Theoretical background of T.T. Brown Electro-Gravity Communication System

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Abstract

The article describes communication system working on base of gravity waves. Such system of devices should work if the electromagnetic field curves space-time. Theoretical results shows that the artificial change of gravity of space-time curvature should observes in the distance much more bigger than dimension of transmitter antenna. The article end with discussion of details of technical properties of working electro-gravity communication system.

Keywords— Biefeld-Brown effect, electromagnetic gravity, electro-gravity communication, gravitational waves, gravitoelectromagnetic equations, space-time curvature.

1 Introduction

By late 1915, Einstein published his general theory of relativity in the form in which it is used today (Einstein, 1916). Two years later Levi-Civita (Levi-Civita, 1917) proposed that each field energy curves gravity space-time. Still in 1928 Brown patented apparatus generating propulsion by using of electric field (T. Brown, 1928), this effect is known as a Biefeld-Brown effect. Theoretical explanation of this effect could be based on the same proposal of Levi-Civita that electromagnetic field should curves gravity space-time (Maknickas, 2013). Historically the first time gravitational waves (GWs) was investigated when the quadrupole equation first derived by Einstein 1918 (Einstein, 1918). So it was logical to create communication device based on GWs (T. T. Brown, 1953). But until now does not exist theoretical explanation of how works this device.

The aims of this article are theoretical explanation of electro-gravity communication system based on Biefeld-Brown effect by using of linearised gravitoelectromagnetic equations proposed by authors (Mashhoon, Gronwald, & Lichtenegger, 1999), (Clark & Tucker, 2000).

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2 Space-time curvature of electromagnetic field

According (Maknickas, 2013) one cane explain Biefeld-Brown effect as space-time curvature of gravity field induced by electromagnetic field as follow

$$R = \frac{32\pi G}{c^4}\left(\rho c^2 + \frac{\alpha_g c^2}{2\mu_0}\left(B^2 - \frac{E^2}{c^2}\right)\right), \tag{1}$$

yielding the equivalent form of Richi tensor

$$R_{\mu\nu} = g_{\mu\nu}\frac{8\pi G}{c^4}\left(\rho c^2 + \frac{\alpha_g c^2}{2\mu_0}\left(B^2 - \frac{E^2}{c^2}\right)\right), \tag{2}$$

where α_g is electromagnetic gravity coupling constant. So, space curvature of spheric gravity mass with radius r in terms of additional mass generated by electromagnetic field could be expressed as follow

$$R = \frac{32G}{c^2}\left(\rho_g - \rho_{eg}\right), \tag{3}$$

$$\rho_{eg} = \frac{\alpha_g}{2}\left(\varepsilon\varepsilon_0 E^2 - \frac{B^2}{\mu\mu_0}\right), \tag{4}$$

where ρ_{eg} and ρ_g is electromagnetic mass and gravity mass density, accordingly.

3 Gravitoelectromagnetism equations

According to general relativity, the gravitational field produced by a rotating object (or any rotating massenergy) can, in a particular limiting case, be described by equations that have the same form as in classical electromagnetism. Starting from the basic equation of general relativity, the Einstein field equation, and assuming a weak gravitational field or reasonably flat spacetime, the gravitational analogs to Maxwell's equations for electromagnetism, called the "GEM equations", can be derived. GEM equations compared to Maxwell's equations in SI units are (Mashhoon et al., 1999),(Clark & Tucker, 2000):

$$\nabla \cdot \mathbf{E}_g = -4\pi G \rho_g \tag{5}$$

$$\nabla \cdot \mathbf{B}_g = 0 \tag{6}$$

$$\nabla \times \mathbf{E}_g = -\frac{\partial \mathbf{B}_g}{\partial t} \tag{7}$$

$$\nabla \times \mathbf{B}_g = 4\left(-\frac{4\pi G}{c^2}\mathbf{J}_g + \frac{1}{c^2}\frac{\partial \mathbf{E}_g}{\partial t}\right) \tag{8}$$

