Gravity Particles and the Strong Force

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This paper displays a graphical model for gravitational particles, so as to determine the wavelength of gravity waves. This wavelength is obtained graphically by trigonometry, in order to compute the gravitational acceleration, due to a body, at any point in space measured from the center of the body. The objective is to determine the gravitational acceleration, the wavelength of the gravitational wave, speed of the wave and its specific internal energy. To do the study we used formulas for acceleration and velocity which were obtained from hypothesis and well sustained experiment. Tables of results are shown which compare the results for gravitational acceleration obtained in this model, the results of Newton's equation and the results for 45° taken from a book of physics [2]. It is concluded that gravitational force is a strong force and gravitational wave speed equals the speed of light at the center of the earth and diminishes with movement away from its center.

1. Introduction

I describe a theoretical graphic model of the duality particle wave, of gravitational waves, in order to calculate the gravitational acceleration at any point of space measured from the center of the earth. This model is inspired from the Reynolds apparatus.

Figures are shown of the theoretical gravitational wave particle which allow us, using examples, to determine its wavelength, the speed of the wave, its specific internal energy and its distance from the center of the earth.

Tables 1 and 2 show the gravitational acceleration calculated for a different number of wavelength particles (Figs. 2 and 3 respectively) at the earth's surface. These are compared with Newton's Eq. (3).

This paper will demonstrate that very short wavelength gravitational particles, on the earth's surface, have the same value as at the center of the earth, where the speed of the gravitational particle is the speed of the light. The gravitational acceleration at the center of the earth, its frequency and its energy are also calculated.

It will also show an example where, for a 12 cm diameter disc located on the surface of the earth, the speed, frequency and energy required to change the acceleration vector to the opposite direction from the gravitational acceleration is calculated.

2. List of Symbols

Calculations in this paper will be carried to five significant figures, the limit of the universal gravitational constant G [1].

h_P 6.6261×10^{-34} J-s , Planck constant

l_P 1.6162×10^{-35} m , Planck length

c 2.9979×10^{8} m/s , speed of light

G 6.6730×10^{-11} $\text{N-m}^2/\text{kg}^2$, gravitational constant

M_e 5.9742×10^{24} kg , earth mass

R_e 6.3781×10^{6} m , earth radius

R_E 2 (unitless), Reynolds number

g_r gravitational acceleration, calculated (m/s²)

g_N gravitational acceleration, Newtonian (m/s²)

h distance from the earth's surface to a point in the space (m)

r_P radius of the gravitational particle (m)

λ wavelength of a gravitational particle at a point in space (m)

λ_S wavelength of a gravitational particle at earth's surface (m)

v_r threshold speed at equilibrium, gravitational particles (m/s)

ν specific internal energy, equivalent to kinematic viscosity (m²/s = J-s/kg)

f frequency (Hz)

ω frequency (rad/s)

θ parameter related to the number of particles

3. Theoretical Model

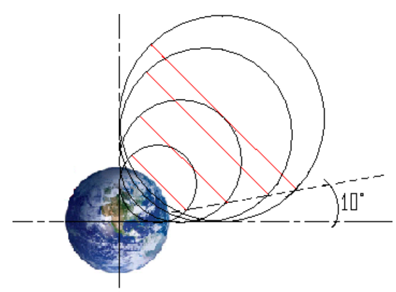

Fig. 1. Theoretical model for gravitational particles

The central circle in Fig. 1 represents the earth. Toward the center of the earth flow four gravitational particles, whose diameters are diminishing as demonstrated. Fig. 2 is an illustration of the magnitude of the gravitational particle wavelength λ located at distance h above the earth's surface, and the magnitude of the gravitational particle wavelength λ_S located at the earth's surface.

