Quantum Controller of Gravitational Mass Using Photon Gas

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Here, we propose a device that can strongly reduce the *Gravitational Mass* of a body. Basically, it contains a thin layer of *Photon Gas*, between the plates of a capacitor, produced by lasers conveniently positioned. By controlling the value of the gravitational mass of the Photon gas, by means of the electric field produced by the capacitor, it is possible to control the *Gravitational Mass* of a body, when it is placed upon the photon gas. From the technical point of view this device can be used to strongly reduce the gravitational masses of aircrafts or spacecrafts.

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

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

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

$$= \left\{1 - 2\left[\sqrt{1+\left(\frac{Un_r}{m_{i0}c^2}\right)^2} - 1\right]\right\} =$$

$$= \left\{1 - 2\left[\sqrt{1+\left(\frac{Wn_r}{\rho c^2}\right)^2} - 1\right]\right\} \qquad (1)$$

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 (kg/m^3) 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*).

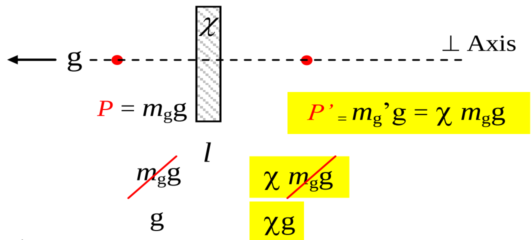


Fig. 1 - The *gravitational mass* of the particle *in the other side of the lamina* becomes $m'_g = \chi m_g$.

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, I describe a device that can strongly reduce the *Gravitational Mass* of a body. Basically, it contains a thin layer of *Photon Gas*, between the plates of a capacitor. By controlling the value of the gravitational mass of the Photon gas, by means of the electric field produced by the capacitor, it also is possible to control the *Gravitational Mass* of a particle when it is placed upon the photon gas (See Block B in Fig.2). This device is easy to build, and can be used to strongly reduce the gravitational masses of *aircrafts* or *spacecrafts*. This can be highly relevant to the development of novel aircrafts and spacecrafts.

THEORY

Consider the parallel plate capacitor shown in Fig.2 (in red). The volume V, between the plates of the capacitor, is given by $V = S\Delta x$, where S is the area of the cross-section perpendicular to the distance Δx (See Fig. 2).

In the volume V is made *Ultra-high Vacuum*. When the lasers are actived (See Fig. 2), the most of the material particles remnants inside the volume V are ejected to out of the V, in such way that practically only a *photon gas* occupies the mentioned volume.

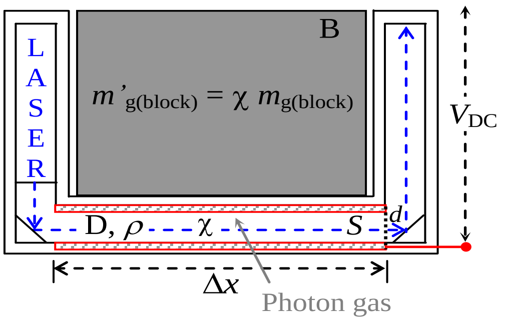


Fig.2- *Quantum Controller of Gravitational Mass* using Photon Gas

Kinetic theory enables us to deduce a single relationship between the *internal energy*, U, and the *pressure*, p, of a *photon gas* [3,4], i.e.,

$$U = 3pV \tag{2}$$

Due to the relativistic dispersion, for photons, we have, U=3pV instead of U=3/2 pV.

On the other hand, we can write that the power density, D, of the laser through the volume V is given by

$$D = \frac{P}{S} = \frac{U/\Delta t}{S} \tag{3}$$

or

$$U = DS\Delta t \tag{4}$$

where $\Delta t = \Delta x / c$.

Equation (2) can be rewritten as follows

$$U = 3pV = 3pS\Delta x \tag{5}$$

By comparing Eqs. (5) and (4), we obtain

$$p\left(\frac{\Delta x}{\Delta t}\right) = \frac{D}{3} \tag{6}$$

By dividing both members of Eq. (6) by c^3, we get

$$\frac{p}{c^2} = \frac{D}{3c^3} \tag{7}$$

where $p/c^2 \equiv \rho$ in Eq.(1), i.e.,

$$\rho \equiv D/3c^3 \tag{8}$$

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

$$W = \tfrac{1}{2}\varepsilon E^2 + \tfrac{1}{2}\mu H^2 \tag{9}$$

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

It is well-know that *static electric fields* interact with *photons*, and that *static magnetic fields don't interact* with photons. This means that, while a *photon gas* can be affected by *static electric fields*; *static magnetic fields do not* produce any effect on a *photon gas*. Then, in order to calculate $\chi = m_{g(photongas)} / m_{i0(photongas)}$ there is no sense considers the parcel $\frac{1}{2}\mu H^2$ of Eq. (9), i.e., $\frac{1}{2}\mu H^2 \equiv 0$, thus , here W reduces to

