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Gravity Wave Generation by the Electromagnetic Field

Takaaki Musha

Advanced Science-Technology Research Organization,Yokohama,JAPAN
Foundation of Physics Research Center (FoPRC), Cosenza, ITALY.
E-mail: takaaki.mushya@gmail.com

Corresponding author details: Takaaki Musha; takaaki.mushya@gmail.com

ABSTRACT
According to the theory on the relation between the rest mass and ZPF field in the vacuum, the author shows the possibility to generate a gravitational wave by the high intensity impulsive electric field.

Keywords: ZPF field; gravitational wave; high intensity electric field; mass shift

INTRODUCTION
H. E. Puthoff proposed the gravity theory that gravity is a form of long-range van der Waals force associated with the Zitterbewegung of elementary particles in response to zero-point fluctuations (ZPF) of the vacuum and the inertia mass also interacts with the vacuum electromagnetic zero-point field [1]. According to his idea, which shows the relation between the rest mass of a particle and ZPF energy in the vacuum, it can be shown that gravitational wave can be generated by high intensity impulsive electric field.

RELATION BETWEEN ELECTROMAGNETIC FIELD AND ZPF FIELD IN A VACUUM
Under an intense electromagnetic field, it has been theoretically predicted that electron experiences an increase of its rest mass.

Let H_A be the electrodynamic Hamiltonian of the particle under high electromagnetic field, it has the form shown as

$$H_A = \frac{e^2}{2m_0c^2} < A^2 > , \qquad (1)$$

which was analogically discovered by Milonni shown in the paper by Haish, Rueda and Puthoff [2], where m_0 is the rest mass of the particle, e is its charge, A is the vector potential of electromagnetic field and c is the light speed.
The similar equation by using terms of the ZPF field was also proposed by Haisch, Rueda and Puthoff shown as [2]

$$H'_A = \frac{e^2\hbar}{2\pi\ m_0c^3}\omega_c^2 , \qquad (2)$$

where $\hbar$ is a Plank constant divided by 2π and ω_c is a cutoff frequency of ZPF spectrum in the vacuum. Assuming that electrodynamic Hamiltonians, shown in Eqs. (1) and (2), are identical with each other, we have $\Delta H_A = \Delta H'_A$ for the elementary particle under impressed electric field. From which, we have an equation on the mass shift of the particle.

Gravity wave generation by the high intensity electromagnetic field
We suppose that the cutoff frequency of the vacuum is shifted as $\omega_c = \omega_0 + \Delta\omega$ when the electromagnetic field is impressed to the elementary particle, $\Delta H'_A$ becomes

$$\Delta H'_A = \frac{e^2\hbar}{2\pi m_0c^3}\{(\omega_0+\Delta\omega)^2 - \omega_0^2\} \approx \frac{e^2\hbar}{\pi m_0c^3}\omega_0\Delta\omega \quad , \qquad (3)$$

where ω_0 is the Plank frequency given by

$\omega_0 = \sqrt{c^5/\hbar G} \approx 3\times10^{43}$ Hz.

We can suppose that $H_A = 0$ at the initial state, then we obtain the formula given by

$$\Delta\omega \approx \frac{\pi\ c}{2\hbar\omega_0} < A^2 >, \qquad (4)$$

from Eq. (1).
As the wave equation of the vector potential field can be described as

$$\nabla^2 A - \frac{1}{c^2}\frac{\partial^2 A}{\partial t^2} = -\frac{1}{\varepsilon_0 c^2}\, j(t), \qquad (5)$$

then we have [3]

$$A_z = \frac{1}{4\pi\varepsilon_0 c^2}\frac{\dot{p}(t-r/c)}{r}, \qquad (6)$$

for the alternating electric field, where $p = q\cdot d$ and r is a distance from the source.

As the dipole field generated by the alternating electric field is given by

$$d(t)=\frac{e}{m}\frac{E_0}{\omega_e^2-\omega^2}\cos[\omega(t-r/c)], \quad (7)$$

where p is a dipole momentum given by $p=qd$ (q: charge of the particle, d : displacement of the charge). From which, we have

$$\langle A^2\rangle=\left(\frac{1}{4\pi\varepsilon_0c^2}\right)^2\left(\frac{e}{m}\frac{E_0}{\omega_e^2-\omega^2}\frac{\omega Ne}{r}\right)^2\frac{1}{2}\cos^2\theta$$
$$=\frac{N^2}{16\pi^2\varepsilon_0^2c^4}\frac{e^4}{m^2}\frac{\omega^2}{(\omega_e^2-\omega^2)^2}\frac{E_0^2}{2}\frac{\cos^2\theta}{r^2}, \quad (8)$$

where N is a number of electrons per unit volume inside the electromagnetic source, E_0 is a magnitude of the electric field, ε_0 is a permittivity of free space and ω_e is a resonant angular frequency given by $\omega_e=\sqrt{Ze^2/\alpha_e m}$ (α_e : electron polarizability), which yields about $10^{15}\sim 10^{16}$ Hz.