The wavelength is the diameter of the gravitational particle at a point in space. Fig. 2 shows the radius r_P of a gravitational particle ($\theta = 45°$ in the figure),

$$r_P = (R_e + h)\cos\theta , \qquad \text{(a)}$$

but the wavelength λ is just the diameter of the particle:

$$\lambda = 2r_P = 2(R_e + h)\cos\theta . \qquad \text{(b)}$$

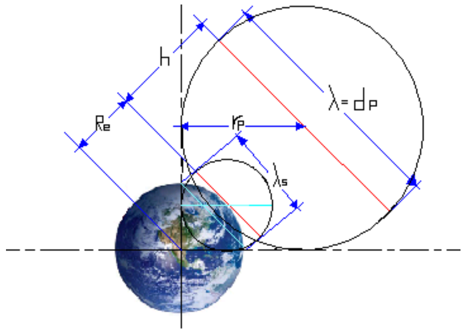

Fig. 2. Gravitational particles model at $\theta = 45°$.

The equation for gravitational acceleration g_r in this study:

$$g_r = \frac{12 v_r^2}{\pi R_E \lambda} \ . \tag{1}$$

The threshold speed for equilibrium of gravity particles:

$$v_r = \frac{2\nu}{\lambda} \ . \tag{2}$$

Newton's equation for gravitational acceleration g_N :

$$g_N = \frac{GM_e}{(R_e + h)^2} \ . \tag{3}$$

4. Example: At the Earth's Surface, $\theta = 45°$

The following calculations apply at the earth's surface ($h = 0$, $\lambda = \lambda_S$) at $\theta = 45°$.

Gravitational acceleration *g*, by Eq. (3):

$$g_N = \frac{GM_e}{(R_e + h)^2} = \frac{\left(6.6730 \times 10^{-11}\right)\left(5.9742 \times 10^{24}\right)}{\left(6.3781 \times 10^6 + 0\right)^2} = 9.7998 \ \mathrm{m/s^2}$$

Gravitational wavelength $\lambda = \lambda_S$, by Eq. (b):

$$\lambda_S = 2(R_e + h)\cos\theta = 2\left(6.3781 \times 10^6 + 0\right)\cos 45° = 9.0200 \times 10^6 \ \mathrm{m}$$

Gravitational particle threshold speed v_r , by Eq. (1):

$$v_r = \sqrt{\frac{\pi R_E g_N \lambda}{12}} = \sqrt{\frac{\pi(2)(9.7998)\left(9.0200 \times 10^6\right)}{12}} = 6803.2 \ \mathrm{m/s}$$

Gravitational particle specific internal energy ν , by Eq. (2):

$$\nu = \frac{1}{2} v_r \lambda = \frac{1}{2}(6803.2)\left(9.0200 \times 10^6\right) = 3.0682 \times 10^{10} \ \mathrm{m^2/s}$$

Assuming ν , as just calculated, remains constant at any point in space, where the speed of the gravitational particle $v_r = c$, we calculate the following.

Gravitational wavelength λ , by Eq. (2):

$$\lambda = \frac{2\nu}{c} = \frac{2\left(3.0682 \times 10^{10}\right)}{2.9979 \times 10^8} = 204.69 \ \mathrm{m}$$

Distance from the earth center $R_e + h$, by Eq. (b):

$$R_e + h = \frac{\lambda}{2\cos\theta} = \frac{204.69}{2\cos 45°} = 144.74 \ \mathrm{m}$$

Gravitational acceleration g_r at this point, by Eq. (1):

$$g_r = \frac{12c^2}{\pi R_E \lambda} = \frac{12\left(2.9979 \times 10^8\right)^2}{\pi(2)(204.69)} = 8.3856 \times 10^{14} \ \mathrm{m/s^2}$$

5. Example: Above the Earth, $\theta = 45°$

The following calculations apply at height $h = 100{,}000$ m above the earth surface, at $\theta = 45°$. Variables g_N , λ , v_r are given by Eq. (3), (b) and (2) respectively.

