THE POSSIBLE EXISTENCE OF A 'GRAVITO-ELECTRIC' CURRENT.

By

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Abstract.

The unification of gravitation and electromagnetism requires the existence of a gravito-electric current, however small, and an equation for the velocity of gravitation taking the existence of such a current into account enables us to quantify this current in ampères, and to relate the value of the Newtonian gravitational constant to the values of the magnetic and electric constants.

Keywords: gravitation; electromagnetism; velocity of gravity; velocity of light; electric current; Newtonian gravitational constant; electric constant; magnetic constant.

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Five equations, all numbered; no tables or diagrams.

The classical works on the unification of gravitation and electromagnetism are those of Nordström (1914), Kaluza (1921) and Klein (1926). None of these, however, make any mention of the possibility of a gravito-electric current, which would appear to be a natural concomitant of gravitational propagation, given that electric current is simply moving electric charge or charges.

Laplace attempted, using Newtonian theory (Newton, 1687), and the assumption that gravity behaves similarly to a fluid, to calculate the

speed of gravity in Laplace (1776), and arrived at the conclusion that it travelled at a speed of 7.45 million times that of light. Einstein, in the early part of the twentieth century, corrected this idea, demonstrating that the speed of light is universal, and that gravitation propagates, in wave form, at light speed (Einstein, 1905; 1918).

If we combine these two ideas, we find that:

$$v_G = c = |\sqrt[4]{G\mu_0 I_G^2}| = |(\varepsilon_0\mu_0)^{-½}| \quad (1)$$

Here, v_G is the speed of gravitation, c that of light or electromagnetic radiation, ε_0 and μ_0 the electric and magnetic constants, G the Newtonian gravitational constant, and I_G the purported 'gravito-electric' current.

If the above is correct, then:

$$G\mu_0 I_G^2 = (\varepsilon_0\mu_0)^{-2} = c^4 \quad (2)$$

From this straightforward algebra, we can conclude that:

$$I_G = c^2(G\mu_0)^{-½} \quad (3)$$

and also:

$$G = c^4/\mu_0 I_G^2 \quad (4)$$

A quick dimensional analysis confirms that these formulae are correct, as may readily be seen. Equation (3) enables us to obtain a value for the gravito-electric current, I_G, of 9.81372×10^{24} A.

This would seem to be absurd and unphysical – but it is the simplest obtainable relation, nevertheless, and we find that:

$$e/t_P = 2.9718 \times 10^{24} \text{ A} \quad (5)$$

where e is the fundamental electric charge and t_P is the Planck time. $I_G \simeq 3.3\ e/t_P$.

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