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Quantum Controller of Gravitational Mass Using *Free Electrons Gas*

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Here, we showed a Quantum Controller of Gravitational Mass using Free Electrons Gas. It is similar to the Quantum Controller of Gravitational Mass using Photon Gas, which I have proposed recently [4], but this new device is extremely advantageous from the technical viewpoint. It is easy to build and can be used for several applications since to propel spacecrafts, cars, etc.

Key words: *Gravitation, Gravitational Mass, Inertial Mass, Gravity, Quantum Device.*

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INTRODUCTION

Several years ago I have published a fundamental paper [1] where a correlation between gravitational mass, m_g, and rest inertial mass, m_{i0}, was obtained. The correlation is expressed by

$$\chi = \frac{m_g}{m_{i0}} = \left\{1 - 2\left[\sqrt{1+\left(\frac{\Delta p}{m_{i0}c}\right)^2} - 1\right]\right\} = $$
$$= \left\{1 - 2\left[\sqrt{1+\left(\frac{Un_r}{m_{i0}c^2}\right)^2} - 1\right]\right\} = $$
$$= \left\{1 - 2\left[\sqrt{1+\left(\frac{Wn_r}{\rho c^2}\right)^2} - 1\right]\right\} \qquad (1)$$

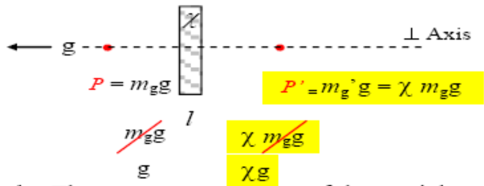


Fig. 1 - The *gravitational mass* of the particle *in the other side of the lamina* becomes $m'_g = \chi m_g$.

Only when $\chi = 1$, the weight is equal in both sides of the lamina. This means that, by controlling the value of χ in the lamina, it also is possible to control the *Gravitational Mass* of a particle when it is placed in the other side of the lamina.

Here, we showed that by controlling the value of the gravitational mass of a *lamina* of *free electrons gas*, by means of an electric field (or magnetic), it is possible to control the *Gravitational Mass* of a body, when it is placed just upon the free electrons gas.

where Δp 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); ρ is the matter density $\left(kg/m^3\right)$ and c is the speed of light.

Also I shown in another paper [2] that, if the *weight* of a particle in a side of a lamina is $\vec{P} = m_g \vec{g}$ ($\vec{g}$ perpendicular to the lamina) then the weight of the same particle, in the other side of the lamina (See Fig.1) is $\vec{P}' = \chi m_g \vec{g}$, where $\chi = m_g^l / m_{i0}^l$ (m_g^l and m_{i0}^l are respectively, the gravitational mass and the rest inertial mass *of the lamina*).

THEORY

Consider the device shown in Fig.2.

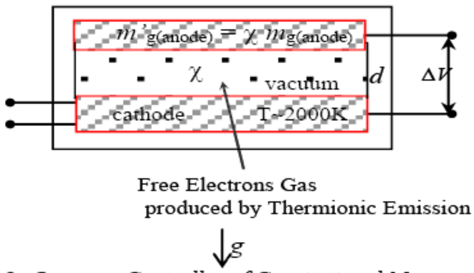


Fig.2- *Quantum Controller of Gravitational Mass* using *Free Electrons Gas*

The thermionic emission produces a *lamina* of *free electrons* gas between the plates of the

capacitor. According to Eq. (1), the electric field $E = \Delta V / d$, between the parallel plates of the capacitor modifies the *gravitational mass of the electron gas* according to the following equation:

$$\chi = \frac{m_{g(electron\ gas)}}{m_{i0(electron\ gas)}} = \\ = \left\{1 - 2\left[\sqrt{1 + \left(\frac{\varepsilon E^2 n_r}{2\rho c^2}\right)^2} - 1\right]\right\} \qquad (2)$$

Assuming that $n_r = 1$ and $\varepsilon = \varepsilon_0$, for the electron gas. Then Eq. (2) can be rewritten as follows

$$\chi = \frac{m_{g(electron\ gas)}}{m_{i0(electron\ gas)}} = \\ = \left\{1 - 2\left[\sqrt{1 + \left(\frac{\varepsilon_0 E^2}{2\rho c^2}\right)^2} - 1\right]\right\} \qquad (3)$$