$$W = \tfrac{1}{2}\varepsilon E^2 \tag{10}$$

Substitution of Eq. (10) into Eq. (1) gives

$$\chi = \frac{m_g}{m_{i0}} = \left\{1 - 2\left[\sqrt{1 + \left(\frac{\varepsilon E^2 n_r}{2\rho c^2}\right)^2} - 1\right]\right\} \tag{11}$$

Between the plates of the capacitor there is the *photon gas* (See Fig. 2), consequently, in this region we can consider $n_r = 1$ and $\varepsilon = \varepsilon_0$. Thus, we obtain from Eq. (11) that

$$\chi = \frac{m_{g(photongas)}}{m_{i0(photongas)}} =$$

$$= \left\{1 - 2\left[\sqrt{1 + \left(\frac{\varepsilon_0 E^2}{2\rho c^2}\right)^2} - 1\right]\right\} \tag{12}$$

where $E = V_{DC}/d$ is the electric field between the plates of the capacitor and ρ is given by Eq. (8).

Thus, in the device shown in Fig.2, the *photon gas* can works like the "lamina" mentioned in Fig.1, transforming the *gravitational mass* of the block B (See Fig.2) into $m'_{g(block)} = \chi m_{g(block)}$ (where χ, in this case, is given by Eq. (12)). By substituting Eq. (8) into Eq. (12) we get

$$\frac{m'_{g(block)}}{m_{g(block)}} = \left\{1 - 2\left[\sqrt{1 + \left(\frac{\frac{3}{2}\varepsilon_0 c}{D}\right)^2 \left(\frac{V_{DC}}{d}\right)^4} - 1\right]\right\} \tag{13}$$

For $D = 1000W/m^2$, $d = 1cm$, Eq. (13) yields

$$\frac{m'_{g(block)}}{m_{g(block)}} = \left\{1 - 2\left[\sqrt{1 + 1.58 \times 10^{-3} V_{Dc}^4} - 1\right]\right\} \tag{14}$$

For $V_{DC} = 24volts$, Eq. (14) gives

$$\chi = \frac{m'_{g(block)}}{m_{g(block)}} = -42.8 \tag{15}$$

Now, consider to put the *Quantum Controller of Gravitational Mass* shown in Fig.2, inside a *Spherical Spacecraft*, with gravitational mass, $m_{g(spacecraft)}$, as shown in Fig.3.

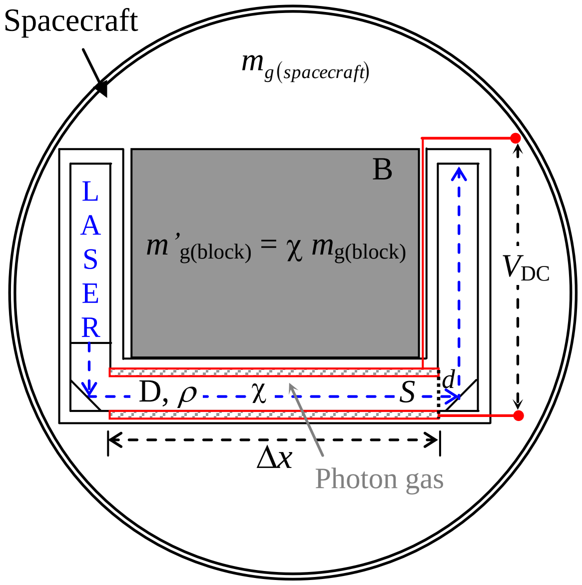


Fig.3- The Quantum Controller of Gravitational Mass *inside* a spherical spacecraft with gravitational mass $m_{g\,(spacecraft)}$..