As the mass shift of the particle can be given by

$$\Delta m=\frac{\Gamma\hbar}{\pi c^2}\omega_c\Delta\omega_c, \quad (9)$$

from $m=\Gamma\hbar\omega_c^2/(2\pi c^2)$, where Γ is a damping constant of ZPF energy, then we have the following equation by substituting $\omega\rightarrow\omega\left(1+i\frac{\eta}{2}\right)$ [4];

$$\frac{\Delta m}{m}\approx\frac{\pi c}{\hbar\omega_0^2}\langle A^2\rangle$$
$$=\frac{\pi G}{c^4}\frac{N^2}{16\pi^2\varepsilon_0^2c^4}\frac{e^4}{m^2}\frac{E_0^2\cos^2\theta}{2r^2}\int_{\omega_1}^{\omega_2}\frac{\omega^2}{(\omega_e^2-\omega^2)^2+\eta^2\omega^4}d\omega, \quad (10)$$

where G is a gravitational constant which equals $G=\pi c^5/\hbar\omega_c^2$ [2], and η is a damping factor of the ZPF field that equals to the Abraham-Lorenz damping constant [5]. Then the mass shift of the matter consisted of elementary particles induced by the high intensity electric pulse becomes

$$\frac{\Delta m}{m}\approx\frac{\pi G}{c^4}\frac{N^2}{16\pi^2\varepsilon_0^2c^4}\frac{e^4}{m^2}\frac{E_0^2\cos^2\theta}{2r^2}\frac{\pi}{2\eta\omega_e}$$
$$=\frac{G}{64c^8}\frac{N^2e^4}{\varepsilon_0^2m^2\eta\omega_e}\frac{E_0^2}{r^2}\cos^2\theta\,. \quad (11)$$

Finally, we obtain

$$\frac{\Delta m}{m}\approx\frac{G}{64c^8}\frac{N^2e^4}{\varepsilon_0^2m^2\eta\omega_e}\frac{V_0^2}{d^2r^2}\cos^2\theta\,, \quad (12)$$

where V_0 is an applied voltage and d is a separation between electrodes.

GRAVIY WAVE GENERATOR

From Eq. (12), high intensity electric field induces a mass shift of the rest mass of the particle which is apart from the electric source and it is considered that we can generate gravitational wave as a fluctuation of ZPF field by the device shown in the FIGURE 1.

It is consisted of two electrodes in the case and a high voltage generator.

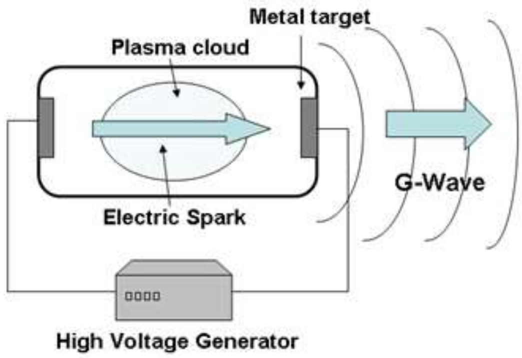

FIGURE 1: Schematic diagram of the Gravity wave generator

The directivity of gravitational waves generated by this device is shown as FIGURE 2

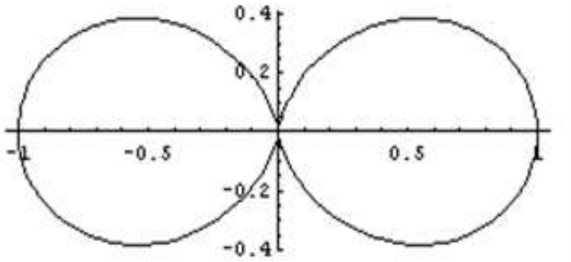

FIGURE 2: Directivity of generated waves

From which, the intensity of the gravitational wave is maximized in the direction of the electric spark.

CONCLUSION

From the theory proposed by Puthoff, it can be shown that gravity waves can be generated by the device which can produce high intensity impulsive electric field.

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