How a Planet with Earth's size can have a Gravitational Field Much Stronger than the Neptune

Fran De Aquino
Professor Emeritus of Physics, Maranhao State University, UEMA.
Titular Researcher (R) of National Institute for Space Research, INPE

In this paper we show how the gravitational field can be amplified under certain circumstances, and how a planet with Earth's size can have a gravitational field much stronger than the Neptune. A new interpretation for *quasars* is here formulated.

Key words: Amplified Gravitational Fields, Gravitation, Gravity, TNOs, Quasars.

1. Introduction

Recent numerical calculations have revealed that there could be at least two unknown planets hidden well beyond Pluto, whose gravitational influence determines the orbits and strange distribution of objects observed beyond Neptune [1, 2]. The authors believe that some invisible forces are altering the distribution of the orbital elements of the extreme trans-Neptunian objects (ETNO) and consider that the most probable explanation is that other unknown planets exist beyond Neptune and Pluto. The calculation shows that these planets need to have more mass than Neptune. Planets of this kind, even with the size of Neptune, at the predicted distance, would be very difficult to be detected in visible light - but not impossible. They could still be detected by the infrared that they emit. However, a study published last year, using data obtained by the NASA infrared satellite WISE [3], showed that there are no planets with size of Saturn up to the limit of 10 000 AU, or with size of Jupiter up to the limit of 26 000 AU. Then, the only possibility is that the planets must be much smaller than Jupiter or Saturn, or even smaller than Neptune. But as a planet smaller than Neptune can have a gravitational field much stronger than the Neptune?

The correlation between gravitational mass and inertial mass, recently discovered, associated to the gravitational shielding effect, which results of the mentioned correlation [4], show that the gravitational field can be amplified under certain circumstances.

In this paper we show how a planet with Earth's size can have a gravitational field much stronger than the Neptune. In addition, a new interpretation for *quasars* is here formulated.

2. Theory

The quantization of gravity shows that the *gravitational mass* m_g and *inertial mass* m_i are not equivalents, but correlated by means of a factor χ, i.e.,

$$m_g = \chi \ m_{i0} \tag{1}$$

where m_{i0} is the *rest* inertial mass of the particle. The expression of χ can be put in the following forms [4]:

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

$$\chi = \frac{m_g}{m_{i0}} = \left\{1 - 2\left[\sqrt{1 + \left(\frac{W}{\rho \ c^2} n_r\right)^2} - 1\right]\right\} \tag{3}$$

where U is the electromagnetic energy absorbed by the particle and n_r is its index of refraction; W is the density of electromagnetic energy on the particle $\left(J/m^3\right)$; ρ is the matter density of the particle; c is the speed of light.

If the particle is *also* rotating, with an angular speed ω around its central axis, then it acquires an additional energy equal to its rotational energy $E_k = \frac{1}{2} I\omega^2$ (I is the moment of inertia of the particle). Since this is an increase in the internal energy of the body, and this energy is basically electromagnetic, we can assume that E_k, such as U, corresponds to an amount of electromagnetic energy absorbed by the body.

Thus, we can consider E_k as an increase $\Delta U = E_k$ in the electromagnetic energy U absorbed by the body. Consequently, in this case, we must replace U in Eq. (2) for $(U+\Delta U)$. If $U << \Delta U$, the Eq. (2) reduces to

$$m_g \cong \left\{1-2\left[\sqrt{1+\left(\frac{I\omega^2 n_r}{2m_{i0}c^2}\right)^2}-1\right]\right\}m_{i0} \qquad (4)$$

Note that the contribution of the electromagnetic radiation applied upon the particle is highly relevant, because in the absence of this radiation the index of refraction in Eq.(4), becomes equal to 1.

On the other hand, Electrodynamics tell us that

$$v=\frac{dz}{dt}=\frac{\omega}{\kappa_r}=\frac{c}{\sqrt{\frac{\varepsilon_r\mu_r}{2}\left(\sqrt{1+(\sigma/\omega\varepsilon)^2}+1\right)}} \qquad (5)$$

where k_r is the real part of the *propagation vector* $\vec{k}$ (also called *phase constant*); $k=\left|\vec{k}\right|=k_r+ik_i$; ε , μ and σ, are the electromagnetic characteristics of the medium (permittivity, magnetic permeability and electrical conductivity) in which the incident radiation is propagating ($\varepsilon=\varepsilon_r\varepsilon_0$; $\varepsilon_0=8.854\times10^{-12}F/m$; $\mu=\mu_r\mu_0$, where $\mu_0=4\pi\times10^{-7}H/m$).