According to showed in Fig. (1), we can conclude that the *gravitational mass* of the *anode* (See Fig.(2)) becomes $m'_{g(anode)} = \chi m_{g(anode)}$. Considering that $m_{g(anode)} \cong m_{i0(anode)}$, then, we can write that

$$m'_{g(anode)} \cong \chi m_{i0(anode)} \qquad (4)$$

Kinetic theory tells us that, the temperature of a gas is the expression of the average kinetic energy that the particles in the system have. While any one particle may have much more or less energy than the average, the entire system has a predictably constant average. The expression for the average kinetic energy of a single particle in a system is $K = \frac{3}{2} k_B T$ where K is the *average kinetic energy* per particle, T is the temperature of the system, and k_B is the Boltzmann constant which is equal to $1.38 \times 10^{-23} J/^{o}K$. The *total energy* of the entire system, can be obtained simply multiplying the number of particles, N, by the average

is the voltage between the plates. Then the density of the free electrons gas can be expressed by:

$$\rho = \frac{2p}{v^2} = \frac{3}{2} n \left(\frac{m_e}{e\Delta V}\right) k_B T \qquad (7)$$

On the other hand, we know that the current density, j, can be expressed by the following expression (*Richardson-Dushman Equation*):

$$j = AT^2 e^{-\frac{b}{T}} = nev \qquad (8)$$

where A and b are the emission constants [3]. From Eq. (8), we get

$$n = \frac{1}{v}\left(\frac{AT^2}{e}\right) e^{-\frac{b}{T}} = \sqrt{\frac{m_e}{2e\Delta V}} \left(\frac{AT^2}{e}\right) e^{-\frac{b}{T}} \qquad (9)$$

By substuting Eq. (9) into Eq. (7), we obtain

$$\rho = \frac{3}{2}\left(\sqrt{\frac{m_e^3}{2e^5 \Delta V^3}}\right) A k_B T^3 e^{-\frac{b}{T}} \qquad (10)$$

For *Tungsten*, the values of A and b are respectively given by: $A = 6.02 \times 10^5 amp/m^2.K^2$ and $b = 5.24 \times 10^4 K$ [3]. Then, if the cathode is made with *Tungsten*, Eq. (10) tells us that

$$\rho = 7.4 \times 10^{-16} \left(\frac{T^3}{\Delta V^{\frac{3}{2}}}\right) e^{-\frac{5.4 \times 10^4}{T}} \qquad (11)$$

For $T = 2000K$ (Temperature of the Cathode), and $\Delta V = 1500 volts$ Eq.(11) yields

$$\rho = 1.9 \times 10^{-22} kg.m^{-3} \qquad (12)$$

By substituting this value into Eq. (3), we get

$$\chi = \left\{1 - 2\left[\sqrt{1 + 6.7 \times 10^{-14} \left(\frac{\Delta V}{d}\right)^4} - 1\right]\right\} \qquad (13)$$

For $\Delta V = 1500 volts$ and $d = 7cm$, Eq. (13) tells us that $\chi = -234.7$. In this case, the *weight* P *of the anode* becomes $\vec{P}'$, given by

$$\vec{P}' = m'_{g(anode)} g = \chi m_{i0(anode)} g = \\ = -234.7 m_{i0(anode)} g = -234.7 \vec{P} \qquad (14)$$

kinetic energy. This is also the *internal energy* U *of the free electron gas*, i.e.,

$$U = \tfrac{3}{2} N k_B T \qquad (5)$$

On the other hand, the *pressure*, p, is given by the derivate of the internal energy with respect to volume (V), i.e.,