$$g_N = \frac{GM_e}{(R_e + h)^2} = \frac{\left(6.673 \times 10^{-11}\right)\left(5.9742 \times 10^{24}\right)}{\left(6.3781 \times 10^6 + 100{,}000\right)^2} = 9.4996 \ \mathrm{m/s^2}$$

$$\lambda = 2(R_e + h)\cos\theta = 2\left(6.3781 \times 10^6 + 100{,}000\right)\cos 45°$$
$$= 9.1614 \times 10^6 \ \mathrm{m}[= 9161 \ \mathrm{km}]$$

$$v_r = \frac{2\nu}{\lambda} = \frac{2\left(3.0682 \times 10^{10}\right)}{9.1614 \times 10^6} = 6698.1 \ \mathrm{m/s}$$

Now substitute v_r and λ into Eq. (1):

$$g_r = \frac{12 v_r^2}{\pi R_E \lambda} = \frac{12(6698.1)^2}{\pi(2)\left(9.1614 \times 10^6\right)} = 9.3528 \ \mathrm{m/s^2} \ .$$

Table 1 shows results obtained for gravitational acceleration for different values of *h* in Fig. 2. Compare the values obtained between g_r in Eq. (1), Newton's g_N in Eq. (3), and measured g_m for $\theta = 45°$ given in [2].

h (m)	λ (10^6 m)	v_r (m/s)	g_r (m/s²)	g_N (m/s²)	g_m (m/s²)
0	9.0200	6803.2	9.7998	9.7998	9.806
1000	9.0214	6802.1	9.7952	9.7968	9.803
4000	9.0257	6798.9	9.7814	9.7875	9.794
8000	9.0313	6794.7	9.7630	9.7753	9.782
16000	9.0426	6786.2	9.7264	9.7508	9.757
32000	9.0653	6769.2	9.6538	9.7022	9.71
100000	9.1614	6698.1	9.3528	9.4996	9.60
500000	9.7271	6308.6	7.7842	8.4268	8.53
1000000	10.434	5881.1	6.3308	7.3234	7.41
$0.38e^9$	546.42	112.30	$4.41e^{-5}$	$2.60e^{-3}$	$2.71e^{-3}$
$149e^9$	210730	0.2912	$7.69e^{-13}$	$1.80e^{-8}$	----

Table 1. Calculated properties for $\theta = 45°$, Fig. 2.

6. Example: At the Earth's Surface, $\theta = 30°$

Fig. 3 shows a model for three gravitational particles flowing to the center of the earth, at the earth surface ($h = 0$, $\lambda = \lambda_S$) for the case $\theta = 30°$. Calculate $\lambda = \lambda_S$, v_r , ν by Eqs. (b), (1) and (2).

$$\lambda_S = 2(R_e + h)\cos\theta = 2\left(6.3781 \times 10^6 + 0\right)\cos 30° = 1.1047 \times 10^7 \ \mathrm{m}$$

$$v_r = \sqrt{\frac{\pi R_E g \lambda}{12}} = \sqrt{\frac{\pi(2)(9.7998)\left(11.047 \times 10^6\right)}{12}} = 7528.9 \ \mathrm{m/s}$$

$$\nu = \frac{1}{2} v_r \lambda = \frac{1}{2}(7528.9)\left(1.1047 \times 10^7\right) = 4.1586 \times 10^{10} \ \mathrm{m^2/s}$$

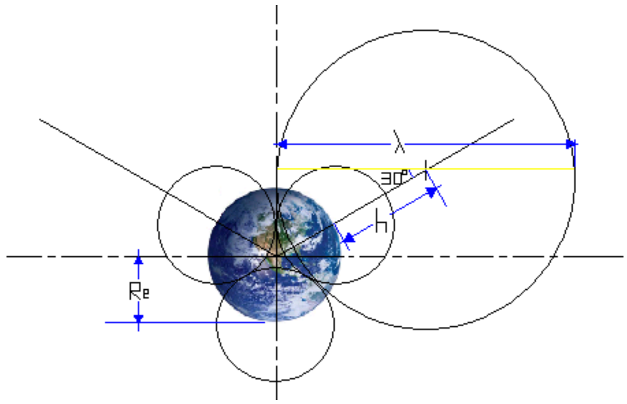

Fig. 3. Gravitational particles model at $\theta = 30°$.

