High-power ELF radiation generated by modulated HF heating of the ionosphere can cause Earthquakes, Cyclones and localized heating

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The High Frequency Active Auroral Research Program (HAARP) is currently the most important facility used to generate extremely low frequency (ELF) electromagnetic radiation in the ionosphere. In order to produce this ELF radiation the HAARP transmitter radiates a strong beam of high-frequency (HF) waves modulated at ELF. This HF heating modulates the electrons' temperature in the D region ionosphere and leads to modulated conductivity and a time-varying current which then radiates at the modulation frequency. Recently, the HAARP HF transmitter operated with 3.6GW of effective radiated power modulated at frequency of 2.5Hz. It is shown that high-power ELF radiation generated by HF ionospheric heaters, such as the current HAARP heater, can cause Earthquakes, Cyclones and strong localized heating.
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1. Introduction

Generating electromagnetic radiation at extremely-low frequencies is difficult because the long wavelengths require long antennas, extending for hundreds of kilometers. Natural ionospheric currents provide such an antenna if they can be modulated at the desired frequency [1-6]. The generation of ELF electromagnetic radiation by modulated heating of the ionosphere has been the subject matter of numerous papers [7-13].

In 1974, it was shown that ionospheric heater can generate ELF waves by heating the ionosphere with high-frequency (HF) radiation in the megahertz range [7]. This heating modulates the electron's temperature in the D region ionosphere, leading to modulated conductivity and a time-varying current, which then radiates at the modulation frequency.

Several HF ionospheric heaters have been built in the course of the latest decades in order to study the ELF waves produced by the heating of the ionosphere with HF radiation. Currently, the HAARP heater is the most powerful ionospheric heater, with 3.6GW of effective power using HF heating beam, modulated at ELF (2.5Hz) [14, 15]. This paper shows that high-power ELF radiation generated by modulated HF heating of the lower ionosphere, such as that produced by the current HAARP heater, can cause Earthquakes, Cyclones and strong localized heating.

2. Gravitational Shielding

The contemporary greatest challenge of the Theoretical Physics was to prove that, Gravity is a *quantum* phenomenon. Since General Relativity describes gravity as related to the curvature of space-time then, the quantization of the gravity implies the quantization of the proper space-time. Until the end of the century XX, several attempts to quantize gravity were made. However, all of them resulted fruitless [16, 17].

In the beginning of this century, it was clearly noticed that there was something unsatisfactory about the whole notion of quantization and that the quantization process had many ambiguities. Then, a new approach has been proposed starting from the generalization of the *action function**. The result has been the derivation of a theoretical background, which finally led to the so-sought quantization of the gravity and of the

* The formulation of the *action* in Classical Mechanics extends to Quantum Mechanics and has been the basis for the development of the *Strings Theory*.

space-time. Published with the title "*Mathematical Foundations of the Relativistic Theory of Quantum Gravity*"[18], this theory predicts a consistent *unification* of Gravity with Electromagnetism. It shows that the *strong* equivalence principle is reaffirmed and, consequently, Einstein's equations are preserved. In fact, Einstein's equations can be deduced directly from the mentioned theory. This shows, therefore, that the General Relativity is a particularization of this new theory, just as Newton's theory is a particular case of the General Relativity. Besides, it was deduced from the new theory an important correlation between the *gravitational mass* and the *inertial mass*, which shows that the gravitational mass of a particle can be *decreased* and even made *negative*, independently of its inertial mass, i.e., while the gravitational mass is progressively reduced, the inertial mass does not vary. This is highly relevant because it means that the weight of a body can also be reduced and even inverted in certain circumstances, since Newton's gravity law defines the weight P of a body as the product of its *gravitational mass* m_g by the local gravity acceleration g, i.e.,

$$P = m_g g \tag{1}$$

It arises from the mentioned law that the gravity acceleration (or simply the gravity) produced by a body with gravitational mass M_g is given by

$$g = \frac{GM_g}{r^2} \tag{2}$$

The physical property of mass has two distinct aspects: *gravitational mass* m_g and *inertial mass* m_i. The gravitational mass produces and responds to gravitational fields; it supplies the mass factor in Newton's famous inverse-square law of gravity $\left(F = GM_g m_g / r^2\right)$. The inertial mass is the mass factor in *Newton's 2nd Law of Motion* $\left(F = m_i a\right)$. These two masses are not equivalent but correlated by means of the following factor [18]:

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

Where m_{i0} is the *rest* inertial mass and Δp is the variation in the particle's *kinetic momentum*; c is the speed of light.

This equation shows that only for $\Delta p = 0$ the gravitational mass is equal to the inertial mass. Instances in which Δp is produced by *electromagnetic radiation*, Eq. (3) can be rewritten as follows [18]:

$$\frac{m_g}{m_{i0}} = \left\{1 - 2\left[\sqrt{1 + \left(\frac{n_r^2 D}{\rho c^3}\right)^2} - 1\right]\right\} \tag{4}$$

Where n_r is *the refraction index* of the particle; D is the power density of the electromagnetic radiation absorbed by the particle; and ρ, its density of inertial mass.

From electrodynamics we know that

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

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 in which the incident radiation is propagating ($\varepsilon = \varepsilon_r \varepsilon_0$; $\varepsilon_0 = 8.854 \times 10^{-12} F/m$; $\mu = \mu_r \mu_0$, where $\mu_0 = 4\pi \times 10^{-7} H/m$).

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

$$n_r = \sqrt{\frac{\mu_r \sigma}{4\pi f \varepsilon_0}} \tag{6}$$

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

$$\chi = \frac{m_g}{m_{i0}} = \left\{1 - 2\left[\sqrt{1 + \left(\frac{\mu\sigma D}{4\pi\rho\, cf}\right)^2} - 1\right]\right\} \quad (7)$$

It was shown that there is an additional effect - *Gravitational Shielding* effect - produced by a substance whose gravitational mass was reduced or made negative [18]. This effect shows that just *beyond* the substance the gravity acceleration g_1 will be reduced at the same proportion $\chi_1 = m_g / m_{i0}$, i.e., $g_1 = \chi_1 g$, (g is the gravity acceleration *before* the substance). Consequently, *after a second gravitational shielding*, the gravity will be given by $g_2 = \chi_2 g_1 = \chi_1 \chi_2 g$, where χ_2 is the value of the ratio m_g / m_{i0} for the *second* gravitational shielding. In a generalized way, we can write that after the *nth* gravitational shielding the gravity, g_n, will be given by

$$g_n = \chi_1 \chi_2 \chi_3 \ldots \chi_n g$$

The dependence of the shielding effect on the height, at which the samples are placed above a superconducting disk with radius $r_D = 0.1375m$, has been recently measured up to a height of about 3m [19]. This means that the gravitational shielding effect extends, beyond the disk, for approximately *20 times* the disk *radius*.

3. Gravitational Shieldings in the Van Allen belts

The *Van Allen belts* are torus of plasma around Earth, which are held in place by Earth's magnetic field (See Fig.1). The existence of the belts was confirmed by the Explorer 1 and Explorer 3 missions in early 1958, under Dr James Van Allen at the University of Iowa. The term *Van Allen belts* refers specifically to the radiation belts surrounding Earth; however, similar radiation belts have been discovered around other planets.

Now consider the ionospheric heating with HF beam, modulated at ELF (See Fig. 2). The amplitude-modulated HF heating wave is absorbed by the ionospheric plasma, modulating the local conductivity σ. The current density $j = \sigma E_0$ radiates ELF electromagnetic waves that pass through the Van Allen belts producing two Gravitational Shieldings where the densities are *minima*, i.e., where they are approximately equal to density of the *interplanetary medium* near Earth. The quasi-vacuum of the interplanetary space might be thought of as beginning at an altitude of about 1000km above the Earth's surface [20]. Thus, we can assume that the densities ρ_i and ρ_o respectively, at the first gravitational shielding S_i (at the *inner* Van Allen belt) and at S_o (at the *outer* Van Allen belt) are $\rho_o \cong \rho_i \cong 0.8\times10^{-20} kg.m^{-3}$ (density of the *interplanetary medium* near the Earth [21]).