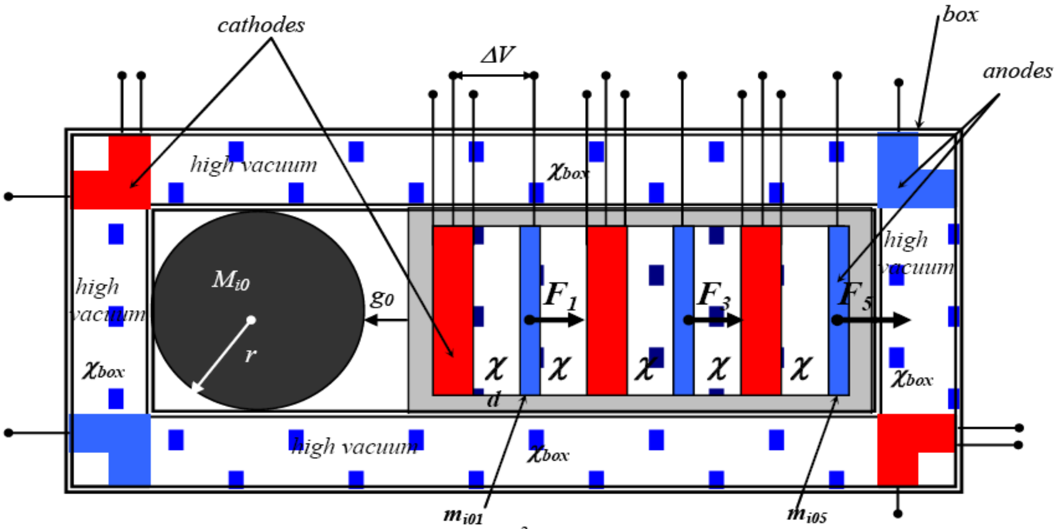
$$p = -\frac{\partial U}{\partial V} = \tfrac{3}{2}\left(\frac{N}{V}\right) k_B T = \tfrac{3}{2} n k_B T \qquad (6)$$

Since $p = \frac{1}{2}\rho v^2$, where $v = \sqrt{2e\Delta V/m_e}$; ΔV

The sign $(-)$, in this equation, means that the force P' has opposite direction to P. Note that the force P' is 234.7 times greater than the force P.

In a previous paper we have proposed a *Universal Gravitational Thruster* [4]. Here, we propose a similar system based on the system shown in Fig. 2. See Fig. 3.

Universal Gravitational Thruster.



The box is designed to obtain $\chi_{box} << 10^{-3}$. Thus, inside the box any external gravity g becomes $\chi_{box} g$ (See Fig. 1). In this way, inside the box, the effects of the external gravity become negligible.

The *gravity* produced by the sphere inside the box is $g_0 = -GM_{i0}/r^2$; $G = 6.67\times10^{-11} N.m^2.kg^2$. Thus, for M_{i0} =10kg, and r = 5 cm, we get

$$g_0 = 2.7\times10^{-7}\ m.s^{-2}$$

$$\vec{F}_1 = m_{i01}\vec{g}_1 = m_{i01}(\chi\vec{g}_0) = \chi m_{i01}\vec{g}_0$$

$$\vec{F}_2 = m_{i02}\vec{g}_2 = m_{i02}(\chi\vec{g}_1) = m_{i02}[\chi(\chi\vec{g}_0)] = \chi^2 m_{i02}\vec{g}_0$$
$$\vec{F}_3 = m_{i03}\vec{g}_2 = m_{i03}(\chi\vec{g}_2) = m_{i03}[\chi(\chi^2\vec{g}_0)] = \chi^3 m_{i03}\vec{g}_0$$
$$\vec{F}_4 = m_{i04}\vec{g}_3 = m_{i04}(\chi\vec{g}_3) = m_{i04}[\chi(\chi^3\vec{g}_0)] = \chi^4 m_{i04}\vec{g}_0$$
$$\vec{F}_5 = m_{i05}\vec{g}_4 = m_{i05}(\chi\vec{g}_4) = m_{i05}[\chi(\chi^4\vec{g}_0)] = \chi^5 m_{i05}\vec{g}_0$$

Note that, due to $\chi < 0$, $\chi^3 < 0$ and $\chi^5 < 0$ then $\vec{F}_3$ and $\vec{F}_5$ has the same direction of $\vec{F}_1$.

The resultant $\vec{R}$ is

$$\vec{R} = \vec{F}_1 + \vec{F}_2 + \vec{F}_3 + \vec{F}_4 + F_5 \cong \vec{F}_5 = \chi^5 m_{i5}\vec{g}_0$$

If the *cathodes* are made with ***Tungsten***, and $T = 2000K$ (Temperature of the Cathode), then Eq. (13) tells us that, if $\Delta V = 1500 volts$ and $d = 0.07m$, we obtain $\chi = -234.7$. Thus, we can write that

$$R \cong F_5 = \chi^5 m_{i05} g_0 = (-234.7)^5 (2.7\times10^{-7}) m_{i05} \cong 192000 m_{i05}$$

If $m_{i05} = 1kg$ the result is

$$R \cong 192kN$$

Fig. 3 – Schematic diagram of a Universal Gravitational Thruster using *Thermionic electrons gas*.