Under these circumstances, the *total gravitational mass* of the spacecraft, $M_{g(spacecraft)}$, assuming that $m_{g(device)} \cong m_{g(block)}$, becomes:

$$M_{g(spacecraft)} = m_{g(spacecraft)} + m'_{g(block)} = \\ = m_{g(spacecraft)} + \chi m_{g(block)} \qquad (16)$$

For example, if $m_{g(spacecraft)} = 30{,}000kg$, $\chi = -42.8$ and $m_{g(bloct)} = 700kg$ then the *total gravitational mass* of the spacecraft becomes $M_{g(spacecraft)} = 40kg$. Thus, if the thruster of spacecraft is able to produce 10kN (Usually, this value is produced by small thrusters used in aircrafts) then the spacecraft acquires an acceleration, $a_{spacecraft}$, given by

$$a_{spacecraft} = \frac{10{,}000}{40} = 250m.s^{-2}$$

Then, in just *one minute* the spacecraft can acquires a speed, $v_{spacecraft}$, given by

$$v_{spacecraft} = a_{spacecraft}t = 250 \times 60 = 15{,}000m.s^{-1} = \\ = 15km.s^{-1} = 54{,}000km/h$$

With this speed the spacecraft could encircles the Earth in a time interval less than *one hour*.

This technology is unprecedented in the literature, and it can revolutionize the design of spacecrafts.

CONCLUSION

The device here showed can produce values of χ much greater than the device using Ultra-Conductive Magnesium, which I have proposed recently [5]. In addition, it does not require magnetic fields of Extra-low frequencies to work. It works with continuous electric fields produced by continuous voltage, which is extremely advantageous from the technical viewpoint.

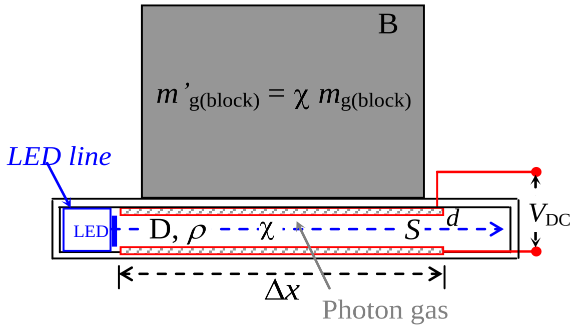


Fig.4- Another design for the *Quantum Controller of Gravitational Mass* using Photon Gas

APPENDIX I (June 9, 2023)

According to Eq. (6), the *pressure* p of the *photon gas* is given by

$$p = \frac{D}{3c} \qquad (Eq.6)$$

Note that, if the *pressure* p of the *photon gas* is *equal or greater* than *atmospheric* pressure p_a, $\left(p_a = 1.01325\times10^5 N.m^{-2}\right)$, then, obviously, there will be not material particles inside the *photon gas*, and consequently, the density ρ between the plates of the capacitor (See Fig. 2 and Fig.4) will be equal to the density of the photon gas, i.e.,

$$\rho = \frac{D}{3c^3} \qquad (Eq.8)$$

Consequently, it is not necessary to make *vacuum* between the plates of the capacitor, *if we have* $p \geq p_a$. However, Eq. (6), shows that

$$D \geq 3cp_a = 9.1\times10^{13} W.m^{-2} \qquad (I)$$

Obviously, this not a practicing solution. The ideal solution is reducing the local pressure p_{local}, using vacuum pumps. In this case, we can write that

$$D \geq 3cp_{local} \qquad (II)$$

Vacuum pumps can easily produce $p_{local} = 10^{-6} Pa = 10^{-6} N.m^{-2}$ (*high vacuum*). Consequently, the density, D, can be reduced to the following value

$$D \geq 3cp_{local} = 900 W.m^{-2} \qquad (III)$$

For $S = d\times L = 1cm\times1m = 10^{-2} m^2$, $(P = DS)$, the result is

$$P \geq 9W \qquad (IV)$$

Assuming $P = 22W$ (LED tape 22W/m), we get

$$D = \frac{P}{S} = 2200\ W.m^{-2} \qquad (V)$$

Under these conditions, the density ρ *between the plates of the capacitor* (will be equal to the density of the photon gas) and, according to Eq. (8), it will be given by

$$\rho = \frac{D}{3c^3} = 2.7\times10^{-23} kg.m^{-3} \qquad (VI)$$

Substitution of this value into Eq. (12) gives

$$\chi = \frac{m_{g(photongas)}}{m_{i0(photongas)}} =$$

$$= \left\{1 - 2\left[\sqrt{1 + 3.3\times10^{-12}\left(\frac{V_{DC}}{d}\right)^4} - 1\right]\right\} \qquad (VII)$$