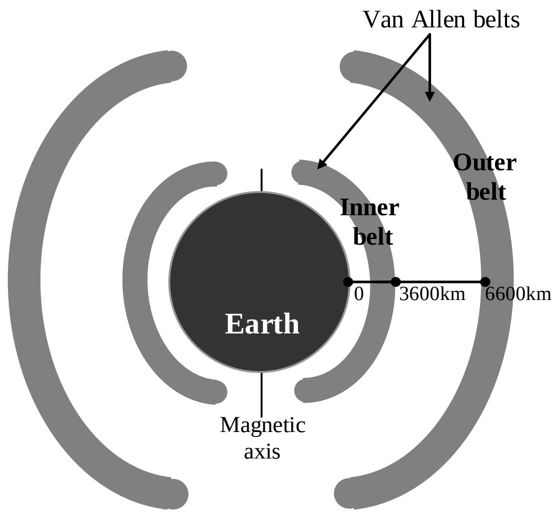

Fig.1 – Van Allen belts

The parallel conductivities,† σ_{0i} and σ_{0o}, respectively at S_i and S_o, present values which lie between those for metallic conductors and those for semiconductors [20], i.e., $\sigma_{0i} \cong \sigma_{0o} \sim 1S/m$. Thus, in these two Gravitational Shielding, according to Eq. (7), we have, respectively:

$$\chi_i = \left\{1 - 2\left[\sqrt{1 + \left(4.1\times10^4 \frac{D_i}{f}\right)^2} - 1\right]\right\} \quad (8)$$

† Conductivity in presence of the Earth's magnetic field

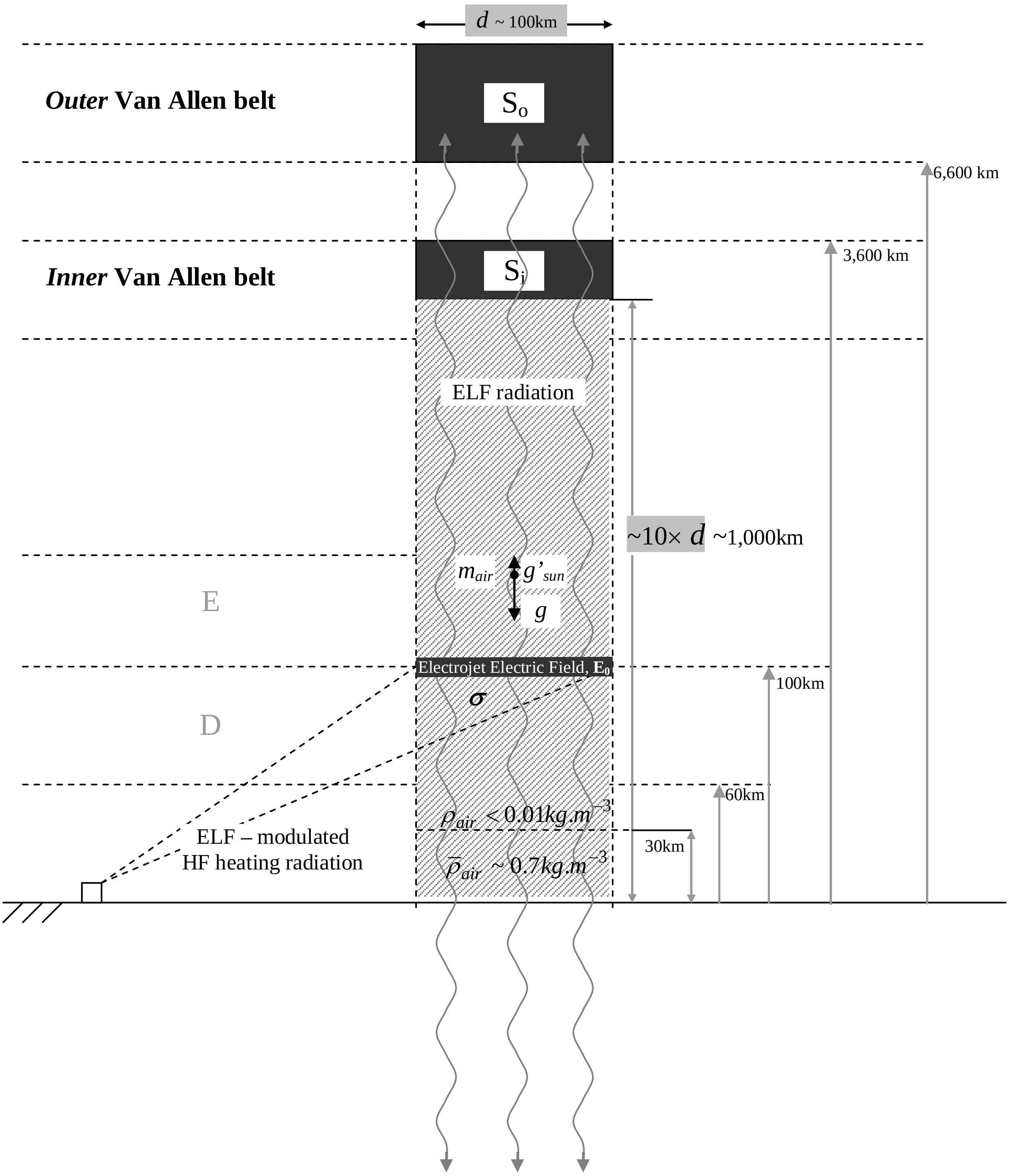

Fig. 2 – *Ionospheric Gravitational Shieldings* - The amplitude-modulated HF heating wave is absorbed by the ionospheric plasma, modulating the local conductivity σ_0. The current density $j = \sigma_0 E_0$ (E_0 is the Electrojet Electric Field), radiates ELF electromagnetic waves (d is the length of the ELF dipole). Two gravitational shieldings (S_o and S_i) are formed at the Van Allen belts. Then, the gravity due to the Sun, after the shielding S_i, becomes $g'_{sun} = \chi_o \chi_i g_{sun}$. The effect of the gravitational shielding reaches $\sim 20 \times r_D = \sim 10 \times d \cong 1{,}000 km$.

and

$$\chi_o = \left\{1 - 2\left[\sqrt{1 + \left(4.1\times10^4 \frac{D_o}{f}\right)^2} - 1\right]\right\} \qquad (9)$$

where

$$D_i \cong D_o \cong \frac{P_{ELF}}{S_a} \qquad (10)$$

P_{ELF} is the ELF radiation power, radiated from the ELF ionospheric antenna; S_a is the area of the antenna.

Substitution of (10) into (8) and (9) leads to

$$\chi_o\chi_i = \left\{1 - 2\left[\sqrt{1 + \left(4.1\times10^4 \frac{P_{ELF}}{S_a f}\right)^2} - 1\right]\right\}^2 \qquad (11)$$

4. Effect of the gravitational shieldings S_i **and** S_o **on the Earth and its environment.**

Based on the Podkletnov experiment, previously mentioned, in which the effect of the Gravitational Shielding extends for approximately *20 times* the disk *radius* (r_D), we can assume that the effect of the gravitational shielding S_i extends for approximately 10 times the dipole length (d). For a dipole length of about 100km, we can conclude that the effect of the gravitational shielding reaches about 1,000Km below S_i (See Fig.2), affecting therefore an air mass, m_{air}, given by ‡

$$m_{air} = \bar{\rho}_{air} V_{air} = $$
$$= \left(\sim 0.7 kg.m^{-3}\right)(100{,}000m)^2(30{,}000m) =$$
$$\sim 10^{14} kg \qquad (12)$$

The gravitational potential energy related to m_{air}, with respect to the Sun's center, without the effects produced by the gravitational shieldings S_o and S_i is

$$E_{p0} = m_{air} r_{se}\left(g - g_{sun}\right) \qquad (13)$$

where, $r_{se} = 1.49\times10^{11} m$ (distance from the Sun to Earth, 1 AU), $g = 9.8 m/s^2$ and $g_{sun} = -GM_{sun}/r_{se}^2 = 5.92\times10^{-3} m/s^2$, is the gravity due to the Sun at the Earth.