Again assuming ν , as just calculated, remains constant at any point in space, where the speed of the gravitational particle $v_r = c$, calculate λ , $R_e + h$, and g_r by (2), (b) and (1).

$$\lambda = \frac{2\nu}{c} = \frac{2\left(4.1586\times10^{10}\right)}{2.9979\times10^{8}} = 277.43 \text{ m}$$

$$R_e + h = \frac{\lambda}{2\cos\theta} = \frac{277.43}{2\cos 30°} = 160.17 \text{ m}$$

$$g_r = \frac{12c^2}{\pi R_E \lambda} = \frac{12\left(2.9979\times10^{8}\right)^2}{\pi(2)(277.43)} = 6.1870\times10^{14} \text{ m/s}^2$$

7. Example: Above the Earth, $\theta = 30°$

The following calculations apply at height $h = 100{,}000$ m above the earth surface, at $\theta = 30°$. Variables λ , v_r , g_r are given by Eqs. (b), (2) and (1) respectively.

$$\lambda = 2\left(R_e + h\right)\cos\theta = 2\left(6.3781\times10^{6} + 100{,}000\right)\cos 30° = 1.1220\times10^{6} \text{ m}$$

$$v_r = \frac{2\nu}{\lambda} = \frac{2\left(4.1586\times10^{10}\right)}{1.1220\times10^{6}} = 7412.8 \text{ m/s}$$

$$g_r = \frac{12 v_r^2}{\pi R_E \lambda} = \frac{12(7412.8)^2}{\pi(2)\left(1.1220\times10^{7}\right)} = 9.3530 \text{ m/s}^2$$

Table 2 shows the results obtained for gravitational acceleration for different values of *h*.

h (m)	λ (10^7 m)	v_r (m/s)	g_r (m/s²)	g_N (m/s²)
0	1.1033	7528.9	9.7998	9.7998
1000	1.1034	7527.8	9.7952	9.7968
4000	1.1040	7524.2	9.7814	9.7875
8000	1.1047	7519.5	9.7630	9.7753
16000	1.1061	7510.1	9.7264	9.7508
32000	1.1088	7491.4	9.6538	9.7022
100000	1.1206	7412.8	9.3530	9.4996
500000	1.1899	6981.6	7.8142	8.4268
1000000	1.2033	6508.5	6.3308	7.3234
0.38e^{9}	66.921	124.28	4.41e^{-5}	2.67e^{-3}
149e^{9}	25808	0.3223	7.69e^{-13}	1.80e^{-8}

Table 2. Calculated properties for $\theta = 30°$, Fig. 3.

8. Near the Earth Center

Calculate the distance to the earth center $R_e + h$ where the gravitational particle speed is the speed of light, and the wavelength on the earth's surface is $\lambda_S = 2.2235$ mm . On the earth's surface, from Eq. (1):

$$v_r = \sqrt{\frac{\pi R_E g \lambda_S}{12}} = \sqrt{\frac{\pi(2)(9.7998)\left(2.2235\times10^{-3}\right)}{12}} = 0.10681 \text{ m/s}$$

From Eq. (2):

$$\nu = \frac{1}{2} v_r \lambda_S = \frac{1}{2}(0.10681)\left(2.2235\times10^{-3}\right) = 1.1874\times10^{-4} \text{ m}^2/\text{s}$$

Near the center of the earth, with $v_r = c$, from Eq. (2):

$$\lambda = \frac{2\nu}{c} = \frac{2\left(1.1874\times10^{-4}\right)}{2.9979\times10^{8}} = 7.9215\times10^{-13} \text{ m}$$

At this same point near the earth center, by Eq. (b):

$$R_e + h = \frac{\lambda}{2\cos\theta} = \frac{7.9215\times10^{-13}}{2\cos 89.99999999°} = 2.2693\times10^{-3} \text{ m} = 2.2693 \text{ mm}$$