The **Universal Gravitational Thruster** (UGT) can be designed in order to act in just one sense (χ^3, χ^4, etc.). Thus, by using 6 UGT we obtain the following thruster system:

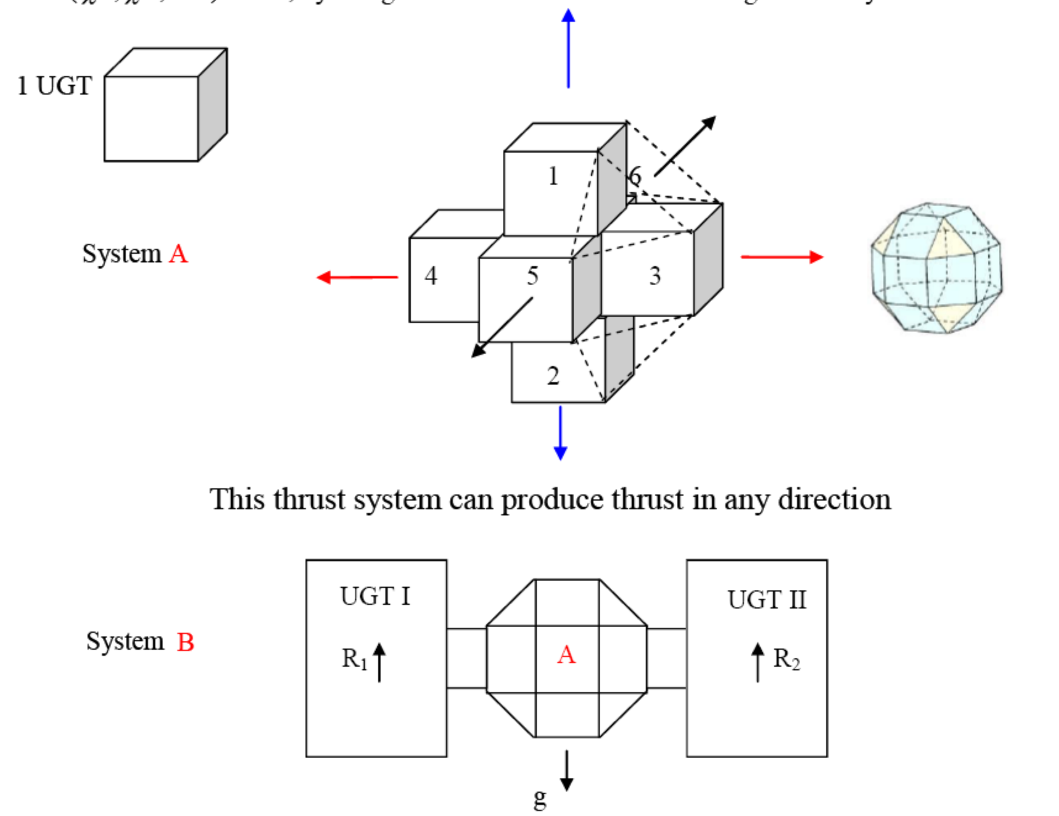
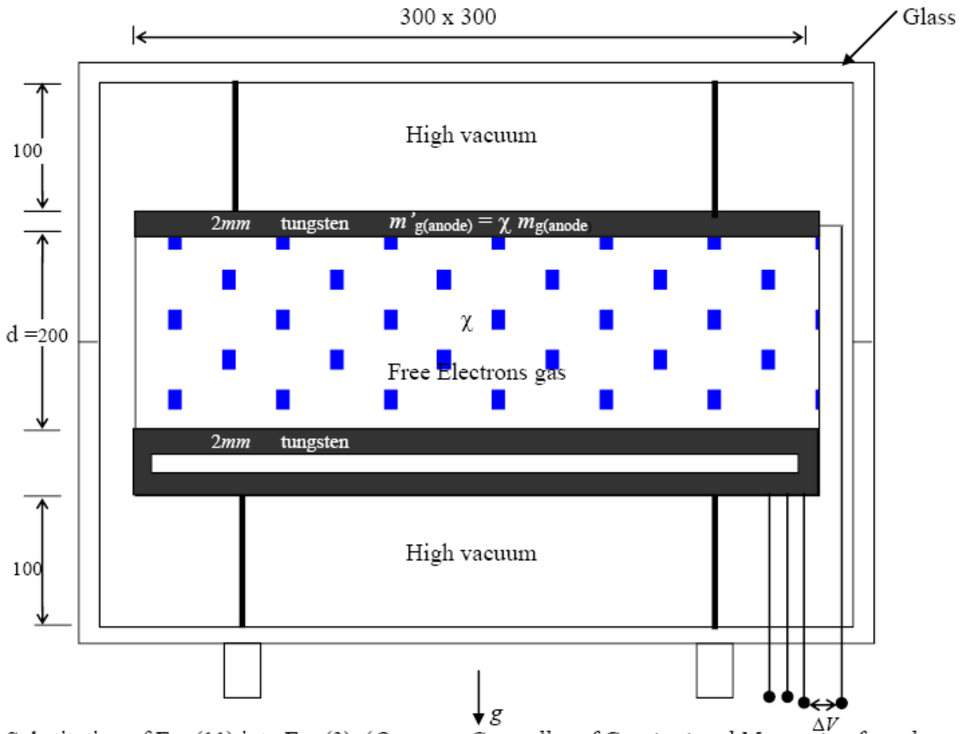