The gravitational potential energy related to m_{air}, with respect to the Sun's center, considering the effects produced by the gravitational shieldings S_o and S_i, is

$$E_p = m_{air} r_{se}\left(g - \chi_o\chi_i g_{sun}\right) \qquad (14)$$

Thus, the *decrease* in the gravitational potential energy is

$$\Delta E_p = E_p - E_{p0} = \left(1 - \chi_o\chi_i\right) m_{air} r_{se} g_{sun} \qquad (15)$$

Substitution of (11) into (15) gives

$$\Delta E_p = \left\{1 - \left\{1 - 2\left[\sqrt{1 + \left(4.1\times10^4 \frac{P_{ELF}}{S_a f}\right)^2} - 1\right]\right\}^2\right\} m_{air} r_{se} g_{sun} \qquad (16)$$

The HF power produced by the HAARP transmitter is $P_{HF} = 3.6GW$ modulated at $f = 2.5Hz$. The ELF conversion efficiency at HAARP is estimated to be $\sim 10^{-4}\%$ for wave generated using sinusoidal amplitude modulation. This means that

$$P_{ELF} \sim 4kW$$

Substitution of $P_{ELF} \sim 4kW$, $f = 2.5Hz$ and $S_a = (100{,}000)^2 = 1\times10^{10} m^2$ into (16) yields

$$\Delta E_p \sim 10^{-4} m_{air} r_{se} g_{sun} \sim 10^{19} joules \qquad (17)$$

This decrease in the gravitational potential energy of the air column, ΔE_p, produces a decrease Δp in the local pressure p (*Bernoulli principle*). Then the pressure equilibrium between the Earth's mantle and the Earth's atmosphere, in the region corresponding to the air column, is broken. This is equivalent to an increase of pressure Δp in the region of the mantle corresponding to the air column. This phenomenon is similar to an Earthquake, which liberates an energy equal to ΔE_p (see Fig.3).

‡ The mass of the air column above 30km height is negligible in comparison with the mass of the air column below 30km height, whose average density is ~0.7kg./m^3.

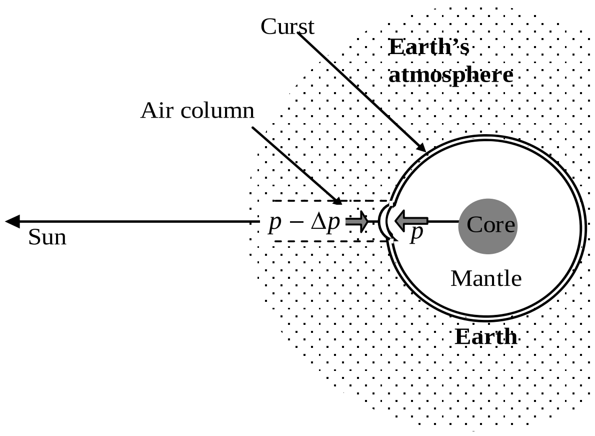

Fig. 3 - The decrease in the gravitational potential energy of the air column, ΔE_p, produces a decrease Δp in the local pressure p (Principle of Bernoulli). Then the pressure equilibrium between the Earth's mantle and the Earth's atmosphere, in the region corresponding to the air column, is broken. This is equivalent to an increase of pressure Δp in the region of the mantle corresponding to the air column. This phenomenon is similar to an Earthquake, which liberates an amount of energy equal to ΔE_p.

The magnitude M_s in the *Richter scales*, corresponding to liberation of an amount of energy, $\Delta E_p \sim 10^{19}\, joules$, is obtained by means of the well-known equation:

$$10^{19} = 10^{(5+1.44 M_s)} \qquad (18)$$

which gives $M_s = 9.1$. That is, an Earthquake with magnitude of about 9.1 in the *Richter scales*.

The decrease in the gravitational potential energy in the air column whose mass is m_{air} gives to the air column an initial kinetic energy $E_k = \frac{1}{2} m_{air} V_{0air}^2 = \Delta E_p$, where ΔE_p is given by (15).

In the previously mentioned HAARP conditions, Eq.(11) gives $(1-\chi_o \chi_i) \sim 10^{-4}$. Thus, from (15), we obtain

$$\Delta E_p \sim 10^{-4} m_{air} r_{se} g_{sun} \qquad (19)$$

Thus, the initial air speed V_{0air} is

$$V_{0air} \cong \sqrt{10^{-4} g_{sun} r_{se}} \sim 10^2 m/s \sim 400 km/h \qquad (20)$$

This velocity will strongly reduce the pressure in the air column (*Bernoulli principle*) and it is sufficient to produce a powerful *Cyclone* around the air column (*Coriolis Effect*).

Note that, by reducing the diameter of the HF beam radiation, it is possible to reduce dipole length (d) and consequently to reduce the reach of the Gravitational Shielding, since the effect of the gravitational shielding reaches approximately18 times the dipole length. By reducing d, we also reduce the area S_a, increasing consequently the value of $\chi_o \chi_i$ (See Eq. (18)). This can cause an increase in the velocity V_{0air} (See Eq. (22)).

On the other hand, if the dipole length (d) is increased, the reach of the Gravitational Shielding will also be increased. For example, by increasing the value of d for $d = 101 km$, the effect of the Gravitational Shielding reaches approximately $1010 km$, and can surpass the surface of the Earth or the Oceans (See Fig.2). In this case, the decrease in the gravitational potential energy at the local, by analogy to Eq.(15), is

$$\Delta E_p = (1-\chi_o \chi_i) m\, r_{se} g_{sun} \qquad (21)$$

where m is the mass of the soil, or the mass of the ocean water, according to the case.

The decrease, ΔE_p, in the gravitational potential energy increases the kinetic energy of the local at the same ratio, in such way that the mass m acquires a kinetic energy $E_k = \Delta E_p$. If this energy is not enough to pluck the mass m from the soil or the ocean, and launch it into space, then E_k is converted into heat, raising the local temperature by ΔT, the value of which can be obtained from the following expression:

$$\left\langle \frac{E_k}{N} \right\rangle \cong k \Delta T \qquad (22)$$

where N is the number of atoms in the volume V of the substance considered; $k = 1.38 \times 10^{-23} J/K$ is the *Boltzmann constant*. Thus, we get

$$\Delta T \cong \frac{E_k}{Nk} = \frac{(1-\chi_o \chi_i) m\ r_{se} g_{sun}}{(nV)k} = \frac{(1-\chi_o \chi_i)\ \rho\ r_{se} g_{sun}}{nk} \qquad (23)$$

where n is the number of atoms/m^3 in the substance considered.

In the previously mentioned HAARP conditions, Eq. (11) gives $(1-\chi_o\chi_i)\sim 10^{-4}$. Thus, from (23), we obtain

$$\Delta T \cong \frac{6.4\times 10^{27}}{n}\rho \qquad (24)$$

For most liquid and solid substances the value of n is about $10^{28}\,atoms/m^3$, and $\rho\sim 10^3\,kg/m^3$. Therefore, in this case, Eq. (24) gives

$$\Delta T \cong 640K \cong 400°C$$

This means that, the region in the soil or in the ocean will have its temperature increased by approximately 400°C.

By increasing P_{ELF} or decreasing the frequency, f, of the ELF radiation, it is possible to increase ΔT (See Eq.(16)). In this way, it is possible to produce *strong localized heating on Land or on the Oceans*.

This process suggests that, by means of two *small* Gravitational Shieldings built with *Gas* or *Plasma* at ultra-low pressure, as shown in the processes of gravity control [22], it is possible to produce the same heating effects. Thus, for example, the water inside a container can be strongly heated when the container is placed below the mentioned Gravitational Shieldings.

Let us now consider another source of ELF radiation, which can activate the Gravitational Shieldings S_o and S_i.

It is known that the *Schumann resonances* [23] are global electromagnetic resonances (a set of spectrum peaks in the extremely low frequency ELF), excited by lightning discharges in the *spherical resonant cavity* formed by the Earth's surface and the inner edge of the ionosphere (60km from the Earth's surface). The Earth–ionosphere waveguide behaves like a resonator at ELF frequencies and amplifies the spectral signals from lightning at the resonance frequencies. In the normal mode descriptions of Schumann resonances, the fundamental mode $(n=1)$ is a standing wave in the Earth–ionosphere cavity with a wavelength equal to the circumference of the Earth. This lowest-frequency (and highest-intensity) mode of the Schumann resonance occurs at a frequency $f_1 = 7.83Hz$ [24].