E_g is the static gravitational field (conventional gravity, also called gravitoelectric in analogous usage) in $m \cdot s^2$; B_g is the gravitomagnetic field in s^1; ρ_g is mass density in $kg \cdot m^3$; J_g is mass current density or mass flux ($J_g = \rho_g v_\rho$, where v_ρ is the velocity of the mass flow generating the gravitomagnetic field) in $kg \cdot m^2 \cdot s^1$; G is the gravitational constant in $m^3 \cdot kg^1 \cdot s^2$; c is the speed of propagation of gravity (which is equal to the speed of light according to general relativity) in $m \cdot s^1$.

3.1 A_g and ϕ_g potential fields

Regarding the analogy of gravitoelectromagnetic and electromagnetic equations the last one equations could be used as a theoretical background of gravitoelectromagnetic equations (Matulis, 2001). Introducing the scalar potential φ_g and the vector potential $\mathbf{A}_g$ defined from the $\mathbf{E}_g$ and $\mathbf{B}_g$ fields by:

$$\mathbf{E}_g = -\nabla\varphi_g - \frac{\partial \mathbf{A}_g}{\partial t}, \quad \mathbf{B}_g = \nabla\times\mathbf{A}_g, \tag{9}$$

the four gravitoelectromagnetic equations in a vacuum with charge ρ_g and current J_g sources reduce to two equations, gravity analogous Gauss' law is:

$$\nabla^2\varphi_g + \frac{\partial}{\partial t}(\nabla\cdot\mathbf{A}_g) = 4\pi G\rho_g, \tag{10}$$

and the gravity analogous Ampre-Maxwell law is:

$$\nabla^2\mathbf{A}_g - \frac{1}{c^2}\frac{\partial^2\mathbf{A}_g}{\partial t^2} - \nabla\left(\frac{1}{c^2}\frac{\partial\varphi_g}{\partial t} + \nabla\cdot\mathbf{A}_g\right) = \frac{16\pi G}{c^2}\mathbf{J}_g. \tag{11}$$

The source terms are now much simpler, but the wave terms are less obvious. Since the potentials are not unique, but have gauge freedom, these equations can be simplified by gauge fixing. A common choice is the Lorenz gauge condition:

$$\frac{1}{c^2}\frac{\partial\varphi_g}{\partial t} + \nabla\cdot\mathbf{A}_g = 0 \tag{12}$$

Then the nonhomogeneous wave equations become uncoupled and symmetric in the potentials:

$$\nabla^2\varphi_g - \frac{1}{c^2}\frac{\partial^2\varphi_g}{\partial t^2} = 4\pi G\rho_g, \tag{13}$$

$$\nabla^2\mathbf{A}_g - \frac{1}{c^2}\frac{\partial^2\mathbf{A}_g}{\partial t^2} = \frac{16\pi G}{c^2}\mathbf{J}_g. \tag{14}$$

In the case that there are no boundaries surrounding the sources, the solutions (SI units) of the nonhomogeneous wave equations are

$$\begin{aligned}
\varphi_g(\mathbf{r},t) &= -G\int\frac{\delta\left(t' + \frac{|\mathbf{r}-\mathbf{r}'|}{c} - t\right)}{|\mathbf{r}-\mathbf{r}'|}\rho_g(\mathbf{r}',t')d^3r'dt' &(15)\\
&= -G\int\frac{\rho_g(\mathbf{r}',t-\frac{|\mathbf{r}-\mathbf{r}'|}{c})}{|\mathbf{r}-\mathbf{r}'|}d^3r' &(16)
\end{aligned}$$

