Gravity Transmission Parameters between at Rest Masses: a Proposition

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Abstract

This article does not embody a gravitational radiation theory among masses. Rather, it is a proposition, whose root is a refitting of the Universal Gravitational Constant in Planck units, which establishes the lowermost scale of its range. Therefore, no quantum gravity concepts will come into play; the physics is Newtonian throughout. Nevertheless, the key provided by the constant's refitting, applied to the simplest scenario of two rest masses, allows recognizing that gravity interlocking follows a P-type oscillation at very high frequencies whether the medium is vacuum – the highest – or not.

Introduction

The pioneer Newton's formula for the gravitational attraction among bodies, once applied to two homogeneous rest masses (M, m), separated by a distance (r) between their centers, asserts that a force (F) literally expressed as

$$F \propto \frac{M \cdot m}{r^2} \qquad (1)$$

binding the two masses. Mass **m** may attain different values, the medium being vacuum, or not. Force **F** has only been quantified about 80 years later, by Cavendish, after his insertion in the literal formula of the dimensionally numerical coefficient G, (He) obtained from a delicate lab experiment. Since then, one writes

$$F = G \cdot \frac{M \cdot m}{r^2} \qquad (2)$$

where

$$G \approx \frac{2}{3 \cdot 10^{10}} N \cdot m^2 / kg^2$$

is called Universal Gravitational Constant, for being valid at any scale and at any medium.

In the MKS system $N = kg \cdot m / s^2$; therefore G may also be expressed as

$$G \approx \frac{2}{3 \cdot 10^{10}} \frac{(m/s)^2}{kg/m}$$

a ratio between a velocity squared and a mass over length gradient. Since gravity transmission speed in vacuum equals $c = 3 \cdot 10^8 m/s$, it becomes more comprehensive to rewrite

$$G \approx \frac{c^2}{1.35 \times 10^{27}} \; (MKS\ units) \qquad (3)$$

Now **G** is an universal constant at any medium; **c**, an universal constant in vacuum; so, for vacuum, 1.35×10^{27} kg/m will also be an universal constant. It could range from 1.28×10^{43} kg/light year, at one extreme, to M_p / L_p at the lowermost, where $M_p \approx 2.2 \times 10^{-8}$kg and $L_P \approx 1.6 \times 10^{-35}$m are identified as the "quantum" of mass and the "quantum" of space, after Planck (Luna, 2011).

It is a fact that the **G** value is immutable, the medium being vacuum or not. In gravity prospecting, be it performed on land, sea or airborne, the formulae deduced to compute survey's correction (like "free-air", "Bouguer", etc.) and for depths evaluation of subsurface "anomalies", the constancy of **G** is unquestionable. Nevertheless, at non-vacuum medium, a new value ($\bar{c}$) has to be introduced for gravity transmission velocity, being $\bar{c} < c$. This requires, then, that a new denominator has to be applied to (3); in the case of water, for instance, $\bar{c} < 0.33 \times c$ (GPR MALA Geoscience Manual, 2002) which requires

$\overline{M_P} / \overline{L_P} = (0{,}33)^2 \times M_P / L_P$. Since M_P cannot be below the Planck limit of 2.2×10^{-8} kg a new $\bar{L}_P \approx \frac{L_P}{(0.33)^2} \approx 10 \cdot L_P$ has to be introduced to maintain the constancy of **G**.

Gravity transmission: a Proposition

It has already been assumed that gravity transmission follows some of the rules that belong to electro-magnetic, mainly the speed c in vacuum and lower ones through non-vacuum medium.

Gravitational intensities at an external point P are defined as $g_M = G\frac{M}{r_M^2}, g_m = G\frac{m}{r_m^2}$ that are orthogonal to the surfaces $4\pi r_M^2$ and $4\pi r_m^2$, respectively and crossing at P (Figure 1, a 2D cross section of the plane containing P and points P_1 and P_2, that belong to line O_1O_2).

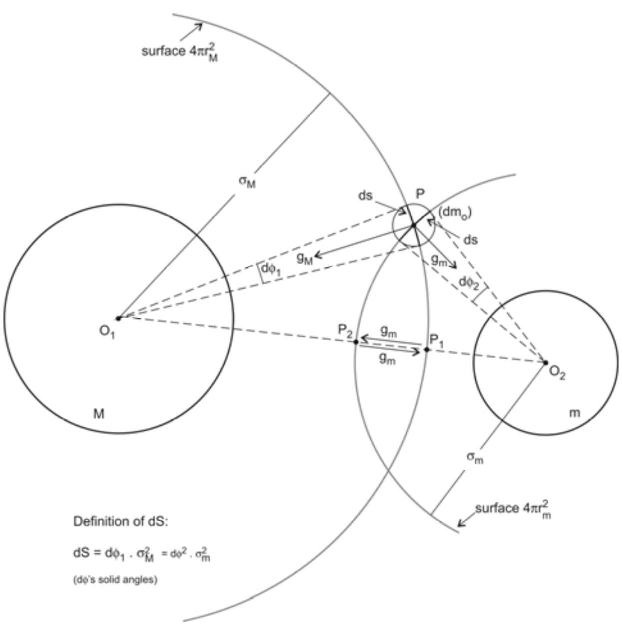


Figure 1

By being directed orthogonally to the referred surfaces, gravitational intensities differ from electromagnetic ones, since these incorporate an S-type oscillation; g´s are exclusively P-type, no tangencial component exist at any point of the $4\pi r_M^2$ and $4\pi r_m^2$ surfaces. In fact, by definition, at any mass-point (dm_o) on the surface surrounding the pair of masses M and m (Figure 2), gravitational intensities are