It was experimentally observed that ELF radiation escapes from the *Earth–ionosphere waveguide* and reaches the Van Allen belts [25-28]. In the ionospheric spherical cavity, the ELF radiation power density, D, is related to the energy density inside the cavity, W, by means of the well-known expression:

$$D=\frac{c}{4}W \qquad (25)$$

where c is the speed of light, and $W=\frac{1}{2}\varepsilon_0 E^2$. The electric field E, is given by

$$E=\frac{q}{4\pi\varepsilon_0 r_\oplus^2}$$

where $q=500{,}000C$ [24] and $r_\oplus = 6.371\times 10^6 m$. Therefore, we get

$$E = 110.7V/m,$$
$$W = 5.4\times 10^{-8}\,J/m^3,$$
$$D \cong 4.1\ W/m^2 \qquad (26)$$

The area, S, of the cross-section of the cavity is $S=2\pi r_\oplus d = 2.4\times 10^{12}\,m^2$. Thus, the ELF radiation power is $P = DS \cong 9.8\times 10^{12}W$. The total power escaping from the Earth-ionosphere waveguide, P_{esc}, is only a fraction of this value and need to be determined.

When this ELF radiation crosses the Van Allen belts the Gravitational Shieldings S_o and S_i can be produced (See Fig.4).

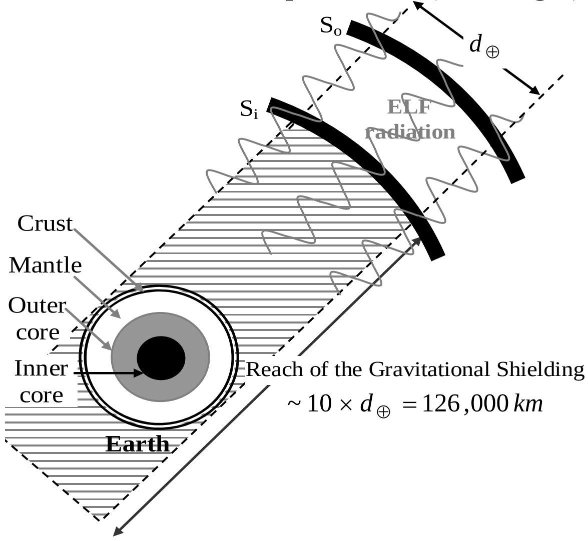

Fig.4 – ELF radiation escaping from the *Earth–ionosphere waveguide* can produce the Gravitational Shieldings S_o and S_i in the Van Allen belts.

The ELF radiation power densities D_i and D_o, respectively in S_i and S_o, are given by

$$D_i = \frac{P_{esc}}{4\pi r_i^2} \qquad (27)$$

and

$$D_o = \frac{P_{esc}}{4\pi r_o^2} \qquad (28)$$

where r_i and r_o are respectively, the distances from the Earth's center up to the Gravitational Shieldings S_i and S_o .

Under these circumstances, the *kinetic energy* related to the mass, m_{oc}, of the Earth's *outer core*[§], with respect to the Sun's center, considering the effects produced by the Gravitational Shieldings S_o and S_i [**] is

$$E_k = (1 - \chi_o \chi_i) m_{oc} r_{se} g_{sun} = \tfrac{1}{2} m_{oc} \overline{V}_{oc}^2 \qquad (29)$$

Thus, we get

$$\overline{V}_{oc} = \sqrt{(1 - \chi_o \chi_i) r_{se} g_{sun}} \qquad (30)$$

The average radius of the *outer core* is $\bar{r}_{oc} = 2.3 \times 10^6 \, m$. Then, assuming that the average angular speed of the outer core, ϖ_{oc}, has the same order of magnitude of the average angular speed of the Earth's *crust*, $\varpi_\oplus$, i.e., $\varpi_{oc} \sim \varpi_\oplus = 7.29 \times 10^{-5} \, rad/s$, then we get $V_{oc} = \varpi_{oc} \bar{r}_{oc} \sim 10^2 \, m/s$. Thus, Eq. (30) gives

$$(1 - \chi_o \chi_i) \sim 10^{-5} \qquad (31)$$

This relationship shows that, *if the power of the ELF radiation escaping from the Earth-ionosphere waveguide is progressively increasing* (for example, by the increasing of the dimensions of the holes in the Earth-ionosphere waveguide[††]), then as soon as the value of $\chi_o \chi_i$ equals 1, and the speed $\overline{V}_{oc}$ will be null. After a time interval, the progressive increasing of the power density of the ELF radiation makes $\chi_o \chi_i$ greater than 1. Equation (29) shows that, at this moment, the velocity V_{oc} resurges, but now in the *opposite direction*.

The Earth's magnetic field is generated by the outer core motion, i.e., the molten iron in the *outer core* is spinning with angular speed, ϖ_{oc}, and it's spinning inside the Sun's magnetic field, so a magnetic field is generated in the molten core. This process is called *dynamo effect*.

Since Eq. (31) tells us that the factor $(1 - \chi_o \chi_i)$ is currently very close to zero, we can conclude that the moment of the *reversion* of the Earth's magnetic field is very close.

5. Device for moving very heavy loads.

Based on the phenomenon of reduction of local gravity related to the Gravitational Shieldings S_o and S_i, it is possible to create a device for moving very heavy loads such as large monoliths, for example.

Imagine a large monolith on the Earth's surface. At noon the gravity acceleration upon the monolith is basically given by

$$g_R = g - g_{sun}$$

where $g_{sun} = -GM_{sun}/r_{se}^2 = 5.92 \times 10^{-3} m/s^2$ is the gravity due to the Sun at the monolith and $g = 9.8 m/s^2$.

If we place upon the monolith a *mantle* with a set of n Gravitational Shieldings inside, the value of g_R becomes

$$g_R = g - \chi^n g_{sun}$$

This shows that, it is possible to reduce g_R down to values very close to zero, and thus to transport very heavy loads (See Fig.5). We will call the mentioned mantle of *Gravitational Shielding Mantle*. Figure 5 shows one of these mantles with a set of 8 Gravitational Shieldings. Since the mantle thickness must be thin, the option is to use Gravitational Shieldings produced by layers of *high-dielectric strength* semiconductor [22]. When the Gravitational Shieldings are active the

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[§] The Earth is an oblate spheroid. It is composed of a number of different layers. An outer silicate solid *crust*, a highly viscous *mantle*, a liquid *outer core* that is much less viscous than the mantle, and a solid *inner core*. The *outer core* is made of *liquid* iron and nickel.

[**] Note that the *reach* of the Gravitational Shielding is $\sim 10 \times d_\oplus = 126{,}000 km$.

[††] The amount of ELF radiation that escapes from the Earth-ionosphere waveguide is directly proportional to the *number of holes* in inner edge of the ionosphere and the *dimensions* of these holes. Thus, if the amount of holes or its dimensions are increasing, then the *power of the ELF radiation escaping from the Earth-ionosphere waveguide* will also be increased.