and

$$\begin{aligned}
\mathbf{A}_g(\mathbf{r},t) &= -\frac{G}{c^2}\int\frac{\delta\left(t' + \frac{|\mathbf{r}-\mathbf{r}'|}{c} - t\right)}{|\mathbf{r}-\mathbf{r}'|}\frac{\mathbf{J}_g(\mathbf{r}',t')}{c}d^3r'dt' &(17)\\
&= -\frac{G}{c^3}\int\frac{\mathbf{J}_g(\mathbf{r}',t-\frac{|\mathbf{r}-\mathbf{r}'|}{c})}{|\mathbf{r}-\mathbf{r}'|}d^3r' &(18)
\end{aligned}$$

where

$$\delta\left(t' + \frac{|\mathbf{r}-\mathbf{r}'|}{c} - t\right) \tag{19}$$

is a Dirac delta function. These solutions are known as the retarded Lorenz gauge potentials. They represent a superposition of spherical light waves travelling outward from the sources of the waves, from the present into the future.

3.2 Small wave source

Let start to investigate harmonic oscillation of gravity mass density in electro-gravity antenna as follow

$$\begin{aligned} \rho_g(\mathbf{r},t) &= \rho_g(\mathbf{r})e^{-i\omega t} & (20)\\ \mathbf{J}_g(\mathbf{r},t) &= \mathbf{J}_g(\mathbf{r})e^{-i\omega t} & (21) \end{aligned}$$

According linearity of gravitoelectromagnetic equations transmitted electro-gravity scalar potential depends from time in such case

$$\begin{aligned} \mathbf{A}_g(\mathbf{r},t) &= \mathbf{A}_g(\mathbf{r})e^{-\omega t} & (22)\\ \rho_g(\mathbf{r},t) &= \rho_g(\mathbf{r})e^{-\omega t} & (23) \end{aligned}$$

Inserting following equation into scalar potential solution of gravity wave equation one could obtain

$$\begin{aligned} \varphi_g(\mathbf{r},t) &= -\frac{G}{c^2}\int \frac{\rho_g(\mathbf{r}', t - \frac{|\mathbf{r}-\mathbf{r}'|}{c})}{|\mathbf{r}-\mathbf{r}'|} d^3r' \\ &= -\frac{Ge^{-i\omega t}}{c^2}\int \frac{\rho_g(\mathbf{r}')e^{ik|\mathbf{r}-\mathbf{r}'|}}{|\mathbf{r}-\mathbf{r}'|} d^3r' & (24) \end{aligned}$$

or

$$\varphi_g(\mathbf{r}) = -\frac{G}{c^2}\int \frac{\rho_g(\mathbf{r}')e^{ik|\mathbf{r}-\mathbf{r}'|}}{|\mathbf{r}-\mathbf{r}'|} d^3r' \tag{25}$$

Now one can apply for small source ($r' \leq d << r$) following approximation

$$|\mathbf{r}-\mathbf{r}'| \approx r - \mathbf{n}\cdot\mathbf{r}' \tag{26}$$

where $\mathbf{n} = \mathbf{r}/r$ is normal vector of propagating scalar wave in $\mathbf{k}||\mathbf{r}$ direction. So function in the integral one could expand as follow

$$\begin{aligned} \frac{e^{ik|\mathbf{r}-\mathbf{r}'|}}{|\mathbf{r}-\mathbf{r}'|} &\simeq \frac{e^{ikr}}{r}\cdot\frac{e^{-ik\mathbf{n}\cdot\mathbf{r}'}}{1-(\mathbf{n}\cdot\mathbf{r}')/r} & (27)\\ &= \frac{e^{ikr}}{r}\left(1+\left(\frac{1}{r}-ik\right)(\mathbf{n}\cdot\mathbf{r}')+\frac{1}{2}\left(\frac{2}{r^2}-\frac{ik}{r}-k^2\right)(\mathbf{n}\cdot\mathbf{r}')^2+\cdots\right) & (28) \end{aligned}$$