Fig. 4 – A Thrust System using UGT



Substitution of Eq. (11) into Eq. (3), (*Quantum Controller of Gravitational Mass using free electron gas*), gives

$$\chi=\left\{1-2\left[\sqrt{1+4.43\times10^{-27}\left(\frac{\Delta V^3}{T^6}\right)e^{\frac{1.08\times10^5}{T}}\left(\frac{\Delta V}{d}\right)^4}-1\right]\right\}=$$

$$=\left\{1-2\left[\sqrt{1+4.43\times10^{-27}\left(\frac{\Delta V^7}{T^6 d^4}\right)e^{\frac{1.08\times10^5}{T}}}-1\right]\right\}$$

If $T=2000K$, we get

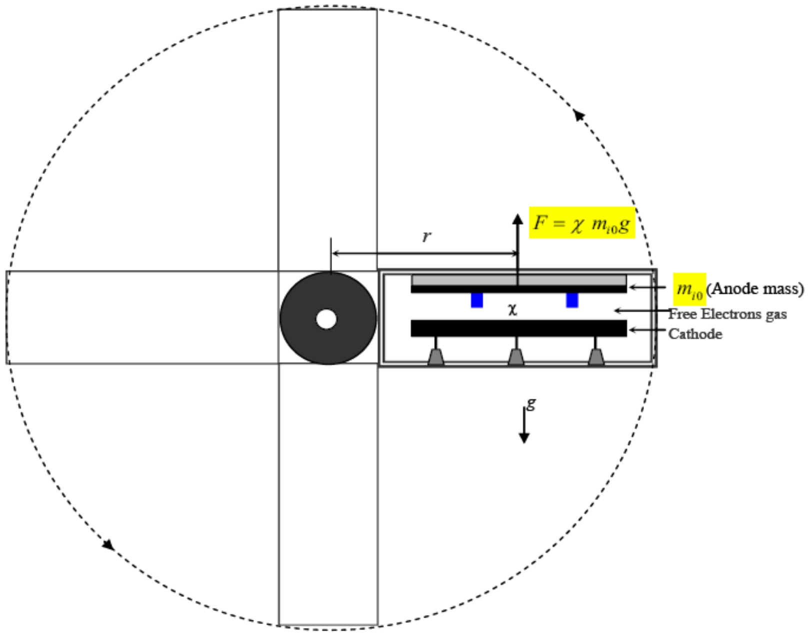
$$\chi=\left\{1-2\left[\sqrt{1+1.95\times10^{-23}\left(\frac{\Delta V^7}{d^4}\right)}-1\right]\right\}$$