Equation (5), shows that the *index of refraction* $n_r=c/v$, for $\sigma>>\omega\varepsilon$, is given by

$$n_r=\sqrt{\frac{\mu_r\sigma}{4\pi f\varepsilon_0}} \qquad (6)$$

Substitution of Eq. (6) into Eq. (4) gives

$$m_g \cong \left\{1-2\left[\sqrt{1+\left(\frac{I\omega^2}{2m_{i0}c^2}\sqrt{\frac{\mu_r\sigma}{4\pi f\varepsilon_0}}\right)^2}-1\right]\right\}m_{i0} \qquad (7)$$

It was shown that there is an additional effect - *Gravitational Shielding* effect - *produced by a substance whose gravitational mass was reduced or made negative* [4]. It was shown 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 is $\vec{P}'=\chi m_g\vec{g}$, 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 $P'=\chi P=(\chi m_g)g=m_g(\chi g)$, we can consider that $m_g'=\chi m_g$ or that $g'=\chi g$.

If we take two parallel gravitational shieldings, with χ_1 and χ_2 respectively, then the gravitational masses become: $m_{g1}=\chi_1 m_g$, $m_{g2}=\chi_2 m_{g1}=\chi_1\chi_2 m_g$, and the gravity will be given by $g_1=\chi_1 g$, $g_2=\chi_2 g_1=\chi_1\chi_2 g$. In the case of multiples gravitational shieldings, with $\chi_1,\chi_2,\dots,\chi_n$, we can write that, after the n^{th} gravitational shielding the gravitational mass, m_{gn}, and the gravity, g_n, will be given by

$$m_{gn}=\chi_1\chi_2\chi_3\cdots\chi_n m_g\,,\quad g_n=\chi_1\chi_2\chi_3\cdots\chi_n g \qquad (8)$$

This means that, n superposed gravitational shieldings with different $\chi_1,\chi_2,\chi_3,\dots,\chi_n$ are equivalent to a single gravitational shielding with $\chi=\chi_1\chi_2\chi_3\cdots\chi_n$.

Now consider a planet or any cosmic object made of pure iron ($\mu_r=4{,}000$; $\rho_{iron}=7{,}800kg.m^{-3}$; $\sigma=1.03\times10^7 S.m^{-1}$), with size equal to the Earth ($r_\oplus=6.371\times10^6 m$). If it is rotating with angular velocity ω, then the gravity g produced by its gravitational mass, according to Eq. (7), is given by

$$g=-\frac{Gm_g}{r^2}=-\frac{Gm_{i0}}{r^2}\left\{1-2\left[\sqrt{1+\left(\frac{I\omega^2}{2m_{i0}c^2}\sqrt{\frac{\mu_r\sigma}{4\pi f\varepsilon_0}}\right)^2}-1\right]\right\}=$$

$$=-\frac{Gm_{i0}}{r^2}\left\{1-2\left[\sqrt{1+\left(\frac{\left(\frac{1}{2}\right)m_{i0}r_\oplus^2\omega^2}{2m_{i0}c^2}\sqrt{\frac{\mu_r\sigma}{4\pi f\varepsilon_0}}\right)^2}-1\right]\right\}=$$

$$=-\frac{Gm_{i0}}{r^2}\left\{1-2\left[\sqrt{1+\left(\frac{r_\oplus^2\omega^2}{4c^2}\sqrt{\frac{\mu_r\sigma}{4\pi f\varepsilon_0}}\right)^2}-1\right]\right\}=$$

$$=-\frac{Gm_{i0}}{r^2}\left\{1-2\left[\sqrt{1+4.71\times10^{12}\frac{\omega^4}{f}}-1\right]\right\} \qquad (9)$$

Data from radioastronomy point to the existence of an *extragalactic radio background spectrum* between 0.5 MHz and 400MHz [5].