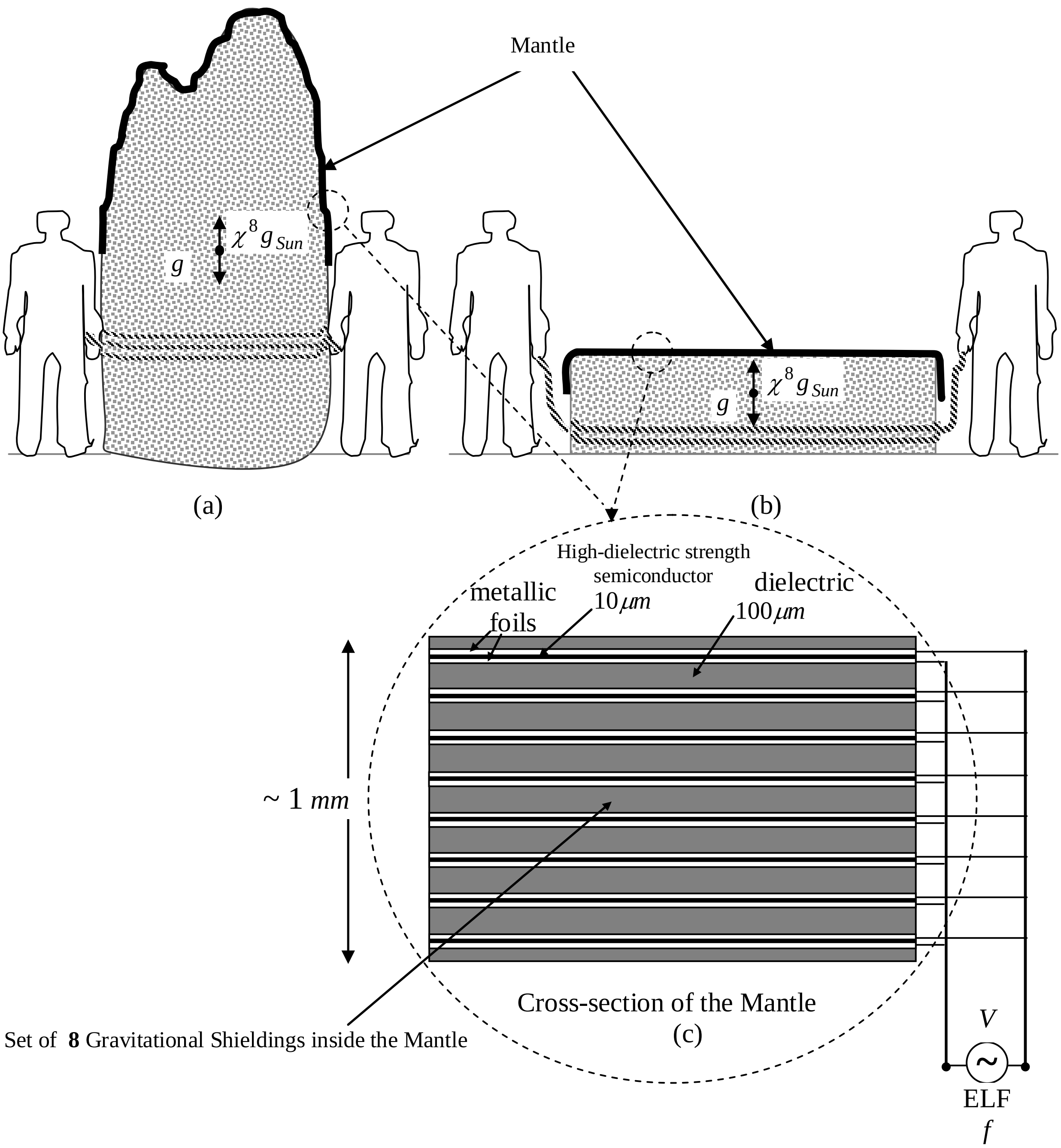

Fig. 5 – *Device for transporting very heavy loads*. It is possible to transport very heavy loads by using a Gravitational Shielding Mantle - A Mantle with a set of 8 semiconductor layers or more (each layer with $10\mu m$ thickness, sandwiched by two metallic foils with $10\mu m$ thickness). The total thickness of the mantle (including the insulation layers) is ~1*mm*. The metallic foils are connected to the ends of an ELF voltage source in order to generate ELF electromagnetic fields through the semiconductor layers. The objective is to create 8 Gravitational Shieldings as shown in (c). When the Gravitational Shieldings are active the gravity due to the Sun is multiplied by the factor χ^8, in such way that the gravity resultant upon the monoliths (a) and (b) becomes $g_R = g - \chi^8 g_{Sun}$. Thus, for example, if $\chi = -2.525$ results $g_R = 0.028 m/s^2$. Under these circumstances, the weight of the monolith becomes 2.9×10^{-3} of the initial weight.

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6. Gates to the imaginary spacetime in the Earth-ionosphere waveguide.

It is known that strong densities of electric charges can occur in some regions of the upper boundary of the Earth-ionosphere waveguide, for example, as a result of the lightning discharges [29]. These anomalies increase strongly the electric field E_w in the mentioned regions, and possibly can produce a tunneling effect to the imaginary spacetime.

The electric field E_w will produce an *electrons flux* in a direction and an *ions flux* in an opposite direction. From the viewpoint of electric current, the ions flux can be considered as an "electrons" flux at the same direction of the real electrons flux. Thus, the current density through the air, j_w, will be the *double* of the current density expressed by the well-known equation of Langmuir-Child

$$j = \frac{4}{9}\varepsilon_r\varepsilon_0\sqrt{\frac{2e}{m_e}}\frac{V^{\frac{3}{2}}}{r^2} = \alpha\frac{V^{\frac{3}{2}}}{r^2} = 2.33\times10^{-6}\frac{V^{\frac{3}{2}}}{r^2} \qquad (32)$$

where $\varepsilon_r \cong 1$ for the *air*; $\alpha = 2.33\times10^{-6}$ is the called *Child's constant*; r, in this case, is the distance between the center of the charges and the Gravitational Shieldings S_{w1} and S_{w2} (see Fig.6) ($r = \frac{1}{2}\left(1.4\times10^{-15}m\right) = 7\times10^{-16}m$); V is the voltage drop given by

$$V = E_w r = \frac{\sigma_Q}{2\varepsilon_0} r = \frac{Qr}{2\varepsilon_0 A} \qquad (33)$$

where Q is the anomalous amount of charge in the region with area A, i.e., $\sigma_Q = Q/A = \eta\sigma_q$, η is the ratio of proportionality, and $\sigma_q = q/4\pi R^2 \cong 9.8\times10^{-10} C/m^2$ is the normal charge density ; $q = 500{,}000C$ is the total charge[24], then $Q = \eta A\sigma_q = \eta q_n$ ($q_n = A\sigma_q$ is the normal amount of charge in the area A).

By substituting (33) into (32), we get

$$j_w = 2j = 2\alpha\frac{V^{\frac{3}{2}}}{r^2} = 2\alpha\frac{\left(\frac{Qr}{2\varepsilon_0 A}\right)^{\frac{3}{2}}}{r^2} = \frac{2\alpha}{\sqrt{r}}\left(\frac{Q}{2\varepsilon_0 A}\right)^{\frac{3}{2}} \qquad (34)$$

Since $E_w = \sigma_Q/2\varepsilon_0$ and $j_w = \sigma_w E_w$, we can write that

$$\sigma_w^3 E_w^4 = j_w^3 E_w = \left[\frac{2\alpha}{\sqrt{r}}\left(\frac{Q}{2\varepsilon_0 A}\right)^{\frac{3}{2}}\right]^3 \frac{Q}{2\varepsilon_0 A} =$$

$$= \frac{0.18\alpha^3 Q^{5.5}}{r^{1.5}\varepsilon_0^{5.5}A^{5.5}} = \frac{0.18\alpha^3\sigma_Q^{5.5}}{r^{1.5}\varepsilon_0^{5.5}} = \frac{0.18\alpha^3\left(\eta\sigma_q\right)^{5.5}}{r^{1.5}\varepsilon_0^{5.5}} =$$

$$= 2.14\times10^{16}\eta^{5.5} \qquad (35)$$

The electric field E_w has an oscillating component, E_{w1}, with frequency, f, equal to the lowest Schumann resonance frequency $f_1 = 7.83Hz$. Then, by using Eq. (7), that can be rewritten in the following form [18]:

$$\chi = \frac{m_g}{m_i} = \left\{1 - 2\left[\sqrt{1 + 1.758\times10^{-27}\frac{\mu_r\sigma^3 E^4}{\rho^2 f^3}} - 1\right]\right\} \qquad (36)$$

we can write that

$$\chi_w = \frac{m_g}{m_i} = \left\{1 - 2\left[\sqrt{1 + 1.758\times10^{-27}\frac{\mu_{rw}\sigma_w^3 E_{w1}^4}{\rho_w^2 f_1^3}} - 1\right]\right\} \qquad (37)$$