This value is almost equal to the wavelength on the surface λ_S . The gravitational acceleration g_r at this point, from Eq. (1):

$$g_r = \frac{12c^2}{\pi R_E \lambda} = \frac{12\left(2.9979\times10^{8}\right)^2}{\pi(2)\left(7.9215\times10^{-13}\right)} = 2.1668\times10^{29} \text{ m/s}^2$$

Since $\lambda_S \approx R_e + h$ for $v_r = c$ in the center of the earth, substitute $\lambda_S = l_P$, the Planck length. Then the gravitational acceleration g_P in the center of the earth is:

$$g_P = \frac{12c^2}{\pi R_E l_p} = \frac{12\left(2.9979\times10^{8}\right)^2}{\pi(2)\left(1.6162\times10^{-35}\right)} = 1.0620\times10^{52} \text{ m/s}^2$$

The frequency ω is:

$$\omega = \frac{v_r}{\lambda} = \frac{c}{l_p} = \frac{2.9979\times10^{8}}{1.6162\times10^{-35}} = 1.8549\times10^{43} \text{ rad/s},$$

or

$$f = \frac{\omega}{2\pi} = 2.96562\times10^{42} \text{ Hz}$$

The energy is:

$$E = h_P f = \left(6.6261\times10^{-34}\right)\left(1.8549\times10^{43}\right) = 1.2291\times10^{10} \text{ J}$$

Fig.	Particles	$R_e + h$ (m)	g_r (m/s²)	θ (degrees)
3	3	160.17	6.1870e^{14}	30°
2	4	144.74	8.3856e^{14}	45°
4	1.8e^{10}	2.2693e^{-3}	2.1668e^{29}	89.99999999°

Table 3. Calculated accelerations for $R_e + h$, $v_r = c$, at various θ

Table 3 shows that the higher the number of particles around the earth, the shorter the distance from the center of the earth, where $v_r = c$ and the strength of the gravity is highest. $R_e + h$ is the distance to the Earth's center, and "Particles" means the number of particles around the Earth.

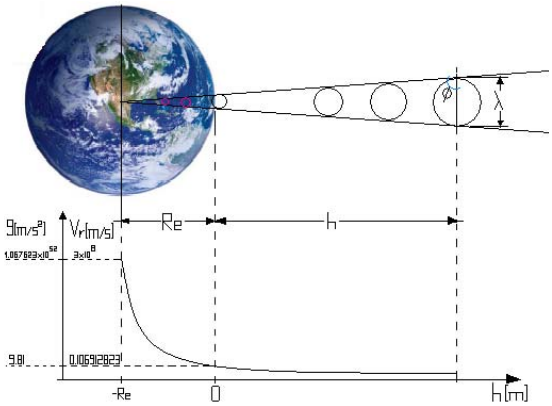

Fig. 4. Schematized for the shortest wavelength $\lambda_S = 2.2235$ mm .

9. Gravity Wave through a Disk

Calculate of the threshold speed for equilibrium v_r , internal specific energy ν , for the gravitational wave flowing through a disc of diameter $\lambda = 12\text{ cm} = 0.12\text{ m}$ located on the earth's surface. From Eq. (1):

$$v_r = \sqrt{\frac{\pi R_E g \lambda}{12}} = \sqrt{\frac{\pi(2)(9.7998)(0.12)}{12}} = 0.78469 \text{ m/s}$$

From Eq. (2):

$$\nu = \frac{1}{2} v_r \lambda_S = \frac{1}{2}(0.78469)(0.12) = 0.047081 \text{ m}^2/\text{s}$$

The frequency ω is:

$$\omega = \frac{v_r}{\lambda} = \frac{2\nu}{\lambda^2} = \frac{2(0.047081)}{(0.12)^2} = 6.5390 \text{ rad/s}$$

or $$f = \frac{\omega}{2\pi} = 1.0407 \text{ Hz}$$

And the energy is:

$$E = h_P f = \left(6.6261 \times 10^{-34}\right)(6.5390) = 4.3328 \times 10^{-33} \text{ J}$$

10. Conclusion

The speed of the gravity wave is equal to the speed of light at a point located at a distance equal to the Planck length from the earth's center. This speed variation is from $c = 3 \times 10^8$ m/s at this point to zero in the infinite.