Thus, if the considered object is in the interplanetary medium of the solar system, then this radiation incides on it. However, according to Eq. (9), the more significant contribution is due to the lower frequency radiation, i.e. $f = 0.5MHz$. In this case, Eq. (9) reduces to

$$g = -\frac{Gm_{i0}}{r^2}\left\{1-2\left[\sqrt{1+9.42\times10^6\omega^4}-1\right]\right\} \qquad (10)$$

Note that the gravity becomes *repulsive* and greater than $+Gm_{i0}/r^2$ for $\omega > 0.0238 rad.s^{-1}$. (Compare with the average angular velocity of Earth: $\overline{\omega}_{\oplus} = 7.29\times10^{-5} rad.s^{-1}$).

This repulsive gravity repels the atoms around the iron object, causing a significant decreasing in the number of atoms close to the object, and reducing consequently, the density at this region, which is initially equal to the density of the *interplanetary density* $\left(\rho_{ipm} \approx 10^{-20} kg.m^{-3}\right)$. Thus, the density, ρ , at the mentioned region can becomes of the order of $10^{-21} kg.m^{-3}$, i.e., very close to the density of the interstellar medium, ρ_{ism}, (*one hydrogen atom per cubic centimeter* $\cong 1.67\times10^{-21} kg.m^{-3}$ [6]).

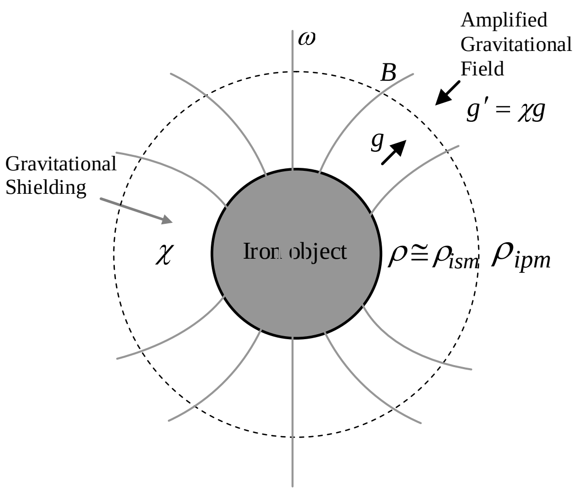

Fig. 1 – *Inversion and Amplification of the Gravitational Field*. The gravitational field produced by the rotating iron object, g (repulsive), is inverted and amplified by the *gravitational shielding* (region with density $\rho \cong \rho_{ism}$, between the iron object and the dotted circle). Thus, out of the gravitational shielding the gravity acceleration becomes attractive, with intensity: $g' = \chi g$.

Therefore, if the iron object has an own magnetic field B , then, according to Eq.(3), the density of magnetic energy at the mentioned region will change the local value of χ , which will be given by

$$\chi = \frac{m_g}{m_{i0}} = \left\{1-2\left[\sqrt{1+\left(\frac{W}{\rho_{ism}c^2}n_r\right)^2}-1\right]\right\} =$$

$$= \left\{1-2\left[\sqrt{1+\left(\frac{B^2}{\mu_0\rho_{ism}c^2}\right)^2}-1\right]\right\} =$$

$$= \left\{1-2\left[\sqrt{1+2.81\times10^{19}B^4}-1\right]\right\} \qquad (11)$$

Thus, the region close to the object will become a *Gravitational Shielding*, and the gravity acceleration out of it (See Fig.1), according to Eq. (8),(10) and (11), will expressed by

$$g' = \chi g = -\frac{\chi Gm_{i0}}{r^2}\left\{1-2\left[\sqrt{1+9.42\times10^6\omega^4}-1\right]\right\} =$$

$$= \left\{1-2\left[\sqrt{1+2.81\times10^{19}B^4}-1\right]\right\}\times$$

$$\times\left\{1-2\left[\sqrt{1+9.42\times10^6\omega^4}-1\right]\right\}\left(-\frac{Gm_{i0}}{r^2}\right) \qquad (12)$$

Therefore, if $\omega > 0.02 rad.s^{-1}$ and $B > 10^{-4}T$, then the gravity acceleration out of the gravitational shielding is

$$g' > (-1030)(-1)\left(-\frac{Gm_{i0}}{r^2}\right) > -103\frac{Gm_{i0}}{r^2} = -\frac{GM_{i0}}{r^2} \qquad (13)$$

where $M_{i0} = 103m_{i0}$ is the mass equivalent to the mass of an object, which would produce similar gravity acceleration.