If $\Delta V=1000volts$ and $d=200mm=0.20m$, we obtain $\chi=-4.26$. Thus, we can write that

$$P_{(anode)}=\chi m_{i0(anode)}g=-4.26m_{i0(anode)}g\ ;\ m_{i0(anode)}=(0.3)^2 2\times10^{-3}(19250)=3.5kg$$

$$P_{(anode)}=-4.26m_{i0(anode)}g\cong-14.76g\cong-144N$$

Fig. 5 – Schematic diagram of a Quantum Controller of Gravitational Mass using *Free electrons Gas* (G valve).



$$P=\frac{W}{t}=\frac{F.r}{\left(\frac{2\pi r}{v}\right)}=\frac{Fv}{2\pi}\qquad v=\sqrt{2a(2\pi r)}=\sqrt{4\pi a r}$$

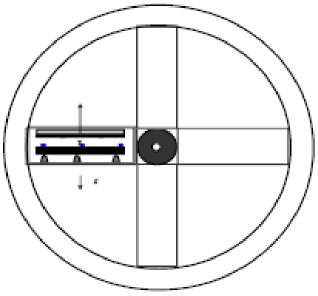
$$P=\frac{Fv}{2\pi}=\frac{F\sqrt{4\pi a r}}{2\pi}=F\sqrt{\frac{ar}{\pi}}=\sqrt{\frac{F^2 r}{\pi}\left(\frac{F}{m_{i0}}\right)}=\sqrt{\frac{F^3 r}{\pi m_{i0}}}=\sqrt{\frac{\chi^3 m_{i0}^2 g^3 r}{\pi}}$$

$$P=m_{i0}\sqrt{\frac{\chi^3 g^3 r}{\pi}}$$

For $m_{i0}=10kg$; $\chi=80$; $r=0.13m$, we get

$$P=8\times10^4 W\cong100HP$$

Fig. 6 - **Gravitational Motor**



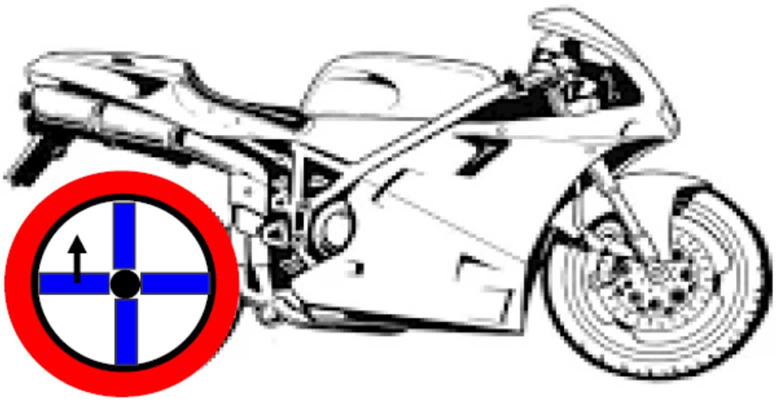
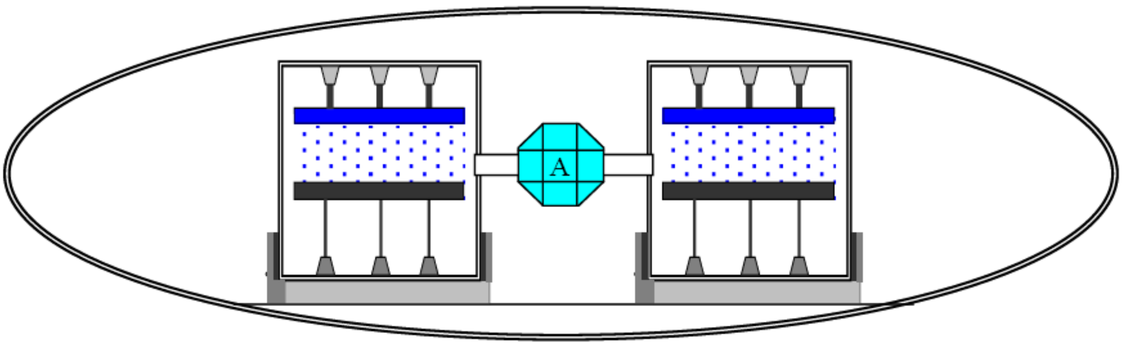