$$g_M = \frac{dF_M}{dm_o} = \frac{dF_M}{dS} \cdot \frac{ds}{dm_o} = \sigma_M \cdot k \tag{4}$$

$$g_m = \frac{dF_m}{dm_o} = \frac{dF_m}{dS} \cdot \frac{dS}{dm_o} = \sigma_m \cdot k \tag{5}$$

which directly correlate them to normal stresses (σ) at P; k is not a number, has dimensions $\left[L^2 M^{-1}\right]$, but it is an invariant (for this reason, in Figure 2, k is omitted).The force equation for equilibrium at P

$$\sigma_M \cdot dS \cdot \cos\alpha_M + \sigma_m \cdot dS \cdot \cos\alpha_m = \sigma_P \cdot dS$$

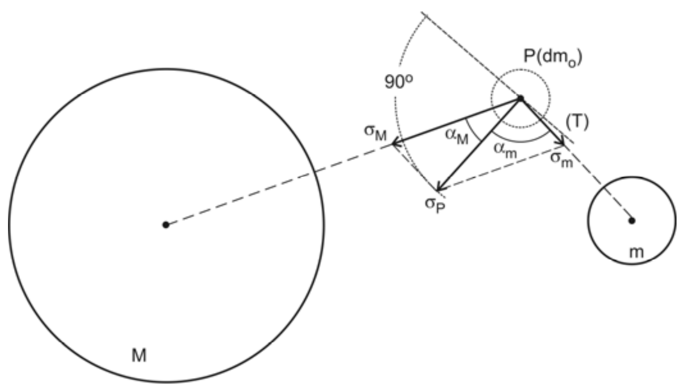
becomes simply

$$\sigma_M \cdot \cos\alpha_M + \sigma_m \cdot \cos\alpha_m = \sigma_P \tag{6}$$

And

$$\sigma_M \cdot \mathrm{sen}\alpha_M - \sigma_m \cdot \mathrm{sen}\alpha_m = 0 \tag{7}$$

since no tangencial stress is present.



Note: (T) is the local direction of the equipotential surface through P; being σ_P perpendicular to it, at P, no tangencial component will there exist. Infinitesimal sphere dm_o represents P.

Figure 2

Conclusions

We are not dealing, in this article, with any gravity sudden-disturbance pull: the two-mass scenario is static. Masses are at rest. What is pursued is the mechanical parameters that mold the gravity permanent signal between two bodies within any medium. As seen, g_M and g_m propagate as normal stress pulses, independently of each other, rather cooperating, never interfering, in spite of their opposite directions of travel. This interlocking causes a permamency of a force. Masses **M** at one end, **m** at the other function as gravity “sinks”, not sources. The minimum separation that allows a force to manifest itself would be (see Figure 3) equal to $2 \cdot L_P \approx 3.2 \times 10^{-35}\,m$ in vacuum; any other separation will be a multiple of $3.2 \times 10^{-35}\,m$. The fundamental wavelength then should be $\lambda_0 \approx 3.2 \times 10^{-35}\,m$, and the fundamental frequency, $f_0 \approx 3 \times 10^{8} / 3.2 \times 10^{-35} \approx 10^{43}\,Hz$, which places gravity transmision at the very top of the radiation spectrum.

The P pulses occur as assymetric senoidal-like signals (in Figure 3, the use of step-like bursts, instead of spike-like ones, has no conceptual significance). Within non-vacuum media, $\bar{c} < c$; then $\bar{\lambda} > \lambda_o$ and $\bar{f} << f_o$, as needed to keep G constant (again, in water medium, $\bar{\lambda} \approx 10 \cdot \lambda_o \approx 32 \times 10^{-35}\,m$ and $\bar{f} \approx 0{,}03 \cdot f_o \approx 3 \times 10^{41} Hz$).

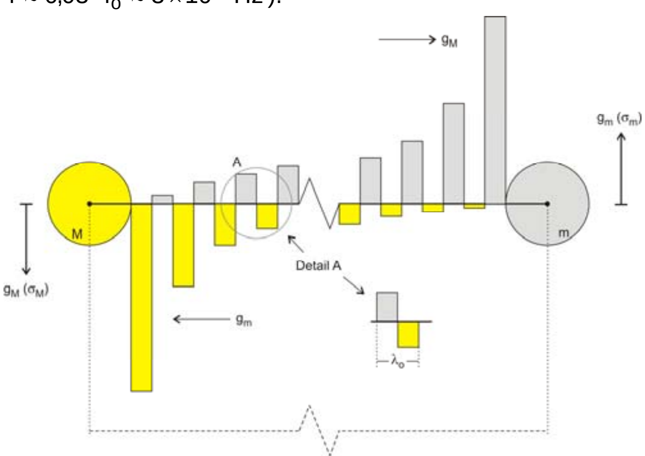


Figure 3

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