Without the *photon gas* we would have just air between the capacitor plates, in this case, the air density, ρ_{air}, between the capacitor plates, would be given by

$$\rho_{air} = \frac{M_{air}p}{RT} =$$

$$= \frac{(28.97kg/mol)(10^{-6} Pa)}{(8.31432\times10^3 N.m.kmol^{-1}.K^{-1})(300K)} =$$

$$= 1.1\times10^{-11} kg.m^{-3}$$

Consequently, we would obtain:

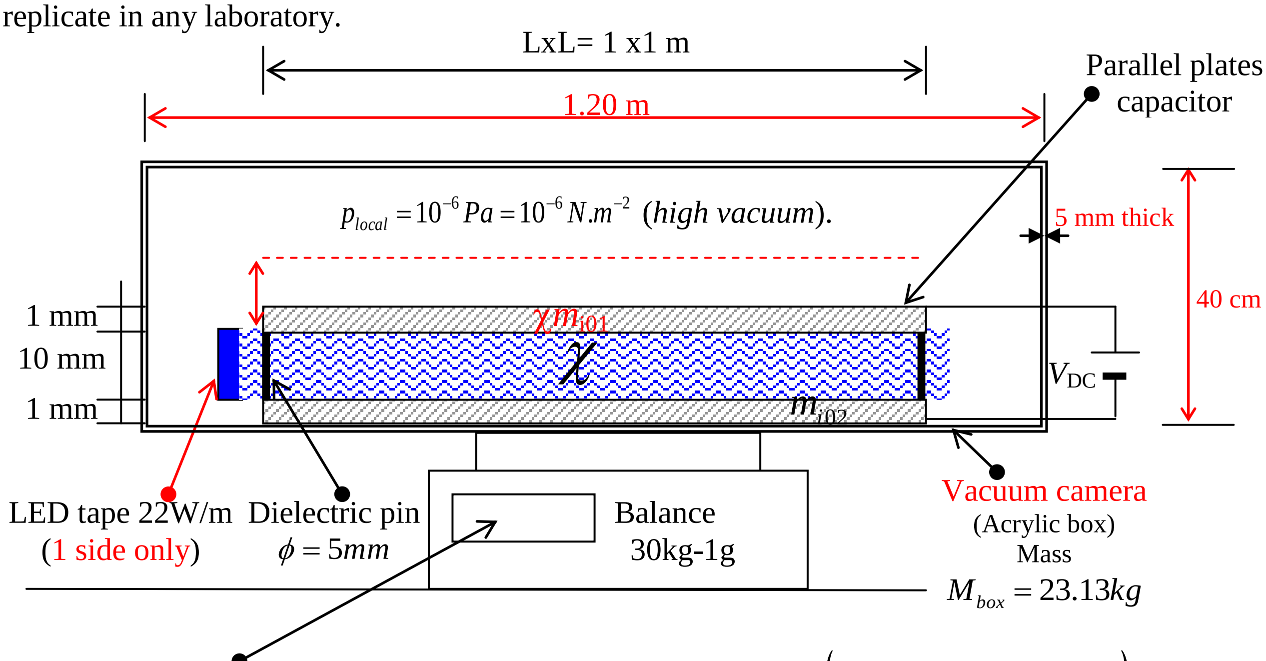
$$\chi = \frac{m_{g(air)}}{m_{i0(air)}} =$$

$$= \left\{1 - 2\left[\sqrt{2\times10^{-35}\left(\frac{V_{DC}}{d}\right)^4} - 1\right]\right\} \qquad (VIII)$$

By comparing Eq. (VII) with Eq. (VIII), we can see the strong advantage using the photon gas.

APPENDIX II

Here, I show a simplified model of Quantum Controller of Gravitational Mass, which can be replicate in any laboratory.



$$M_{gT} = M_g + m_{g1} = M_{i0} + \chi m_{i01} \qquad \left(M_{i0} = M_{gT(initial)} - m_{i01}\right)$$

System OFF $(\chi = 1)$: $M_{gT(initial)} = M_{i0} + m_{i01}$

System ON $(\chi < 1)$: $M_{gT} = M_{i0} + \chi m_{i01}$

Eq. (IV) of Appendix I, tells us for $S = 1cm \times 1m = 10^{-2}m^2$ the result is $P \geq 9W$;