Fig. 7 - Gravitational Moto



Gravitational Spacecraft

The *total* gravitational mass of the spacecraft, $M_{gS(total)}$, can be expressed by means of the following expression: $M_{gS(total)} = M_{gS} + 2M_{gP}$, where M_{gS} is the total gravitational mass of the spacecraft *withou* the gravitational mass, $2M_{gP}$, of the *two* tungsten plates (in blue) . Assuming that the density of *externa* electromagnetic energy in M_{gS} is negligible, then we can write that $M_{gS} \cong M_{i0S}$, where M_{i0S} is the *res.* inertial mass of the spacecraft (without the *two* tungsten plates). On the other hand, since $M_{gP} = \chi M_{i0P} = \left\{1 - 2\left[\sqrt{1 + 6.70\times10^{-14}(\Delta V/d)^4} - 1\right]\right\}M_{i0P}$, we can write that

$$M_{gS(total)} = M_{gS} + 2M_{gP} \cong M_{i0S} + 2\left\{1 - 2\left[\sqrt{1 + 6.70\times10^{-14}(\Delta V/d)^4} - 1\right]\right\}M_{i0P}$$

For example, if $M_{i0S} = 10{,}000kg$; $M_{i0P} = 10kg$; $\Delta V = 1558.54volts$ and $d = 0.05m$, then equation above yields

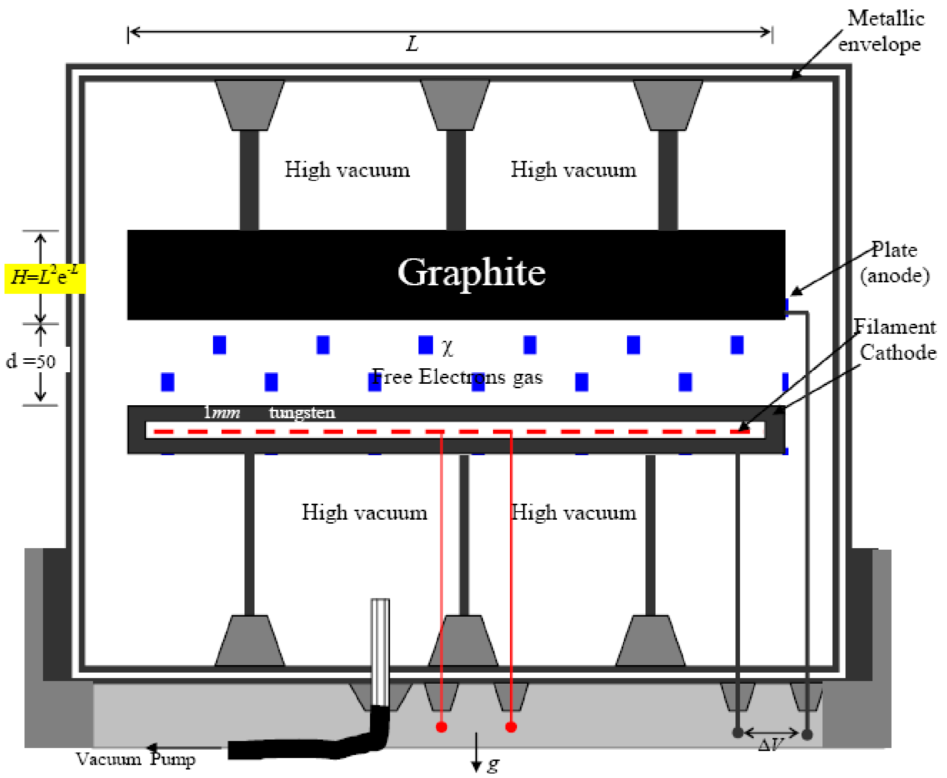
$$M_{gS(total)} \cong 10{,}000 - 999.99\times10 = 0.1kg.$$

This means that, on the Earth surface, the weight of the spacecraft becomes less than 1N !!!

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_{ii} acting on a particle are proportional to *gravitational mass*, m_g, of the particle, i.e., $F_{ii} = m_g a_i$ [1]. This fact shows that the inertial effects upon a spacecraft can be strongly reduced because, as it shown above, the *gravitational mass* of the spacecraft $M_{gS(total)}$ can be strongly reduced ($F_{ii} = M_{gS(total)} a_i$). 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 be destructed.