After insertion of following expansion one can obtain for scalar potential φ

$$\varphi = \sum_{m=0}^{\infty} \varphi_m \tag{29}$$

where

$$\varphi_m = \frac{e^{ikr}}{r}\left(1+\frac{a_1}{ikr}+\cdots+\frac{a_m}{(ikr)^m}\right)\frac{(-ik)^m}{m!}\int \rho_g(\mathbf{r}')(\mathbf{n}\cdot\mathbf{r}')^m d^3r' \tag{30}$$

3.3 Electro-gravity spherical radiation

Investigating first term of scalar potential one can obtain for dipole electro-gravity scalar potential

$$\varphi(\mathbf{r}) = \frac{Ge^{ikr}}{rc^2}\int \rho_g(\mathbf{r})d^3r \tag{31}$$

Integrating integral for asymmetric capacitor one can obtain after replacing ρ_g by ρ_{eg}

$$\int (\rho_{eg}(\mathbf{r}))\, d^3r = -\frac{1}{2}\alpha_g CV^2 \tag{32}$$

or

$$\varphi(\mathbf{r}) = -\frac{G}{rc^2}\frac{1}{2}CV^2e^{ikr} \tag{33}$$

where C is capacitance of asymmetric capacitor and V is amplitude of electric voltage and m mass of asymmetric capacitor.

Now one can find for static gravitational field following expression

$$\mathbf{E}_g = \nabla(\varphi_g(\mathbf{r})) = -\frac{\alpha_g CGV^2}{2c^2}\nabla\frac{e^{ikr}}{r} = -\frac{\alpha_g GCV^2}{2c^2}\mathbf{n}\left(\frac{ik}{r}-\frac{1}{r^2}\right)e^{ikr} \approx -\frac{GCV^2}{2c^2}\frac{ike^{ikr}}{r}\mathbf{n} \tag{34}$$

Obtained expressions describe propagation direction of static gravity wave. This wave propagate in normal direction to the sphere with centre of asymmetric capacitor. The energy of static gravity wave one can express as follow

$$S = 4\pi G(\mathbf{E}_g\cdot\mathbf{E}_g^*) = \frac{\pi G^3C^2V^4\alpha_g^2k^2}{c^4r^2} = \frac{\pi G^3C^2V^4\alpha_g^2\omega^2}{c^2r^2} \tag{35}$$

4 Discussion

Analysing obtained result one can find dependence of static gravity wave propagation energy form capacitance, voltage, frequency and distance as follow

$$S \sim \frac{C^2V^4\omega^2}{r^2} \tag{36}$$

T.T. Brown (T. T. Brown, 1953) described electro-gravity communication (EGC) transmitter as a asymmetric capacitor connected to the oscillating high voltage. Author declared in other document ”Project Winterhaven - A Proposal for Join Services and Development Research” that he used barium titanate dielectrics with electric permittivity at range 1250-10000 for asymmetric capacitors, voltage about 100KV and frequency a few Hz. Todays values of electric permittivity are greater than 250000 for calcium copper titanate. So, one can hope to obtain five time bigger distance than Brown's obtained for the same voltage and frequency. The working distance could be increased more four-five times by using of fractal capacitors in comparison to traditional capacitors. But if one will use 10MHz he should obtain increase of working distance in 10000 km.

Section I describing receiver of EGC system of above mentioned patent is not available, and all further information generated by the U.S. Patent Office application is unavaliable. The U.S. Patent Office is constantly screened by the U.S. military. Inventions pertaining to, or having some bearing on advances in weaponry, camouflage, defensive armor, communication systems, and the like, are routinely classified under the auspices of national security. In case the description of receiver is hidden still today, so description of the receiver antenna should be grounded on theory proposed above. Dielectric material with a high permittivity is piezoelectric, so the same material should be used for receiver antenna. For increasing to maximum stress of dielectric material which is induced by variation of curvature along of gravity wave one should use multiple half wave distance receiver antenna as a symmetric capacitor. Increasing of working frequency one can reduce not only dimension of receiver and transmitter antennas but also and consumption of dielectric material.

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