LED tape 22W/m $\Rightarrow$ 1m $\Rightarrow$ $P = 22W \Rightarrow D = P/S = 2.2\times10^3\,W/m^2$ then we get:

$$\rho = D/3c^3 = 2.7\times10^{-23}\,kg/m^3$$

Thus, we obtain (Eq.12)

$$\chi = \frac{m_{g(photongas)}}{m_{i0(photongas)}} = \left\{1 - 2\left[\sqrt{1 + \left(\frac{\varepsilon_0 E^2}{2\rho c^2}\right)^2} - 1\right]\right\} = \left\{1 - 2\left[\sqrt{1 + 3.3\times10^{-12}\left(\frac{V_{DC}}{d}\right)^4} - 1\right]\right\}$$

For $d = 0.01m$ and $V_{DC}^{max} = 10\ volts$ we get : $\chi = -1.14$. Then

$$\chi m_{i01} = (-1.14)\underbrace{(2700\times(1\times1)0.001)}_{2.7kg} = -3.07kg \quad \text{and} \quad m_{i02} = 2700\times(1\times1)0.001 = 2.7kg.$$ Therefore

$$M_{i0R} = \chi m_{i01} + m_{i02} = -0.37kg$$

Since $M_{box} = 23.13kg$ then, considering $M_{total} = M_{box} + m_{LED} + m_{PINs} \cong 25Kg$ (balance 30Kg -1g), the resultant is

$$M_{total} - 0.37kg > 24.63kg$$

APPENDIX III – Horizontal Thrust

If the system shown in Fig. 4 is turned of an angle ϕ in respect to its vertical axis, the *weight* P of the block, in the direction of g' (see Fig. I) becomes P', given by

$$P' = m_{g(block)}g' = \chi m_{i0(block)}g' \qquad (i)$$

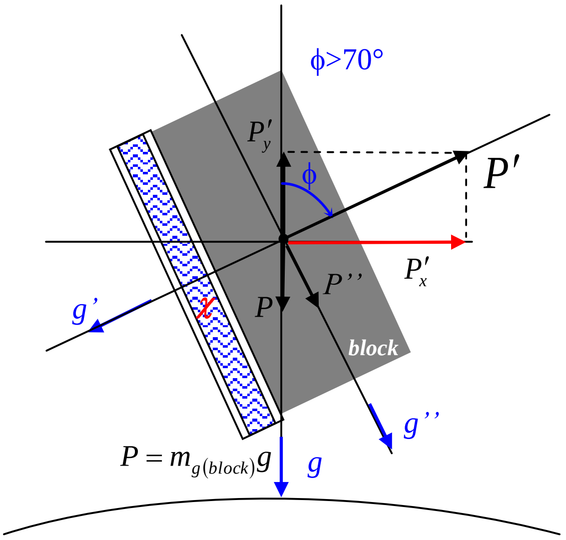


Fig. I – Producing horizontal thrust.
If $\phi < 70°$, the direction of the force P will cross the *Quantum Controller of Gravitational Mass*, affecting the magnitude and direction of P.

Note that, inside the block shown in Fig. I, in the direction of P'', we have $\chi \cong 1$. Thus we can assume that $P'' \cong m_{i0(block)}g''$.

By comparing $|P''|$ with
$|P'| = |\chi| m_{io(block)}g'$; $|\chi| >> 1; |\chi|g' >> g''$,
we can conclude that $|P''| << |P'|$ and, consequently $|P''|$ can be disregarded in respect to $|P'|$.

The expression of P'_x is

$$P'_x = P'\sin\phi = |\chi| m_{io(block)}g'\sin\phi \qquad (ii)$$

If this force P'_x is applied on a *car* with mass $M_{i0(car)}$, it acquires acceleration $a_{x(car)}$, given by

$$a_{x(car)} = \frac{|P'_x|}{M_{i0(car)}} = \left(\frac{m_{i0(block)}}{M_{i0(car)}}\right)(|\chi|g')\sin\phi \qquad (iii)$$

On the other hand, P'_y is given by

$$P'_y = P'\cos\phi = |\chi|\ m_{i0(block)}g'\cos\phi \qquad (iv)$$

Note that, in order to maintain the stability of the car, the value of P'_y *must be much smaller than* the value of $P_{(car)} + P$. Therefore, assuming that $P'_y = (P_{(car)} + P)/10$, we can write that

$$|\chi|\ m_{i0(block)}g'\cos\phi = \frac{P_{(car)} + P}{10} \qquad (v)$$

whence we obtain

$$|\chi|g' = \frac{g}{10\cos\phi}\left(\frac{M_{i0(car)}}{m_{i0(block)}} + 1\right) \qquad (vi)$$

By substituting Eq. (*vi*) into Eq.(*iii*) we get

$$a_{x(car)} = \left(1 + \frac{m_{i0(block)}}{M_{i0(car)}}\right)\frac{g}{10}\tan\phi \qquad (vii)$$

Since $M_{i0(car)} \approx 1000\ kg$ and $m_{i0(block)} \cong 100kg$, then equation above reduces to

$$a_{x(car)} \cong \tfrac{1}{10}g\tan\phi \qquad (viii)$$

For example, if $\phi = 85°$ the result is

$$a_{x(car)} \cong 11.2 m.s^{-2}$$

With this acceleration a car can go from 0 to100km/h in less than 4 seconds.