The gravity waves can have any value of wavelength. The wavelength of the gravity wave is directly proportional to its specific internal energy and its speed. The gravitational acceleration at a point located at the Planck length from the earth center is $g_P = 1.0620 \times 10^{52}\text{ m/s}^2$, which makes the gravitational energy $E = 4.3328 \times 10^{-33}$ J . This behaves like the strong force, because next to the earth's center any unit of mass experiences a strong gravity acceleration.

Gravity calculated for the distance earth-moon using Eq. (1) and Newton Eq. (3) has a ratio of 6 which is the same ratio between earth and moon.

We invite experiments which build a coil capable of generating electromagnetic waves at different speeds which coincide with the speed of the gravitational wave for a specific wavelength (the diameter of the coil) and distance from the earth's surface. Maybe it will let us obtain levitation and displacement.

Like an explanatory, all the calculations were made using five significant figures in order to do not clutter the tables 1 and 2, but it is necessary consider the higher quantity of digits in order to obtain precise expected measurements about speed and wavelength in experiments like LIGO project. In the other hand, Eqs. (1) and (2) were obtained linearly, and perhaps corrections will be needed.

Appendix [2]

Art. 16-6 VARIACIONES DE LA ACELERACION DEBIDAS A LA... 525

TABLA 16-1. VARIACIONES DE g CON LA ALTITUD A LA LATITUD DE 45°

Altitud, metros	g, m/seg²	Altitud, metros	g, m/seg²
0	9.806	32 000	9.71
1 000	9.803	100 000	9.60
4 000	9.794	500 000	8.53
8 000	9.782	1 000 000¹	7.41
16 000	9.757	380 000 000²	0.00271

¹ Altura de un satélite típico (= 1 000 km).
² Radio de la órbita de la Luna (=386 000 km).

una esfera. Obtuvo un valor de 7 400 km, en comparación con el valor moderno de 6 371 km. Esta información fundamental relativa a la forma de la Tierra se fue olvidando gradualmente y no se redescubrió sino hasta la época de los grandes viajes de exploración del siglo xv.

Posteriormente, las mediciones indicaron que, como una buena segunda aproximación, el geoide no es una esfera sino un elipsoide de revolución, achatado a lo largo del eje de rotación de la Tierra y ensanchado en el ecuador. De hecho, el radio ecuatorial excede en 21 km al radio polar. Este achatamiento es motivado por los efectos centrífugos en la Tierra plástica en rotación. La superficie del geoide no es exactamente elipsoidal, se encuentra fuera del elipsoide que más se le ajusta, bajo las masas de montañas, y dentro de él, en los océanos.

El hecho de que el ecuador se encuentra más lejos del centro de la Tierra que lo que están los polos significa que debe haber un aumento constante en el valor medio de g al avanzar del ecuador (latitud 0°) a cualquier polo (latitud 90°). Esto es lo que se ve en la Tabla 16-2. Sin embargo, como lo muestra el Ej. 2, aproximadamente la mitad de esta variación se puede explicar por otro efecto, a saber, el cambio en el valor efectivo de g producido por la rotación de la Tierra. Por ejemplo, si la Tierra estuviera girando con suficiente rapidez, los objetos colocados en su superficie en el ecuador parecerían

TABLA 16-2. VARIACION DE g CON LA LATITUD AL NIVEL DEL MAR

Latitud	g, m/seg²	Latitud	g, m/seg²
0°	9.78039	50°	9.81071
10°	9.78195	60°	9.81918
20°	9.78641	70°	9.82608
30°	9.79329	80°	9.83059
40°	9.80171	90°	9.83217

References

[1] http://physics.nist.gov/cuu/Constants/index.html.

[2] Robert Resnick & David Halliday, **Fisica**, Parte I, p. 525 (CIA. Editorial Continental, 1977).