Fig. 8 – The Gravitational Spacecraft



Above the *free electrons gas* there is the anode, which is made of Carbon (Graphite). Consequently, the Gravitational Masses of the Carbon atoms becomes $m'_{g(C)} = \chi m_{gC} = \chi m_{i0C}$. Therefore, the gravitational forces between them is given by $F_g = G\frac{(m'_{g(C)})^2}{r^2} = G\frac{(\chi m_{i0(C)})^2}{r^2}$;

$m_{i0C} = 12.01u = 2\times10^{-26}kg$. Then, the nuclear fusion will occur if $F_g > F_e = \frac{Z^2e^2}{4\pi\varepsilon_0 r^2}$, i.e., if

$$|\chi| > \sqrt{\frac{Z^2e^2}{4\pi\varepsilon_0 G m_{i0(C)}}} = 7.8\times10^4.$$

On the other hand, if $T = 2000K$, we get

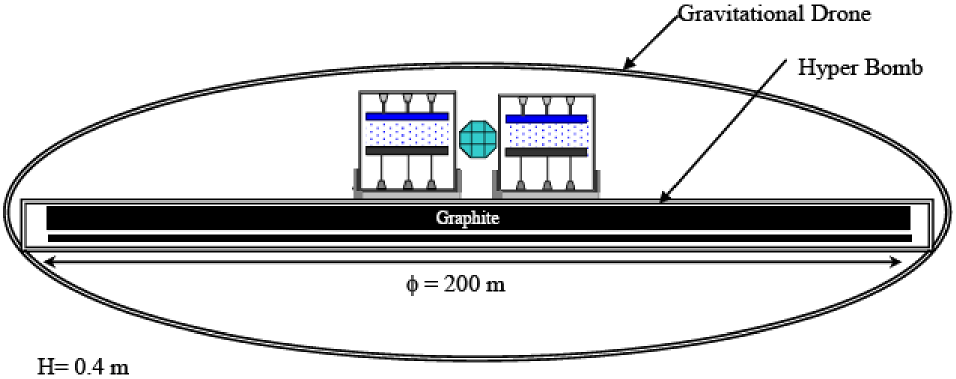
$$\chi = \left\{1 - 2\left[\sqrt{1+1.95\times10^{-23}\left(\Delta V^7/d^4\right)}-1\right]\right\}$$

If $\Delta V = 8000volts$ and $d = 50mm = 0.05m$, we obtain $\chi = -1.6\times10^5$.

Note that $H \le L^2e^{-L}$. Thus, for $L = 1.1m$, we get $H \le 0.402m$. Assuming $H = 0.4m$ the volume V of the Graphite is $V = 0.48m^3$; the density of the Graphite is 2267kg/m^3, then we can write that $m_{i0(Graphite)Total} = 1088.16kg$. Since $m_{i0(C)} = 2\times10^{-26}kg$, we can conclude that there are $5.4\times10^{28} atoms$.

The fusion of *two* Carbon atoms produces $\ge 1MeV$ =1.602 x 10^{-13} j. Therefore the total liberated energy is about **≥ 4.3x10^{15} j ≈ 1 Megaton**.

Fig. 9 - Nuclear Cold Fusion



H= 0.4 m

Graphite Volume: $V = \left(\frac{\pi\phi^2}{4}\right)H = 1.2\times10^4 m^3$; the density of the Graphite is 2267kg/m^3, then we can write that $m_{i0(Graphite)Total} = 2.7\times10^7 kg$. Since $m_{i0(C)} = 2\times10^{-26} kg$, we can conclude that there are $1.3\times10^{33}\, atoms$. The fusion of *two* Carbon atoms produces $\gtrsim 1 MeV$ =1.602 x 10^{-13} j. Therefore the total liberated energy is about **$\gtrsim 1\text{x}10^{20}$ j ≈ 20 Gigatons**.

Fig. 10 - The Hyper Bomb of Nuclear Cold Fusion (Inside a Gravitational Drone)

CONCLUSION

The Quantum Controller of Gravitational Mass using *Free Electrons Gas*, showed here, is similar to the Quantum Controller of Gravitational Mass using *Photon Gas*, which I have proposed recently [4], but this new device is extremely advantageous from the technical viewpoint. It is easy to build and can be used for several applications since to propel spacecrafts, cars, etc.

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