By substitution of Eq. (35), $\mu_{rw} = 1$, $\rho_w = 1\times10^{-2} kg/m^3$ and $f_1 = 7.83Hz$ into the expression above, we obtain

$$\chi_w = \left\{1 - 2\left[\sqrt{1 + 7.84\times10^{-10}\eta^{5.5}} - 1\right]\right\} \qquad (38)$$

The gravity below S_{w2} will be decreased by the effect of the Gravitational Shieldings S_{w1} and S_{w2}, according to the following expression

$$\left(g - \chi_{w1}\chi_{w2}g_{sun}\right)$$

where $\chi_{w1} = \chi_{w2} = \chi_w$. Thus, we get

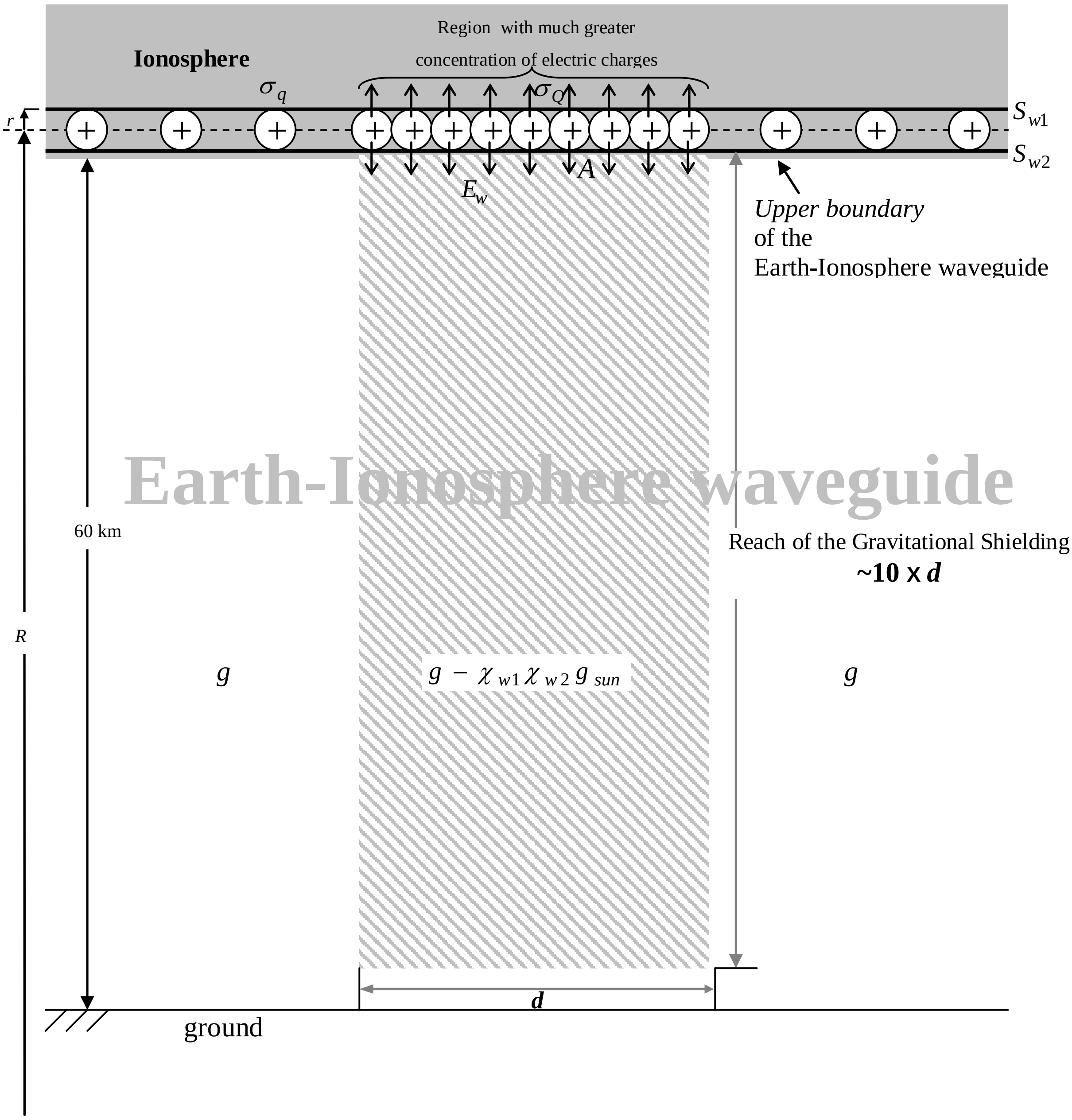


Fig. 6 - Gravitational Shieldings S_{w1} and S_{w2} produced by strong densities of electric charge in the upper boundary of the Earth-Ionosphere.

$$\left\{1-\left\{1-2\left[\sqrt{1+7.84\times10^{-10}\eta^{5.5}}-1\right]\right\}^2\frac{g_{sun}}{g}\right\}g=\chi g$$

where

$$\chi=\left\{1-\left\{1-2\left[\sqrt{1+7.84\times10^{-10}\eta^{5.5}}-1\right]\right\}^2\frac{g_{sun}}{g}\right\} \quad (39)$$

In a previous article [18], it was shown that, when the gravitational mass of a body is reduced to a value in the range of $+0.159m_i$ to $-0.159m_i$ *or the local gravity* (g) *is reduced to a value in the range of* $+0.159g$ *to* $-0.159g$, the body performs a transition to the *imaginary spacetime*. This means that, if the value of χ given by Eq.(39) is in the range $0.159<\chi<-0.159$, then *any body* (aircrafts, ships, etc) that enters the region - defined by the volume $(A \times\sim 10d)$ *below* the Gravitational Shielding S_{w2}, will perform a transition to the imaginary spacetime. Consequently, it will disappear from our Real Universe and will appear in the Imaginary Universe. However, the electric field E_{w1}, which reduces the gravitational mass of the body (or the gravitational shieldings, which reduce the local gravity) does not accompany the body; they stay at the Real Universe. Consequently, the body returns immediately from the Imaginary Universe. Meanwhile, it is important to note that, in the case of *collapse* of the *wavefunction* Ψ of the body, it will never more come back to the Real Universe.

Equation (39) shows that, in order to obtain χ in the range of $0.159<\chi<-0.159$ the value of η must be in the following range:

$$127.1<\eta<135.4$$

Since the normal charge density is $\sigma_q\cong 9.8\times10^{-10}C/m^2$ then it must be increased by about 130 times in order to transform the region $(A \times\sim 10d)$, *below* the Gravitational Shielding S_{w2}, in a gate to the imaginary spacetime.

It is known that in the Earth's atmosphere occur transitorily large densities of electromagnetic energy across extensive areas. We have already seen how the density of electromagnetic energy affects the gravitational mass (Eq. (4)). Now, it will be shown that it also affects the length of an object. *Length contraction* or Lorentz contraction is the physical phenomenon of a decrease in length detected by an observer of objects that travel at any non-zero velocity relative to that observer. If L_0 is the length of the object in its rest frame, then the length L, observed by an observer in relative motion with respect to the object, is given by

$$L=\frac{L_0}{\gamma(V)}=L_0\sqrt{1-V^2/c^2} \quad (40)$$

where V is the relative velocity between the observer and the moving object and c the speed of light. The function $\gamma(V)$ is known as the *Lorentz factor*.