Therefore, this thrust system can be used to produce strong *horizontal* thrust in order to propel *cars*, *trains*, *trucks*, *ships*, etc.

Furthermore, it can also be used to propel aircrafts at Earth's atmosphere.

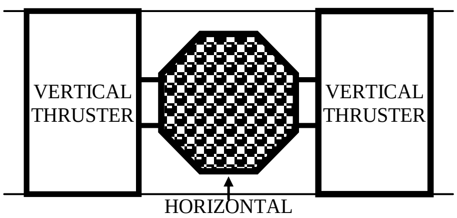
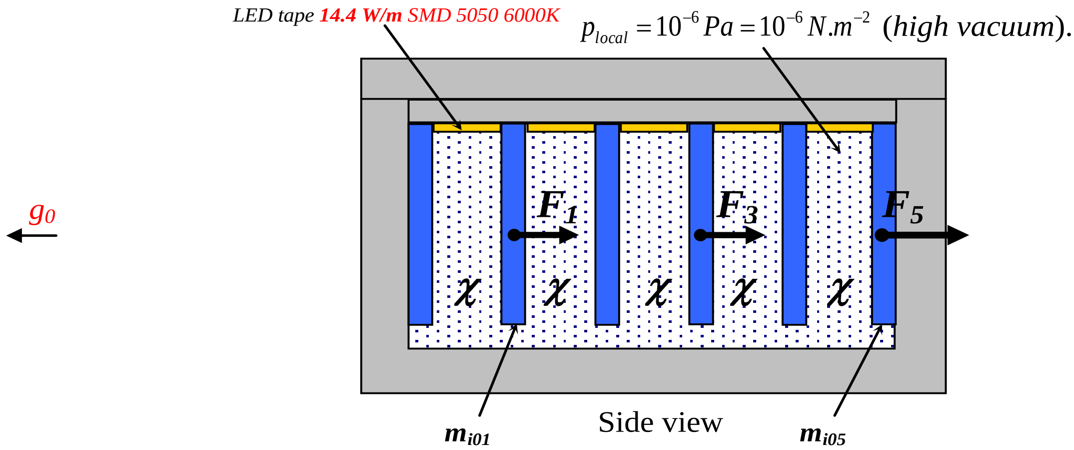


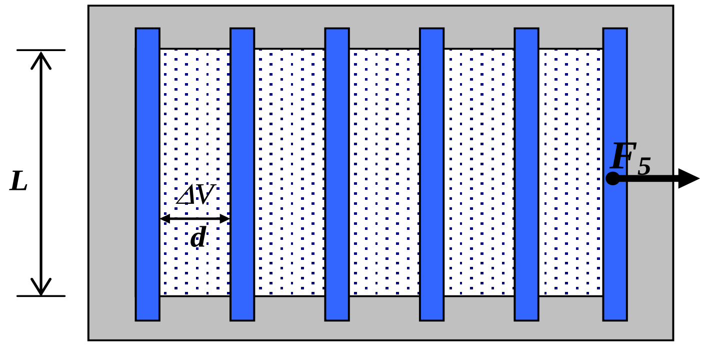
Fig. II – System to produce *vertical* and *horizontal* thrust.

Universal Gravitational Thruster

Using photon gas.



Side view



Top view

Consider a UGT with 6 plates (0, 1, …5). Between them there is *high vacuum*. When the LEDs are actived, we get

$\vec{F}_1 = m_{i01}\vec{g}_1 = m_{i01}(\chi\vec{g}_0) = \chi m_{i01}\vec{g}_0$; $\vec{F}_2 = m_{i02}\vec{g}_2 = m_{i02}(\chi\vec{g}_1) = m_{i02}[\chi(\chi\vec{g}_0)] = \chi^2 m_{i02}\vec{g}_0$

