Quantum Gravitational Shielding

Fran De Aquino
Professor Emeritus of Physics, Maranhao State University, S.Luis/MA, Brazil.
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We propose here a new type of Gravitational Shielding. This is a quantum device because results from the behaviour of the matter and energy on the subatomic length scale. From the technical point of view this Gravitational Shielding can be produced in lamina with positive electric charge, subjected to a magnetic field sufficiently intense. It is easy to build, and can be used to develop several devices for gravity control.

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

1. Introduction

Some years ago [1] I wrote a paper where a correlation between gravitational mass and inertial mass was obtained. In the paper I pointed out that the relationship between gravitational mass, \( m_g \), and rest inertial mass, \( m_{i0} \), is given by

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

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.

Also it was shown that, if the weight of a particle in a side of a lamina is \( \bar{P} = m_g \bar{g} \) (\( \bar{g} \) perpendicular to the lamina) then the weight of the same particle, in the other side of the lamina is \( \bar{P}' = \chi m_g \bar{g} \), where \( \chi = m_g/m_{i0} \) (\( m_g \) and \( m_{i0} \) are respectively, the gravitational mass and the inertial mass of the lamina). Only when \( \chi = 1 \), the weight is equal in both sides of the lamina. The lamina works as a Gravitational Shielding. This is the Gravitational Shielding effect. Since \( \bar{P}' = \chi \bar{P} = (\chi m_g)g = m_g (\chi g) \), we can consider that \( m_g' = \chi m_g \) or that \( g' = \chi g \).

In the last years I have proposed several types of Gravitational Shieldings. Here, I describe the Quantum Gravitational Shielding. This quantum device is easy to build and can be used in order to test the correlation between gravitational mass and inertial mass previously obtained.

2. Theory

Consider a conducting spherical shell with outer radius \( r \). From the subatomic viewpoint the region with thickness of \( e \phi \) (diameter of an electron) in the border of the spherical shell (See Fig.1 (a)) contains an amount, \( N_e \), of electrons. Since the number of atoms per \( m^3 \), \( n_a \), in the spherical shell is given by

\[
n_a = \frac{N_0 \rho_s}{A_s} (2)
\]

where \( N_0 = 6.02214129 \times 10^{26} \) atoms/kmole, is the Avogadro’s number; \( \rho_s \) is the matter density of the spherical shell (in \( kg/m^3 \)) and \( A_s \) is the molar mass (\( kg \cdot kmole^{-1} \)). Then, at a volume \( \phi S \) of the spherical shell, there are \( N_0 \) atoms per \( m^3 \), where
Fig. 1 – Subatomic view of the border of the conducting spherical shell.
\[ N_e = n_e \rho S \]  
(3)

Similarly, if there are \( n_e \) electrons per \( m^3 \) in the same volume \( \rho S \), then we can write that

\[ N_e = n_e \rho S \]  
(4)

By dividing both sides of Eq. (3) by \( N_e \), given by Eq. (4), we get

\[ n_e = n_a \left( \frac{N_e}{N_a} \right) \]  
(5)

Then, the amount of electrons, in the border of the spherical shell, at the region with thickness of \( \phi_e \) is

\[ N_e (\phi_e) = n_e \rho e S = \frac{N_0 \rho Z}{A_s} \left( \frac{N_e}{N_a} \right) \phi_e S \]  
(6)

Assuming that in the border of the spherical shell, at the region with thickness of \( x \approx \phi_d / 2 \) (See Fig.1 (b)), each atom contributes with approximately \( Z/2 \) electrons \((Z\) is the atomic number). Thus, the total number of electrons, in this region, is

\[ N_e (x) = (Z/2) N_e (\phi_e) \]  
(7)

where \( (N_e/N_a)_x \approx Z/2 \).

Now, if a potential \( V \) is applied on the spherical shell an amount of electrons, \( N_h \), is removed from the mentioned region. Since \( N_h = q/e \) and \( E = q/4\pi \varepsilon_0 r_0 r^2 \), then we obtain

\[ N_h = \frac{4\pi \varepsilon_0 e V}{e} = \frac{S e \varepsilon_0 E}{e} \]  
(8)

Thus, we can express the matter density, \( \rho \), in the border of the spherical shell, at the region with thickness of \( x \approx \phi_d / 2 \), by means of the following equation

\[ \rho = \left( \frac{N_e (x) - N_h}{S x} \right) \frac{n_m}{2 m_0} = \left( \frac{N_e (x) - N_h}{S \phi_d} \right) \frac{2 m_0}{e} \]

\[ = \left( \frac{Z}{2} \right) \frac{N_0 \rho Z}{A_s} \left( \frac{\phi_e}{\phi_d} \right) \left( \frac{e r_0 E}{e \phi_d} \right) \frac{2 m_0}{e} \]

or

\[ \rho = \left( \frac{Z}{2} \right) \frac{N_0 \rho Z}{A_s} \left( \frac{\phi_e}{\phi_d} \right) \left( \frac{e r_0 V}{e \phi_d} \right) \frac{2 m_0}{e} \]  
(9)

since \( E = V/r \).