Since $m_{i0} = \rho_{iron}\left(\frac{4}{3}\pi r_{\oplus}^3\right) = 8.44\times10^{24} kg$, then the gravity acceleration produced by the iron object would be equivalent to the one produced by an object with mass, M_{i0} , given by

$$M_{i0} = 103m_{i0} \cong 8.6\times10^{26} kg \cong 8.4M_{Neptune} \qquad (14)$$

where $N_{Neptune} = 1.0243\times10^{26} kg$ is the Neptune's mass [7]. Thus, according to Eq. (13), the gravity acceleration produced by the iron object would be much stronger than the gravity of Neptune.

3. Quasars

The results above make possible formulate a new interpretation for the *quasars*.

Consider Eq. (12), which gives the gravity acceleration *out of the gravitational shielding* (See Fig.1). For $\omega > 0.02 rad.s^{-1}$ and $B \cong 10^3 T$ (*neutron stars* have $\omega \approx 1 rad.s^{-1}$ and magnetic fields of the order of $10^8 Teslas$; *magnetars* have magnetic fields between 10^8 to $10^{11} Teslas$ [8]), the result is

$$g' > \left(-1.06\times10^{16}\right)(-1)\left(-\frac{Gm_{i0}}{r^2}\right) > -1.06\times10^{16}\frac{Gm_{i0}}{r^2} \quad (15)$$

where $M_{i0} = 1.06\times10^{16} m_{i0}$ is the mass equivalent to the mass of an object, which would produce similar gravity acceleration.

If $m_{i0} = \rho_{iron}\left(\frac{4}{3}\pi r_{\oplus}^3\right) = 8.44\times10^{24} kg$, then the gravity acceleration produced by the iron object would be equivalent to the one produced by an object with mass, M_{i0}, given by

$$M_{i0} = 1.06\times10^{16} m_{i0} \cong 8.94\times10^{40} kg \cong 4.5\times10^{10} m_{sun} \quad (16)$$

This means *45 billion solar masses* ($m_{sun} = 1.9891\times10^{30} kg$).

Known *quasars* contain nuclei with masses of about *one billion solar masses* $\left(10^9 m_{sun}\right)$ [9 - 16]. Recently, it was discovered a supermassive quasar with *12 billion solar masses* [17].

Based on the result given by Eq.(16), we can then infer that the hypothesis of the existence of “black-holes” in the centers of the *quasars* is not necessary, because the strong gravity of the *quasars* can be produced, for example, by means of iron objects with the characteristics above ($\omega > 0.02 rad.s^{-1}$ and $B \cong 10^3 T$ and $r = r_{\oplus}$), in the center of the *quasars*.

As concerns to the extreme amount of electromagnetic energy radiated from the *quasars* [18], the new interpretation here formulated, follows the general consensus that the *quasars are in dense regions* in the center of massive galaxies [19], and that their radiation are generated by the *gravitational stress and immense friction* on the surrounding masses that are attracted to the center of the quasars [20] (See Fig.2).

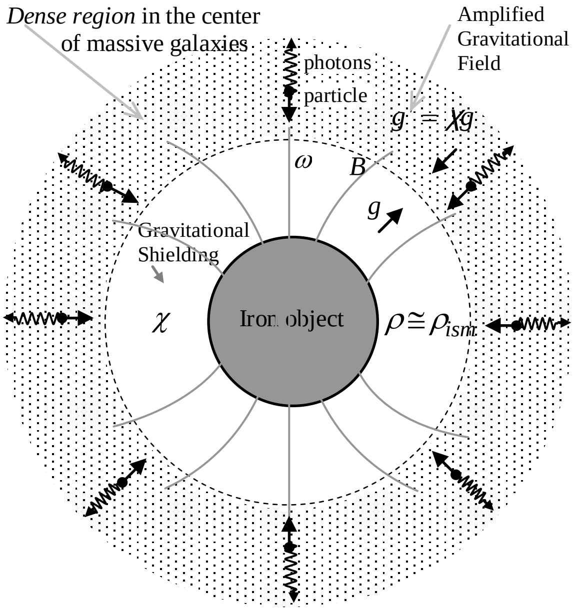

Fig. 2 – *Quasar* - Surrounding the gravitational shielding the gravity acceleration becomes strongly *attractive*, with intensity: $g' = \chi g$. The radiation emitted from the *quasar* is generated by the *gravitational stress and immense friction* on the surrounding particles that are attracted to the center of the *quasar*.

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