It was shown that Eq. (3) can be written in the following form [18]:

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

This expression shows that

$$\sqrt{1+\left(\frac{\Delta p}{m_{i0}c}\right)^2}=\frac{1}{\sqrt{1-V^2/c^2}}=\gamma(V) \quad (41)$$

By substitution of Eq. (41) into Eq.(40) we get

$$L=\frac{L_0}{\gamma(V)}=\frac{L_0}{\sqrt{1+\left(\frac{\Delta p}{m_{i0}c}\right)^2}} \quad (42)$$

It was shown that, the term, $\Delta p/m_{i0}c$, in the equation above is equal to $Wn_r/\rho c^2$, where W is the density of electromagnetic energy absorbed by the body and n_r the index of refraction, given by

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

In the case of $\sigma>>2\pi f\varepsilon$, $W=(\sigma/8\pi f)E^2$ and $n_r=c/v=\sqrt{\mu\sigma c^2/4\pi f}$ [30]. Thus, in this case, Eq. (42) can be written as follows

$$L=\frac{L_0}{\sqrt{1+1.758\times10^{-27}\left(\frac{\mu_r\sigma^3}{\rho^2 f^3}\right)E^4}} \quad (43)$$

Note that $E = E_m \sin \omega t$ .The average value for E^2 is equal to $\frac{1}{2} E_m^2$ because E varies sinusoidaly (E_m is the maximum value for E). On the other hand, $E_{rms} = E_m / \sqrt{2}$. Consequently we can change E^4 by E_{rms}^4, and the equation above can be rewritten as follows

$$L = \frac{L_0}{\sqrt{1 + 1.758 \times 10^{-27} \left(\frac{\mu_r \sigma^3}{\rho^2 f^3} \right) E_{rms}^4}} \tag{44}$$

Now, consider an airplane traveling in a region of the atmosphere. Suddenly, along a distance L_0 of the trajectory of the airplane arises an ELF electric field with intensity $E_{rms} \sim 10^5 V.m^{-1}$ and frequency $f \sim 1Hz$. The Aluminum density is $\rho = 2.7 \times 10^3 kg.m^{-3}$ and its conductivity is $\sigma = 3.82 \times 10^7 S.m^{-1}$. According to Eq. (44), for the airplane the distance L_0 is shortened by 2.7×10^{-5} . Under these conditions, a distance L_0 of about 3000km will become just 0.08km.

Time dilation is an observed difference of elapsed time between two observers which are moving relative to each other, or being differently situated from nearby gravitational masses. This effect arises from the nature of space-time described by the theory of relativity. The expression for determining time dilation in special relativity is:

$$T = T_0 \gamma(V) = \frac{T_0}{\sqrt{1 - V^2/c^2}}$$

where T_0 is the interval time measured at the object in its rest frame (known as the *proper time*); T is the time interval observed by an observer in relative motion with respect to the object.

Based on Eq. (41), we can write the expression of T in the following form:

$$T = \frac{T_0}{\sqrt{1 - V^2/c^2}} = T_0 \sqrt{1 + \left(\frac{\Delta p}{m_{i0} c} \right)^2}$$

For $V << c$, we can write that $\Delta p = m_{i0} V$ and

$$\tfrac{1}{2} m_{i0} V^2 = m_{i0} g r = m_{i0} \varphi \quad \Rightarrow \quad V^2 = 2\varphi$$

where φ is the gravitational potential. Then, it follows that

$$\left(\frac{\Delta p}{m_{i0}} \right)^2 = V^2 = 2\varphi \quad and \quad \left(\frac{\Delta p}{m_{i0} c} \right)^2 = \frac{V^2}{c^2} = \frac{2\varphi}{c^2}$$

Consequently, the expression of T becomes

$$T = \frac{T_0}{\sqrt{1 - V^2/c^2}} = T_0 \sqrt{1 + \frac{2\varphi}{c^2}}$$

which is the well-known expression obtained in the General Relativity.

Based on Eq. (41) we can also write the expression of T in the following form:

$$T = T_0 \sqrt{1 + \left(\frac{\Delta p}{m_{i0} c} \right)^2} = T_0 \sqrt{1 + 1.758 \times 10^{-27} \left(\frac{\mu_r \sigma^3}{\rho^2 f^3} \right) E_{rms}^4} \tag{45}$$

Now, consider a ship in the ocean. It is made of steel ($\mu_r = 300$; $\sigma = 1.1 \times 10^6 S.m^{-1}$; $\rho = 7.8 \times 10^3 kg.m^{-3}$). When subjected to a uniform ELF electromagnetic field, with intensity $E_{rms} = 1.36 \times 10^3 V.m^{-1}$ and frequency $f = 1Hz$, the ship will perform a transition in time to a time T given by

$$T = T_0 \sqrt{1 + 1.758 \times 10^{-27} \left(\frac{\mu_r \sigma^3}{\rho^2 f^3} \right) E_{rms}^4} = \\ = T_0 (1.0195574) \tag{46}$$

If $T_0 = January, 1\ 1943,\ 0h\ 0 \min\ 0s$ then the ship performs a transition in time to $T = January, 1\ 1981,\ 0h\ 0 \min\ 0s$. Note that the use of ELF $(f = 1Hz)$ is fundamental.

It is important to note that *the electromagnetic field E_{rms}, besides being uniform, must remain with the ship during the transition to the time T*. If it is not uniform, each part of the ship will perform transitions for different times in the future. On the other hand, the field must remain with the ship, because, if it stays at the time T_0, the transition is interrupted. In order to the electromagnetic field remains at the ship, it is necessary that all the parts, which are involved with the generation of the field, stay *inside* the ship. If persons are inside the ship they will perform transitions for different times in the future because their conductivities and densities are different. Since the conductivity and density of the ship and of the persons are different, they will perform transitions to different times. This means that the ship and the persons must have the same characteristics, in order to perform transitions to the same time. Thus, *in this way is unsuitable and highly dangerous to make transitions to the future with persons*. However, there is a way to solve this problem. If we can control the gravitational mass of a body, in such way that $m_g = \chi\ m_{i0}$, and we put this body inside a ship with gravitational mass $M_g \cong M_{i0}$, then the total gravitational mass of the ship will be given by‡‡

$$M_{g(total)} = M_g + m_g = M_{i0} + \chi\ m_{i0}$$

or

$$\chi_{ship} = \frac{M_{g(total)}}{M_{i0}} = 1 + \frac{\chi\ m_{i0}}{M_{i0}} \tag{47}$$

Since

$$\chi_{ship} = \frac{M_g}{M_{i0}} = \left\{1 - 2\left[\sqrt{1+\left(\frac{\Delta p}{M_{i0}c}\right)^2} - 1\right]\right\}$$

we can write that

$$\sqrt{1+\left(\frac{\Delta p}{M_{i0}c}\right)^2} = \frac{3-\chi_{ship}}{2} \tag{48}$$

Then it follows that

$$T = T_0\sqrt{1+\left(\frac{\Delta p}{M_{i0}c}\right)^2} = T_0\left(\frac{3-\chi_{ship}}{2}\right) \tag{49}$$

Substitution of Eq. (47) into Eq. (49) gives

$$T = T_0\left(1 - \frac{\chi\, m_{i0}}{2M_{i0}}\right) \tag{50}$$

Note that, if $\chi = -0.0391148(M_{i0}/m_{i0})$, Eq. (50) gives

$$T = T_0(1.0195574)$$

which is the same value given by Eq.(46).

‡‡ This idea was originally presented by the author in the paper: *The Gravitational Spacecraft* [30].

Other safe way to make transitions in the time is by means of flights with relativistic speeds, according to predicted by the equation:

$$T = \frac{T_0}{\pm\sqrt{1 - V^2/c^2}} \tag{51}$$

With the advent of the Gravitational Spacecrafts [30], which could reach velocities close to the light speed, this possibility will become very promising.

It was shown in a previous paper [18] that by varying the gravitational mass of the spacecraft for *negative* or *positive* we can go respectively to the *past* or *future*.

If the gravitational mass of a particle is *positive*, then t is always *positive* and given by

$$t = +t_0\Big/\sqrt{1 - V^2/c^2} \tag{52}$$

This leads to the well-known relativistic prediction that the particle goes to the *future* if $V \to c$. However, if the gravitational mass of the particle is negative, then t is also *negative* and, therefore, given by

$$t = -t_0\Big/\sqrt{1 - V^2/c^2} \tag{53}$$

In this case, the prevision is that the particle goes to the *past* if $V \to c$. In this way, *negative gravitational mass* is the necessary condition to the particle to go to the *past*.

