy, by using the GMs.

Finally, note the small volume of the rotor of this type Gravitational Motor, it shows that the total volume of the motor can be smaller than 1m3.

![Fig. 5 – Schematic diagram (cross-section) of another type of Gravitational Motor.](image)

**GRAVITATIONAL THRUSTER OF FLUIDS**

The Gravity Multipliers can be used to make particles acquire enormous accelerations. In practice, this can lead to the conception of a Gravitational Thruster of Fluids (See Fig.6). In this case, the gravity acceleration after the nth plate, \( g_{n} \), for \( \chi = -2.5 \) (See Eq. (21)), \( n = 7 \) and \( g = 9.8m.s^{-2} \), is given by
\[ g_{n} = \chi^{n}g = (-2.5)^{7}g \approx -5.981m.s^{-2} \] 
(35)

In Fig.7 it is shown a schematic diagram of a thruster system - using a Gravitational Thruster of Fluids, for spacecrafts in the Earth’s atmosphere. This system can be used to propeller the spacecraft in any direction.

![Fig. 6- Gravitational Thruster of Fluids](image)
MICROGRAVITY ENVIRONMENTS

In a previous paper [6] we described a way to produce microgravity environments at level of the Earth’s surface, in order to “activate” the cellular autophagy process. After an infection, autophagy can destroy bacteria and viruses. Based on the theory here explained, it easy to see that, microgravity environments can be also produced using an Mg plate, subjected to an alternating magnetic field with Extra-low frequency, $f$ (See Fig.8).

According Eq. (20), we get

$$\chi = m_{gr}/m_{rup} = \left[ 1 - 2 \sqrt{1 + 5.1 \times 10^{-12} B_{rms}^4/f - 1} \right]$$

For $B = 395.6715 \text{T}$ and $f = 0.1 \text{Hz}$, the equation above gives $\chi \cong 1.3 \times 10^{-6}$. Thus, we get $g_1 = \chi g = 1.2 \times 10^{-5} \text{m.s}^{-2}$. The acceleration experienced by a body in a microgravity environment, by definition, is one-millionth ($10^{-6}$) of that experienced at Earth’s surface (1g). Consequently, a microgravity environment is one where the acceleration induced by gravity has little or no measurable effect.

The pressure $p_a$ at point $a$ (See Fig.9) is

$$p_a = \rho g^a = \rho g (\chi \hat{g})$$

Equation above shows that the pressure inside the sphere A can be reduced by reducing $\chi$. The decreasing of the pressure causes the decreasing of the temperature, $T_A$, in sphere A, $\left(P/T^a = P/T\right)$. In this case, the system shown in Fig 9, it can works like a Cooling Gravitational System.

By increasing the magnitude of the magnetic field $B_{rms}$, it is possible to make $\chi$ negative (See Eq. (20)), and also to increase its magnitude $|\chi|$. In this case, $g^a$ will be expressed by $g^a = -|\chi| g$, and the pressure $p_b$ at point b becomes

$$p_b = \rho g^b = -\rho |\chi| \hat{g}$$

Note that, the pressure $p_b$ is in opposite direction to $\hat{g}$. The increase of $p_b$ causes a increasing of the pressure inside the spherical shell B, producing consequently, an increasing of the temperature, $T_B$, in the spherical shell B. In this case, the system shown in Fig 9 can works like a Heating Gravitational System.

COOLING AND HEATING GRAVITATIONAL SYSTEM

Consider the system shown in Fig. 9. It has two hollow spheres A and B connected by a tube; inside this system there is a liquid with density $\rho$. Bellow sphere A there is an Mg plate (in red Fig.9), subjected to an alternating magnetic field $B_{rms}$ with Extra-low frequency, $f$. The pressure $p_a$ at point $a$ (See Fig.9) is

$$p_a = \rho g^a = \rho g (\chi \hat{g})$$

Equation above shows that the pressure inside the sphere A can be reduced by reducing $\chi$. The decreasing of the pressure causes the decreasing of the temperature, $T_A$, in sphere A, $\left(P/T^a = P/T\right)$. In this case, the system shown in Fig 9, it can works like a Cooling Gravitational System.

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References