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

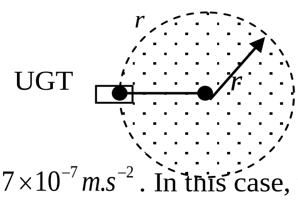
$\vec{F}_5 = m_{i05}\vec{g}_4 = m_{i05}(\chi\vec{g}_4) = m_{i05}[\chi(\chi^4\vec{g}_0)] = \chi^5 m_{i05}\vec{g}_0$

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

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

Equation (13) tells us that $\chi = \left\{1 - 2\left[\sqrt{1 + \left(\frac{\frac{3}{2}\varepsilon_0 c}{D}\right)^2 \left(\frac{V_{DC}}{d}\right)^4} - 1\right]\right\}$. For $D = 1000W/m^2$ *, $d = 1cm$ (the LED tape must have the following characteristic: $D = P/S = P/Ld = 1000 \Rightarrow P/L = 10W/m$; ***14.4 W/m***), we get $\chi = \left\{1 - 2\left[\sqrt{1 + 1.58\times10^{-3}V_{DC}^4} - 1\right]\right\}$. For $V_{DC} = 50 volts$, we obtain $\chi = -195.7$. Thus, we can write that $R \cong F_5 = \chi^5 m_{i05} g_0 = (-195.7)^5 m_{i05} g_0$. If $m_{i05} = 10kg$ the result is $R \cong 2.8\times10^{12} g_0$

If the UGT is inside Earth's atmosphere at a distance $r = 1km$ from the center of an "air' sphere".



Then $g_0 = Gm/r^2 = G\left(\frac{4}{3}\pi\rho_{air} r\right)/r^2 = \frac{4}{3}\pi G\rho_{air} r = 2.7\times10^{-7} m.s^{-2}$. In this case, we get

$$R \cong 756kN$$

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*See next page

The pressure exerted by the luminous flux of the LED tape, p_{light}, can be expressed by the following equation:

$$p_{light} = \frac{F_{light}}{S_{LED}} = \frac{\frac{1}{c}\left(\frac{dU}{dt}\right)_{light}}{S_{LED}} = \frac{1}{c}\left[\frac{\left(\frac{dU}{dt}\right)_{light}}{S_{LED}}\right] = \frac{1}{c}D_{light} \qquad (I)$$

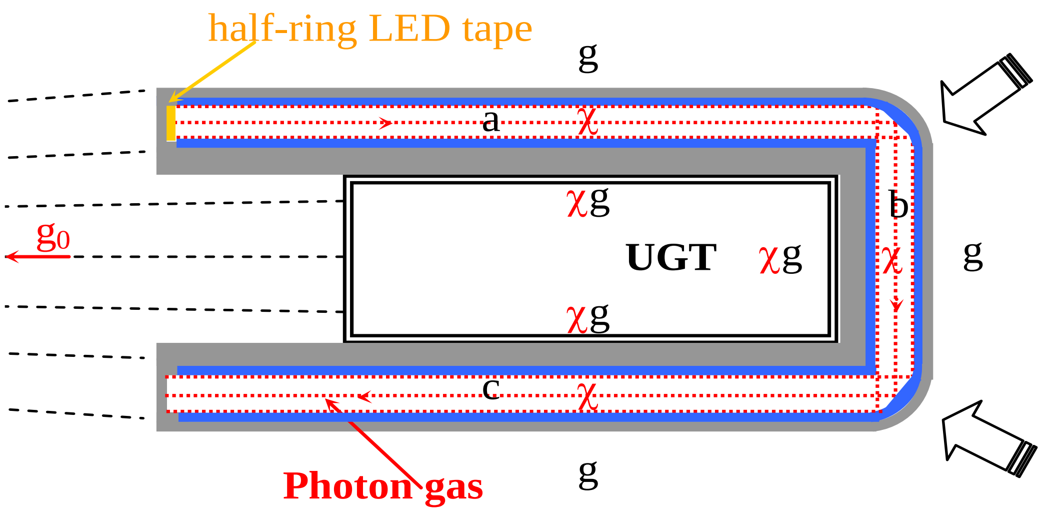
Where D_{light} is the *power density* (watts/m^2) of the luminous flux.

The density ρ between the capacitors plates will be equal to the *density of the photon gas*, if $p_{light} > p_{local}$ (high vacuum), i.e., According to Eq. (I), if $D_{light} > p_{local}c$. In the case of the high vacuum, $p_{local} = 10^{-6}\,N/m^2$, thus we get $D_{light} > 300\,watts/m^2$

It follows from this condition, the choice of $D = 1000\,watts/m^2$, make in the previous page.