If the spherical shell is made of Lithium \((Z = 3, \rho_s = 534 kg m^{-3}, A_s = 6.941 kg/kmole)\, \phi_d = 3.04 \times 10^{-10} m\) and outer radius \( r = 0.10 m \) and covered with a thin layer \((20 \mu m)\) of Barium titanate \((BaTiO_3)\), whose relative permittivity at 20 C is \( \varepsilon_r = 1250 \), then Eq. (9) gives

\[ \rho = \left(3.4310685 \times 10^{-38} \phi_e - 2.2725033 \times 10^{-1} V \right) 2 m_0 \]  
(10)

Assuming that the electron is a sphere with radius \( r_e \), and surface charge \(-e\), and that at an atomic orbit its total energy \( E \approx m_e c^2 \) is equal to the potential electrostatic energy of the surface charge, \( E_{pot} = e^2 / 4\pi \varepsilon_0 r \) \([2]\), then these conditions determine the radius \( r_r \):

\[ r_e = e^2 / 2 \pi \varepsilon_0 m_e c^2 \approx 1.4 \times 10^{-15} m \]

Thus, we can conclude that in the atom, electrons, protons and neutrons have the same radius. Thus, substitution of \( \phi_e = 2 r_e = 28 \times 10^{-15} m \) into Eq. (10) gives

\[ \rho = \left(9.6069918 \times 10^{-23} - 2.2725033 \times 10^{-21} V \right) 2 m_0 \]  
(11)

For \( V = 422.7493 \) volts, Eq. (11) gives

\[ \rho = \left(6.8 \times 10^{-14} \right) 2 m_0 = 1.2 \times 10^{-15} kg m^{-3} \]  
(12)

Note that the voltage \( V = 422.7493 \) volts is only a theoretical value resulting from inaccurate values of the constants present in the Eq. (11), and that leads to the critical value \( 6.8 \times 10^{-14} \) shown in Eq. (12), which is fundamental to obtain a low density, \( \rho \).

However, if for example, \( V = 422.7 \) volts, then the critical value increases to \( 1.1 \times 10^{20} \) (more than 100,000 times the initial value) and, therefore the system shown in

\[ ^* \text{Dielectric Strength: } 6 kV/mm, \text{ density: } 6.020 kg/m^3 \]

\[ ^\dagger \text{ The radius of the electron depends on the circumstances (energy, interaction, etc) in which it is measured. This is because its structure is easily deformable. For example, the radius of a free electron is of the order of } 10^{-13} m \ [3], \text{ when accelerated to } 1 GeV \text{ total energy it has a radius of } 0.9 \times 10^{-16} m \ [4]. \]
Fig. 2 will require a magnetic field 402 times more intense. In practice, the value of $\nu$, which should lead to the critical value $6.8 \times 10^{14}$ or a close value, must be found by using a very accurate voltage source in order to apply accurate voltages around the value $V = 4227493 \text{ volts}$ at ambient temperature of $20^\circ \text{C}$.

Substitution of the value of $\rho$, given by Eq. (12), into Eq. (1) yields

$$\chi = \left\{ 1 - 2 \left[ \sqrt{1 + \left(9.3 \times 10^{-3} W\right)^2} - 1 \right] \right\}.$$  \hspace{1cm} (13)

Substitution of

$$W = \frac{1}{2} \varepsilon_0 E^2 + \frac{1}{2} \mu_0 H^2 = \frac{1}{2} \varepsilon_0 c^2 E^2 + \frac{1}{2} \left[ B^2 / \mu_0 \right] = B^2 / \mu_0$$

into Eq. (13) gives

$$\chi = \left\{ 1 - 2 \left[ \sqrt{1 + 5.4 \times 10^{-7} B^4} - 1 \right] \right\}.$$  \hspace{1cm} (14)

Therefore, if a magnetic field $B = 0.020T$ passes through the spherical shell (See Fig. (2)) the result is

$$\chi \approx -3.$$  \hspace{1cm} (15)
Fig. 2 – Quantum Gravitational Shielding produced in a Lithium Spherical Shell with positive electric charge, subjected to a magnetic field $B$. 
References