Now, consider a parallel plate capacitor, which has a *high-dielectric strength* semiconductor between its plates, with the following characteristics $\mu_r = 1$; $\sigma = 10^4 S.m^{-1}$; $\rho = 10^3 kg.m^{-3}$. According to Eq.(45), when the semiconductor is subjected to a uniform ELF electromagnetic field, with intensity $E_{rms} = 10^5 V.m^{-1}$ $(0.1KV/mm)$ and frequency $f = 1Hz$, *it should perform* a transition in time to a time T given by

$$T = T_0\sqrt{1 + 1.758\times10^{-27}\left(\frac{\mu_r\sigma^3}{\rho^2 f^3}\right)E_{rms}^4} =$$

$$= T_0(1.08434) \tag{54}$$

However, the transition *is not performed*, because the electromagnetic field is *external* to the semiconductor, and obviously would not accompany the semiconductor during the transition. In other words, the field stays at the time T_0, and the transition is not performed.

7. Detection of Earthquakes at the Very Early Stage

When an earthquake occurs, energy radiates outwards in all directions. The energy travels through and around the earth as three types of seismic waves called primary, secondary, and surface waves (P-wave, S-wave and Surface-waves). All various types of earthquakes follow this pattern. At a given distance from the epicenter, first the P-waves arrive, then the S-waves, both of which have such small energies that they are mostly not threatening. Finally, the surface waves arrive with all of their damaging energies. It is predominantly the surface waves that we would notice as the earthquake. This knowledge, that, preceding any destructive earthquake, there are telltales P-waves, are used by the earthquake warning systems to reliably initiate an alarm before the arrival of the destructive waves. Unfortunately, the warning time of these earthquake warning systems is less than 60 seconds.

Earthquakes are caused by the movement of tectonic plates. There are three types of motion: plates moving away from each other (at divergent boundaries); moving towards each other (at convergent boundaries) or sliding past one another (at transform boundaries). When these movements are interrupted by an obstacle (rocks, for example), an Earthquake occurs when the obstacle breaks (due to the sudden release of stored energy).

The pressure P acting on the obstacle and the corresponding reaction modifies the *gravitational mass* of the matter along the pressing surfaces, according to the following expression [18]:

$$m_g = \left\{1 - 2\left[\sqrt{1+\left(\frac{P^2}{2\rho^2 c v^3}\right)^2} - 1\right]\right\} m_{i0} \qquad (55)$$

where ρ and v are respectively, the *density* of matter and the *speed of the pressure waves* in the mentioned region.

Hooke's law tells us that $P = \rho v^2$, thus Eq. (55) can be rewritten as follows

$$m_g = \left\{1 - 2\left[\sqrt{1+\frac{P}{4c^2\rho}} - 1\right]\right\} m_{i0} \qquad (56)$$

or

$$\chi = \frac{m_g}{m_{i0}} = \left\{1 - 2\left[\sqrt{1+\frac{P}{4c^2\rho}} - 1\right]\right\} \qquad (57)$$

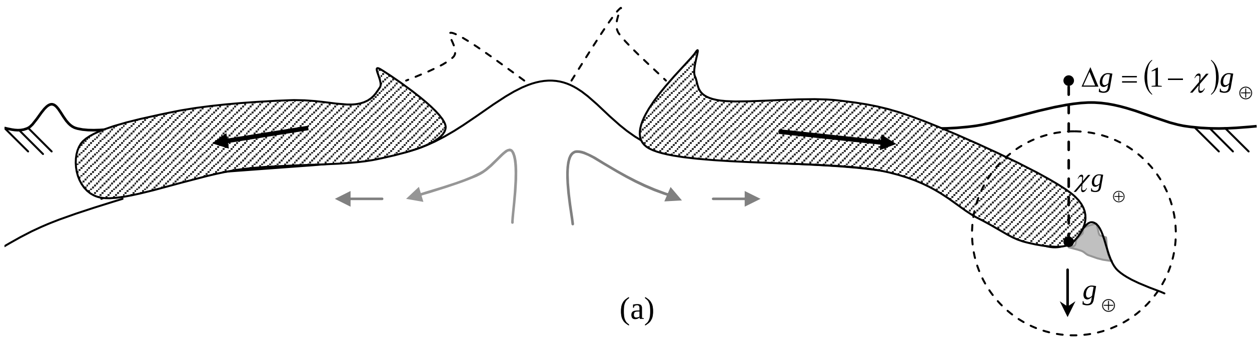
Thus, the matter subjected to the pressure P works as a Gravitational Shielding. Consequently, if the gravity below it is $g_{\oplus}$, then the gravity *above* it is $\chi g_{\oplus}$, in such way that a gravimeter on the Earth surface (See Fig.7) shall detect a *gravity anomaly* Δg given by

$$\Delta g = g_{\oplus} - \chi g_{\oplus} = (1-\chi) g_{\oplus} \qquad (58)$$

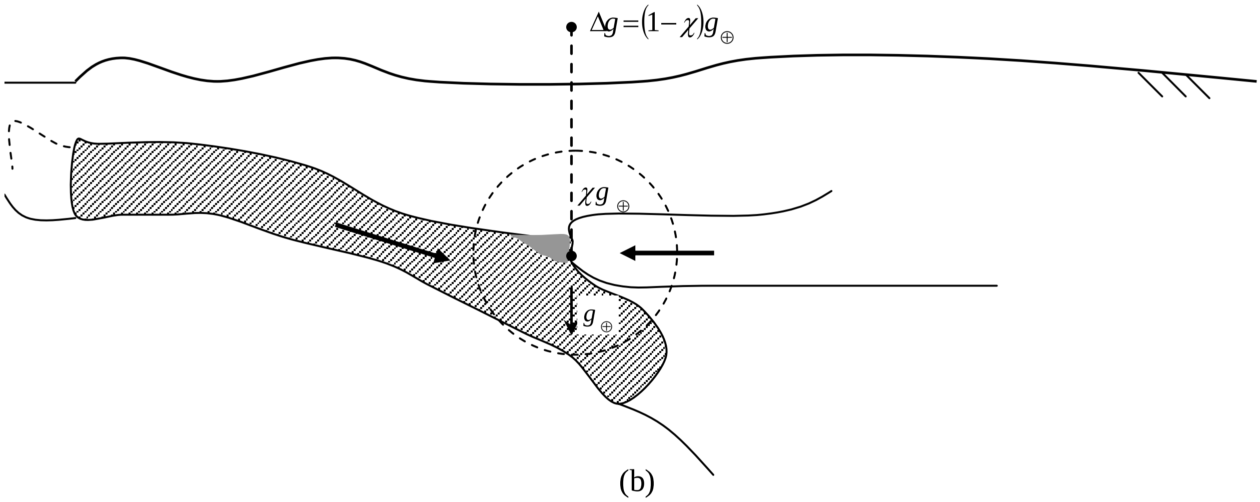
Substitution of Eq. (57) into this Eq. (58) yields

$$\Delta g = 2\left[\sqrt{1+\frac{P}{4c^2\rho}} - 1\right] g_{\oplus} \qquad (59)$$

Thus, when a gravity anomaly is detected, we can evaluate, by means of Eq. (59), the magnitude of the ratio P/ρ in the compressing region. On the other hand, several experimental observations of the *time interval* between the appearing of gravity anomaly Δg and the breaking of the obstacle (beginning of the Earthquake) will give us a statistical value for the mentioned time interval, which will warn us (earthquake warning system) when to initiate an alarm. Obviously, the earthquake warning time, in this case becomes much greater than 60 seconds.



(a)



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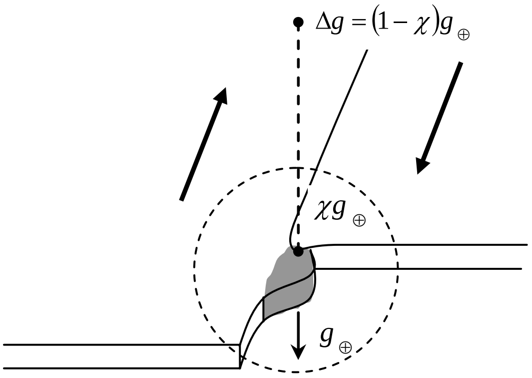

(c)

Fig. 7 – *Three main types of movements*: (a) Divergent (tectonic plates diverge). (b) Convergent (plates converge). (c) Transform (plates slide past each other). Earthquakes occur when the obstacle breaks (due to the sudden release of stored energy).

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