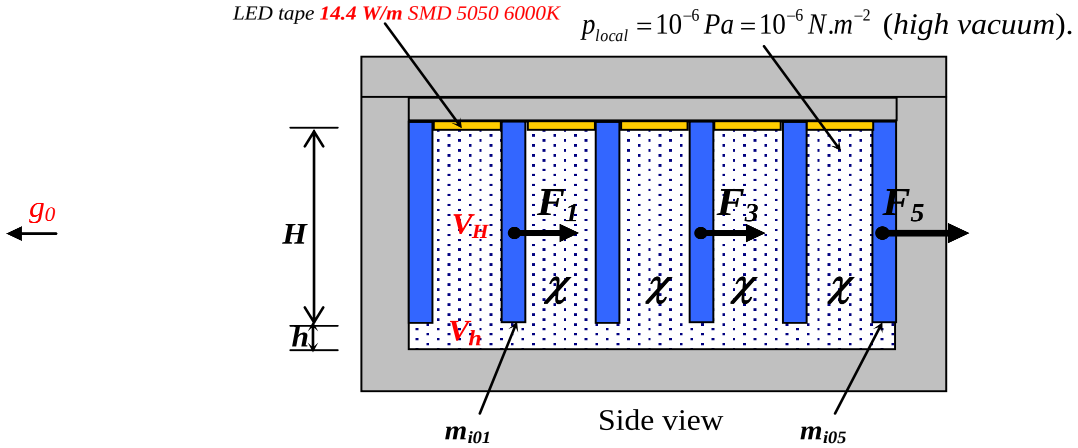
Encapsulation for gravitational shielding of the UGT

If $\chi \approx 0$, the effects of the external gravity, upon a UGT inside the system below, will be practically reduced to g_0.

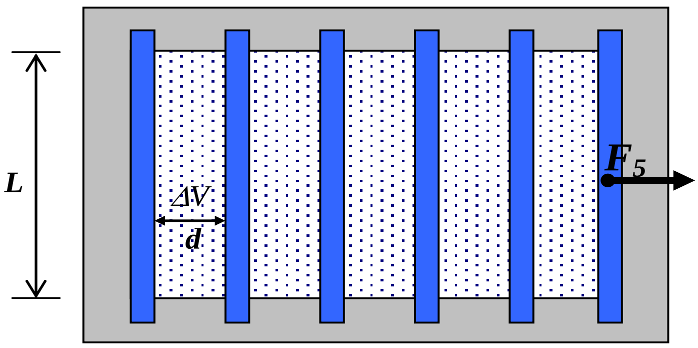


The intensities of the electric fields in these corners are different from the intensities of the lateral electric fields (a,b,c), but this does not matter because the necessary shielding effect (χg) is produced exclusively by the lateral electric fields (a,b,c).

Important considerations about the UGT (using photon gas)



Side view



Top view

Considering the volumes $V_H = HLd$ and $V_h = hLd$, and that, p_H and p_h are the pressures inside the volumes V_H and V_h, respectively. Then, since $p_H V_H = p_h V_h$, we can write that

$$p_h = p_H \left(\frac{V_H}{V_h} \right)$$

Note that, if the volume V_h is less than the volume V_H, then the pressure, p_h, inside the volume V_h is greater than the pressure inside the volume V_H. Consequently, the *light pressure*, $p_{light} = \frac{1}{c} D_{light}$, on the volume V_h, $p_{light(h)}$, *must be greater than* the pressure on the volume V_H, $p_{light(H)}$. In order to solve this problem, it is necessary to increase the power of the LED tape, according to the following equation: $D_{light} > p_h c \Rightarrow \frac{P_{light}}{S_{LED}} = \frac{P_{light}}{Ld} > p_h c$, i.e.,

$$P_{light}/L > p_h cd = \left[p_H \left(\frac{H}{h} \right) \right] cd$$

For $p_H = 10^{-6}\,Pa = 10^{-6}\,N.m^{-2}$ (high vacuum), and $d = 1cm = 0.01m$ we get

$$P_{light}/L > 3 \left(\frac{H}{h} \right)$$

Then, by using a LED tape of 14.4W/m, it follows that $14.4 > 3(H/h) \Rightarrow H/h < 4.8$. For $H = 100cm$ we must have $h > 20.8cm$. It is more convenient to use a LED tape of 50W/m (This type of LED tape is easily found in the market). In this case, for $H = 100cm$, the value of h is $h > 3H/50 = 6cm$.

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